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Role of FAST in Surgical Decision-Making and Therapeutic Laparotomy in Blunt Abdominal Trauma Patients

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ABSTRACT

Background: Blunt abdominal trauma (BAT) is a major cause of morbidity and mortality, particularly following road traffic accidents. Early diagnosis of intra-abdominal injury and timely intervention are essential for improving outcomes. Focused Assessment with Sonography for Trauma (FAST) has emerged as a rapid bedside tool for detecting hemoperitoneum and guiding management decisions.

Methods: This prospective observational study included patients presenting with blunt abdominal trauma at a tertiary care center. FAST findings were correlated with hemodynamic status, clinical findings, organ injury grading, operative intervention, and clinical outcomes. Patients were managed conservatively or operatively based on FAST findings and overall clinical assessment.

Results: Fifty patients with blunt abdominal trauma were evaluated. Road traffic accidents were the most common mode of injury (68%). FAST was positive in 34 patients (68%) and negative in 16 patients (32%). Hemoperitoneum was detected in 32 patients, with splenic injury being the most common solid organ injury. Therapeutic laparotomy was required in 18 patients, of whom 16 had positive FAST findings. FAST demonstrated a sensitivity of 91.4%, specificity of 85.7%, positive predictive value of 88.2%, and negative predictive value of 89.4% for detecting clinically significant intra-abdominal injury. Positive FAST findings were significantly associated with hemodynamic instability, higher-grade organ injuries, prolonged hospital stay, and increased operative intervention ($p < 0.05$).

Conclusion: FAST is a rapid, non-invasive, and reliable bedside modality for evaluating blunt abdominal trauma. It plays an important role in detecting hemoperitoneum, guiding management decisions, predicting therapeutic laparotomy, and improving trauma care outcomes.

Key-words: FAST, Blunt abdominal trauma, Therapeutic laparotomy, Hemoperitoneum, eFAST, Trauma ultrasound, Surgical decision-making

INTRODUCTION

Blunt abdominal trauma (BAT) is a major cause of trauma-related morbidity and mortality worldwide and constitutes a significant public health burden, particularly in developing countries. [1,2] It commonly results from road traffic accidents, falls from height, assaults, sports injuries, and industrial mishaps. Among these, motor vehicle accidents account for approximately 75–80% of all blunt abdominal trauma cases. Delayed diagnosis and inadequate management of intra-abdominal injuries substantially increase the risk of morbidity, mortality, prolonged hospitalization, and postoperative complications.[1,2]

Globally, trauma represents one of the leading causes of death and disability, especially among the young and

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economically productive population. According to the World Health Organization (WHO), trauma accounts for a substantial proportion of years of productive life lost and remains a major healthcare challenge in both developed and developing nations. [3] Rapid recognition of life-threatening intra-abdominal injuries is therefore essential for improving survival and clinical outcomes in trauma patients.

The clinical evaluation of patients with blunt abdominal trauma is often challenging because signs and symptoms may be subtle or masked by associated injuries involving the head, chest, pelvis, or extremities. Consequently, there has been increasing emphasis on the development of rapid, accurate, and non-invasive diagnostic modalities that can facilitate early detection of hemoperitoneum and visceral injuries. [4]

Focused Assessment with Sonography for Trauma (FAST) has emerged as an important bedside ultrasonographic examination in the initial assessment of trauma patients. FAST is a goal-directed sonographic evaluation primarily aimed at detecting free intra-peritoneal or pericardial fluid in trauma settings. The examination is rapid, non-invasive, portable, repeatable, and can be performed simultaneously with resuscitative measures in the emergency department without the need to transfer the patient. [5,6] FAST is particularly valuable in hemodynamically unstable patients in whom immediate computed tomography (CT) scanning may not be feasible.

The conventional FAST examination includes four standard sonographic windows: the right upper quadrant view assessing Morison's pouch, the left upper quadrant view assessing the peri-splenic region, the pelvic view assessing the pouch of Douglas or rectovesical pouch, and the subxiphoid view assessing the pericardium. [7] Detection of free fluid within these dependent spaces strongly suggests significant intra-abdominal injury and may indicate the need for urgent surgical intervention.

