

Comparison of The Accuracy of The Blunt Abdominal Trauma Scoring System and The Novel Scoring System in Predicting Outcomes in Patients With Blunt Abdominal Trauma At Dr. Soetomo General Hospital, Surabaya, January–December 2025

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ABSTRACT

Background: Blunt abdominal trauma is a significant cause of morbidity and mortality among trauma patients. Rapid determination of the need for laparotomy is essential to prevent delays in treatment. Several scoring systems, including the Blunt Abdominal Trauma Scoring System (BATSS) and the Novel Scoring System, have been developed to assist in predicting the need for operative intervention. This study aimed to compare the accuracy of these two scoring systems in predicting the need for laparotomy in patients with blunt abdominal trauma.

Objective: This observational analytic study employed a retrospective cohort design using medical records of 82 patients with blunt abdominal trauma treated at Dr. Soetomo General Hospital, Surabaya, from January to December 2025. The diagnostic performance of BATSS and the Novel Scoring System was evaluated using receiver operating characteristic (ROC) curve analysis, including area under the curve (AUC), sensitivity, specificity, and accuracy.

Results: The AUC of BATSS was 81%, which was higher than that of the Novel Scoring System (73.2%). At a cut-off value of 10.5, BATSS demonstrated a sensitivity of 60%, specificity of 97.3%, and accuracy of 81%. In comparison, the Novel Scoring System at a cut-off value of 0.75 demonstrated a sensitivity of 57.8%, specificity of 89.2%, and accuracy of 73.2%. These findings indicate that BATSS is superior in identifying patients who require and those who do not require laparotomy.

Conclusion: BATSS demonstrated better diagnostic performance than the Novel Scoring System in predicting the need for laparotomy in patients with blunt abdominal trauma and may serve as an adjunctive tool for initial screening and clinical decision-making.

Keywords: Blunt abdominal trauma, BATSS, Novel Scoring System, laparotomy, diagnostic accuracy.

1. INTRODUCTION

Blunt abdominal trauma is a significant cause of morbidity and mortality among trauma patients. This type of trauma occurs without penetration into the peritoneal cavity and may result from blows, impacts, explosions, deceleration, or compression. Motor vehicle collisions, assaults, and falls from height are common mechanisms and may cause multiple injuries to intra-abdominal organs, including the spleen, liver, and hollow viscera such as the small intestine (Şahin et al., 2023).

Management of blunt abdominal trauma is performed systematically through the primary survey and secondary survey, with the main principle of maintaining hemodynamic stability. Focused assessment with sonography for trauma (FAST) and abdominal computed tomography (CT) play important roles in diagnosing intra-abdominal injuries. Abdominal CT is a highly accurate examination, but it requires patient transport, exposes the patient to radiation, incurs additional costs, and cannot be performed in hemodynamically unstable patients. FAST is faster and non-invasive, but it is operator-dependent and has limitations in detecting injuries to certain organs (American College of Surgeons, 2025; Achatz et al., 2020; Zarama et al., 2024).

These limitations make rapid determination of the need for operative intervention challenging. One clinical tool developed to address this issue is the Blunt Abdominal Trauma Scoring System (BATSS), which combines clinical parameters and FAST findings. BATSS has demonstrated sensitivity of up to 100% and specificity of 87.1% in several studies, although results may vary among populations. The system includes blood pressure, heart rate, abdominal pain, abdominal tenderness, pelvic fracture, chest wall signs, and FAST findings, with a maximum score of 24 (Shah et al., 2023).

Another scoring system is the Novel Scoring System, which uses a statistical approach incorporating clinical variables such as vomiting, abdominal rigidity, rebound tenderness, absence of bowel sounds, pelvic fracture, free intra-abdominal fluid on FAST, and history of first aid. Previous research reported a sensitivity of 76.9% and specificity of 74.3% for predicting the need for laparotomy (Sunil Krishna et al., 2022). BATSS has the advantage of ease of use and integration of simple clinical data, whereas the Novel Scoring System provides a more individualized probabilistic approach.

Based on this background, this study was conducted to compare the accuracy of BATSS and the Novel Scoring System in predicting the need for laparotomy in patients with blunt abdominal trauma at Dr. Soetomo General Hospital, Surabaya, from January to December 2025. The parameters compared included sensitivity, specificity, positive predictive value, negative predictive value, accuracy, and area under the curve (AUC) based on ROC analysis.

