

**Research Article**

DOI: <http://dx.doi.org/10.18203/2349-2902.isj20151096>

## **Splenic injury: a clinical study and management in a tertiary care hospital**

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**Received:** 08 September 2015

**Revised:** 23 September 2015

**Accepted:** 08 October 2015

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### **ABSTRACT**

**Background:** Splenic injury is one of the most commonly injured solid organs in blunt abdominal injury and it is often associated with significant mortality and morbidity. With the advancement in diagnosis and treatment, the management strategy has gradually changed to a non-invasive management. This study is aimed to study the Clinical presentation in a patient with splenic trauma, importance of FAST and CT scan in a patient with splenic trauma and to study the line of management in special reference to non-operative management.

**Methods:** A retrospective study of 30 splenic injury patients who were admitted under the Department of Surgery, GMCH between June 2012 and May 2013 was done. Data regarding demographic details, mode of injury, investigation findings, management and outcome, hospital stay and follow up were recorded and analyzed. USG (FAST) and CT scan findings were used to grade the splenic injury.

**Results:** 30 patients were included in the study. All patients with Grade I and Grade II injury were managed conservatively. In Grade III injury 5 patients were managed non-operatively and 7 patients operatively. In Grade IV injury 4 patients were managed non-operatively while 2 patients required operative intervention. In Grade V injury, 2 patients needed splenectomy while 2 were treated conservatively. Thus, there is a trend towards non operative management of splenic injury especially in the lower Grades.

**Conclusions:** Non-operative management of splenic injury can be done without increased mortality and morbidity through proper monitoring, rest, blood transfusion and repeated imaging studies especially CT scan.

**Keywords:** Splenic injury, FAST, CT scan

### **INTRODUCTION**

Due to the rapid industrialization and urbanization spleen is 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. Majority of cases with splenic injury are observed in 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.

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 in medical knowledge, conservative management has received worldwide acceptance, especially in the lesser grades of splenic injury.

A review of world literature indicates that the reasons for routine splenectomy for trauma can be traced to four sets of misconceptions, passed on from generation to generation of surgeons viz.: (a) the spleen has no function

and is, therefore, not essential for life, (b) non-operative management carries a high mortality of 90 to 100%, (c) imminent danger of delayed rupture, if the spleen is not removed and (d) the spleen is a friable, vascular organ and, therefore, splenic lacerations cannot be safely sutured.

The evolution of the present policy of conservative management is, indeed, a landmark in the history of clinical research. It tells how a rational inquiry supported by a well-planned study can change a centuries-old irrational surgical practice.

In this study, all the patients admitted in general surgery department with splenic injury following blunt trauma abdomen were studied. The aims and objectives of this study are:

1. Clinical presentation in a patient with splenic trauma,
2. Importance of FAST and CT Scan in a patient with splenic trauma,
3. To study the line of management in special reference to non-operative management.

## METHODS

A clinical study of “splenic trauma and its management” was carried out in the Guwahati Medical College and Hospital for a period of one year with effect from 1st June 2012 to 31st May 2013. During the defined study period, patients with history of splenic trauma who were treated under the various surgical wards of Guwahati Medical College and Hospital were studied. Patients were selected randomly for ages above 14 years and both the sexes and detailed clinical history and physical examination were carried out. Some of the patients with history of splenic trauma were excluded from our study on the basis of the following criteria- patients below 14 years of age, iatrogenic splenic injury, and spontaneous rupture of spleen following splenic abscess.

Clinical history regarding the mode of splenic injury was taken and a quick general examination was done for all patients immediately on arrival at surgical outpatient department or casualty to look for the vital signs and for any external haemorrhage due to associated injury. If the patient was in collapsed state or shock immediate resuscitative measures were done. Careful examination of the abdomen and other systems was done for each patient. Relevant investigations were done for all the patients and this included- blood investigations, chest x ray, x-ray plain picture abdomen (in erect or sitting position), ultrasonography (FAST), and CT scan of the abdomen. CT angiography was done for one patient.

The patients were closely monitored and decision was taken whether to continue conservative management or undertake laparotomy. Patients who did not respond to conservative treatment, patients who were haemodynamically unstable, and showed deterioration

despite aggressive resuscitation, who showed features of continued intra-abdominal hemorrhage and peritonitis and those who had evidence of bowel injury were taken up for laparotomy.

Data regarding demographic profile of the patients, mode of injury, signs and symptoms, imaging studies, operative findings, associated injuries, transfusion requirements, post-operative morbidity and mortality, length of hospital stay were recorded. Follow up status of the patients were obtained from the respective admitting units.

