ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

DEPARTMENT OF EMERGENCY MEDICINE

UTILIZATION OF DIAGNOSTIC FAST ULTRASOUND IN DETECTING INTRA-PERITONEAL FREE FLUID COLLECTION DONE IN TASH ED FOR ABDOMINAL TRAUMA PATIENTS

BY Dr. TINBIT YEHUALAESHET

EMERGENCY MEDICINE AND CRITICAL CARE RESIDENT

ADVISORS

- **PROFESSOR AKLILU AZAZH**
- **DR BIRUK GIRMA**

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RESEARCH THESIS ON

THE UTILIZATION OF AND DIAGNOSTIC ACCURACY OF FAST US IN DETECTING INTRAPERITONEAL FREE FLUID COLLECTION FOR ABDOMINAL TRAUMA PATIENTS DONE IN TASH ED, ADDIS ABABA, ETHIOPIA, 2017

Name of investigators	TinbitYehualaeshet ,MD, Aklilu Azazh, professor, BirukGirma,MD
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Address of the investigators	Cell phone: +251913624179,
	Email: doyyoye@gmail.com

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ACRONYMS AND ABREVIATIONS

1. **CT**- Computed tomography
2. DPL- Diagnostic peritoneal lavage
3. **FAST**- Focused assessment with sonography for trauma
4. **ROC curve**- Receiver operator characteristics curve
5. **RTA**- Road traffic accident
6. TASH- Tikur anbessa specialized hospital

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ABSTRACT

INTRODUCTION- Ultrasound has emerged as an alternative means of evaluating patients who sustained blunt abdominal injury. As a screening tool for evaluating the presence of intra peritoneal fluid because it is quick, non-invasive, repeatable, and inexpensive and entails no radiation. Ultrasound machines are also portable so that it could be taken to the unstable patient's bedside for continuous monitoring 0. It also shows the amount and extent of intraperitoneal hemorrhage.

OBJECTIVE- This study will generally asses the utilization of FAST in abdominal trauma patients and the diagnostic accuracy in intra-op findings and to validate the use of FAST US in all abdominal trauma patients.

METHODS AND MATERIALS- This is a prospective cross sectional study to assess the utilization of bedside FAST US and the diagnostic accuracy of bedside FAST US in detecting intraperitoneal collection for patients presenting to the TASH ED with abdominal trauma and who are hemodynamically stable or unstable. FAST performed by emergency medicine senior (R3) residents or attending emergency physicians in the ED will be taken and compared with the results of formal ultrasound, CT scan or intra-op findings.

RESULTS- 40 patients were included in this study and 75% of them were from the working class and 7.5% of them were students accounting for more than a third of all patients. Most of this patients came from Oromiya region (57.5%) and Addis Ababa(20%). 70% of the patients had normal blood pressure measurement, where as 55% of them were Tachycardic and 27.5% were Tachypneic. Only 2(5%) of patients presented with GCS of <8. Majority of the patients 39(97.5%) had blunt abdominal trauma and only one patient presented with penetrating abdominal trauma and was taken to the OR immediately. Polytrauma was the most encountered associated injury accounting for 14(35%) of patients. The sensitivity and specificity of the FAST scan were 100% and 86%, respectively. The negative predictive value was 1, while the positive predictive value was 0.73.

CONCLUSION- This study shows that FAST scanning for abdominal trauma patients is a good screening method for intraperitoneal fluid collection, hence valuable to rule out abdominal solid organ injury and bleeding. Therefore we recommend the use of FAST ultrasound in all abdominal injury patients.

INTRODUCTION

Background of the problem

Trauma is defined as

Threat to life or limb; severe physical harm or injury, including sexual assault; Receipt of intentional injury or harm; exposure to the grotesque; violent, sudden loss of a loved one; witnessing or learning of violence to a loved one; learning of exposure to a noxious agent; and causing death or severe harm to another (21).

