

Original Research Article

A COMPARATIVE STUDY OF EXTENDED FOCUSED ASSESSMENT SONOGRAPHY FOR TRAUMA (E-FAST) VERSUS COMPUTED TOMOGRAPHY (CT) IN DIAGNOSING BLUNT THORACO-ABDOMINAL INJURIES

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ABSTRACT

Background: Blunt thoraco-abdominal trauma is a major cause of morbidity and mortality worldwide. Rapid identification of internal injuries is essential for timely intervention and improved outcomes. Although Computed Tomography (CT) is considered the gold standard for trauma evaluation, Extended Focused Assessment with Sonography for Trauma (e-FAST) offers a rapid, bedside, radiation-free alternative for the initial assessment of trauma patients. The objective is to evaluate the utility of e-FAST in patients presenting with blunt thoraco-abdominal trauma and to compare its effectiveness with CT in diagnosing thoracic and abdominal injuries.

Materials and Methods: This prospective observational comparative study was conducted in the Department of Emergency Medicine, PES Institute of Medical Sciences and Research, Kuppam, Andhra Pradesh, from January 2024 to June 2025. A total of 63 patients with blunt thoraco-abdominal trauma were enrolled. All patients underwent e-FAST examination followed by CT evaluation, which served as the reference standard. The diagnostic performance of e-FAST was assessed by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy.

Results: The majority of patients belonged to the 21–30 years age group (33.3%), and males constituted 90.5% of the study population. Road traffic accidents were the most common mechanism of injury (57.1%). On e-FAST examination, pneumothorax and abdominal free fluid were each detected in 33.3% of patients, while hemothorax was identified in 27.0%. CT detected injuries in 88.9% of patients. Compared with CT, e-FAST demonstrated a sensitivity of 83.93%, specificity of 100%, PPV of 100%, NPV of 43.75%, and overall diagnostic accuracy of 85.7%. The association between e-FAST and CT findings was statistically significant ($\chi^2=18.52$, $p<0.0001$). Rib fractures (55.6%) and lung contusions (44.4%) constituted the false-negative cases.

Conclusion: e-FAST is a rapid, reliable, and highly specific bedside imaging modality for the evaluation of blunt thoraco-abdominal trauma. Although CT remains the gold standard, e-FAST serves as an effective initial screening and triage tool, facilitating early diagnosis and management, particularly in emergency and resource-limited settings.

Keywords: Blunt thoraco-abdominal trauma; Extended focused assessment with sonography for trauma (e-FAST); Computed tomography; Trauma imaging; Pneumothorax; Hemothorax; Diagnostic accuracy.

INTRODUCTION

Blunt thoraco-abdominal trauma remains a major cause of morbidity and mortality worldwide, particularly among young and economically productive individuals. Road traffic accidents are the most common mechanism of injury, followed by falls and assaults, and frequently result in complex injury patterns involving multiple organ systems. Early identification of life-threatening thoracic and abdominal injuries is essential, as delayed diagnosis and intervention significantly increase the risk of hemorrhagic shock, respiratory compromise, organ failure, and death. Clinical assessment alone is often inadequate in trauma patients due to altered sensorium, associated injuries, and the absence of early overt signs of internal bleeding, making timely diagnosis challenging.^[1,2]

Imaging therefore plays a central role in the evaluation and management of blunt thoraco-abdominal trauma. Contrast-enhanced computed tomography (CT) is widely regarded as the gold standard imaging modality because of its ability to provide detailed anatomical information, accurately identify thoracic and abdominal injuries, detect active bleeding, and assess injury severity. However, CT has several limitations in the acute trauma setting, including radiation exposure, cost, limited availability, the need for patient transport, and difficulty in performing the examination in hemodynamically unstable patients.^[3]

