

Diagnostic Accuracy of Focused Abdominal Sonography in Trauma (FAST) in patients with blunt abdominal trauma

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ABSTRACT

Aim: To determine the diagnostic accuracy of FAST in patients with blunt abdominal trauma by taking operative findings as gold standard

Study Design: cross sectional study

Place and duration of study: Six months study carried out at Emergency Wing of Radiology department, Nishtar Hospital Multan

Methods: This was a cross sectional study which included 155 patients with blunt abdominal trauma. All the patients had FAST followed by surgery (operative findings as gold standard). Diagnostic accuracy of FAST was detected by determining sensitivity, specificity and accuracy.

Results: The sensitivity, specificity and diagnostic accuracy of FAST was 82.1%, 90.6% and 83.9%, respectively

Conclusion: FAST is a reliable test and should be done in every case of blunt abdominal trauma.

Keywords: FAST; blunt abdominal trauma

INTRODUCTION

Blunt abdominal trauma (BAT) is a leading cause of morbidity and mortality in adult patients in the emergency department, and speedy diagnosis and treatment are considered vital in the successful management of the trauma patient¹.

Prevalence of intraabdominal injury after abdominal trauma varies widely, ranging from 7.7% to 65%. Blunt abdominal trauma usually occurs due to road traffic accidents (RTA), fall from heights or during sports^{2,3}. There is always emphasis on prompt assessment, monitoring and management in cases of blunt abdominal trauma. Missed intraabdominal injuries continue to cause preventable deaths. ⁴Clinical evaluation of patients with blunt abdominal trauma has always been a challenge for the most of the abdominal trauma surgeons. Clinical findings stay unreliable (diagnostic accuracy of clinical findings is only 47 to 87%) in most of the patients because of altered consciousness, neurological deficit, medication, or other associated injuries. ^{5,6}In this scenario, the modalities available to the clinician in the emergency room are Diagnostic Peritoneal Lavage (DPL), clinician performed Ultrasonography (USG) in the Casualty department and Computed Tomography (CT) scanning⁷.

Diagnostic peritoneal lavage had been used for decades to detect hemoperitoneum but is ineffective for detecting retroperitoneal injuries and solid organ injuries not associated with hemoperitoneum^{8,9}.

Furthermore, diagnostic peritoneal lavage is an invasive procedure with sensitive but nonspecific findings that may lead to unnecessary laparotomies and the associated complications. ¹⁰ Increasingly, noninvasive methods such as CT and sonography have gradually replaced diagnostic peritoneal lavage. CT can effectively depict hemoperitoneum, retroperitoneal injury, and solid organ injury, but CT is less accurate in showing pancreatic, diaphragmatic, and hollow viscus injuries¹¹. However, CT has disadvantages including ionizing radiation, IV injection of radioiodinated contrast material, and time required for patient transport and scanning of critically injured or unstable patients. Sonography is a fast, simple, noninvasive, and readily available screening examination¹².

Focused assessment with sonography for trauma (FAST) was popularized in the United States by Rozycki et al in the early 1990s. ¹³ Initial and follow-up experience indicated that FAST was accurate, non-invasive, and expeditious in assessing the critically injured patient in the emergency department (ED). The procedure could be performed by surgeons as well as radiologists with equal reliability and was particularly useful in detecting blood in the abdominal cavity. As a result, FAST has largely supplanted diagnostic peritoneal lavage (DPL) in evaluating the trauma abdomen¹⁴. The reported frequency of detecting correct finding of USG is 90% in one study and 93% in another study^{4,15}.

The management of blunt abdominal trauma is demanding and requires early diagnosis to be established. FAST is a least invasive and easily available technology that can establish the diagnosis

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of intraabdominal injuries. However, this is not very commonly practiced and most of the surgeons rely upon clinical findings or other investigations like DPL or CT scan which have their own drawbacks. FAST can aid in early triage of patients for speedy management decision saving time and reducing patient mortality as well as cost. I conducted this study in order to detect that how frequently FAST detects the correct findings of intra-abdominal injury in case of blunt abdominal trauma. This would not only reduce the burden in tertiary care hospital but also help us in making policies for the management of patients with blunt abdominal trauma.

MATERIAL AND METHOD

A total of 155 patients fulfilling the inclusion criteria reporting to ER of Nishtar hospital, Multan were included in the study. Permission for data collection was taken from ethical committee. The demographic information like name, age and gender were recorded. Informed consent was taken from all patients. All USG examination were done free of cost with conventional Ultrasonography machine by Emergency Radiologist confirmed by Consultant Radiologist (having 5 years experience). All these patients underwent surgery and the findings detected by FAST were compared with intraoperative findings. Later on sensitivity, specificity, positive predictive value and negative predictive value were calculated taking intraoperative findings as gold standard. The data was analyzed using computer program SPSS version 10; descriptive statistics were applied to calculate the quantitative variables like age and duration of the injury by taking mean and standard deviation. The qualitative variables like gender was calculated by taking their frequencies and percentage. Confounding factors were controlled by making stratified cross match tables for age and duration of injury. Sensitivity and specificity was calculated for FAST using following formula: $Sensitivity = TP / (TP + FN) \times 100$, $Specificity = TN / (TN + FP) \times 100$ Positive predictive value and negative predictive value were calculated by using the following formula: $PPV = TP / (TP + FP)$, $NPV = TN / (TN + FN)$ Intraoperative findings were taken as gold standard.

