

# Role of FAST in blunt trauma abdomen: A promising diagnostic tool to evaluate management in patients and comparison of its accuracy with CT and laparotomy



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Submission: 21-12-2022

Revision: 02-04-2023

Publication: 01-05-2023

## ABSTRACT

**Background:** Focused assessment with sonography for trauma (FAST) is a limited ultrasound examination directed solely at identifying the presence of free intraperitoneal or pericardial fluid. In the context of traumatic injury, free fluid is usually due to hemorrhage and contributes to the assessment of the circulation. Performed in the trauma room by properly trained and credentialed staff, it allows the timely diagnosis of potentially life-threatening hemorrhage and is a decision-making tool to help determine the need for transfer to the operating room, computed tomography (CT) scanner, or angiography suite. The FAST scan is a 4 view scan reliant on detecting the presence of fluid within the pericardium and most dependent zones of the peritoneum in the horizontal patient. It is capable of detecting more than 100–250 mL of free fluid. CT scanning, in comparison, is capable of detecting more than approximately 100 mL of free fluid in the abdominal cavity. As a “rule of thumb,” a rim of 0.5 cm of fluid in Morison’s pouch represents approximately 500 mL of free fluid, and a 1 cm rim represents approximately 1000 mL. **Aims and Objectives:** The aims of this study were as follows: Role of FAST in blunt trauma abdomen: A promising diagnostic tool to evaluate management in patients and comparison of its accuracy with CT and laparotomy. **Materials and Methods:** The FAST scan was performed by Color Doppler Siemens Sonoline G-50 machine using either 2–5 MHz convex transducers or 5–10 MHz linear transducer department of Radiology L.L.R. Hospital, Kanpur. At FAST examines four areas for free fluid, perihepatic and hepatorenal space, perisplenic, and pelvis pericardium. **Results:** Sensitivity of FAST: 87.5%, specificity of FAST: 75%, and negative predictive value (NPV) of FAST are 80%. CT scan had sensitivity of: 97%, specificity of: 95%, and positive predictive value of CT scan: 92% NPV of: 100%. Laparotomy was GOLD standard with specificity of 100%. **Conclusion:** FAST was positive in 62.5% cases of blunt trauma abdomen. Sensitivity of FAST: 87.5%, specificity of FAST: 75%, and NPV of FAST are 80%. CT scan had sensitivity of: 97%, specificity of: 95%, positive predictive value of CT scan: 92%, and NPV of: 100%. Laparotomy was GOLD standard with specificity of 100%.

**Key words:** Focused assessment with sonography for trauma USG; Computed tomography (CT); Laparotomy

## INTRODUCTION

Focused assessment with sonography in trauma (commonly abbreviated as FAST) is a rapid bedside ultrasound examination performed by surgeons, emergency physicians,

and paramedics as a screening test for blood around the heart (pericardial effusion) or abdominal organs (hemoperitoneum) after trauma (Bar Chart 1).<sup>1</sup> There is also the extended FAST which includes some additional ultrasound views to assess for pneumothorax.<sup>2</sup> Trauma is

