

A Study of the Efficacy of Ultrasonography for Diagnosis after Blunt Abdominal Trauma

Dr. Kunkunuru Sudheer*

Assistant Professor, Department of Radiology, Prathima Institute of Medical Sciences, Nagunoor, Karimnagar, Telangana, India

***Corresponding author**

Dr. Kunkunuru Sudheer

Article History

Received: 08.06.2018

Accepted: 23.06.2018

Published: 30.06.2018

DOI:

10.21276/sjm.2018.3.6.10



Abstract: Blunt abdominal trauma presents a challenge for diagnosis because it may be associated with multiple organ injuries thus physical examination alone may result in an improper diagnosis. Ultrasonography is one of the important tools in the examination of such patients. The aim of the present study was to determine the accuracy of Focused Assessment Sonography for Trauma [FAST technique] in blunt abdominal trauma patients. Methods: The study involved 120 Abdominal trauma patients admitted to Prathima Institute of Medical Sciences and Hospital. Every patient was examined by abdominal sonography in those patients who required urgent management because of serious injuries were excluded from the study. All the patients based on clinical assessments were suspected of abdominal trauma. The sonographies were done using the FAST technique "Focused Assessment Sonography for Trauma" in which six areas of the abdomen were examined. Results: Out of the 120 patients 94 were diagnosed as positive after abdominal sonography out of which 73 were confirmed as positive by CT, DPL, and explorative laparotomy and remaining 21 were found to be negative. Similarly out of 24 diagnosed as negative by sonography 2 were found to be positive by CT, DPL, and explorative laparotomy. The mean sensitivity in all patients was found to be 97.33% with 95% Confidence Interval ranging from 90.70% - 99.68%, the specificity was 53.33% 95% CI 37.87% - 68.34%, the positive predictive value PPV was 77.66% range 71.73% - 82.64% the negative predictive value NPV was 92.31% range 74.85% - 97.98%, the overall accuracy was 80.33% and range was 72.64% - 87.44%. Conclusion: within the limitations of the present study it can be concluded that abdominal ultrasonography with FAST technique is fairly reliable and accurate method of evaluation in blunt abdominal trauma. Abdominal ultrasonography is a valuable tool after clinical examination of the patients with blunt abdominal trauma. It has a relatively high negative predictive value that prevents the patients from undergoing unnecessary tests after blunt abdominal injuries.

Keywords: Efficacy, Ultrasonography, Blunt abdominal trauma.

INTRODUCTION

Trauma has increased tremendously nowadays due to increased urbanization and increase use of transport. It is now becoming one of the important causes of mortality in young and middle-aged individuals [1, 2]. It also causes decreased work productivity and efficiency of the individuals as compared to cardiovascular diseases or cancers [3]. Delay in diagnosis is one of the important factors for increase in trauma caused mortality especially in those cases involving abdominal injuries [3, 4] Accurate assessment of patients with blunt abdominal trauma should include a safe and reliable method of determining the need for operative intervention because of the mortality and morbidity related to these injuries. Peritoneal signs are often hidden and overshadowed by pain from associated injury or masked head trauma and intoxicants, clinical methods of diagnosis are often unreliable. The use of timely use of adequate diagnostic

procedures and interventions directed to immediate life-threatening problems decreases the chances of morbidity and mortality [5]. The method of assessment for abdominal trauma should be through an organized plan of assessment and resuscitation. This evaluation must focus on determine the needs for early surgical therapy in unstable patients and then should be directed to specific treatment for organ injuries in stable patients [5]. There is an increased interest for the use of ultrasonography for evaluating the patients with blunt abdominal trauma [6]. Recent advancements in technology and cost-effectiveness and extensive clinical experience has made ultrasonography as one of an important method of choice for diagnosis of abdominal trauma in most centers [5-7]. Previous studies have shown that it was rare to see false-negative results when using ultrasonography [8, 9]. However some studies have shown that ultrasonography by Focused Assessment Sonography for Trauma may lead to under

diagnosis of retroperitoneal injuries, bowel and mesenteric injuries, visceral organ injury including diaphragmatic ruptures [10, 11]. Although chances of hollow visceral organ injuries is lesser in blunt abdominal trauma such injuries requires immediate operative intervention [12]. According to previous reports the morbidity of GI injury is mostly related to delay in diagnosis [13]. Therefore we in the present study tried to evaluate the patients with blunt abdominal injuries with FAST technique followed by the evaluation by CT, DPL, and explorative laparotomy to evaluate the efficacy of the diagnosis by ultrasonography.

This study was conducted in the Department of Radiology, Prathima Institute of Medical Sciences, Naganoor, Karimnagar from the period March 2016 to April 2017. Institutional Ethical committee permission was obtained for the study. The study involved 120 Abdominal trauma patients admitted to Prathima Hospital. Every patient was examined by abdominal sonography in those patients who required urgent management because of serious injuries were excluded from the study. All the patients based on surgeons and clinical assessments were suspected of abdominal trauma. The sonographies were done using the FAST technique "Focused Assessment Sonography for trauma" in which six areas of the abdomen were examined. These regions included left upper quadrant, Morrison Pouch, right upper quadrant, pelvis, right and left paracolic gutters. The minimum depth of free peritoneal fluid to be considered positive was fixed at 2mm. The patients were examined with full bladders for accurate observation of pelvis. Patients with extreme obesity, those who are not co-operative and with subcutaneous emphysema were excluded from the study. The results of sonography were recorded and the

accuracy was assessed by CT or DPL. The abdominal and pelvic CT scan was achieved with 10mm slice thickness oral and IV contrast 300mg/ml. The results were compared with the sonography. If the DPL showed the presence of more than 100,000 erythrocytes/mm³ or presence of amylase or foodstuff in the peritoneal lavage then it was considered positive. Those whose sonography examination revealed free peritoneal fluid and the CT and DPL were positive were considered as true positive. A negative ultrasonography with CT or DPL positive was considered as false negative and those patients whose sonography together with CT and DPL were negative were considered as true negative. Finally, the sensitivity, specificity, accuracy, positive predictive value, and negative predictive values were determined

