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# COMPARATIVE STUDY BETWEEN BLUNT ABDOMINAL TRAUMA SCORING SYSTEM (BATSS) AND CECT ABDOMEN TO DETECT BLUNT TRAUMA ABDOMEN IN ADULT PATIENTS

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**ABSTRACT**

**Background**: Blunt abdominal trauma is the third most common cause of death resulting from trauma. The Blunt Trauma Scoring System (BATSS) was developed to diagnose intra-abdominal injuries and identify a select subset of patients for further investigations. This scoring system simplifies triage, reduces unnecessary computed tomography (CT) scans, minimizes radiation exposure, and lowers the costs associated with diagnosis and treatment.

**Aim**: To compare BATSS with Contrast-Enhanced Computed Tomography (CECT) of the abdomen in diagnosing blunt abdominal trauma among adults.

**Patients and Methods**: This descriptive study was conducted on a population of 155 adult patients who presented to the general surgery casualty at Government Medical College, Kozhikode.

**Results**: Among the 155 patients, 89.7% were male. The BATSS and CECT identified intra-abdominal injuries in 90.3% (n=140) of the cases. Notably, all patients with intra-abdominal injury had a BATSS score greater than 8. The sensitivity and specificity of BATSS in diagnosing blunt abdominal trauma were found to be 100% and 97.3% respectively, with an optimal cutoff ROC curve value of 8.5. A BATSS score greater than 8 strongly predicts the presence of intra-abdominal injury.

**Conclusion**: BATSS, which incorporates clinical manifestations, pelvic fractures, and Focused Assessment with Sonography in Trauma (FAST), is a highly precise and reliable diagnostic tool for detecting blunt abdominal trauma. It has the potential to reduce unnecessary CT scans and associated costs.

**Keywords:** Blunt trauma abdomen, Blunt trauma scoring system, Laparotomy.

## Introduction:

Injury to the abdomen is the third most common cause of death from trauma.[1] Early diagnosis and treatment can reduce mortality by up to 50%.[2] Some questions may arise when facing a patient with suspected blunt abdominal trauma (BAT) in the emergency department (ED). There is no exact available protocol to prioritise diagnostic procedures in BAT. Some diagnostic methods are not reliable, and some that can be trusted are not available or too expensive and have serious side effects.

Intraabdominal injuries (IAI) diagnostic methods include a physical exam,

ultrasound, CT scan, laparoscopy, laparotomy, and laboratory tests.[3] All of these methods had advantages and disadvantages. A careful physical exam is very important in determining the choice of diagnostic approach and management, but its accuracy is low, especially in unconscious patients.[4-5] Although ultrasound is the first diagnostic approach for IAI[6], its accuracy is quite operator-dependent and has low efficacy for hollow viscous and non-bleeding parenchymal injuries. Therefore, it is not very reliable in detecting BAT,[7] CT scan is the gold standard for assessing BAT,[8-9] but in addition to being expensive and not easily accessible, it entails irradiation to the patient.[10,11] As previously stated, emergency physicians do not have clinical prediction tools to identify trauma patients at risk for IAI after BAT. Each diagnostic method has disadvantages that limit its use. In other words, the use of various diagnostic methods is not only time-consuming but also expensive and imposes high costs to the patient as well as the health care system. Thus designing a scoring system for the correct selection of patients based on risk assessment and performing suitable diagnostic tests or discharging the patients would be highly recommended. Therefore, this study was established to present an applicable scoring system for the selection of patients suspected of BAT and sought to make easy triage to save time, and reduce unnecessary CT scans, radiation exposures and costs for diagnosis and treatment.

## Patients and Methods

**Study design:** Cross-sectional study.

**Study period:** One and half years from June 2021 to June 2022. The last 6 months of the study period were utilized to analyze the data collected and to document the findings in the thesis format.

**Study setting:** General Surgery casualty, Government Medical College Kozhikode, India.

**Study population:** Adult patients with blunt trauma abdomen coming to the casualty of Government Medical College, Kozhikode.

**Inclusion criteria:**

All patients with a history of blunt trauma abdomen due to road traffic accidents, fall from heights, acceleration-deceleration injuries, pedestrian trauma, motorcycle crash, or direct trauma.

**Exclusion criteria:**

Patients under 18 years of age.

Patients on Warfarin.

Patients without reliable history or physical examination (GCS<12).

Impaired verbal patients unable to give careful history.

Penetrating abdominal trauma.



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**Sample Size:** As per the frequency of intra-abdominal injuries (18.4%) among blunt trauma patients in a previous study, the sample size is calculated using the formula $4pq/d^2$ proportion. In the previous study, out of 261 patients, 48 cases of intra-abdominal injuries were detected, so the proportion of intraabdominal injuries using the CECT abdomen was found to be 18.4%.[12,13]

Sensitivity (p): 80%; q-20; Absolute precision (d) -15.

n = 4x80 x 20 / 15x15 = 155.

Sample Size: 155.

