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Splenic Trauma-Clinical Presentation, Evauation & Management Options-A Clinical Study

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ABSTRACT

Background: Although protected under the bony ribcage, the spleen remains the most commonly affected organ in blunt injury to the abdomen in all age groups. Aim: 1.To know the incidence, modes of presentation, grade of splenic trauma and to access the factors responsible for mortality and morbidity, 2. To present a comprehensive picture of recent concepts in assessment and management of splenic injuries. **Methods:** After obtaining Institutional Ethics Committee approval, this study was conducted at Osmania general Hospital, Hyderabad, Telangana, India. A brief history about the date and time of injury, mode of injury and complaints noted. Diagnostic tap of abdomen, plain X-ray erect abdomen, emergency ultrasound of the abdomen and pelvic cavity and CT scan of abdomen (with and without contrast) done to decide on the operative or non-operative management. **Results:** Road traffic accident was the commonest cause of injury. Lapse time of injury and admission varied from 45 min to 72 hours. 60% presented within 8 hours after injury. 30% of patients presented with unstable vitals and were resuscitated. The common presentation was pain abdomen with grade I injury. Out of 30 patients 5 patients were non-operatively managed, 25 patients were operatively managed. Mortality was 10%. **Conclusion:** Time lapse between injury and treatment, grade of splenic injury, continuous monitoring of patient and associated injuries have direct impact on outcome. Pre-operative ultrasound scan of abdomen and pelvic cavity and CT scan is most useful in deciding the management modality.

Keywords: Blunt injury abdomen, splenic trauma, CT scan, operative and non-operative management.

INTRODUCTION

In 1893, Reigner published the first documented successful splenectomy in German literature. Operative mortality rates remained high until the 1950s after which new and rapid advancements in surgical and anesthesia sciences occurred. Non-operative care during this period was predominantly fatal. Prior to the advent of CT scanning, physical examination and diagnostic procedures such as diagnostic peritoneal lavage (DPL) and radioisotope scans were the only diagnostic methods. Minor splenic injury was probably frequently missed, while major injury prompting laparotomy for hypotension or physical findings was the norm.

Because of the immunologic function of the spleen, interest over the last century has turned towards salvage of the spleen rather than splenectomy. The advent of CT scanning has made conservative management more practical and safer for victims of splenic injury. The images can help quantitate the amount of blood in the abdomen and can reveal individual organs with precision1. CT scanning has facilitated safe, non-operative management in young and old patients to an unprecedented degree, but deaths due to splenic rupture are still reported in hospital discharge statistics from both level I trauma centers and community hospitals.

This study analysis of 30 patients with splenic trauma attempts to put forward the observations and data pertaining to the comprehensive picture of recent concepts in assessment and management of splenic injuries with specific reference to non-operative management.

Algorithm for Blunt Abdominal Trauma and Suspected Splenic Injury.[2]

Patients and Methods

This study was conducted at Osmania general Hospital, Hyderabad, Telangana, India. 30 patients of splenic trauma out of 122 patients of blunt injury abdomen who were admitted in Osmania General Hospital and who underwent non-operative management (5), non-operative converted to operative management (1) and operative management (24) for abdomen trauma with splenic injury form the sample of the study. This study was

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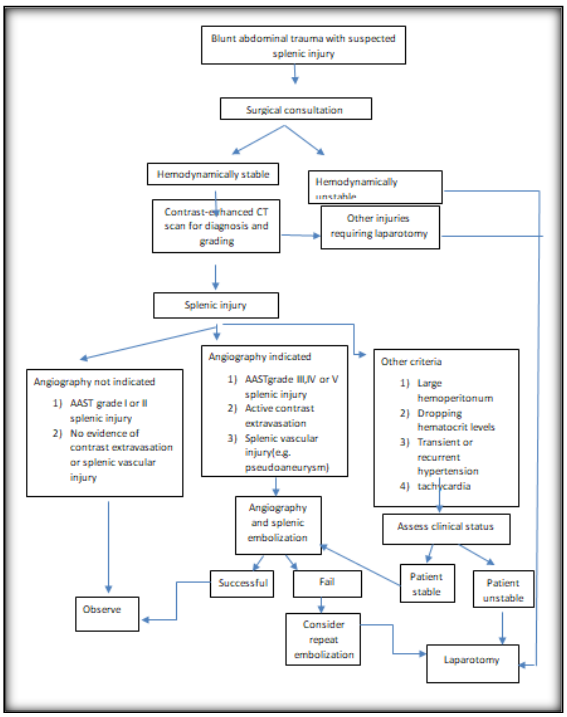
conducted over a span of 27 months from August 2015 to October 2017.



