

A study on management of splenic injuries in abdominal trauma

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Abstract

Aim: To study about the different grades and their clinical presentations of splenic injury and various management options of the same & their outcome on follow-up for a period of 3 months.

Background and Objectives: Spleen being a most common solid organ injured in abdominal trauma. Successful management of splenic injury consists of diagnosis and prompt management of potentially life threatening hemorrhage. The present study is conducted to highlight the important clinical manifestations, to identify different grades, to identify proper investigation modalities for rapid and accurate diagnosis and to study criteria to select best management option.

Methods: 30 consecutive cases of splenic injury at Bapuji hospital and Chigateri hospital, Davangere, Karnataka, India, were studied with regard to etiologies, clinical manifestations, best diagnostic modality available, different grades & their behavior, management options best available in our setup, outcome and complications. Patients with associated head injury and with age less than 15 years were excluded.

Results: Predominantly male patients within age group of 25-45 years were found to be more prone for traumatic splenic injury, RTA being most common cause. Pain abdomen was most common symptom and tenderness was most common sign. CT-Scan abdomen was most useful and accurate in diagnosing the injury. Grade II splenic injury was most common grade and Grade V was most fatal. Operative management was the most common modality of management. The mortality rate was 3.

Conclusion: Even with so many advances in management of splenic injury, hemodynamic instability, higher grades of injury and lack of facilities, expertise and low socioeconomic status makes NOM unsuccessful. Operative management is still most commonly used modality to manage splenic injuries.

Keywords: Grade of injury, Hemodynamic stability, Operative management, NOM (Non-operative management).

1. Introduction

Trauma is one of the leading causes of death in people younger than age 40 years and, therefore, is an important problem in general healthcare.[1,2] The spleen is one of the most commonly injured intra-abdominal organ. The diagnosis and prompt management of potentially life-threatening hemorrhage is the primary goal.

Management of splenic injuries has changed considerably during the past 20 years. Traditionally, a laparotomy and splenectomy was performed for splenic injuries. [3] The trend toward splenic salvage evolved after the identification of lifelong risk for overwhelming post-splenectomy infection (OPSI). [4,5]

Non-operative management (NOM) has now replaced splenography as the most common method of splenic salvage. Splenic artery embolization SAE can increase the success rate of NOM by stopping ongoing bleeding and by preventing delayed rupture of the spleen.[3] Nonoperative management (NOM) has evolved to be the standard of care in haemodynamically stable patients.

Splenectomy for injury was described in the 18th century and the earliest operations on the spleen were associated with severe or penetrating injuries. Splenectomy remained the standard of care for all injuries, based on multiple premises:

- Splenectomy was without consequence.

- The spleen was incapable of healing.
- Delayed splenic rupture after injury was common.[6]

The risk of overwhelming post-splenectomy sepsis (OPSI) is now well characterized after splenectomy for any cause^{7,8}. After removal of the spleen for trauma, the risk of sepsis has been noted to be 1.0–2.1% with mortality of 0.6–0.9%.⁷ Given that the overall risk of OPSI is low, a patient with an actively bleeding splenic injury should be managed according to his hemodynamic status with OPSI a minor consideration in management.

Splenic healing occurs with non-operative management; time to healing is longer with higher grade injury[9,10]. The historical view of “delayed splenic rupture” likely represented delayed recognition of a splenic injury and bleeding, rather than rupture later in the patients’ course. True delayed rupture of the spleen, with a normal CT scan or diagnostic peritoneal lavage (DPL) on admission, has an incidence of less than 1%.[9-12]

2. Methodology

2.1 Source of data

The clinical study was carried out on patients with splenic injury in abdominal trauma and was admitted to Chigateri General Hospital and Bapuji Hospital of J.J.M. Medical Collage, Davangere.

Method of collection of data, from the above mentioned source, 30 consecutive cases were taken from those who fulfill inclusion and exclusion criteria.

2.2 Inclusion criteria

- Patients admitted with history of trauma to the abdomen (blunt or penetrating) and subsequently diagnosed as having splenic injury shown by investigations.
- Patients above 15 years of age with splenic injury were included in the study.
- Unconscious patients with guarding / rigidity or distension of abdomen.