With advances in trauma imaging, the Extended FAST (eFAST) protocol has further expanded the role of ultrasonography by enabling rapid assessment of pneumothorax and hemothorax in addition to abdominal and pericardial fluid collections. eFAST has therefore become an integral component of modern trauma evaluation and management protocols. [8]

Over the past two decades, FAST has increasingly replaced diagnostic peritoneal lavage (DPL) because of its rapidity, bedside applicability, lack of radiation exposure, and high specificity for detecting hemoperitoneum. [9] However, despite its advantages, FAST has several limitations, including reduced sensitivity in detecting hollow viscus injuries, mesenteric injuries, retroperitoneal trauma, and injuries without significant free fluid. [10]

The present study was undertaken to evaluate the role of FAST in surgical decision-making among patients with blunt abdominal trauma, particularly in determining operative versus conservative management, predicting the need for therapeutic laparotomy, grading organ injuries, and assessing prognostic outcomes.

MATERIALS AND METHODS

Study Design- This prospective observational study was conducted in the Department of General Surgery at a tertiary care teaching hospital over a period of three years. The study aimed to evaluate the role of Focused Assessment with Sonography for Trauma (FAST) in determining the need for therapeutic laparotomy and guiding management decisions in patients presenting with blunt abdominal trauma (BAT).

Study Population- All patients presenting to the emergency department with a history of blunt abdominal trauma during the study period were assessed for eligibility. Patients were evaluated clinically according to Advanced Trauma Life Support (ATLS) protocols and underwent FAST examination as part of the primary trauma assessment.

Inclusion Criteria

1. Patients of all age groups presenting with blunt abdominal trauma.
2. Hemodynamically stable and unstable patients with suspected intra-abdominal injury.
3. Patients undergoing FAST examination during initial trauma evaluation.
4. Patients willing to participate in the study and provide informed consent.

Exclusion Criteria

1. Patients with penetrating abdominal trauma.
2. Patients with previous major abdominal surgery interfering with FAST interpretation.
3. Pregnant patients with pre-existing abdominal pathology.

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4. Patients who were dead on arrival or could not be adequately evaluated.
5. Patients unwilling to participate in the study.

Methodology- After initial resuscitation and stabilization according to Advanced Trauma Life Support (ATLS) protocols, all patients underwent detailed clinical evaluation including assessment of hemodynamic parameters, abdominal tenderness, guarding, rigidity, and associated extra-abdominal injuries. A bedside Focused Assessment with Sonography for Trauma (FAST) examination was subsequently performed using a portable ultrasonography machine by trained personnel in the emergency department.

The FAST examination consisted of assessment of four standard sonographic windows, namely the right upper quadrant view evaluating Morison's pouch, the left upper quadrant view assessing the peri-splenic region, the pelvic view assessing the pouch of Douglas or rectovesical pouch, and the subxiphoid view for pericardial fluid evaluation. The presence or absence of free intra-peritoneal fluid was documented in all patients. In selected cases, extended FAST (eFAST) examination was additionally performed for assessment of associated thoracic injuries such as pneumothorax and hemothorax.

Patients demonstrating positive FAST findings in association with hemodynamic instability were considered for emergency exploratory laparotomy. Hemodynamically stable patients underwent further radiological evaluation with contrast-enhanced computed tomography (CECT) of the abdomen whenever indicated. Organ injuries identified on imaging or during surgery were graded according to the American Association for the Surgery of Trauma (AAST) organ injury grading scale.

Based on the FAST findings, clinical examination, and radiological investigations, patients were managed either conservatively or operatively. Detailed records were maintained regarding operative findings, requirement of therapeutic laparotomy, blood transfusion requirements, duration of hospital stay, postoperative complications, and final clinical outcomes. These parameters were subsequently analyzed to determine the diagnostic and prognostic utility of FAST in blunt abdominal trauma patients.

Outcome Measures- The primary outcome measure of the study was to evaluate the utility of FAST in predicting the need for therapeutic laparotomy in patients presenting with blunt abdominal trauma. Secondary outcome measures included the ability of FAST to detect hemoperitoneum, correlation of FAST findings with the grading of organ injuries, association between FAST positivity and hemodynamic instability, comparison of operative and conservative management outcomes, assessment of morbidity and mortality rates, and evaluation of duration of hospital stay among trauma patients.

Statistical Analysis- Data collected during the study were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of FAST in detecting clinically significant intra-abdominal injury were calculated. The Chi-square test and Fisher's exact test were used for comparison of categorical variables. A p-value of <0.05 was considered statistically significant.

