

CASS – A cost-effective strategy in the management of blunt trauma abdomen



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ABSTRACT

Background: Abdominal trauma is one of the leading causes of morbidity and mortality in both developing and developed countries. Management of blunt trauma abdomen (BTA) relies on most importantly, the clinical presentation of the patient. **Aims and Objectives:** This study aims at determining the accuracy of the clinical abdominal scoring system (CASS) in predicting the need for operative management of blunt abdominal trauma patients and also comparing the CASS score with the American association for the surgery of trauma – computed tomography (AAST CT) score. **Materials and Methods:** A total of 50 patients with BTA presenting to the Government tertiary care center Mysore were evaluated for age, sex, type of trauma, systolic blood pressure, Glasgow coma scale, pulse rate, time of presentation after trauma, abdominal clinical findings, respiratory rate, and hemoglobin concentration. Radiological investigations were done as indicated. CASS score was calculated and a comparison of the same with CT findings, in determining the need for laparotomy, was studied. Patients with co-existing head injuries and comorbidities were excluded from the study. **Results:** Among 50 cases, 44 were male accounting for 88% of the study population and 6 were female. The majority belonged to 18–30 years of age, accounting for 46%. In 42% of cases, a road traffic accident was the mode of injury, followed by a fall from height in 4%. Latent period 52% of cases presented to the hospital between 0 and 6 h of the incident. 10% associated chest injuries. 42% showed splenic injury, thereby making it the most commonly injured organ. 28% had the liver injury. 28% had hemoperitoneum with source of bleed being unknown. **Conclusion:** CASS is a reliable and promising scoring system with sensitivity comparable to AAST CT grading in determining the need for surgical intervention in BTA patients. CASS provides an effective means of saving time and resources and gives the added advantage of avoiding expenses to underprivileged patients in our country.

Key words: Abdominal injuries; Hemoperitoneum; Computed tomography

INTRODUCTION

Trauma has been called the neglected disease of modern society. Trauma is the leading cause of death and disability in developing countries and the most common cause of death under 45 years of age.¹ World over, injury due to trauma is the 7th cause of mortality and the abdomen is the third most common injured organ. 85% of abdominal traumas are of blunt character.²

The main causes of blunt abdominal trauma (BAT) are Road Traffic accidents (collisions), fall from bikes, fall from

heights at workplace, assault with blunt objects, sports injuries, industrial accidents, rail accidents, etc. Blunt trauma abdomen (BTA) may be missed, especially in a polytrauma patient, if not carefully looked for. Early diagnosis and treatment can bring down the mortality by 50%. However, the time lag in the presentation to the hospital, and delay in diagnosis, either due to a low index of suspicion, or lack of diagnostic equipment in developing countries, restricts the efforts in alleviating the morbidity and mortality in BAT.

A prompt and meticulous clinical examination of a BAT patient is the key to diagnosing the condition. This may

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be aided by radiological investigations such as focussed assessment of solid organs in trauma (FAST) and abdomen contrast-enhanced computed tomography (CECT). However, it is a well-known fact that the availability of equipment and an experienced radiologist is difficult, especially in rural setup. More often than not, this leads to delays in the diagnosis and brings in poor outcomes in a salvageable BAT patient.

In view of above-mentioned difficulties, a clinical scoring system – clinical abdominal scoring system (CASS) has been developed for easy, quick, cost-effective, and reliable assessment and decision-making regarding the management of BAT patients. The purpose of this study is to assess the efficacy of CASS and also to compare its efficacy with that of American association for the surgery of trauma – CT (AAST – CT) scoring system in deciding the need for emergency laparotomy in a BAT patient.

According to CASS, the total score range is 5–15. Patients with a score of 12 or above are subjected to immediate laparotomy. Patients with scores of 9–11 are subjected to auxiliary investigations such as CT scanning and USG. Patients with a score of 8 and below are subjected to clinical observation with no auxiliary investigations.

Aims and objectives

- To score all the patients with BTA with CASS
- To compare the score of CASS with AAST - CT grading.

MATERIALS AND METHODS

Study design, population, location, and duration

The current study is a prospective observational study conducted on all patients with BTA treated in the department of general surgery of K R Hospital, Mysore between the study period of July 2021 and June 2022.

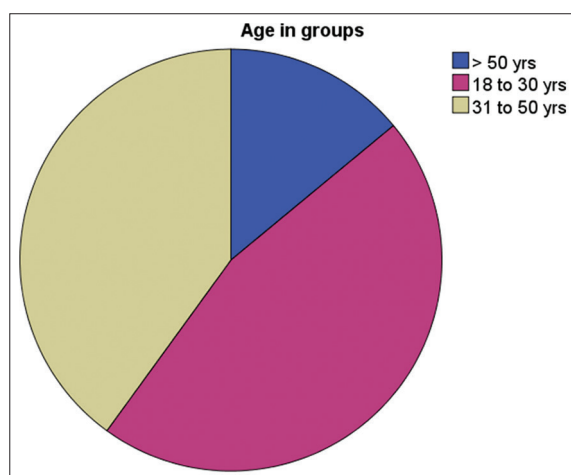


Figure 1: Age distribution of blunt trauma abdomen patients

Sample size

The sample size for frequency in population was calculated to be 50.

