

## ORIGINAL RESEARCH

# Focussed Assessment Sonography for Trauma (FAST) and CT Scan in Blunt Abdominal Trauma: Surgeon's Perspective

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## ABSTRACT

**Background:** To evaluate the role of focussed assessment sonography for trauma in blunt abdominal trauma patients, and to see if the role of computed tomography scan could be limited to only those cases in which sonography was positive. The FAST exam is a tool that trauma surgeons can use to evaluate patients with blunt trauma and possible abdominal injury. Currently, FAST has become the method of choice in evaluating hemodynamically unstable patients due to the rapid determination of any life-threatening abdominal injuries. The question that remains is the value of the FAST exam in hemodynamically stable blunt abdominal trauma patients.

**Objective:** The aim of this communication is to define the recent role of FAST and CT scan of the abdomen in the diagnosis of blunt abdominal trauma.

**Method:** A prospective descriptive study of 126 adult patients who received FAST for the evaluation of blunt abdominal trauma between Feb 2014 to Jan 2015 at Bangalore Medical College, Bangalore. Ultrasound findings were correlated with CT scan findings, operative findings if managed surgically, clinical outcomes whether managed surgically or conservatively.

**Results:** FAST was negative in 107 (84.9%) patients. Fifteen (15%) of these patients died from all-cause mortality, none of which was due to intra-abdominal injury. Ten patients with negative FAST underwent CT scan owing to change in clinical course, and 5 patients with negative FAST underwent laparotomy owing to change in clinical course, with positive findings in 2 patients – a bowel injury requiring resection (not seen on CT). A negative FAST was shown to be an excellent predictor for the absence of significant intra-abdominal trauma.

**Conclusions:** FAST is best modality of investigation initially in blunt abdomen injury who are haemodynamically unstable and can proceed to exploratory laparotomy instead wasting time in other imaging modalities like CT abdomen. But in haemodynamically stable patient CT abdomen will be investigation of choice.

**Keywords:** Blunt abdomen trauma, CT abdomen, FAST, DPL, injuries.

**How to cite this article:** Abdul Razack, Vikas N Raj, Ramesh M Tambat. Focussed assessment sonogra-

phy for trauma (FAST) and CT scan in blunt abdominal trauma: surgeon's perspective. *International Journal of Contemporary Medical Research* 2015;2(4): 796-800

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**Source of Support:** Nil

**Conflict of Interest:** None

## INTRODUCTION

An injury is the physical damage that results when a human body is suddenly or briefly subjected to intolerable levels of energy. Injuries are currently a leading cause of death in the world<sup>1</sup> and a global problem worldwide.<sup>2</sup> Intraperitoneal fluid found during ultrasound abdomen scan in a blunt abdomen trauma has been a useful predictor to decide whether patient needs surgical intervention or not. In a blunt abdomen trauma it is always confusing that patient requires active surgical intervention based on the signs and symptoms. For hemodynamically unstable patient who requires immediate intervention to avoid mortality, where there is no time for other imaging modalities, in that situation FAST is useful in decision making.<sup>3</sup> Clinical history, physical examination, and laboratory tests are often unreliable in the evaluation of blunt abdominal trauma.<sup>4</sup> CECT abdomen scans can produce very detailed images, are non-invasive and have become the gold standard investigation in assessing blunt abdominal trauma. With the development of helical CT, the time taken to do the scan has been significantly reduced along with that the sensitivity and specificity is around 95% and the high negative predictive value of nearly 100%.<sup>5</sup>

CT scans do however have their draw backs. The principal one being the need to transfer the patient to the scanner from the emergency department, making it unsuitable in unstable patients. Paediatric patients often require sedation, which, means constant monitoring for risk of airway compromise. The procedure also requires specialised radiographers to perform the investigation and radiologists to interpret the images.