**Data collection:** This Cross-sectional clinical study conducted on Patients admitted with a history of blunt trauma abdomen, undergoing surgical intervention, or treated by non-operative management. Patients with penetrating injuries and gunshot injuries were excluded from the study. After admission, data was collected by direct interview with the patient or patient relatives accompanying the patient and obtained a detailed history.

Based on ATLS and ED protocol, all patients were assessed first followed by appropriate treatment. CT scans were also performed based on ED protocol and results were considered the gold standard. The questionnaire (Closed response format questionnaire) was filled based on patient history, physical examination, and USG findings, and completed after CT scan. In the physical exam, data collected including vital signs such as blood pressure and pulse rate (PR), abdominal guarding, abdominal tenderness, abdominal wall sign (erythema, ecchymosis, abrasion), low chest ribs (6 lower ribs) tenderness, chest wall sign (erythema, ecchymosis, abrasion ) and pelvic fracture. Focussed Assessment with Sonography in Trauma (FAST) of 4 abdominal areas (hepatorenal, splenorenal, pericardial, perivesical) by USG device. Detection of free fluid is considered positive and pathologic.

CECT abdomen with intravenous contrast were done and it was considered the gold standard for IAI detection.

A 24-point blunt abdominal trauma scoring system (BATSS) was developed. The point for each factor was;

- PR>100/min-1,
- Chest wall Sign -1,
- Abdominal pain -2,
- Abdominal tenderness -3,
- SBP<100mmHg-4,
- Pelvic fracture -5,
- FAST -8.

Patients with scores <8 were identified as low risk for IAI, while those with scores>12 should be highly suspected of having IAI. Scores between 8-11 were identified as moderate-risk patients and

needed additional observations and tests to find the correct diagnosis. Written consent was obtained from the patient before the study.

Study tools used including clinical Examination; Proforma ; Imaging Studies-FAST, CECT (Abdomen), Scoring system (BATSS).

**Statistics:** The blunt abdominal trauma scoring system (BATSS) for diagnosing blunt trauma abdomen would be compared with CT findings, ROC analysis, and optimal cut-off will be identified. Sensitivity and specificity for optimal cut-off was calculated.

**Ethical concern:** Study protocol approval taken from Institutional Ethics Committee, Government Medical College Kozhikode. Written informed consent was taken from the participants.

## Results

Out of 155 patients, we observed that 140 (90.3%) patients 155 had intra-abdominal injuries. The majority of patients with blunt trauma abdomen were found in the age group of 18-30 years (32.3%,n=50), followed by 36 cases in 40-50 yrs, 35 cases in 30-40 yrs, and 34 cases in aged older than 50 years age group respectively. Out of 140 patients with intra-abdominal injury (IAI), we observed that the BATSS score was greater than 8 in all 140 patients. BATSS score 8-11 was found in 16 patients (10.3%) and BATSS score >12 was found in 124 patients (80%). CECT abdomen was found to be positive in 140 patients who had BATSS scores of more than 8 which suggest that the patient has an intra-abdominal injury.

Majority of patients with blunt trauma abdomen were observed to be males (89.7%,n=139). Majority of patients with BATSS >8 have been associated with intra-abdominal injuries. 80% (n=124) of patients were noted to have BATSS > 12, followed by 16 cases in BATSS 8-11, and 15 cases in BATSS <8 score respectively. 139 patients out of 155 had positive CT abdomen. One patient underwent laparotomy on an emergency basis.

140 patients had a BATS score of more than 8. Out of these 123 patients, patients had an intra-abdominal injury which was confirmed by CT Abdomen. 16 patients underwent laparotomy for solid organ injury. one patient underwent laparotomy without CT abdomen. The liver (43.2%,n=67) was the most common organ injured in blunt trauma in this study. Spleen (17.4%,n=30), and renal injury (7.1%,n=13) were noted (Table I).

**Table I. Basic demographics and findings of CECT abdomen, injury type and BATSS score at admission**

| | Frequency, n | Percentage |
|---|---|---|
| Age group | | |
| 18-30 yr | 50 | 32.25 |
| 31-40 yr | 35 | 22.58 |
| 41-50 yr | 36 | 23.22 |
| >50 yr | 34 | 21.94 |
| Sex | | |
| Male | 139 | 89.67 |
| Female | 16 | 10.33 |
| **BATSS** | | |
| **<8** | 15 | 9.67 |
| **8-11** | 16 | 10.33 |
| **>12** | 124 | 80 |
| **CECT abdomen** | | |
| **Positive** | 139 | 89.67 |
| **Negative** | 15 | 10.33 |
| **Organs injured** | | |
| **Liver** | 67 | 43.22 |
| **spleen** | 30 | 19.35 |
| **Multiple injury** | 25 | 16.13 |
| **Renal** | 13 | 8.39 |
| **GIT** | 5 | 3.22 |

The plotted ROC curve showed a close relationship between BATSS and the results of CT abdomen. ROC analysis was done and the optimal cut-off was found to be 8.5. Based on this curve, the sensitivity of the BATSS found to be 100 % which demonstrated the high accuracy of this scoring system (Figure 1). The specificity of BATSS was found to be around 97.3% .