Globally, trauma is one of the most life threatening public health problems and the third most important cause of death. According to WHO, an estimated 5.06 million people die each year as a result of some form of trauma, comprising almost 9% of all deaths. Trauma deaths on average cost, 40yrs of life and 18yrs of reproductive life.30, 31

In 2010 there were 5.1 million deaths from injuries comprising almost one out of every 10 deaths in the world. The total number of deaths from injuries was greater than the number of deaths from infection with HIV, tuberculosis and malaria combined (3.8 million). 19

Approximately 1.24 million of these deaths stem from road traffic injuries with 92% of deaths occurring in low- and middle-income countries. 19

Ethiopia has one of the highest mortality rates in Africa secondary to road traffic accidents. It is estimated 180 deaths per 10,000 cars in a year. Other mechanisms of injury are not studied well and their effect is not measured in terms of mortality and morbidity. Here, in Addis Ababa around 28% of emergency room visits are related to trauma. 60% of the deaths are among people in the age range of 15-44 which causes heavy economic consequences. 30,19

The exact prevalence of blunt abdominal injury among trauma admissions is not known but it ranks third as a cause of traumatic deaths after head and chest injuries. The prevalence reported in the international literature ranges from 6-65% .33

Evaluation of patients who sustained blunt abdominal trauma remains the most resource intensive aspect of managing acute trauma. It causes a wide spectrum of injury which could be simple and single system or devastating and multi system trauma. Physical examination is unreliable in patients with multi system injuries, intoxication, change in mentation, distracting injuries etc. [9,11,13,14]

Due to the inadequacy of the physical examination findings, for the unstable or marginally stable patient, diagnostic peritoneal lavage was the modality of choice for assessment of intra-abdominal hemorrhage. But DPL is invasive and has a significant false positive rate. It could also delay laparotomy by waiting for laboratory determination of red blood cell counts.[18,19, 34]

CT scan of the abdomen is widely considered as the gold standard diagnostic imaging in trauma. But it is expensive and time consuming.[33]

CT is not an option for patients who are clinically unstable to be transferred to the CT unit, pregnant females, patients with large body habitus and there isuse of iodinated contrast agents with the associated risk of contrast reaction or nephrotoxicity.[33]

More recently ultrasound has emerged as an alternative means of evaluating patients who sustained blunt abdominal injury. As a screening tool for evaluating the presence of intra peritoneal fluid because it is quick, non-invasive, repeatable, and inexpensive and entails no radiation. Ultrasound machines are also portable so that it could be taken to the unstable patient's bedside for continuous monitoring. It also shows the amount and extent of intraperitoneal hemorrhage.[8,9,11,12,13,33,34,35]

FAST done by emergency physicians is focused and of a limited technique only detect intra peritoneal fluid collection which is taken as blood in the context of trauma.[9]FAST is used to detect fluid in the perihepatic, perisplenic, pelvis and pericardium. It has been shown to be both sensitive and specific for intra peritoneal fluid collection.

In a hemodynamically unstable patient a positive FAST means a hemoperitoneum and that laparotomy should be done. In patients who are hemodynamically stable but have a positive FAST, it's followed by CT scan.[9,12,33,34]

Even though the purpose in the initial assessment of abdominal trauma is only to assess the presence of free intra-peritoneal fluid which in the context of trauma is assumed to be blood, the absence of free fluid does not exclude serious intra-abdominal injury. It also shows the amount and extent of intraperitoneal hemorrhage. 1, 9 11, 13, 14,

Kristensen described the use of ultrasound scanning for the diagnosis of abdominal injury in 1971. 8

US was first utilized for the examination of trauma patients in the 1970s in
Europe. It was not widely adopted in North America until the 1990s. 10

The acronym FAST appeared in 1996 to refer to focused abdominal assessment for trauma but subsequently it was changed to focused assessment for the sonographic examination of trauma patients (4)

STATEMENT OF THE PROBLEM

The role of focused assessment with sonography for trauma (FAST) is well described in the literature in high-resource emergency care setups. FAST US is currently being a crucial part of emergency center practice. It is also growing to be part of critical care practice. It serves to rule in or out life threatening conditions and change the course of resuscitation and subsequent management. 1,2,

FAST US is a highly relevant tool for low resource settings like TASH ED since it requires less financial and human resources compared to other diagnostic imaging tests like CT scan and can be provided free of charge to patients.1

There is however a very limited data on the utilization of FAST in TASH emergency department.