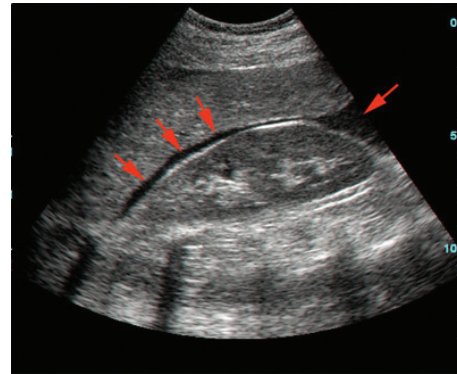
In some literature studies have shown that focused assessment with sonography for trauma (FAST) in blunt abdomen trauma is useful in screening tool to detect intraperitoneal free fluid which indirectly signify intra-abdominal injury as the source of haemorrhage in haemodynamically unstable patients who would then require emergency laparotomy before spending more time in doing other imaging. Previous studies have demonstrated the sensitivity and specificity of FAST for the detection of free fluid to be 0.64 - 0.98 and 0.86 - 1.00, respectively, compared with abdominal computed tomography (CT).<sup>6</sup> Some authors even mentioned that FAST is more sensitive in detecting free fluid intraperitoneal than CT.<sup>7</sup> Randomised controlled trials has shown that incorporating FAST in the triage protocol result in increased efficiency, cost effective and reduced reliance on CT, compared to the triage protocol where they exclusively utilise CT.<sup>8-11</sup> However, we cannot only depend on FAST and general physical examination where FAST is negative.<sup>12,13</sup>

Haemodynamically stable, negative FAST patients routinely underwent CECT abdomen scan as a triage protocol in view that ultrasonography may have missed solid organ injury. The sensitivity of FAST for solid organ injury ranges from 0.4 - 0.8, even after the administration of intravenous contrast agent.<sup>14</sup> Despite that FAST have missed the solid organ injuries are not clinically significant, or would be detected during observation without any serious morbidity, most of the triage protocol in tertiary hospitals maintains the necessity of routine CECT abdomen scan, even without obvious signs of injury.<sup>15</sup> Other factors include over-investigation by surgeons in view of medico legal purposes, institutional financial gain from CT scanning, and patient demand for advanced imaging to rule out injury.

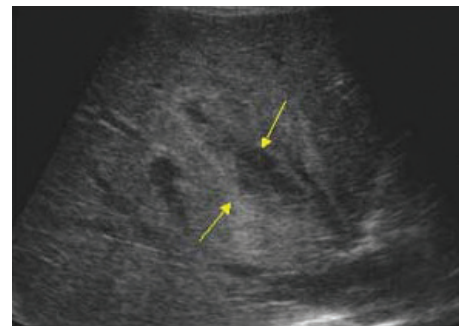
## MATERIAL AND METHODS

126 patients admitted between Feb 2014 and Jan 2015 in surgery department of Bangalore medical college diagnosed of blunt abdomen trauma who received a FAST scan as part of the triage protocol were prospectively enrolled in the study after taking informed con-

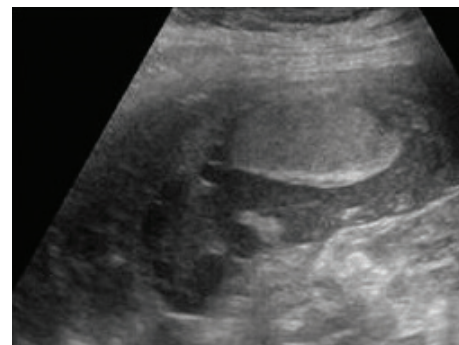
sent from the patients and approval for study from the institute. Patients sustaining blunt abdominal trauma



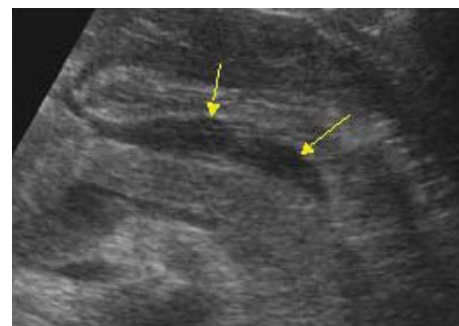
**Figure-1:** A 22 yr old male had a blunt abdomen trauma following RTA showing free fluid in the Morrison pouch on FAST



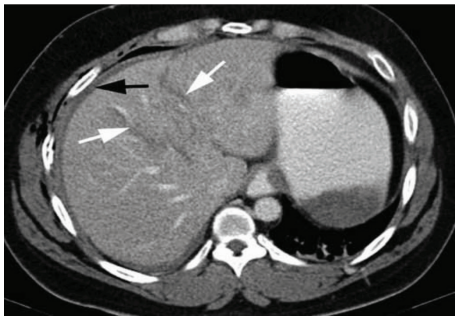
**Figure-2:** A 30 old male had a blunt trauma abdomen following fall from height showing liver laceration on FAST



