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Blunt Abdominal Trauma Severity Scoring System: Exceptional Score in Blunt Abdominal Trauma Management

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ABSTRACT

Objectives: The abdomen is a diagnostic black box. Physical examination of the abdomen is unreliable in making this determination, and sometimes clinical evaluation is difficult due to the influence of drugs or alcohol by patients or abdominal injuries occurring with head or spinal cord injuries. However, the presence of abdominal rigidity or hemodynamic compromise is an indication for prompt surgical exploration. For the remainder of patients, a variety of diagnostic adjuncts are used to identify abdominal injury. In this study, our aim is to find the answer of these questions, (1) What was the major indication for operation in each case? (2) Did delays in getting the patient to the operating room affect the outcome? (3) How to find morbidity and mortality in blunt abdominal injuries, at the behest of the Blunt Abdominal Trauma Severity Scoring System (BATSS).

Material and Methods: A retrospective study of 100 cases of blunt abdominal trauma was done at Sheth Lallubhai Gordhandas Municipal General Hospital, Narendra Modi Medical College, Ahmedabad, for the accuracy of the BATSS score. Patients were divided into three groups according to the BATSS: (1) ≥12 score group, (2) 8–11 score group, and (3) <8 score group.

Results: Operative management was more common in the high-risk group, while the low-risk group was managed conservatively under expert guidance. The mean BATSS scores in operative and conservative management were 14.77 ± 2.91 and 5.12 ± 2.56, respectively. The BATSS score had an 87.1% Specificity, 100% Sensitivity, 94.5% Negative Predictive value (NPV), 100% Positive Predictive value (PPV) and an overall Accuracy of 96%.

Conclusion: BATSS is important for triage and is an excellent tool for recognising and picking up high-risk patients with blunt abdominal injuries.

Keywords: Blunt abdominal trauma, Clinical evaluation, Scoring system (BATSS)

INTRODUCTION

Trauma, especially road traffic injury, is one of the major health-related issues throughout the world, especially in developing countries like India.[1] Road traffic accidents still remain one of the top reasons for blunt abdominal trauma (BAT). Other causes of BAT include recreational accidents, fall and assault.[2]

Abdominal injuries are frequently encountered in the management of trauma patients. Of all patients in the 2009 National Trauma Data Bank (NTDB), 13% sustained abdominal injuries, associated with an overall mortality rate of 7.7%.[3] During the evaluation of the injured patient, the abdomen is of high priority because of the vital nature of the contained organs and structures.

Blunt trauma can result in the laceration of solid organs, usually causing bleeding, which, in its most severe form, manifests as haemorrhagic shock or visceral perforation of the gastrointestinal (GI) tract.[4]

The abdomen is a diagnostic black box. Physical examination of the abdomen is unreliable in making this determination, and drugs, alcohol, and head and spinal cord injuries complicate its clinical evaluation.[5] In patients sustaining blunt abdominal trauma, physical signs of significant organ involvement are often lacking. However, the presence of abdominal rigidity or hemodynamic compromise is an indication for prompt surgical exploration. As a result, a number of algorithms have been proposed to exclude the presence of serious intra-abdominal injuries.[6] Therefore, this study was established to present an applicable scoring system (BATSS) for the selection of patients suspected of having BAT, and to get the maximum result in the management of blunt abdominal trauma.

MATERIAL AND METHODS

This is a retrospective study. All the data is collected retrospectively from records of patients present with blunt abdominal injuries during the period from May 2019 to February 2022 in Sheth Lallubhai Gordhandas Municipal General Hospital, Narendra Modi Medical College, Ahmedabad. The number of cases studied is 100.

Inclusion criteria

- All patients, who have blunt abdominal injury and hospitalized for the same.

Exclusion criteria

- All patients who have blunt abdominal injury but are not hospitalized.
- Patients having associated penetrating injuries.

After initial resuscitation of the trauma victims and achieving hemodynamic stability, a careful history was taken to document any associated medical problems. Documentation of patients, which included identification like age, sex, occupation, etc., history like nature and time of accident leading to the injury, clinical findings, diagnostic tests like Focused Abdominal Sonography for Trauma (FAST), full abdominal sonography or CT scan if needed, etc., operative findings, operative procedures and complications during the stay in the hospital and during the subsequent follow-up period, were all recorded on a specially prepared performa. On behalf of that performa, patients were divided into the following three groups according to the BATSS:

1. High risk: 12 and more than 12 BATSS score group,
2. Medium risk: 8–11 BATSS score group,
3. Low risk: Less than 8 BATSS score group.