CASS

CASS	
Time of presentation after the trauma (hours)	
<2	1
2–6	2
>6	3
Pulse rate (beats/minute)	
<90	1
90–110	2
>110	3
Systolic blood pressure (mmHg)	
>120	1
90–120	2
<90	3
GCS	
13–15	1
9–12	2
<9	3
Abdominal clinical findings	
Abdominal pain	1
Guarding	2
Abdominal rigidity and tenderness	3

GCS: Glasgow coma scale, CASS: Clinical abdominal scoring system

Inclusion criteria

- All patients of the age group 18–70 years
- Rib fractures with pneumothorax
- Peritonitis secondary to hollow viscous organ injury following trauma and solid organ injury.

Exclusion criteria

BTA associated with

- Head trauma
- Pregnant women.
- Pediatric age group.

Data collection

All patients who are suspected to have BTA were scored using CASS and radiological investigations done in the emergency department of KR hospital by the junior resident under the guidance of a consultant.

The decision to proceed with the surgery was taken if the patient had CASS, a score of more than 12 and/or if the radiological investigations AAST – CT scoring suggested the same.

Statistical analysis

Data were entered into a Microsoft Excel data sheet and was analyzed using SPSS 22 version software. Categorical data were represented in the form of frequencies and proportions. Continuous data were represented as mean and SD. Analysis of variance or Kruskal–Wallis test was the test of significance to identify the mean difference between

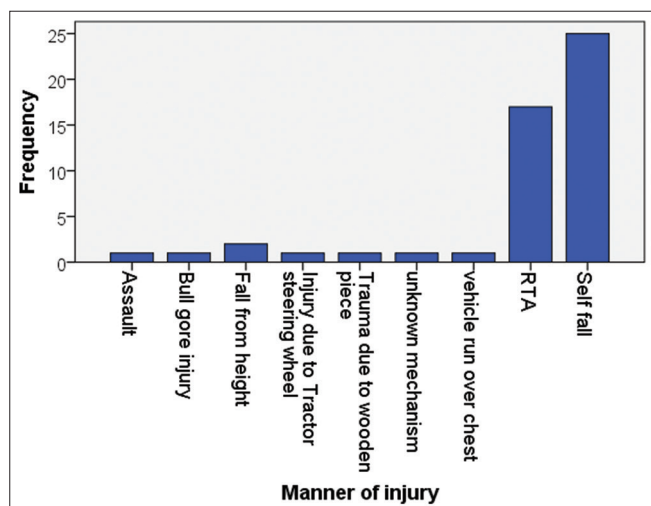


Figure 2: Graph representing manner of injury

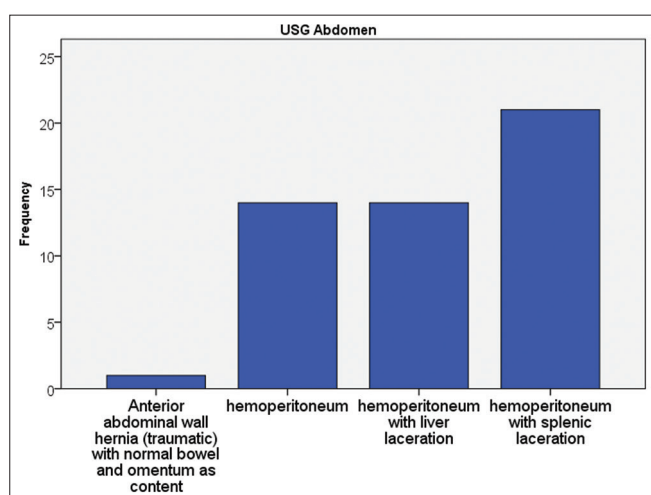


Figure 3: Focussed assessment of solid organ in trauma scan findings

more than two groups for quantitative and qualitative data, respectively.

MS Excel and MS Word were used for the graphical representation of data such as bar diagrams, pie diagram, and scatter plots. The probability that the result is true; $P < 0.05$ was considered statistically significant after assuming all the rules of statistical tests.

RESULTS

Gender distribution

In 50 cases, 44 were males accounting for 88% of the study population and 6 were females.³

Age distribution [Figure 1]

In this study, the majority of the cases belong to 18–30 years of age accounting for 46%, followed by 31–50 years of age, representing the working age groups.

