

Focused Assessment with Sonography for Trauma (FAST) Scan Versus Exploratory Laparotomy in Patients with Blunt Abdominal Trauma

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ABSTRACT

Objective: To determine the diagnostic accuracy of FAST scans in patients with blunt abdominal trauma keeping exploratory laparotomy as a gold standard.

Study Design: Cross-sectional validation study.

Place and Duration of Study: Surgical Unit of Combined Military Hospital Kohat from Jan 2019 to June 2019.

Methodology: Trauma patients reporting to the emergency department had a FAST scan using a portable ultrasound machine. The radiologist performed and interpreted the scans within one hour of the patient's arrival. The four standard views were obtained. Those who had positive FAST scans underwent a laparotomy without further evaluation. Patients with negative FAST scans did not have laparotomy unless unstable. Only those patients who underwent laparotomy were included in our study.

Results: Out of 70 cases, comparison of the FAST scans in patients with blunt abdominal trauma keeping exploratory laparotomy as the gold standard to diagnose intra-abdominal injury was recorded as 88.88%, 82.35%, 94.00%, 70.00% and 87.14% for sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy respectively.

Conclusion: Diagnostic accuracy of FAST scan in diagnosing intra-abdominal injury is higher, so it can be used routinely to diagnose intra-abdominal injury as a result of blunt abdominal trauma.

Keywords: Blunt abdominal trauma, Diagnosis, Exploratory laparotomy, Focused assessment with sonography for trauma (FAST) scan, Intra-abdominal injury.

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INTRODUCTION

Globally, blunt abdominal trauma (BAT) is one of the most typical causes of mortality and morbidity in trauma patients.¹ Undiagnosed intra-abdominal injuries lead to avoidable deaths. Therefore, its immediate diagnosis and management can lessen the mortality rate by 50%.^{2,3}

Depending on the site, spleen and liver are the most often injured solid organs. Pancreas, mesentery, bladder, diaphragm and retroperitoneal structures (kidneys, abdominal aorta) usually suffer less.⁴ An increase in radial pulse and respiratory rate, low blood pressure, and abdominal pain and tenderness help guide such injuries. However, changes in patient awareness, neurological deficiencies, medicinal prescriptions or other diverting wounds can make such injuries hard to identify.⁵

Multiple modalities are used to diagnose BAT,

such as diagnostic peritoneal lavage, CT scan, FAST scan or ultrasonography.⁶ However, exploratory laparotomy is regarded as the gold standard.⁷ 'FAST' is an abbreviation for Focused Assessment with Sonography for Trauma. It facilitates the exploration of free fluid in pericardial and intra-peritoneal cavities, which indicates the severity of acute haemorrhage and injury to visceral organs.⁸ The results mentioned in previous studies about FAST diagnostic accuracy are variable and inconsistent. Some literature evidence insinuates high specificity and sensitivity of FAST scan as 99% and 93%, respectively.⁹ In contrast, some studies have reported sensitivity of as low as 46.2% and 50%.¹⁰

The objective of carrying out this study was to test and establish the accuracy of the FAST scan in our setup and if we can document its precision for its incorporation into the essential overview in patients with doubt of intra-abdominal damage/injury. Our peripheral setups and minor medical clinics usually have no accessibility of CT scans; somewhat, their radiology assets are also restricted. Therefore, we could utilize ultrasound as an assistant for giving helpful data to specialists.

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METHODOLOGY

The study was carried out in the Surgical Unit of Combined Military Hospital Kohat over six months, from Jan 2019 to June 2019. It was designed as a cross-sectional validation study. Sample size of 70 was calculated using the WHO sample size calculator, keeping prevalence of intra-abdominal injury among patients presenting to the Emergency Department with BAT as 65%¹¹ and FAST scan sensitivity and specificity as 82.1% 90.6% respectively.¹² The sampling technique was non-probability consecutive sampling.

Inclusion Criteria: Patients with age >12 years to <60 years, presenting within 48 hours of blunt abdominal trauma and those undergoing exploratory laparotomy were included in the study.

Exclusion Criteria: Pregnant females, patients with penetrating abdominal injuries or more than 48 hours history of blunt abdominal trauma and those who had Indeterminate (inconclusive) FAST scan reported by the sonologist were excluded from the study.

After taking approval from the Ethical Committee, written informed consent was sought from the patient or their relatives. The FAST scan was done as part of ATLS protocols in the Emergency Department. The scan was performed and interpreted by a sonologist within 1 hour of the patient's arrival. An ultrasound machine with live 2-D mode/quick B-mode was utilized with transducer frequencies between 36M Hz. Ideal profundity settings rely upon patient body habitus. The four standard perspectives obtained with the patient in the supine position were, pericardial/epigastric, perihepatic, perisplenic and pelvic.

Patients fulfilling the inclusion criteria underwent

and pelvis. In cases where a CT scan was indicated, the patient underwent a laparotomy. Only patients who underwent laparotomy were included in the study.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Qualitative variables like gender, mode of injury were measured in terms of frequency and percentages. At the same time, quantitative variables were estimated as mean and standard deviation. The diagnostic parameters of the FAST scan were calculated using a 2 x 2 Table. Sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy for the FAST scan were determined by using the standard formulas.

RESULTS

A total of 70 patients were included in the study having a mean age of 36.3 ± 2.23 years. Patients between 12-40 years of age were 43(61.42%), whereas 27 (38.57%) patients were between 41-60 years of age. Gender distribution revealed that 45 (64.28%) was males and 25 (35.71%) were females.

