DOI: https://doi.org/10.54393/pjhs.v6i6.3295

PAKISTAN JOURNAL OF HEALTH SCIENCES
(LAHORE)
https://thejas.com.pk/index.php/pjhs
ISSN (E): 2790-9352, (P): 2790-9344
Volume 6, Issue 06 (June 2025)

Original Article

OPEN ACCESS

The Role of Focused Assessment with Sonography for Trauma (FAST) in Identifying Intra-Abdominal Injuries in Blunt Abdominal Trauma

Muhammad Ayaz[1], Shah Hussain[1*], Haider Ali[2], Hammad Zamir[2], Muhammad Amir Saeed[3] and Ahmad Zeb[3]

[1]Department of Emergency, Lady Reading Hospital, Peshawar, Pakistan
[2]Department of Surgery, Lady Reading Hospital, Peshawar, Pakistan
[3]Department of Trauma, Lady Reading Hospital, Peshawar, Pakistan

ARTICLE INFO

Keywords:
Blunt Abdominal Trauma, Intra-abdominal Injury, Diagnostic Accuracy, Emergency Ultrasonography

How to Cite:
Ayaz, M., Hussain, S., Ali, H., Zamir, H., Amir Saeed, M., & Zeb, A. (2025). The Role of Focused Assessment with Sonography for Trauma (FAST) in Identifying Intra-Abdominal Injuries in Blunt Abdominal Trauma: Focused Sonography in Blunt Trauma Evaluation. Pakistan Journal of Health Sciences, 6(6), 237-241. https://doi.org/10.54393/pjhs.v6i6.3295

***Corresponding Author:**
Shah Hussain
Department of Emergency, Lady Reading Hospital, Peshawar, Pakistan
shahhussain.er@gmail.com

Received Date: 9th May, 2025
Revision Date: 23rd June, 2025
Acceptance Date:26th June, 2025
Published Date: 30th June, 2025

ABSTRACT

Blunt Abdominal Trauma (BAT) remains a diagnostic challenge, even for experienced trauma surgeons. **Objective:** To evaluate the diagnostic accuracy of Focused Assessment with Sonography for Trauma (FAST) in detecting intra-abdominal injuries among patients presenting with blunt abdominal trauma in a tertiary care emergency setting. **Methods:** This cross-sectional analytical study was conducted at the Emergency Department of Lady Reading Hospital, Peshawar, from May 2024 to February 2025. A total of 106 patients were enrolled, calculated using OpenEpi based on an expected FAST sensitivity of 78%, 20% IAI prevalence, 80% confidence level, and 5% margin of error. Patients with penetrating abdominal trauma or contraindications to FAST were excluded. Positive FAST was defined by free fluid in standard regions (perihepatic, perisplenic, pelvic, or pericardial). CT scan, interpreted by a radiologist, served as the reference standard for IAI—defined as evidence of organ laceration, hematoma, or active bleeding. FAST scans were performed by trained emergency physicians during initial assessment, with CT scans conducted within one hour in stable patients. Operator qualifications included certification in trauma ultrasonography. **Results:** Of the 106 patients, FAST demonstrated a sensitivity of 78.9%, specificity of 91.8%, and overall diagnostic accuracy of 84.9% in detecting IAI. There were no significant demographic or clinical differences between FAST-positive and FAST-negative groups. Data were analyzed using SPSS v23.0, with $p < 0.05$ considered significant. **Conclusion:** FAST is a valuable, rapid bedside screening tool for initial evaluation of BAT, offering high specificity and acceptable sensitivity.