2.3 Exclusion criteria

- Patients associated with head injury.
- Patients less than 15 years of age.

The patients were selected as per inclusion and exclusion criteria. An informed consent was taken. Careful history was taken from selected patients who then underwent general and systemic examination. Patients were evaluated in the self designed examination proforma.

The relevant investigations were done to achieve the correct diagnosis. The patients were operated on emergency basis or after wait and watch policy. The operative findings were noted.

The follow up was done with regard to complications. In cases managed conservatively, the manner of management and complications were noted. The cause of death was noted in cases of death.

3. Result

The present study included 30 cases admitted in both the teaching hospitals namely Chigateri General Hospital and Bapuji Hospital, Davangere, Karnataka, India. The study was done for a period of two years from June 2011 to May 2013.

Table 1: Age Wise Distribution

Age group (yrs)	No. of cases	Percentage
15 – 25	7	23.4
26 – 35	11	36.6
36 – 45	5	16.6
46 – 55	5	16.6
56 – 65	1	3.4
66 – 75	1	3.4
Total	30	100

In the present study, maximum number of cases were in 25-35 age group (36.6%) followed 15-25 age group (23.4%). Average age was 35.9 years. Range was from 15 to 75 years.

Table 2: Sex Wise Distribution

Gender	No. of cases	Percentage
Male	24	80
Female	6	20
Total	30	100

M: F Ratio 4:1

In the present study, 24 (80%) cases were males and 6 (20%) were females. Male to female ratio was 4:1.

Table 3: Injury and Admission Interval (Hrs)

Injury and admission (Hours)	No. of cases	%
<2	4	13.4
2 – 5	18	60
5 – 10	5	16.6
10 – 24	2	6.6
> 24	1	3.4
Total	30	100

Range 1 – 18 hrs.

In this study, maximum number of patients (18) (60%) were brought to the hospital between 2-5 hours after the accident. Only 1(3.4%) patient was brought to the hospital after 24 hours. 5(16.6%) cases were brought between 5-10 hours. 4 (13.4%) cases were brought within 2 hours and 2 (6.6%) cases were brought between 10-24 hours. Range was from 1 to 18 hours.

Table 4: Admission and Surgery Interval

Admission and surgery (Hrs)	No. of cases	%
1 – 2	0	0
2 – 6	4	14.8
6 – 12	12	44.5
12 – 24	6	22.2
> 24	5	18.5
Total	27	100

In the present study, 27 (90%) out of 30 cases were managed surgically. The time interval between admission and surgery varied from 2-47 hours with a mean interval of 15.37 hours.

6 cases (22.2%) were operated between 12-24 hours of admission. 4 (14.8%) cases were operated 2-6 hours after admission. Maximum number of cases 12 (44.5%) were operated between 6-12 hours. 5 cases (18.5%) were operated after delay of more than 24 hours.

Table 5: Duration of Hospital Stay (Including Deaths)

Duration of stay (days)	No. of cases	%
<1	2	6.7
1 – 5	0	0
5 – 10	8	26.6
10 – 15	12	40
15 – 20	6	20
>20	2	6.7
Total	30	100

In the present study, duration of stay raised from 1-18 days. Mean duration of stay was 11.26 days. Mean duration of stay for operated cases was 11.5 days and that for nonoperated cases was 20 days. 2 (6.7%) patients stayed for >20 days. Maximum number of cases 12(40%) stayed for 10-15 days. 8 patients (26.6%) stayed for 5-10 days and 6(20%) patients for 15-20 days whereas 2 (6.7%) patients died within 1 day of admission.

Table 6: Etiology of Injuries

Nature of injury	No. of cases	%
Road traffic accidents	20	66.6
Fall from height	6	20
Hit by blunt objects	3	10
Assault	1	3.4
Total	30	100

In this study, most common cause of splenic injuries was road traffic accidents (20) (62%) cases. Second common cause was falls (6)(20%). Other causes were hit by blunt objects and assaults.

Table 7: Type of Injury

Signs	No. of cases	%
Blunt injury	30	100
Penetrating	0	0

In this study all the cases studied are with blunt trauma to abdomen, none were with penetrating injury.