Mode of injury [Figure 2]

In 84% of cases, road traffic accident (including a self-fall from the bike) was the mode of injury, followed by fall from height in 4%. Assault (blunt trauma to the abdomen) and fall from height in workplace being the other modes.⁴ Understanding the mode of injury helps in preventing the cause, thereby solving the root of the menace. Mehta et al say increase in the ease of procuring the vehicles, daily migration to urban areas, lack of safety and ignorance of safety measures have led to the current situation.⁵

Latent period

52% of cases presented to the hospital between 0 and 6 h of the incident. 36% of cases presented between 7 and 12 h. To not miss the golden hour of resuscitation, the latent period has to be kept as minimal as possible. In developing countries like India, improvement in prompt, well-equipped ambulance services plays a pivotal role.

Associated injuries

BTA is more often than not, a component of Polytrauma, as most cases are secondary to RTA. In our study, only BAT with chest injuries were included. However, cases of head injury were not included as that would alter the CASS scoring by impacting the Glasgow coma scale.

Hemoglobin (Hb) percentage

78% of the patients had a Hb value of more than 10 g% on presentation. Serial Hb and PCV monitoring was performed for cases that were being managed conservatively, to look for ongoing blood losses, i.e., in the form of hemoperitoneum.

Radiographic findings

Erect X-ray abdomen and chest X-ray were done in almost all the cases to look for associated rib fractures and hollow viscus perforation. 84% of X-rays were normal in our series. 6% had air under the diaphragm (pneumoperitoneum). 10% had associated chest injuries, i.e., rib fractures, hemothorax, and pneumothorax.

Diagnostic peritoneal lavage

DPL was performed in 8 out of 50 cases and was found to be positive in 80% of the patients.

Organ involvement [Table 1]

Among the 50 cases studied, 56% had splenic injury. 22% had a liver injury. 28% had hemoperitoneum with source of bleed being unknown. Hence, spleen is the most commonly injured organ, followed by the liver, Kidney, bowel and mesentery.

USG findings (FAST) [Figure 3]

The FAST scan is considered an extension of clinical examination, that helps us to localize the source of bleed

Table 1: Organ involvement in BTA patients

Organ	Number of patients	Percentage
Spleen	27	54
Liver	11	22
Kidney	2	4
Mesentery	1	2
Others	9	18

BTA: Blunt trauma abdomen

Table 2: CECT findings in BAT patients

CECT ABD findings	Frequency	Percent
Grade 2 AAST liver injury	2	4.0
Grade 3 AAST liver injury	4	8.0
Grade 4 AAST liver injury	1	2.0
Grade 5 AAST liver injury	1	2.0
Grade 2 AAST splenic injury	7	14.0
Grade 3 AAST splenic injury	9	18.0
Grade 4 AAST splenic injury	7	14.0
Grade 5 AAST splenic injury	1	2.0
Grade 2 AAST injury of liver and	1	2.0
Grade 3 AAST kidney injury		
Grade 3 AAST liver injury and	2	4.0
Grade 3 AAST splenic injury.		
Grade 3 AAST splenic injury	1	2.0
and Grade 3 AAST kidney injury.		
Not done	11	22.0
Perforation of distal jejunal loop with	1	2.0
adjacent collection and air pockets		
Pneumoperitoneum	1	2.0
Vascular congestion in the mesentery	1	2.0
Total	50	100.0

BAT: Blunt abdominal trauma

Table 3: Cross tabulation showing the comparison of CASS scoring with AAST CT grading of spleen

CECT AAST Grade of Splenic injury	CASS			Total
	<8	9–11	≥12	
2				
Count	0	7	0	7
% within CECT spleen	0.0%	100.0%	0.0%	100.0%
3				
Count	1	10	1	12
% within CECT spleen	8.3%	83.3%	8.3%	100.0%
4				
Count	1	6	0	7
% within CECT spleen	14.3%	85.7%	0.0%	100.0%
5				
Count	0	1	0	1
% within CECT spleen	0.0%	100.0%	0.0%	100.0%
Total				
Count	2	24	1	27
% within CECT spleen	7.4%	88.9%	3.7%	100.0%

Chi-square 0.872

P=0.767

quickly along with quantifying the hemoperitoneum, assisting in planning further management. Its importance cannot be emphasized enough as it is a quick, reliable, and handy tool in the assessment of a blunt trauma patient.⁶

Table 4: Cross tabulation showing the comparison of CASS scoring with AAST CT grading of liver

CECT AAST grade of liver injury	CASS		Total
	<8	9–11	
2			
Count	1	2	3
% within CECT liver	33.3%	66.7%	100.0%
3			
Count	2	4	6
% within CECT liver	33.3%	66.7%	100.0%
4			
Count	1	0	1
% within CECT liver	100.0%	0.0%	100.0%
5			
Count	0	1	1
% within CECT liver	0.0%	100.0%	100.0%
Total			
Count	4	7	11
% within CECT liver	36.4%	63.6%	100.0%

Chi-square- 0.502, P=0.397

Table 5: Management of BAT patients-surgical versus conservative

Treatment	No of patients	Percentage
Conservative	43	86
Operative	07	14

BAT: Blunt abdominal trauma

Hence FAST scan is the first, quick and easy tool used in the assessment of BAT patients.

