

Free fluid in FAST (Focused Assessment with Sonography in Trauma) findings before and after serum therapy in blunt abdominal trauma



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Abstract:

Background: Trauma is the first cause of youth mortality in developing countries. Focused Assessment Sonography for Trauma (FAST) is a reliable tool for examining trauma patients. Hence, the purpose of this study was to compare the FAST findings before and after serum therapy.

Materials and Methods: This descriptive-analytical study was performed on 200 trauma patients, who randomly entered the study. Inclusion criteria were the patients with suspected and normal cases in FAST results, and stable vital signs and exclusion criteria were positive FAST findings, penetrating abdominal trauma, and unstable vital signs. The trauma patients underwent sonography at the baseline and four hours after serum therapy. Data were analyzed using descriptive (mean and percentage) and inferential (Wilcoxon) statistics.

Results: The mean age of patients participating in the study group was 33.47 ± 15.85 years, including 86.5% male and 13.5% female. The results showed that serum therapy could significantly increase oxygen saturation, diastolic blood pressure, and level of consciousness ($P=0.001$). Respiratory rate, pulse rate, and systolic blood pressure were reduced, and the number of FAST-based suspicious diagnoses was also decreased ($P=0.001$).

Conclusion: Our study demonstrated that serum therapy reduces suspected cases in the FAST examination.

Keywords: Blunt Abdominal Trauma, FAST, Serum Therapy, Hydration

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Introduction

Trauma is the first cause of youth mortality in developing countries (1). This is while 20% of trauma patients die from trauma-induced intra-abdominal hemorrhage (2-4). According to studies, the leading causes of increased mortality in patients with abdominal trauma are the delay in the correct diagnosis of patients with risky abdominal injuries,

as well as an incorrect assessment of the severity of abdominal lesions (6-7). In the past years, many methods have been considered by surgeons, who have always sought a method to detect abdominal damages quickly. The first method for evaluating abdominal damage was Diagnostic Peritoneal Lavage (DPL), then CT scan, and currently Focused

Assessment Sonography for Trauma (FAST) (8-10). The FAST is part of the primary examination in patients with blunt abdominal trauma, which is a valuable portion of the critical care unit of the patients (11). In recent years, the ultrasound has been performed for the trauma patients due to the absence of radiologists in non-working shifts and the need for rapid implementation of this test in emergency situations by the emergency medical specialists, who are attended to the patient's bedside immediately upon arrival trauma patients, preventing the waste of time and cost, especially in life-threatening conditions (12). The ultrasound is also a reliable tool for trauma patients and plays a decisive role in clinical decision making due to its availability for emergency medicine specialists at the initial moments of patients' arrival at the bedside. If emergency medicine specialists are properly trained, they can successfully perform this technique for trauma patients (13). The FAST provides rapid information about the hemodynamically unstable patient to the surgeon. The diagnostic value of ultrasound has been well documented in detecting different trauma-induced abdominal injuries (14). The ultrasound can be an ideal method for examining trauma patients by means of features such as portability, easy access, not annoying the patient, posterior peritoneum examination, pleura, and pericardium examination. However, there are limitations in performing the FAST, including the difficulty of observing the abdomen and posterior peritoneum due to skin ulcers, broken bones, patient limitation in the position change, and excessive belching (14). Therefore, the present study was conducted with the aim of comparing the FAST findings before and after serum therapy in patients with blunt abdominal trauma referred to the Emergency Department (ED).

Methods

Study Design

The current descriptive-analytical study was performed on 200 blunt abdominal trauma patients who were referred to the ED of Peymanieh Hospital affiliated with Jahrom University of Medical Sciences, Iran. Subjects of this study were selected using available simple sampling. This study was performed between June 2017 and 2018 for one year. The study was conducted in accordance with the declaration of Helsinki, and the protocol was approved by the ethics committee of Jahrom University of medical sciences (project identification code IR.JUMS.REC.1396.104).

The blunt abdominal trauma patients, aged 17-65-year-old with normal vital signs referred to the ED were randomly enrolled in the study. All patients with normal FAST and stable vital signs remained for further testing. The patients with positive FAST findings, penetrating abdominal trauma, and unstable vital signs were excluded from the study.

