

## SPLenic INJURIES AND CLINICAL ANALYSIS

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### ABSTRACT

#### BACKGROUND

Trauma being the most underrated killer of the young needs more careful management. Spleen is the most common intraabdominal injured organ in blunt trauma cases. An adequate clinical analysis, assessment of the patients, diagnosis and treatment with high suspicion of any concealed injury within the abdomen is a must. My study comprises a comprehensive study of cases with splenic injury, mechanism of injury, clinical presentation, grading the injury and accordingly the most appropriate management.

#### MATERIALS AND METHODS

Prospective observational study at Hi-Tech Medical College and Hospital from July 20, 2014, to July 20, 2017. 30 patients with splenic injury were first assessed in the casualty, primary survey done according to ATLS, once patient is stable; secondary and tertiary survey carried out, relevant data collected and all patients managed under standard protocol to assess the outcome and establish better treatment plans.

#### RESULTS

Most patients were young adult, presented to the hospital within four hours of injury, most common cause was high speed road traffic accident. 90% patients had abdominal signs. Investigations showed most patients had isolated splenic injury with 40% grade I. 40% patients were conservatively managed, rest 60% operated (repair/resection). Three patients died.

#### CONCLUSION

Young working class, living in urban areas with a fast life (high-speed traffic and industrial injuries) are more prone for splenic injury, increasing financial and social burden. Early presentation to hospital, meticulous monitoring, adequate grading and prompt investigations leads to early diagnosis and optimum treatment of such patients; thus improving healthcare outcomes.

#### KEYWORDS

Blunt Trauma, Splenic Injury, Grading, Diagnosis, Optimum Management.

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#### BACKGROUND

Trauma today is the biggest killer in young age group. It kills with a cold face, sees no one young or old, man or woman, adult or child. Every eight and a half minute sees a life lost due to an accident and every minute one accident in India.<sup>1</sup> Meticulous examination, continuous monitoring and high degree of suspicion forms the basic pillars of blunt abdominal trauma management.

Spleen is the commonest intraabdominal organ that is injured after blunt abdominal trauma.<sup>2,3</sup> A team effort of

trauma surgeons and radiology experts help an early diagnosis and treatment, which facilitated primary management of these injuries.<sup>2</sup>

Injuries to the spleen may be treated either by operative or nonoperative technique. Newer operative techniques, modern anaesthesia and blood transfusion facilities have made splenic injury management conservative<sup>4</sup> after recognition of its immunological importance.<sup>2,4,5</sup>

With standard diagnostic methods for assessment of splenic injury such as peritoneal lavage, CT and USG and with the advent of diagnostic laparoscopy, grading of splenic injuries can be done accurately.<sup>3,6</sup>

It appears to be safe in the paediatric age group to deal with mild splenic lesions by conservative management, in stable patients, in view of its immunological importance.<sup>1,7</sup>

#### Aims and Objectives

a. To know the incidence of splenic trauma, means of presentation and grade them.

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- b. To identify the mechanism of injury.
- c. To study the correlation between the severity of splenic injury to the line of management.

### MATERIALS AND METHODS

The study includes 30 patients with splenic injury, admitted for blunt abdominal trauma, in a major tertiary institution for trauma in Hi-Tech Medical College and Hospital, Bhubaneswar, from July 20, 2014.

- Age and sex.
- Mode of sustaining injury.
- Time interval between injury to admission and management.
- Condition on admission.
- Signs and symptoms.
- Resuscitative measures.
- Investigations.
- Different methods management.
- Indications for laparotomy findings and procedures done.
- Types and grades of splenic injury.
- Units of blood required in management.
- Associated injuries.
- Postoperative course and hospital stay.
- Morbidity and mortality.

All the patients of abdominal injury were first assessed in casualty by surgical resident and after evaluation accordingly admitted to intensive care unit. Once the patients were admitted, a primary survey (life sustaining priorities) carried out-

1. Airway - to secure a patent airway and optimise ventilation.
2. Breathing.
3. Circulation - Establish IV access to combat hypotension and to enhance cardiovascular performance.
4. Immobilise cervical spine.
5. Blood sent for grouping, cross-matching and haematocrit.