RESULTS

In the present study 120 patients were included that included male (n=83) 69.17% and female (n=37) 30.83%. The mean age was 32.6 yrs and the majority of the patients belonged to the age group 28-35 years. These patients had no surgical problems and were in good general condition. Complimentary tests were undertaken for the patients when sonography results were doubtful that included CT of DPL. Among these 32 patients underwent surgical operations immediately. Among 120 patients sonography was positive in 94 patients and negative in 26 patients. Of the 94 positive cases, 73 (77.66%) were found to be true positive and 21 (22.34%) were found to be false positive cases. Sonography was negative in 26 cases of which 24 (92.30%) were found to be true negative and 2 (7.69%) were found to be the false negative. The results of FAST sonography were then compared with pelvic CT, DPL and explorative laparotomy showed in table-1.

Table-1: Results obtained by Focused Assessment sonography for trauma

		Positive	Negative	Total
FAST	Positive	73	21	94
	Negative	2	22	26
	Total	75	43	120

Table-1 shows the results obtained in the patients using the FAST technique. Out of the 120 patients 94 were diagnosed as positive after abdominal sonography out of which 73 were confirmed as positive

by CT, DPL and explorative laparotomy and remaining 21 were found to be negative. Similarly out of 24 diagnosed as negative by sonography 2 were found to be positive by CT, DPL, and explorative laparotomy.

Table-2: showing the sensitivity, specificity, PPV, NPV, and Accuracy of FAST

	Sensitivity	Specificity	PPV	NPV	Accuracy
Focused	CI 95%	CI 95%	CI 95%	CI 95%	CI 95%
assessment	97.33%	53.33 %	77.66%	92.31 %	80.83%
Sonography	90.70% - 99.68%	37.87% - 68.34%	71.73% - 82.64%	74.85% - 97.98%	72.64% - 87.44%
for trauma					

The mean sensitivity in all patients was found to be 97.33% with 95% Confidence Interval ranging from 90.70% - 99.68%, the specificity was 53.33% 95%

CI 37.87% - 68.34%, the positive predictive value PPV was 77.66% range 71.73% - 82.64% the negative predictive value was 92.31% range 74.85% - 97.98%,

the overall accuracy was 80.33% and range was 72.64% - 87.44% shown in table-2.

DISCUSSION

There is a lot of debate with regard to the use of US as a screening tool in blunt abdominal trauma patients to detect intra-abdominal fluid and organ injuries [5, 6, 14]. Ultrasound operator's skill and technique are important factors that affect the results. The accuracy of clinical diagnosis of blunt abdominal trauma has been reported from 37% to 87% in different studies [15-17]. In the present study we found the overall accuracy of 80.33% it agrees with most of the results of other studies. A review of the literature reveals that the sensitivity of US in identifying intra-abdominal injuries in blunt abdominal trauma ranges from 63% to 98% [18-20]. In this study we found the mean sensitivity in all patients was found to be 97.33% ranging from 90.70% - 99.68%. Richards et al in a prospective study in 3264 patients found sensitivity, specificity, and the positive and negative predictive values of the intra-abdominal fluid identified by US in revealing intra-abdominal injuries as 60%, 98%, 82% and 95%, respectively [18]. In the present study we found sensitivity 97.33%, specificity was 53.33%, positive predictive value PPV was 77.66% the negative predictive value was 92.31%. Katz et al; sensitivity, specificity, positive and negative predictive values for US in identifying intra-abdominal injuries were 90.9%, 83.6%, 55.5% and 98.9%, respectively [21] in our study we found 2 (7.69%) were found to be false negative in these cases there was only minimal free fluid found by the US. The present study also showed 94 positive cases 73 (77.66%) were found to be true positive and 21 (22.34%) were found to be false positive cases. Of the 21 false positive cases, 18 cases were of female patients and 3 cases were male. It is believed that the most common cause of false positive cases in the female is related to the presence of physiological fluid observed in females. Although based on numbers alone in the present study the false positive rate was somewhat higher compared to other studies, however, the most important problem is false negative results, not the false positive ones. Richards *et al.*, [18] 3,264 patients, 132 false negative and 57 false positive results were reported. In most of the false positive results, minimal free fluid was reported in the US, yet this was not confirmed by other diagnostic tests [18]. Computed tomography (CT) is the gold standard after blunt abdominal injury however it takes a long time and requires shifting of the patient and exposure to radiations. The US, therefore, are being used increasingly in emergency departments and in trauma referral centers due to the overload of work in both emergency and radiology departments it has the advantage of being done at the bedside. Therefore overall US can play a good role in the triage of patients who need more imaging assessment or surgical interventions for hemodynamic stabilization [22]. Emergency physicians having good US skills can be of

great help in decision making with a high degree of accuracy. The ultimate aim of evaluation in a blunt abdominal trauma patient is the immediate diagnosis of emergency laparotomy in critical cases such as screening test for abdominal injury should have high sensitivity and NPV and this study has convincingly shown that the US has got high sensitivity and NPV.

CONCLUSION

Within the limitations of the present study, it can be concluded that abdominal ultrasonography with FAST technique is fairly reliable and accurate method of evaluation in blunt abdominal trauma. Abdominal ultrasonography is a valuable tool after clinical examination of the patients with blunt abdominal trauma. It has relatively high sensitivity and negative predictive value that prevents the patients from undergoing unnecessary laparotomy after blunt abdominal injuries.

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