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Do we really rely on fast for decision-making in the management of blunt abdominal trauma?☆

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ABSTRACT

Introduction: The Focused Assessment with Sonography in Trauma examination (FAST) is currently taught and recommended in the ATLS®, often as an addendum to the primary survey for patients with blunt abdominal trauma. Although it is non-invasive and rapidly performed at bedside, the utility of FAST in blunt abdominal trauma has been questioned. We designed this study to examine our hypothesis that FAST is not an efficacious screening tool for identifying intra-abdominal injuries.

Methods: We performed a retrospective chart review of all patients with confirmatory diagnosis of blunt abdominal injuries with CT and/or laparotomy for a period of 1.5 years (from 7/2009 to 11/2010). FAST was performed by ED residents and considered positive when free intra-abdominal fluid was visualized. Abdominal CT, or exploratory laparotomy findings were used as confirmation of intra-abdominal injury.

Results: A total of 1671 blunt trauma patients were admitted to and evaluated in the Emergency Department during a 1½ year period and 146 patients were confirmed intra-abdominal injuries by CT and/or laparotomy. Intraoperative findings include injuries to the liver, spleen, kidneys, and bowels. In 114 hemodynamically stable patients, FAST was positive in 25 patients, with a sensitivity of 22%. In 32 hemodynamically unstable patients, FAST was positive in 9 patients, with a sensitivity of 28%. A free peritoneal fluid and splenic injury are associated with a positive FAST on univariate analysis, and are the independent predictors for a positive FAST on multiple logistic regression.

Conclusion: FAST has a very low sensitivity in detecting blunt intraabdominal injury. In hemodynamically stable patients, a negative FAST without a CT may result in missed intra-abdominal injuries. In hemodynamically unstable blunt trauma patients, with clear physical findings on examination, the decision for exploratory laparotomy should not be distracted by a negative FAST.

Introduction

The detection of closed abdominal injury remains a challenge for trauma surgeons, especially when a patient presents with multiple trauma. Either false-positive or false-negative findings in the diagnosis carries a risk of severe complications. The Focused Assessment with Sonography in Trauma (FAST) is a non-invasive bedside test that can be performed in conjunction with resuscitation. The application of FAST has been taught in the Advanced Trauma Life Support® (ATLS®), and recommended as the screening tool of choice for early diagnostic investigations in patients with suspected blunt abdominal trauma. It has been used for more than 20 years [1], as an addendum to the primary survey. FAST is universally available in almost all trauma centres in the United States and other countries where ATLS has been adapted. Ultrasound is portable and can be repeated throughout resuscitation and during any period of observation. The ultrasound based clinical pathways enhance the speed of primary trauma assessment, reduce the exposure of ionizing radiation and cut costs. However, the role of FAST in the diagnosis of intraabdominal injuries has not been well established. FAST compares unfavourably with computed tomography (CT) in the diagnosis of blunt intraabdominal injuries. Thus far, it is not clear whether FAST can be safely used as a tool for identifying intraabdominal injuries and obviating the use of CT before a laparotomy is performed.

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We therefore performed this retrospective study to evaluate whether FAST examination is reliable as a primary tool for the assessment of intraabdominal injury and to determine if a CT scan can be obviated before the decision-making of management of patients with blunt trauma. Our hypothesis is that FAST examination is not reliable for decision-making in the management of patients with blunt abdominal trauma.

Materials and methods

This study was approved by the institutional review board (IRB) of the University at Buffalo, the State University of New York. We retrospectively identified consecutive patients with intraabdominal injuries from our Trauma Registry from July 2009 through December 2010. These patients were identified with the International Classification of Diseases (ICD, 9th edition) diagnosis codes of intra-abdominal injuries, including 863 (GI), 864 (liver), 865 (spleen), 866 (kidney), 867 (pelvic organs), 868 (other abdominal). In other words, these patients had a confirmed diagnosis of blunt abdominal injury by either CT scan or laparotomy. We did not include diaphragmatic injury, pelvic fractures, retroperioneal (pancreatic and adrenal) injuries as well as vascular injuries into our study since sonography has limited utility in the trauma setting for these injuries [2]. The patients' medical records were reviewed. The exclusion criteria included patients age younger than 18 years and with a penetrating abdominal injury. Variables collected included demographics, mechanism of injury, vital signs, laboratory results, injuries, FAST exam results, CT scan results and intraoperative findings.