Upon discharge, patients are typically restricted from participation in high-risk activities such as skiing, mountain biking, skydiving, wrestling, contact sports, military combat, and vigorous sexual intercourse for a period of up to three months. Patients are also advised to report to the hospital immediately if there is high fever with altered sensorium.

## RESULTS

During the period of study from 1st June 2012 to 31st May 2013, 30 patients with splenic trauma admitted in the Department of Surgery, Gauhati Medical College Hospital, were taken up for the purpose of this study. Age of the patients varied from 15 years to 65 years. Peak incidence was in the age group of 15 to 25 years (40%) followed by the age group of 26 to 35 years (26.66%). The mean age was 40 years. Male was affected more than the female with the male to female ratio of 6.5:1. In the study we had 26 male and 4 female patients.

Road traffic accidents were the commonest cause of splenic injury accounting for 66.66% of the cases (20/30). Of these, 46.66% (14/30) resulted from motor vehicle accidents while motor cycle accidents accounted for 20 % (6/30) cases. This was followed by fall from height 10% (3/30), street injury 10 % (3/30) and assault 6.66% (2/30). One of the patients got injured by an animal (cow) and one patient had sustained injury while playing football. These cases included both isolated splenic injuries as well as polytrauma. Associated intra and extra abdominal injuries were found in 9(30%) splenic trauma patients. Most common injuries were chest injury with 4 patients (44.44%), followed by the liver injury with 2 patients (22.22%) while head injury, renal injury, and intestinal perforation were present in 1 patient each (11.11%).

Pain was the most common presenting symptom (56.66%). Distension of abdomen was the next in frequency with 6 patients (20%), followed by vomiting (10%) and dyspnea (10%). One patient (3.33 %) had oliguria. Among the physical signs, abdominal tenderness was the most common physical finding being present in 19 (63.33%) patients. This was followed by abdominal distention in 10( 33.33%) patients, tenderness over the chest in 9 (30%) patients, shock in 4 patients (13.33%), abdominal rigidity in 3 (10%) patients, absent bowel sound in 2 patients (6.66%) and pallor in 2 (6.66%)

patients. Most of the patients had combinations of two or more of the above signs.

**Table 1: Time interval between injury and operation.**

Sl. No.	Time interval (from injury to operation)	No. of cases	percentage
1	Within 6 Hrs	5	45.45%
2	6-12 Hrs	1	09.09 %
3	12-24 Hrs	2	18.18 %
4	24-36 Hrs	1	09.09 %
5	36-48 Hrs	0	00.00 %
6	48-72Hrs	1	09.09 %
7	After 72 Hrs	1	09.09 %

**Table 2: Operative findings.**

Sl. No.	Findings	No. of cases	Percentage
1	large subcapsular hematoma (Gr III)	2	18.18 %
2	intraparenchymal laceration(Gr III)	4	36.36 %
3	laceration with involvement of hilar vessels(Gr IV)	1	09.09 %
4	Intra parenchymal laceration (Gr III)	1	09.09 %
5	Avulsed spleen with extensive perisplenic hematoma (Gr IV)	1	09.09 %
6	completely shattered spleen(Gr V)	2	18.18 %

Diagnostic peritoneal tap was performed in all 30 cases with splenic trauma. Non clotting blood was present in 18 cases while the remaining 12 patients had a negative tap. All 30 patients underwent USG (FAST) in the casualty department itself. USG detected splenic injuries in 25 patients (83.33%), hemoperitoneum in 22 patients (73.33%) and hepatic injuries in 5 patients (16.66%). 4 patients had chest injuries (13.33%) and 1 patient had multiple ring-down artifacts. 5 patients had more than one visceral injury. Only 21 patients had undergone CT scan examination. All the 18 patients had splenic injury, 3 patients had hepatic injury and one patient detected with renal injury. In this study only one patient had undergone for CT scan angiography, who has detected active blush.

