Original Research Article

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Clinical and radiological presentation in patients with conserved blunt liver and splenic injuries at a tertiary care center in western India

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ABSTRACT

Background: There has been an increase in abdominal injuries following industrialisation and urbanisation. The mortality due to these injuries however has shown a declining trend worldwide. This is most probably due to early presentation, better access to health care and improved monitoring and treatment modalities.

Methods: 51 patients of conserved blunt liver and/or splenic injuries admitted in the trauma ICU of a tertiary care center were studied over a year for demographics, mode of injuries, pre- hospital delay, clinical and radiological presentation.

Results: Majority of the patients were males in the age group of 16-30 years. Vehicular accidents were the commonest mode of injuries. Liver was commonly injured. Both liver and spleen were injured in only 3 patients. 20 out of the injured 51 patients received blood transfusion and majority of them had high grade injuries. The severity of injuries was graded with both USG abdomen and CT scan of the abdomen. There was not much difference in grading of liver and splenic injuries by Ultrasound and CT scan.

Conclusions: Blunt liver and splenic injuries were commonly seen in young males. Blood transfusion was required in patients with high grade injuries. USG abdomen can be safely used to grade injuries without much discrepancy when compared to CT abdomen.

Keywords: Blunt abdominal trauma, Blood transfusions, CT scan, Liver injuries, Splenic injuries, Vehicular accidents, Ultrasonography

INTRODUCTION

With industrialisation and urbanisation coupled with ever increasing spatter of violence the incidence of abdominal trauma has shown an increasing trend. Blunt abdominal injuries are predominantly due to vehicular accidents and to a lesser extent due to direct blows to the abdomen. Among the intra-abdominal viscera, the liver and spleen are the commonly injured organs.

The mortality from liver injuries in developed countries has shown a gradual decline from 60% in the pre-World war II era, to about 10% at present. This has accompanied a change in pattern of presentation from earlier times, when patients with liver injury often presented late (i.e. after 24-48hrs) after the trauma. In India, we frequently still encounter patients presenting late after abdominal injury and therefore all that is current in the literature may not be directly applicable to our situation. A better understanding of the function of spleen and its function especially in immunological defense has led to the practice of conserving Spleen in blunt abdominal injuries. This study aims to study the clinical and radiographic presentation of patients with conserved blunt liver and spleen injury presenting to a tertiary care center.

METHODS

The study was a prospective observational study conducted at a tertiary care trauma center in Mumbai over a period of 1 year from February 2003-January 2004

There were 51 patients of conserved blunt liver and/or splenic injuries admitted in the trauma ICU of a tertiary care hospital over one year were analyzed and studied for demographics, pre-hospital delay and mode of injury.

Assessment of physiological status on admission included vital parameters like temperature, pulse, blood pressure and respiratory rate. Maintenance of hemodynamic stability was one of the most important parameters for patients included in the study.

Patients with Glasgow Coma Score (GCS) <9, severe fracture pelvis, retroperitoneal hematoma (diagnosed radiologically and/or clinically) and patients with bilateral amputations and fracture spine were excluded from the study. Patients were strictly monitored for hemodynamic stability and abdominal girth in the ICU. General assessment of the patient was done in order to evaluate other conditions such as head injuries, chest injuries, long bone injuries etc. The patients were subjected to biochemical and radiological investigations.

Patients were evaluated for Hb (hemoglobin), CBC(complete blood count), PCV (packed cell volume), liver function profile, renal function profile and blood grouping and cross matching. Radiological investigations included X-ray chest, X-ray abdomen, ultrasound (USG) abdomen and CT scan of the abdomen.

To maximize the consistency of data and to avoid incongruous or missing data or inappropriate coding, the various trauma surgeons on duty were asked to give a detailed description of the various injuries and other findings. A uniform method of evaluation of physiologic status was adopted. Scoring of the various injuries was done using USG and CT scan.

RESULTS

There were 51 cases of conserved blunt abdominal trauma were studied over a period of 1 year. Majority of the patients were in the age group of 16-30 years (45.1%). This was followed by patients in age group of 31-55 years (33%). 8 patients were less than 15 years and 3 patients were more than 55 years. The study had patients predominantly in the productive age group.

There were 42 patients (82.4%) of patients in the study group were males and only 9(17.6%) were females. Modes of injury of the patients in the study group was also analyzed. As per the study vehicular injury was the commonest mode of injury followed by fall (Table 1).