At our institution, all patients with a blunt trauma underwent FAST examinations with a Sonosite Titan portable ultrasound device during the primary or secondary survey. The FAST examinations were performed by the Department of Emergency Medicine residents with postgraduate training levels ranging from years 1 to 3. The examination was supervised and reports were co-signed by emergency department attending physicians who were credentialed to perform and interpret FAST results. All of the emergency department residents had undergone FAST in-service training before performing beside FAST. The training included didactic instruction followed by training using live models. Three views (the Morrison pouch, the splenorenal junction, and the pelvis) were routinely used to evaluate for hemoperitoneum. A fourth pericardial view was used to evaluate for hemopericardium. The FAST were considered positive when free intraperitoneal fluid was visualized. These findings were documented in the medical records. Abdominal CT scan or exploratory laparotomy findings were used as standard confirmatory test for intra-abdominal injury. Decision for CT scan was based on the emergency department or surgical trauma team's discretion, after evaluating the mechanisms of injury. The two CT scanners used in our institution were Siemens SOMATOM 64 and Philips Brillance CT (64 slice). With both scanners, intravenous contrast (Omnipaque 350 IV) was given at 100 cc at 3–4 cc/s for all trauma patients. No oral contrast was used. The radiologist readings were performed by our staff radiologists during between the hours of 08:00 am–11:00 pm. During the hours of 11:00 pm–08:00 am, the images were wet-read by a nighthawk radiologist, and reviewed by our staff radiologist during office hours. Exploratory laparotomy was the decision of and performed by the trauma team.

The study was divided into two groups according the haemodynamics. We define haemodynamical instability as a worse reading of systolic pressure <90 mmHg within the first 2 h in the ED. We strictly followed the ATLS® (Advanced Trauma Life Support) guidelines for resuscitation for hypotensive patients. In our study, 2 patients initially presented with normal vital signs but subsequently became unstable with tachycardia and hypotension. They were immediately taken to the operating room for exploratory laparotomy. Our study does not include those blunt abdominal trauma patients without a FAST.

The CT scans in the Picture Archiving and Communications System (PACS) and degree of solid organ injuries were also scored using Injury Scoring Scales from the American Association for the Surgery of Trauma (AAST) website (http://www.aast.org/Library/TraumaTools/InjuryScoringScales.aspx). The amount of peritoneal effusion was quantified using the Federle score [3] by counting the number of compartments affected by the spread of blood. Seven compartments in the peritoneal cavity were considered: Morison's pouch, perihepatic space, perisplenic space, two pericolic gutters, floating intestinal loops, and the Douglas's pouch. A hemoperitoneum was categorized as minimal if one compartment was affected by the effusion, moderate if there were two compartments affected, and large if three or more were affected.

Statistical analysis

All data underwent statistical analysis using Minitab 16 statistical software (State College, PA). Dichotomous data were analyzed by χ^2 analysis with Yates's correction; continuous data were analyzed by Student's t test. Multiple logistic regression statistical analysis using a forward stepwise procedure was conducted to determine predictors of a positive FAST and need for emergent exploratory laparotomy. Any values of $p < 0.05$ were considered statistically significant for any test.

Results

For the 1½ year study period, 1671 blunt trauma patients were admitted to and evaluated in the Emergency Department at our institute with an average ISS score of 23. A total of 142 patients were confirmed with CT scan (53 of them underwent surgical interventions), and 4 patients were confirmed only with intraoperative findings of blunt intraabdominal injuries without CT scan (Fig. 1). Of those 32 hypotensive patients with intraabdominal injury, three patients were directly taken to the operating room for exploratory laparotomy after the primary survey and FAST, because they were the "non-responders" to fluid resuscitation, with persistent hypotension and tachycardia during the secondary survey. Of note, one of these patients had an initial FAST exam that was equivocal, and the second FAST was positive. One of the patient in the normotensive group also bypassed CT scan and was directly taken to the operating room for exploratory laparotomy because of severe acidosis and peritonitis. Mechanisms of injury among these patients included motor vehicle collision (MVC, 42%), motorcycle crash (MCC, 15%), fall from height (16%), pedestrian-auto collision (8%), and other (19.0%).

The characteristics of 142 patients with positive and false negative FAST are shown in Table 1. There was no difference between the true positive and false negative groups in terms of gender, age, the injury severity score (ISS), hemodynamical instability, the Glasgow coma scale (GCS), hospital length of stay (LOS), as well as mortality. However, the need for laparotomy was significantly higher in the true positive groups than the false negative group ($p < 0.001$). The indications for interventions are shown in Table 2. Thirty-two out of All 33 patients underwent therapeutic laparotomy. The other patient underwent laparotomy because of signs of hemo- and pneumo-peritoneum, as well as liver laceration on CT scan. On laparotomy, two hemostatic liver lacerations were identified, as well as a detachment of the ascending colon from the lateral peritoneum. All these findings and injury did not require further operative intervention.