Once the patient's general condition was stabilised, secondary survey was conducted. This consisted of thorough physical examination including-

- Examination of chest.
- Examination of abdomen, flanks, back, perineum and axillae.
- Examination of head, spine and neck.
- Peripheral pulses, neurological examination.
- Per rectal examination for blood and sphincter tone.
- Splinting of long bone fractures.

Wherever deemed necessary, specialists from appropriate fields were called for.

Once stable, tertiary survey was carried out to rule out occult injuries such as bowel perforations or pancreatic injuries.

Whenever, a splenic trauma was suspected, the following therapeutic measures were carried out-

- i. Nil by mouth.
- ii. RT aspiration 1 hourly and continuous.
- iii. Foley's catheter to monitor urine output and to rule out haematuria.
- iv. Intravenous fluids, both crystalloids and colloids were administered through wide bore IV cannula in the upper extremity.
- v. Blood transfusion given depending on Hb and PCV.
- vi. Broad-spectrum antibiotics (cefotaxime/gentamicin/metronidazole) given.
- vii. Inj. Tetanus toxoid 0.5 cc IM given.
- viii. Inj. Ranitidine (50 mg) IV given to prevent stress-induced gastritis.

Simultaneously, the following investigations were carried out-

- i. Hb and PCV.
- ii. Blood grouping and cross-matching.
- iii. BUN, S. creatinine and random blood sugar.
- iv. Urine examination.
- v. X-ray chest and abdomen.
- vi. Abdominal paracentesis.
- vii. USG.
- viii. CT scan (abdomen).

On coeliotomy, the following points were noted-

1. Grade of splenic injury.
2. Type of procedure performed.
3. Other associated visceral injuries.

Postoperatively, the patients were given IV fluids and kept continuous Ryle's Tube (RT) aspiration.

The quantity of fluid and electrolyte administration were adjusted according to chemical parameters, i.e. temp, pulse, BP, CVP, urine output, RT aspirate and serum Na<sup>+</sup> and K<sup>+</sup> levels.

All patients were given broad-spectrum antibiotics from the start. Higher antibiotics were added according to the patient's postoperative course and Inj. Pneumovac given. The patients were kept on continuous RT aspiration till-

- Decreasing nasogastric aspirate.
- Decreasing abdominal distension.
- Return of bowel sounds.
- Passage of flatus or stools.

Early ambulation and physiotherapy were encouraged to prevent deep vein thrombosis and chest complications-

- Tincture benzoin inhalations.
- Deep breathing exercises.
- Frequent change of position and early ambulation.
- Adequate hydration.

### OBSERVATIONS AND RESULTS

The study includes 30 cases admitted in our hospital.

**Age Incidence-** Maximum patients (12) were reported between 21 to 30 years.

**Sex Incidence-** Males are predominantly affected.

- 90% males (27 patients).
- 10% females (3 patients).

**Time of Presentation-** The time interval between the injury and presentation or admission were variable from 0-10 hrs. Maximum number of patients, 25 patients (84%) presented in casualty within 6 hours of injury, whereas 13.33% (4 patients) presented between 6 to 8 hrs. Only 1 patient presented at 9<sup>th</sup> hour.

Time Interval (in Hours)	No. of Patients	%
<2	2	11.11
2-4	8	44.44
4-6	6	33.34
6-8	2	11.11
>8	0	0

**Table 1. Lapse Time of Injury and Surgery**

The above table shows the time interval between injury and patient taken for surgery. Maximum 89% (16 out of 18 patients) of patients were taken for surgery within 6 hours of injury.

**Mode of Injury-** Maximum (20 patients) 67% of patients having splenic injury are caused by vehicular accidents, 7 due to fall from height and 3 from assault.

Abdominal Signs	No. of Patients	Percentage
Positive	27	90
Negative	3	10

**Table 2. Clinical Presentation**

The above table shows that 90% patients had abdominal signs. 5% patients had abdominal signs negative due to altered sensorium, head injury being the key factor.

