



DIAGNOSTIC ROLE OF ULTRASOUND AND CHEST XRAY IN COMPARISON TO SOLE CHEST XRAY IN ACUTE RIB FRACTURES

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Dissertation submitted to the Society for Emergency Medicine India In Partial Fulfilment of the requirements for the Degree of CCTEM in Emergency Medicine

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Date of Submission: 27-10-2024

Date of Acceptance: 07-11-2024

ABSTRACT

Introduction

Rib fractures are one of the most common chest wall injuries due to blunt chest trauma. Ultrasound promises a quick, radiation free, conveniently repeatable alternative to chest Xray for diagnosis of rib fractures in blunt chest trauma. Most ERs are well equipped with a portable ultrasound machine, which scrubs need for physical relocation of patients, as is required for Xray diagnosis. Though ultrasound poses certain faults diagnoses wise, for example factors posing variability between patients and fracture sites as in difficulty visualising subscapular/infraclavicular rib segments, impediment due to breast tissue/ in obese patients; it has found to be more sensitive than conventional chest radiography for diagnosis of rib fractures, especially sternal and costal cartilage injuries. Evidences for bony injury on ultrasound are detected by a disruption in anterior echogenic margin, linear acoustic edge shadow/focal hematoma. With increasingly more procedures and diagnostic modalities in ER utilising ultrasound compounded with the weight of evidence favouring its use in rib trauma diagnoses – it is promising to appraise the practice.

Aim

In this study we aimed to study the diagnostic utility of POCUS in acute rib injury.

Methodology

Rib fractures are evidenced on ultrasound by disruption in anterior echogenic margin, loss of linear acoustic shadow, focal hematoma and on X-ray from cortical disruption.

Data collected is recorded on the data sheet and compared. Data collected over the 2 years of study duration compiled. Confidentiality of all patients duly maintained.

Result:

The study comprised 200 participants, with a notable concentration (29%) in the 65-74 age group, and a predominant male majority at 60%. The ultrasound accuracy rates were impressive: the B profile demonstrated 97.46% sensitivity for pulmonary edema, while the normal profile achieved 96.59% sensitivity for COPD and asthma. The A profile plus venous thrombosis exhibited 88.23% sensitivity for pulmonary embolism, and indicators like absent anterior lung sliding, anterior A-lines, and a positive lung point search yielded 87.5% sensitivity for pneumothorax. Pneumonia sensitivity reached 96.875% with the A profile plus PLAPS. These findings underscore the efficacy of ultrasound in diverse respiratory conditions.

Conclusion:

Our Study concludes that the application of the BLUE protocol in acute dyspneic Emergency Department (ED) patients is reliable. To enhance diagnostic effectiveness in EDs, it is advised to adapt the BLUE protocol specifically for evaluating pleural and pericardial effusions.

I. MATERIALS AND METHODS

This was a single centred Prospective, Observational study hospital based study. Planned to be performed in the Emergency department of PRS Hospital, Trivandrum with all advancements, well trained staffs and faculties to handle all medical and surgical emergencies 24 x 7, with Dr .Ashish Salim as Deputy Chief and Consultant and mentor. The study period was 1 year, starting from Jan 2023 to Jan 2024

Study period: 1 year.



Sample size:

With this the sample size was calculated using the formula
 $N = 4pq / d^2$
 $N = 4 \times 90(100-95) / 5^2$ N = 144
 where n is the sample size, p is the prevalence, q is 100-p, d is the absolute precision which will be taken as 5%. So an approximate of 200 patients who presented with breathlessness.

These items will be assessed:

1. Rib fractures detected on POCUS
2. Rib fractures detected by Chest Xray
3. Rib fractures on final CT Chest

The diagnosis of rib fractures by POCUS was established without interrupting management protocol. Diagnosis established in hospitalisation reports using standardized test by other clinician.

Inclusion Criteria

Acute cases of blunt chest trauma with suspected rib injury as evidenced by increased chest wall pain on cough, inspiration, change in position, breathing difficulty.

