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Comparing the Ability of FAST and CT scan in Determining Free Fluid in Stable Patients with Blunt Abdominal Trauma

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ABSTRACT

Background: Blunt abdominal trauma (BAT) has a high rate of morbidity and mortality. In the past few years, focused assessment with sonography in trauma (FAST) and computerized tomography (CT) scan have been extensively utilized and studied in management of BAT. The present study aims to compare the diagnostic accuracy of FAST and CT scan in detection of free fluid in BAT patients.

Methods: In this cross-sectional study, patients with BAT were evaluated by both FAST and CT scans in Shahid Sadoughi Hospital, Yazd, Iran, from May 2017 to February 2018. The results were compared and the sensitivity, specificity, and accuracy of FAST and CT scan were calculated. In addition, the accuracy of FASTs performed by emergency medicine residents (EMR) was compared with those procedures performed by radiology residents (RR) in detecting abdominal free fluid following blunt trauma.

Results: In this study, 175 patients were participated and most of them were males. The commonest cause of trauma was a road traffic accident (RTA). When FAST was performed by EMRs, sensitivity was 96.3%, specificity 75%, 60% positive and 98.1% negative predictive values and 94.8% accuracy in true evaluating free fluid , and Sensitivity 97.5%, specificity 83.3%, 71.4% positive and 98.8% negative predictive values when FAST was performed by RRs.

Conclusion: Based on this study finding, it seems that FAST is highly sensitive, specific and accurate in the initial evaluation of patients with BAT.

Keywords: Trauma, Abdominal Trauma, Blunt Trauma, CT Scan, FAST Exam, Focused Abdominal Sonography for Trauma

Introduction

Blunt abdominal trauma (BAT), is a critical situation with a high level of morbidity and mortality among all age groups. Diagnostics and management are still a challenge, since the

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presentation is often not obvious during the initial assessment.

The prevalence of intra-abdominal injury in patients with BAT is approximately 13 % (1). The most common mechanism of BAT is road traffic accident (RTA) (such as motor vehicle accidents and auto-pedestrian accidents). Other causes include falls, direct hit to the abdomen because of assault, fight, and sport related injuries (2). Due to increased number of vehicles and industrial development, abdominal trauma, is increased especially in developing countries, such as Iran (3) .

Focused abdominal sonography in trauma (FAST) is used in the initial evaluation of the patient with BAT in many centers called primary survey (4-7) . Over the past years, use of FAST has increased due to its advantages of its rapid discovering of free fluid in abdomen, non-invasive ability, portability, lack of ionizing radiation, and its repeatability. Different studies have demonstrated that utility of FAST upgraded trauma care in the management of BAT, by finding of abdominal free fluid. A disadvantage of FAST could be misinterpretation or misdiagnosis due to operator low training. On the other hand, computerized tomography (CT) might be neither an available nor an affordable tool for routine trauma investigation in rural areas, or developing countries(8, 9). Thus, this study compares the diagnostic accuracy of FAST in diagnostic investigations of abdomino-pelvic free fluid in patients with BAT.

Material and methods

This cross sectional study was performed from May 2017 to February 2018 at Shahid Sadoughi Hospital, in Yazd, Iran. During the study period, all patients aged above 18 years with BAT who were stable enough to undergo both focused assessment with sonography in trauma (FAST) and CT scans were evaluated for abdominal fluid. The study was approved by the ethics committee of Shahid Sadoughi University of Medical Sciences. Informed consent was obtained from all patients. Patients with underlying diseases causing fluid accumulation in the abdomen, such as cirrhosis, penetrating trauma to the chest or abdomen, BMI>30, unstable patients, including patients with hypotension and hemorrhage were excluded. FAST was performed for all patients by the emergency medicine residents (EMR) and then by third year radiology resident (RR) who were blind to each other's ultrasound findings. The ultrasonography was performed with HS-2000 Honda Ultrasound equipment and CT scans of the abdomen were done on spiral CT scan taking (> 200 ml) free fluid in the peritoneal cavity as a positive finding.

Demographic data were recorded by the researcher. Ultrasound findings for each patient were compared with the results of computed tomography in relation to presence of abdominal free fluid.

Statistical analysis

Specificity, sensitivity, and positive and negative predictive values of FAST performed by EMRs and RRs were calculated and compared using Chi-square analysis. P-value less than 0.05 was considered statistically significant.

Result

During the study period, 175 patients with BAT were evaluated with both FAST and CT.

All patients went under EMR FAST at the first 2-5 min of arrival after evaluation and fixing of Airway and Breathing by EMR. Then, all of them were candidate for both FAST by RR and CT scan as soon as possible.

Table 1. Patients' demographic characteristics

Variable		Number (%)
Sex	Male	146 (83.4%)
	Female	29(16,6%)
Mean age of patients		38.4 yrs (19 - 52)
Mechanism of injury	RTA	135(77.14%)

	Fall	28 (16%)
	Assult	12(6.85%)

Table 2. Comparition of fast reports and abdominal CT findings

FAST		Abdominal CT scan		Sensitivity	Specificity	PPV	NPV
		Positive	Negative				
ER FAST	Positive	9	6	96.3	75	60	98.1
	Negative	3	157				
RR FAST	Positive	10	4	97.5	83.3	71.4	98.8
	Negative	2	159				

ER: emergency residents; RR: radiology residents; PPV: positive predictive value; NPV: Negative predictive value

by Engles et al., the overall FAST results showed a specificity of 92.1% and accuracy of 80.8%; however, the sensitivity in their manuscript was only 69.8%, which was less than that of found in the literature (17). The sensitivity of FAST performed by Fleming et al. was found to be only 46.2% , although, their study showed a higher specificity of 94.7% compared to the present study (97.5%) (18).

