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Surgery

A Clinical Study and Management of Splenic Injury in Blunt Trauma Abdomen

Dr. Rajendra Prasad Bugalia[1*], Dr Anuradha Salvi[2], Dr RK Jenaw[3]
[1]Assistant Professor, Department of Surgery SMS Medical college Jaipur, Rajasthan India.
[2]Senior Resident Department of Obst & Gynae, SMS Medical college, Jaipur, Rajasthan India.
[3]Senior Professor & Head of Department, Department of Surgery, SMS Medical college Jaipur. Rajasthan India.

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***Corresponding author**
Dr. Rajendra Prasad Bugalia

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Abstract: Trauma is an increasing cause of morbidity and mortality in India. Although protected under the bony ribcage, the spleen remains the most commonly affected organ in blunt injury to the abdomen in all age groups. Blunt injury to the abdomen frequently results in life-threatening splenic injuries. There was a significant male predominance. Road traffic accident (RTA) was the predominant mode of injury followed by fall from height. On examination, the majority of the patients had abdominal tenderness. All the patients were started on crystalloids while blood products were transfused in shocked patients. Splenic injury was diagnosed during the primary survey and confirmed by free fluid and solid organ injuries on focused abdominal sonography in trauma (FAST). Computed tomography scan of the abdomen was performed in 22% of the patients. About two third of the patients were managed conservatively. Splenectomy was performed with all grade IV and grade V injuries showing hemodynamic instability.
Keywords: Road traffic accident, Blunt splenic injury, Conservative management

INTRODUCTION

With economic growth, industrialization and rapid growth of automobile industries, the number of road traffic accidents (RTA) is sharply on the rise in developing countries like India[1]. The abdomen is a very vulnerable site with many vital organs, and abdominal injuries are often life-threatening. Blunt trauma abdomen accounts for approximately 79% of all abdominal injuries[2]. The spleen and liver are the most commonly injured intra-abdominal organs following blunt trauma. Over 75% of splenic injuries occur due to motor vehicle collisions[3].

Abdominal pain with left upper quadrant tenderness or signs of peritonitis in a patient with history of trauma is the most common presentation of this condition[4]. Four types of splenic injuries are recognised namely: intraparenchymal laceration, subcapsular haematoma, and splenic rupture and delayed rupture .Signs of splenic trauma include splenic enlargement, a sonolucent rim of subcapsular haematoma, heterogencity of splenic echotexture caused by a parenchymal haematoma, linear or stellate lucencies representing tears or lacerations and free peritoneal fluid indicating haemoperitoneum . Splenic enlargement often occurs in blunt abdominal trauma. This enlargement is not necessarily an indicator of clinical deterioration but most likely due to marked adrenergic stimulation and changing blood volume[5]. In these patients, splenic enlargement could have been due to a combination of this mechanism and the intraparenchymal haematomas.Perisplenic fluid noted above the spleen following trauma should be regarded as a sign of splenic trauma. This can be helpful when splenic injury is not clinically obvious and an ultrasound scan is obtained as a screening examination[6]. The left lobe of the liver, in some individuals, extends between the spleen and the left hemidiaphragm and when echo-poor, can resemble a perisplenic (subcapsular) haematoma .An acute haematoma may be hyperechoic to the spleen then later become echopoor. A splenic laceration may be missed by ultrasound because haematomas may have the same echogenicity as the spleen [7].

Ultrasound tends to under estimate splenic injuries. Some authorities indicate that false-negative scan results may be as high as 50%. Inspite of this disadvantage, ultrasound is cheap, free of radiation risks and more readily available compared to computed tomography and magnetic resonance imaging (MRI) modality that can be used to assess splenic injury[7].The decision to operate these patients was arrived at with the help of the ultrasound findings which influenced management in all the patients. The high sensitivity of ultrasound to free peritoneal fluid makes it very important in detecting

haemopeitoneum[8]. Computed tomography is the initial choice in patients who sustain significant abdominal truama and like MRI is highly accurate. The disadvantage of computed tomography and MRI is high cost and the fact that they are not readily available in our environment. Scintigraphy has also proved very accurate in indentification of splenic injuries, with 90–98% sensitivity. Plain radiography may show features associated with splenic trauma such as left pleural effusion and associated left lower rib fractures[9]. All patients who sustain abdominal trauma should undergo an ultrasound examination in order to detect possible splenic injury early.

