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DIAGNOSTIC ACCURACY OF FAST SCAN IN BLUNT ABDOMINAL TRAUMA PATIENTS TAKING CT ABDOMINAL AS GOLD STANDARD

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ABSTRACT

Introduction: Blunt abdomen trauma is common in surgical emergencies. Faster detection of intra-abdominal damage in BAT patients using a FAST scan and CT scan can lead to early treatment, reducing complications associated with late detection. This study aims to evaluate the diagnostic accuracy of FAST scans compared to CT scans in detecting intra-abdominal injuries.

Methodology: The study, conducted at Lahore General Hospital's Emergency Department from July 3, 2024, to January 2, 2025, enrolled 366 subjects meeting inclusion criteria. Patients had initial FAST exams and subsequent CT scans. FAST scans, performed by supervised residents using SAOTE MYLAB SEVEN, focused on detecting free intra-abdominal fluid in three pouches. Positive FAST results indicated fluid presence, leading to CT confirmation. Regardless of USG readings, all patients underwent FAST to compare outcomes and assess injuries for recording alongside patient details in a study proforma. Data was analyzed using SPSS V-20 for diagnostic measures.

Results: In this study, 336 patients were enrolled meeting the criteria. 66.7% were males and 33.3% were females. Ages ranged from 14 to 50 years, with a mean of 32.3±12.6 years. The study found FAST scan sensitivity at 94.5%, specificity at 80.6%, PPV at 95.5%, NPV at 86.9%, and accuracy at 91.9% for identifying intra-abdominal injury positively.

Conclusion: The FAST scan shows diagnostic accuracy similar to CT scans, based on local and international data, making it useful for triaging blunt abdominal trauma patients.

Keywords: Blunt Abdomen Trauma, CT Scan, FAST Scan, Diagnostic Accuracy.

INTRODUCTION

Blunt abdominal trauma (BAT) represents a common occurrence within the surgical emergency departments of major hospitals. The incidence of intra-abdominal injuries among individuals with

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BAT is estimated to be 13%.[1]Ultrasonography (Focused Assessment with Sonography for Trauma - FAST), computed tomography (CT) scan, and/or exploratory laparotomy are methodologies employed for the identification of intra-abdominal injuries. The Focused Assessment with Sonography for Trauma (FAST) represents a point-of-care ultrasound technique utilized to identify the presence of free intraperitoneal fluid in patients presenting to the emergency department with blunt abdominal trauma (BAT).[2-3]

The FAST examination can be conducted swiftly and with high reliability (by both radiologists and emergency physicians), at a minimal expense, and without subjecting the patient to ionizing radiation. The execution of a FAST assessment reduces the duration required to transition to definitive care, which contributes to improved outcomes for trauma patients. Consequently, numerous guidelines and professional organizations have endorsed the implementation of FAST, establishing it as a critical component of the trauma assessment process for patients with blunt abdominal trauma (BAT).[4-5]

While the therapeutic advantages of early identification of free intra-abdominal fluid have been established in hemodynamically unstable patients suffering from blunt abdominal trauma (BAT), the implications of conducting a FAST examination in hemodynamically stable patients remain ambiguous. Prior studies have indicated that the sensitivity of FAST in detecting free intraperitoneal fluid in these individuals is notably limited. Despite FAST demonstrating improved sensitivity for identifying free intraperitoneal fluid, computed tomographic (CT) imaging is often preferred when making therapeutic decisions (surgical versus conservative) in instances where the FAST results are positive.[6-7]

Prior investigations have predominantly concentrated on the diagnostic precision of FAST, with lesser emphasis on its potential as a risk stratification instrument. Consequently, the objective of this study was to examine the application of FAST as a preliminary risk assessment tool in hemodynamically stable individuals who presented after blunt abdominal trauma (BAT).[8]

In this study, we aimed to detect intra-abdominal injuries early using cost-effective FAST and CT scans for prompt treatment, reducing complications linked to delayed diagnosis. Limited local data prompted this investigation comparing FAST and CT scan accuracy in blunt abdominal trauma, with CT as the gold standard. This project seeks to establish FAST scanning as a reliable, affordable diagnostic tool for intra-abdominal injuries, streamlining the detection process with minimal resources and personnel training.