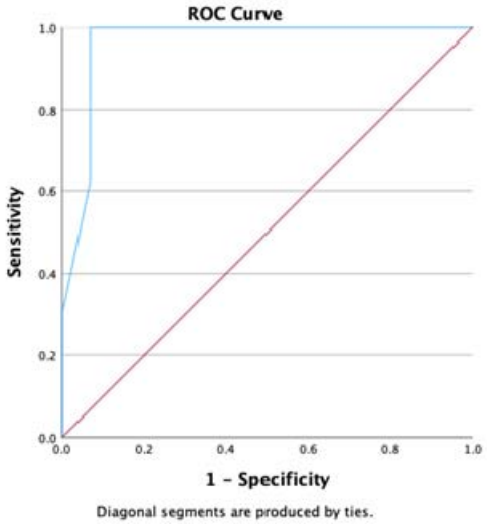


**Figure 1. ROC curve of BATSS and CT abdomen**

**Discussion:**

This study was done to assess the sensitivity and specificity of BATSS in diagnosing intra-abdominal injuries.

BATSS for diagnosing intra-abdominal injuries in patients with blunt trauma abdomen was based on clinical presentation such as patient history, physical examination, and FAST. Diagnosis based on this scoring system is very similar to the results obtained from the CT scan (sensitivity of 100% based on the ROC curve). The specificity of the BATSS score was found to be 97.3%. And the optimal cut-off of the BATSS score according to the ROC curve was found to be 8.5. BATSS of more than 8 is a strong predictor of having intra-abdominal injury following blunt trauma abdomen. Thus BATSS has the potential to prevent unnecessary CT scans in patients with suspected IAI after blunt trauma abdomen.

According to this scoring system (BATSS), patients were classified into three groups in order of severity. Low-risk groups (BATSS<8) don't need a CT scan after blunt trauma abdomen and can be discharged without additional tests. Moderate risk groups (BATSS 8-11) may have an intra-abdominal injury and needs additional investigations such as a CT scan, diagnostic lavage, serial ultrasound, physical examination, or diagnostic laparoscopy to rule out intra-abdominal injuries. All high risks groups (BATSS>12) suffer from intra-abdominal injury and may need medical or surgical intervention at the earliest. In our study, we did CT scans for our patients who were FAST-positive in the initial evaluation.

Shojaee et al suggested that no CT scan is needed for patients who are FAST negative and BATSS less than 8. Thus, BATSS can help in predicting intra-abdominal injuries following blunt trauma abdomen and this can help reduce healthcare systems costs, amount of radiation as well as ED overcrowding.[14]

Few other studies have been described in the literature regarding the reliable scoring system for intra-abdominal injury detection in blunt trauma abdomen patients. Afifi et al[22] provided a 15-point scoring system based on five parameters including the ED admission time post-trauma, PR, SBP, GCS, and three clinch signs of abdominal trauma. Patients were divided into three groups based on severity. Group, I score >-12 immediate laparotomy should be done. Group II score between 9-11 needs further assessments and Group III (score <-8) should be kept under observation. In this study[15] they include children over two years old, where the rate of hypotension in this age range is different from that of adults.

Cotton et al pointed out in their study that the absence of abrasion, ecchymosis, or abdominal tenderness with normal liver



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enzymes in children can rule out an intra-abdominal injury with a sensitivity of 100%.[16] Another study by Poletti et al[7] found that if abdominal physical examination, ultrasound, chest Xray and lab findings ( hematocrits, WBC, serum Aspartate transaminase ) are normal, intra-abdominal injury can be ruled out.

BATSS was designed due to a lack of clinical guidelines for taking CT scans in patients affected with blunt trauma abdomen. This BATSS can help in selecting a subset of patients with blunt trauma abdomen for interventions. Thus it may be in reducing unnecessary CT scans, ED overcrowding, radiation exposure, time-wasting, and high expenses. Combination of clinical presentation, FAST results has sensitivity and specificity similar to CT scan in the diagnosis of IAI. This scoring system enables the ED personnel to have quick and accurate IAI diagnosis in patients suspected of blunt trauma abdomen.

A potential limitation of the present study would be the small assessed proportion. Another limitation is the age which covers 21-30 years old. This would convey that other age groups especially the older and the children alters BATSS into rather inaccurate and inefficient in these age groups. However, this study may still be the most needed one in the setting of ER with accessible diagnostic criteria because trauma is more common in the age group of 21-30 as described in this study.

## Conclusion:

The Blunt trauma abdominal scoring system (BATSS) based on clinical manifestations, and pelvic fractures, FAST possesses high precision and reliable diagnostic tool for blunt trauma abdomen detection and has the potential to reduce unwanted CT scans and cut unnecessary costs.

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1-Manjush E, 2-Sathish Kumar R
Work concept and design 1,2
Data collection and analysis 1,2
Responsibility for statistical analysis 1,2
Writing the article 1,2
Critical review 1

Final approval of the article 1,2
Each author believes that the manuscript represents honest work and certifies that the article is original, is not under consideration by any other journal, and has not been previously published.
**Availability of Data and Material:** The corresponding author is prompt to supply datasets generated during and/or analyzed during the current study on wise request.

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