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Presentation

The utility of focused abdominal ultrasound in blunt abdominal trauma: a reappraisal

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Abstract

Background: Focused assessment with sonography for trauma (FAST) has become commonplace in the management of blunt abdominal trauma. However, newer computed tomography (CT) scanners have decreased imaging time for trauma patients and provide more detailed examination of abdominal contents. It was the aim of the current study to evaluate practice patterns of FAST and abdominal CT in blunt trauma victims.
Methods: This was a retrospective study of all blunt trauma patients (N = 299) who received at least 1 FAST examination in the emergency department by surgeons and were admitted. Patients were tracked for subsequent CT scanning, disposition from the emergency department, any operative findings, and survival.
Results: Twenty-one of 299 patients (7%) had a positive FAST. There were 7 deaths and 14 patients were taken directly to the operating room (OR) for control of abdominal bleeding. Thirty-one of 299 (10%) had equivocal FAST. There were 4 deaths and 8 patients were taken to the OR for control of abdominal bleeding. A total of 247 of the 299 patients had a negative FAST. CT scans were performed in 193: 15 showed a visceral injury. There were 13 deaths and 29 patients were taken to the OR (4 for bleeding). Patients with a positive FAST had a higher mortality than FAST-negative patients ($P < .001$) and greater likelihood for operation ($P < .001$). Those with equivocal FAST had a greater likelihood for operation than FAST-negative patients ($P < .05$).
Conclusions: FAST examinations can identify patients at risk for hemorrhage and in whom operation may be needed and, therefore, can guide mobilization of hospital resources. FAST-negative patients can be managed expectantly, using more specific imaging techniques. © 2007 Excerpta Medica Inc. All rights reserved.

Keywords: Blunt abdominal trauma; Trauma; Diagnostic ultrasound

Focused assessment with sonography for trauma (FAST) was popularized in the United States by Rozycki et al [1] in the early 1990s. Initial and follow-up experience indicated that FAST was accurate, non-invasive, and expeditious in assessing the critically injured patient in the emergency department (ED). The procedure could be performed by surgeons as well as radiologists with equal reliability [2–4] and was particularly useful in detecting blood in the abdominal cavity. As a result, FAST has largely supplanted diagnostic peritoneal lavage (DPL) in evaluating the trauma abdomen. Of late, the introduction of rapid sequence helical computed tomography (CT) has added a new dimension to the evaluation of trauma patients and has enabled surgeons to quickly assess the blunt trauma abdomen (in addition to head, spine, and chest) in more detail than can be obtained using FAST [5–7]. In fact, some investigators [8] have shown that there are no clinical parameters, including FAST, that can reliably exclude intra-abdominal injuries without performing CT, particularly in obtunded patients. Others [9] have demonstrated a low sensitivity to FAST and discordance between FAST and CT scans and have urged that FAST not be used alone to rule out intra-abdominal injuries. Importantly, in some, if not many EDs, CT scanners have been placed in close proximity so that trauma patients can be rapidly transported for CT examination and this imaging modality incorporated in the early secondary evaluation of injured patients, even to the point of near-routine "pan-scanning" [7].

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How useful, then, is FAST? As CT scanners become faster and more accessible, what role does FAST play in the initial evaluation of trauma patients? Through a retrospective analysis, we sought to examine the utility of FAST performed by surgeons during the primary survey in victims of blunt trauma in an era of expanding use of CT scanning. When there is invaluable definition with contrast-enhanced abdominal CT scan, does the rather gross assessment of the abdominal cavity by ultrasound still contribute to patient care or is it a diagnostic modality whose time has come and gone?

