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Original Article

Clinical Study of Splenic Trauma in Blunt Injury Abdomen

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Abstract

Introduction: Motor vehicle accidents account for most of the cases of splenic injury. Although protected under the bony ribcage, the spleen remains the most commonly affected organ in blunt injury to the abdomen in all age groups.

Aims and Objectives: The aim of the study is to evaluate the incidence of blunt injury abdomen, clinical presentation, mortality, and morbidity.

Materials and Methods: This study is conducted at Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India. After admission, data for the study were collected by detailed history, thorough clinical examination, and relevant diagnostic investigations performed over the patient.

Results: In our study, total abdominal injuries from June 2015 to November 2017, total injuries of splenic trauma 50, incidence of splenic trauma 25.2%.

Conclusion: Spleen is most commonly injured organ in intra-abdominal injuries age and sex has no association with the outcome of management. Mean age group involved in splenic trauma 28.45 years.

Key words: Blunt injury abdomen, Mortality, Road traffic accidents

INTRODUCTION

Although protected under the bony ribcage, the spleen remains the most commonly affected organ in blunt injury to the abdomen in all age groups. Due to the rapid industrialization and urbanization spleen are at the top of the solid organ lists injured in blunt trauma abdomen. Motor vehicle accidents account for most of the cases of splenic injury. Although protected under the bony ribcage, the spleen remains the most commonly affected organ in blunt injury to the abdomen in all age groups. Majority of cases with splenic injury are observed in the second and third decade of life, this being the most active period of life when movements in motor vehicles and outdoor works result in increased risk of trauma. These injuries are common in both rural and urban environments and result from motor vehicle crashes, domestic violence, sporting events, and accidents involving bicycle handlebars.

A quarter of a century ago, removing an injured spleen was routine surgical practice. In fact, the thought of saving a torn spleen with even a minor tear was considered quite preposterous. With the advancement of medical knowledge, conservative management has received worldwide acceptance, especially in the lesser grades of splenic injury.

All surgeons involved in emergency care, especially, whether rural or urban, must keep up-to-date on issues regarding splenic injury diagnosis, splenic salvage techniques, indications for both non-operative treatment and potential complications arising from both operative splenectomy and non-operative management of this important organ. Associated injuries to other organs, uncontrolled hemorrhage contribute significantly to morbidity and mortality.

This dissertation with analysis of 50 patients with splenic trauma attempts to put forward the observations and data

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pertaining to the comprehensive picture of recent concepts in assessment and management of splenic injuries with specific reference to non-operative management. The objective of the dissertation will be fulfilled if it can guide a general surgeon for a right decision when facing problem in management of splenic trauma.

Aims and Objectives

The aim of the study was to know the incidence of splenic trauma, means of presentation, and grade them. To present a comprehensive picture of recent concepts in assessment and management of splenic injuries with specific reference to non-operative management. To asses the failure rate of nonoperative management of splenic trauma. To asses the factors responsible for mortality and morbidity.

MATERIALS AND METHODS

This study is conducted at Mahatma Gandhi Memorial Hospital, Warangal, Telangana, India. 50 patients of splenic trauma of 252 patients of blunt injury abdomen who are admitted to Mahatma Gandhi Memorial Hospital and who underwent non-operative (13 patients), non-operative converted to operative (2 patients), and operative management (35 patients) for abdominal trauma and having splenic injury forms the material of the study. This study is conducted over a span of June 2015–November 2017.

All the patients were first received at casualty department and general surgery of the patient is done to identify emergency treatment conditions. After securing the airway and breathing an intravenous line are secured, and blood is drawn and sent for blood grouping and typing, crossmatching, urea and sugar, hemoglobin percentage. Initially, Ringer's lactate is infused for resuscitation. Depending on the severity of injury if the patient is not responding to initial crystalloids, compatible whole blood transfusion is given which are brought after cross matching from our 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 is taken, and site size, shape, and character of wounds are noted. Specific examination of the abdomen is done with special reference to tenderness, guarding and rigidity and bowel sounds. In all cases of blunt injury plain X-ray erect abdomen, chest X-ray and if necessary, plain X-ray of other parts of the body is taken. Emergency ultrasound of the abdomen and pelvic cavity of the patient is done using ultrasound machine 3.5 Mhz curvilinear transducers with the patient in the supine position by a radiologist. Unstable patients are not subjected to ultrasound. Computed tomography (CT) scan of the abdomen (with and without contrast) done for those patients who are stable, who have no free peritoneal tap, and who are planned to be managed by the non-operative procedure.