Focused Assessment with Sonography for Trauma (FAST) was developed as a rapid bedside ultrasonographic examination for the detection of free intraperitoneal and pericardial fluid in trauma patients. With advances in trauma imaging, FAST evolved into Extended Focused Assessment with Sonography for Trauma (e-FAST), which additionally evaluates the thoracic cavity for pneumothorax and hemothorax. e-FAST can be performed rapidly at the bedside, is non-invasive, repeatable, free of ionizing radiation, and can be integrated into the initial trauma assessment without interrupting resuscitative efforts.^[4]

The use of e-FAST has gained widespread acceptance in emergency and trauma care because it enables early identification of potentially life-threatening conditions such as hemoperitoneum, hemothorax, pneumothorax, and cardiac tamponade. Its portability and ease of use make it particularly valuable in emergency departments, prehospital settings, and resource-limited environments.

Furthermore, e-FAST assists clinicians in making rapid management decisions by helping differentiate patients who require urgent intervention from those who may be managed conservatively.^[5]

Despite its advantages, variability exists in the reported diagnostic performance of e-FAST. Its sensitivity may be influenced by operator expertise, patient characteristics, injury pattern, and the volume of free fluid present. In addition, certain injuries such as hollow viscus injuries, mesenteric injuries, retroperitoneal hemorrhage, and low-grade solid organ injuries may be missed. Therefore, understanding the diagnostic utility of e-FAST in comparison with CT is essential for optimizing trauma evaluation and management strategies.^[6,7]

The present study was undertaken to evaluate the utility of e-FAST in patients presenting with blunt thoraco-abdominal trauma and to compare its effectiveness with computed tomography in diagnosing thoracic and abdominal injuries. By assessing the correlation between e-FAST and CT findings, this study aims to further define the role of e-FAST as a frontline diagnostic tool in trauma care.

Aims and Objectives

Aim

To evaluate the utility of Extended Focused Assessment with Sonography for Trauma (e-FAST) in patients with blunt thoraco-abdominal trauma and to compare its effectiveness with Computed Tomography (CT) in diagnosing thoracic and abdominal injuries.

Objectives

- To explore the utility and assess e-FAST in patients presenting with blunt thoraco-abdominal trauma.
- To compare the effectiveness of e-FAST with Computed Tomography in diagnosing blunt thoraco-abdominal injuries.

MATERIALS AND METHODS

This prospective observational comparative study was conducted in the Department of Emergency Medicine, PES Institute of Medical Sciences and Research (PESIMSR), Kuppam, Andhra Pradesh, over a period of 18 months from January 2024 to June 2025. The study was undertaken after obtaining approval from the Institutional Ethics Committee, and informed consent was obtained from all participants or their legally authorized representatives before enrolment.

The study included patients presenting to the Emergency Department with a history of blunt thoracic, abdominal, or thoraco-abdominal trauma. Consecutive eligible patients fulfilling the inclusion criteria were recruited during the study period. Patients with penetrating trauma, those requiring immediate surgical intervention before imaging evaluation, pregnant women, and patients with incomplete clinical or imaging data were excluded from the study.

Following initial assessment and resuscitation according to Advanced Trauma Life Support (ATLS) principles, demographic details, mechanism of injury, clinical presentation, and hemodynamic parameters were recorded. All patients underwent a detailed physical examination and baseline investigations as part of routine trauma evaluation.

An Extended Focused Assessment with Sonography for Trauma (e-FAST) examination was performed at the bedside using a portable ultrasound machine by trained emergency physicians. The examination included assessment of the pericardial space for pericardial effusion, the hepatorenal and splenorenal recesses for free intraperitoneal fluid, the pelvic cavity for fluid collection, and bilateral thoracic cavities for the detection of pneumothorax and hemothorax. Findings were documented immediately after the examination.

Subsequently, all patients underwent Computed Tomography (CT) evaluation of the thorax, abdomen, or both, depending on the clinical indication. CT findings were interpreted by radiologists and were considered the reference standard for diagnosis. The results of e-FAST were compared with CT findings to determine the diagnostic performance of e-FAST in detecting blunt thoraco-abdominal injuries.

