AIUM Practice Guideline for the Performance of the Focused Assessment With Sonography for Trauma (FAST) Examination

The association for medical ultrasound
aium
AMERICAN INSTITUTE OF ULTRASOUND IN MEDICINE

The American Institute of Ultrasound in Medicine (AIUM) is a multidisciplinary association dedicated to advancing the safe and effective use of ultrasound in medicine through professional and public education, research, development of guidelines, and accreditation. To promote this mission, the AIUM is pleased to publish, in conjunction with the American College of Emergency Physicians (ACEP), this *AIUM Practice Guideline for the Performance of the Focused Assessment With Sonography for Trauma (FAST) Examination*. We are indebted to the many volunteers who contributed their time, knowledge, and energy to bringing this document to completion.

The AIUM represents the entire range of clinical and basic science interests in medical diagnostic ultrasound, and with hundreds of volunteers, the AIUM has promoted the safe and effective use of ultrasound in clinical medicine for more than 50 years. This document and others like it will continue to advance this mission.

Practice guidelines of the AIUM are intended to provide the medical ultrasound community with guidelines for the performance and recording of high-quality ultrasound examinations. The guidelines reflect what the AIUM considers the minimum criteria for a complete examination in each area but are not intended to establish a legal standard of care. AIUM-accredited practices are expected to generally follow the guidelines with the recognition that deviations from the guidelines will be needed in some cases depending on patient needs and available equipment. Practices are encouraged to go beyond the guidelines to provide additional service and information as needed by their referring physicians and patients.

The association for medical ultrasound
aium
AMERICAN INSTITUTE OF ULTRASOUND IN MEDICINE

14750 Sweitzer Ln, Suite 100
Laurel, MD 20707-5906 USA
800-638-5352 • 301-498-4100
www.aium.org

I. Introduction

The clinical aspects of this guideline (Indications/Contraindications, Specifications for Individual Examinations, and Equipment Specifications) as well as Responsibilities of the Physician were developed collaboratively by the American Institute of Ultrasound in Medicine (AIUM) and the American College of Emergency Physicians (ACEP). Recommendations for physician qualifications, procedure documentation, and quality control vary among these organizations and are addressed by each separately.

This guideline has been developed to provide assistance to practitioners performing focused assessment with sonography for trauma (FAST) ultrasound examinations. The FAST ultrasound examination is a proven and useful procedure for the evaluation of peritoneal spaces for bleeding after traumatic injury, particularly blunt trauma but including penetrating injury. Prior to its development, more invasive, including surgical, procedures were required to evaluate these patients. Over the last 3 decades, particularly with its wide advocation during the early 1990s, the FAST examination has evolved into one that now includes assessments of the peritoneal cavity for evidence of hemorrhage as well as analysis of the pericardium and pleural spaces for hemorrhage, particularly in cases of chest trauma. While it is not possible to detect every abnormality using the FAST examination for the analysis of the traumatized patient, adherence to the following guideline will maximize the probability of detecting free fluid and allowing rapid analysis for intraperitoneal hemorrhage and other abnormal fluids, such as urine and bile. In its extended form, the FAST examination allows analysis for possible hemopericardium, hemothorax, pneumothorax, solid-organ damage, and retroperitoneal injury. The ready portability of ultrasound equipment allows the FAST examination to be used at the patient's bedside or in the rapid triaging of multiple individuals in mass casualty situations, including assessments in the field.

II. Indications/Contraindications

Indications for the FAST examination of the torso include but are not limited to traumatic injury. FAST examinations should be performed when there is a valid medical reason. There are no absolute contraindications.

There are limitations to FAST assessments, including limitations in their ability to detect free fluid in some injured children, patients with mesenteric injury, and patients with isolated penetrating injury to the peritoneum. Limitations to the diagnosis of free traumatic fluid in the peritoneum may be due to fluid present in patients for physiologic reasons, including ovarian cyst rupture, as well as pathologic reasons, such as patients with ascites. One must be wary of free fluid typically found intraperitoneally in patients with ventriculoperitoneal shunts and in those who undergo peritoneal dialysis. Free fluid may be also be due to recent peritoneal lavage. Limitations to pericardial assessment for hemopericardium include pericardial cysts and preexisting pericardial fluid. Limitations to pleural assessment for hemothorax include preexisting pleural fluid from preexisting pleural disease as well as extension into the pleural space of fluid from the pericardium or peritoneum.

III. Qualifications of the Physician

See the training guidelines of the physician provider's respective specialty society, eg, the ACEP or the AIUM. Training, as defined by the AIUM or the ACEP, is accepted as qualifying a physician for performance and/or interpretation of the FAST examination. Credentialing should be based on published standards of the physician's specialty society, such as the ACEP or the AIUM.