Table 1: Distribution of cases according to mode of injury.

Mode of injury	Frequency	Percentage (%)
Vehicular	23	45.1
Assault	7	13.7
Fall	14	27.5
Railway	5	9.8
Fall of object	2	3.9
Total	51	100

Table 2: Grades of liver injury and blood transfusion.

Grades of liver injury N (%)						Total (%)
Blood transfusion	Grade 1	Grade 2	Grade 3	Grade 4	CT Scan not done*	
Not given	4 (100)	9 (60)	3 (42.9)		2 (100)	18 (56.3)
1 unit given		4 (26.7)	3 (42.9)			7 (21.9)
2-4 units given		2 (13.3)	1 (14.3)	3 (75)		6 (18.8)
More than 4 units					1 (25)	1 (3.1)
Total	4 (100)	15 (100)	7 (100)	4 (100)	2 (100)	32 (100)

^{*}Patients with grade 1 liver injury on USG and whose CT scan was not done.

Distribution of the sustained visceral injuries was documented. Liver was the commonest (32 i.e. 62.7 %) followed by spleen (19 i.e. 37.3%). Both liver and spleen were involved in only 3 patients (5.8%).

Of the 51 patients, hypotension was observed in 3 patients (5.9%). The rest of the patients maintained hemodynamic stability. Abdominal paracentesis was done in the 3 patients with hypotension. 2 of these 3 patients had a positive paracentesis for hemoperitoneum.

11 patients (21.6%) had up to 2 spikes of fever and only 1 patient (2%) had more than 2 spikes of fever.

We studied as to how many of our patients had an increase in WBC (>11,000/cmm). It was inferred that 13 patients (25.5%) had leukocytosis. In patients with liver injury, 1 patient had grade 2, 4 patients had grade 3 and 4 patients had grade 4 liver injuries. 4 patients with grade 3 splenic injuries had leukocytosis.

Patients were also analyzed for the number of blood transfusions the received. Majority of the patients (31 of 51) did not receive blood transfusion. 10 patients received 1 unit, 9 received 2-4 units and only 1 patient received more than 4 units.

The grades of liver and spleen injury were correlated with the number of transfusions received. All patients with grade 1 liver injury and 2 patients whose CT scan was not done did not receive any blood transfusion. All patients with grade 4 injuries received at least 2 units of blood. (Table 2).

In patients with splenic injury, patients having grade 1 injury on CT scan did not receive any blood transfusion. Patients with both grade 2 and 3 received transfusion but none of the patients with splenic injuries received more than 4 units of blood transfusion (Table 3).

Liver and splenic injuries were graded by Ultrasound and CT scan. Of the 32 patients with liver injuries, 14 patients had grade2 injuries, 9 patients had grade 3 and only 3 patients had grade 4 injuries on ultrasound. 15 patients (46.8%) had grade2, 7 patients (21.9%) had grade 3 injuries. 4 patients each had grade 1 and grade 4 injuries of the liver on CT scan. Of the 22 patients with splenic injuries, 11 patients (50%) had grade 2 injuries, 8 patients (36.4%) had grade 3 injuries and 3 patients had grade 1 injury. 11 patients (50%) had grade 2 injuries, 9 patients (40.9%) had grade 3 and only 2 patients (9.1%) had grade 1 splenic injuries on CT scan.

A cross tabulation of grading of liver and splenic injury by CT scan and ultrasound was done to look for discrepancy in the findings of the two investigation modalities (Table 4 and 5). It was found that there was slight difference in the grading of injuries in the 2 modalities.

	Table 3: Grades of s	plenic injury (C'	T scan) receiving	blood transfusion.
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	Grades of splei	Grades of splenic injury N (%)			
Blood transfusion	Grade 1	Grade 2	Grade 3		
Not given	2 (100)	8 (72.77)	4 (44.4)	14 (63.6)	
1 unit given		2 (18.25)	3 (33.3)	5 (22.7)	
2-4 units		1 (9.1)	2 (22.2)	3 (13.6)	
More than 4 units	-	-	-	· -	
Total	2 (100)	11 (100)	9 (100)	22 (100)	

Table 4: Cross tabulation of CT (Liver injury) versus ultrasound (Liver injury).