### Access this article online

**Website:**

<http://nepjol.info/index.php/AJMS>

**DOI:** 10.3126/ajms.v14i5.50465

**E-ISSN:** 2091-0576

**P-ISSN:** 2467-9100

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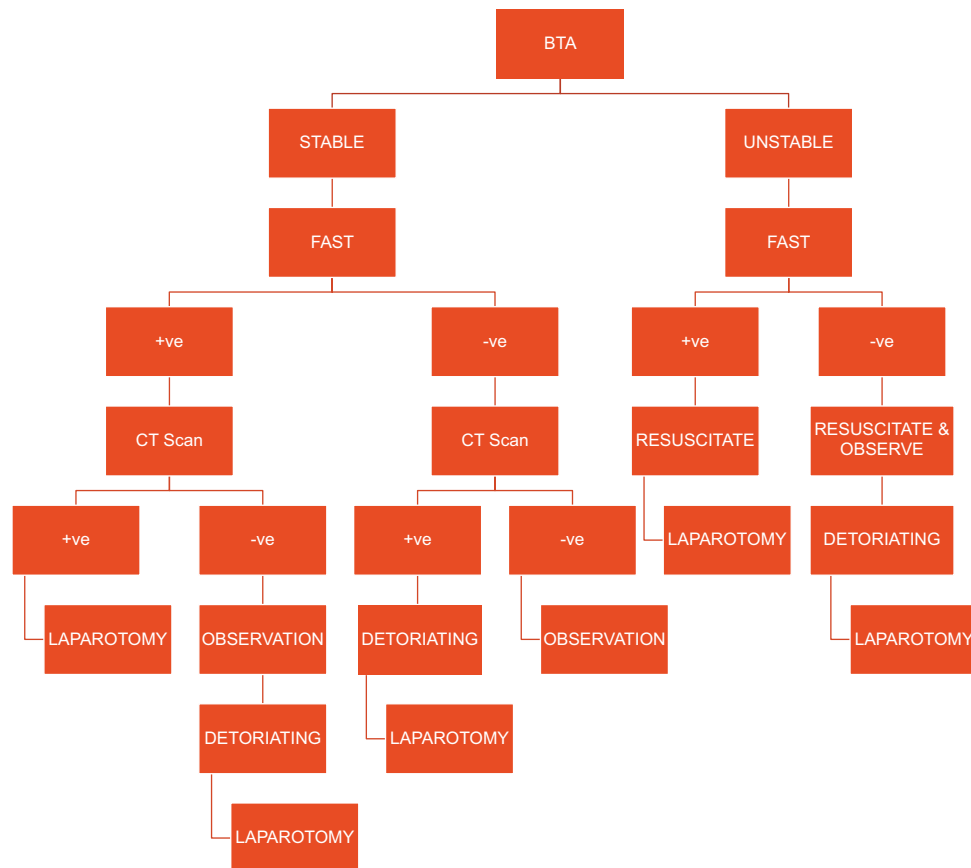


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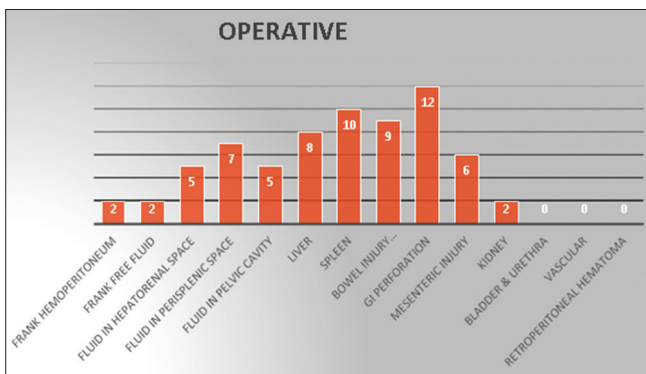
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**Flow Chart 1:** Treatment decis in this study, we will also be comparing the accuracy of FAST versus CT/laparotomy



**Bar Chart 1:** FAST in blunt trauma abdomen

the most common cause of death among youth and adults, specifically aged 1–45 years. Trauma to the abdomen is most often severe and generally, associated with injuries to the other parts of the body as head, chest, and fractures of the limbs or it may be complicated by alcoholism, epilepsy, shock, or unconsciousness making the diagnosis more difficult. The appropriate management of blunt trauma abdomen depends on careful initial evaluation, the timely use of diagnostic procedures, and vigorous therapy directed at immediate life-threatening problems. Early investigation and rapid diagnosis result in decreased morbidity and mortality of the patients. Of the various modalities available

at present, focused assessment with sonography in blunt abdominal trauma (FAST) is a rapid and non-invasive test for quick diagnosis of free intra-abdominal fluid.