19 out of 30 patients (63.33%) were managed conservatively with rest, nasogastric aspiration, intravenous antibiotics, intravenous fluids, blood transfusion, analgesics & sedatives and splenic artery embolization. Rest 11 patients (36.66%) had undergone operative management. A decision for laparotomy was taken based on one or more of the following- obvious clinical deterioration, unexplained sustained hypotension (Systolic BP < 90 mmHg with further fall in erect

posture) not responding to fluid challenge, signs of continuing intraabdominal haemorrhage in an initially normotensive patient (drop in Hb% by > 1.5 gm% or systolic BP < 90 mmHg/progressively falling hematocrit/appearance of free fluids in the abdomen within 3 hours of admission), signs of generalized peritonitis or associated intra-abdominal injury (increasing abdominal distension, tenderness and rigidity, vomiting, absent bowel sounds), paracentesis positive for blood with any one or more of the remaining criteria's, increase in size of the splenic hematoma on repeat abdominal USG, and active blush on CT Angiography (Figure 1). Some patients initially selected for non-operative management ultimately needed operation on the basis of deteriorating symptoms and signs. Time interval between injury and operation varied from 2 hrs to 72 hrs.

On laparotomy blood in peritoneal cavity was found in all cases. The splenic injuries varied from large sub capsular hematoma, intraparenchymal laceration, and laceration with involvement of hilar vessels to completely shattered spleen and splenectomy was performed in all those cases. Out of the 11 patients who underwent splenectomy, 7 had grade III, 2 had grade IV and the remaining 2 had grade V splenic injury.

Post-operative complications were recorded in 6 patients (20%). Out of the 6 patients, wound related infection was the most common complication with 3 patients (50%). UTI was found in 1 patient (16.66%) and 1 patient had chest infection (16.66%). Intra peritoneal abscess was detected in 1 (16.66 %) patient. In our study, total 2 (6.66%) patients had expired, one (3.33%) patients died in the operative group and one (3.33%) patient expired in the non-operative group. All the patients were associated with splenic injuries.

All the patients were followed up for a variable period as feasible within this time frame. All patients could be followed up to the first and second visit. Thereafter the number of patient dramatically decreased. During the follow up period patients were examined for evidence of thrombocytosis, overwhelming post splenectomy infection or infection with capsulated organism.

## DISCUSSION

In this present study, the commonest age group of patients was found to be between 15 and 25 years, with an incidence of 40% (12 out of 30 patients). Age of the patient ranged from 15 years to 65 years with mean age group of 40 years. 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, Peter 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.<sup>1,2</sup> Karen J. Brasel et al found patient between 6 and 84 years with mean age of 31.4 years.<sup>3</sup>

In this study males grossly outnumbered the females, with male-female relative percentages being 86.66% and 13.33% respectively. Review of other series shows similar results. The report of Stork, 1940, showed the incidence of splenic injury in male and female as 69.69% and 30.3% respectively.<sup>4</sup> Elmo et al found incidence between male and female as 84.98% and 15.01%.<sup>5</sup> Fuchs et al found male-female incidence of 80% and 20%.<sup>6</sup> Peter et al in 1986 found male-female incidence of 69.69% and 30.0%.<sup>1</sup> Akio & Toshiumi found incidence of 81.91% and 18.8%.<sup>2</sup> Arlet et al found male-female incidence of 77.02% and 22.08% respectively.<sup>7</sup> The higher incidence of splenic trauma in male is due to the fact that, the males are more exposed to trauma because of their outdoor works. But in west this difference is relatively narrow



**Figure 1: Active splenic blush.**

In the present study the most common cause of blunt splenic trauma was found to be motor vehicle accident, accounting for 46.66% of cases. This figure correlates with studies shown by Bailey 60%, Goins, Rodriguez, Manjari, Joshi and Jacob 53%, Satish D and T.T. Changlani 40%, Powel and Colleagues 67%, R. Khanna et al 52%.<sup>8-12</sup>

**Clinical features: Symptoms:** Abdominal pain was the symptom present in 56.66% of cases (17 patients). Pain varied from mild to severe. But Stork reported that, pain is frequently slight or absent.<sup>4</sup> Loris (1948) reported it to be the commonest symptoms of abdominal trauma. Whiteshell reported that pain constantly dominated the symptomatology of splenic laceration.<sup>13</sup> Tripathi et al reported pain in 91.4% of cases.