55 (78.57%) cases were of road traffic accidents, and it emerged as the leading mode of injury, whereas 15 (21.43%) had a history of fight. 53 (75.71%) cases have an intra-abdominal injury diagnosed on the gold standard, whereas 17 (28.28%) had no positive injury findings.

The comparison of FAST scans in patients with blunt abdominal trauma keeping exploratory laparotomy as the gold standard to diagnose intra-abdominal injury was recorded as 88.88%, 82.35% 94.00%, 70.00% and 87.14% for sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy, respectively (Table).

Table: Diagnostic accuracy of fast scans in patients with blunt abdominal trauma.

		Patients with Blunt Abdominal Trauma (n=70) (As Confirmed on Exploratory Laparotomy)		Total
		Positive Exploratory Laparotomy	Negative Exploratory Laparotomy	
Focused Assessment Sonography for Trauma	Positive Focused Assessment Sonography For Trauma (FAST) Scans	True Positive (a) 47	False Positive (b) 03	a ± b 50
	Negative Focused Assessment Sonography for Trauma (FAST Scans)	False Negative (c) 06	True Negative (d) 14	c ± d 20
	Total	a ± c 53	b ± d 17	70

Specificity=82.35%, Sensitivity=88.88%, Negative predictive value=70.00%, Positive predictive value=94.00%, Accuracy rate=87.14%

a FAST scan. Those who were FAST scan positive had laparotomy. Hemodynamically stable or FAST scan negative patients were evaluated by CECT (Contrast-Enhanced Computed Tomography) of the abdomen

DISCUSSION

We evaluated that the demonstrative precision of the FAST scan in identifying intra-abdominal damage is higher. The FAST scan gives a practical option in

contrast to different examinations in the BAT patients since it has the benefits of being non-invasive, reproducible and inexpensive. The most highlighted advantage is the ability to be performed immediately at the patient's bedside.

80% of abdominal injuries received into the Emergency Department are caused mainly by blunt abdominal trauma (BAT),^{13,14} which is undoubtedly a profound reason for disability and death. Motor vehicle collision (MVC) is the top reason for BAT. 6-9% injuries are caused by falls and blows to the abdomen.¹⁵ Occult BAT may also be caused by child abuse and domestic violence.

Diagnostic peritoneal lavage is a promising modality for assessing intra-abdominal injury. However, it is an invasive procedure and can cause damage to organs. It cannot measure accurately the amount of fluid present intra-abdominally. Furthermore, specific organ damage cannot be estimated through it. Therefore, it can lead to a high rate of negative and non-helpful laparotomies.

CT scan is an entrenched examination, particularly in those patients who are hemodynamically steady after dull injury. However, it is costly and involves inescapable time delay, requires a patient transfer, introduces harmful radiation, and is inadmissible for hemodynamically unsteady patients. Allergic reactions to various contrast agents are clinically documented in various patients.

Inconsistency of diagnostic accuracy of FAST is evident in various studies; some studies have shown sensitivity and specificity of FAST as 76.92%, 70.83%,¹⁶ while others have reported it as 82.1%, 90.6%.¹⁷ Our study reported diagnostic accuracy of FAST scans in patients with BAT keeping exploratory laparotomy as the gold standard for diagnosis of intra-abdominal injury as 88.88%, 82.35% for sensitivity and specificity as 94.00%, 70.00% and 87.14% for PPV, NPV and AR.

We compared our results with previous studies where high sensitivity and specificity of 93% and 99% respectively were recorded in a study by Boutros *et al.*⁹ Similarly, Bano *et al.*, have reported it as 94.7%, 92.5%,¹² our results were consistent with the above studies. Contrary to this, Shek *et al.*, in their study, reported low sensitivity of 46.2% and 50%.¹³ These findings were contrary to our results. In a study by Tabassum *et al.*,¹⁷ they concluded that FAST has high precision and diagnostic accuracy.

Quick diagnosis speeds up the disposal of trauma patients, decreasing the extra time taken to reach the final diagnosis leading to definitive care and treatment.¹⁸ McCarter *et al.*, in their trial, demonstrated that broad instructional training sessions and examinations were not required for trauma specialists to gather more information related to FAST scanning.¹⁹ Buzzas *et al.*, presumed that residents of the surgery department could safely perform FAST scans.²⁰ In a study conducted by Soundappan *et al.*, the sensitivity of FAST was 80% as performed by sonologists or radiologists.²¹

A fully elaborated standard FAST examination, known as E-FAST scan, can also offer additional information, especially in patients with hemothorax or pneumothorax.²² Along with imaging of the GIT area in E-FAST, perspectives for hemithoraces and bilateral upper anterior chest walls are incorporated to evaluate hemothorax and pneumothorax, respectively.

Helping the clinician for timely recognition of the intra-abdominal injury is the most important development in enabling the clinician to develop the management for patients with blunt abdominal trauma. We believe that by diagnosing the location of free fluid in the peritoneal cavity in patients with blunt abdominal trauma, FAST scans can be safely performed, giving more precise and accurate results than other modalities. It might be incorporated into the initial assessment protocol of grown-up patients with blunt abdominal injury for quickly recognizing the requirement for laparotomy.

CONCLUSION

Diagnostic accuracy of FAST scan in diagnosing intra-abdominal injury is higher, so it can be used routinely to diagnose intra-abdominal injury as a result of blunt abdominal trauma.

Conflict of Interest: None.

Authors' Contribution

UA: MSA: Conception of design writing and editing of manuscript, GA: Editing of manuscript, HA: Data collection.

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