METHODOLOGY

The study was conducted at the Emergency Department of Lahore General Hospital from July 3, 2024, to January 2, 2025. After the approval from the Ethical Review Committee, 366 subjects meeting the operational definitions and the inclusion criteria were enrolled in the study after informed consent. By using the sensitivity and specificity sample size calculator, keeping anticipated sensitivity, specificity and prevalence of the tested population as 92.8%, 93.75% and 61.4%[11] respectively; and the absolute precision for sensitivity and specificity as 4% and confidence interval 95%, sample size of **336**.

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The study included patients aged 15 to 50 of either gender presenting with blunt abdominal trauma manifesting in symptoms like abdominal or flank pain, tenderness on palpation, abdominal distension, or abdominal wall bruising. Exclusions comprised patients with penetrating injuries, instability necessitating diagnostic tests, hemodynamic instability, polytrauma, early discharged patients, and those with subcutaneous emphysema.

Patients received initial FAST exams in the emergency room within one hour of admission. These exams were performed by radiology residents under supervision, using a SAOTE MYLAB SEVEN machine with a C6-2 curved array transducer to check for free intraperitoneal fluid in the hepatorenal, splenorenal, and rectovesical pouches. Results were documented as positive or negative. If positive, a CT scan was then performed to confirm. All patients underwent FAST scans regardless of USG results, focusing on detecting free fluid in the abdomen and pelvis. CT scans were conducted to assess intra-abdominal injuries with patient details recorded on a study proforma.

Data was collected, entered, and analyzed using SPSS V-20. Mean and standard deviation were calculated for quantitative variables (e.g., age, BMI), while frequency and percentage were computed for qualitative variables (e.g., gender, cause of injury, BAT on FAST and CT). Sensitivity, specificity, PPV, NPV, and diagnostic accuracy were determined through a 2 x 2 table. Certification was done for age, gender, BMI, and trauma cause, and post-stratification was applied to calculate diagnostic accuracy.

RESULTS

In this study, 336 patients were enrolled, with 66.7% males and 33.3% females. The age range was 14 to 50 years, with a mean age of 32.3±12.6 years. Most patients (44.6%) were aged 26-35 years, followed by 31.0% (14-25 years) and 24.4% (36-50 years). The mean BMI was 27.5±2.3 kg/m2, with 72.3% having normal BMI, 26.8% overweight, and 0.9% obese. Trauma causes were: 49.7% RTA, 42.0% fall from height, and 8.3% sports injury.

In the patient group, a high percentage was confirmed to have an intra-abdominal injury on both CT scan (81.5%) and FAST scan (80.7%). The FAST scan showed strong performance in identifying intra-abdominal injury, with sensitivity at 94.5%, specificity at 80.6%, PPV at 95.5%, NPV at 86.9%, and accuracy at 91.9%. This study also analyzed the performance of CT and FAST scans across different criteria like gender, age, BMI, and cause of trauma, demonstrating consistently high sensitivity and specificity in each subgroup.

Table 1: Frequency distribution of different variables

Gender	**Frequency**	**Per cent**
Male	224	66.7
Female	112	33.3
Total	336	100.0
Age groups		

Journal of Medical & Health Sciences Review
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https://jmhsr.com/index.php/jmhsr

14-25 years	104	31.0
26-35 years	150	44.6
36-50 years	82	24.4
Total	336	100.0
Body mass index		
Normal	243	72.3
Overweight	90	26.8
Obese	3	0.9
Total	336	100.0
Cause of trauma		
RTA	167	49.7
Fall from height	141	42.0
Sports Injury	28	8.3
Total	336	100.0
Intra-abdominal injury on CT scan		
Present	274	81.5
Absent	62	18.5
Total	336	100.0
Intra-abdominal injury on FAST scan		
Present	271	80.7
Absent	65	19.3
Total	336	100.0