Focused assessment with sonography for trauma (FAST) is used in the emergency department of TASH and most physicians are familiar with it.

Over the last decade the utilization of FAST in TASH ED has become routine for all trauma patients. It has helped for the improvement of patient care, diagnosis and timely management.[1]

This paper will provide an overview of the utilization of bedside ultrasound for trauma and the diagnostic accuracy of FAST U/S by which the emergency physician is able to pick intraperitoneal collection in the blunt abdominal trauma patient.

LITRATURE REVIEW

Globally, trauma is one of the most life threatening public health problems and the third most important cause of death. According to WHO, an estimated 5.06 million people die each year as a result of some form of trauma, comprising almost 9% of all deaths. Trauma deaths on average cost, 40yrs of life and 18yrs of reproductive life. 30,19

Ethiopia has one of the highest mortality rates in Africa secondary to road traffic accidents. It is estimated 180 deaths per 10,000 cars in a year. Other mechanisms of injury are not studied well and their effect is not measured in terms of mortality and morbidity. Here, in Addis Ababa around 28% of emergency room visits are related to trauma. 60% of the deaths are among people in the age range of 15-44 which causes heavy economic consequences.30, 19

Evaluating patients who sustained blunt abdominal trauma is still one of the most resource intensive aspects of acute trauma management.3,5,10Physical examination is mostly unreliable because majority of patients have multisystem injuries and associated intoxication, concomitant head injuries, and other distracting injuries.3,5,9

Historically, diagnostic peritoneal lavage (DPL) was done and patients were hospitalized. DPL is an invasive procedure and it could be overly sensitive causing unnecessary laparotomies and has poor specificity for severity of organ injury.3, 27

Diagnostic Peritoneal Lavage (DPL) involves instillation of sterile normal saline in the peritoneal cavity and assessing the nature of effluent fluid to determine the probability of intra-abdominal visceral injury. 11

After patients arrival to ED only physical examination and DPL resulted in a non-therapeutic operation in as many as 19% to 39% of patients. In the patient with multiple injuries, if the major source of hemorrhage is from orthopedic or retroperitoneal trauma, unnecessary laparatomy wastes time and delays control of serious injury.27

In the past few decades, computed tomography was being used because it is a sensitive means of detecting intraperitoneal injury, but it is expensive and requires longer time to prepare and execute.1,3,10

More recently, ultrasound has emerged as an alternative means of evaluating patients who have sustained blunt abdominal trauma. Ultrasound can be performed rapidly, is readily repeatable, is a sensitive means of detecting abdominal injury, has no radiation, inexpensive, can be done at the patients bed side and it does not interrupt resuscitation efforts..1,3,4,7, 14, 8, 9

Reductions in costs for CT scans and reduced charges for 24-hour admissions by using FAST scan suggests a potential financial benefit in evaluating blunt abdominal trauma.Ultrasound represents a less costly technology than CT scanning both in terms of the initial capital outlay and the cost per subsequent study.3

The focused assessment with sonography for trauma (FAST) examination is increasingly being used as a crucial part of the initial emergency department (ED) evaluation of trauma patients and the rapid triaging of hemodynamically unstable patients for definitive surgical intervention.1,4,9

FAST for trauma was associated with decreased diagnostic test use, hospital length of stay, composite complications rate, and total charges. The benefits of FAST are multidimensional and include better ED and hospital resource utilization, decreased morbidity and cost-effectiveness. 1, 5,

Serial FAST examinations decreased the false-negative rate by 50% and increased sensitivity for free fluid detection from 69% to 85%. 7
Time allows for an increase in shed intraperitoneal blood after blunt trauma and t a secondary ultrasound of the abdomen increases the sensitivity of diagnosing hemoperitoneum in blunt trauma patients.21

In a study done in TASH ED, FAST US was found to provide clinically useful information in 95% of patients (95% CI: 90–98). In 45% of patients (95% CI: 36–54), it changed the working

diagnosis therefore changing the pre-US management. It also significantly changed a procedure/surgical intervention, consultation with a specialist and disposition decision.1

