ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 02 | February - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ULTRASONOGRAPHIC ASSESSMENT OF LUNG IN DYSPNEIC PATIENTS WITH LUNG INFECTION.

Radiology

Dr. Bhagyasri Kammari Junior Resident 3, Department of Radiology, Dr. D.Y. Patil Medical College Hospital, and Research Institute, Kolhapur, Maharashtra.

Dr. Falguni Singh Rathore JR 3, Department of Radiology, Dr. D.Y. Patil Medical College Hospital, and Research Institute, Kolhapur, Maharashtra.

Dr. J. K. Patil* MD DNB, Associate Professor, Department of Radiology, Dr. D.Y. Patil Medical College Hospital, and Research Institute, Kolhapur, Maharashtra. *Corresponding Author

ABSTRACT

Introduction- A wide range of pulmonary illnesses with a significant clinical prevalence includes infectious lung disease. Numerous studies have examined the clinical value of lung ultrasonography (LUS) in the treatment of patients who present with dyspnea due to an infectious lung illness in the last ten years. We present data on the methodical and standardised use of bedside LUS in the differential diagnosis of patients with acute dyspnea due to infective pulmonary diseases. **Materials and Methods-** We conducted a cross-sectional study on 120 patients with infectious lung illnesses (mean age, 54.2± 11.5 years; range, 25-85 years; 40 women, 80 men). All individuals underwent a chest X-ray and bedside LUS using a convex probe. A clinically necessary chest CT was done on a subgroup of individuals. **Results-** By comparing the percentage of pleural effusion and pulmonary consolidation determined by LUS to X-ray, we found a statistically significant difference (54 vs. 20.8%, respectively, p 0.05; 90 vs. 46.6%, p 0.001). 38.3% of the LUS-detected consolidations had air bronchograms, which were mixed, hypo, and hyperechoic lesions. When conducted, chest CT verified every finding determined by LUS. **Conclusion-** LUS is a helpful supplemental technique when used in conjunction with clinical, laboratory, and radiographic workup, as specified by clinical guidelines. When there are chest X-ray visible opacities or when clinical suspicion is high and radiological results are negative, the approach is very helpful in differentiating between pleural effusion and lung consolidation.

KEYWORDS

ultrasound, lung, dyspnea, pneumonia, emergency

INTRODUCTION-

In a range of pulmonary illnesses with a high incidence in clinical practice, infectious lung disease is a fairly frequent reason for hospital admission for dyspnea. Clinical practice guidelines advise that when diagnosing Community-Acquired Pneumonia in adults, clinical evaluation, laboratory results, and chest imaging should all be taken into account.

Chest high-resolution computed tomography (HRCT), lung ultrasound (LUS), and radiography (X-ray) are the imaging techniques most frequently used in clinical practice.

The clinical evaluation of various pleuro-pulmonary illnesses has shown in the last ten years that lung ultrasonography is significantly valuable.[1,2] It serves as a helpful resource and supplemental diagnostic tool for both diagnostic and therapeutic interventional procedures.[3,4] Numerous research in the last ten years has concentrated on the function of LUS in the early differential diagnosis of individuals with acute dyspnea from various sources. [5–7] When combined with clinical evidence, LUS specifically showed to have a valuable accuracy in the diagnosis of pneumonia. [8, 9] Numerous studies have established the potential of LUS in CAP and ventilator-associated pneumonia; new data also point to a role for LUS in COVID-19 pneumonia. [8]

The detection and characterisation of pleural effusions as well as using LUS as a thoracocentesis guide are two of the most significant and well-known applications of LUS in clinical practice. [10] Thoracocentesis-related complications were shown to be greatly reduced by the routine use of LUS in the assessment of pleural effusion before and during the procedure. [10, 11] According to historical data, pneumothorax was observed to occur 0.5% of the time with LUS-guided thoracocentesis, compared to a prevalence of 7 to 15% when LUS was not employed. [12] Last but not least, LUS is a useful tool for percutaneous transthoracic needle biopsy guiding, with a rate of complications in our case series of 0.5%. [4,13]

METHOD AND MATERIALS:

Patients hospitalised for infective lung illness participated in a cross-sectional study that we conducted at Dr. D.Y. Patil Medical college hospital, and research center, Kolhapur.

In order to perform LUS and chest X-rays on any patient, written informed consent from the patient and/or their proxy was also sought. The protocol was followed in accordance with the ethical guidelines.

Acute dyspnea caused by infectious lung disease, diagnosed in accordance with American Thoracic Society/Infectious Diseases Society of America recommendations (ATA/IDSA), was one of the inclusion criteria. [14] The emergency room, intensive care, general medicine, and geriatric units all recruited patients. the following conditions were excluded: serious bleeding, metabolic acidosis, any kind of brain damage, severe pulmonary embolism, and any psychogenic cause of dyspnea. From October 2022 to December 2022, patients were enrolled.

