

Focussed Assessment with Sonography in Trauma: A narrative review

Dr. Shalinder Koul^{1*}, Dr. Navin Gupta², Dr. Heenu Dhar³, Dr. Arka Mondal⁴, Addya Chaddha⁵, Mahi Mahla⁶, Yakshita Jain⁷, Arpita Vakil⁸

^{1*}Associate Professor, Dept. of Surgery, Faculty of Medicine & Health Sciences, SGT University, Gurugram, India.

²Assistant Professor, Dept. of Physiology, World college of Medical Sciences, Research and Hospital, Gurawar, Jhajjar, Haryana-124102. Orcid Id: [0009-0006-1786-5010](https://orcid.org/0009-0006-1786-5010)

³Professor, Department of Pharmacology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, India-122505. (Corresponding author)

Email: heenu_fmhs@sgtuniversity.org

⁴Assistant Professor, Department of Pharmacology, Faculty of Medicine & Health Sciences, SGT University, Gurugram, India-122505.

^{5,6,7,8}Final year MBBS Student, Faculty of Medicine & Health Sciences, SGT University, Gurugram.

Received: 28th March, 2026; Accepted: 10th April, 2026; Available Online: 24th May, 2026

ABSTRACT

Focused Assessment with Sonography for Trauma (FAST) provides rapid, bedside detection of free fluid in peritoneal, pericardial, and thoracic cavities, making it invaluable in early trauma management. Extended FAST (eFAST) further improves diagnostic accuracy by identifying pneumothorax and haemothorax. Compared to diagnostic peritoneal lavage and CT, FAST is safer, quicker, and applicable in children and pregnant patients, though limited by operator dependency and reduced sensitivity for solid organ injuries. Serial FAST scans enhance sensitivity and reduce false negatives, supporting decision-making in resource-limited settings. Future developments, including IVC diameter assessment and contrast-enhanced ultrasound should expand its role in guiding resuscitation and detecting solid organ injuries.

Keywords: Blunt abdominal trauma (BAT); Diagnostic peritoneal Lavage (DPL); eFAST (Extended Focussed Abdominal sonography for trauma); LUQ (Left upper quadrant); RUQ (Right upper quadrant)

How to cite this article: Koul S, Gupta N, Dhar H, Mondal A, Chaddha A, Mahla M, Jain Y, Vakil A. Focussed Assessment with Sonography in Trauma: A narrative review. Int J Drug Deliv Technol. 2026;16(49s): 85-88. DOI: 10.25258/ijddt.16.49s.10

Source of support: Nil.

Conflict of interest: None

Introduction

Trauma is the leading cause of morbidity and mortality in the younger population. Eighty percent of the traumatic injuries are due to blunt trauma with the majority of mortality due to the hypovolemic shock. Intraperitoneal bleeds occur in upto 12 percent of blunt trauma patients.¹ Of all the deaths by trauma 30-40 percent are caused by haemorrhage.² For every three minutes of delay in trauma patients needing emergency laparotomy mortality increases by approximately 1 percent.³ Clinical assessment of abdomen may be inaccurate and physiological evaluation is unreliable in blunt trauma abdomen. Hence an early radiological evaluation is recommended.⁴

FAST: Utility in Trauma

Focussed Assessment with Sonography for Trauma is a rapid bedside ultrasonography used in blunt abdominal trauma patients in the emergency department. FAST can provide valuable information within few minutes and help in deciding the early management. It detects free fluid in the pericardial, peritoneal and the thoracic cavities. The first hour after traumatic injury is the most crucial period and is rightly termed as the 'Golden Hour'. The main steps in the early management of trauma are the primary assessment and resuscitation followed by reassessment of airway, breathing and circulation (ABC) and by secondary assessment.

Diagnostic peritoneal lavage (DPL) was historically used to determine which patient of BAT would need laparotomy. DPL is difficult to perform in pregnant cases of trauma and is very sensitive test leading to high negative laparotomy rate. Also, frequent serial assessment with DPL is not feasible. DPL is invasive with a complication rate of 0.8%.^{5,6} Abdominal CT scan is better than DPL for intraabdominal injury in BAT but it is not indicated in haemodynamically unstable patients and pregnant ladies. Abdominal CT scan is expensive and requires transfer of patients to the radiology suite.