If the patient is having chest injury with or without fracture ribs and with hemothorax or pneumothorax, intercostal drainage tube is inserted in the 4th or 5th intercostal space in midaxillary line using a 32F or 28F intercostal drainage tube underwater seal kit, under local anesthesia with strict aseptic precautions.

Other associated injuries are treated by the concerned specialists of our hospital. Those patients (15) who are stable, no free diagnostic peritoneal tap, minimal free fluid on ultrasound are subjected to CT scan of abdomen and pelvis graded accordingly by grading system given by American, Association for the surgery of trauma splenic injury scale (1994 revision) and recorded and managed nonoperatively by continuous monitoring, two of them are converted to operative procedure after deterioration of the condition and contrast blush on CT scan. Rest of the patients are taken up for surgery (splenectomy) after a reasonable time of resuscitation. All the patients are operated under general anesthesia with endotracheal intubation.

Laparotomy

Incision and procedure: All the patients were operated by midline incision and incision extended when necessary. Hemoperitoneum evacuated by suction apparatus and injury evacuated. Grading of spleen injury assessed according to grading system given by American Association for the surgery of trauma splenic injury scale (1994 revision) and recorded. Spleen is mobilized after incising all ligamentous attachments (splenophrenic ligament at the superior pole and the splenocolic and splenorenal ligaments at inferior pole), then short gastric vessels are ligated splenic artery and vein are double ligated, hemostasis secured well, peritoneal cavity washed with normal saline, drain kept in the splenic bed and abdomen closed after examining liver, stomach, small, and large bowel and mesentery. Induction doses of intravenous Ceftriaxone 1 g I.V. B.D, Gentamicin 80 mg I.V. B.D, and metronidazole 500 mg I.V., T.I.D, are given to the patients. In high-risk patients cephalosporins such as cefotaxim and piperacilline with Amikacin and Metronidazole are used. The antibiotics were continued in the post-operative period and are used until the patients are discharged. Pneumococcal vaccine administered to all the patients postoperatively. Patients are allowed on an oral diet from 2nd or 3rd post-operative day if uncomplicated. Abdominal drain removed whenever the collection is <25 m1 or whenever there is no drainage. In our series, most of the drains are removed on the 3rd or 4th post-operative day.

RESULTS

Total abdominal injuries from June 2015 to November 2017 total injuries of splenic trauma 50 incidence of splenic trauma 25.2%

It is clear from above data that a maximum number of patients are in the age group of 21–30 years (38%). Mean age of presentation is 28.45 years (8–60 years). There is no single patient aged >60 years [Table 1].

Sex incidence [Table 2]

Table 2 shows 88% of patients (44) are males and 12% of patients (6/50) are females. So the male female ratio is 7.38 : 1.

Lapse Time of Injury and Admission

Lapse time of injury and admission varied from 30 min to 78 h and the patient ho injured after 78 h following injury does not remember the incidence of injury. It is clear that 58% of patients (29/50) presented within 8 h after injury.

Lapse Time of Admission and Surgery

The lapse time of surgery after the admission of the patient is varying from 30 min to 11 h 25 min. 4% of patients (2/50) are operated within 1 h that was in 30 min. One patient, who is operated after 11 h and 25 min after admission, did not respond to resuscitation.

Mode of injury [Table 3]

The Table 3 shows The maximum number of patients presented with injury are due to road traffic accidents 74% (37/50).

Vital Parameters at Admission

Nearly 75% of patients (35/50) present with stable vital data, i.e. pulse rate from 60 to 100 min and blood pressure ranging from >100 mm Hg of systolic to 70–90 mm Hg diastolic blood pressure. 24% of patients (12/50) presented with unstable vitals and were resuscitated, 3 patients presented with thread pulse and low blood pressure (shock) of which only one patient died without responding on resuscitation.