Grades of Splenic Injury	No. of Patients	%
I Capsular tear of minor parenchymal laceration (<10%) surface area	12	40
II Minor capsular avulsion (10-50%) with active bleed	4	13.33
III Expanding subcapsular haematoma (>50%) with intraparenchymal haematoma	8	26.67
IV Ruptured parenchymal haematoma with active bleed	4	13.33
V Shattered or avulsed spleen	2	6.67

**Table 3. Grades of Splenic Injury**

Procedure	No. of Patients	Percentage
Conservative	12	40
Splenorrhaphy	3	10
Splenectomy	15	50

**Table 4. Type of Management**

The above table represents the various modalities of management that were done for our patients- The 2003 EAST Guidelines was considered.<sup>4</sup> 12 patients (40%) were managed conservatively, 15 patients (50%) underwent splenectomy mainly due to the grade of injury and a few due to haemodynamic instability. 3 patients (10%) underwent splenorrhaphy.

**Number of Units of Blood Transfusion-** 30% patients required less than 2 units of blood, 60% patients required 2 to 4 units of blood and 10% patients required more than 4 units of blood. Blood requirement was more influenced by associated injury and grades of injury rather than by process of conservation.<sup>8,9</sup>

**Mortality-** 3 patients, i.e. 10% patients expired mainly due to head injury and associated fracture of long bones, one patient expired due to postoperative malarial infection. None of the patient died due to nonoperative management.

**(A) Associated Intraabdominal Injury**

Intraabdominal Injury	No. of Patients	Percentage
Isolated splenic injury	25	83.33
Associated intraabdominal injury	5	16.67

**Table 5. Associated Injuries (A) Associated Intra-Abdominal Injury**

**(B) Specific Organ Injury**

Specific Organ Injury	No. of Patients	Percentage
Liver	4	22.22
Stomach and duodenum	1	5.55
Bowel and mesentery	1	5.55
Retroperitoneum	3	16.66

**Table 5. Associated Injuries (B) Specific Organ Injury**

The above table represents associated intraabdominal injuries noted on laparotomy. About 22% patients were associated liver injuries and 17% patients were associated retroperitoneal injury.

Non-Abdominal Injury	No. of Patients	Percentage
Fracture ribs	6	20
Fracture pelvis	2	6.67
Head injuries	15	50
Other bony fractures	12	40

**Table 5. Associated Injuries (C) Non-Abdominal Injury**

The above table shows associated non-abdominal injuries. Head injuries constituted 50% (15 patients). 40% patients had other bony fractures, 20% patients had fracture ribs on left side and 7% patients had associated pelvic fracture.

Only 3 patients (10%) were having isolated splenic injuries neither associated intraabdominal injury nor associated non-abdominal injuries.

**DISCUSSION**

The data collected from the admissions in the emergency ward for trauma included a vast draining area including both urban and rural populations.

Spleen remains the most commonly injured intraabdominal organ in patients who have suffered blunt abdominal trauma. Splenic trauma constitutes a broad spectrum of injuries ranging from minor lacerations with minimal bleeding that requires little or no interventions, to massive injuries, shattered or avulsed spleen.<sup>1</sup> The rise in modern means of transport has led to rise in abdominal trauma and hence resulting in an increase of splenic injuries. However, mortality from splenic trauma has decreased over the past decade, which attributed to faster patient transportation from site of trauma to the hospital, improved methods of resuscitation, intensive care, anaesthetist and postoperative care. The advent of diagnostic techniques such as USG and CT scan has helped us to understand the nature course of splenic trauma.<sup>3</sup>

In our study, 40% patients with splenic trauma are between 21 to 30 years of age. Third decade of life represented maximum splenic injuries. Mean age of presentation is 28.5 years. In Cocanour CS et al series, the mean age of presentation is 35.3 years.<sup>7</sup>

In our series, 90% of patients are males and only 10% of patients are females. In Cocanour CS et al series, 90% of patients are males, 10% of patients are females. Males are more affected with splenic injury.<sup>7</sup> In our series, road traffic accidents causing blunt trauma accounted for 66.67% of patients, 23.33% of patients presented with injury due to fall from height and 10% of patients due to an assault.

The minimum lapse time was 1 hr. in our series and the maximum period was 9 hours. 80% of patients presented within 6 hours of injury. The patients who presented early within 2 hours have good outcome. The patients who presented late had higher complication rates. 72% of patients presented with stable vitals. 28% presented with unstable vitals. The patients were resuscitated thoroughly before taking for laparotomy with crystalloids and whole blood transfusion.