Table 2: Comparison of results of intra-abdominal injury onCT and FAST scan

Intra-abdominal injury on CT scan	**Intra-abdominal injury on FAST scan**		**Total**	
	Present	Absent		
Present	259	12	271	Sn=94.5%, Sp=80.6%, PPV=95.5%, NPV=86.9%, DA=91.9%
Absent	15	50	65	

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https://jmhsr.com/index.php/jmhsr

Total	274	62	336	

Table 3: Stratification of intra-abdominal injury on CT and FAST scan concerning gender

Gender	**Intra-abdominal injury on FAST scan**	**Intra-abdominal injury on CT scan**		**Total**	
		Present	Absent		
Male	Present	162	8	170	Sn=95.8%, Sp=85.4%, PPV=95.2%, NPV=87.1%, DA=93.3%
	Absent	7	47	54	
	Total	169	55	224	
Female	Present	97	4	101	Sn=92.3%, Sp=82.8%, PPV=96.1%, NPV=87.2%, DA=89.2%
	Absent	8	3	11	
	Total	105	7	112	

Table 4: Stratification of intra-abdominal injury on CT and FAST scan concerning age

Age groups	**Intra-abdominal injury on FAST scan**	**Intra-abdominal injury on CT scan**		**Total**	
		Present	Absent		
14-25 years	Present	78	0	78	Sn=91.7%, Sp=100.0%, PPV=100.0%, NPV=83.3%, DA=93.2%
	Absent	7	19	26	
	Total	85	19	104	
26-35 years	Present	110	12	122	Sn=95.6%, Sp=85.7%, PPV=90.1%,
	Absent	5	23	28	
	Total	115	35	150	

Journal of Medical & Health Sciences Review
VOL-2, ISSUE-1, 2025
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https://jmhsr.com/index.php/jmhsr

					NPV=82.1%, DA=88.6%
36-50 years	Present	71	0	71	Sn=95.9%, Sp=100.0%, PPV=100.0%, NPV=82.7%, DA=96.3%
	Absent	3	8	11	
	Total	74	8	82	

Table 5: Stratification of intra-abdominal injury on CT and FAST scan for BMI

Body mass index	**Intra-abdominal injury on FAST scan**	**Intra-abdominal injury on CT scan**		**Total**	
		Present	Absent		
Normal	Present	184	4	188	Sn=95.3%, Sp=92.0%, PPV=97.8%, NPV=83.6%, DA=94.6%
	Absent	9	46	55	
	Total	193	50	243	
Overweight	Present	72	8	80	Sn=92.3%, Sp=83.3%, PPV=90.0%, NPV=80.0%, DA=84.4%
	Absent	6	4	10	
	Total	78	12	90	
Obese	Present	3	0	3	Sn=100.0%, Sp=N/A, PPV=100.0%, NPV=N/A, DA=100.0%
	Absent	0	0	0	
	Total	3	0	3	

Table 6: Stratification of intra-abdominal injury on CT and FAST scan concerning cause of trauma

Cause of trauma	**Intra-abdominal injury on FAST scan**	**Intra-abdominal injury on CT scan**		**Total**	
		Present	Absent		
RTA	Present	124	12	136	Sn=91.8%, Sp=82.5%, PPV=91.1%, NPV=84.5%, DA=86.2%
	Absent	11	20	31	
	Total	135	32	167	

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https://jmhsr.com/index.php/jmhsr

Fall from height	Present	115	0	115	Sn=96.6%, Sp=100.0%, PPV=100.0%, NPV=84.6%, DA=97.1%
	Absent	4	22	26	
	Total	119	22	141	
Sports Injury	Present	20	0	20	Sn=100.0%, Sp=100.0%, PPV=100.0%, NPV=100.0, DA=100.0%
	Absent	0	8	8	
	Total	20	8	28	

DISCUSSION

Blunt abdominal trauma (BAT) is a common occurrence in the emergency department, often linked to vehicular trauma and a mortality rate of approximately 11%. The civilian population most frequently experiences BAT due to vehicular accidents. Commonly affected organs are the spleen and liver.[9-10]Abdominal assessment for trauma-related injury is challenging for clinicians. CT is highly accurate for stable blunt trauma patients. A recent study found CT's negative predictive value (99.63%) safe for discharging such patients after a negative scan.[11]