CT liver	USG liver N	Total (%)			
CI liver	Grade 1	Grade 2	Grade 3	Grade 4	
Grade1	4 (66.7)				4 (12.5)
Grade2		14 (100)	1 (11.1)		15 (46.9)
Grade3			7 (77.8)		7 (21.9)
Grade4			1 (11.1)	3 (100)	4 (12.5)
CT not done	2 (33.3)				2 (6.3)
Total	6 (100)	14 (100)	9 (100)	3 (100)	32 (100)

Table 5: Cross tabulation of CT (splenic injury) versus ultrasound (splenic injury).

	USG spleen N (%)	USG spleen N (%)			
	Grade 1	Grade 2	Grade 3		
Grade 1	2 (66.7)			2 (9.1)	
Grade 2	1 (33.3)	9 (81.8)	1 (12.5)	11 (50)	
Grade 3		2 (18.2)	7 (87.5)	9 (40.9)	
Total	3 (100)	11 (100)	8 (100)	22 (100)	

DISCUSSION

During the study period of one year, 51 cases of conserved blunt abdominal injuries were studied. As males constituted major part of the working population, they were more prone to injuries. Our study had a predominance of male patients as compared to female patients with a ratio of 42:9.

A study carried out by Slotta et al, showed a male:female ratio of 42:22. Similarly, a study carried out by Patel et al, showed a ratio of 39:3. Also, a study carried out by Mucha P et al showed a male:female ratio 163:74 i.e. 68% of patients were males. 2,3

Study carried out by Cox et al shows a male:female ratio of 2.7:1.⁴ The most common mode of injury in our study

was vehicular accidents followed by fall. Mucha et al, in their series found 73% of injuries due to vehicular accidents.³ Kidd et al, in their series of 70 patients found 60% of injury due to vehicular accidents.⁵

Currie et al, found 58.6% of blunt abdominal trauma due to vehicular accidents.⁶ Allan et al in their series found 70% of injuries due to vehicular accidents.⁷

Prehospital delay plays a significant role in the outcome of blunt liver and splenic injury. This is so because patients with higher grades of liver and splenic injuries presenting late may come up with a greater degree of hemodynamic instability which may complicate the management strategy of these patients.

In our study maximum patients (45.1%) came to the emergency department within 2-6hours following the injury. 37.3% of patients came with a delay of 6-18hrs. Delay is probably due to lack of facility for rapid transport and delay in shifting patients to specialist care centers. This is in contrast to the Western world wherein pre hospital delay is minimal as paramedical workers play an important role in the transportation process.

Amongst the 51 patients studied by us, 29 patients (56.9%) had liver injuries, 19 patients (37.3%) had splenic injuries and 3 patients (5.8%) had combined liver and splenic injuries.

A study carried out by Falimirski et al, of showed that out of 37 patients managed non-operatively, 24 patients sustained hepatic injuries, 12 patients sustained splenic injuries and one patient sustained both liver and splenic injuries.⁸

Ultrasonography is accurate and useful in evaluation of blunt abdominal trauma. In Europe and Japan, diagnostic ultrasound has replaced diagnostic peritoneal lavage as a diagnostic tool of choice. 9,10 It is fast, non-invasive and accurate. McKenny and associates from university of Miami report a sensitivity of 88% and a specificity of 99% and an accuracy of 97% in detecting intraabdominal injuries by ultrasound. 11

All our patients were subjected to ultrasonography, which could grade the liver and splenic injury according to the dimensions of the injury sustained on USG. Of the liver injuries, 18.8% were grade 1, 43.7% were grade 2, 28.1% were grade 3 and 9.38% were grade 4. Grade 5 & 6 injuries were not encountered in our study group.

Similarly, amongst the splenic injury, 13.6% had grade 1, 50 % had grade 2 and 36.4% had grade 3 injuries. No grade 4 and grade 5 injuries were encountered in our study.

Single greatest factor permitting safe, non-operative management of blunt abdominal injury is CT scan. 12 It

can accurately delineate anatomy of the injury and provide accurate information about the amount of hemoperitoenum and intra-abdominal injuries. ¹² CT scan gives a better yield than DPL. ^{13,14}

Matsubara et al found CT scan to be accurate in 88% cases. 15 49 out of 51 of our patients were subjected to CT abdomen. 2 patients whose CT abdomen was not done were grade 1 liver injuries on ultrasound.

Amongst the liver injuries, 12.5% of patients had grade 1, 46.8% had grade 2, 21.8% had grade 3, 12.5% had grade 4 injuries. Similarly, among splenic injuries, 13.6% had grade 1, 50 % had grade 2 and 36.4% had grade splenic injury. Grade 4 & 5 splenic injuries were not encountered in our study.

