

Research article

Study on value of Extended-Focused Abdominal Scan For Trauma (e-FAST) performed by non-radiologist emergency care doctors in Management of Trauma at Emergency Trauma Centre, Teaching Hospital, Karapitiya, Galle, Sri Lanka

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Abstract

Background

This study was designed to evaluate the accuracy and usefulness of ultrasound in the hands of emergency physicians and medical officers who are non-radiologists in assessing Trauma patients at Emergency Trauma Centre (ETC) at Teaching Hospital, Karapitiya, Galle, Sri Lanka

Methodology

We performed an observational study on Trauma patients admitted to Emergency Department at Teaching Hospital, Karapitiya from 1.12.2014 to 31.12.2014 who fulfilled indications for e-FAST using a specially designed performa. Accuracy of eFAST was tested by comparing the original with subsequent imaging, clinical decision by surgeons, findings at surgery or more than one of the above.

Results

69 patients fulfilled the entry criteria. Nineteen of the scans were performed by consultants while rest was done by senior medical officers. All of them were trained in eFAST. Of the 20 scans which were positive there were four pneumothoraxes and one haemothorax. 15 scans which were positive for intraperitoneal free fluid were later. Out of 49 Patients who had negative scans 47 did not require surgery or any interventions. Other two required laparotomy later. Sensitivity and specificity of eFast was 90.4% and 97.9% respectively. Positive predictive value was 95.0% while Negative predictive value was at 95.9%.

Conclusions

eFAST is a rapid and reliable alternative in detecting free intra-abdominal fluid as well as pneumotorax and haemothorax. It is a safe decision making tool which can be used with confidence and accuracy after brief training and experience by non radiologists which will reduce morbidity and mortality in trauma patients of Sri Lanka.

Key words: E-FAST; Ultrasound performed by non-radiologist doctors; Assessment of blunt trauma to abdomen

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Introduction

Extended-Focused Abdominal Scan For Trauma (eFAST) is a rapidly emerging diagnostic tool in Emergency departments managing trauma throughout the World (1, 2). It is a quick, non-invasive, inexpensive and easily repeatable life saving tool. Non-radiologists, from paramedics to surgeons, can be trained to use it as the technique is problem based rather than organ based requiring much less theoretical knowledge and practical skills from the part of the operator compared to those required for conventional Ultra sound (US) Examination (3). Many inexpensive portable machines have been designed. Prices as well as physical dimensions of the machines are getting smaller by day. Some medical practitioners have dubbed US as “virtual stethoscope” of 21st Century” as it is expected to be used by many specialties for wide range of purposes (4).

Sri Lankan National Health Service has started launching specially designed emergency departments whose main purpose is to care for trauma victims. Currently eFAST by non-radiologists are practiced in few such departments only. Acquisition of US machines and training of non-radiologist with required skills are in the agenda but progress has been slow. Many professionals doubt the value of eFAST in Trauma while those who believe in it doubt the ability of non-radiologists to acquire required skills to perform accurate examinations with resultant impact on patient safety.

Assessing the value of US in the hands of non radiologists is an emerging problem in local as well as global healthcare systems. Critics of the concept are abounded and issues such as importance of operator experience are highly emphasized. This study was designed to evaluate the accuracy and usefulness of ultrasound in the hands of emergency physicians and medical officers who are non-radiologists in assessing Trauma patients

Methods

This study was conducted at Emergency Trauma Centre (ETC) at Teaching Hospital, Karapitiya, Galle, Sri Lanka. ETC in Galle was established in 2007 as a model centre in Emergency Medicine, a donation from Government of the State Victoria, Australia. This is the first purpose designed Emergency Care Unit in Sri Lanka. This Unit receives all Medical and Surgical Emergency patients from the catchment area of Teaching Hospital, Karapitiya. ETC receives an average of 25-30 trauma patients over 24 hours and approximately 3-4 of them fulfill the local indications for an eFAST. The present study was carried out among consecutive trauma patients admitted to Emergency Department at Teaching Hospital, Karapitiya from 01 December 2014 to 31 December 2014 who fulfilled indications for eFAST as listed in the table 1.

Patient selection was based on current indications for eFAST scans as decided by the senior doctor on duty who perform eFAST himself after screening all trauma patients admitted to the unit. We used specially designed

data collection form to collect data more effectively which were analyzed subsequently with a view to decide on sensitivity, specificity and predictive values for eFAST scans done. Australian triage scale was used to triage all admissions. Accuracy was tested by comparing the original with subsequent imaging, clinical decision by surgeons, findings at surgery or more than one of the above.

Table 1 Indications for e FAST

Indications	n	%
Abdominal wall Tenderness	32	46.4
Abdominal wall laceration/abrasion/bruise	30	43.5
Chest wall injury laceration/abrasion/bruise	29	42
Chest wall tenderness	28	40.6
Abdominal pain	22	31.9
Abdominal distension	12	17.4
Multiple injuries	11	15.9
Abnormal respiratory parameters	5	7.3
Hypotension (SBP 100 Hg mm or below)	41	59.4

Results

Of the 69 patients who underwent eFAST examination 49 (71%) were males. Commonest age group was 51-60 years (26.5%) in males followed by 41-50 (22.4%), 31-40 (18.4%), and 21-30 (18.4%). In females 61-70 years age group was preponderant (25.0%). The cause of injury was blunt trauma for 59(85.5), while 10(14.5%) was caused by a penetrating mechanism. Road traffic accidents accounted for 53.6% followed by domestic accidents (17.4%). In 1-4 Australian triage scale with 1 being severely ill, patients who had eFAST were distributed as 3(4.4%), 41(59.4%), 24(34.8%) and 1(1.5%) respectively. Systolic blood pressure 100 Hg mm or under was recorded among 41 (59.6%) patients on arrival suggesting hemodynamic compromise. Of this group 14 (34.1%) became positive for eFAST. Out of 28(40.6%) with Systolic blood pressure more than 100 Hgmm, 6(21.4%) had positive eFAST.

