

Diagnostic accuracy of emergency-performed focused assessment with sonography for trauma (FAST) in blunt abdominal traumaHamed Basir Ghafouri¹, Morteza Zare², Azam Bazrafshan³, Ehsan Modirian⁴, Shervin Farahmand⁵, Niloofar Abazarian⁶

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Abstract

Introduction: Intra-abdominal hemorrhage due to blunt abdominal trauma is a major cause of trauma-related mortality. Therefore, any action taken for facilitating the diagnosis of intra-abdominal hemorrhage could save the lives of patients more effectively. The aim of this study was to determine the accuracy of focused assessment with sonography for trauma (FAST) performed by emergency physicians.

Methods: In this cross-sectional study from February 2011 to January 2012 at 7th Tir Hospital in Tehran (Iran), 120 patients with abdominal blunt trauma were chosen and evaluated for abdominal fluid. FAST sonography was performed for all the subjects by emergency residents and radiologists while they were blind to the other tests. Abdominal CTs, which is the gold standard, were done for all of the cases. SPSS 20.0 was used to analyze the results.

Results: During the study, 120 patients with abdominal blunt trauma were evaluated; the mean age of the patients was 33.0 ± 16.6 and the gender ratio was 3/1 (M/F). The results of FAST sonography by emergency physicians showed free fluid in the abdomen or pelvic spaces in 33 patients (27.5%), but this was not observed by the results of CT scans of six patients; sensitivity and specificity were 93.1 and 93.4%, respectively. As for tests performed by radiology residents, sensitivity was a bit higher (96.5%) with lower specificity (92.3%).

Conclusion: The results suggested that emergency physicians can use ultrasonography as a safe and reliable method in evaluating blunt abdominal trauma.

Keywords: FAST, Emergency, Radiology

1. Introduction

Blunt abdominal trauma is a critical and deceptive situation, and it causes a variety of signs and symptoms, ranging from insignificant symptoms to severe shock, leading to higher risk of mortality because of the difficulty in diagnosing the damage to intra-peritoneal organs (1). Since the mental status of patients who have undergone trauma usually is affected, physical findings are often unreliable. Diagnostic peritoneal lavage (DPL), which is an invasive procedure, provides information about the presence or absence of peritoneal fluid, but it lacks specificity and does not provide information about any possible injuries to the intra-abdominal organs (2). It is essential for emergency physicians to determine who should approach a blunt abdominal trauma, and they must rely on physical examination

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or performing diagnostic procedures, such as FAST ultrasonography, diagnostic peritoneal lavage (DPL), or computed tomography (CT) to determine which patients require any therapeutic intervention. Although DPL is very sensitive in identifying hemoperitoneum and is still a useful tool to exclude hollow organ perforations that may be undetected by CT, recent advances in imaging diagnostic procedures have reduced its usage (3). Contrast abdominal CT is considered the gold standard, but there are limitations, such as high cost, being time-consuming, need to transfer the patient out of the Emergency Department, and exposure to radiation, that make it the last choice in low-risk patients. In most of the centers, FAST ultrasonography is the primary procedure for blunt abdominal trauma to determine whether intra-peritoneal free fluid is present. It can be performed rapidly and conducted in the resuscitation room in the ED. FAST US has excellent sensitivity and specificity for hemoperitoneum (4, 5), but intra-abdominal injuries that require laparotomy cannot be excluded in the case of negative FAST reports (6). In this prospective study, we evaluated the FAST scans performed by emergency residents to determine whether they were reliable compared to radiologists and abdominal CT scans.

2. Material and Methods

2.1. Research Design and Setting

This prospective study was performed from February 2011 to January 2012 at 7th Tir Hospital, which is affiliated with the Iran University of Medical Sciences (IUMS) in Tehran, Iran.

2.2. Procedures and instruments

During the study period, 120 patients with blunt abdominal trauma were evaluated for abdominal fluid. FAST sonography was performed for all the patients by emergency residents and radiologists who were blind to the other tests. All ultrasound evaluations were performed using the FAST technique during the primary survey of advanced trauma life support (ATLS) guidelines. Third-year emergency residents, with at least eight hours in the bedside training program, including instructions and practical sessions before study, were responsible for performing the FAST exams. The exams were repeated by Radiology residents (PG-2) who were blind to the prior results. The SonositeTM180, handheld system was used for the tests. A curvilinear probe (2-4 MHz) was used. Positive findings included the presence of abdominal fluid in any of the abdomino-pelvic spaces.

Abdominal CT with IV and oral contrast as the gold standard were done for all of the patients. The results and other necessary demographic and physical exam data were recorded by the researcher. Since some patients had been transferred directly to the operating room and underwent laparotomies without performing abdominal CT scans, we used a combination of laparotomy (if performed) and abdominal CT scan as our gold standards. Asymptomatic patients with normal physical exams along with normal FAST reports and 24 hours of ED observation also were accepted as correct FAST results. CT scans were performed within four hours of the patient's arrival at the ED.

