Accuracy of Point of Care Ultrasound in the Detection of Pneumothorax in Pediatric Trauma Activations

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Background

Trauma is one of the leading causes of morbidity and mortality in children and adults. Point of care ultrasound (PoCUS) can rapidly identify life threatening injuries requiring urgent intervention. Imaging with PoCUS has increased sensitivity in detection of occult pneumothorax as compared to chest x-ray (gold standard being CT or procedure). Despite widespread application of PoCUS in adult trauma, its application and accuracy has not been adequately studied in the pediatric population. Particularly, when evaluating if urgent interventions such as thoracostomy are performed based solely on pneumothorax identification with PoCUS.

Objectives

- The primary objective of this study is to evaluate the accuracy of PoCUS in diagnosing pneumothorax in a cohort of pediatric trauma patients requiring the highest-level trauma activation.
- Additionally, we sought to evaluate the accuracy of PoCUS in diagnosis of pneumothorax requiring decompression with thoracostomy.

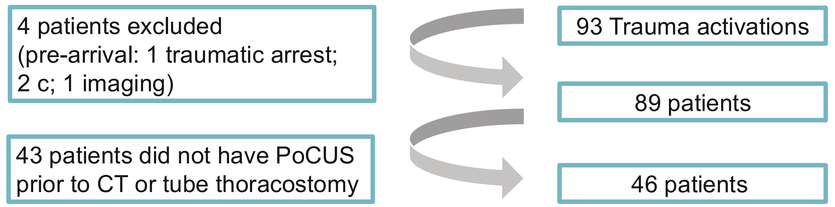
Methods

- Retrospective observational cohort study from a regional suburban Level 1 adult and pediatric trauma center using records identified from the Suffolk County, NY trauma registry
- Patients < 17 years who presented to the ED between June 1, 2019 and October 31, 2022, and were designated with the highest-level pediatric trauma activation.
- Exclusion criteria: patients receiving chest imaging prior to arrival, those who underwent needle decompression or tube thoracostomy prior to arrival, those in traumatic arrest.

Results

Sample Characteristic	Cases* (n= 46)	No PTX (n = 45)	PTX on PoCUS (n = 1)	PTX on CXR (n = 1)	PTX on CT (n = 1)	Tube Thoracostomy (n = 1)
Sex						
Male	32 (70%)	31	1	1	1	1
Female	14 (30%)	14	0	0	0	0
Ethnicity						
Hispanic	21 (46%)	20	1	1	1	1
Non-Hispanic	25 (54%)	25	0	0	0	0
Race						
White	21 (46%)	20	1	1	1	1
African American	7 (15%)	7	0	0	0	0
Unknown	18 (39%)	0	0	0	0	0
Mechanism of injury						
Fall	8 (17%)	8	0	0	0	0
MVC/MVA	15 (33%)	15	0	0	0	0
Struck by object	7 (15%)	7	0	0	0	0
Cut/pierce	3 (7%)	2	1	1	1	1
Firearm	3 (7%)	0	0	0	0	0
Pedal cyclist	5 (11%)	5	0	0	0	0
Pedestrian	2 (4%)	2	0	0	0	0
Drowning	2 (4%)	2	0	0	0	0
Other	1 (2%)	1	0	0	0	0

Population



Analysis

Mean age 10 yrs (SD=5 yrs)
67% Male
10% Penetrating trauma
4% Overall incidence of PTX

Sensitivity of PoCUS for PTX 100% (95% CI 0.057-1.0)
Specificity 100% (0.979-1.0)
Positive predictive value 100% (0.057-1.0)
Negative predictive value 100% (0.979-1.0)
Sensitivity of PoCUS for PTX requiring intervention 100% (95% CI 0.057-1.0)

Discussion and Conclusions

- In a population of patients <17 years of age meeting the highest trauma activation criteria, PoCUS can rapidly identify patients who present with occult pneumothorax.
- The NPV of PoCUS performed prior to other imaging may be sufficient to exclude clinically significant pneumothorax without additional ionizing radiation, which is especially beneficial in the pediatric population.
- Utilizing PoCUS could reduce timing to critical interventions and rapidly assess dynamic changes in the patient's clinical condition.
- Given the lack of pediatric patients with pneumothorax in this study who met inclusion criteria, further prospective studies are needed with a larger population to better quantify the benefits of PoCUS in the pediatric trauma population and assess its ultimate utility, particularly regarding patients who would receive a thoracostomy.
- PoCUS was not universally performed in evaluation of pediatric trauma patients.
- PoCUS imaging was not available for review on all patients and some cases were based on documentation.

References

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