FAST has a major role in triage and guiding the diagnosis and management of trauma patients. Ollerton et al. found that the management was changed in 32.8% of patients after FAST. In addition, with the use of FAST, diagnostic peritoneal lavage (DPL) rates decreased from 9% to 1% while CT utilization decreased from 47% to 34%.⁷

FAST is a helpful diagnostic alternative to DPL and CT, being non-invasive, easily available, easily reproducible, less expensive and can be used in pregnant females & children. Though FAST is only 85% sensitive, requiring the presence of more than 150 to 200ml of intraperitoneal fluid to show positive result,⁸ it has become an indispensable part of resuscitation of trauma patients and has been incorporated into ATLS courses as well.⁹ It's

specificity for diagnosis of hemoperitoneum, pericardial effusion and haemothorax is high. In haemodynamically unstable patients FAST can be quickly performed and can provide us a potential site and source of haemorrhage, thus helping in deciding early intervention to stop bleeding.

FAST can be performed by Emergency physicians or trained paramedical staff as well besides well trained radiologists. As per studies the sensitivity and specificity of FAST are 75.8% and 97.4%. In penetrating trauma, the reported sensitivity of FAST ranges from 28.1% to 100% but the specificity was high from 94.1% to 100%. For diagnosing solid organ injuries reported sensitivity was only 38.5%. Such variation in sensitivity can be explained by differences in the comparator reference standards.¹⁰ The addition of anterior chest scan to detect the pneumothorax has further improved the validity of FAST. It is called eFAST. Indications for eFAST include abdominal trauma (blunt or penetrating) with or without thoracic trauma and undifferentiated shock. As per study the sensitivity and specificity of eFAST for identification of pneumothorax is about 96% and 100% and about 83% and 98% for the detection of haemothorax.^{11,12} Usually visceral and parietal pleura move against one another, creating a slinging artifact called as "The ants marching sign". The absence of this sign is indicative of pneumothorax.¹³

The RUQ view is most likely to detect free fluid with 66% sensitivity. Evidence suggests that the caudal edge of the right lobe of liver has the highest sensitivity of 93%.¹⁴ The subxiphoid view ultrasound can detect pericardial fluid as small as 20ml with the sensitivity and specificity approaching 100%. The subcostal view also helps in differentiating between pleural and pericardial effusion. Next the LUQ is imaged for fluid in the splenorenal recess, the left subphrenic space, the left paracolic gutter and the left lower hemithorax.¹⁵ The suprapubic image estimates fluid in the rectovesical pouch in males and the rectouterine and vesicouterine pouches in females.

Limitations of FAST

The results of FAST are operator dependent. LUQ view is usually the most challenging one to perform, requiring longer time and effort. FAST cannot reliably grade solid organ injuries. The mean minimum volume of intraperitoneal fluid needed for ultrasound detection is 668ml in supine position and 444ml in Trendelenburg position in the RUQ view and 157ml in the pelvic view.¹⁶ Fluid is more commonly and more easily detected in the left paracolic gutter. Both false positive and false negative examinations can lead to further radiological evaluation or unnecessary surgery. Delayed presentation in trauma can lead to false-negative result because once the intraperitoneal blood forms clots its differentiation from the

surrounding tissue becomes difficult on ultrasound. Mild abdominal and severe head injuries are associated with a false negative report. There can be misinterpretation of double-line sign as free fluid and an anatomically elongated left hepatic lobe as a splenic hematoma.¹⁷ FAST has a limited value in detecting retroperitoneal fluid or small intraperitoneal fluid. Free fluid in FAST is invariably presumed to be blood though it can be injury related bile, bowel contents or urine. Gravid uterus can distort the normal anatomy and it may be difficult to distinguish between intrauterine and extrauterine fluids. Free intraperitoneal fluid can be secondary to haemorrhage, amniotic fluid from uterine rupture or both. eFAST can overlook a pneumothorax at areas around lung apices and bases.¹⁸

Conclusions:

FAST is an extremely useful diagnostic tool in the emergency department in blunt trauma abdomen and is quite helpful in the diagnosis and management of trauma patients. Early decision regarding bleeding control by embolization or by laparoscopy/laparotomy can be made depending upon the facilities and the expertise available. It can avoid unnecessary radiation exposure in CT scan in a subset of trauma patients like the children and the pregnant where the chances of chest and abdominal trauma are least.

It is an accepted standard in the ATLS protocol and the physicians or surgeons performing it must be adequately trained as technical and interpretive challenges are present. Follow-up FAST can be an option if a low-grade injury is suspected. Serial FAST scans are recommended in non-major trauma where CT scan is not accessible and it can reduce the false negative rate by 50% and increase sensitivity from 69% to 85%. Moylan et al concluded in their retrospective study that FAST exam helped in making early decisions regarding laparotomy in trauma patients who were normotensive¹⁹.

Future prospectus

Along with the evolution of eFAST which can detect hemopneumothorax and help in its management in the emergency settings, changes in the diameter of IVC can be measured which correlates with the intravascular volume status, thus guiding fluid resuscitation. A flat IVC is an indicator of poor prognosis. Contrast enhanced ultrasound for trauma may detect solid organ injury more efficiently^{20,21}.

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