The trauma patients, who were stable in pressure and pulse at normal and near-normal levels, underwent sonography at the baseline and four hours after serum therapy. The patients were brought by Emergency medical services (EMS) or self-referred. After the arrival of the trauma patients at the emergency department, the initial resuscitation measures were performed, and then the FAST was fulfilled in the resuscitation room for all patients under study. The patients were hydrated according to the clinical conditions to the appropriate amount (500 or 1000 cc) (based on the amount of bleeding, age, history of the disease), and vital signs were monitored. The second FAST was performed four hours after the first ultrasound, and the patient's vital signs were re-charted, and the changes were recorded. The patient information and the FAST findings were collected by a researcher-made questionnaire. The Glasgow Coma Scale (GCS) was used to determine the level of consciousness.

Statistical analysis:

To determine the normal distribution of the data, we used Kolmogorov- Smirnov test, and then data

were analyzed by SPSS version 16 using descriptive statistics (mean, percentage, standard deviation) and inferential statistics (Chi-Square, Wilcoxon, and McNamara's tests).

Results:

This study evaluated 200 blunt abdominal trauma patients referring to the ED. The mean age of patients participating in the study group was 33.47 ± 15.85 years, including 86.5% male and 13.5% female. Damage mechanisms were falling from height (19.6%), car accident (18.6%), motorcycle accident (46.7%), car role-over (10.1%) and bicycle role-over (5%), which had abdominal muscle strain (59.5%), abdominal tenderness (18.5%) and long bone fracture (56.8%). The total infused serum volume was 500 in 75% of patients. Table 1 shows the frequency distribution of epidemiologic indices in the patients.

Table 2 showed that the FAST findings were suspicious in 6% of patients and normal in 94%. However, the FAST findings were normal in all patients after serum therapy. The McNamara's test

showed that the sonographic findings before and after serum therapy were significant in patients ($P=0.001$), indicating the effect of serum therapy on the damage mechanisms. Table 3 exhibits increased blood oxygen saturation at the baseline (96.05 ± 2.65) and after serum therapy (96.52 ± 5.97) in patients with blunt abdominal trauma referring to the ED. The Wilcoxon test showed that the blood oxygen saturation before and after serum therapy was significant in patients ($P=0.001$).

Table 3 shows the increased amount of systolic blood pressure at the baseline (119.37 ± 14.78) and after the serum therapy (121.27 ± 11.24) in blunt abdominal trauma patients referred to the ED. The Wilcoxon test revealed that the systolic blood pressure before and after serum therapy was significant in patients ($P=0.001$). The diastolic blood pressure at the baseline (76.93 ± 6.86) and after the serum therapy (77.61 ± 7.21) was increased in blunt abdominal trauma patients referring to the ED. The Wilcoxon test showed that diastolic blood pressure before and after serum therapy was significant in patients ($P=0.008$).

Table 1. Epidemiologic indices of blunt abdominal trauma patients referring to the ED

		Frequency	Percent
sex	Man	173	86.5
	Woman	27	13.5
Mechanism of injury	Falling	39	19.6
	Car accident	37	18.6
	Motorcycle accident	93	46.7
	Car Role over	20	10.1
	Bicycle role over	10	5
Abdominal Muscle Strain	Yes	43	21.8
	No	154	78.2
Abdominal Tenderness	Yes	37	18.5
	No	163	81.5
Long Bone Fracture	Yes	113	56.8
	No	86	43.2
Used serum volume	500	151	75.5
	1000	47	23.5
	2000	1	0.5

Table 2. Comparison of sonographic findings before and after serum therapy

		Normal FAST	Suspicious FAST	Free fluid in FAST	P-value
		n (%)	n (%)	n (%)	
FAST findings	Before serum therapy	188 (94)	12 (6)	0 (0)	0.0001
	After serum therapy	200 (100)	0 (0)	0 (0)	

Table 3 showed a reduction in pulse rate at the baseline (82.67 ± 8.34) and after the serum therapy (79.51 ± 9.04) in patients with blunt abdominal trauma referring to the ED. The Wilcoxon test indicated that the pulse rate before and after serum therapy was significant in patients ($P=0.001$). Also, a decrease in the respiratory rate at the baseline (20.43 ± 4.73) and serum therapy (19.63 ± 5.88) in patients with blunt abdominal trauma referring to the ED happened. The Wilcoxon test demonstrated that the respiratory rate before and after serum therapy was significant in patients ($P=0.001$). The level of consciousness was 12 in 1%, 13 in 4%, and 14 in 6% and 15 in 89% at the baseline. Meanwhile, the level of consciousness was 12 in 0.5%, 13 in 2.5%, 14 in 5%, and 15 in 92% after serum therapy. The results of the Wilcoxon test showed that the level of consciousness before and after serum therapy was significant in patients ($P=0.001$), indicating an increased level of consciousness by serum therapy in the patients.