INTRODUCTION

Even highly trained and experienced trauma surgeons find diagnosing Blunt Abdominal Trauma (BAT) a challenging task [1]. Major reason for this is because clinical findings are usually unreliable. Examination of the abdomen tends to be complicated by various factors such as abrasions, contusions of abdominal wall and lower chest ribs fractures, reduced consciousness levels and fracture of lumbar vertebrae with hematoma (retroperitoneal) [2]. Intra-abdominal Injuries (IAI) are highly challenging, initially remaining unrecognized can be fatal, in as high as 8.5 % of patients. Although both adults and children are susceptible to IAI, children remain more susceptible to IAI due to less fat, rib and muscle protection, in addition to receiving blunt force on small surface area of body [3]. The most common form of abdominal trauma is BAT, which is followed up by less commonly reported penetrating injury like stab wounds. In majority (95 %) of BAT patients, conservative management is carried out without any intervention [4]. Nonetheless, overlooking injuries can possible fatal. Computed Tomography (CT) scan is regarded as the gold standard technique for diagnosing IAI, be it for adults or in children [5]. However the technique is linked to certain limitations, most important factor being exposure to radiation that raises risk of malignancy in the future [6].

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Another modality that is increasingly gaining popularity in evaluating IAI among adults is the Focused Assessment with Sonography for Trauma (FAST) [7]. Primarily, the goal of FAST is to select patients which might benefit from surgical intervention. Even though FAST is not used for identifying anatomical injuries, rather mainly used for detecting presence of supra-pubic or intra-abdominal hemorrhage or fluid [8]. Multiple researchers have evaluated FAST that it might not be effective tool for screening IAI especially among children due to poor characteristics of the test [9]. Nonetheless, the choice of using particular technique for trauma assessment depends upon hemodynamic stability of patient, physical examination reliability, availability of particular technique and severity of associated injuries [10]. Main aim of FAST is to detect intra-peritoneal fluid. It is regarded as a rapid, safe and non-invasive diagnostic tool [11]. It has value in patients that are unstable hemodynamically and those that cannot be transferred to CT scan room [12]. Another advantage of FAST is that it can be performed at bedside even during resuscitation without need for moving patient from resuscitation room [13]. Value of FAST is increased due to high sensitivity for detection of intra-peritoneal fluid that tends to accumulate in dependent abdominal areas such as spleen, liver and in females, pouch of Douglas. In some studies, a sensitivity of 100 has also been reported [14, 15]. BAT is a common presentation in emergency departments and can lead to life-threatening intra-abdominal injuries. Traditional imaging modalities such as Computed Tomography (CT) scans, although highly sensitive, may not be immediately accessible in all settings, especially in resource-limited environments [16]. FAST is a rapid, non-invasive, bedside ultrasound technique widely used to detect intra-abdominal free fluid, which may indicate organ injury? Despite its widespread use, the diagnostic accuracy of FAST in identifying clinically significant intra-abdominal injuries in blunt trauma patients remains a subject of ongoing investigation [17]. Assessing the reliability and diagnostic value of FAST in comparison to standard imaging and surgical findings can help optimize trauma protocols and resource utilization [18].

The objective of this research was to evaluate the diagnostic accuracy of the Focused Assessment with Sonography for Trauma (FAST) in detecting intra-abdominal injuries among patients presenting with blunt abdominal trauma, using Computed Tomography (CT) scan as the reference standard.