An ED FAST examination demonstrating free intraperitoneal fluid is strongly associated with therapeutic laparatomy among normotensive blunt trauma patients..6

Its use as a screening tool to detect intraperitoneal fluid stems from the fact that most clinically significant organ injuries will be associated with the presence of free fluid in dependent intraperitoneal areas.6

Sonography also permits the demonstration of the amount and extent of intraperitoneal hemorrhage.6 When FAST was positive, the quantity of free blood found at laparotomy ranged from 150 to 1,500 mL, with a mean of 542 +/- 184 mL.22

However, the prevalence of organ injury without accompanying free fluid ranges from 5% to 37% (Yoshii 1998).Contrast-enhanced sonography may be useful in a trauma setting to examine patients with clinical suspicion of parenchyma lesions with sensitivity of 57.1% for liver, 47.1% for spleen and 40% for spleen. 7

Currently, FAST is defined as real-time sonographic scanning in four distinct regions of the torso, identified as the four Ps: (1) pericardial; (2) perihepatic; (3) perisplenic; and (4) pelvic. 29

The standard windows of the FAST exam are the right upper quadrant (RUQ), left upper quadrant (LUQ), sub-xiphoid (or subcostal), and suprapubic. The quadrants are examined for fluid in the gutters or space between the organs in each window. In the RUQ (also called Morrison’s Pouch), evidence of fluid may be found between the liver and the kidney. Fluid may also be found between the kidney and spleen in the LUQ view or in the pelvis in the suprapubic view . 15

When US is performed for free fluid, the detection of free fluid is taken as a positive result. The absence of free fluid yields a negative result. US views that are not clearly positive or negative are declared indeterminate. 29,30

The high specificity (99%), positive predictive value (0.98), and likelihood ratio for positive tests (LR+86) and sensitivity of 78% makes FAST a good 'rule in' tool for patients with blunt abdominal trauma. The high negative predictive value also causes FAST scan to be a useful screening tool. Patients with spleen, liver, or abdominal vascular injuries are less likely to have false-negative FAST examination results. 8,18

A negative FAST scan was an excellent predictor of the absence of significant intra-abdominal injury. 13

Emergency physicians, after a short training program, can use FAST in the early assessment of trauma patients with sufficient specificity.9They should have formalized and accredited training in order to undertake this technique.

The introduction of FAST training and requisite equipment in resource stressed healthcare settings is desirable and also found feasible.2

Between 35 and 70 FAST examinations were necessary to gain proficiency with interpreting the FAST examination. Well-performed and confidently interpreted FAST examinations hold promise to decrease the utilization of more expensive CT scanning.17

The first FAST consensus conference in 1999 specifies at least 200 supervised examinations must be performed to be considered experienced. 4, 10

SIGNIFICANCE OF THE STUDY

Doing FAST ultrasound for trauma patients in the ED is a routine procedure in TASH ED. It's one of the most common uses of ultrasound in the emergency department.

This research project tries to see the utilization of FAST in TASH ED and its sensitivity, specificity, positive predictive value and negative predictive value in finding intra-peritoneal

collection for blunt abdominal trauma patients. This study decreases the unnecessary cost and the time taken to diagnosis and intervention by avoiding time taking procedures like formal ultrasound and abdominal CT scan. It also decreases the complications which arise by transporting patients out of the ED for diagnostic procedures. Finally it's used to guide further management of the patient depending on the FAST result

OBJECTIVES OF THE STUDY

GENERAL OBJECTIVES

This study generally assessed the utilization of FAST in abdominal trauma patients and the diagnostic use in those with intraperitoneal collection as compared with formal US, CT scan and intra-op finding.

SPECIFIC OBJECTIVES

- To assess the utilization of FAST for all trauma patients
- To assess the sensitivity, specificity, positive predictive value and negative predictive value of bedside FAST US in detecting intraperitoneal collection done by emergency physicians
- To validate the use of FAST US use in all abdominal trauma patients.