The spleen is the most vascular organ of the body, and approximately 350 liters of blood passes through it per day. It is located posterolaterally in the left upper quadrant of the abdomen beneath the left hemidiaphragm and lateral to the greater curvature of the stomach. Splenic injuries, therefore, result in a potentially life-threatening situation in patients with thoracoabdominal trauma[10]. The spectrum of injuries range from the trivial to the catastrophic and hence the initial assessment, resuscitation, and investigation of patients with abdominal trauma must be individualized[11]. The primary goal is prompt diagnosis and aggressive management of potentially life-threatening hemorrhage. The preservation of functional splenic tissue is secondary and in selected patients may be accomplished using non-operative management or operative salvage techniques[12]. Emergent and urgent splenectomy remains a life-saving measure for many patients. The outcome of conservative management of splenic injuries remains unpredictable because of the risk of a delayed splenic rupture despite the initial computed tomography (CT) scan showing only a minor parenchymal injury[13]. Our aim is to study the profile of splenic injuries following blunt abdominal trauma among patients.

The Organ Injury Scaling (OIS) Committee of the American Association for the Surgery of Trauma (AAST) was organized formally in 1987; the fundamental purpose was to devise injury severity scores for individual organs to facilitate clinical investigation and outcomes research. The principal charge was to devise injury severity scores for individual organs to facilitate clinical research. The resultant classification scheme is fundamentally an anatomic description, scaled from 1 to 5, representing the least to the most severe injury[14].

American Association for the Surgery of Trauma Grading Scales for Splenic Injuries.

Splenic injury grade	Subcapsular Hematoma	Laceration
Grade 1	<10% of surface area	<1cm in depth
Grade 2	10%-50% of surface area	1-3 cm
Grade 3	>50%of surface area or >10cm in depth	>3 cm
Grade 4	>25% devascularization	At hilum
Grade 5	Shattered spleen , complete devascularisation	

Aim & Objectives

- To find out the proportion of outcome of different modalities of splenic injury in blunt trauma abdomen management.
- To determine association of outcomes of different modalities of splenic injury in blunt trauma abdomen management with the vitals, clinical assessment, USG abdomen, CECT abdomen.

MATERIAL & METHODS

This hospital based descriptive type of observational study was conducted in poly trauma unit / department of general surgery, SMS Hospital Jaipur from july 2015 to july 2017 on 130 cases of splenic injury due to blunt trauma abdomen. On the basis of clinical examination and various modalities of investigations (USG abdomen & CECT abdomen) the diagnosis of splenic injury was made and further management was done.

Inclusion criteria

- All patients with blunt splenic injury were included in the study.

Exclusion criteria

- Hemodynamic instability due to associated injuries.
- Laparotomy due to other injuries.

Observations

Table-1: Distribution of cases basis on causes of blunt splenic trauma

S no.	Cause of trauma	Male	female	Total	%
1	Road accidents	90	11	101	77.69
2	Fall from height	13	03	16	12.30
3	Assault	05	02	07	05.38
4	Animal related injury	02	04	06	04.61
5	Total	110	20	130	100