A study evaluated the accuracy of FAST and CT scan for the diagnosis of blunt torso (chest and abdomen) trauma. They showed that FAST play a key role in the management of patients who may require more procedures and therapy for hemodynamic stabilization (14). FAST has some advantages, such as simplicity, intra-abdominal hemorrhage, and no radiation for patients. These advantages make it a preferred modality in ED and for all abdominal trauma patients.

Published studies on FAST have pointed out some disadvantages. Dolich et al. showed that up to 33% of abdominal injuries may be missed accepting FAST (19). Although, studies suggest that false negative results are rare with ultrasound (1%)(14, 20), there are rare reports, claiming that FAST may miss some of the major injuries, such as hepatic injury, requiring immediate care for life of the patient (21). It is so important to know FAST examination alone as a screening tool for BAT, in the hemodynamically stable trauma patient results in diagnosis of intra-abdominal injury (22). Physicians should know this issue and use other modalities, such as physical examination, repeated FAST, organ specific sonography or CT SCAN in best time.

Discussion

It is very important for physicians working in Emergency Department (ED) to evaluate patients with BAT quickly, correctly, and accurately. FAST is largely used as the preferred screening technique for initial evaluation of free abdominal fluid in many trauma centers.

The present study was designed to evaluate the accuracy of FAST by two resident groups and compare it with the results of abdominal CT scan. The results of the current study showed that the accuracy of FAST performed by RR and emergency residents (ER) were 96.5% and 94.8%, respectively. In addition, EMR who performed FASTs had 96.3% sensitivity and 75 % specificity, and RR performed FASTs which had 97.5% sensitivity and 83.3%. The present study indicates consistency with prior studies by showing very high values of sensitivity and specificity (10-13). .In the study by Pandey et al., the sensitivity, specificity, and accuracy was 92.68%, 98.31%, and 96%, respectively, for free fluid on FAST, which is comparable to the present study (10). Based on the systematic review conducted by Lee et al., sensitivity, specificity, and positive predictive values (PPV) and negative predictive values (NPV) for identification of intra-abdominal free fluid by FAST were 92.1% (87.8–95.6), 98.7% (96.0–99.9), 90.7% (70.0–98.0), and 98.8% (98.1–99.5), respectively. In a recent study by Akram et al., FAST was utilized for evaluating blunt trauma in 125 patients. The values of sensitivity, specificity, PPV, and NPV were 100%, 91.67%, 100%, and 85.42%, respectively (14). In another study done

other vehicles or being the main part of workers, making them more prone to harms compared to the females. In the present study, most of the participants were in the age group of 19-52, which is the most active span of life. Engles et al. conducted a study on 104 patients who were comparable to the present study (17). They showed that RTA at the first, and then falls and assults are more responsible for BAT. In other study done by Smith and Wood, 74.1% of the total cases had RTA, which is comparable to the present study (34). Pandey et al. also found RTA as the most common cause of BAT in their study.

Conclusion

According to the findings, it seems that FAST could be a valuable and reliable modality in detecting free fluid even in stable patients with BAT. FAST can be performed by emergency residents and specialists, who are just as reliable as radiologists. Future studies are recommended to evaluate the added benefits of FAST.

Conflict of interest

The authors declare that there is no conflict of interest about this article.

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Some studies have documented CT as the reference technique especially for patients with BAT (23,25). CT has some disadvantages, such as requiring experienced personnel, the need to transfer the patient out of emergency department and is not a suitable diagnostic approach in hemodynamically unstable patients (26, 27). However it is a good modality in the investigation of patient with stable hemodynamic and for hepatic or splenic injury detection. The current study excluded unstable patients (such as patients with shock and hypotension and obvious hemorrhage). Fewer studies have studied the sensitivity and specificity of FAST in patients with hypotension after trauma. In a multicenter cohort study FAST had a specificity of 83% and sensitivity of 62% in injured patients with hypotension that needed an emergent or urgent surgical procedure. The sensitivity, specificity, the PPV, the NPV, and accuracy of FAST were higher in the normotensive group of patients. This may be due to disadvantage of FAST in finding retroperitoneal hemorrhages (28), which is consistent with the present study.

As a result, EMR who performed FASTs had acceptable sensitivity and specificity similar to that of performed by RRs, which is in in line with previous studies conducted in Iran and other countries (29). FAST can be carried out by radiologists, surgical resident or emergency physician with good training. Many previous scholarships showed the equivalent accuracy of FAST performed by radiologists and non-radiologists (11, 12, 26, 30). Shojaee et al. evaluated the accuracy of 286 cases of FAST performed by EMRs and reported that they can perform this test with high accuracy for patients with BAT (29). A similar study by Dolatabadi et al. indicated that EMRs can do FAST on patients with abdominal trauma as successfully as RRs (31). Ghafouri et al. revealed that emergency physicians with 8hour sonography training can perform FAST perfectly (26).

Most of the members in this study were males (83.4%), which is consistent with the previous studies (9, 10, 33). This finding could be due to more number of males driving automobiles and

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