PATIENTS AND METHODS

MATERIALS AND METHODS

This is a prospective study to assess the utilization of bedside FAST US and the diagnostic accuracy of bedside FAST US in detecting intraperitoneal collection for patients presenting to the TASH ED with abdominal trauma and who are hemodynamically stable or unstable.

FAST performed by emergency medicine and critical care third year residents or attending emergency physicians in the ED was taken and compared with the results of formal ultrasound, CT scan or intra-op findings.

Patients were examined in a supine position with a two dimensional gray scale bedside ultrasound. The Morrison's pouch, spleeno-renal recess and sub-diaphragmatic space bilaterally was seen for any fluid collection.

STUDY AREA

This study is conducted in TASH emergency department. It is the largest referral hospital in Ethiopia, Addis Ababa and sees around 350,000-400,000 patients per year and the emergency department sees around 20,000 patients per year. It has organized emergency department and provides emergency service in a 24 – hour basis.

It's the largest teaching hospital under Addis Ababa University, school of medicine and health sciences.

STUDY DESIGN AND PERIOD

This was a prospective cross-sectional study conducted at Emergency Room of the TASH. Approval was obtained from the Ethical and Research Committee of TASH. The study was done from November 2017 to June 2018.

SOURCE POPULATION

All blunt and penetrating abdominal trauma patients presenting to the TASH ED from November 2017 to June 2018 were included in this study.

STUDY POPULATION

Patients were eligible for analysis if they were identified as trauma activation patients by standard regional trauma criteria, were 12 years or older, with blunt or penetrating abdominal injury and had an ED FAST examination recorded and confirmed during the initial ED evaluation.

All ED FAST results were denoted as either positive or negative at the time of the examination and all FAST examinations represented the initial sonographic assessment of the patient after arrival to the ED.

As part of ED ultrasound quality assurance programs, FAST results will be confirmed by comparing results with formal US by a senior radiology resident or radiologist, dictated CT scan interpretations or operative findings.

INCLUSION CRITERIA

All blunt or penetrating abdominal trauma patients presenting to the TASH ED for whom bedside FAST scanning was done.

EXCLUSION CRITERIA

- Patients were excluded if they were directly admitted to the hospital or operating room without an ED encounter,
- Had operative intervention performed at an outside facility before being transferred to TASH ED, or

- Had pathologic free fluid identified greater than 24 hours after the ED encounter (suggesting that free fluid in these patients may not have been present during the initial assessment).
- Trauma patients with no FAST examination

SAMPLE SIZE AND SAMPLING TECHNIQUE

Sample size is not determined because all abdominal trauma patients are included in the study.

ETHICAL CONSIDERATION

Ethical clearance was secured from Research Ethics Committee (REC) of the Emergency Medicine Department as mandated by Addis Ababa University. Letter of permission was obtained from TASH.

Informed consent was obtained from all conscious victims prior to data collection after FAST scanning was done. In case of unconscious trauma patients consent was taken from their attendants. This was done after clear description of the objectives of the study and of its procedures. Then, each respondent was asked to check whether information provided on the purpose of the study has been adequately understood. Confidentiality of the information obtained from each participant was maintained.

DATA COLLECTION

Data was collected using structured questionnaire which included the card number, the date and time when the patient get registered to TASH, age, sex, the type of trauma sustained, mechanism of injury, vital signs at admission, triage color, ultra-sonographic findings, finally the confirmed diagnosis with formal abdominal ultrasound, abdominal CT scan or intra-op finding of free fluid.

The bedside FAST scan result was documented on the patients chart by third year emergency medicine and critical care residents or consultant emergency physicians from which I transcribed into a structured questionnaire.

DATA QUALITY CONTROL

The data quality control measures include: proper training of data collectors on how to fill the questionnaires from the Principal Investigator, through careful design, pre-testing of the questionnaire, close supervision of the data collecting procedures, proper categorization and coding of the data. The Principal Investigator had an ongoing supervision each day during the data collection period to ensure the quality of data by checking filled formats for their completeness and consistency and gave clarifications when ambiguity occurred during data collection. Discussions were held among the principal investigator and data collectors, as necessary. Based on the feedback from the supervisors and data collectors, immediate corrective measures were taken.