MATERIALS AND METHODS

- Written informed consent was obtained from all subjects and/or their guardians after full explanation of the procedure.
- All surgical interventions were performed with pre-op preparation including pre-op dose of antibiotic and pre-op evaluation with ultrasonography and CT abdomen.

Inclusion Criteria

Any patient presenting to the causality OPD with either blunt trauma or penetrating injury to the abdomen.
Age: 12 years and above
Both sexes

Exclusion criteria

1. Hematological disorders of spleen
2. Congenital anomalies of spleen
3. Infections and neoplasms of spleen
4. Age: below 12yrs

All the patients were first received at casualty department and general survey of the patient was done to identify emergency situations needing immediate attention and attended to. After securing airway and breathing, an intravenous line was secured and blood drawn and sent for blood grouping and typing, cross matching, urea, creatinine, sugar and hemoglobin levels. Initially Ringer's lactate was infused for resuscitation. Depending on severity of injury if the patient was not responding to initial crystalloids, compatible whole blood transfusions were given after cross matching from our own blood bank.

A brief history about the date and time of injury, mode of injury and complaints with special reference to pain abdomen, vomiting and distension of abdomen were taken and site, size, shape and character of wounds were noted. Specific examination of abdomen was done with special reference to tenderness, guarding and rigidity and bowel sounds.

Investigations

The diagnostic tap of abdomen done for all cases.

In hemodynamically stable cases of blunt injury, plain X-ray erect abdomen, chest X-ray and if necessary plain X-ray of other parts of the body were taken. Emergency ultrasound of the abdomen and pelvic cavity of the patient was done by using ESAOTE-MY LAB 40 model Ultrasound machine 3.5 MHz curvilinear transducer with patient in supine position by a Radiologist. Unstable patients were not subjected to ultrasound.

CT scan of abdomen (with and without contrast) done for those patients who were stable, who had no free peritoneal tap and who were planned to be managed by non-operative procedure. Graded accordingly by grading system given by American Association for the Surgery of Trauma Splenic Injury Scale (1994 Revision) and recorded and managed non-operatively by continuous monitoring in hemodynamically stable patients, one of them was converted to operative procedure after deterioration of the condition and contrast blush on CT scan and the rest managed by surgical intervention due to hemodynamic liability.

Rest of the patients who were not subjected to CT scan were taken up for surgery after reasonable time of resuscitation. All the patients were operated under general anesthesia with endotracheal intubation.

If the patient had chest injury with or without fracture ribs and with hemothorax or pneumothorax, intercostal drainage tube inserted in the 4^{th} or 5^{th} intercostal space, in anterior axillary line using a 32F or 28F intercostal drainage tube under titer seal kit, under local anesthesia with strict aseptic precautions. Other associated injuries were treated by the concerned specialists of our hospital.

RESULTS

It is clear from above data that maximum number of patients are in the age group of 21-30 years (43.3%) with a mean age of presentation at 28 years. There is no single patient aged more than 60 years. 90 % of patients (27 /30) are males and 10% of patients (3 /30) are females. So the male to female ratio is 9:1

Lapse Time of Injury and Admission

Lapse time of injury and admission varied from 45 min to 72 hours. 60% of patients (18/30) presented within 8 hours after injury.

Lapse Time of Admission and Surgery

The lapse time of surgery after admission of patient is varying from few minutes to 15 hours. 4% of patients (1/25) were operated within two hour. One patient, who was operated after 7 hours of admission, was converted from non-operative to operative management.

Mode of Injury

The maximum number of patients presented with injury were due to road traffic accidents 83.3 % (25/30).

Vital Parameters at Admission

70 % of patients (21 /30) presented with stable vital data i.e., pulse from 60-100/min and blood pressure ranging from >100 mm Hg of systolic and 70-90 mm Hg diastolic pressure.

30% of patients (9 /30) presented with unstable vitals and were resuscitated, patients presented with thread pulse and low blood pressure (shock).