All patients got an LUS examination and a posterior-anterior chest X-ray at the time of admission. GE Logiq F8 was the machine used for the examination. A convex low-medium frequency (3.5–5 MHz) probe was used for each inspection.

The transthoracic investigation was done under the following conditions: 7–14 cm is the depth of pictures (penetration); 50–60% is the gain control; harmonic imaging is used; and the pleural line is the electronic focus. The participants were assessed while seated, and bilateral scans were performed through the ventral, lateral, and posterior intercostal gaps along the parasternal, mid-clavicle, and anterior axillary lines, as well as along the posterior axillary and paravertebral lines. The entire hemithorax was evaluated, top to bottom. Any LUS exam has an operational time of around 10 minutes.

The final diagnosis provided by the doctors in charge of any patient was compared with the results of the LUS and X-rays using clinical criteria [14]. A subgroup of patients had chest HRCT in order to achieve the necessary final diagnosis.

RESULTS-

We studied 120 patients (40 women and 80 men, mean age 54.2 ± 11.5 years, age range 25–85 years).

Table 1 reports the clinical characteristics of patients, LUS, and chest X-ray findings. According to the data, LUS recognized a higher percentage of individuals with pleural effusion than chest X-ray, whether the pleural effusion was present alone or in conjunction with lung consolidation. In particular, there was a statistically significant difference between the two techniques in the percentage of pleural effusion (54 vs. 20.8%, $p < 0.05$ by McNemar's test) (**Figure 1**). Pulmonary consolidation was found in 90% of patients by LUS and in 46.6 % by chest X-ray ($p < 0.001$ by McNemar's test) Fig.1.

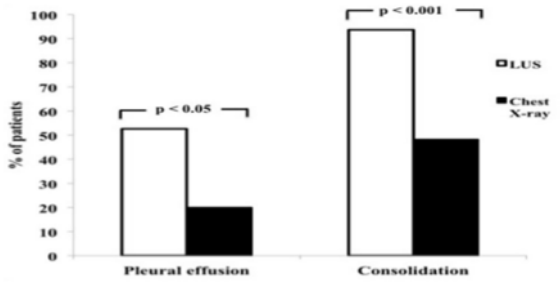

Fig.1. Percentage of pleural effusion and lung consolidation detected on LUS and chest X ray.

>3 B-lines were shown on LUS in all patients. (**Table 1**).

Table 2 shows the ultrasound semantics of the disease pattern. A single consolidation was found in 112 patients (93% of cases) and multiple consolidations in the remaining 8 (6.6%) of cases. The maximum number of the consolidations seen on LUS was situated in the postero-basal and lateral-basal areas and 2–3 cm of main diameter (**Table 2**). They were mostly mixed, hypo- and hyperechoic lesions, with hyperechoic spots ("air bronchogram") visualized by LUS in 38% of cases (**Tables 1,2**).

Chest HRCT was performed in 65 patients (54.1% of the total), as needed for the final diagnosis. All of the aforementioned observations made by LUS were supported by chest HRCT when it was done. By using HRCT, it was possible to identify pleural effusion and pulmonary consolidation in 56.2 and 98.7% of patients, respectively (p= 0.211 and 0.101 vs. LUS).

Table- 1clinical Characteristics Of Patients With Dyspnea, LUS, chest X-ray findings (n = 120)

Age, years (mean ± SD)	54.2 ± 11.5, Age range=25-85yrs.
Female/male ratio	1/2.
Current smoking, number of patients (% of the total)	90 (75)
Comorbidities, number of patients (% of the total)	75(62.5)
LUS FINDINGS	
Pleural effusion	65 (54)
Lung consolidation	108 (90)
Hyperechoic spots ("Air Bronchogram")	49 (40)
Pleural effusion and lung consolidation	63 (52.5)
B-lines >3	120 (100)
CHEST X-RAY FINDINGS	
Pleural effusion	25 (20.8)
Lung consolidation	56 (46.6)
Air Bronchogram	11 (9.1)
Pleural effusion and lung consolidation	9 (7.5)

Table 2 Ultrasound Semantics Of Lung Consolidation.