CECT findings [Table 2]

CECT was performed in 39 out of 50 cases (i.e., excluding the cases with pneumoperitoneum and severe hemodynamic instability), not necessarily following the CASS protocol, as in this study, the sensitivity of CASS scoring to predict the need for laparotomy was being studied in comparison to that of AAST CT grading.

56% of the cases had a splenic injury and 22% of the cases had a liver injury, followed by 4% of the cases had kidney injury with AAST CT Grades as mentioned in the table above.

Comparison of CASS score with AAST CT score Spleen [Table 3]

7 cases of Grade 2 AAST CT corresponded to a CASS score between 9 and 11.

1 case of Grade 3 AAST CT corresponded to a CASS score of <8, 10 cases – score of 9–11 and 1 case – score of >12.

1 case of Grade 4 AAST CT score corresponded to a CASS score of < 8, 6 cases – score of 9–11.

1 case of Grade 5 AAST CT score corresponded to a CASS score between 9 and 11.

Liver [Table 4]

1 case of grade 2 AAST CT corresponded to <8 CASS score, 2 cases corresponded to 9–11 CASS score.

2 cases of grade 3 AAST CT corresponded to <8 CASS score, 4 cases corresponded to 9–11 CASS score.

1 case of grade 4 AAST CT score corresponded to <8 CASS score, 1 case corresponded to 9–11 CASS score.

1 case of grade 5 AAST CT score corresponded to 9–11 CASS score.

With the above results, a strong positive correlation can be established between the CASS score and AAST CT grading. Eventhough preliminary bivariate analysis could not prove a statistically significant correlation under a confidence interval of 95%, the numerical values and percentage values show good association.

Ratio of operative to conservative treatment [Table 5]

07 (14%) of the patients underwent emergency laparotomy because of hemodynamic instability and associated hollow viscus injury. 43 patients were managed non-operatively because they had no signs of peritonitis and they were hemodynamically stable.

Mortality

There were no deaths in the present study.

DISCUSSION

- Males (82%) outnumbered females (18%). The most common age group affected is of 21–30 years which forms the young and reproductive group. The numbers were in comparison with a study conducted by Yogesh et al., where there were 75% of males and the rest, females³ which was comparable to a study conducted by Kumar et al – 78.6%.⁷
- Road traffic accident forms the most common mode of injury (84%).

The majority of our study population (90%) presented with pain abdomen followed by abdominal distension (56%).

- The latent period in our study was <12 h in 88% of cases. Timely evaluation of Blunt Trauma plays a significant role in its management⁶
- X-ray erect abdomen and chest X-ray forms important investigational tools.
- Ultrasonography (FAST) has picked up solid organ

injury or collection in 90–95% of cases. Hence, it becomes an important tool in an emergency setup, more so in hemodynamically unstable patients.

- Spleen was the most commonly injured solid organ. A similar study conducted by Singh et al., showed 28% involvement of spleen > liver (18%) >bowel (16%)⁸
- DPL was done in a small number of patients since the facility of high-resolution ultrasonography (FAST) was available in our institution.
- CECT abdomen was performed in 76% of the study population and had a pivotal role in deciding operative or conservative management in hemodynamically stable patients. The results of the same were correlated to the CASS scoring as a part of the study and analyzed. There were no deaths in our study. However a similar study conducted by Vanitha et al showed 8% mortality proving a strong correlation of higher CASS with increased mortality⁹ and Dave D. showed 10%¹⁰ proving a strong correlation of higher CASS with increased mortality.

Limitations of the study

- A statistically significant association between CASS scoring and AAST CT grading could not be derived probably because of the low sample size.
- Due to the low sample size, number of cases with kidney and pancreatic injury was very low and hence the current study limits itself to that of the liver and spleen.
- Since the patients who underwent surgery also had an associated hollow viscous injury, the decision of laparotomy cannot be wholly attributed to the CASS score corresponding to >12 for a solid organ injury.

CONCLUSION

- CASS scoring is therefore inferred to be a reliable, quick and easy diagnostic tool for determining the need for laparotomy and aids in avoiding the stress of surgery in patients who can be managed non-operatively
- CASS has sensitivity in determining the need for laparotomy, almost comparable to that of AAST CT grading.

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UBZ- Definition of intellectual content, Literature survey, Prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **MNY-** Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **SDH-** Design of study, statistical Analysis and Interpretation; **HR-** Review Manuscript.

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