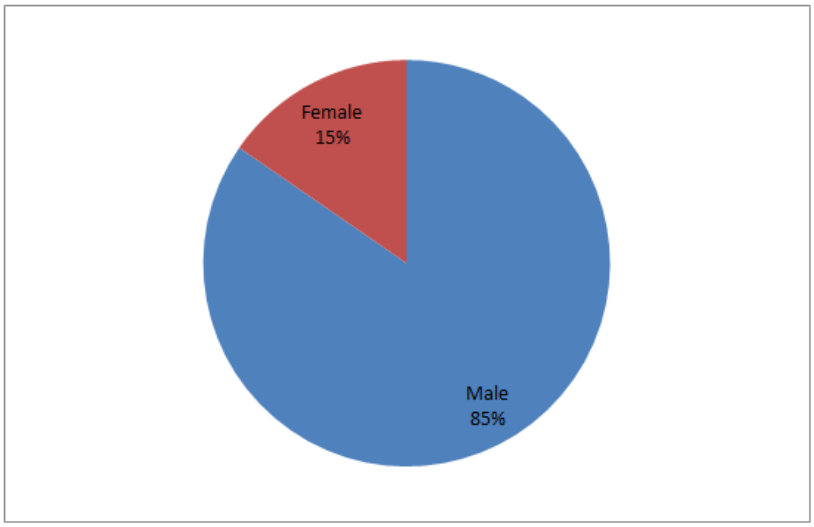

Fig-1: Sex incidence

Table-2: Age distribution in blunt splenic trauma

S no.	Age(in years)	Male	Female	Total	%
1	12-20	14	02	16	12.30
2	21-30	54	09	63	48.46
3	31-40	25	05	30	23.07
4	41-50	11	02	13	10.00
5	51-60	04	01	05	03.84
6	61 & above	02	01	03	02.30
7	Total	110	20	130	100

Table-3: Distribution of cases on basis of clinical features

S no.	Clinical features	Numbers of cases	%
1	Abdominal pain	126	96.92
2	Vomiting	98	75.38
3	Left chest wall pain	52	40.00
4	Tenderness over left upper abdomen	82	63.07
5	Rigidity and guarding	33	25.38
6	Shifting dullness	22	16.92
7	Absent peristalsis	18	13.84
8	Tachycardia	26	20.00
9	Hypotension	24	18.46
10	Tachypnea	22	16.92
11	Shock	19	14.61

Table-4: Distribution of cases on basis of Investigations

Hb		USG abdomen		CECT abdomen	
Finding	cases	finding	cases	Finding	cases
>13 gms	54	Subcapsular hematoma	52	Grade 1	02
<13 >10 gms	44	Parenchymal hematoma	49	Grade 2	03
<10 >8 gms	13	Splenic tear , mild free fluid	11	Grade 3	16
< 8 >5 gms	12	Splenic laceration, moderate free fluid	10	Grade 4	06
<5 gms	07	Splenic enlargement , gross free fluid	08	Grade 5	01
Total	130	Total	130	Total	28

Table-5: Duration between admission & operation

S no.	Duration b/w admission & operation	Blood transfusion (no. of unit)	Number of cases	%
1	< 24 hrs	06	24	75.00
2	>24 to < 48 hrs	05	05	15.62
3	>48 to <72 hrs	04	02	06.25
4	>72 hrs	03	01	03.12
5	Total		32	100

Table-6: Operative findings

S no	Operative findings	cases	%
1	Subcapsular hematoma (Gr II)	03	09.37
2	Intraparenchymal laceration(Gr III)	08	25.00
3	Parenchymal hematoma (Grade III)	03	09.37
4	Laceration with involvement of hilar vessels(Gr IV)	04	12.50
5	Avulsed spleen with extensive perisplenic hematoma (Gr IV)	09	28.12
6	Completely shattered spleen(Gr V)	05	15.62
7	Total	32	100

Table-7: Distribution of cases on the basis of methods of treatment employed

S no	Type of treatment	cases	%
1	Treated conservatively	98	75.38
2	Splenorrhaphy	11	08.46
3	Splenorrhaphy with interposition of gelfoam	02	01.53
4	Hemostasis by gel foam only	01	00.76
5	Splenectomy	18	13.84
6	Total	130	100