Associated Injuries

Of 27 patients, 15 patients had fractures to various bones of the body. Associated bony injuries and head injuries were managed by orthopedician and neurosurgeon accordingly. In the rest 12 patients who had associated injuries, 5 patients had laceration to the skin where suturing under aseptic conditions is done at the time of admission. The rest 7 patients had hemothorax and pneumothorax, which was confirmed with the intercoastal drainage tube was inserted for, immediately at the time of admission [Table 4].

Table 1: Age

Age of patients (years)	Number of patients (%)
0–10	5 (10)
11–20	8 (16)
21–30	19 (38)
31–40	11 (22)
41–50	4 (8)
51–60	3 (6)
>60	0 (0)

Table 2: Sex incidence

Sex	Number of patients (%)
Male	44 (88)
Female	6 (12)

Table 3: Mode of injury

Mode of injury	Number of patients (%)
Road traffic accidents	37 (74)
Wall collapse	4 (8)
Bullock cart injury	5 (10)
Fall from height (tree)	4 (8)

Table 4: Associated injuries

Associated bony injuries	Number of patients
Fracture clavicle	1
Fracture femur	5
Fracture both bone legs	2
Colles fracture	2
Fracture ribs	5
Fracture pelvis	2
Fracture both bone forearm	1
Other abdominal injuries	5
Head injuries	4
Total	27

Ultrasound Scan of Abdomen and Pelvic Cavity

In our series 88% of patients were scanned with ultrasound scan abdomen and pelvis preoperatively. The sensitivity of ultrasound scan in our series is 81.81%. Of these 44 patients, the pre-operative ultrasound scanning of the abdomen and pelvic cavity of was consistent with CT scan and laparotomy findings in 36 patients. Sensitivity in our series is 81.81%.

Incidence of Grade of Spleen Injury

The most common grade of splenic trauma is both Grade II and Grade III. These two grade constituting 78% of splenic injuries [Table 5].

Management Procedure

Of 50 patients, 13 patients are nonoperatively managed, 35 patients are operatively managed, 2 patients are initially managed, and nonoperatively then converted to operative management [Table 6].

Table 5: Incidence of grade of spleen injury

Grade of spleen injury	Number of patients (%)
I	9 (18)
II	20 (40)
III	19 (38)
IV	2 (1)
V	0 (0)

Table 6: Management procedure

Total number of patients	50
Non-operative	13
Operative	35
Non-operative converted to operative	2

Cause of Death

Nearly 8% of patients (4/50) expired. One patient died of primary hemorrhage from open fracture right femur and both bone of both legs. One patient died of acute respiratory distress syndrome following septicemia. One patient died of subdural hemorrhage. One patient died of hemorrhagic shock from pelvic fracture.

DISCUSSION

This is a prospective study of 50 patients done during a time span of June 2015–November 2017.

Splenic Trauma Incidence

Nearly 25.2% of abdominal trauma resulted in splenic injury.

Age Incidence

About 38% of patients (19/50) presented to us are in the age group of 21–30 years and 22% of patients (11/50) are in the age group of 31–40 years. Only 10% of patients (5/50) are <10 years old. There are no patients above 60 years. The most affected population is in the age group of 21–30 years (19 patients). In our series, mean age of presentation is 28.45 years (8–60). This data tally with the report of Wilson and Loris who found the greatest number of patient in the age group between 20 and 40 years, Shackford *et al.* found patient between 4 and 82 years, mean age 27.5 years and Akio and Toshibumi between 6 and 80 years with mean age of 33 years.[1,2] Brasel *et al.* found patient between 6 and 84 years with mean age of 31.4 years. Ahmed *et al.* studied mean age of presentation is 15–25 years with the incidence of 40%.[3]

Sex Incidence

In our series, 88% of patients (44/50) are males and only 12% of patients (6/50) are females. In Cocanour 11 *et al.* series 90% of patients are males and 10% of patients are females. Males are more affected with spleen injury. Hussain *et al.* studied males grossly outnumbered the females, with male-female relative percentages being 86.66% and 13.33%, respectively., Elmo *et al.* found incidence between male and female as 84.98% and 15.01%. Fuchs *et al.* found the male-female incidence of 80% and 20%. Peter *et al.*, in 1986, found the male-female incidence of 69.69% and 30.0%.[1] Akio and Toshibumi found the incidence of 81.91% and 18.8%.[2] Arlet *et al.* found the male-female incidence of 77.02% and 22.08%, respectively.