Materials and Methods

All cases of blunt trauma admitted to the Memorial Medical Center in Johnstown, PA over a 5-year period between 2000 and 2005 and who received a FAST examination in the ED on at least 1 occasion were reviewed. Information was obtained from the trauma registry, and only those patients were included in the study whose FAST results were clearly documented. The Memorial Medical Center Level I, or Regional Resource Trauma Center, is a Pennsylvania Trauma Systems Foundation verified trauma center serving a multicounty rural area in west central Pennsylvania. All patients were brought to a trauma resuscitation area where a team of healthcare providers conducted a primary survey, necessary resuscitation, and secondary survey in a standardized, methodical fashion. The FAST examination was performed during the primary survey, after an airway and adequate oxygenation/ventilation were established. Each patient for whom the trauma team was activated received a FAST examination. The FAST examinations were performed using 4 windows: subxiphoid, right upper quadrant, left upper quadrant, and suprapubic. The critical areas for intra-abdominal bleeding were the hepato-renal space (Morrison's pouch), the spleno-renal space, and the pelvic pouch of Douglas. The Sonosite 180Plus (Sonosite, Inc, Bothell, WA) with a 4-2 MHz transducer and Mediflat 15-color LCD monitor (Richardson Electronics, Ltd, Lafox, IL), kept in the trauma resuscitation area, was used for these examinations. The addition of a Mediflat color LCD monitor enhanced the ability to visualize intra-abdominal structures. General surgery residents performed the FAST examinations with attending surgeon supervision. There was no immediate radiology input or interpretation. The FAST examinations were classified as positive (clearly showing fluid on at least one view), equivocal (no critical views seen), or negative (good visualization in at least three windows, no fluid seen). No quantitative scoring system was used for the amount of fluid detected. The primary aim of the FAST examination was to detect intra-abdominal blood. Secondarily, the aim of FAST was to detect pericardial fluid/blood. There was no attempt to determine visceral organ injury. For purposes of analysis, the initial FAST examination was used even though, in a minority of cases, more than one FAST might have been done. ED deaths were not excluded as long as they received a FAST examination. The FAST examinations were performed by general surgery residents with an attending trauma surgeon present. The FAST examinations were interpreted on the spot and results recorded by the trauma nurse recorder and eventually entered into the trauma registry. The FAST examinations were performed in real time. There was no "second read" nor could radiologists provide a follow-up report.

CT scans of the head, chest, abdomen, and pelvis were performed when indicated, usually if the clinical examination was equivocal or unreliable, and if the patient remained hemodynamically stable. A General Electric 4-slice Lightspeed Plus scanner (General Electric Company, Piscataway, NJ) was used. Intravenous contrast only was used in chest, abdomen, and pelvis CT scans. The helical CT scanners were located adjacent to the ED on the same level. Patients were grouped into FAST-positive, FAST-equivocal, and FAST-negative. As a separate group unstable patients, defined as admitted to the ED hypotensive (systolic blood pressure $<$90 mm Hg), were analyzed. Disposition of the patients from the ED was then tracked. Need for emergency operation or any operation was recorded, and operative findings were noted.

Outcome measures consisted of live/die status. Where appropriate, chi-square analysis was performed with significance determined at $P < .05$. In this retrospective review, all patient identifiers were removed for purposes of analysis in compliance with the Health Insurance Portability and Accountability Act of 1996.

Results

Over a 5-year period between 2000 and 2005, a total of 5,294 patients were admitted to the trauma service. Initially, 324 patients were identified who had a FAST in the ED and whose results had been recorded in the trauma registry. Patients who had a FAST performed but the results had not been recorded were excluded (as all examinations were performed in real time, there was no ability to review the results). The study group, then, consisted of 299 patients who received at least 1 FAST examination in the ED with documented findings.

Of this group, 21 (7%) had a positive FAST indicating fluid (blood) in the peritoneal cavity (Fig. 1). Fourteen were taken to the operating room (OR), 10 without any further imaging studies, 4 receiving a CT scan before they were taken to the OR. Time to the OR for the 10 patients receiving only a FAST was 36 $\pm$ 13 minutes. The CT scans in the 4 patients who received them were all abnormal, showing obvious peritoneal hemorrhage. Ten of the 14 patients had more than 1 intra-abdominal or retroperitoneal injury (mean 2.6 injuries per patient). Seven of the 14 patients died, 6 in the OR, of exsanguination or irreversible shock (including 1 patient who received a CT scan at an outside hospital before going to the OR). Of the remaining 7 patients with a positive FAST, all received a CT scan. Five were admitted to the intensive care unit (ICU). In 4 of these 5 patients, the CT scan was abnormal (splenic injury in each). All were managed nonoperatively. Two were admitted to the surgical ward. All of these patients survived.

Thirty-one patients (10%) had an equivocal FAST. Of the 4 patients in this group who received only a FAST, all were taken to the OR (45 $\pm$ 18 minutes), and 3 died in the OR (exsanguination). The remaining 27 patients received a CT scan. Five were then taken to the OR, all of whom had evidence of splenic injury. All survived. Four other patients

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