2. MATERIALS AND METHODS

2.1 Study Design

This was an observational analytic study with a retrospective cohort design using a diagnostic accuracy study approach. The study evaluated the ability of BATSS and the Novel Scoring System to predict the clinical outcome of either laparotomy or conservative management. Data were obtained from the medical records of patients with blunt abdominal trauma who received management at Dr. Soetomo General Hospital, Surabaya.

The study population consisted of all patients diagnosed with blunt abdominal trauma who presented to Dr. Soetomo General Hospital, Surabaya, during January–December 2025. The sample consisted of patients who met the study criteria and had the medical-record data required to calculate both scoring systems. Consecutive sampling was used.

2.2 Data Collection and Processing

The collected data included age, sex, mechanism of injury, heart rate, blood pressure, abdominal clinical findings, FAST findings, data required to calculate BATSS and the Novel Scoring System, and patient outcome in the form of laparotomy or conservative management.

BATSS was calculated using clinical and imaging parameters according to the BATSS system, with a score ranging from 0 to 24. Risk categories consisted of low, moderate, and high risk. In this study, diagnostic analysis used the optimal cut-off obtained from ROC analysis and the Youden Index.

The Novel Scoring System was calculated using a statistical model based on clinical variables obtained from the medical records, including vomiting, abdominal rigidity, rebound tenderness, absence of bowel sounds, pelvic fracture, free intra-abdominal fluid on FAST, and history of first aid.

2.3 Statistical Analysis

Discriminatory performance was assessed using receiver operating characteristic (ROC) analysis and the area under the curve (AUC). AUC values were compared to assess the ability of each scoring system to distinguish patients who required laparotomy from those who did not. The optimal cut-off was determined using the Youden Index. At the selected cut-off, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy were calculated. A p-value <0.05 was considered statistically significant.

3. RESULTS

Patient characteristics

A total of 82 patients with blunt abdominal trauma were analyzed. The mean age was 38.87 ± 17.87 years. Most patients were aged 18–59 years, comprising 63 patients (76.8%), followed by patients aged ≥ 60 years (13 patients; 15.9%) and ≤ 17 years (6 patients; 7.3%). Most patients were male (65 patients; 79.3%), while 17 patients (20.7%) were female.

Regarding the mechanism of trauma, deceleration was the most common mechanism, occurring in 46 patients (56.1%), followed by external compression in 28 patients (34.1%) and crushing in 8 patients (9.8%). Thirty-five patients (42.7%) underwent laparotomy, while 47 patients (57.3%) received conservative management. Seventy-seven patients (93.9%) were discharged from the hospital, while 5 patients (6.1%) died.

The distribution of BATSS scores showed that 28 patients (34.1%) had a score < 8 , 40 patients (48.8%) had a score of 8–12, and 14 patients (17.1%) had a score ≥ 12 . For the Novel Scoring System, 52 patients (63.4%) were categorized as low risk and 30 patients (36.6%) as high risk.

Table 1. Patient characteristics

Variable	n	%
Age, mean $\pm$ SD	38.87 ± 17.87	
≤ 17 years	6	7.3
18–59 years	63	76.8
≥ 60 years	13	15.9
Male	65	79.3
Female	17	20.7
Crushing	8	9.8
External compression	28	34.1
Deceleration	46	56.1
Laparotomy	35	42.7
Conservative management	47	57.3
Discharged	77	93.9
Death	5	6.1
BATSS < 8	28	34.1
BATSS 8–12	40	48.8
BATSS ≥ 12	14	17.1
Novel low risk	52	63.4
Novel high risk	30	36.6

ROC analysis and cut-off values

The Novel Scoring System had an AUC of 0.732 with a standard error of 0.056, $p=0.000$, and a 95% confidence interval of 0.622–0.841. This value indicates fair discriminatory ability in distinguishing patients who required laparotomy from those who did not.

BATSS had an AUC of 0.810 with a standard error of 0.049, $p=0.000$, and a 95% confidence interval of 0.714–0.907. This value indicates good discriminatory ability. The AUC of BATSS was higher than that of the Novel Scoring System. Based on the Youden Index, the optimal

BATSS cut-off was 10.5. At this cut-off, BATSS had a sensitivity of 60%, specificity of 97.3%, and accuracy of 81%. The Novel Scoring System used a cut-off of 0.75, with a sensitivity of 57.8%, specificity of 89.2%, and accuracy of 73.2%. The PPV and NPV of the Novel Scoring System were still listed as blank data in the source final paper; therefore, they were not

Table 2. Comparison of the diagnostic performance of BATSS and the Novel Scoring System

System	Cut-off	AUC	Sensitivity	Specificity	Accuracy
BATSS	10.5	0.810 (81%)	60%	97.3%	81%
Novel Scoring System	0.75	0.732 (73.2%)	57.8%	89.2%	73.2%

4. DISCUSSION

This study demonstrated that BATSS had better diagnostic performance than the Novel Scoring System in predicting the need for laparotomy in patients with blunt abdominal trauma. This was reflected by the AUC of 0.810 for BATSS, which was higher than the AUC of 0.732 for the Novel Scoring System. At the optimal cut-off, BATSS also had higher specificity and accuracy, whereas the sensitivities of the two systems were relatively similar.