In our series, 90% of patients presented with clinically positive abdominal signs, the most common symptom is pain abdomen and clinical sign is tenderness of abdomen associated with guarding and rigidity.<sup>10,11</sup>

Trauma over the left side of the abdomen and fracture left lower ribs are very valuable findings for the diagnosis of splenic trauma. Persistent fall of blood pressure in spite of resuscitation is a sure sign of internal bleeding.<sup>12,13</sup>

Abdominal paracentesis is a simple bedside procedure, which found very useful. In our study, abdominal tap was done in all patients and was positive in 72.5% cases.

Ultrasonography is a basic investigation in cases of blunt abdominal trauma. In our series, portable USG was done in all patients and 86.6% cases were positive.

In haemodynamically stable patients, CT scan plays an important role in picking up concealed injuries and hence assists in deciding the management.<sup>14,15</sup>

In our series, a large number of patients suffered from grade I and grade III splenic injuries mainly as a result of associated left-sided blunt chest trauma. The incidence of splenectomy was 50%, because 26.67% suffered grade III injuries, 13.33% suffered grade IV injuries and 6.67% suffered grade V splenic injuries, in which case splenic salvage procedure was not possible.<sup>9</sup>

40% of patients managed nonoperatively and 60% are managed operatively. 3% of patients are initially managed nonoperatively and then explored later in view of hypotension with splenectomy.

26.67% patients required less than 2 units of blood transfusion. Due to a well-equipped blood bank and fresh blood availability, none of the patients suffered from inadequacy of management due to deficit of blood.

All the patients in our study who had undergone splenectomy were given injection Pneumovac and Penidure prophylaxis.<sup>8,9</sup>

10% patients expired in our series mainly due to head injury and associated fracture of long bones, one patient expired due to postoperative malarial infection. None of the patient died due to nonoperative management unlike seen in studies by Ochsner MG.<sup>16</sup>

Grade of Splenic Injury	Zucker et al (n=68)	Our Series (n=30)
I	19	12
II	28	4
III	17	8
IV	4	4
V	0	2

**Table 6. Incidence of Grade of Splenic Injury**

In Zucker et al series, grade I and grade II injuries are commonly involved accounting to 70% of patients.<sup>6</sup>

In our series, grade I and grade III injuries are more commonly involved accounting to 77% of patients.

**Management Procedure**

Study Group	Myers et al <sup>5</sup>	Zucker et al <sup>6</sup>	Cocanour et al <sup>7</sup>	Our Series
Total no. of patients	204	68	368	30
Operative	136	44	311	18
Nonoperative	68	24	57	12
Nonoperative	93%	95%	86%	92%
Success %				
Nonoperative	7%	5%	14%	8%
Failure %				

**Table 7. Management Procedure**

In Myers et al<sup>5</sup> series, 68 out of 204 were nonoperatively managed and success rate of nonoperative management is 93% and failure rate is 7%.

In Zucker et al<sup>6</sup> series, 24 out of 68 were nonoperatively managed and success rate of nonoperative management is 95% and failure rate is 5%.

In Cocanour et al<sup>7</sup> series, 57 out of 311 were nonoperatively managed and success rate of nonoperative management is 86% and failure rate is 14%.

In our series, 12 out of 30 were nonoperatively managed and success rate of nonoperative management is 92% and failure rate is 8%.

### CONCLUSION

The common age group affected by trauma is of young working class men. This produces loss of working hands to the nation and affects its economy. Increase in high-speed traffic and industries in urban India has given rise to marked rise in accidental injuries. Time lapse between injury and treatment has significant association with outcome. Patients who present with less than 2 hours of injury are having better prognosis with less morbidity and mortality. Grade of splenic injury, continuous monitoring of patient and associated injuries have direct bearing on outcome. Preoperative ultrasound scan of abdomen and pelvic cavity is diagnostic of splenic injury with a sensitivity rate of 86.6%. In haemodynamically stable patient, CT scan offers best modality to decide line of management. Abdominal paracentesis is very useful in diagnosis of intraabdominal injury. The method is very much reliable and carries no risk. Overall, splenic injuries of grade I and grade II have good outcome with nonoperative management when not associated with other injuries. Grade IV and grade V splenic injuries treated surgically gives excellent results. In multiorgan injury, results of treatment are poor. Prophylactic antibiotics will prevent postoperative complications. Pneumococcal vaccine prevent overwhelming post-splenectomy infections. Failure of nonoperative management is due to haemodynamic instability, age older than 55 years, contrast vascular blush on CT scan.