DATA ANALYSIS AND INTERPRETATION

The collected data was cleaned, compiled, edited and entered into SPSS for Windows version 23 and the results are presented below using tables, charts and different figures.

DATA ANALYSIS

The research was analyzed by using SPSS 23 software. The general utilization of FAST ultrasound and diagnostic accuracy was seen. Furthermore, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of FAST protocol in diagnosis of intraperitoneal collection will be calculated. A 0.95 confidence interval will be considered as the level of significance in this analysis.

Descriptive statistics were used to summarize the data. Bivariate logistic regression was used to explore the association of each independent variable with the dependent variable. Variable with P-value of < 0.5 were considered for multivariate logistic regression to control the effect of the confounders. Then, the significance level was set at $P<0.05$

DISSEMINATION OF RESULTS

At the end, the result of the study will be disseminated to the governmental and non-governmental organizations to provide information about the use of FAST scanning as a

screening tool for abdominal trauma patients and its sensitivity and specificity to detect intra peritoneal fluid collection. In addition, it will be submitted to Addis Ababa University health science library. Further efforts will be made to publish the findings on national or international journal.

OPERATIONAL DEFINITIONS

FAST- Focused abdominal sonography for trauma

PPV- Positive predictive value

NPV- Negative predictive value

RESULTS

There were a total of 40 patients who fulfilled the inclusion criteria with no missing data and for whom FAST scanning was done and documented. Of this 29 (72.5%) were male and 11 (27.5%) were female with a mean age of 30.5yrs. the male to female ratio inthis study was 2.6 to 1.

SOCIO-DEMOGRAPHICS

Of the forty patients, 75% were from the working class followed by students accounting for 7.5% added to give more than a third of all patients. Most of this patients came from Oromiya region(57.5%) and AddisAbaba (20%) accounting for the fact that TASH is found in Addis Ababa.

Below is a table depicting the socio demographic characteristics of patients (see table 1).

Table 1. Socio-demographic data of patients

		MALE	FEMALE	TOTAL(n-40)	PERCENTAGE
Occupation	Working	23	7	30	75%
	Student	2	1	3	7.5%
	Retired	1	1	2	5%
	Non-working	1	1	2	5%
	House wife	0	1	1	2.5%
	Unknown	2	0	2	5%
	Percentage (%)	72.5%	27.5%		
Address	Oromiya	16	7	23	57.5%
	Amhara	4	1	5	12.5%
	SNNPR	2	0	2	5%
	Addis Ababa	6	2	8	20%
	Unknown	1	1	2	5%
	Percentage (%)	72.5%	27.5%		

CLINICAL PARAMETERS

70% of the patients had normal blood pressure measurement, where as 55% of them were Tachycardic and27.5% were Tachypneic. Only 2(5%) of patients presented with GCSof <8. Majority of the patients 39(97.5%) had blunt abdominal trauma and only one patient presented with penetrating abdominal trauma and was taken to the OR immediately. Polytrauma was the most encountered associated injury accounting for 14(35%) of patients.Most of the patients 14(35%) presented within 6hrs of sustaining trauma and 12(30%) of the patients presented after 24hrs.

The clinical findings of the patients are summarized in the table below.

Table 2. Clinical findings of patients

PE		MALE	FEMALE	TOTAL	PERCENTAGE
BP	Hypotensive	9	1	10	25%
	Normal	19	9	28	70%
	Hypertensive	1	1	2	5%
Pulse rate	Tachycardic	16	6	22	55%
	Normal	12	4	16	40%
	Bradycardic	1	1	2	5%
Respiratory rate	Tachypneic	9	2	11	27.5%
	Normal	20	9	29	72.5%
GCS	15	19	6	25	62.5%
	13-14	5	0	5	12.5%
	8-13	4	4	8	20%
	<8	1	1	2	5%
Abdominal trauma	Blunt	29	10	39	97.5%
	Penetrating	0	1	1	2.5%
Associated injury	TBI	2	2	4	10%
	SCI	2	2	4	10%
	Cardio-thoracic	6	0	6	15%
	Pelvic	1	1	2	5%
	Extremity	1	0	1	2.5%
	Poly trauma	9	5	14	35%
	None	7	1	8	20%
Duration of presentation	0-6hrs	11	3	14	35%
	7-12hrs	7	3	10	25%
	13-24hrs	2	1	3	7.5%

	>24hrs	8	4	12	30%	
	Unknown	1	0	1	2.5%	

Circumstances of the trauma

24(60%) of patients sustained road traffic accident whereas 10(25%) had fall down injury and 3(7.5%) were assaulted and in 3(7.5%) the mechanism of injury was unknown.