Vomiting was found in 3 patients (10%). Carter and Griseff noted that vomiting was a common symptom in 88% of abdominal injury cases.<sup>14</sup> Griswold and Collier stated that, splenic injury was always associated with vertigo, nausea and vomiting.<sup>15</sup> Arlet et al found 28% of

the patient with blunt trauma abdomen presenting with vomiting.<sup>7</sup> In the present series 4 (13.33%) patients presented with shock. Shock was either due to hypovolemia or reflex due to severe pain or apprehension. Stork described two types of shock in abdominal injury cases - hypovolemic and due to psychogenic and neurogenic influences.<sup>4</sup> Davies reported hypovolemic shock in 12% of patients out of his 437 patients of blunt abdominal injury. Tripathi et al reported shock in 37% of cases.<sup>16</sup>

Tenderness was found in 19 numbers of cases (63.33%) and found to be more in the left hypochondrium and epigastrium. Whiteshell reported that tenderness constantly dominated patient with splenic laceration.<sup>13</sup> Tripathi et al reported tenderness in 91.4% of cases.<sup>16</sup> Signs: In the present study the rigidity was observed in 3 cases (10%) and mainly to the left side of the upper abdomen. Jervis et al observed rigidity was a reliable finding in patient with blunt trauma abdomen.<sup>17</sup> 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. But in splenic injury frequently the dullness on the left side cannot be shifted (Ballance sign). Diagnosis: Ultrasonography (FAST) of abdomen -Ultrasonography was performed in all 30 cases with splenic trauma as soon as the patients reached surgery department (within 15-20 mins). Johns et al suggested USG can be done in abdominal trauma in 10-15 minutes time and can be repeated to detect the progress. Ultrasonography (FAST) is a routine investigation for blunt abdominal trauma and is found to be safe, accurate and absolutely non-invasive and is not time consuming and 25 out of 30 patients (83.33%) detected with splenic injury preoperatively. Karen J. Brasel et al stated that ultrasound had an accuracy of 95.6% in trained hands. Rozycki et al stated specificity of 99.7% and sensitivity of 81.5%. Mathew J Kuehnert stated ultrasonography was able to detect abnormal fluid including hemoperitoneum in 25 of 25 patients and isolated splenic parenchymal injuries in 22 of 25 patients. Straight skiagram of abdomen-Straight skiagram of abdomen including lower chest was done in 12 cases only as few patients were too critical for radiography. Obliterated psoas shadow was found in 5 cases who at operation were found to have intraperitoneal haemorrhage. Generalized haziness was found in three cases due to hemoperitoneum. Kravit said X-ray sign of splenic rupture are displacement of splenic flexure of colon and gastric air bubble, visible splenic enlargement, elevation of left hemidiaphragm; loss of psoas margin, ground glass appearance i.e. increased radio density throughout the abdomen due to intraperitoneal blood. One patient had gas under the diaphragm in straight x-ray of abdomen due to associated bowel perforation.

**Diagnostic peritoneal tap (aspiration):** Diagnostic peritoneal tap (aspiration), either four quadrant or bilateral flank tap was performed in all 30 cases showing positive tap in 18 cases and negative tap in 12 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. Patients with negative tap were treated successfully conservatively. No untoward complication was found in present study, confirming the safety of the method as shown by Neuhaf and Cohen and Tripathi et.al.<sup>15,18</sup> CT SCAN of abdomen : CT scan was performed in limited number of patients (21 cases). The cases which didn't merit immediate laparotomy on 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 is of great clinical importance in the conservative management of splenic rupture. Federle and Co-workers reported 99% accuracy of CT scan in 200 patients of blunt trauma abdomen. Matthew J Kuehnert stated CT specificity of 99.5 % and sensitivity of 74.3%. Sutyak and coworkers stated CT in 49 patients with 43 splenic injuries correlated surgically with CT findings.<sup>19</sup> Most of the patients with grade I and grade II splenic injury can be managed non-operatively. Stassen and co-workers cited that Intravenous contrast enhanced computed tomographic scan is the diagnostic modality of choice for evaluating blunt splenic injuries.<sup>20</sup>

### **Treatment**

**Conservative management:** In our present study, out of 30 cases with splenic trauma 19 cases were managed non-operatively (63.33%), and out of 19 patients 18 cases were managed conservatively (94.73%) and 1 case with splenic artery embolization (5.26%). Among the 19 patients who were selected for non-operative management-

1. Grade I- 5 Patients
2. Grade II – 3 Patients
3. Grade III – 5 Patients
4. Grade IV – 4 Patients
5. Grade V – 2 Patients

In the present study there is reported only one patient died in this group and success rate is 94.73 %. Cogbill reported 72-93% success rate for Non Operative Management. Shakford & Molin reported 69%, Smith reported 31-48% success rate for Non Operative Management. Matthew J. Kuehnert reported 83%, Satish D & TT Changlani reported 90% success rate for Non Operative Management.<sup>10</sup> Schurr et al reported 87%, Smith et al reported 97%, Archeriet al reported 93%, Morrell et al reported 52% success rate for Non Operative Management.<sup>21</sup> Davis et al reported 94%, Myers et al reported 93%, Cocanour et al reported 86% success rate and Rajani RR et al reported 77-96% for non-operative management of splenic trauma.<sup>22</sup> Operative

management: In the present study, 11 out of 30 patients underwent operative management (36.66%). Out of 11 patients, 2 cases were initially selected for conservative management and due to the deterioration of the clinical status, ultimately taken up for laparotomy.