Time Interval Between Injury and Admission

The minimum lapse time was 30 min in our series and the maximum period was 78 h. 18% of patients presented within 24 h of injury. The patients who presented early within 2 h have good outcome ($P < 0.01$). 58% of patients (29/50) presented within 8 h. The patients who presented late (>24 h) had higher complication rates (52%).

Time Interval Between Admission and Surgery

About 26°/o of patients (13/50) managed nonoperatively and 70% (35/50) are managed operatively. 4% of patients 2 (50) are initially managed nonoperatively and then converted to operative procedure after 16 h, 80% of patients (28/35) are taken to laparotomy within 8 h, and 3% of patients (1/35) are taken for laparotomy within 1 h. This time duration is utilized for resuscitation and investigations whenever the patient is hemodynamically stable. If they are not stable, they are taken immediately within 1 h as we have done in 3% of patients (1/35).

Mode of Injury

In our series of road traffic accidents causing blunt trauma accounted for 74% of patients (37/50). 8% of patients (4/50) presented with injury due to wall collapse and 8% of patients (4/50) presented with injury due to fall from height (such as tree and building roof). Bullock cart as a cause of injury is seen in 10% of patients (5/50). This figure correlates with studies shown by Ahmed 46.66%,[3] Ellis and Paterson-Brown 60%,[4] Goins, Rodriguez, Manjari, Joshi and Jacob 53%, Satish and Changlani 40%, Powel *et al.* 67%, and Khanna *et al.* 52%.

Vital Data at Admission

About 76% of patients (38/50) presented with stable vitals. 24% (12/50) presented with unstable vitals. The patients were resuscitated thoroughly before taking for laparotomy with crystalloids and whole blood transfusion.

Patient Clinical Presentation

In our series, 94% of patients (47/50) presented with pain abdomen. Some of them have association with distension of abdomen and very few patients have associated vomiting (18%). 92% of patients (46/50) on examination had

tenderness and guarding and rigidity, bowel sound is present in only 56% of patients (28/50). Loris (1948) reported it to be the most common symptoms of abdominal trauma. Whiteshell reported that pain constantly dominated the symptomatology of splenic laceration. Tripathi *et al.* reported pain in 91.4% of cases. Vomiting was found in 3 patients (10%) in Ahmed study.[3]

Griswold and Collier noted that vomiting was a common symptom in 88% of abdominal injury cases.[5] Griswold and Collier stated that the splenic injury was always associated with vertigo, nausea, and vomiting.[5] Arlet *et al.* found 28% of the patient with blunt trauma abdomen presenting with vomiting.[6] Ahmed *et al.* studied that the rigidity was observed in 3 cases (10%) and mainly to the left side of the upper abdomen. Jervis *et al.* observed that the rigidity was a reliable finding in a patient with blunt trauma abdomen. 17 Fixed splenic dullness (Ballance sign) was found in 2 cases. Cope stated that demonstration of shifting dullness in the flank is sufficient to indicate bleeding from solid viscera. However, in splenic injury frequently the dullness on the left side cannot be shifted (Ballance sign).

The most common symptom is pain abdomen and clinical sign in the tenderness of abdomen associated with guarding and rigidity.

Associated Injuries

About 54% of patients (27/50) had associated injuries. 30% of patients (15/50) presented with injuries and fractures of limb bone both upper limb and lower limb. 6% of mortality (3/50) is due to associated injuries. In one patient hemorrhage from fracture femur and both bones legs lead to the death of the patient. In one patient hemorrhagic shock from pelvic fracture lead to death of patient. In one patient subdural hematoma lead to respiratory arrest and death.

Ultrasound Scan of Abdomen and Pelvis (FAST)

In our series, 88% of patients were scanned with ultrasound scan abdomen and pelvis preoperatively. The sensitivity of ultrasound scan in our series is 81.81%.

Ultrasound scan sensitivity study group 63% Bode *et al*.[7] 82% Golleti *et al*.[8] 81.81% Mahatma Gandhi Memorial Hospital. Rozycki *et al.* stated that specificity of 99.7% and sensitivity of 81.5%. Kuehnert stated that ultrasonography was able to detect abnormal fluid including hemoperitoneum in 25 of 25 patients and isolated splenic parenchymal injuries in 22 of 25 patients.