Single, number of patients (% of the total) 112 (93)
Multiple, number of patients (% of the total) 8(6.6)
Localization, number of patients (% of the total)
Anterior-apical 5 (4.1)
Posterior-basal 43(35.8)
Lateral-basal 34(28.3)
Lateral-medial 22 (18.3)
Posterior-medial 16(13.2)
Anterior-medial-lateral 4 (3.4)
Main diameter, number of patients (% of the total)
1–2 cm 4 (3.4)
2–3 cm 31 (25.8)
3–5 cm 73 (60.8)
>5 cm 9 (7.5)
Echogenicity, number of patients (% of the total)
Hypoechoic, regular 31 (25.8)
Hypoechoic, irregular 18 (15)
Mixed (hypo- and hyperechoic), regular 46 (38.3)
Mixed (hypo- and hyperechoic), irregular 28 (23.3)

DISCUSSION-

Clinically helpful in the diagnostic evaluation of acute dyspnea is the systematic use of bedside LUS in conjunction with clinical guidelines for the diagnosis of pneumonia. LUS is specifically reliable for pleural effusion and lung consolidation detection in patients with community-acquired pneumonia. Our results are consistent with the well-known ability of LUS to detect even minute amounts of liquid that a chest X-ray cannot detect. [11,15]The findings show that in cases of opacity shown on a chest X-ray, it is possible to differentiate in real time between pulmonary consolidation and pleural effusion using LUS.

Additionally, LUS may be able to see both pleural effusion and lung consolidation, improving diagnostic precision. Infectious lung disease-related consolidations are typically seen by LUS as mixed, hypo- and hyperechoic, or hypoechoic lesions with regular margins and are, in about half of the cases, accompanied by pleural effusion. LUS can also detect hyperechoic patches, which some authors refer to as "air bronchograms," within lung consolidation in a sizable portion of patients [16]. It is crucial to emphasize in this context that the chest HRCT finding of the air bronchogram, as defined, does not match the hyperechoic pictures. [17]

Patients with acute dyspnea from infectious pulmonary disease had more B lines visible by LUS than those with many other pleuropulmonary conditions. [7] The specificity of B lines in the differential diagnosis of dyspnea is disregarded by these results. Previous research from our team showed that B lines assessment by LUS played no significant effect in the differential diagnosis of dyspnea across a wide range of pleuropulmonary and cardiac disorders. [7] Numerous causes, most of which are connected to the differential in acoustic impedance between normal lungs and those affected by the underlying pleuropulmonary illness, may contribute to the rise in the number of B-line artifacts [7, 18]. These mechanisms are strengthened by the significant proportion of individuals with comorbidities in our study. [19] Nevertheless, the IDSA/ATA consensus recommendations for the diagnosis of community-acquired pneumonia, which include the evaluation of clinical, laboratory, and imaging data (2007; updated in 2019), were followed in making the diagnosis in all patients. [14, 20] Our main goal was to inform doctors about the LUS semantics and findings and how they should be interpreted in patients who present with dyspnea from an infectious lung illness, as well as to describe the clinical value of bedside LUS in these patients.

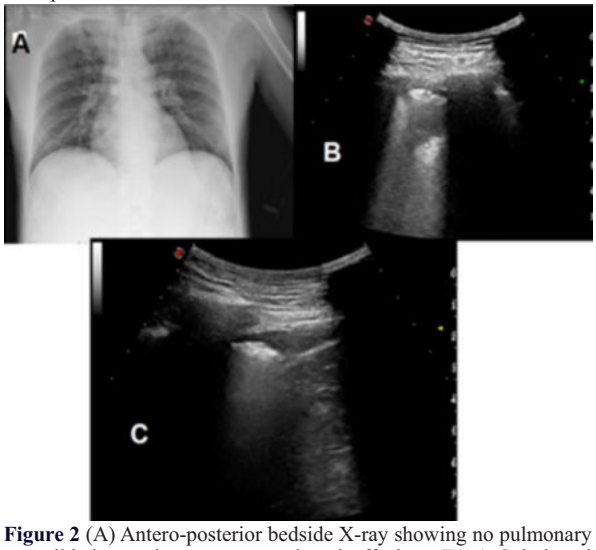

Figure 2 (A) Antero-posterior bedside X-ray showing no pulmonary consolidation and no apparent pleural effusion. (B) A Subpleural thickening of 1.5 cm is visible on the posterior left basal LUS scan. (C) Diaphragmatic costophrenic sinus hypoechoic consensual homolateral pleural effusion (9 mm depth).

CONCLUSION:-

In patients with dyspnea due to infective lung illness, LUS is a helpful supplemental technique when used in conjunction with clinical, laboratory, and radiographic workup, as specified by clinical guidelines. When there are chest X-ray visible opacities or when clinical suspicion is high and radiological results are negative, the approach is very helpful in differentiating between pleural effusion and lung consolidation. About half of all infective lung disease consolidations by LUS have mixed echogenicity and are accompanied

by pleural effusion.