Table 8: Signs

Signs	No. of cases	%
Tenderness	30	100
Guarding	30	100
Rigidity	16	54
Distension	4	14

In the present study 30(100%) patients presented with tenderness and guarding at the time of admission. Next most common sign was local or generalised rigidity (16) (54%) cases, followed by distension which was present in 4 (14%) of cases.

Table 9: Symptoms

Symptoms	No. of cases	%
Pain abdomen	30	100
Vomiting	13	44
Distension	7	24

In the present study most common symptom was pain abdomen (100%). Next common symptom was vomiting 13(44%) cases, followed by distension of abdomen 7 (24%).

Table 10: Associated Injuries

Organ	No. of cases	Operated	Conservative
Liver	4	2	2
Rib	20	-	20
Bowel	0	-	-
External injuries	7	-	7

In our study rib fracture was the most common associated injury (19) (64%). 7(24%) cases had external injuries in the form of abrasion and contusion. Liver was injured in 4 (14%) cases. None of the patients had associated bowel injury.

Table 11: Investigations

Investigations	No. of cases
Ultrasound abdomen	30
X-ray abdomen	30
Diagnostic aspiration	30
CT-scan abdomen	28
Hb (%)	30

Table 12: Grades of Splenic Injury

Grades	No. of cases	%
I	3	10
II	11	36.6
III	7	23.4
IV	7	23.4
V	2	6.6
Total	30	100

In the present study maximum cases (11) (36.6%) had grade II injuries, and most of them are due to RTA. Grade V injuries seen in 2 (6.6%) cases and was proved to be more fatal. 3 cases had grade I injury, 7 cases had grade III and 7 cases had grade IV injury.

Table 13: Management

Type	No. of cases	Percentage
Non operative	3	10
Operative	27	90
Total	30	100

In our study 27(90%) cases were managed using operative procedures. 3 (10%) cases were managed non-operatively, that is by observation.

Table 14: Operative Procedures

Management	No. of cases	Percentage
Splenorrhaphy	6	22.2
Partial splenectomy	2	7.4
Splenectomy	16	59.2
Laparoscopic packing	3	11.2
Total	27	100

In our study 6 (20%) cases underwent splenorrhaphy, out of which 2 were performed using mesh wrap. 2 (6.6%) cases managed with partial splenectomy. Maximum number of cases (16) (53.4) underwent splenectomy and 3(10%) cases were managed by laparoscopic packing to achieve haemostasis as observation was failed in them.

Table 15: Post-Operative Complications

Complications	No. of cases	%
Wound infection (WI)	2	6.6
Wound dehiscence (WD)	1	3.3
Pneumonia (Pne)	1	3.3

In the present study wound infection was the most common complication after the surgery. It was seen in 2 (6.6%) cases. 1 patient (3.3%) developed pneumonia. Wound dehiscence developed in 1 (3.3%) case.

Table 16: Causes of Death

Cause of death	No. of cases
Sudden cardiac arrest	2
ARDS	1
Total	5(10%)

In our study sudden cardiac arrest was the most common cause of death (2 cases). One patient died of ARDS.

Follow-up

Sincere efforts were made to follow up all the cases during the period of study. Most of the patients in non operative group recovered well and did not have any problems later on. Among the operated cases one patient who was underwent splenectomy was readmitted 2 months later for pneumonia. All other operated cases were doing well till the end of the study.