**Figure-3:** A 40 yr old female had blunt abdomen trauma following assault showing spleen laceration with hematoma surrounding on FAST



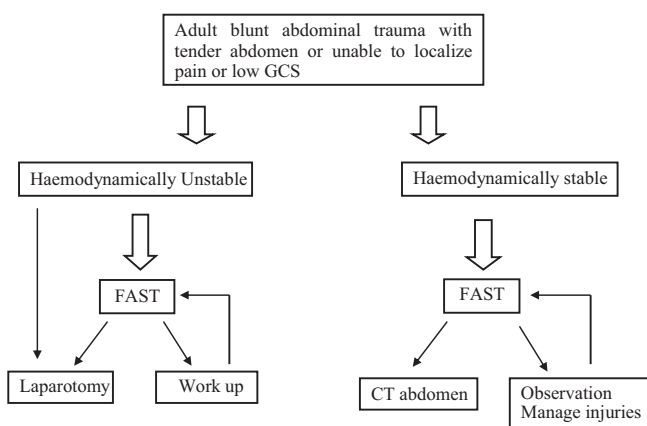
**Figure-4:** A 33 yr old male had blunt trauma abdomen following RTA showing hematoma surrounding pancreas on FAST



**Figure-5:** A 20 yr old male with blunt abdomen trauma following RTA showing grade 1 liver laceration on CECT abdomen which was not detected by FAST in emergency

were evaluated using a diagnostic tree (Figure below), designed to triage the use of CT to those who would obtain the most clinical benefit, based on peer-reviewed literature. Patients with blunt abdominal injury who are hemodynamically stable underwent serial FAST scan and physical examinations for 24 hours without undergoing CT. Patients with positive FAST scans and hemodynamically stable patients received CECT abdomen, to identify injuries which would require surgical management. At any point in the triage pathway, unstable patients underwent immediate exploratory laparotomy. Inclusion criteria included patients who were aged 18 years and older who suffered blunt abdominal trauma and received a FAST scan within 24 hours of presentation.

The primary outcome in this investigation was safe discharge or transfer without mortality or morbidity attributable to abdominal pathology. Secondary outcomes included need for laparotomy, surgical findings and CT findings.



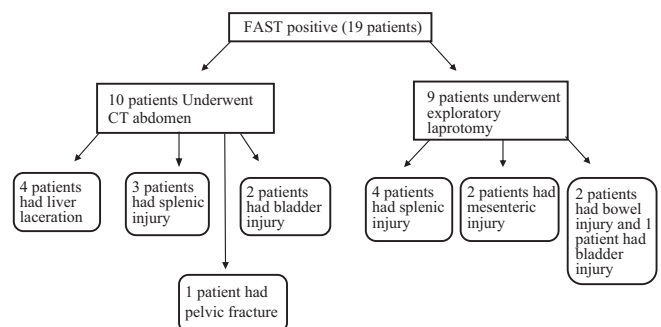
**STATISTICAL ANALYSIS**

Specificity of FAST scanning was high at 94.8% (95% CI: 0.75–0.99), with a sensitivity of 46.7% (95% CI: 0.33–0.60). It also shows a Positive Predictive Value

of 0.90 (0.81–0.99) and a Negative Predictive Value of 0.32 (0.26–0.54). Fisher’s exact test shows that FAST result is significantly associated with the Intra-abdominal pathology ( $p = 0.001$ ). Cohen’s chance corrected agreement between the FAST scans and actual CT/Laparotomy was 0.3 which is fair

**RESULTS**

A total of 126 patients met inclusion criteria during the selection period. The predominant population involved was young males, with 96 (76.1%) male and 30 (23.9%) female patients. There were 83 (65.8%) patients between the ages of 20 and 39. The FAST exam was negative in 107 (84.9%) patients. Fifteen (11.9%) of these patients died from all-cause mortality. The cause of death was neurological in 5 patients (intracranial injury), infectious in 2 patients (hospital acquired pneumonia etc.), orthopedic in 7 patient (pelvic fractures) and unclear in 1 patient, who underwent a postmortem examination that showed no abdominal organ injury or free fluid within the abdomen. Ten patients (7.9%) with negative FAST received a CT scan owing to change in clinical course. Two of these patients had CT findings, namely a splenic contusion and a kidney laceration, neither requiring surgical repair. Five patients with negative FAST underwent laparotomy owing to a change in clinical course with positive clinical findings in 2 patients, i.e. a bowel injury requiring resection that was not detected on CT. Around ten (52.6%) FAST positive patients who are hemodynamically stable underwent CECT abdomen. Out of which free fluid was present in 8 (80%) patients. Out of 10 patients liver laceration was present in 4, splenic laceration in 3, bladder rupture in 2 and pelvic fracture in 1 which is managed conservatively. Another 9 (47.4%) FAST positive patients who are hemodynamically unstable underwent exploratory laparotomy. Out of 9 patients splenic laceration was present in 4 who had grade 4 splenic laceration underwent splenectomy, 2 patients had mesenteric injury and mesenteric repair