Table 1: Common Presentation Pattern

Clinical pattern	No of patients	Percentage
Pain abdomen	27	90
Distension of abdomen	19	63.3
vomiting	9	30
Tenderness	26	86.6
Guarding/rigidity	26	86.6
Audible bowel sounds	20	66.6

The common presentation pattern was pain abdomen with and without distension. On examination 86 % of patients (26 /30) had abdominal tenderness associated with guarding and rigidity

Asssociated Injuries– 13 patients presented with associated injuries like diaphragmatic injury(2), fracture ribs(2), other abdominal injury (GIT)(7) and other fractures(2).

Incidence of Grade of Spleen Injury

The most common Grade of splenic trauma is Grade II followed by Grade I. these two Grades constitute 66 6% of splenic injuries.

Table 2: Management Procedure

Management	No of patients	Percentage
Non- operative	5	17
Operative	24	80
Non operative converted to operative	1	3
Total	30	

Out of 30 patients 5 patients were non-operatively managed, 24 patients were operatively managed 1 patient was initially managed non-operatively then converted to operative management.

Table 3: Operative Procedure

Operative procedure	Number of patients	Percentage
Splenectomy patients	21	87.5
Spleen salvage procedure	3	12.5

Out of 24 patients who were managed operatively, 21 (87.5%) underwent splenectomy, 3 (12.5 %) underwent spleen salvage procedure (splenorrhaphy, Abgel application).

Duration of Hospital Stay

This duration ranges from less than 24 hours to 38 days. Patients who presented with hemodynamic instability and died are the ones who had stay less than 24 hours.

Cause of Death

10% of patients (3/30) expired. One patient died of sub-dural hematoma with depressed fracture of parietal bone. On patient died of acute respiratory distress syndrome following septicemia due to bile leak. One patient died of hypovolemic shock.

DISCUSSION

This is prospective study of 30 patients done during a time span of 27 months from August 2015 to October 2017.

Splenic trauma incidence:

In our study 24.5% of abdominal trauma resulted in splenic injury.

In a recent review, El Matbouly et al,[3] observed that 25% of blunt abdominal trauma accounted for splenic injury,.Proper selection of these patients based on the clinical and radiological findings for OM or NOM will decrease morbidity and mortality. In the present study also 24.5% of blunt abdominal trauma was associated with splenic injury.

Age incidence

43.3% of patients (13/30) presented to us were in the age group of 21-30 years and 20% of patients (6/30) were in the age group of 31-40 years. The most effected population were in the age group of 21-30 years (13).In our series, mean age of presentation was 28 years. In Cocanour CS et al series,[4] the mean age of presentation was 35.3 years.

The high incidence of splenic injuries in this age group (21-30yrs) can be attributed to high activity levels and participation in high risk activities. This group represents the economically active age and portrays loss to family and nation.

Sex incidence

In our series, 90% of patients (27 /30) were males and only 10% of patients (3/30) were females. In Cocanour CS4 et al series, 90% of patients were males, 10% of patients were females. Males were more affected with spleen injury.

Table 4: Sex Incidence in Various Study Groups

Sex incidence	Study group
90 % are males	Cocanour CS et al,[4] series
66 % are males	John L. Kendall et al,[5]
90 % are males	Our study

Time interval between injury and admission

The minimum time lapse was 45 minutes in our series and the maximum period was 72 hours. 86.6% of patients presented within 24 hours of injury. 60% of patients (18/30) presented within 8 hours. The

patients who presented late (>24hours) had higher complication rate.

Time interval between admission and surgery

17% of patients (5/30) managed non-operatively and 80% (24/30) were managed operatively. 3% of patients (1/30) was initially managed non-operatively and then converted to operative procedure after 7 hours. 48% of patients (12/25) were taken to laparotomy within 2 to 4 hours, 40% of patients (10/25) were taken up for surgery within 4 to 8 hours of admission and 4% of patients (1/25) was taken for laparotomy within 2 hours.

This time duration was utilized for resuscitation and investigations whenever the patient was hemodynamically stable.

Mode of Injury

In our series, road traffic accidents causing blunt trauma accounted for 83.3% of patients (25/30). 3.3% of patients (1/30) presented with injury due to stabbing and 13.4% of patients (4/30) presented with injury due to fall from height (building roof).