The FAST technique quickly screens deep peritoneal areas to detect free fluid collections, indicating potential acute haemorrhage and organ injury.[12-13]McKenney proposed using focused ultrasonography to identify fluid such as blood or enteral contents in the peritoneal cavity, pleura, or pericardium.[14]

The trauma US exam targets specific sites in the abdomen where blood is likely to collect: Morrison's pouch, splenorenal recess, and lower intraperitoneal cavity (including Douglas's pouch). Dark areas caused by blood are best seen near organs like the liver, spleen, and kidneys. This, along with pericardium evaluation, makes up the FAST scan for trauma. Reported FAST sensitivity ranges from 64% to 98%.[15-16] Specificity is high, at 86-100%.[17]

Our study demonstrated that the FAST scan is highly sensitive (94.5%) and specific (80.6%), effectively identifying intra-abdominal injury post-BAT. With a positive predictive value of 95.5%, it minimizes unnecessary exploratory laparotomies. The negative predictive value stands at 86.9%, indicating the accuracy of ruling out intra-abdominal injury. International studies, like Chambers et al., have reported the FAST scan's specificity of 97%, affirming its reliability in trauma assessment.[18]

A Cochrane review showed high sensitivity (85-95%) in detecting hemoperitoneum in trauma patients, with even higher specificity.[19]In blunt trauma FAST scanning studies, results typically show 90-99% specificity and 86-99% sensitivity.[20-22]Baloch et al.'s local data and Brooks et al.'s international data both show a 90% accuracy rate for FAST scan in blunt abdominal trauma.[23-24]

In their retrospective study of 100 BAT patients, Fleming et al. compared FAST to CT and laparotomy within two days. FAST's accuracy in BAT was 59.2%, with 43.7% confirmed by CT

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https://jmhsr.com/index.php/jmhsr

and 15% by laparotomy. 40.8% of FAST scans were inaccurate, all confirmed by CT. FAST specificity was 94.7% and sensitivity 46.2%. Positive FAST results were accurate 75% of the time.[25]

Miller's study found that using FAST for blunt abdominal trauma screening might miss injuries, affecting patient treatment and outcomes. Among 359 patients studied, FAST showed high specificity (98%) but low sensitivity (42%), leading to missed injuries in six patients needing surgery and 16 requiring nonoperative management. Thus, the study suggests that hemodynamically stable trauma patients suspected of abdominal injury should undergo routine CT scanning for accurate diagnosis and treatment.[26]

In the last decade, Sheng et al. observed a decline in abdominal CT use alongside a growth in FAST utilization. The increase in FAST usage could have contributed to the decrease in abdominal CT scans. This shift in imaging trends contradicts the general pattern, suggesting a potential connection between the rise in FAST scans and the drop in CT imaging. Notably, repeated scanning can enhance the sensitivity of FAST examinations.[27]

In stable patients, trauma surgeons prefer FAST (77.6%) and early CT (82.3%) for diagnosis. For unstable patients, 93.4% find FAST necessary, but it can't detect retroperitoneal injuries or diaphragmatic rupture.[28-29]In a separate study, FAST scan showed a sensitivity of 92.8% and specificity of 93.75%, with positive predictive value at 96.3% and negative predictive value at 88.2%. Overall diagnostic accuracy was 93.2%, and FAST scan tested positive in 61.4% of cases.[30]CT scan of the abdomen is highly accurate for detecting intra-abdominal injuries (100% sensitivity and 94.7% specificity).[31]

Abdominal ultrasonography is a cost-effective, non-invasive tool that is quick, repeatable, and widely available. It is suitable for use in resuscitation of unstable patients and can be easily learned by less experienced medical professionals. This makes it valuable for triaging blunt abdominal trauma patients for surgery. In our study, FAST showed similar accuracy to other data sources, suggesting it as a viable alternative for investigating these patients. It can be part of the initial assessment for those suspected of intra-abdominal injuries.

CONCLUSION

The FAST scan is comparably accurate to CT scans based on existing local and international data. It can be regularly used for triaging blunt abdominal trauma patients. However, further validation through a multi-institutional research study in our setting is necessary.

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