was done, 2 patients had bowel injury and underwent resection and anastomosis, 1 patient had bladder injury and primary repair was done. FAST scan was done by the doctor who has undergone 15 days of training and the surgeon who is operating has done at least of 50 laparotomies.

## FOLLOW UP

FAST negative patient was kept on observation in emergency ward and regular USG abdomen was done in all FAST negative patients after 24 hr of admission as a routine protocol of our hospital.

Out of 107 only 10 (9.3%) patient had developed free fluid in the peritoneum after 24hrs. Later on these patients were subjected to CECT abdomen. 5 patients out of 10 had grade 1 liver laceration, 3 had grade 1 splenic laceration and 2 had mesenteric injury. All the 10 patients were managed conservatively.

## DISCUSSION

CT of the abdomen was not performed routinely for FAST-negative patients who showed no clinical sign of intra-abdominal trauma, which suggests that performing CT in this group would incur unnecessary cost and risk from ionizing radiation, while showing no benefit to the patient.<sup>16</sup>

A negative FAST scan was an excellent predictor of the absence of significant intra-abdominal injury.<sup>17</sup> While the mortality rates of patients in the FAST-negative group was disconcertingly high, the cause of death, after thorough chart review, was not attributable to missed injury. Two missed injuries that were found on CT (i.e. a liver contusion and a minor splenic laceration) did not require operative intervention and were successfully managed conservatively. There were 2 injuries in the FAST-negative group that received a laparotomy: A bowel injury that was missed on CT and a diaphragmatic hernia that was found on screening chest radiography. These injuries must be kept in the differential for any patient who sustains blunt abdominal trauma, but do not obviate the triage algorithm in question.

CT showed the presence of free fluid in 80% of FAST-positive patients, with free fluid or blood in the peritoneal cavity found at laparotomy in 91% of FAST-positive patients, confirming the superior sensitivity of ultrasound to CT for detecting the presence of free fluid.

These days usage of CT abdomen has increased but it is a challenge that how to decrease the utilization of CT

abdomen without affecting the management of the patients. CT abdomen has a sensitivity of 99% in detecting intraperitoneal fluid and minor solid organ injuries which will not cause intraperitoneal bleed.<sup>18-23</sup> FAST on the other side only detects intraperitoneal bleed and major solid organ injuries and cannot detect minor solid organ injuries, bowel or mesentery injury.

Some studies have shown that with the introduction of FAST a triage protocol there is significant reduce in utilization of CT abdomen from 56% to 26%.<sup>24</sup> Same study also showed that there is cost reduction of \$400,000 at their hospital with use of ultrasound in triage protocol. Another study showed that about 2/3<sup>rd</sup> reduction in the cost which is spent by the patient in seeking health care by simply introducing FAST instead of CT scan or DPL in the triage protocol.<sup>25</sup> These studies suggest that physician who efficient in performing FAST has drastically reduced the CT utilization and greater diagnostic efficiency without increased incidence of missed injuries.<sup>26</sup> Compared to our study, a study done by Inaba et al showed that there is little but significant increase in use of CT scan but they did not mention neither on FAST nor on blunt abdomen trauma.<sup>27</sup> and another study done by Roudsari et al showed that increase in utilization of CT scan by 16% in the year 1996-2006 in a patients aged more than 55 years of age with the history of blunt abdomen trauma.<sup>28</sup>

## CONCLUSION

FAST is best modality of investigation initially in blunt abdomen injury who are haemodynamically unstable and can proceed to exploratory laparotomy instead wasting time in other imaging modalities like CT abdomen. But in haemodynamically stable patient CT abdomen will be investigation of choice.

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