With better understanding of the role of spleen in body immunology, the management of splenic trauma has changed in last two decades and today splenic salvage is the goal. Various treatment options for splenic trauma are- Nonoperative treatment, conservative surgery and splenectomy.

One has to weigh the risks of exsanguinations, which is immediate, against that of OPSI, which may occur later.

Splenectomy is the treatment of choice for haemodynamically unstable patient, patient with polytrauma, severe grade of splenic injury and pathological spleen with injury.

Splenic injuries can be successfully treated nonoperatively in children in centres where close monitoring is possible, emergency surgical intervention can be done, backup facilities exist.

Laparoscopy for abdominal trauma carries a high diagnostic yield in the identification of visceral injuries.

### REFERENCES

- [1] Coccolini F, Montori G, Catena F, et al. Splenic Trauma: WSES Classification and Guidelines for Adult and Pediatric Patients. *World J Emerg Surg* 2017;12:40.
- [2] Forsythe RM, Harbrecht BG, Peitzman AB. Blunt splenic trauma. *Scandinavian Journal of Surgery* 2006;95(3):146-151.
- [3] Morrell DG, Change FC, Helmer SD, et al. Changing trends in the management of splenic injury. *Am J Surg* 1995;170(6):689-690.
- [4] Bee TK, Croce MA, Miller PR, et al. Failures of splenic non operative management: is the glass half empty or half full? *J Trauma* 2001;50(2):230-236.
- [5] Myers JG, Dent DL, Stewart RM. Blunt splenic injuries: dedicated trauma surgeons can achieve a high rate of nonoperative success in patients of all areas. *J Trauma* 2000;48(5):801-805,805-806.
- [6] Zucker K, Browns K, Rossman D, et al. Nonoperative management of splenic trauma. Conservative or radical treatment. *Arch Surg* 1984;119(4):400-404.
- [7] Cocanour CS, Moore FA, Ware DN. Age should not be a consideration for non-operative management of blunt splenic injury. *J Trauma* 2000;48(4):606-610; discussion 610-2.
- [8] Williams NS, Blstroke CJK, O'Connel PR, et al. *Bailey & Love's short practice of surgery*. 26th edn. CRC Press 2013:1087-1095.
- [9] Townsend CM, Beauchamp RD. *Sabiston textbook of surgery: the biological basis of modern surgical practice*. Elsevier Saunders 2012:1548-1561.
- [10] Standring S, Borley NR. *Gray's anatomy: the anatomical basis of clinical practice*. 40th edn. Philadelphia, PA: Churchill Livingstone 2008:2190-2201.
- [11] Scott-Conner CEH. *Chassin's operative strategy in general surgery: an expositive atlas*. New York, NY: Springer 2014:861-865.
- [12] Fischer JE, Jones DB. *Fischer's mastery of surgery*. 6th edn. Wolters Kluwer Health/Lippincott Williams & Wilkins 2012:1850-1870.
- [13] Brunicaardi FC, Andersen DK, Billiar TR, et al. *Schwartz's principles of surgery*. 10th edn. New York: McGraw-Hill 2015:1423-1435.
- [14] Peitzman AB, Harbrecht BG, Rivera L, et al. Failure of observation of blunt splenic injury in adults: variability in practice and adverse consequences. *J Am Coll Surg* 2005;201(2):179-187.
- [15] Haan J, Ilahi ON, Kramer M, et al. Protocol driven nonoperative management in patients with splenic trauma and minimal associated injury decreases length of stay. *J Trauma* 2003;55(2):317-322.
- [16] Ochsner MG. Factors of failure for nonoperative management of blunt liver and splenic injuries. *World J Surg* 2001;25(11):1993-1996.