REFERENCES

1. Taylor, A., Anjum, F., & O'Rourke, M. C. (2021). Thoracic and lung ultrasound. In StatPearls [Internet]. StatPearls Publishing.
2. Müller, N. L., Franquet, T., Lee, K. S., & Silva, C. I. S. (Eds.). (2007). Imaging of pulmonary infections. Lippincott Williams & Wilkins.
5. Taylor A, Anjum F, O'Rourke MC. Thoracic and Lung Ultrasound. BTI – StatPearls Publishing LLC (2020).
4. Sperandeo, M., Del Colle, A., Frongillo, E., Rea, G., Dimitri, L., Cipriani, C., & Lacedonia, D. (2019). Safety maximization of percutaneous transthoracic needle biopsy with ultrasound guide in subpleural lesions in the evaluation of pulmonary consolidation. Respiratory Research, 20(1), 1-3.
5. Bekgoz, B., Kilicaslan, I., Bildik, F., Keles, A., Demircan, A., Hakoglu, O., ... & Demir, H. A. (2019). BLUE protocol ultrasonography in Emergency Department patients presenting with acute dyspnea. The American journal of emergency medicine, 37(11), 2020-2027.
6. Gargani, L. (2019). Ultrasound of the lungs: more than a room with a view. Heart Failure Clinics, 15(2), 297-303.
7. Sperandeo, M., Varriale, A., Sperandeo, G., Polverino, E., Feragalli, B., Piattelli, M. L., ... & Cipriani, C. (2012). Assessment of ultrasound acoustic artifacts in patients with acute dyspnea: a multicentre study. Acta Radiologica, 53(8), 885-892.
8. Kameda, T., Mizuma, Y., Taniguchi, H., Fujita, M., & Taniguchi, N. (2021). Point-of-care lung ultrasound for the assessment of pneumonia: a narrative review in the COVID-19 era. Journal of Medical Ultrasonics, 48(1), 31-43.
9. D'Amato, M., Rea, G., Carnevale, V., Grimaldi, M. A., Saponara, A. R., Rosenthal, E., ... & Sperandeo, M. (2017). Assessment of thoracic ultrasound in complementary diagnosis and in follow up of community-acquired pneumonia (cap). BMC Medical Imaging, 17(1), 1-8.
10. Miles, M. J., & Islam, S. (2019). Point of care ultrasound in thoracic malignancy. Annals of Translational Medicine, 7(15).
11. Sperandeo, M., Filabozzi, P., Varriale, A., Carnevale, V., Piattelli, M. L., Sperandeo, G., ... & Decuzzi, M. (2008). Role of thoracic ultrasound in the assessment of pleural and pulmonary diseases. Journal of ultrasound, 11(2), 39-46.
12. Roy, A. (2009). An application of linear mixed effects model to assess the agreement between two methods with replicated observations. Journal of biopharmaceutical statistics, 19(1), 150-173.
13. Sperandeo, M., Trovato, F. M., Dimitri, L., Catalano, D., Simeone, A., Martines, G. F., ... & Trovato, G. M. (2015). Lung transthoracic ultrasound elastography imaging and guided biopsies of subpleural cancer: a preliminary report. Acta radiologica, 56(7), 798-805.
14. Mandell LA, Wunderink RG, Anzueto A, Bartlett JG, Campbell GD, Dean NC, et al. Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. Clin Infect Dis. (2007) 44(Suppl. 2):S27–72. doi: 10.1086/5 11159
15. Parshall, M. B., Schwartzstein, R. M., Adams, L., Banzett, R. B., Manning, H. L., Bourbeau, J., ... & ATS Committee on Dyspnea. (2012). An official American Thoracic Society statement: update on the mechanisms, assessment, and management of dyspnea. American journal of respiratory and critical care medicine, 185(4), 435-452.
16. Chiappetta, M., Meacci, E., Cesario, A., Smargiassi, A., Inchingolo, R., Ciavarella, L. P., ... & Margaritora, S. (2018). Postoperative chest ultrasound findings and effectiveness after thoracic surgery: A pilot study. Ultrasound in medicine & biology, 44(9), 1960-1967.
17. Tinti, M. G., Cipriani, C., De Cosmo, S., & Sperandeo, M. (2019). Pneumothorax and air bronchogram in transthoracic ultrasound: basic considerations. Ultrasound in Medicine and Biology, 45(6), 1500.
18. Trovato, G. M., & Sperandeo, M. (2013). Sounds, ultrasounds, and artifacts: which clinical role for lung imaging. American journal of respiratory and critical care medicine, 187(7), 780-781.
19. Richards, J. R., & McGahan, J. P. (2017). Focused assessment with sonography in trauma (FAST) in 2017: what radiologists can learn. Radiology, 283(1), 30-48.
20. Shoushtari, A. H., & Nugent, K. (2020). Diagnosis and treatment of adults with community-acquired pneumonia. An official clinical practice guideline of the American thoracic society and infectious diseases society of America. The Southwest Respiratory and Critical Care Chronic