Diagnostic peritoneal tap (aspiration), either four quadrant or bilateral flank tap was performed in all 50 cases showing positive tap in 30 cases and negative tap in 20 cases. Any quantity of fluid aspirated was considered to be positive tap. Negative tap was one which did not reflect any aspirate. The entire positive tap correlated with operative findings.

CT Scan of Abdomen

CT scan was performed in a limited number of patients (21 cases). The cases which did not merit immediate laparotomy on the clinical ground or other investigation findings were subsequently subjected to CT scan whole abdomen for further evaluation. It was done in 21 patients and was found to be accurate in distinguishing subcapsular hematoma from a splenic laceration with free intraperitoneal blood and helps to diagnose accurately associated injury to other intraperitoneal and retroperitoneal structures which are of great clinical importance in the conservative management of splenic rupture. Federle *et al.* reported 99% accuracy of CT scan in 200 patients with blunt trauma abdomen. Kuehnert stated CT specificity of 99.5 % and sensitivity of 74.3%. Sutyak *et al.*stated that CT in 49 patients with 43 splenic injuries correlated surgically with CT findings.

Incision for Laparotomy

All most all patients managed by the operation, midline incision were taken.

Operative Findings

On laparotomy blood in peritoneal cavity was found in all cases. The splenic injuries varied from large subcapsular hematoma, intraparenchymal laceration. Ahmed *et al.* studied group 36.66% underwent operation. All are operated by splenectomy.[3] Satish *et al.* performed splenectomy in 111 of 150 patients, Brasel *et al.* performed splenectomy in 69 of 164 patients, Khanna *et al.* did splenectomy in 5 patients of 19 patients of splenic trauma. Dr. Stuart Thompson reported splenectomy in 30 patients of 52 patients with splenic trauma.

Incidence Grade of Spleen Injury:(Intraoperarive)

In Zucker *et al.* series Grade-I and Grade-II injuries are commonly involved accounting for 70% of patients. In our series, Grade-II and Grade-III injuries are more commonly involved accounting for 78% of patients.

Management Procedure

In Myers *et al.* series 68 of 204 were nonoperatively managed, and success rate of non-operative management is 93%, and the failure rate is 7%.

In Cocanour *et al.* series 57 of 311 patients were nonoperatively managed success rate of non-operative management is 86%, and the failure rate is 4%.

In Zucker *et al.* series 24 of 68 were nonoperatively managed, and success rate of non-operative management is 95%, and the failure rate is 5%.

In our series, 15 of 50 were nonoperatively managed, and success rate of non-operative management is 86.66%, and the failure rate is 13.34%.

All the patients were administered injection *pneumococcal* and *Hemophilus influenzae* vaccine postoperatively.

MORTALITY

Mortality rate is 8% in our series (4 patients). One patient died of a primary hemorrhage from open fracture right femur and both bone of both legs. One patient died of acute respiratory distress syndrome following septicemia. One patient died of subdural hemorrhage. One patient died of hemorrhagic shock from pelvic fracture. None of our patients are died due to non-operative management.

CONCLUSIONS

Spleen is most commonly injured organ in intra-abdominal injuries (25.2%). Age and sex have no association with the outcome of management. Males are commonly involved than females. Mean age group involved in splenic trauma 28.45 years. Time lapse between injury and treatment has a significant association with outcome. Patients who present with <2 h of injury are having a better prognosis with less morbidity and mortality ($P < 0.005$). Grade of splenic injury, continuous monitoring of the patient and associated injuries have a direct bearing on the outcome. Pre-operative ultrasound scan of the abdomen and the pelvic cavity is diagnostic of splenic with a sensitivity rate of 81.81%. Overall, splenic injuries of Grade I, II, have good outcome with non-operative management when not associated with other injuries ($P < 0.001$). Prophylactic antibiotics will prevent post-operative complications. *Pneumococcal*, *H. influenza* vaccine prevents overwhelming post splenectomy infections. Respiratory complications are common in post-operative patients. Associated injuries add to morbidity and mortality of splenic trauma patient.

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

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