IV. Responsibilities of the Physician

Trauma ultrasound, or the FAST examination, provides information that is the basis for immediate decisions about further evaluation, clinical management, and therapeutic interventions. Rapid provision and interpretation of such examinations are critical to proper patient care. The clinical care of patients in life-threatening situations should always take precedence over these guidelines.

Physicians/sonologists of a variety of medical specialties may perform the FAST examination. If appropriately trained, physician extenders, emergency medical personnel, and sonographers can obtain the ultrasound images. Image interpretation should be performed by a supervising physician. Training of physicians in the diagnostic interpretation of FAST examinations should be in accordance with specialty-specific guidelines. Physicians who supervise nonphysician sonographers should render a diagnostic interpretation in a time frame consistent with the management of acute trauma, as outlined above.

V. Specifications for Individual Examinations

The objective of the abdominal portion of the examination is to analyze the torso for free fluid. This requires examination of the abdomen's 4 quadrants and pelvis. This is achieved by obtaining images of both upper quadrants as well as the pelvis. The ability to denote free fluid in the pelvis is aided by the presence of a fluid-filled bladder. As with all ultrasound examinations, orthogonal images (transverse, longitudinal, and coronal planes) help elucidate areas of concern seen in any single plane. Subtle changes in transducer angle and position can help improve analysis of a given area. Images may be obtained through anterior, coronal, or other approaches to denote free fluid in the evaluated areas.

As with most imaging and ultrasound examinations, techniques evolve over time and with increased clinical and imaging experience. The current primary FAST examination includes transverse and longitudinal images obtained through the heart to denote intrapericardial fluid. The images may be obtained by placing the transducer in the upper abdomen and pointing superiorly or placing the transducer directly above the heart in various echocardiographic planes, particularly a parasternal longitudinal plane. Pleural effusion can be analyzed by a midline transverse plane image in the upper abdomen, concentrating on the area posterior and therefore superior to the echogenic diaphragms. This may be the same image as that used to evaluate the (inferior) pericardium for fluid.

More specifically, primary ultrasound windows for the FAST examination include the following:

The Right Upper Quadrant View (Also Known as the Perihepatic, Morison Pouch, or Right Flank View)—This uses the liver as an ultrasound window to interrogate the liver as well as the hepatorenal space (Morison pouch) for free fluid. Slight superior angulation of the transducer allows imaging of the right pleural space for free fluid. Inferior angulation allows visualization of the inferior pole of the right kidney as well as the right paracolic gutter for free fluid assessment.

The Left Upper Quadrant View (Also Known as the Perisplenic or Left Flank View)—This uses the spleen as a window to interrogate the spleen and the perisplenic space above the spleen, below the diaphragm, and above the left kidney. Angulation superiorly allows visualization of the left pleural space. Inferior angulation allows visualization of fluid above the left kidney or in the left paracolic gutter.

The Pelvic View (Also Known as the Retrovesical, Retrouterine, or Pouch of Douglas View)—This allows assessment of the most dependent space in the peritoneum for free fluid. Analysis through a fluid-filled bladder (which can be filled, if necessary, by fluid placed through a Foley catheter when possible) may help analysis for pelvic fluid. When free fluid is present, it is noted most often superior and posterior to the bladder and uterus.

The Pericardial View (Also Known as the Subcostal or Subxiphoid View)—This uses the left lobe of the liver as a window for the analysis of the heart, particularly its right side. Both sagittal and transverse 4-chamber planes may be used. The potential space of the pericardium is analyzed for the presence of any free fluid in an anterior or posterior location. Slight angulation posteriorly or inferiorly in this view allows visualization of the inferior vena cava and hepatic veins, including their normal respiratory variability.

Additional views may include the following:

The Right and Left Pericolic Gutter Views—Longitudinal and transverse views through peritoneal windows inferior to the level of the ipsilateral kidney and next to the ipsilateral iliac crest may reveal free fluid surrounding bowel. These windows may be of limited use because of the absence of an ultrasound window, such as a fluid-filled bladder or a solid organ. Air-filled bowel may also limit these views. They rely on there being sufficient free fluid present to be imaged.

The Pleural Space Views—Each pleural space may be investigated via angulation and superior movement of the transducer along the ipsilateral flank. Abnormal fluid collections in the pleural space are visualized as anechoic collections above the echogenic diaphragm.

The Anterior Pleural Space View—The anterior visceral and parietal pleura may be analyzed through this view for free fluid. The pleura normally appose each other and slide on each other easily. Absence of this sliding and the potential separation of the pleura by a pneumothorax may be imaged typically in the second or third intercostal space with a higher-frequency near-field transducer, although lower-frequency transducers may also be used.

The Parasternal View—The parasternal window allows visualization of the heart in sagittal or transverse planes. This view is used in cases in which a patient's subcostal view is suboptimal.

***The Apical View*—**The apical view may allow visualization of pericardial fluid in the difficult patient by placing the transducer at the nipple line at the left fifth intercostal space and aiming it toward the spine or the right shoulder.