Figure 1: Contuion over anterior abdominal wall in splenic injury patient



Figure 2: Shattered spleen specimen



Figure 3: On table findings of Grade III Splenic injury

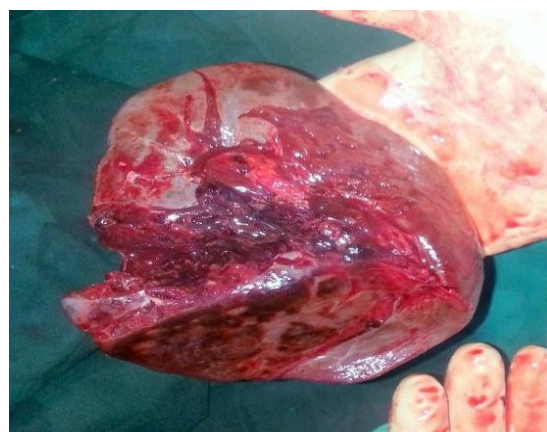


Figure 4: Grade IV splenic injury specimen

4. Discussion

4.1 Age wise distribution

In the present study, the maximum numbers of cases were in third decade of life (36.6%). Most of the cases were in second to fourth decades of life. This indicates trauma is more common in young people. Range was from 15 years to 35 years. There were only 2 cases (6.8%) beyond 56 years of age. Average age was 35.9 years. Sinha S *et al* (2008)[14] reported similar findings with more than 3/4th of victims in first four decades of life and majority belonging to 15-45 years age group.

4.2 Sex wise distribution

In the present study, 24 (80%) patients were males and 6 (20%) were females. In our study male to female ratio was 4:1. Male to female ratio was less in our study as compared to other studies like Sinha S *et al* (2008)[13] reported a ratio of 6:1 and Garber BG *et al* (2000)[15] reported a ratio of 7:1. This difference was due to more number of cases and more years of study duration included in their study.

4.3 Injury and Admission Interval

In our study, maximum number of patients (18) (60%) were brought to the hospital between 2-5 hours after the accident or injury. 4 (13.4%) patients were brought to the hospital within 2 hours of injury. 2 (6.6%) cases were brought between 10-24 hours and 1(3.4%) case was brought

after 24 hours. Range was from 1 to 18 hours. The delay in hospital admission was probably due to the fact that both the teaching hospitals are referral hospitals and patients were referred from primary health centers or District Hospitals or private nursing homes up to a distance of 150 kms. Delay in most cases was due to distance travelled or difficulty in transportation due to unavailability of resources, poor socioeconomic status. Delay in hospital admission is also reported by other Indian authors as well.[16]

4.4 Admission and surgery interval

In our study, 27 (90%) out of 30 cases were managed surgically. The time interval between admission and surgery varied from 2-47 hours with a mean interval of 12.7 hours. Maximum number of cases 16 (59.3%) were operated between 2-6 hours. 2 (12.5%) cases were operated between 6-12 hours of admission. 4(14.8%) cases were operated between 12-24 hours after admission. This time interval was used to resuscitate the patients, doing diagnostic investigations, arranging blood. 5 (18.5%) cases were operated after delay of more than 24 hours. These were the cases in which non operative treatment was tried initially.

4.5 Duration of Hospital Stay

In our study, duration of stay varied from 1-23 days with a mean duration of 12.4 days. Mean duration for operated cases was 11.5 days and that for non operated cases was 20 days. Only 2(6.7%) patients stayed for 1 to 5 days, out of which 2 had expired on the same day of admission. A case of Grade I splenic injury after blunt trauma abdomen stayed for a maximum of 23 days. Mean duration of stay in our study was little higher as compared to other studies [14], which reported mean hospital stay of 13.9 days for the nonoperated group and 8.4 days for the operative group.

4.6 Etiology of Injuries

The most common cause of splenic injury in abdominal trauma is Road traffic accidents (66.6%) in our study which is comparable to most other studies. Sinha S *et al*[14] also reported 62% cases of blunt injury abdomen were due to RTA. Fall from height was found to be the second most common cause (20%). Other important causes were hit by blunt objects (10%) and assaults (3.4%).

4.6.1 Signs

Out of 30 cases in our study, all had abdominal tenderness at the time of admission. Local or generalized guarding was present in all 30 (100%) cases. Only 3 cases (10%) that had guarding could be managed conservatively which indicates guarding is usually associated with severe injuries. 5 (16%) patients presented with shock. Systolic BP of less than 90 mmHg at admission was considered as shock. Out of 5 patients in shock 1 had associated liver injury. Rigidity was observed in 16 (54%) cases and abdominal distension was observed in 4 (14%) cases.

Forsythe et al[17] also reported tenderness as most common sign.

4.6.2 Symptoms

In our study, the most common symptom was pain abdomen (100%). Vomiting was the second most common symptom 13 (44%) followed by distension of abdomen 7 (24%). Another study by Forsythe *et al*[17] also reported pain abdomen in 91% of their patients.