2.3. Statistical Analysis

Sensitivity, specificity, and the positive and negative predictive values of FAST were calculated by the emergency or radiology residents. Statistical analysis was done by SPSS, version 13.

3. Results

During the study, 120 patients with abdominal blunt trauma were evaluated; the mean age of the patients was 33.0±16.6, and the gender ratio was 3/1 (M/F). Most of the subjects were referred to the hospital due to motor vehicle accidents (97.5%). All of the patients underwent FAST sonography by an emergency resident and a radiology resident. According to their physical exam and FAST results showing abdominal free fluid, 10 patients were transferred directly to the operating room; abdominal CT scans were performed for 81 patients (67.5%), and the other 29 patient did not need any further diagnostic studies during the 24-hour observation period (Table 1). The results of FAST sonography by emergency physicians showed free fluid in the abdomen or pelvic spaces in 33 patients (27.5%), but this was not proved with CT scan results in six patients; Sensitivity and specificity were 93.1 and 93.4%, respectively. For the tests performed by the radiology residents, sensitivity was a bit higher (96.5%) with a lower specificity (92.3%) (Table 2).

4. Discussion

The use of FAST examination instead of abdominal contrasted CT scans is increasing significantly, and its role as a single imaging modality for blunt abdominal trauma also is increasing (7). It is a critical and challenging task for emergency physicians to assess subjects with blunt abdominal trauma quickly and accurately. Using FAST exam for detecting abdominal free fluid is an easy and rapid approach that could be employed by an accessible, portable sonography unit during the primary survey in the first several minutes of the patient's arrival in the ED. Although

abdominal CT is considered the gold standard, its limitations, such as higher cost and time, the need to transfer the patient out of emergency department and exposure to radiation implies that ultrasound can safely replace it, provided that FAST shows high sensitivity and specificity.

Table 1. *Subjects with disagreement results*

No.	Gender	Age (year)	VS	ER FAST	RAD FAST	CT	LAPA
1	Female	19	Stable	Free Fluid	Free Fluid	Normal	
2	Female	42	Stable	Free Fluid	Free Fluid	Normal	
3	Male	7	Stable	Free Fluid	Free Fluid	Normal	
4	Male	43	Stable	Normal	Free Fluid	Free Fluid	Yes
5	Male	4	Stable	Normal	Free Fluid	Normal	
6	Male	32	Stable	Normal	Free Fluid	Normal	
7	Male	19	Stable	Normal	Free Fluid	Normal	
8	Male	50	Stable	Normal	Free Fluid	Normal	
9	Male	33	Stable	Free Fluid	Normal	Normal	
10	Male	34	Stable	Free Fluid	Normal	Normal	
11	Male	80	Stable	Free Fluid	Normal	Normal	
12	Female	25	Stable	Normal	Normal	Free Fluid	Yes

Table 2. *Accuracy of FAST results compared with abdominal CT scan results*

FAST		Gold standard		Sensitivity	Specificity	PPV	NPV
		Positive	Normal				
ER FAST	Free Fluid	27	6	93.1	93.4	81.8	97.7
	Normal	2	85				
Radiologist FAST	Free Fluid	28	7	96.5	92.3	80	98.8
	Normal	1	84				

Although ultrasound is probably the most strongly operator-dependent of all imaging modalities (8), there are reports that FAST operators with a broad range of experience can perform the task, without any impact on the results (9). Surgeon-performed or non-radiologist FAST technique seems to be an accurate method to evaluate the possibility of blunt abdominal trauma in stable patients in detecting free fluid (7, 10-12). Although it is difficult to perform in cases of excessive bowel gas, obesity, and an empty bladder (2), finding fluid in the right upper quadrant by FAST resulted in a higher probability of subsequent therapeutic laparotomy (13, 14). Most recent studies have reported high sensitivity and specificity for non-radiologist performed FAST exam except for Ollerton et al.'s and Gaarder et al.'s studies, which suggested that further performance improvement was required and recommended that FAST be performed by radiologists or by the trauma team leaders (8, 9). However, Cazes et al. showed that 20 ultrasounds, including 10 "real life" FAST exams, were sufficient to perform the test with high accuracy (15). Our results also demonstrated that emergency physicians with an eight-hour education can perform FAST exams as reliably as radiologists.

5. Conclusions

The use of FAST examination instead of abdominal contrasted CT scan is increasing significantly, and its role as a single imaging modality for blunt abdominal trauma also is increasing. It is a critical and challenging task for the emergency physicians to rapidly and accurately assess subjects with blunt abdominal trauma. According to our findings, FAST exams can be performed by emergency physicians, and they are reliable and sensitive, but, since FAST ultrasounds have a high negative predictive value in patients with blunt abdominal trauma and, thus, cannot reliably exclude intra-abdominal bleeding, it is recommended to keep patients with negative ultrasound results under close observation for 12-24 h before discharge.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

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