Patients selected for non-operative or conservative management were placed on strict bed rest and subjected to serial clinical examination which included hourly pulse rate, blood pressure, respiratory rate and repeated examination of abdomen and other systems, and a full ultrasonography of abdomen or CT scan was done if needed to avoid any misjudgement. The patients were followed up for a period of one week, whether the patient was taken up for laparotomy or whether the patient was managed conservatively.

This 24-point BATSS was developed based on factors like abdominal pain, abdominal tenderness, systolic blood pressure, pulse rate, chest wall sign, pelvic fracture, and FAST [Table 1].[7]

Statistical analysis

All the statistical analysis was performed using IBM SPSS software version 22 and MS Office Excel software. Chi-square

Table 1: BATSS – Blunt abdominal trauma severity scoring system.[7]

Parameter	Score
Pulse rate	
Less than 100 beats/min	0
More than 100 beats/min	1
Systolic blood pressure	
Above 100 mmHg	0
Less than 100 mmHg	4
Abdominal pain	
Absent	0
Present	2
Abdominal tenderness	
Absent	0
Present	3
Chest wall sign	
Absent	0
Present	1
Pelvic fracture	
Absent	0
Present	5
FAST (Focused Abdominal Sonography for Trauma)	
Absent	0
Presence of free fluid	
Perihepatic	2
Perisplenic	2
Pelvic	2
Pericardial	2
Total FAST score	***8***
Grand total of BATSS score	**24**

method was used for the validity of the FAST examination and the validity of BATSS score was done by Fisher exact test and P value < 0.05 was considered significant. With regard to the prediction of operative management with the BATSS score, the odds ratio (OR) and 95% confidence interval (95% Cl) of each group score were compared with an outcome of an "<8" group score and P value <0.05 was considered significant.

RESULTS

Mostly commonly affected age group was 21–30 years followed by 31–40 years and 11–20 years with mean age as 30.73 ± 14.52 years in the present study. The youth of country is most commonly affected by blunt abdominal injuries [Table 2].

There were 74 males (74%) and 26 females (26%) with male:female ratio was 2.85:1 in the present study.

Thirty-nine patients were present with more than 100 beats/min pulse, and 38 patients presented with less than 100 mmHg systolic blood pressure. Around 77% of patients presented with only abdominal pain, while 65% presented with abdominal pain and abdominal tenderness, guarding or rigidity. Pelvic fracture was presented in five patients, while 17 patients presented with chest wall sign like rib tenderness, rib fracture, pneumothorax or haemothorax. Out of the 22 patients who had a pelvic fracture or chest wall sign, two patients had both chest wall signs and a pelvic fracture [Table 3].

Positive FAST was found in 29 patients with a 4.55 ± 1.68 mean score. In the present study, out of 100 patients, FAST examinations were true in 94 patients (27 true positives and 67 true negatives) and 6 examinations were false (2 false positive and 4 false negative) with sensitivity 87%, specificity 97%, Positive Predictive Value (PPV) 93%, Negative Predictive Value (NPV) 94% and accuracy 94%. The chi-square statistic was 73.6479. The *p*-value was 0.00001. This result was significant at $p < 0.05$ [Table 4].

In the present study, the number of patients in the high-risk group (BATSS scores ≥12) was 27. Among the 27 patients, one had to be managed conservatively as he was hemodynamically unstable with severe head injury. The patient was unconscious and disoriented, but free fluid was present in the FAST examination, and a liver laceration was also found in the abdominal sonography, the patient managed to reach the operation theater, but due to a delay shifting, he expired. Out of 26 operative patients, two patients expired. (one patient had head injury with a right renal injury, liver laceration and inferior vena cava tear, the other patient had a severe liver injury with huge volume of hemoperitoneum.) The number of patients with medium-risk group (BATSS score 8–11) was 11. Out of five operative patients, one patient went through negative laparotomy with retroperitoneal haematoma, due to misjudgement of clinical data and FAST examination. Patient was managed conservatively. The number of patients in the low-risk group (BATSS <8 score) was 62, and all were managed conservatively.

