

Comparative Analysis of Lung Ultrasonography and Chest Radiography in Suspected Cases of Pneumonia in Critically Ill Patients

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Abstract

Background: The present study compared lung ultrasound (USG) and chest radiography in alleged cases of pneumonia in seriously ill patients. **Subjects and Methods:** A total of 70 subjects attending to the emergency room with symptoms of pneumonia and those were admitted in ICU with a suspicion of pneumonia over an eighteen month period were included in this study. Patients then underwent imaging studies in the form of chest radiograph and lung ultrasound. **Results:** Out of 70 subjects, males were 39 and females were 31. Age group 20-30 years had 4 patients, 30-40 years had 6, 40-50 years had 10, 50-60 years had 16 and >60 years had 20 subjects. The dissimilarity was significant ($P < 0.05$). Chest x ray revealed 50 out of 70 cases positive and 20 negative and USH showed 65 positive and 5 negative. Positive predictive value (PPV) of chest x-ray was 71.4% and USG was 92.8%. **Conclusion:** Authors found that lung ultrasound is an effective radiological implement for the assessment of suspected cases of pneumonia as compared to chest x-ray.

Keywords: Chest x-ray, lung ultrasound, Pneumonia, Positive predictive value

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Introduction

Pneumonia is defined as consolidation of lung parenchyma produced by inflammatory exudates, usually by an infectious agent. It is a foremost reason of death in the third world, among the very old, the very young and the chronically ill patients.^[1] Pneumonia is most important reason of death worldwide, and in low-income countries, it is the most important reason of mortality. The analysis of pneumonia is not forever obvious on arrival to health care amenities.^[2]

Imaging plays a vital role in premature analysis of pneumonia as the clinical presentation is not forever obvious at the time of arrival to the emergency department. Imaging methods are necessary for optimizing analytic and therapeutic events in the management of critically ill patients. The physical examination has established to be unpredictable for exposure of pneumonia, yet in specialist hands.^[3] In the ICU, bedside chest radiography remains the primary line of examination in a patient with suspected pneumonia. Inadequate diagnostic presentation and effectiveness of bedside moveable chest radiography have been accounted in numerous earlier researches.^[4-6] CT scan of the chest is measured as the gold standard for the analysis of pneumonia and its associated complications.

The compensation of lung ultrasound comprise its energetic scenery being executed genuine time through tidal ventilation, which is in distinguish to stationary imaging by customary imaging techniques, and the truth it can effortlessly be recurring subsequent therapeutic interventions.^[7]

Subjects with acute respiratory symptoms, lung ultrasound (LUS) is a helpful analysis for detecting pneumonia, particularly when chest x-ray (CXR) consequences are negative or inconclusive. Strategy still believe CXR as the suggested first-line diagnostic test in all subjects with suspected pneumonia.^[7] Nevertheless, its diagnostic precision is not best, owing to elevated interobserver variability in explanation. Subject-related things may also prejudice the gaining of a good radiograph, particularly in those with ruthless symptoms. These restrictions may add to the amount of chest CT prescriptions.^[8] On the other hand, the schedule submission of LUS in emergency departments and intensive care units (ICUs) is connected with an development of analytic correctness for pneumonia and may still in some cases replace CXR, dropping the need of CT scans.^[9]

The present study compared lung ultrasound (USG) and chest radiography in suspected cases of pneumonia in critically ill

patients.

Subjects and Methods

A total of 70 patients presenting to the emergency room with symptoms of pneumonia and those were admitted in ICU with a suspicion of pneumonia over an eighteen month period were included in this study. Patients in respiratory distress who require emergency resuscitation procedure and children below 14 years of age were excluded from the study. The enrolled patients were well-versed concerning the research and their written permission was acquired. All patients underwent postero-anterior (PA) chest X-ray.

Statistical analysis

The data was analyzed using SPSS version 15. For all tests, confidence level and level of significance were set at 95% and 5% respectively.

Results

[Table 1] demonstrates that out of 70 subjects, males were 39 and females were 31. [Table 2,] demonstrates that age group 20-30 years had 4 patients, 30-40 years had 6, 40-50 years had 10, 50-60 years had 16 and >60 years had 20 patients. The disparity was noteworthy ($P < 0.05$). [Table 3] shows that chest x ray revealed 50 out of 70 cases positive and 20 negative and USH showed 65 positive and 5 negative. Positive predictive value (PPV) of chest x- ray was 71.4% and USG was 92.8%. The dissimilarity was important ($P < 0.05$).