Six (8.7%) patients had one indication for eFAST. 18(26.1%) had two, 25(36.2%) had three while 20(28%) had more than three indications. Of the 20 scans which were positive there were four pneumothoraces and one haemothorax. 15 scans which were positive for intraperitoneal free fluid were later confirmed with investigations, interventions or surgery. One positive abdominal scan done by a consultant had a negative laparotomy showing one false positive in e-FAST. Findings were some bruises in small bowel and small right sided retroperitoneal haematoma.

Out of 49 Patients who had negative scans 47 did not require surgery or any interventions for their torso injuries. Two required laparotomy later (False negatives). Both of them had laceration of small bowel with mild contamination of peritoneal cavity. Sensitivity and

specificity of the e-FAST was 90.5% and 97.9%.

Table 2 **Validity of eFAST**

Test characteristics	n	%
Sensitivity	90.48	69.58 - 98.55
Specificity	97.92	88.89 - 99.65
Positive predictive value	95.00	75.05 - 99.17
Negative predictive value	95.92	85.99-99.38

Discussion

Ultrasound has been used as a diagnostic, therapeutic and screening tool for many decades. Its use in relatively recent specialty of emergency medicine was welcomed by many users which go with fundamental concepts governing emergency care such as point of care testing and self sufficiency. Ultrasound fits well in to higher concept of '24 hour hospital' where patients arriving any time of the day should receive comparable service (5). In this context Ultrasound is becoming a rapid decision making tool (in a way a triage tool) sorting trauma patients between those who need surgical intervention, those requiring further evaluation via investigations such as X-ray or CT and those who need observation and non operative management. Ultrasound is named as an adjunct to Primary survey of advanced trauma life support(ATLS) protocol and therefore used immediately afterwards.

The ultrasound machines used in emergency medicine are usually compact, portable and simple to use. The most widely used protocol termed extended focused abdominal sonography for trauma (eFAST) involves a rapid assessment of abdomen and chest mainly searching for fluid in,hepato-renal Pouch, peri-Splenic area, pelvis, an Indication for Exploratory Laparotomy pericardium, an Indication for pericardiocentesis followed by Thoracotomy and fluid or air in either chest, an Indication for immediate Insertion of a chest drain.

All the doctors performing ultrasound at ETC, Galle have undergone basic theoretical instructions in a one day course and have performed over 30 scans under supervision which is the qualifying value indicated for a non-radiologist by Foo *et al*. Their study showed sensitivity, specificity, positive predicting value and negative predictive value of 86%, 92%, 89% and 90% respectively (6). Studies by Abbasi *et al* (7) and Crouch *et al* (8) point to non radiologists gaining confidence and accuracy following short training periods. More Recent studies indicate a steep learning curve and as few as 10 ultrasound scans can make a physician competent in eFAST examination(5).

In detecting free fluid in peritoneum the most useful single view is that of sub hepatic space but other views add to sensitivity and specificity (5). This is confirmed in our study as of the 15 scans positive for intraperitoneal free fluid operator detected free fluid sub hepatic space in 12 (80%). In a smaller study in 2013 Schleder *et al* showed sensitivity and specificity of 75% and 100% for

free fluid respectively when eFAST was done by non-Radiologists (9). Certain studies have thrown more doubts across the above concept. In 2014, study by Iqbal *et al* provided lower values of 76.92%, 70.83%, 74.07% and 73.9% for sensitivity, specificity, positive predicting value and negative predictor value respectively (10).

FAST has a valuable role in all traumas with haemodynamical compromise than those without (8).Natarajan *et al* claim that haemodynamically stable blunt trauma patients do not benefit significantly from eFAST (11). None of Our 49 eFAST negative patients who had BP above 100 Hgmm required any intervention for haemodynamic compromise favors their view although two required laparotomy for bowel injury and contamination. Positive eFAST percentage for those with features suggestive of haemodynamic compromise and those who did not have such features was 34.1% and 21.42% respectively. We feel this is not significant enough to withhold this simple, rapid and potentially lifesaving investigation from those with indications even though they are haemodynamically normal. eFAST lacks sensitivity and specificity of Direct peritoneal lavage (DPL) and accuracy of CT (7). Missing of two small bowel lacerations would not have happened with DPL and CT would have diagnosed the patient with retroperitoneal haematoma in our study and negative laparotomy could have been avoided.

Pneumothorax is one of the leading causes of preventable trauma deaths. In a study in 2013 involving 153 patients Abbasi *et al* showed eFAST to have sensitivity, specificity, positive predicting value and negative predictor value of 86.4%, 100%, 100% and 95.6% respectively in diagnosing pneumothorax (7). Corresponding values for Chest X ray was lower at 48.6%, 100%, 100% and 85.1%. Our study has identified all four pneumothoraxes presented and has not missed any.

Conclusions

Due to time critical nature of trauma, sum of the Care giver's assessment time and response time must beat time to death from a particular injury/s.eFAST is a rapid and reliable alternative in detecting free intra-abdominal fluid as well as pneumotorax and haemothorax. It is a safe decision making tool which can be used with confidence and accuracy after brief training and experience by non radiologists. The use of eFAST by emergency care doctors should be encourage by organizing short training courses and making machines widely available which will reduce morbidity and mortality in trauma patients of Sri Lanka.

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None

Competing Interests

None

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