Discussion:

Blunt abdominal trauma is one of the main causes of morbidity and mortality in the ED (15). If the FAST is done purposefully in the trauma patients, it will be considered part of the primary examination as well as valuable help for ED care for the trauma patients (16). Therefore, this study aimed to compare FAST findings before and after serum therapy in patients with blunt abdominal trauma referring to ED. The mean age of the patients participating in the study group was 33.47 ± 15.85 years, including 86.5% male and 13.5% female. The most common causes of abdominal traumas include crashes, falls, and conflicts (5). The main cause of the traumatic event in our study was motorcycle accidents. Based on the findings of this study, serum therapy can improve the amount of blood oxygen saturation, reduce systolic blood pressure and increase diastolic pressure before recording the FAST findings in patients with blunt abdominal trauma. According to the study of Tremblay et al., the desired serum therapy of the traumatic body produces optimal blood supply and adequate oxygen supply and reduces the need for blood transfusion (19).

Table 3. vital signs of participants before and after serum therapy

	Before serum therapy		After serum therapy		P-value
	Mean	SD	Mean	SD	
Oxygen saturation, %	96.05	2.65	96.52	5.97	0.001
Systolic blood pressure, mmHg	119.37	14.78	121.27	11.24	0.001
Diastolic blood pressure, mmHg	76.93	6.86	77.61	7.21	0.008
Pulse rate, per min	82.67	8.34	79.51	9.04	0.001
Respiratory Rate, per min	20.43	4.73	19.63	5.88	0.001

In the study of the relationship between systolic blood pressure and internal hemorrhage in a study by Kassavin et al (20). It was found that bleeding is more common in people with lower blood pressure. In the present study, serum therapy was associated with an improved FAST examination finding, as no suspicious positive observation of fluid in the abdominal cavity was found in FAST results. In the baseline FAST at the emergency department, 6% of cases were suspected of bleeding and the presence of free fluid in the abdominal cavity; however, repeated FAST after four hours showed no suspicious cases after serum therapy (decreased systolic blood pressure, pulse rate, and increased diastolic blood pressure). The serum therapy seems to be able to increase the diagnostic accuracy of FAST by reducing the number of suspected cases of internal bleeding. Jeremy et al. (21) expressed that free fluid accumulation in the pelvic cavity in the false-negative FAST findings present in CT findings, and that mild ruptured spleen was recorded in the CT findings in three cases of false-negative FAST; meanwhile, the present study evaluated the FAST diagnostic accuracy rate before and after serum therapy.

The use of other more accurate diagnostic tests could provide more cumulative results compared with the FAST. Concerning the level of consciousness of patients before and after serum therapy, the results indicated that the level of consciousness before and after serum therapy was significantly increased ($P=0.001$). These results revealed an increase in the level of consciousness of patients after serum therapy. In fact, a decrease in the level of consciousness occurs in people with blunt abdominal trauma due to problems in the blood supply to the brain (22, 23). Haut et al. figured out that the use of serum therapy strategy lacked the benefit for the trauma patients and suggested that this method should be discontinued (24). While intravenous fluid administration improved our patients' consciousness condition. Despite these

data limitations, our study suggests that before and after serum therapy, the FAST exam did not get altered in patients with abdominal blunt trauma with stable vital signs. Our study had several limitations one limitation of this study was that we did not use CT scan as a means for definitive exclusion of internal bleeding (6). Also, we did not consider laboratory findings such as hemoglobin level and Base excess (BE) for a definition of dehydration.

Conclusion:

The results of our study showed that the serum therapy in the patients with blunt abdominal trauma could improve blood oxygen saturation, decrease systolic blood pressure, increase diastolic blood pressure, increase the level of consciousness, and decrease tachypnea and pulse rate after four hours of patient administration in the emergency department. Our most important finding was that the serum therapy reduced the number of suspected cases in the FAST examination and may be increased the diagnostic accuracy of this imaging technique alone. However, CT scans need to be used to determine precise accuracy.

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