The primary outcome measure was the diagnostic accuracy of e-FAST compared with CT in identifying thoracic and abdominal injuries. Secondary outcomes included the detection of pneumothorax, hemothorax, intra-abdominal free fluid, and associated traumatic injuries.

All data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software. Continuous variables were

expressed as mean $\pm$ standard deviation, while categorical variables were presented as frequencies and percentages. The sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy of e-FAST were calculated using CT findings as the gold standard. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 63 patients with blunt thoraco-abdominal trauma were included in the study. The majority belonged to the 21–30 years age group (33.3%), followed by 31–40 years (28.6%). Males constituted 90.5% of the study population. Road traffic accidents were the most common mechanism of injury (57.1%), followed by falls (27.0%) and assaults (15.9%). These baseline characteristics are summarized in [Table 1].

On e-FAST examination, pneumothorax and abdominal free fluid were each identified in 33.3% of patients, while hemothorax was detected in 27.0%. No patient had pericardial effusion. Overall, e-FAST was positive in 74.6% of cases. Computed tomography detected thoracic injuries alone in 33.3% of patients, isolated abdominal injuries in 27.0%, combined thoraco-abdominal injuries in 14.3%, and no detectable injury in 25.4% of patients. The distribution of imaging findings is shown in [Table 2].

Comparison of e-FAST with CT demonstrated a statistically significant association ($\chi^2=18.52$, $p<0.0001$). e-FAST correctly identified 47 CT-positive cases and showed no false-positive results. Using CT as the reference standard, e-FAST demonstrated a sensitivity of 83.93%, specificity of 100%, positive predictive value of 100%, negative predictive value of 43.75%, and overall diagnostic accuracy of 85.7%. Among the nine false-negative cases, rib fractures (55.6%) and lung contusions (44.4%) were the most commonly missed injuries. Diagnostic performance and missed injuries are summarized in [Table 3].

Table 1: Baseline Characteristics of Study Population (n=63)

Variable	n (%)
Age Group (years)	
12–20	7 (11.1)
21–30	21 (33.3)
31–40	18 (28.6)
41–50	14 (22.2)
51–60	3 (4.8)
Gender	
Male	57 (90.5)
Female	6 (9.5)
Mechanism of Injury	
Road traffic accident	36 (57.1)
Fall	17 (27.0)
Assault	10 (15.9)

Table 2: Distribution of e-FAST and CT Findings

Variable	n (%)
e-FAST Findings	
Pneumothorax	21 (33.3)
Hemothorax	17 (27.0)
Abdominal free fluid	21 (33.3)
Pericardial effusion	0 (0.0)
e-FAST Positive	47 (74.6)
e-FAST Negative	16 (25.4)
CT Findings	
Thoracic injuries only	21 (33.3)
Abdominal injuries only	17 (27.0)
Combined thoraco-abdominal injuries	9 (14.3)
No detectable injury	16 (25.4)
CT Positive	56 (88.9)
CT Negative	7 (11.1)

Table 3: Diagnostic Performance of e-FAST Compared with CT

Parameter	Value
True Positive	47
False Positive	0
True Negative	7
False Negative	9
Sensitivity	83.93%
Specificity	100.00%
Positive Predictive Value	100.00%
Negative Predictive Value	43.75%
Diagnostic Accuracy	85.70%
χ^2 value	18.52
p value	<0.0001
Missed Injuries (False Negatives)	
Rib fractures	5 (55.6)
Lung contusions	4 (44.4)

DISCUSSION

Blunt thoraco-abdominal trauma remains a major cause of morbidity and mortality, particularly among young adults. In the present study, most patients belonged to the 21–30 years age group (33.3%), followed by the 31–40 years age group (28.6%). Similar findings were reported by Ajagallay and Nirala,^[8] and Tripura et al,^[9] who observed that trauma predominantly affects young and economically productive individuals due to greater exposure to road traffic accidents and occupational hazards.