**Incisions:** Most commonly paramedian incisions either rectus splitting or rectus retracting, were used. Out of 11 Patients, who underwent operation, midline incision were used in 4 patients, midline incision with lateral extension (T or L Shaped) in 5 patients, left paramedian incision with lateral extension were used in 1 patients and in 1 patient left subcostal incision with hockey stick extension was used.

In all cases liberal incisions were used to give adequate exposure. Webb et al and Jervis et al found that vertical incisions (paramedian or midline) were advantageous for extending upwards or downwards or for lateral extension.<sup>17,23</sup>

**Operative findings:** On laparotomy blood in peritoneal cavity was found in all cases. The splenic injuries varied from large subcapsular hematoma, intraparenchymal laceration and laceration with involvement of hilar vessels to completely shattered spleen and splenectomy was performed in all those cases.

**Splenectomy:** Out of 30 cases with splenic trauma 11 patients needed operations (36.66%). The entire splenic injury patient's treated operatively underwent splenectomy in this study. Dr. Stuart Thompson reported splenectomy in 30 patients out of 52 patients with splenic trauma. Eraklis et al performed splenectomy in 467 children.<sup>24</sup> Singer et al 688 patients, Balfanz et al performed splenectomy in 12 patients.<sup>25,26</sup> Robinette and Fraumeni in 740 patients, Matthew J Kuehnert in 12 of 144 patients, Satish D et al performed splenectomy in 111 of 150 patients, Karen J Brasel et al performed splenectomy in 69 of 164 patients.<sup>10,27,28</sup>

Khanna et al did splenectomy in 5 patients out of 19 patients of splenic trauma.<sup>12</sup> In 1952, King and Schumaker reported fatal post-splenectomy infection in infants with spherocytosis.<sup>21</sup> Since then a number of reviews concerning overwhelming post-splenectomy infection (OPSI) have been published. Eraklis & Filler reported OPSI in 3 of 342 children (0.9%), Singer 25 (1973) reported 10 of 688 children (1.45%) with OPSI, Balfanz et al reported 5 of 12 adults with OPSI, Matthew J Kuehnert reported 0-2.2% adults with OPSI, Satish Det al reported 5% after splenectomy and over all incidence 3-8%.<sup>10,24,26</sup>

All the patients were administered injection pneumococcal and meningococcal vaccine as early as possible post operatively.

### **Results**

In our study we have managed successfully grade III & IV splenic injury and one patient with grade V conservatively and splenectomy was performed with all grade IV and grade V injuries showing hemodynamic instability. One patient with grade V died who was managing conservatively and one patient with grade V died post splenectomy at day 5th day post operatively. Karen J Brasel reported successful non operative

management in 6 patients with grade I-III splenic injury and 5 patients with grade IV splenic injury.<sup>4</sup> Matthew J Kuehnert reported that all grade I injuries and 57% grade II injuries were repaired using hemostatic agents only. The rest of the grade II injuries and all grade III injuries required suture or mesh bag. Of the grade IV injuries 80% were treated with segmental splenectomy, 8% with total splenectomy and 12% with suture repair. All grade V patients underwent total splenectomy. Satis D et al reported 40% patient with grade I and grade II splenic injury, 50% with grade III and grade IV splenic injury and 10% with grade V splenic injury (out of total 150 cases).<sup>4</sup> R. Daniel et al stated that most grade I and grade II injuries can be managed non operatively, these accounts for about 60-70% of cases of non-operative management. As experience has accumulated, most feel comfortable with observing stable grade III injuries and many have begun observing grade IV and V injuries.

### Complication

In our present study, POST operative complications were recorded in 6 patients (20 %). Wound related complications were most common. Only in 25 patients, we could follow up for more than 6 month. Out of these 25 patients, only one had recurrent chest infection.

**Table 3: Complications.**

Sl. No.	Complication	No. of cases	Percentage (out of 6 patients)
1	Wound infection	3	50 %
2	Urinary tract infection	1	16.66%
3	Chest infection	1	16.66%
4	Intra peritoneal abscess	1	16.66%

### Associated injury

Associated (both intra and extra abdominal injuries) were found in 9 cases (30 %). The incidence of associated intra-abdominal injury was 44.44 % (total 4 out of 9 patients) and extra abdominal injuries were 55.55% (total 5 out of 9 patients).