Overall, out of 100 cases, 31 patients (31%) went through operative management, whereas 69 patients (69%) were managed conservatively in the present study. Two patients expired during operative management, while one patient expired during conservative management. So the overall success rate of the present study was 97%, with a 3% failure rate.

The data of those who could not reach the operative room and expired were not included in Table 5. BATSS score had **87.1%** Specificity, **100%** Sensitivity, **94.5%** NPV, **100%** PPV and an overall Accuracy of **96%.** The Fisher exact test statistic value is less than 0.00001. The result is significant at $p < 0.05$.

Table 2: Age distribution.

Age distribution	No of patients	Percentage
<10 years	06	06%
11–20 years	21	21%
21–30 years	32	32%
31–40 years	19	19%
41–50 years	11	11%
>50 years	11	11%
Total	**100**	**100%**

Table 3: BATSS with parameters.

Parameter	No of patients with percentage	Mean ± SD
Pulse rate		
Less than 100 beats/min	61 (61%)	80.95 ± 7.13
More than 100 beats/min	39 (39%)	115.28 ± 10.24
Systolic blood pressure		
Above 100 mmHg	62 (62%)	118.55 ± 9.85
Less than 100 mmHg	38 (38%)	92.32 ± 8.27
Abdominal pain		
Absent	23 (23%)	--
Present	77 (77%)	
Abdominal tenderness		
Absent	35 (35%)	--
Present	65 (65%)	
Chest wall sign		
Absent	83 (83%)	--
Present	17 (17%)	
Pelvic fracture		
Absent	95 (95%)	--
Present	5 (5%)	
FAST (Focused Abdominal Sonography for Trauma)		
Absent	71 (71%)	0
Presence of free fluid	29 (29%)	4.55 ± 1.68

Table 4: No. of patients in groups according to BATSS score with adjusted odds ratio in operative management.

BATSS score	Total number of patients	Operative	Conservative	Adjusted odds ratio (95% Confidence Interval)	p-value
<8	62 (62%)	0	62	-	-
8–11	11 (11%)	5	6	105.77 (5.24–2,136.55)	0.0024
≥12	27 (27%)	26	1	2,208.3 (87.12–55,979.86)	<0.0001

Table 5: Validity of BATSS for diagnosis in blunt abdominal trauma.

BATSS score	Abdominal scan/Laparotomy	
	Rupture of organ (+)	Rupture of organ (–)
≥12	27	0
<12	4	68

The mean BATSS scores in operative and conservative management were 14.77 ± 2.91 and 5.12 ± 2.56, respectively.

DISCUSSION

In the present study, the most commonly affected age group was 21–30 years (32%), which was similar to Sude NS *et al.*[8] study where 34.5% of patients were from the 21–30 years group.

There were 74 males (74%) and 26 females (26%) and the male:female ratio was 2.85:1 in the present study, but in Sude NS *et al.*[8] study, male:female ratio was 5:1 and the male percentage was 83.6%. In this study, road traffic accidents were the most common cause of blunt abdominal injuries with 50% of cases, followed by assaulted injuries (41%), falls from heights (9%), which was the same as in Davis *et al.*[9] study and Khanna *et al.*[10] study with road traffic accidents at 70% and 57%, assaulted injuries at 17% and 33% and fall from heights at 6% and 15%, respectively. Globally, almost three times (2.7) as many males as compared to females died from road traffic injuries, accounting for the largest sex differentials in mortality rates from unintentional injury. Injury and fatality rates for males are higher for every category of road injury victim in several developing countries. A higher risk of male road traffic injuries and fatalities is associated, to a significant extent, with greater exposure to driving as well as to patterns of high-risk behavior while driving. Gender role, socialization, and the association of masculinity with risk-taking behavior, acceptance of risk, and a disregard for pain and injury may be the factors leading to hazardous actions on the part of men. These factors include excessive consumption of alcohol, drug use, aggressive behavior, and risky driving.

In the present study, FAST examination was true in 94 patients (27 true positive and 67 true negative) and 6 examinations were false (2 false positive and 4 false negative) with a p value of 0.00001 which was similar to Shojaee *et al.*[11] study, where p value of FAST examination was less than 0.0001. Because of FAST examination, unwanted CT scans and wastage time reduced in operative patients of BAT. So FAST is highly valid, precision and accurate diagnostic tool in BAT.