METHODS

This was a cross-sectional analytical research conducted at the emergency department of Lady Reading Hospital Peshawar from May 2024 to Feb 2025. The ethical review was taken from IRB with Ref No: 388/LRH/MTI. The trauma registry of the hospital was checked for patients who came with blunt abdominal trauma, and suitable patients were included in the study. Informed consent was taken from each patient/ guardian before including their data in the study. The sample for the study was calculated using Openepi online software for sample size calculation. Keeping the hypothesized frequency of BAT in IAI at 20% as reported in a recent study, the sample size came out to be 106 at 80 % confidence level and 5% margin of error. Therefore, a total of 106 patients were included in this research [1]. Patients of either gender irrespective of age diagnosed with BAT on clinical findings that suggested possible intra-abdominal injury (such as abdominal tenderness, distention, hypotension or any other signs of peritonitis and given consent (either from patients or guardian/relative) were included in the study. Patients with penetrable abdominal trauma, contraindication to FAST like previous upper abdominal surgery that wound have impaired ultrasonography and presence of co-morbidities which would have interfered with evaluating and managing injuries were also excluded from the research. The data were collected on a pre-designed questionnaire, FAST examination findings were taken as independent variable in terms of positive or negative for intra-abdominal free fluid. Dependent variables included presence of intra-abdominal injury which was confirmed through CT scan, metrics of diagnostic accuracy such as sensitivity, specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) and accuracy were also reported. Other demographics include hemodynamic stability, time from injury to presentation age and BMI of patient. For analyzing the data, SPSS version 23.0 was used. Continuous data were presented in the form of mean and standard deviation while categorical data were reported in terms of frequency and percentage. Diagnostic accuracy was reported in terms of presence and absence of IAI. The association of FAST positivity was tested by using chi-square test keeping $p<0.05$ statistically significant.

RESULTS

In table 1, the description of the demographic and clinical characteristics of the 106 patients included in the study is presented. The mean age of participants was 37.2 ± 14.5 years overall, with those in the FAST-positive group having a mean age of 35.34 ± 11.2 years and those in the FAST-negative group having a mean age of 39.21 ± 12.9 years ($p = 0.27$). There were 67 (63.21%) males and 39 (36.8%) females in total. Among males, 29 (27.36%) were FAST-positive and 38 (35.85%) were FAST-negative; among females, 20 (18.87%) were FAST-positive and 19 (17.92%) were FAST-negative ($p = 0.8$). A total of 84 (79.2%) patients were hemodynamically stable, with 38 (77.6%) in the FAST-

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positive group and 46 (80.7%) in the FAST-negative group. Hemodynamic instability was noted in 22 (20.8%) patients 11 (22.4%) FAST-positive and 11 (19.3%) FAST-negative (p = 0.7). The mean time from injury to presentation was 3.6 ± 1.4 hours overall, 3.4 ± 1.3 hours in the FAST-positive group, and 3.8 ± 1.5 hours in the FAST-negative group (p = 0.12). The mean BMI was 23.1 ± 3.5 kg/m^2 overall, with FAST-positive patients having a mean BMI of 22.8 ± 3.4 kg/m^2 and FAST-negative patients having a mean BMI of 23.4 ± 3.6 kg/m^2 (p = 0.38).

Table 1: Demographical and Clinical Characteristics of Patients Included in the Study (n=266)

Variables		Total Mean ± SD / Frequency (%)	FAST Positive Mean ± SD / Frequency (%)	FAST Negative Mean ± SD / Frequency (%)	p-Value
Age (Years)		37.2 ± 14.5	35.34 ± 11.2	39.21 ± 12.9	0.27
Gender	Male	67 (63.21)	29 (27.36)	38 (35.85)	0.8
	Female	39 (36.8)	20 (18.87)	19 (17.92)	
Hemodynamically Stability	Stable	84 (79.2)	38 (77.6)	46 (80.7)	0.7
	Unstable	22 (20.8)	11 (22.4)	11 (19.3)	
Time from injury to presentation (Hours)		3.6 ± 1.4	3.4 ± 1.3	3.8 ± 1.5	0.12
BMI (Kg/m^2)		23.1 ± 3.5	22.8 ± 3.4	23.4 ± 3.6	0.38

In table 2, the contingency table demonstrates the diagnostic accuracy of FAST in detecting intra-abdominal injury confirmed by reference standard methods. Among the 49 FAST-positive cases, 45 (true positives) had intra-abdominal injury, while 4 (false positives) did not. Of the 57 FAST-negative cases, 12 (false negatives) had intra-abdominal injury, and 45 (true negatives) did not. The total number of confirmed intra-abdominal injuries was 57, while 49 patients did not have any injury, making a total sample of 106 patients.