Chest injury with rib fracture was found in 4 patients and other extra abdominal injuries were head injury in 1 patient with minor scalp laceration and subdural hematoma. Among the intra-abdominal injuries, hepatic injury was found in 2 patients, bowel injury in 1 patient and renal injury with 1 patient.

Allen and Curry studied patient with blunt abdominal trauma and found that extra abdominal injuries as:<sup>29</sup> thoracic injury 6.1%, skeletal 58.9%, craniocerebral 47.2% and spinal injury 2.2%. David et al studied 913 patients with blunt abdominal trauma and found 77 extra

abdominal injuries in 47 patients.<sup>31</sup> Mclellan et al studied 919 patients with blunt abdominal trauma between 1979 and 1983 and found extra abdominal injuries as:<sup>31</sup> Head injury 81%, thoracic injury 59%, pelvic fracture 22%, spinal cord injury 4% of cases. Akio Toshibumi.<sup>2</sup> In the group of patient with polytrauma 80% patient had combined injury (Cranio-cerebral and trauma of locomotor system) and 20% patient had multiple abdominal injuries. Mortality: Only 2 patient died in this series (one in operative group and second with non-operative group), making the overall mortality rate of 6.66 %. The cause of death was hypovolaemic shock due to suspected dislodge of splenic hematoma on 3rd day who was managing conservatively and second case was due to generalized septicemia with secondary haemorrhage on 5 days of splenectomy with associated necrotizing pancreatitis detected only after reexploration. Satish Dharap and T.T. Changlani reported mortality rate in isolated splenic injury was 7.2 percent and in patient with associated extra abdominal injuries, the mortality was 33.7%.<sup>10</sup> Mortality rate in the present series doesn't reflect the actual mortality of the society, because most of the patients with severe injury do not reach the hospital due to lack of proper transportation facilities. Esters reported that in abdominal visceral trauma mortality was high, largely because of frequency of multiple major injuries which are inevitably and rapidly fatal. Griswold, reported that mortality increases directly with the amount of haemorrhage. He reported from his study as follows:<sup>32</sup>

1. Haemorrhage less than 500cc -- 17.2% mortality
2. Haemorrhage of 500-1000cc -- 41.5% mortality
3. Haemorrhage over 1000cc -- 64.4% mortality

Allen and Curry reported shock contributed to 40% mortality in abdominal injury.<sup>29</sup> Burnet33 1950, David et al, Dent and Jene found mortality associated with splenic injury to be 16.5%, 30%, and 43% respectively.<sup>34,35</sup> Hospital stay: In the present series the average hospital stay in both operative and conservative groups were 8 and 12-14 days respectively. Patients were advised to avoid exertional activity for a period of 3 months. The finding is more or less similar to report of Satis D and T.T Changlani.<sup>10</sup> Follow up: All the patients were followed up for a variable period as feasible within this time frame. All patients could be followed up to the first and second visit. Thereafter the number of patient dramatically decreased. During the follow up period patients were examined for evidence of thrombocytosis, overwhelming post splenectomy infection or infection with capsulated organism.

### CONCLUSION

It had been found that the commonest cause of splenic injury was road traffic accident. Young males between 20-30 years of age were the commonest sufferers of splenic injuries. Careful physical examination is the key point in early diagnosis. Investigation reports are complementary to physical findings.

Early hospitalization, better methods of diagnosis, proper timely surgical intervention, availability of blood transfusion, closed clinical observation and nursing care are important contributory factors for reduction in mortality resulting from blunt splenic trauma. Improvements in assessment of injuries with adjuncts such as the FAST and higher resolution CT scanners have allowed reliable identification of variables that can guide the surgeon either to immediate laparotomy, angiography, or a non-operative course.

Blunt splenic injury can be managed non-operatively in a majority of patients. Selection of patients for operative vs non operative treatment remains a tricky scenario. Close monitoring of patients undergoing conservative treatment and the availability of urgent surgical intervention if required is paramount to the successful management of the patients of splenic injury.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the institutional ethics committee*

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**Cite this article as:** Ahmed H, Pegu N, Rajkhowa K, Baishya RK, Hiquemat N. Splenic injury: a clinical study and management in a tertiary care hospital. *Int Surg J* 2015;2:652-9.