Exclusion Criteria

Severe or penetrating chest trauma, unstable haemodynamics Lack of consent

Table 3 USG findings distribution of the patients and their percentages

USG Findings	Frequency	Percent
Negative Findings	48	33.8
Positive Findings	94	66.2
Total	142	100.0

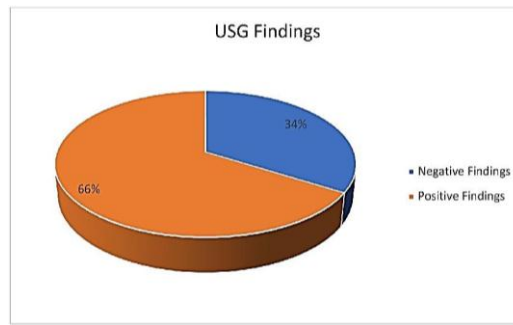


Table 4 Chest Xray Findings distribution of the patients and their percentages

Chest Xray Findings	Frequency	Percent
Negative Findings	62	43.7
Positive Findings	80	56.3
Total	142	100.0

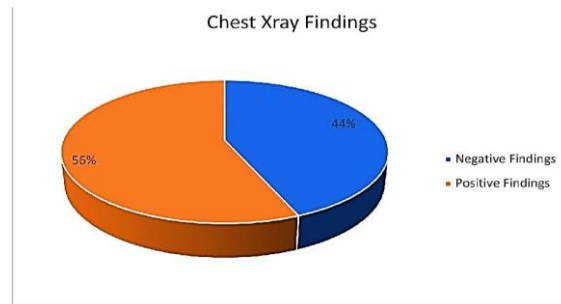
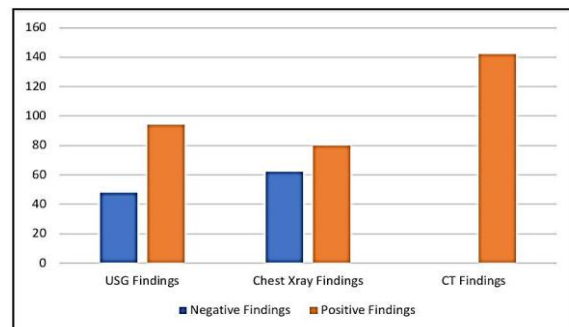


Table 10:- Comparing the fracture detection results across ultrasound (USG), chest X-ray, and CT imaging

Fracture Detection	Negative Findings	Positive Findings
USG Findings	48	94
Chest Xray Findings	62	80
CT Findings	0	142





Comparing the fracture detection results across ultrasound (USG), chest X-ray, and CT imaging modalities reveals notable differences in their efficacy.

Starting with USG findings, out of 142 cases examined, it identified 94 positive findings and 48 negative findings. This indicates a higher sensitivity in detecting fractures compared to chest X-ray, which reported 80 positive findings out of 142 cases, with 62 cases being negative. CT imaging, on the other hand, showed the most impressive results with all 142 cases presenting positive findings and none negative. This suggests CT as the most sensitive modality for detecting fractures among the three.

While USG and CT imaging demonstrate high sensitivity, it's also important to consider their accessibility, cost effectiveness, and any potential risks associated with radiation exposure, especially in the case of CT scans. Chest X-rays, although less sensitive in this context, still play a valuable role in initial screening due to their widespread availability, lower cost, and minimal radiation exposure.

In summary, CT imaging emerges as the most sensitive modality for fracture detection, followed by ultrasound, and then chest X-rays.

II. CONCLUSION

In conclusion, the study provides a comprehensive analysis of diagnostic findings across different imaging modalities in a sample of 142 individuals. The demographic distribution indicates a predominant age group of 31-60 years, with a slight male predominance. USG and chest X-ray findings revealed varying proportions of negative and positive results, while comparisons between CT scans and other modalities demonstrated significant differences in detecting haemothorax, pneumothorax, and fractures. Overall, CT imaging emerges as the most sensitive modality for fracture detection, followed by ultrasound, with chest X-rays being less sensitive. These findings underscore the importance of selecting appropriate imaging techniques based on diagnostic needs and patient characteristics.