### Aims and objectives

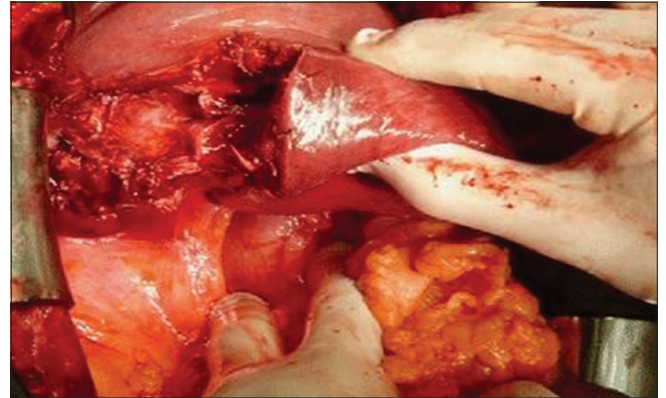
Role of FAST in Blunt Trauma Abdomen and to evaluate management In patients & comparison of its accuracy with CT and Laparotomy.

### FAST

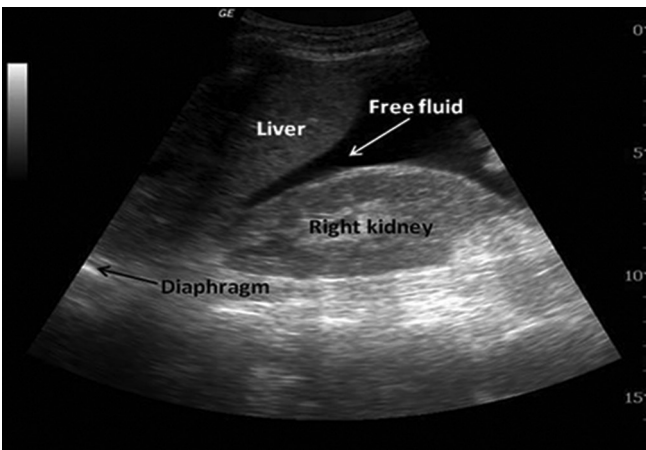
The focused abdominal sonogram in trauma is a focused, a goal directed, and sonographic examination of the abdomen aimed at detecting the presence or absence of hemoperitoneum. It provides viable alternative to other investigations in the blunt abdominal trauma patient and can be integrated into the primary survey in patients with signs of hemorrhagic shock or suspicion of intra-abdominal injury. It has the additional advantages of being non-invasive and reproducible and is capable of being rapidly performed. Indeed, the FAST scan is often regarded as being a simple extension of clinical examination rather than a definitive diagnostic investigation. A standard four view examination can be completed in approximately 2 min. Searching for parenchymal abnormalities as well as free fluid improved the sensitivity of ultrasonography



**Figure 1:** Demonstrating the standard four Views(FAST-USG)



**Figure 4:** Exploratory laparotomy demonstrating a liver laceration due to blunt trauma abdomen



**Figure 2:** FAST(USG) demonstrating free fluid in Morrison's pouch

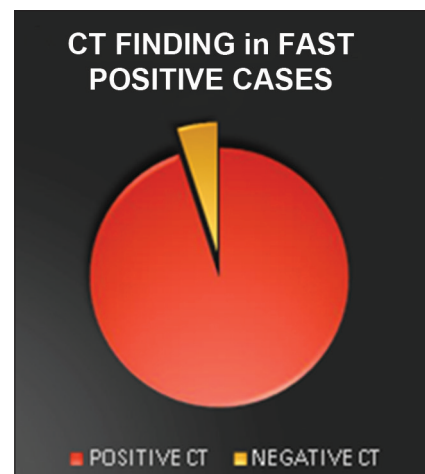


**Figure 3:** CECT whole abdomen showing spleen tear

in some reports, but, conversely,<sup>3</sup> ultrasonography was limited mainly by its low sensitivity for identifying organ injuries in hemodynamically stable patients in other reports.<sup>4</sup> FAST is a limited ultrasound examination directed solely at identifying the presence of free intraperitoneal or pericardial fluid. In the context of traumatic injury, free fluid is usually



**Figure 5:** In all the 65% stable patients, who underwent FAST and were found to be negative - (1) Only 10% had positive CT scan findings. (2) 90% negative CT scan findings