While comparing ultrasound and CT abdomen for liver, ultrasound overstaged one grade 2 injury and understaged one grade 4 injury (Table 4).

Similarly, in spleen, ultrasound overstaged one grade 1 injury and understaged one grade 3 injury (Table 5). Thus, there was a slight discrepancy in grading of liver and splenic injuries when a comparison between ultrasound and CT scan was made.

Although there was a slight discrepancy in the grading of liver and splenic injuries, it was inferred that ultrasound did pick up all the injuries detected on the CT scan and hence ultrasound still remains an important investigation modality because of its easy availability in the emergency department for rapid diagnosis of liver and splenic injuries.

Despite the lack of evidence, traditional trauma teaching has suggested that lower rib fractures increase the risk of abdominal solid organ injuries. Study carried out by Shweiki et al showed an evidence of 10.7% and 11.3% for liver and splenic injuries respectively after conducting a study of 476 rib fracture patients. ¹⁶

In our study we found an overwhelming number of patients with lower rib fractures which accounted for 41.2% of the patients.

We studied the behavior of liver enzymes (SGOT/PT) in relation to the liver injuries. We found that 50% of the patients had an elevation of liver enzymes (Table 6).

We further studied the characteristics of this derangement by corelating it with the number of days for which the enzymes were deranged. We found that 5 of the 15 patients with grade 2 liver injuries had derangement for 2 days which later on regressed. As far as grade 3 liver injuries were concerned, all 7 patients showed derangement of liver enzymes wherein 6 patients had derangement up to 2 days and only 1 patient had derangement extending up to 3-5 days.

Table 6: Grades	of liver in	iurv and d	lerangement of	LFT.
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	Deranged LFT N (%)				
Grades of liver injury	No derangement	Derangement up to 2 days	Deranges up to 3-5 days		
Grade 1	4 (25)			4 (12.5)	
Grade 2	10 (62.5)	5 (45.5)		15 (46.9)	
Grade 3		6 (54.5)	1 (20.0)	7 (21.9)	
Grade 4			4 (80)	4 (12.5)	
CT not done	2 (12.5)			2 (6.3)	
Total	16 (100)	11 (100)	5 (100)	32 (100)	

All patients with grade 4 liver injury had derangements of LFT extending up to 3-5 days which later on regressed. Study carried out by Al-Mulhin et al showed elevated liver enzymes in 87.5% of the patients. ¹⁷

We studied the number of blood transfusion given to our patients. 10 patients (19.6%) received 1 unit. 9 patients (17.6%) received blood transfusion in the range of 2-4 units and one patient (2%) received more than 4 units of blood transfusion.

We further analyzed these transfusion rates in relation to liver and splenic injuries. 14 (43. 7%) out of 32 patients of liver trauma patients received blood transfusion.

We observed that 4 patients with grade 2 injuries and 3 patients with grade 3 liver injuries received 1 unit of blood. 2 patients with grade 2 liver injuries, 1 patient with grade 3 and 3 patients with grade 4 liver injuries received 2-4 units of blood transfusion. Only 1 patient received 4 units of blood transfusion of more than 4 units and this patient had grade 4 liver injury.

When splenic injuries were studied against the number of blood transfusion received, we found that 2 patients with grade 2 and 3 patients with grade 3 received blood transfusion. 1 patient of grade 2 injury and 2 patients of grade 3 injuries received blood transfusion in the range of 2-4 units. These patients with grade 3 injuries failed conservative line of management.

Study carried out by Brasel et al, showed that the average blood transfusion requirements in patients undergoing conservative management in liver trauma was 2.7 units. ¹⁸ Malhotra et al, studied that the average blood transfusion under-going NOM was 2.7 units. ¹⁹

Study carried out by Myers et al, shown an average of 1.3 units of blood being given the patients who underwent conservative management in blunt splenic trauma and 5.6 units who failed conservative line of management.²⁰ Study carried out by Parks et al showed a mean transfusion rates of 1.9 units in patients undergoing successful conservative management and liver injuries.²¹ The findings of our study are thus consistent with the findings of various studies mentioned above.

CONCLUSION

To conclude, blunt abdominal trauma was common in males in the young and productive age group with the most common mode of injury being vehicular accidents. Blood transfusion was required in higher grades of injury. The grading of liver and splenic injuries by ultrasound when compared with CT scan were slightly different but not significant.

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