Table 3. Circumstance of the trauma

		MALE	FEMALE	TOTAL	PERCENTAGE(%)
MECHANISM OF INJURY	Fall down injury	8	2	10	25
	Assault	3	0	3	7.5
	RTA	15	9	24	60
	Unknown	3	0	3	7.5

VALIDITY OF FAST

From the 40 patients, 15(37.5%) patients had a positive FAST and 25(62.5%) had a negative FAST result.

In this study, the sensitivity and specificity of the FAST scan were 100% and 86%, respectively. The negative predictive value was 100%, while the positive predictive value was 73.3%.

Below is a table summarizing the number of patients with FAST and formal ultrasound results.

Table 4. FAST ultrasound versus formal ultrasound.

		Formal ultrasound		Total
FAST ultrasound		Positive	Negative	
	Positive	11	4	15
	Negative	0	25	25
Total		11	29	40

Below is a ROC curve showing the sensitivity and 1-specificity values. The area under the curve is wide showing the high sensitivity of FAST ultrasound. Because the sensitivity in this study is 100%, the curve becomes perfectly horizontal on the x axis.

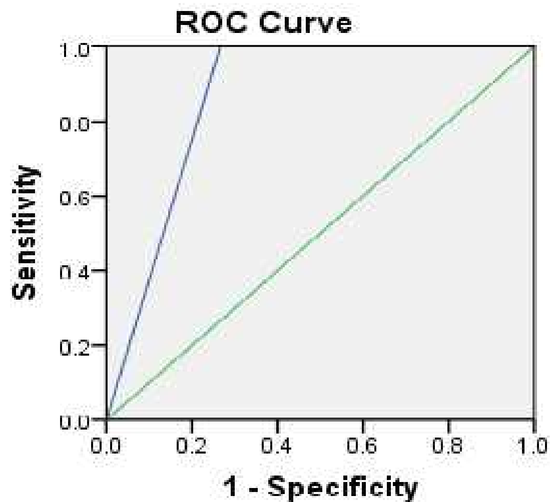

Fig. 2 A ROC curve showing sensitivity and specificity of FAST ultrasound

Only two patients had CT scanning done and both showed intra-peritoneal free fluid collection corresponding to the FAST scan and formal ultrasound results.

DISCUSSION

Ultrasound was first used for the examination of trauma patients in the 1970s in Europe. (Main) Since then, FAST has evolved to become the initial screening tool in the majority of trauma centers worldwide, and it has been included in the Advanced Trauma Life Support program for the evaluation of the hypotensive trauma patient. 11 , 31

FAST scanning for trauma patients in TASH ED, Addis Ababa Ethiopia is a recent phenomenon which started around a decade ago. Studies done since thensupport the performance of POCUS (point of care ultrasound)by emergency physicians or residents as a valuable diagnostic and therapeutic approach for resource-limited settings. 1

The majority of the patients 39(97.5%) presented with blunt abdominal trauma and only 1(2.5%) had penetrating trauma therefore necessitating another study for the patients with penetrating abdominal trauma and the role of FAST as a screening tool not only for intra peritoneal fluid collection but also for detection of solid organ injuries.In penetrating trauma, the emphasis on improvement is in cost-effective evaluation with a reduction in the rate of unnecessary laparotomy.