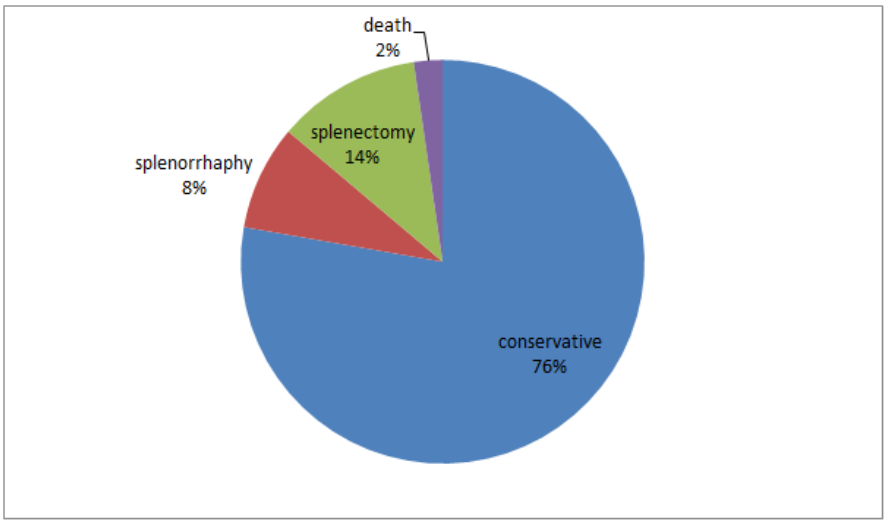

Fig-2: Outcome of blunt splenic trauma

DISCUSSION

The present study indicates that the incidence of splenic trauma is increasing mainly due to increased automobile accidents and violence in recent years with increasing population. In this study the maximum numbers of cases were road traffic accidents (77.69%), followed by fall from height (12.31%) cases and less common causes were assault and animal related injuries (10%). The reason for this might be due to the great force of impact on the body when accidents occurred Griswold RA *et al*. [14].

Male predominance among trauma victims is seen in most international studies, the sex ratio in our study was very heavily toward male (85%). This is explained by the fact that in our country, males are predominantly engaged in outdoor activities and operation of automobiles and hence are more vulnerable to injuries. Among the internal organs in the abdomen, spleen due to its high vascularity remains one of the most vulnerable organs Babatunde AS *et al*. [16], G Norman *et al*. [17].

People of age group 21 to 40 years are particularly vulnerable to splenic trauma possibly active phase of life (71.53%). Abdominal Pain was the most common presenting symptom (96.92%). Vomitting was the next in frequency (75.38%), followed by left chest wall pain(40%). Among the physical signs, Tenderness over left upper abdomen was the most common physical finding being present in (63.03%) patients. This was followed by abdominal rigidity in (25.38%) patients, shifting dullness (16.92%) patients, absent peristalsis (13.82%) patients, tachycardia (20%), tachypnea (16.92%), hypotension (18.46%), shock (18.46%). Most of the patients had combinations of two or more of the above signs Chiu WC *et al*. [18], H Scott Bjerke *et al*. [19], Velmahos GC *et al*. [20].

In our study Ultrasonography was performed in all 130 cases with splenic trauma as soon as the patients reached surgery department (within 20-30 mins). 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 all 130 patients detected with splenic injury preoperatively. Ultrasound had an accuracy of 95.6% in trained hands with specificity of 99.7% and sensitivity of 81.5%. In our study 42 patients had subcapsular hematoma, 45 patients had parenchymal hematoma, 11 patients had splenic tear with mild free fluid in peritoteal cavity, 17 patients had splenic laceration with moderate free fluid in peritoneal cavity and 15 had splenic inlargement with gross free fluid in peritoneal cavity Alamri Y, Moon *et al*. [21]. Straight skiagram of abdomen including lower chest was done in 108 cases only as 22 patients were too critical for radiography. Obliterated psoas shadow was found in15 cases who at operation were found to have intraperitoneal haemorrhage. Generalized haziness was found in 26 cases due to hemoperitoneum. X-ray sign of splenic rupture are displacement of splenic flexure of colon and gastric air bubble, visible splenic enlargement, elevation of left hemidiaphragm;fracture left lower ribs, loss of psoas margin, ground glass appearance i.e. increased radio density throughout the abdomen due to intraperitoneal blood Sözüer EM *et al*. [23].

