UTILITY OF POINT OF CARE ULTRASOUND IN PEDIATRIC TRAUMA MANAGEMENT IN EMERGENCY DEPARTMENT

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INTRODUCTION

Trauma is the leading cause of morbidity and mortality in children of all age groups. Focused assessment with sonography for trauma (FAST) exam is not routinely an integral part of initial evaluation of pediatric trauma patients despite its wide spread use in adult patients. This might be attributed to lack of any randomized clinical trial. Computed Tomography (CT) is the gold standard modality for evaluation of pediatric trauma but, it is expensive and carries risk of malignancy due to exposure to ionizing radiation. There is limited evidence on test characteristics of Point of care ultrasound (POCUS) for diagnosing pneumothorax in pediatric population. POCUS might be an adjunct that increases the precision of clinical decision rules for CT in pediatric patients with head trauma but, further research is needed.

But, the question remains open, as how reliable it is for clinical decision making concerning pediatric trauma.

AIM OF THE WORK

The aim of this study was to investigate the diagnostic accuracy of point of care ultrasound in pediatric trauma management and its impact on early therapeutic interventions.

PATIENTS AND METHODS

This prospective cohort study was conducted on convenience sample of 60 patients from November 2022 till September 2023 in Emergency Department of Alexandria Main University Hospital. All pediatric trauma patients (age < 18 years) admitted during working shifts of the study conductors were enrolled in the study with no selection bias. Exclusion criteria were: patients with isolated head trauma, post cardiac arrest patients and those who presented > 24 hrs from trauma. Informed consent was taken from patients guardians. The study was done by three emergency physicians who were point of care ultrasound (POCUS) certified with at least 2 years' experience in emergency ultrasound before conducting the study. Ethical approval was granted from Alexandria University ethical Committee (Reference number 0107568).The following ultrasound examinations were performed:

Focused Assessment with Sonography for Trauma (FAST)

Lung ultrasound to detect presence of pneumothorax, hemothorax and lung contusions

Optic nerve sheath diameter (ONSD) to detect increased intracranial pressure.

Index test: This includes point of care ultrasound to the chest, abdomen and optic nerve sheath diameter done by emergency physicians.

Reference standard and rationale: Chest x ray or CT chest for chest US as routine use of CT chest for evaluation of blunt chest trauma in pediatrics does not add useful information beyond to that obtained from chest X ray also; it leads to significant radiation exposure with subsequent cancer development. Ultrasound or CT abdomen and pelvis performed by radiologist.

Outcome measures: Index test was compared against reference standard to detect its diagnostic sensitivity, specificity, accuracy, agreement, Positive and negative predictive value negative. Implementation of POCUS in pediatric trauma management was measured as the number of cases which had their management altered after conducting the scan and before performing the reference standard tests. This was in the form of chest tube insertion, emergency laparotomy, early blood product use, use of measures to decrease intracranial pressure and judicious fluid administration.

Data were collected and entered to the computer using SPSS (Statistical Package for Social Science) program for statistical analysis (ver 25).

RESULTS

We recruited 60 patients. Forty cases were males (66.67%)) while, twenty were females (33.33%). The minimum age for the studied cases was one Month and the maximum age was 16 years. The median age was 6 years 95% CI (5-9 yrs.), 25th Percentile – 75th Percentile (4-10 yrs.) There was a substantial agreement (Kappa=0.663) between FAST done by emergency physicians and the results of Reference Standard, as shown in table (1). Reference standard tests were ultrasound done by radiologist in 28.33 % of cases, CT abdomen and pelvis without contrast in 48.33%cases and CT abdomen and pelvis with contrast in 23.33% cases. Sensitivity of FAST examination was 75.61% at 95% CI (59.70% to 87.64%) with specificity and PPV of 100% at 95% CI (82.35% to 100.00%) and (88.78% to 100.00%) respectively and accuracy of 83.33% NPV of 65.52% with 95% CI (52.57% to 76.51%)

		Reference Standard		
		Positive	**Negative)**	**Total**
FAST by Emergency physician	**Positive**	31 (51.67%)	0 (0.00%)	31 (51.67%)
	Negative	10 (16.67%)	19 (31.67%)	29 (48.33%)
	Total	41 (68.33%) 95% CI (54.91-79.40)	19 (31.67%)	60 (100.0%)
Kappa Standard error p value		0.663 0.092 <.001*		
Weighted kappa Standard error 95% CI		0.663 0.091 0.483 – 0.842		

There was an almost perfect agreement (kappa =0.870, 95% CI: 0.728-1.000), between chest Ultrasonography results done by emergency physician and the results of reference standard for detection of either pneumothorax, hemothorax or lung contusions as demonstrated in table (2). Chest x – ray was the reference standard in 21.67 of cases while, CT chest in 78.33 of them. Lung ultrasound carried out by emergency physicians had 100% specificity and positive predictive value for detection of lung contusion as compared to CT chest with 95% CI86.28% to 100.00% and 79.41% to 100.00% respectively while sensitivity and negative predictive value were 72.73% and 80.65% at 95 % CI 49.78% to 89.27% and 67.80% to 89.18% respectively

Table 2: Agreement between results of Ultrasound Chest by Emergency physician (Index) and Results of Reference Standard test

		Reference Standard		
		Positive	**Negative)**	**Total**
Ultrasound chest by Emergency physician	**Positive**	14 (23.33%)	0 (0.00%)	14 (23.33%)
	Negative	3 (5.00%)	43 (71.67%)	46 (76.67%)
	Total	17 (28.33%) 95% CI (54.91-79.40)	43 (71.67%)	60 (100.0%)
Kappa Standard error p value		0.870 0.072 <.001*		
Weighted kappa Standard error 95% CI		0.870 0.072 0.728 – 1.000		

CONCLUSION

Point of care ultrasound had high accuracy as compared to the gold standard tests in pediatric trauma patients. Pediatric trauma ultrasound had a significant role in rapidly diagnosing unstable patients and implementation of life saving interventions.