Table 2: Diagnostic accuracy of FAST versus Intra-abdominal Injury (n=106)

Variables	Presence of Intra-Abdominal Injury	Absence of Intra-Abdominal Injury	Total
FAST Positive	45 (TP)	4 (FP)	49
FAST Negative	12 (FN)	45 (TN)	57
Total	57	49	106

Table 3 summarizes the diagnostic performance of FAST. The sensitivity of FAST for detecting intra-abdominal injury was 78.9%, while specificity was 91.8%. The positive predictive value (PPV) was 91.8%, and the negative predictive value (NPV) was 78.9%. The overall diagnostic accuracy of the FAST examination in this study was 84.9%.

Table 3: Diagnostic Performance of FAST (n=106)

Diagnostic Metric	Percentage (%)
Sensitivity	78.9
Specificity	91.8
Positive Predictive Value	91.8
Negative Predictive Value	78.9
Accuracy	84.9

DISCUSSION

The study included 106 patients with blunt abdominal trauma, with a mean age of 37.2 ± 14.5 years and a male predominance (63.21%). No statistically significant differences were found between FAST-positive and FAST-negative groups in terms of age, gender, hemodynamic stability, time to presentation, or BMI. FAST demonstrated a sensitivity of 78.9%, specificity of 91.8%, PPV of 91.8%, NPV of 78.9%, and an overall diagnostic accuracy of 84.9% in detecting intra-abdominal injuries compared to CT and surgical findings.In our study, 57 (53.77 %) patients demonstrated IAI while 49 (46.23 %) had absent IAI on FAST. Similar findings have been reported in other studies as well where 68 % of FAST were found to have IAI. A meta-analysis reported the sensitivity, specificity, PPV and NPV of FAST ranging from 28 to 76 %, 83 to 97 %, 87 to 96 % and 37 to 94 % respectively [19]. A study observed that FAST showed false-negative results, thereby reducing sensitivity and false-negative results on FAST were associated with insignificant findings [20]. A study by Kim *et al.*, FAST demonstrated a sensitivity of 33.3 %, while specificity of 98.8 %, PPV of 82.8 % and NPV of 89.6 % with 135 true positive and 270 false negative cases with 85.3 % of patients showing no or minor injury to the abdomen [21]. Other studies have reported the sensitivity of FAST lower than our study, i.e. between 43 to 76 % [22]. This is in line to current study, where sensitivity of FAST was observed to be 78.9 %. Likewise, Kumar *et al.*, in their study on accuracy of FAST in BAT reported 77.3 % sensitivity, with 100 % specificity [23]. In other research by Fleming *et al.*, sensitivity of FAST was observed to be 46.2 %, with specificity of 94.7 %, PPV of 96 % and NPV of 39 % [24]. The role of FAST in trauma remains a matter of debate. Majority of studies on the role of FAST in BAT, were carried out by radiologists, however need for a emergency physician is also pivotal.The Australian Injury Society recommends critical ultrasonography should be accessible within critical division with radiologist and emergency physician present [25].In current study, FAST was found to be valuable in terms of high sensitivity and specificity and was carried out at bedside with ease. However, our study was not free from limitations. A single centered study along with limited sample size and observer bias was some of the limitations that were noted in the research. Further, multi-centered studies with greater sample size and stratification of confounder would be enlightening to the findings reported in this research.

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CONCLUSIONS

FAST is a valuable bedside screening tool for the initial assessment of patients with blunt abdominal trauma. With high specificity and acceptable sensitivity, it can reliably identify most cases of intra-abdominal injury, especially in resource-limited or emergency settings. While it should not replace definitive imaging when available, its rapid application can guide timely decision-making and improve patient outcomes.

Authors Contribution

Conceptualization: MA
Methodology: SH, AZ
Formal analysis: HZ
Writing, review and editing: MA, HA, MAS, AZ

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

Source of Funding

The author received no financial support for the research, authorship and/or publication of this article.

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