Diagnostic peritoneal aspiration either four quadrant or bilateral flank tap was performed in all 130 cases showing positive tap in 37 cases and negative tap in 93 cases. Any quantity of fluid aspirated was considered to be positive tap. Negative tap was one which did not reflect any aspirate. Patients with negative tap were treated successfully conservatively. CT scan was performed in limited number of patients 28 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 Davis JJ *et al*. [24]. It was done in 28 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 injury. In our study 2 patients had grade 1 injury , 3 patients had grade 2 injury , 16 patients had grade 3 injury , 6 patients had grade 4 injury , 1 patient had grade 5 injury. CT specificity for splenic injury is 99.5 % and sensitivity of 74.3%. Most of the patients with grade 1, grade 2 and grade 3 splenic injury can be managed non-operatively. Intravenous contrast enhanced computed tomographic scan is the diagnostic modality of choice for evaluating blunt splenic injuries Ertekin C *et al*. [25], Fazili A *et al.* [26], King H *et al*. [27].

In our study during intra venous access blood sample taken for CBC in all 130 patients. In our study 54 patients had > 13 gms hemoglobin (Hb), 34 patients had 10-13 gms Hb, 13 patients had 8-10 gms Hb, 18 patients had 5-8 gms Hb ,11 patients had < 5 gms Hb. Hemoblobin leval reflect the severity of blood loss.

In the present study, 32 out of 130 patients underwent operative management (24.61%). Out of 32 patients, 24 cases operated within 24 hr of admission on the basis of clinical assessment and usg examination, 5 patients operated within 48 hr 0f admission due to non-improvement of patients condition, 3 patients were initially selected for conservative management and due to the deterioration of the clinical status, ultimately taken up for laparotomy.

Laparotomy was done with midline incision, blood in peritoneal cavity was found in all cases. The splenic injuries varied from large sub capsular hematoma 3 cases grade II, intraparenchymal laceration 8 cases grade III, parenchymal hematoma 3 cases grade III, laceration with involvement of hilar vessels 4 cases grade, avulsed spleen with extensive perisplenic hematoma 9 cases and completely shattered spleen 5 cases. Splenic conservation was performed in 14 cases those who had grade II and grade III injury. Out of the 18 patients who underwent splenectomy, 13 had grade IV and the remaining 5 had grade V splenic injury.

Management of blunt trauma of the abdomen is a challenging task even in the best trauma centers with the best traumatologists. In many cases, clinical evaluation of blunt abdominal injuries may be masked by other more obvious external injuries such as head injury or an open extremity injury, and hence diagnosis is frequently delayed. Unrecognized abdominal injury is a frequent cause of preventable death after trauma. Our study studied the profile and outcome of patients

with splenic injury in one of the high volume advanced tertiary care hospitals of India.

About Two-thirds of the patients needed blood transfusion during initial management of shock. Blood transfusion along with crystalloids is the key in the early management of splenic injured patients. Resuscitation in a patient with significant splenic injury without blood products could be fruitless. Many primary and secondary health centers lack certain essential facilities such as CT scan, blood bank, and operating theaters for evaluating and treating severe cases of trauma. Trauma centers with immediate access to blood banks are the need of the hour in a developing country like India Ambroise MM *et al.* [29].

In our study we have managed successfully 76% patients by conservative management. Splenectomy was performed with all grade IV and grade V injuries showing hemodynamic instability (14%). One patient with grade IV and two patient with grade V died post splenectomy at day 3th day post operatively (2%). The rest of the grade II injuries and all grade III injuries required splenic conservation by suture or gel foam (10%) Davis JJ *et al*. [24].

CONCLUSION

Our study showed that RTAs are still the most common cause of splenic injury. Aggressive fluid resuscitation with blood products is the key to survival in both conservatively and surgically managed patients. Although conservative management is one of the standard treatment options, our data suggest that operative managment is an appropriate way to treat patients who are hemodynamically unstable. The awareness of the importance of the immunological function of the spleen and the recognition of the risk of complications induced by splenectomy, especially overwhelming postsplenectomy infection (OPSI), promote alternatives to conservative treatment for the management of pediatric splenic injury. Compared with splenectomy, the benefits of conservative approaches also include fewer blood transfusions, shorter length of hospital stay, and lower hospital costs.

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