**Figure 6:** In all the 65% stable patients, who underwent FAST and were found to be positive - (1) 95% had positive CT scan findings. (2) 5% negative CT findings

due to hemorrhage and contributes to the assessment of the circulation. Performed in the trauma room by properly trained and credentialed staff, it allows the timely diagnosis



**Figure 7:** In 35% unstable patients, had 90% positive. FAST scans – (1) had 100% operative findings. (2) There were 0% negative laparotomies



**Figure 8:** 35% unstable deteriorating patients, they had 10% negative FAST scans – (1) Only 30% had operative findings. (2) 70% had negative laparotomie

of potentially life-threatening hemorrhage and is a decision-making tool to help determine the need for transfer to the operating room, computed tomography (CT) scanner, or angiography suite. The FAST scan is a four view scan reliant on detecting the presence of fluid within the pericardium and most dependent zones of the peritoneum in the horizontal patient. It is capable of detecting more than 100–250 mL of free fluid. CT scanning, in comparison, is capable of detecting more than approximately 100 mL of free fluid in the abdominal cavity. As Kirkpatrick AW et al, a “rule of thumb,” a rim of 0.5 cm of fluid in Morison’s pouch represents approximately 500 mL of free fluid, and a 1 cm rim represents approximately 1000 mL (Figure 2).

FAST examines four areas for free fluid:

- Perihepatic and hepatorenal space
- Perisplenic
- Pelvis
- Pericardium.

FAST is indicated in the patient who has sustained blunt abdominal trauma who may or may not be hemodynamically unstable. The FAST examination is directed purely at detecting free intraperitoneal fluid or the presence of cardiac tamponade. As Neal and Peitzman, hemodynamic instability and free intraperitoneal fluid mandates a laparotomy for intra-abdominal hemorrhage. In the presence of hemorrhagic shock but a negative FAST examination, other sites of hemorrhage must be sought and controlled. Serial FAST examinations may be required. Thoracic hemorrhage may require thoracotomy, pelvic hemorrhage angiographic embolization. Retroperitoneal hemorrhage from vascular injury remains a possibility with a negative FAST. Non-hemorrhagic shock is also a possibility. FAST can detect a pericardial collection causing cardiac tamponade, but profound hypoxia, tension pneumothorax and blunt myocardial injury must also be excluded from the study. As a decision-making tool for identifying the need for laparotomy in hypotensive patients (Systolic BP <90), FAST has a sensitivity of 100%, specificity of 96%, and negative predictive value of 100% (NPV).

#### CT

The contrast-enhanced CT scan is a non-invasive procedure. It has become the gold standard radiographic modality in evaluating blunt abdominal trauma patients CT scanners that are available now in most trauma centers. With the advent of helical CT scan, scan time has become significantly shorter. The public continues to need training and reminders to wear a car seat belt, to avoid BAT. In addition, the public should be constantly reminded about the implications of driving while intoxicated or with sensory impairment.<sup>5</sup> The results of BAT have been enhanced over time. The results are good for patients with minor blunt trauma, but for those suffering from various organ injuries, in-hospital mortality can differ from 3% to 10%. The ready accessibility of CT also enabled physicians to monitor patients carefully, without unnecessary surgery.<sup>6</sup> The implementation of CT and sonography has made significant progress in the treatment of trauma. Although ultrasound equipment systems have enhanced resolution, 50% of acute abdominal wounds are missed. For more specificity, CT was used in blunt trauma. Sonography is mostly considered the best option in the case of an initial assessment of the blunt abdominal injury. However, sonography is favored for those positive and negative diagnostic patients to assess further organ damage.<sup>7</sup> Helical CT scan sagittal and coronal reconstruction images are useful for detecting ruptured diaphragm. Moreover, it seems to improve the diagnosis of gastrointestinal injuries. A positive result suggests hemoperitoneum; often CT scan will be performed if the patient is stable (Figure 3)<sup>8</sup> or a laparotomy if unstable (Figure 4). In those with a negative

FAST result, a search for extra-abdominal sources of bleeding may still need to be performed.