The patient characteristics demonstrated a predominance of the productive-age group. A total of 76.8% of patients were aged 18–59 years. The predominance of this age group is consistent with previous studies and may be related to greater outdoor activity, exposure to motor vehicles, occupational hazards, and other physical activities. Socially, individuals of productive age also have greater exposure to trauma-related risks. Regarding sex, males predominated, accounting for 79.3% of the study population. This finding is consistent with several previous studies demonstrating male predominance in blunt abdominal trauma. This pattern may be associated with greater exposure to high-risk activities, traffic accidents, construction or heavy industrial work, and behavioral factors.

The mechanism of trauma in this study was predominantly deceleration, accounting for 56.1% of cases. High-energy trauma caused by traffic accidents may result in multiple injuries and increase the likelihood of operative intervention. This finding is consistent with previous studies identifying traffic accidents as one of the major etiologies of blunt abdominal trauma.

The distribution of BATSS scores demonstrated clear risk stratification, with the moderate-risk group being the largest. Higher BATSS scores may reflect a combination of more severe clinical and radiological findings, such as hypotension, tachycardia, signs of peritonitis, and positive FAST findings. Clinically, these findings are associated with a greater likelihood of significant intra-abdominal injury and the need for operative intervention.

The AUC results showed that BATSS had good discriminatory ability, whereas the Novel Scoring System had fair discriminatory ability. This difference may be related to the characteristics of the variables included in each system. BATSS integrates hemodynamic parameters, clinical findings, and FAST, making it relatively easy to apply during the initial evaluation. The Novel Scoring System uses a probabilistic approach involving several clinical variables and may provide a more individualized risk estimate, but its implementation depends more heavily on the availability and completeness of the required data.

The high specificity of BATSS in this study indicates good ability to identify patients who do not require laparotomy. This differs from some previous studies that reported lower specificity of BATSS in certain populations. Such differences may be related to population characteristics, injury prevalence, distribution of injury severity, and the clinical setting.

The Novel Scoring System had an AUC of 0.732 in this study, lower than that of BATSS. This finding also differs from some previous reports that demonstrated higher sensitivity and specificity. Variations in performance may be attributable to differences in population characteristics, study design, injury prevalence, and patients' clinical characteristics.

Overall, the findings support the use of BATSS as an adjunctive initial screening tool for predicting the need for laparotomy in blunt abdominal trauma. However, scoring systems do not replace clinical assessment, serial examinations, FAST, CT in appropriate patients, or expert clinical judgment. The Novel Scoring System may still have potential as a predictive tool, particularly in settings where a probabilistic approach is desirable.

Study limitations

This retrospective cohort study depended on the completeness and accuracy of medical-record documentation. The study was conducted at a single center; therefore, generalization of the findings to other populations or hospitals should be undertaken with caution. In addition, the PPV and NPV of the Novel Scoring System were not available in the source manuscript and therefore could not be fully compared.

5. CONCLUSION

BATSS demonstrated good diagnostic performance in predicting the need for laparotomy in patients with blunt abdominal trauma at Dr. Soetomo General Hospital, Surabaya. At a cut-off of 10.5, BATSS had a sensitivity of 60%, specificity of 97.3%, accuracy of 81%, and AUC of 0.810.

The Novel Scoring System was also able to predict the need for laparotomy, but its performance was lower than that of BATSS. At a cut-off of 0.75, the Novel Scoring System had a sensitivity of 57.8%, specificity of 89.2%, accuracy of 73.2%, and AUC of 0.732.

Therefore, BATSS demonstrated better diagnostic performance and may be used as an adjunctive tool for initial screening and clinical decision-making in patients with blunt abdominal trauma.

6. RECOMMENDATIONS

- BATSS is recommended as an adjunctive initial triage tool for predicting the need for laparotomy in blunt abdominal trauma.
- Training of medical personnel is needed to optimize the use and interpretation of the scoring system.
- Future studies should be conducted prospectively in newly presenting patients who have not yet received prior treatment.

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