Table 1: Distribution of Patients according to Gender

Total no of patients : 70		
Gender	Males	Females
Number	39	31

Table 2: Age wise distribution of cases

Age (Years)	Number	P value
19-29	6	0.02*
30-39	9	
40-49	13	
50-59	20	
More than 60	22	

* indicates statistically significant at $p \leq 0.05$

Discussion

The principle of using LUS in diagnosis of pneumonia is that in 90% of cases of symptomatic pneumonia the consolidation

Table 3: Comparison of USG and Chest X ray with CT

	Radiographs	CT Positive (70)	PPV
Chest X-ray	Positive	50	71.4%
	Negative	20	
Ultrasound	Positive	65	92.8%
	Negative	5	

touches a pleural surface.^[10,11] Lung ultrasound established a advanced sensitivity for the analysis of pneumonia contrast to chest X-ray. Earlier researches have establish comparable results about the sensitivity of ultrasound for pneumonia.^[12,13]

Lung ultrasound has better diagnostic correctness (96%) than chest radiograph (74%) in identifying consolidation and may therefore be considered as an alternative to radiography for these patients. In current research, the sensitivity of LUS in detecting pneumonic consolidation was 96.5% and specificity was 93.5%. Our results agree with those of previous studies - Liechtenstein et al. in 2004 who reported a sensitivity of 91% and specificity of 98% and Cortello et al.^[14] in 2012 who found sensitivity and specificity of lung USG being 98% and 96% respectively.

In an article published by Chevaz et al.^[15] which included systematic review and metanalysis of 10 diligently selected articles comparing the analytic correctness of LUS and CXR in diagnosing consolidation, the collective sensitivity and specificity of LUS was 94% and 96% respectively. In non-blinded study of 342 patients, Sperando et al.^[16] admitted with pneumonia, USG was able to detect 92% (314/342) of consolidation almost similar to us.

The diagnosis of consolidation was done on the basis of lung hepatisation, shred sign, dynamic air bronchogram and decreased lung sliding. It has been observed that the sensitivity of lung ultrasound is 90% when tissue hepatisation and shred sign were taken as parameters for diagnosis. Irregular serrated margins were the most common sonographic pattern found in our patients having pneumonia. Most common associated finding, found on ultrasonography, was effusion followed by B- lines, suggestive of interstitial thickening.

In patients diagnosed as pneumonia on radiography, the most common feature was inhomogeneous opacity followed by dense opacity with air bronchogram. The most common associated finding was pleural effusion.

Age group 19-29 years had 6 patients, 30-39 years had 9, 40-49 years had 13, 50-59 years had 20 and >60 years had 22 patients. Similar results found by Bitar et al,^[17] Of the 73 subjects, 31 (42.5%) were male, with a mean age of 68.3 years, and a range of 27 to 94 years. Diagnostic parameters of CXR and LUS were compared with McNemar test on the whole cohort

and after stratification for Rockwood Clinical Frailty Scale. Amatya et al,^[18] also found analogous results.

In patients diagnosed as pneumonia on radiography, the most common feature was inhomogeneous opacity followed by dense opacity with air bronchogram. The most common associated finding was pleural effusion. Places where lung ultrasound is most likely to miss consolidation is in high axillary, subscapular, paravertebral and retrosternal positions. Lung ultrasound could not detect consolidation in one patient with necrotizing pneumonia at initial presentation as the consolidation was present high in the left posterior axillary region. Retrospective evaluation of the patient after a CT scan helped detect consolidation through a single intercostal space.

On comparing Ultrasonography with chest radiography in suspected cases of pneumonia in critically ill patients, it was found that sensitivity, specificity and diagnostic accuracy of lung ultrasound is better, cost effective, safer and quicker than radiography. So when LUS is normal in critically ill patients, radiography can be avoided in large number of patients.

Conclusion

Authors found that lung ultrasound is an effective radiological tool for the assessment of suspected cases of pneumonia as compared to chest x-ray.

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