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An abdominal computed tomography may be safe in selected hypotensive trauma patients with positive Focused Assessment with Sonography in Trauma examination

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Abstract

BACKGROUND: Positive Focused Assessment with Sonography in Trauma examination and hypotension often indicate urgent surgery. An abdomen/pelvis computed tomography (apCT) may allow less invasive management but the delay may be associated with adverse outcomes.

METHODS: Patients in the Prospective Observational Multicenter Major Trauma Transfusion study with hypotension and a positive Focused Assessment with Sonography in Trauma (HF+) examination who underwent a CT (apCT+) were compared with those who did not.

RESULTS: Of the 92 HF+ identified, 32 (35%) underwent apCT during initial evaluation and apCT was associated with decreased odds of an emergency operation (odds ratio .11, 95% confidence interval .001 to .116) and increased odds of angiographic intervention (odds ratio 14.3, 95% confidence interval 1.5 to 135). There was no significant difference in 30-day mortality or need for dialysis.

CONCLUSIONS: An apCT in HF+ patients is associated with reduced odds of emergency surgery, but not mortality. Select HF+ patients can safely undergo apCT to obtain clinically useful information.

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Expeditious control of hemorrhage is an imperative in high-quality trauma care and is associated with improved mortality.[1,2] This imperative to control hemorrhage places a critical emphasis on rapid and accurate diagnosis of injuries. An optimal diagnostic algorithm for abdominal trauma, however, remains in evolution.[3–5]

Traditional diagnosis of intra-abdominal injuries relied on physical examination and diagnostic peritoneal lavage, techniques hampered, respectively, by low sensitivity and low specificity.[6–10] Helical computed tomography (CT) has evolved to become a standard evaluation tool for the diagnostic imaging of abdominal trauma but is limited by concerns over radiation and contrast exposure as well as the logistical challenges of transporting an unstable patient to the radiology suite.[5,11,12] The Focused Assessment with Sonography in Trauma (FAST) examination was developed to provide a rapid, inexpensive, and repeatable bedside tool to evaluate abdominal injuries. Despite concerns over a low sensitivity and operator dependence, a positive FAST examination is specific for intraperitoneal fluid and in the setting of hemodynamic instability, and has been considered an indication for an immediate laparotomy.[5,10,13–18] Despite this sensitivity for hemoperitoneum, FAST examination may not correlate well with the need for an emergent operation.[2]

The advent of angiography and nonoperative management (NOM) of select blunt intra-abdominal injuries along with an evolving understanding of the implications of a nontherapeutic trauma laparotomy has highlighted the importance of balancing speed and accuracy of diagnosis.[19–21] It is no longer necessary to rush every patient with hemoperitoneum to the operating room (OR) and it has been suggested that patients who can be transiently stabilized are candidates for CT evaluation.[22] It is unclear if this delay in definitive care is associated with adverse outcomes and if the information obtained from a CT scan alters clinical decision making.

We therefore sought to determine if patients who were initially hypotensive and who undergo an abdomen and pelvis CT scan following a positive FAST examination have similar long-term outcomes and less urgent operations than patients who do not undergo a CT.

Patients and Methods

Data were obtained from a database created by the Prospective Observational Multicenter Major Trauma Transfusion (PROMMTT) study Data Coordinating Center at the University of Texas Health Science Center at Houston. PROMMTT enrolled 1,245 injured patients who required the highest level activation at one of the 10 Level I trauma centers and who subsequently received one or more units of red blood cells (RBCs) within 6 hours of hospital admission. Exclusion criteria included: patient age younger than 16 years, transfer from another hospital, pregnancy, more than 20% burn injury, inhalation injury, incarceration, cardiopulmonary resuscitation lasting more than 5 minutes occurring prehospital or in the first 30 minutes after admission, and death within 30 minutes of hospital admission. Data were collected in real time on a wide variety of patient characteristics, including fluid and blood product infusions, diagnostic studies, and surgical interventions. The time of mortality or hospital discharge was recorded. Approval was obtained from the institutional review board at each center and from the US Army Human Research Protections Office.[23,24]

Patients who had a positive FAST examination along with hypotension, defined as an admission systolic blood pressure (SBP) less than or equal to 90 mm Hg, were identified. An urgent operation was defined as direct admission to the OR less than 3 hours from presentation. This longer time was chosen to allow for the inherent delay in obtaining a CT scan during trauma workup. Patients who went to the CT were compared with those who did not. Data are presented as medians with 25th and 75th percentile. Univariable comparisons were made with Fisher's exact test and a Mann–Whitney U test for categorical and continuous variables, respectively.

Multivariable comparisons were made with binary logistic regression. Variables were selected for inclusion based on clinical feasibility and selected for inclusion in the multivariable model using backwards stepwise elimination to select relevant variables.

To control for the fact that this study did not prescribe the management of hypotensive patients with a positive FAST examination and the likely fact that patients who went to CT differed from patients who did not go, we derived a propensity score to undergo CT. This was done by constructing a binary logistic regression model with backwards stepwise elimination to select variables that were independently associated with undergoing CT. The propensity score was a conditional probability, between 0 and 1, that a patient would undergo CT based on these variables. This allowed collection of confounding variables into a single propensity that was then used as an independent predictor in binary logistic modeling.[25] These propensity scores for CT and splenectomy were then used as independent variables in binary logistic models to determine independent associations with either operative or angiographic intervention. Results are presented with odds ratio (OR) and 95% confidence intervals (CIs). Statistical analysis was performed using SPSS (IBM Corporation, Armonk, NY) v22.0. Significance was set at P value less than .05.

Results

We identified 255 patients with a positive FAST examination, of whom 46% subsequently went to CT; demographics of this group are presented in Table 1. We subsequently identified 92 patients, 7% of the total population, with admission hypotension and a positive FAST examination. In this group, 32 (35%) patients underwent CT during their initial trauma