4.6.3 Associated injuries

In our study, rib fracture 20 (67%) was commonest associated injury. All cases were managed conservatively by using thoracic binder.

7 (24%) cases had associated external injuries (4 abrasions, 3 contusions), were managed conservatively by cleaning and dressing.

Liver was involved in 4 (14%) cases. 2 cases were with liver haematoma, and 2 cases were with liver laceration. Lacerated cases were managed by hepatorrhaphy.

4.6.4 Investigations:

In our study, x-ray erect abdomen was done in 30 cases. It detected rib fracture in 20 cases. In our study USG abdomen was done in 30 cases. In 22 cases it diagnosed splenic laceration, but in 8 cases it failed to diagnose splenic laceration which was subsequently diagnosed using CT-scan.

In the present study diagnostic aspiration was done in 30 patients and it was positive in 28 cases. On comparison with laparotomy results it was found to be true positive in 18 cases, which is comparable to another study [18], which showed diagnostic aspiration to be 90% accurate.

In our study CT-scan was done in 28 cases, and it was positive in all the cases was found to be the best modality to diagnose and subsequently to select method of management.

4.6.5 Management:

Out of 30 cases in our study 27 (90%) were managed surgically and 3 (10%) were managed conservatively, that is by observation. Among 27 patients, 16 patients underwent splenectomy and other 11 patients underwent splenic salvage procedures.

Among 16 cases of splenectomy group, 3 cases had grade V splenic injury, 6 cases grade IV, 5 cases grade III, 2 cases grade II. In 2 cases of grade II injury and 1 case of grade III injury, it was not possible to achieve haemostasis intra operatively as splenic parenchyma was crushed.

6 cases among operative group underwent splenorrhaphy. Out of which 5 cases had grade II splenic laceration, 1 case had grade III. Splenorrhaphy was performed by using horizontal mattress sutures except for 2 cases in whom it was performed by using mesh wrapping. 2 cases underwent partial splenectomy, among these cases, 1

had grade III and another had grade II splenic laceration at one of the poles of spleen. 3 cases underwent laparoscopic perisplenic packing to achieve haemostasis as these cases failed observation.

3 cases managed conservatively by observation, out of these 2 cases had grade I and 1 case had grade II splenic injury. Nonoperative management consisted of I.V Fluids, blood transfusion, nasogastric aspiration, antibiotics, analgesics, serial haemoglobin estimation.

14 cases, who underwent splenectomy were vaccinated with all 3 vaccines except for the 2 cases who expired on the day of surgery. There were 3 mortalities in operative group whereas 2 patients had morbidity in the form of post operative complications. The results were comparable to a study by Sinha *et al.*[14]

All cases in operative and nonoperative group recovered uneventfully. There were 3 mortalities in operative group out of which 2 cases expired due to sudden cardiac arrest and 1 case due to septicaemia in postoperative period. 4 cases had morbidity in the form of post operative complications like wound infection, wound dehiscence and pneumonia.

It was observed during the study that splenic injuries with higher grade had a greater propensity to undergo surgical management.

In our study it was observed that most of the patient who underwent surgical management had higher grades of splenic injury with haemodynamic instability. A study by Sinha *et al*[14] showed that incidence of operative management increases as grades of splenic injury increases. The same study also showed that the rate of nonoperative management vary in relation to haemodynamic stability of patient, type of injury and availability of expertise (facility).

4.7 Mortality

In our study, out of 30 cases, 3(10%) cases ended up in mortality. Sudden cardiac arrest was the most common cause of death (2 cases). ARDS was the cause in one case. A study by Garber *et al*[15] reported 8 % mortality.

5. Conclusion

Spleen is most commonly injured organ after blunt trauma to abdomen, while spleen is also frequently injured in penetrating trauma to left upper quadrant. Improvement in assessment of injuries with adjuncts such as Focused Assessment with Zoography for Trauma (FAST), Abdominal Computed Tomography (CT) has allowed reliable identification of splenic injury. From our study we conclude that even though there is an increasing trend towards the non operative management of splenic injuries due to abdominal trauma, surgical management is most commonly used modality to treat splenic injuries in country like India due to lack of facilities and low economic status.

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