It was reported that non-therapeutic laparotomy rates for gunshot and stabinjuries were 23.4%, and 41.9% respectively, in a study of 274 patients.(37)Over the last few decades, the use of selective operation after penetrating trauma has decreased the incidence of negative laparotomy and the associated morbidity.22

In previous literatures, the value of sonography in revealing an organ injury varies greatly with the location of the lesion. The detection of spleen injuries has a sensitivity ranging from 27% to 68.6%. Liver because of its larger sizeand easier approach, it has a sensitivity of 51% to 87.5% in different studies. For kidney or adrenal injuries, however, sonography has a low sensitivity varying from 25–40%.7

This study showed that like previous studies males were more affected by trauma accounting 29(72.9%) of all the study population. Road traffic accident was the major cause of trauma in

24(60%) of the patients and most of them were from the working society 30(75%) depicting the heavy economic consequence of trauma and lost productive years of each individual victim as stated in the WHO and previous studies done in our country.Trauma deaths on average cost, 40yrs of life and 18yrs of reproductive life.

In 2010 according to WHO, there were 5.1 million deaths from trauma comprising one out of 10 deaths in the world.Around 1.24 million of these deaths were secondary to road traffic injuries. Of these, 92% of deaths occur in low- and middle-income countries. 60%of these deaths are among young adults (age, 15–44 years) and 75% of those who die are men. 19

In this study, a specificity of 86% and positive predictive value of 0.73 made FAST scan a good 'rule in' tool for abdominal trauma patients. The sensitivity which was 100% and negative predictive value of 1 makes the FAST scanning a valuable screening tool for all trauma patients. Similar results were found in previous international studies showing a sensitivity of 63-99% and a specificity of 83-100%. 9, 11,12,13,14 The lower sensitivity of FAST in this study may be attributed to the fact that it was compared with formal ultrasound results which is operator dependent. We recommend the use of CT scan or laparatomy results as a gold standard for upcoming studies.

In practice FAST can be readily repeated and if there is suspicion of intra-abdominal injury serial scanning is advised.14Clinical judgment must be exercised when there is a negative FAST result. Further imaging should be considered because it is known that ultrasonography is not reliable to detect solid organ or bony pelvic injuries.34Because time allows for an increase in shed intraperitoneal blood after blunt abdominal trauma, a secondary ultrasound study of the abdomen increases the sensitivity of ultrasound to diagnose hemoperitoneum in blunt abdominal trauma patients.21

LIMITATIONS

The study has several limitations that limit the generalizability of the findings

1. It was done in a single center
2. Small sample size
3. Patients were not followed after FAST scanning and one of the gold standard investigations were done. Therefore it's difficult to know the outcome of the patients and if the FAST scanning has led to the change in management of patients.
4. Serial FAST scanning was not done for patients who were FAST negative on the first scan.

CONCLUSION

This study shows that FAST scanning for abdominal trauma patients is a good screening method for intraperitoneal fluid collection, hence valuable to rule out abdominal solid organ injury and bleeding. Therefore we recommend the use of FAST ultrasound in all abdominal injury patients.

CONFLICT OF INTEREST

There was no conflict of interest in doing this research.

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QUESIONNAIRE

1. CARD NUMBER
2. SEX
3. AGE
4. ADDRESS
5. TELEPHONE NUMBER
6. EMPLOYMENT
   - Working
   - Student
   - Retired
   - Non-working
   - House wife
   - Unknown
7. DATE OF ADMISSION
8. TIME OF ADMISSION
9. DATE OF DISCHARGE
10. MECHANISM OF INJURY
    - Fall down accident
    - Assault
    - Road traffic accident
    - Suicide
    - Other
11. Duration of presentation
12. Vital signs at admission

BP - PR- RR- SPO2 –

13. Vital signs at discharge

BP- PR- RR- SPO2-

14. Triage color

Green, Yellow, Orange, Red

15. Previous known illness

16. GCS

17. Abdominal trauma- blunt

- Penetrating

18. Associated injury – state if any

19. Procedure and result

PROCEDURE DONE	**NEGATIVE**	**POSITIVE**				**DONE BY**	
		A	**B**	**C**	**D**	**E**	**F**
FAST US							
ABDOMINAL CT							
FORMAL US							
INTRA-OP FINDINGS							

A- Left sub-diaphragmatic space

B- Right sub-diaphragmatic space

C- Morrison’s pouch

D- Spleeno-renal recess

E- R3 residents

F- Consultant emergency physician