RESULTS

In the study, the mean age of the patients was 39.43 +12.10 years [range 21 – 65]. There were 36 (32.2%) patients of age range of 20 – 30 years, 49 (31.6%) patients of age range of 31 – 40 years, 32 (20.7%) patients of age range of 41 – 50 years, 27 (17.4%) patients of age range of 51 – 60 years and 11 (7.1%) patients of age range of 61 – 65 years (Table 1). There were 98 (63%) male patients and 57 (37%)

female patients in the study. The female to male ratio was 1: 1.72 (Figure 1). Out of 155 patients included in the study, the FAST was detected to be positive in 104 patients. Of these, 101 were proved on operative findings so were labeled as true positive, while rest of the three patients were labeled as false positive. FAST was negative in total 51 patients. Out of these 22 were positive on operative finding (false negative) and 29 were also seen negative on operative findings (true negative) (Table 2). The sensitivity, specificity, positive predictive value, negative predictive value and accuracy of FAST for diagnosis of blunt abdominal trauma was 82.1%, 90.6%, 97.1%, 56.8% and 83.9%, respectively (Table 3).

Table 1: Distribution of patients by age (n=155)

Age in years	n	%age
20 – 30	36	23.2
31 – 40	49	31.6
41 – 50	32	20.7
51 – 60	27	17.4
61 – 65	11	7.1

Mean + SD=39.43 + 12.10

Range: 21-65

Fig 1: Distribution of patients by sex (n=155)

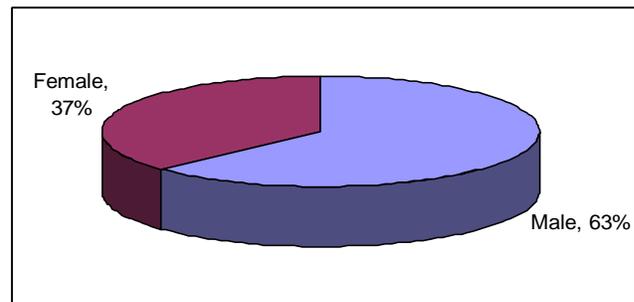


Table 2: Comparison of FAST versus operative findings (n=70)

FAST	Operative Finding (Gold Standard)		Total
	Positive	Negative	
Positive	101 (TP)	3(FP)	104
Negative	22 (FN)	29 (TN)	51
Total	123	32	155

Key: TP=True positive, FP=False positive, FN=False negative, TN=True negative

DISCUSSION

This study was performed to determine the diagnostic accuracy of the FAST for diagnosis of blunt abdominal trauma. It was found that the diagnostic accuracy of FAST was 83.9%. In literature, there are other clinical trials which have described the diagnostic accuracy of the FAST for blunt abdominal trauma. The results of various authors vary with each other.

A study was conducted by Jehangir B, et al¹⁵ in which 56 patients with blunt abdominal trauma were evaluated with FAST followed by exploratory laparotomy. The mean age of the patients in the study was 34.2 years in a range from 3–54 years. The sensitivity of US was 91%, specificity was 100%, positive predictive value was 100% and overall accuracy was 93%. The sensitivity and accuracy of FAST scan in this study was higher than ours.

Dolich and colleagues¹⁶ observed that FAST had a sensitivity of 86%, specificity of 98%, and accuracy of 97% in detection of free fluid after blunt abdominal trauma. Brown and co-workers¹⁷ showed a that specificity of FAST was 96% and over all accuracy was 96%.

A study was conducted by Nunes et al¹⁸ among patients with blunt abdominal trauma for detection of pelvic free fluid. They found that sensitivity, specificity, positive predictive value, negative predictive value and accuracy was 69%, 100%, 100%, 95% and 95%. The sensitivity was lower than our study, but this study was conducted only for detection of pelvic free fluid while in our study, all the four quadrants were inspected. This also reflects that FAST had low sensitivity for pelvic free fluid.

A study was conducted by Amir MS, et al⁴ on 50 patients irrespective of age and sex, presenting to casualty department with blunt trauma. Patients with equivocal signs of peritonitis underwent abdominal ultra sonography followed by diagnostic peritoneal lavage. Out of total 50 patients, sensitivity of FAST was 88.88%, Specificity 91.30%, accuracy 90%, positive predictive value 92.30% and negative predictive value 91.30%. They showed a sensitivity a little higher than ours and recommended that FAST should be preferred over diagnostic peritoneal lavage.

Shiryazdi M, et al³ conducted a study on 60 patients with blunt abdominal trauma. The sensitivity of ultra sonography in diagnosis of blood or fluid in abdomen was 83.3% and specificity was 77.1%. The positive and negative predictive values were 47.6 and 94.9%, respectively. The accuracy was 78.3%.

A study was conducted by Friese RS et al¹⁹ in a level I trauma center. This was a reteroscopic study which included 146 patients with blunt abdominal trauma. Only the patients with pelvic fracture were included. The FAST examination findings were also confirmed with operative findings. The sensitivity and specificity were 26% and 96%, respectively. Positive and negative predictive values were 85% and 63%, respectively. Unlike our study and other studies in literature, this study did not show a high sensitivity and specificity for FAST scan. However, they only included patients with pelvic trauma.

CONCLUSION

FAST is a reliable investigation among patients with blunt abdominal trauma. Its use is recommended in all patients of blunt abdominal trauma a part of routine investigation. The specificity of FAST is high for intraperitoneal free fluid. A positive FAST should be subject to immediate exploration

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