In the present study, 27% patients were included in BATSS score >=12 groups, 11% were included in 8–11 score group and 62% were included in <8 score group. In Vanitha T *et al.* study, 31%, 11% and 58% patients were included in BATSS score ≥12, 8–11 and <8 groups respectively, which was almost similar to our study. In the present study, in the BATSS score ≥12 groups, out of 27 patients, 26 were operative and 1 patient, who was hemodynamically unstable and died before reaching the operative room, was managed conservatively; in the BATSS score 8–11 group, out of 11 patients, 5 were operative and 6 were managed conservatively; and in the BATSS score <8 groups, all 62 patients were managed conservatively. In Vanitha T *et al.*[12] study, in the BATSS score ≥12 groups, all 31 patients were managed operatively; in the BATSS score 8–11 groups, 6 patients were managed operatively and 5 were managed conservatively; and in the BATSS score <8 groups, all 58 patients were managed conservatively. This result was almost identical to the present study.

Overall, out of 100 cases, 31 patients (31%) went through operative management, whereas 69 patients (69%) were managed conservatively in the present study. Two patients died in operative management, while one patient expired in conservative management. In Vanitha T *et a1.*[12] study, operative management was done in 37%, and 63% were managed conservatively and eight patients died during operative management, and there was no mortality in conservatively managed patients. In Davis *et al.*[9] study, out of 437 patients, 153 were managed conservatively, 269 were managed operatively, and 15 died in the emergency room. Forty patients went through negative laparotomy, 3 patients during conservative management and 40 patients during operative management died in Davis *et al.* study.[9] So the overall success rate of the present study was 97% with a 3% failure rate, which was comparably higher than other studies.

In the present study, the mean BATSS scores in operative and conservative management were 14.77 ± 2.91 and 5.12 ± 2.56,

respectively, whereas in Vanitha T *et al.*[12] study, the mean BATSS scores in operative were 13.4 ± 2.17, which was almost similar to the present study.

In the present study, the BATSS score had an 87.1% Specificity, 100% Sensitivity, 94.5% NPV, 100% PPV and an overall Accuracy of 96%, and in Karjosukarso AS *et al.*[13] study, the BATSS score had 91.4% Specificity, 77.8% Sensitivity, 70% NPV, 94.1% PPV and an overall Accuracy of 88.6%. In Shojaee M. *et al.* study, the sensitivity of the BATSS score was 99.3%. In the present study, the p-value was less than 0.00001 which indicated that there was strong significance between the BATSS score and an abdominal scan or laparotomy.

So, patients with a BATSS score ≥ 12 need immediate exploration of the abdomen, whereas patients with a BATSS score 8–12 need further investigation like a CT scan to rule out abdominal organ injury. Patients with a BATSS score <8 can be managed conservatively, and there is no need for a CT scan or other investigation.

LIMITATION OF BATSS SCORE IN THIS STUDY

- Present study was done with a small sample size and single hospital. The validity and accuracy of BATSS score may be adequately calculated with large sample size and multiple centers.
- BATSS score is a combination of clinical examination with radiological examination (FAST). The accuracy of this FAST examination is likely to be influenced by the FAST operator's ability.
- Another drawback of this score is not giving importance to head injury and Glasgow coma score which is important in patient with poly-trauma.

CONCLUSION

Patients in the high-risk group (≥12 BATSS score) should be managed operatively, while patients in the low-risk group (<8 BATSS score) should be managed conservatively. If patients with high-risk group reach the operation theater late, chances of mortality also increase. Mortality was more with the high-risk group, so if the patients in this group can be managed with speedier response and accuracy, the chances of mortality decrease. The chances of negative surgery are more with the medium-risk (8–11 BATSS score) group, if patients are not managed without getting confirmation either clinical or radiological. Avoidance of any misjudgement can decrease the morbidity of patients of medium risk group. The conservative management is done with repeated follow-up examinations either clinical or radiological under expert guidance.

BATSS is important for triage and an excellent tool for recognition and picking up high risks among the patients with blunt abdominal injuries.

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Ethical approval

The research/study complied with the Helsinki Declaration of 1964.

Declaration of patients consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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