Table 5: Mode of Injury and Mean Age of Presentation in Various Studies

Study	Mean age	sex	Mode of injury
Ting-Min Hsieh et al[6]	31.5 years	Male (62%)	RTA
John L. Kendall et al[5]	31 years	Male (66%)	RTA
Present study	32years	Male (88%)	RTA

Identification of risk taking behavior among trauma patients has potential significance for the prevention of injuries.

Vital data at admission

70% of patients (21/30) presented with stable vitals. 30% (9/30) presented with unstable vitals. The patient resuscitated thoroughly before taking for laparotomy with crystalloids and whole blood transfusion.

In the present study, none of our patients had received any pre-hospital care. The lack of advanced pre-hospital care in our environment coupled with ineffective ambulance system for transportation of patients to hospitals is a major challenge in providing care for trauma patients and have contributed significantly to poor outcome of these patients due to delay in definitive management. Similar observations have been noted in other studies in developing countries

Patient clinical presentation

In our series, 90% of patients (27/30) presented with pain abdomen. Some of them had associated distension of abdomen and very few patients had associated vomiting. 86.6% of patients (26/30) on examination had tenderness, guarding and rigidity. Bowel sounds were present in only 66.6% patients (20/30). The most common symptom was pain abdomen and clinical sign is tenderness of abdomen associated with guarding and rigidity.

Associated injuries

43.3% of patients (13/30) had associated injuries. 6% of patients (2/30) had Fractures of long bones, 6% of patients (2/30) had fracture ribs, and 6% of patients (2/30) had diaphragmatic injury. 23% of patients (7/30) had other abdominal injuries.

In a study conducted by Bhatacharya B et al,[7] it was mentioned that rib fractures remain as markers for increased likelihood of solid organ injuries following blunt trauma regardless of modality by which they are diagnosed – chest x-ray or CT scan.

The presence of associated injuries is an important determinant of the outcome of splenic injury patients8. In the present study, the presence of associated injuries was found to be significantly associated with both mortality and length of hospital stay (morbidity). Early recognition and treatment of associated injuries is important in order to reduce mortality and morbidity associated with splenic injuries.

Ultrasound scan of abdomen and pelvis

In our series, 90% of patients were scanned with ultrasound scan abdomen and pelvis pre-operatively. The sensitivity of ultrasound in our series is 88.8%.

Ali Feyzi et al,[9] conducted a study on the diagnostic accuracy of ultrasonography in detection of blunt abdominal trauma and comparison of early and late ultrasonography 24 hours after trauma. Sensitivity, specificity, negative predictive value, positive predictive value and accuracy of ultrasound were 97%, 98.1%, 99.7%, 83% and 98% respectively. Results obtained from this study indicate that negative ultrasound findings associated with negative clinical observation virtually exclude abdominal injury, and confirmation by performing other tests is unnecessary.

In a study conducted by Golett, Orlando MD et al,[10] accuracy of ultrasonography (US) in detecting abdominal lesions and free fluid collections in patients with blunt abdominal trauma was evaluated in 250 patients. The overall sensitivity of Ultrasonography in detecting free fluid collection was 98% (51 of 52 cases) with a specificity of 99% and a positive predictive value of 100%. The overall sensitivity was 93% in spleen injuries, 80% in liver injuries, and 100% in kidney lesions with a positive predictive value of 93%, 100%, and 100%, and a specificity of 99%, 100%, and 100%, respectively. These findings are in correlation with our study showing sensitivity of 88.8% for blunt splenic injury.

Like most other institutions, our institute has begun to employ ultrasonography as our initial screening tool for abdominal injury. Ultrasonography is a rapid, sensitive test for determining the presence of free intra-abdominal fluid, yet it is not as sensitive as CT in determining the source of the fluid. Our

current algorithm for the evaluation of blunt abdominal trauma preferentially uses abdominal ultrasonography in both stable and unstable patients as the initial screening tool. Stable patients undergo CT scanning if ultrasonography results are abnormal or if the patient has an indication for another type of CT. By increasing the use of ultrasonography and decreasing the use of abdominal CT, we decrease costs but increase the possibility of missed splenic injuries

Table 6: Ultrasound Scan Sensitivity in Various Study Groups

Ultrasound scan sensitivity	Study group
93%	Ali Feyzi et al[9]
98%	Golett, Orlando MD et al,[10]
88.8%	Present study group

Table 7: Incidence Grade of Spleen Injury in Various Studies

Grade of injury	Zucker et al,[11] (n=68)	Our series (n=30)
I	19	7
II	28	13
III	17	5
IV	4	4
V	0	1

In Zucker et al,[11] series, grade I and grade II injuries were commonly involve accounting to 70% of patients.

