Accuracy of E-FAST in Diagnosing Traumatic Pneumothorax in the ED

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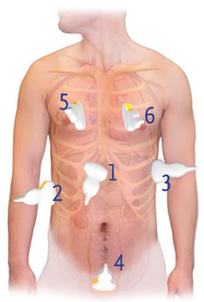
Intro

The incidence of pneumothorax (PTX) in poly trauma may be as high as 20%. E-FAST is a diagnostic tool that utilizes ultrasound to rapidly identify major traumatic injuries at the bedside in trauma patients. We identified major trauma activations at a suburban Level 1 trauma center in which point of care ultrasound (POCUS) was performed by an emergency department provider. We assessed its ability to identify clinically significant PTX as compared to CXR findings. Clinically significant PTX was defined as tube thoracostomy placed within 2 hours.

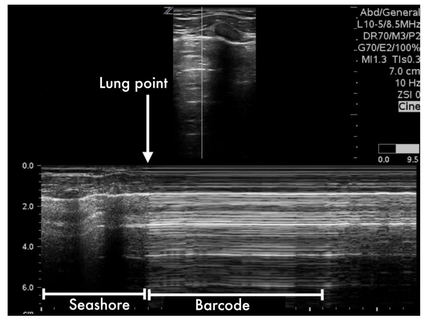
Materials & Methods

A retrospective chart review was performed. All full adult trauma activations (see Code T criteria below) that were admitted from 2019-2022 were included. Exclusion criteria included traumatic arrests, transfers from outside hospitals, and those without a POCUS exam performed. 541 subjects were included and evaluated for the presence or absence of tube thoracostomy, and accuracy of POCUS based on the training level of providers. 87% of patients evaluated had blunt trauma as their mechanism of injury. 100% of POCUS exams were reviewed by the US director and ultrasound fellowship trained faculty member for accuracy of the data.

E-FAST

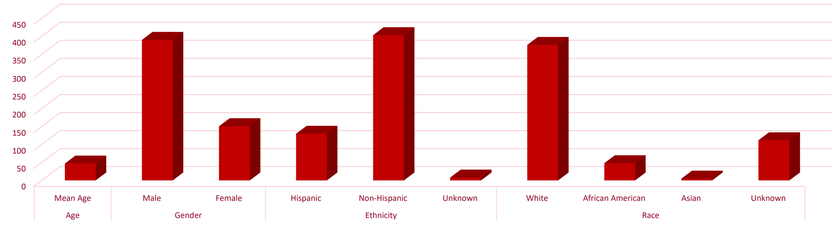


1. Pericardium
2. Right upper quadrant
3. Left upper quadrant
4. Suprapubic area
5. Right anterior thoracic
6. Left anterior thoracic



The E-FAST (Extended Focused Assessment with Sonography for Trauma) is a point of care ultrasound study that assesses for traumatic intraperitoneal, intrapleural, and pericardial fluid, as well as traumatic PTX. Pictured on the right is a lung POCUS indicating a PTX. Normal lung on M-mode resembles a “seashore” or “sandy beach”. Pneumothorax is indicated by the bar code sign where there is no lung tissue.

Demographics



CODE T Criteria

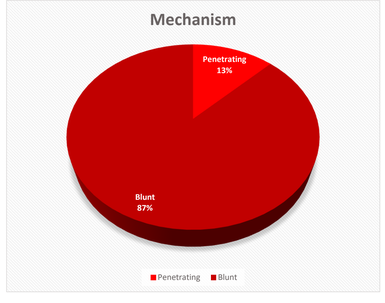
Traumatic mechanism AND injury within 48 hours AND patient ≥ 17 years old

With at least one of the following:

- Cardiac arrest after trauma
- Airway obstruction or compromise (RR < 8)
- Confirmed BP < 90 mmHg at at time
- Intubated, or with advanced airway from scene
- Penetrating injury to the head, neck, chest, or abdomen
- GCS ≤ 8 with mechanism attributed to trauma
- Spinal cord injury or limb paralysis
- Amputation above the wrist or ankle

GERIATRIC CONSIDERATIONS (≥ 65 years old)

- Confirmed SBP < 110 or HR >120



RESULTS	
Total trauma patients	541
Injury Severity Score	16 ± 3
Pneumothorax	76 (14%)
Chest tube for PTX (n)	53
Chest tube for clinically significant PTX	40
CXR sensitivity	47%
POCUS sensitivity (overall)	41%
POCUS sensitivity clinically significant PTX overall	68%
POCUS PPV for clinically significant PTX	100%
POCUS false negative rate	30%

Results

The total PTX rate during the study period was 14%. A chest tube was required in 70% of patients with PTX. The overall sensitivity of POCUS for detection of PTX was similar to CXR. POCUS sensitivity increased with level of training of the person performing the study. POCUS had a high PPV for diagnosing clinically significant PTX. Quality review showed that 12 total PTX were missed on POCUS with 6 of those being clinically significant. If POCUS sensitivity was adjusted for quality review interpretation, the overall sensitivity for diagnosing PTX improved from 41% to 57% and improved further to 84% for clinically significant PTX.

Discussion

E-FAST is an excellent adjunct to our primary and secondary survey in trauma patients. Our study showed that when looking at all PTX in our cohort, CXR and POCUS had comparable sensitivities. When adjusted for clinically significant PTX, POCUS sensitivity significantly increased. This means small apical PTX that ultimately did not require a tube thoracostomy potentially were missed on POCUS. This contributed to the POCUS false negative rate, however the clinical significance of the PTX that were missed on POCUS is questionable. We also saw that as provider training level increased, the sensitivity of POCUS for PTX also increased. It is important to note that less experienced providers will have higher false negative rates and potentially miss clinically significant PTX. This illustrates why it is important to have providers at all levels participating in the E-FAST exam. Based on this data it can be concluded that POCUS should be done on all major trauma patients as it is a quick and inexpensive way to diagnose clinically significant PTX. However, more focus on provider training and image interpretation could improve POCUS sensitivity.

References

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