## MATERIALS AND METHODS

FAST is a goal directed sonographic examination of the abdomen aimed at detecting the presence or absence of free intraperitoneal fluid. It provides a valuable alternative to other investigation in the blunt abdominal trauma patient and can be integrated into the primary survey in the patients with signs of hemorrhagic shock or suspicion of intra-abdominal injury. It has the additional advantage of being non-invasive and reproducible and is capable of five being rapidly performed. A standard four view examination can be completed in approximately 2 min. As Bloom and Gibbons, a four view fast scan was performed at the end of the primary or secondary survey (depending on the clinical stability) in all patients alleged to have sustained blunt abdominal trauma and was admitted to the emergency department of L.L.R. and Associated Hospitals, Kanpur. VERBAL or written consent was taken from the patient if possible. The fast scan was performed by Color Doppler Siemens Sonoline G-50 machine using either 2–5 MHz convex transducers or 5–10 MHz linear transducer department of Radiology L.L.R. Hospital, Kanpur, at FAST examines four areas for free fluid.

### Technique

Patient in supine position 3.5–5.0 MHz convex transducer.

### Five regions may be scanned (Figure 1)<sup>9,10</sup>

#### *Pericardial view*

Commonly referred to as the subcostal or subxiphoid view to examine the pericardium, the liver in the epigastric region is most commonly used as a sonographic window to the heart the potential space between the visceral and parietal pericardium is examined for a pericardial effusion. If anatomical factors preclude epigastric probe placement, parasternal or apical four-chamber views may be used.

#### *Right flank view*

Commonly referred to as the perihepatic view, Morison pouch view or right upper quadrant view four potential spaces are sequentially examined for the accumulation of free fluid the hepatorenal interface (Morison pouch) is first identified, with subsequent assessment of the more cephalad subphrenic and pleural spaces visualization of the inferior pole of the kidney, which is a continuation of the right paracolic gutter, defines the caudad extent of an adequate view.

#### *Left flank view*

Commonly referred to as the perisplenic or left upper quadrant view, four potential spaces are sequentially

examined in an analogous fashion to the right flank, although the splenorenal interface is assessed on the left.

#### *Pelvic view*

Commonly referred to as the suprapubic view, this space is the most dependent peritoneal space in the supine trauma patient.

## OBSERVATIONS

This was a prospective observational study. Sixty patients who sustained blunt abdominal trauma and were admitted to L.L.R. Hospital had undergone this study during a period between January 2021 and August 2022.

### Limitations of the study

Study concluded that FAST is useful as the initial diagnostic tool for abdominal trauma to detect intraabdominal fluid, and use of FAST was only in Emergency Department.

## CONCLUSION

Sixty cases of blunt trauma abdomen in this series admitted in LLR Hospital, Kanpur during the period from January 2021 to August 2022 found sensitivity of FAST: 87.5% and specificity of FAST: 75%. NPV of FAST is 80% (Figures 7 and 8). CT scan had sensitivity of: 97% and specificity of: 95%. Positive predictive value of CT scan: 92% NPV of: 100% (Figures 5 and 6). Laparotomy was GOLD standard with specificity of 100%.

Study concluded that FAST is useful as the initial diagnostic tool for abdominal trauma to detect intra-abdominal fluid. In the hemodynamically stable patients, the diagnostic modality of choice is CT scan. Finally, the laprotomy is the gold standard, but aggressive invasive procedure needs intensive care. These modalities are complimentary and not competitive. Their usefulness is maximized when indicated and applied properly and timely within defined clinical algorithms (Flow Chart 1).

## ACKNOWLEDGMENT

We would like to thank the authorities of GSVM medical college and L.L.R Hospital Kanpur, for their support and help.

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**Authors' Contributions:**

**BMS**-Concept and study design, prepare first draft of manuscript, review of data, interpretation of results, revision of manuscript, **SK**-preparation of manuscript, data collection and analysis.

**Work attributed to:**

GSVM medical college and L.L.R Hospital Kanpur (UP).

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**Source of Support:** Nil, **Conflicts of Interest:** None declared.