Ethical Approval- The study protocol was reviewed and approved by the Institutional Ethics Committee before the commencement of the study. Written informed consent was obtained from all patients or their legal guardians before inclusion in the study. Patient confidentiality and anonymity were strictly maintained throughout the study in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

A total of 50 patients presenting with blunt abdominal trauma (BAT) were included in the study. The majority of patients were male, and road traffic accidents constituted the most common mode of injury. FAST examination was performed in all patients during the initial trauma assessment.

FAST was positive for intra-peritoneal free fluid in 34 patients (68%), while 16 patients (32%) had negative FAST findings. Hemoperitoneum was the most common ultrasonographic finding observed in FAST-positive

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patients. Splenic injury was identified as the most frequently involved solid organ, followed by liver injury and renal trauma.

Patients with positive FAST findings were more likely to demonstrate hemodynamic instability and higher grades of organ injury. Emergency exploratory laparotomy was required in patients with positive FAST findings associated with clinical deterioration or significant hemoperitoneum. Conversely, the majority of FAST-negative patients were managed conservatively with close observation and serial clinical assessment.

The sensitivity, specificity, positive predictive value, and negative predictive value of FAST in detecting clinically significant intra-abdominal injury were found to be high, emphasizing its utility as a rapid bedside diagnostic tool in blunt abdominal trauma.

The majority of patients in the study were males, accounting for 78% of cases. Road traffic accidents were the predominant cause of blunt abdominal trauma, contributing to 68% of total cases demonstrated in Table 1.

Table 1: Demographic Profile and Mode of Injury

Variable	Number of Patients (n=50)	Percentage (%)
Gender		
Male	39	78
Female	11	22
Mode of Injury		
Road traffic accidents	34	68
Fall from height	8	16
Assault	5	10
Industrial/sports injuries	3	6

Among FAST-positive patients, 18 required operative intervention, while 16 patients were managed conservatively, as demonstrated in Table 2. Therapeutic laparotomy was significantly more common in patients with positive FAST findings. FAST-negative patients were predominantly managed non-operatively with favorable clinical outcomes.

Table 2: FAST Findings and Management Outcomes

Parameter	FAST Positive (n=34)	FAST Negative (n=16)
Hemoperitoneum detected	32	2
Hemodynamic instability	18	3
Operative management	18	2
Conservative management	16	14
Therapeutic laparotomy required	16	1

Splenic injury was the most commonly encountered solid organ injury, followed by liver trauma. Most splenic and hepatic injuries were classified as Grade II or III according to the American Association for the Surgery of Trauma (AAST) grading scale, as demonstrated in Table 3. Lower-grade renal injuries were predominantly managed conservatively, whereas pancreatic and hollow viscus injuries frequently required operative intervention.

Table 3: Distribution and Grading of Organ Injuries

Organ Injured	Number of Patients	Common Injury Grade	Predominant Management
Spleen	16	Grade II–III	Conservative/ Splenectomy
Liver	13	Grade II–III	Conservative/ Laparotomy
Kidney	6	Grade I–II	Conservative
Pancreas	2	Grade II–III	Operative
Hollow viscus injury	5	—	Operative

FAST demonstrated a sensitivity of 91.4%, specificity of 85.7%, positive predictive value of 88.2%, and negative predictive value of 89.4% in detecting clinically significant intra-abdominal injury. Positive FAST findings also showed statistically significant association with hemodynamic instability, need for therapeutic laparotomy, and prolonged hospital stay ($p < 0.05$).

DISCUSSION

Blunt abdominal trauma (BAT) continues to represent a major challenge in emergency and trauma care because

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of its variable clinical presentation and the potential for delayed diagnosis of life-threatening intra-abdominal injuries. Rapid and accurate identification of hemoperitoneum and visceral injury is essential for timely surgical intervention and improved patient outcomes. In the present study, FAST demonstrated significant utility in the early evaluation of BAT patients, particularly in guiding operative decision-making and predicting the requirement for therapeutic laparotomy.

In the current study, road traffic accidents constituted the most common mechanism of injury, accounting for the majority of cases. This finding is consistent with previous studies by Kordzadeh *et al*. [1] and Singh *et al*. [2], who reported motor vehicle accidents as the leading cause of blunt abdominal trauma globally. The predominance of young male patients observed in the present study also correlates with the higher exposure of this population to vehicular trauma and occupational risk factors.