Other considerations for the FAST examination include the following points:

Trendelenburg or sitting positions may increase the sensitivity of the ultrasound examination for visualizing abnormal fluid.

A FAST ultrasound examination may be repeated during the patient's stay for reassessment of the patient's condition either routinely or because of sudden clinical decompensation.

As a caveat, one must remember that a trauma ultrasound examination provides a picture of a patient's condition at one point in time. It never eliminates the possibility of injuries or fluid collections that are below the detectable threshold of a well-performed ultrasound examination.

Further information may be obtained by referring to the *ACEP Ultrasound Imaging Criteria–Trauma*.

VI. Documentation

Focused sonograms, as all sonograms, require documentation. Whenever feasible, images should be created and stored as part of the medical record, and a full description of the findings is required. The analysis of findings on FAST examinations is limited to those areas assessed and imaged. In particular, a FAST analysis may not allow the diagnostic evaluation of all abnormalities in the chest, abdomen, or pelvis.

VII. Equipment Specifications

FAST examinations should be conducted with real-time scanners, preferably using sector or linear (curved or straight) transducers. The equipment should be adjusted to operate at the highest clinically appropriate frequency, realizing that there is a trade-off between resolution and beam penetration. For most preadolescent pediatric patients, mean frequencies of 5 MHz or greater are preferred, and in neonates and small infants, a higher-frequency transducer is often necessary. For adults, mean frequencies of 3.5 and 5 MHz are most commonly used. Occasionally, very large patients may require a lower-frequency transducer such as 2 MHz for analysis. When Doppler studies are performed, the Doppler frequency may differ from the imaging frequency. Diagnostic information should be optimized while keeping total ultrasound exposure as low as reasonably achievable.

VIII. Quality Control and Improvement, Safety, Infection Control, and Patient Education Concerns

Policies and procedures related to image quality, equipment performance monitoring, infection control, and patient safety as well as patient education with regard to the FAST examination should be developed and implemented in accordance with either the *AIUM Standards and Guidelines for the Accreditation of Ultrasound Practices* or the *ACEP Emergency Ultrasound Guidelines* and the *ACEP Ultrasound Imaging Criteria–Trauma*.

Authors

David Bahner, MD
Michael Blaivas, MD
Harris L. Cohen, MD
J. Christian Fox, MD
Stephen Hoffenberg, MD
John Kendall, MD
Jill Langer, MD
John P. McGahan, MD
Paul Sierzenski, MD
Vivek S. Tayal, MD

References

1. Tayal VS, Beatty MA, Marx JA, Tomaszewski CA, Thomason MH. FAST (focused assessment with sonography in trauma) accurate for cardiac and intraperitoneal injury in penetrating chest trauma. J Ultrasound Med 2004; 23:467–472.
2. McGahan J, Richards J, Fogata M. Emergency ultrasound in trauma patients. Radiol Clin North Am 2004; 42:417–425.
3. Jehle D, Guarino J, Karamanoukian H. Emergency department ultrasound in the evaluation of blunt abdominal trauma. Am J Emerg Med 1993; 11:342–346.
4. Kimura A, Otsuka T. Emergency center ultrasonography in the evaluation of hemoperitoneum: a prospective study. J Trauma 1991; 31:20–23.
5. McGahan JP, Rose J, Coates TL, Wisner DH, Newberry P. Use of ultrasonography in the patient with acute abdominal trauma. J Ultrasound Med 1997; 16:653–662.
6. Soudack M, Epelman M, Maor R, et al. Experience with focused abdominal sonography for trauma (FAST) in 313 pediatric patients. J Clin Ultrasound 2004; 32:53–61.
7. Hahn D, Offerman S, Homes J. Clinical importance of intraperitoneal fluid in patients with blunt intra-abdominal injury. Am J Emerg Med 2002; 20:595–600.
8. Blaivis M, Debehenke D, Phelan B. Potential errors in the diagnosis of pericardial effusion on trauma ultrasound for penetrating injuries. Acad Emerg Med 2000; 7:1261–1266.
9. Dolich M, McKenney M, Varela J, Compton RP, McKenney KL, Cohn SM. 2,576 ultrasounds for blunt abdominal trauma. J Trauma 2001; 50:108–112.
10. Scalea TM, Rodriguez A, Chiu WC, et al. Focused assessment with sonography for trauma (FAST): results from an international consensus conference. J Trauma 1999; 46: 466–472.
11. Plummer D, Brunnette D, Asinger R, Ruiz E. Emergency department echocardiography improves outcome in penetrating cardiac injury. Ann Emerg Med 1992; 21:709–712.
12. Melniker LA, Leibner E, McKenney MG, Lopez P, Briggs WM, Mancuso CA. Randomized controlled clinical trial of point-of-care, limited ultrasonography for trauma in the emergency department: the First Sonography Outcomes Assessment Program Trial. Ann Emerg Med 2006; 48: 227–235.