In our series, Grade I and Grade II injuries were commonly involved, accounting to 66% of patients.

Many studies have been conducted to evaluate the imaging characteristics of splenic trauma with CT and to address the outcome of conservative treatment. At most institutions, CT is the modality of choice for evaluation of blunt abdominal trauma. Overall, sensitivity and specificity are high for detection of splenic trauma. Heamoperitoneum almost always accompanies splenic injury. Uncommonly, a Perisplenic clot is present without evidence for capsular disruption, which has been reported in approximately 9% of patients and is termed the sentinel clot.

Repeat imaging, as clinically warranted, can aid in detecting ongoing hemorrhage. Increasing hematoma size or changes in character contrary to the expected sequence are indications of continued hemorrhage. In most instances, heamoperitoneum significantly resolves within 1 week

Table 8: Management Procedure

Study Group	Myers et al12	Zucker et al11	Cocanour et al21	Our series
Total no of patients	204	68	368	30
Operative	136	44	311	24
Non-operative	68	24	27	6
Non-operative success%	93%	95%	86%	83.3%
Non operative failure	7%	14%	14%	16.6%

Many authors have attempted to develop grading systems and delineate specific findings to predict the need for laparotomy and assess the success of conservative treatment. Resciniti30 et al proposed a CT scoring system to address the need.

In adult patients with a total CT score of less than 2.5, nonsurgical treatment was successful in all patients. A score of 2.5 or more is correlated with a 46% likelihood of successful nonsurgical treatment. The limitations of CT scanning are few but possibly important. The most detrimental limitation to confident interpretation of a CT scan is motion artifact. Overall, the sensitivity and specificity of CT in the detection of splenic injury is close to 100%.

Operative procedure

In our series, 3 out of 24 patients who underwent surgery had spleen salvage procedure done. Rest underwent splenectomy.

Mortality

Mortality was 10% in our series (3 patients).

The presence of complications has an impact on the final outcome13 of patients presenting with splenic injuries as supported by the present study. The pattern of complications in the present study is similar to what was reported by others,[13,14] early recognition and management of complications following splenic injury is of paramount in reducing the morbidity and mortality resulting from these injuries. The length of hospital stay has been reported to be an important measure of morbidity among trauma patients. Prolonged hospitalization is associated with an unacceptable burden on resources for health and undermines the productive capacity of the population through time lost during hospitalization and disability.[15]

The overall length of hospitalization for both survivors and non-survivors in our study were found to be higher than that reported by other authors.[14,16] This can be explained by the presence of severe trauma patients and large number of patients with associated injuries. Factors responsible for mortality in our study included advanced patient's age, associated injuries, grade of splenic injuries, admission systolic blood pressure $\leq$ 90 mmHg, estimated blood loss > 2000 ml, postoperative complications.

In our environment, the majority of patients post splenectomy fail to attend the follow-up clinic (for vaccination), making further management in those patients problematic. For these reasons, every attempt must be made for splenic salvage.

This observation calls for training of junior surgical staff in methods of splenic salvage (splenorrhaphy). In the present study, our patients received post-splenectomy vaccination. Post-vaccination health education should be given to all splenectomised patients regarding the risk, the importance of prompt diagnosis and treatment of infection, and the need

for strong compliance with anti-malarial prophylaxis.

CONCLUSION

Spleen is most commonly injured organ in intra-abdominal injuries.

Males are commonly affected than females. Age and sex has no association with outcome of management.

Time lapse between injury and treatment has significant association with outcome. Patients with less than 2 hours of injury have better prognosis with less morbidity and mortality.

Grade of splenic injury, continuous monitoring of patient and associated injuries have direct impact on outcome.

Pre-operative ultrasound scan of abdomen and pelvic cavity is diagnostic of splenic injury with a sensitivity rate of 88.8%.

CT scan is most useful in the non -operative management when not associated with other injuries.

Prophylactic antibiotics will prevent post-operative complications.

Pneumococcal vaccine prevents over whelming post- splenectomy infections.

Failure of non-operative management is due to Hemodynamic instability, age older than 55 years, contrast blush on CT scan.

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