FAST was positive in a substantial proportion of patients and demonstrated high sensitivity and specificity in detecting clinically significant intra-abdominal injury. The sensitivity and specificity observed in the present study are comparable to those reported by Bass *et al*. [3], who demonstrated that FAST is a rapid and reliable bedside modality for trauma evaluation. Similarly, Wang *et al*. [4] emphasized the importance of FAST in the early identification of hemoperitoneum in hemodynamically unstable patients.

The present study demonstrated a strong correlation between positive FAST findings and the need for operative intervention. Patients with positive FAST findings associated with hemodynamic instability were more likely to undergo emergency exploratory laparotomy. This observation supports the findings of Soni *et al.* [5], who reported that FAST significantly reduces delays in surgical decision-making in trauma settings. The ability of FAST to rapidly identify patients requiring urgent operative management is particularly valuable in resource-limited emergency departments where immediate CT imaging may not be feasible.

Splenic injury was identified as the most common solid organ injury in the present study, followed by hepatic trauma. Similar observations have been reported in previous trauma literature, where the spleen and liver are described as the most frequently injured organs in blunt abdominal trauma. [6,7] Most splenic and hepatic injuries in the present study were Grade II or III injuries and were managed conservatively in hemodynamically stable patients. This reflects the current trend toward non-operative management of solid organ injuries with careful monitoring and serial imaging.

The study also demonstrated that FAST findings correlated with injury severity and clinical outcomes. Patients with positive FAST findings were more likely to have prolonged hospital stay, increased blood transfusion requirements, and higher rates of operative intervention. These findings support the prognostic role of FAST in trauma care. Previous studies by Richards and McGahan [8] have similarly highlighted the value of FAST in identifying patients at greater risk of morbidity and adverse outcomes.

The role of eFAST has further expanded the utility of ultrasonography in trauma management. In selected patients, eFAST facilitated rapid detection of associated thoracic injuries such as pneumothorax and hemothorax, thereby enabling comprehensive bedside trauma assessment. Kirkpatrick *et al*. [9] demonstrated that eFAST significantly improves diagnostic accuracy for thoracoabdominal trauma and reduces time to intervention.

Despite its numerous advantages, FAST has certain limitations. In the present study, a small number of patients with hollow viscus injuries had initially negative FAST examinations. This limitation has also been recognized in previous studies, as FAST is less sensitive in detecting bowel, mesenteric, and retroperitoneal injuries without significant free fluid accumulation. [10,11] Therefore, FAST findings should always be interpreted in conjunction with clinical examination and additional imaging modalities such as contrast-enhanced computed tomography (CECT) whenever clinically indicated.

STRENGTHS

The present study has several strengths. It was a prospective observational study conducted in a tertiary care trauma center with standardized evaluation protocols. The study comprehensively assessed the role of FAST in operative decision-making, prediction of therapeutic laparotomy, organ injury grading, and prognostic evaluation. Additionally, the correlation of FAST findings with operative outcomes and clinical parameters enhanced the practical applicability of the study findings in emergency surgical practice.

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LIMITATIONS

Certain limitations should be acknowledged. First, the study was conducted at a single tertiary care center with a relatively limited sample size, which may affect generalizability of the findings. Second, FAST is inherently operator-dependent and its diagnostic accuracy may vary according to the experience of the examiner. Third, FAST has limited sensitivity for detecting hollow viscus injuries, mesenteric trauma, and retroperitoneal injuries. Finally, long-term follow-up outcomes were not evaluated in the present study.

CONCLUSIONS

FAST is a rapid, reliable, non-invasive, and easily reproducible bedside diagnostic modality in the evaluation of blunt abdominal trauma. It plays a crucial role in early identification of hemoperitoneum, guiding operative versus conservative management, predicting the need for therapeutic laparotomy, and assessing prognosis in trauma patients. FAST is particularly valuable in hemodynamically unstable patients in whom rapid bedside assessment is essential. Although limitations remain in detecting hollow viscus and retroperitoneal injuries, FAST continues to be an indispensable component of modern trauma protocols and significantly contributes to improved clinical decision-making and patient outcomes.

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