A marked male predominance was observed, with males accounting for 90.5% of cases. Comparable findings have been reported by Fleming et al,^[10] and Devadoss et al,^[11] reflecting the greater involvement of males in outdoor activities, driving, and high-risk occupations. Road traffic accidents were the most common mechanism of injury (57.1%), followed by falls (27.0%) and assaults (15.9%), which is consistent with previous studies on blunt thoraco-abdominal trauma.^[8,9]

In the present study, e-FAST identified pneumothorax and abdominal free fluid in 33.3% of patients each, while hemothorax was detected in 27.0%. No cases of pericardial effusion were observed. These findings highlight the usefulness of e-FAST as a rapid bedside imaging tool for the detection of clinically significant thoracic and abdominal injuries. Kirkpatrick et al,^[12] demonstrated that the addition of thoracic

ultrasonography to conventional FAST improved the detection of pneumothorax and hemothorax, while Ianniello et al.¹³ reported high diagnostic accuracy of e-FAST compared with CT in trauma patients.

Computed tomography identified injuries in 88.9% of patients and remained superior in defining the extent and nature of thoraco-abdominal injuries. Thoracic injuries alone were observed in 33.3% of patients, isolated abdominal injuries in 27.0%, and combined thoraco-abdominal injuries in 14.3%. CT continues to be the reference standard because of its ability to detect injuries that may not be visualized on ultrasonography, particularly retroperitoneal, skeletal, and parenchymal injuries.^[14]

When compared with CT, e-FAST demonstrated a sensitivity of 83.93%, specificity of 100%, positive predictive value of 100%, negative predictive value of 43.75%, and overall diagnostic accuracy of 85.7%. The association between e-FAST and CT findings was statistically significant ($p < 0.0001$). These findings are comparable to those reported by Fleming et al,^[10] and Devadoss et al,^[11] who also demonstrated high specificity and positive predictive value of FAST/e-FAST in trauma assessment. The absence of false-positive examinations in the present study further supports the reliability of positive e-FAST findings in guiding early clinical decision-making.

Despite its excellent specificity, e-FAST missed nine injuries, comprising rib fractures (55.6%) and lung contusions (44.4%). Similar limitations have been reported in previous studies, as e-FAST primarily detects free fluid and pleural air collections and may

not identify injuries that do not produce these findings.^[12,13] Therefore, a negative e-FAST examination should not be considered sufficient to exclude significant injury when clinical suspicion remains high.

Overall, the findings of the present study demonstrate that e-FAST is a rapid, reliable, and highly specific screening tool for blunt thoraco-abdominal trauma. Although CT remains the gold standard for comprehensive injury assessment, e-FAST plays an important role in the initial evaluation and triage of trauma patients, particularly in emergency and resource-limited settings.

Limitations

The present study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings. Only hemodynamically stable patients who underwent CT evaluation were included, potentially introducing selection bias. The diagnostic performance of e-FAST is operator-dependent and may vary with the experience and expertise of the examiner. Additionally, certain injuries such as rib fractures, lung contusions, retroperitoneal injuries, and hollow viscus injuries may not be adequately detected by e-FAST, resulting in false-negative findings.

CONCLUSION

The present study demonstrated that e-FAST is a rapid, reliable, and highly specific bedside imaging modality for the evaluation of blunt thoraco-abdominal trauma. e-FAST showed excellent agreement with CT findings, with a sensitivity of 83.93%, specificity of 100%, and overall diagnostic accuracy of 85.7%. It was particularly effective in detecting pneumothorax, hemothorax, and intra-abdominal free fluid, facilitating early diagnosis and timely clinical decision-making. Although certain injuries such as rib fractures and lung contusions may be missed, e-FAST remains an invaluable screening and triage tool, especially in emergency and resource-limited settings. While CT continues to be the gold standard for comprehensive injury assessment, incorporation of e-FAST into standard trauma protocols can significantly enhance early management, reduce delays in treatment, and

improve patient outcomes in blunt thoraco-abdominal trauma.

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