

Bedside Lung Ultrasound in Patients with Acute Decompensated Heart Failure—An Observational Study

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Abstract

Keywords

- ▶ decompensated heart failure
- ▶ ultrasound

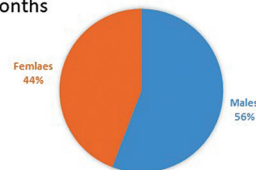
This study was done to evaluate the lung ultrasound findings such as Kerley A and Kerley B lines and the correlation between them with duration of hospital stay, where patients with Kerley A lines had longer duration of hospital stay even though it was statistically insignificant. N-terminal pro-brain natriuretic peptide levels were higher in female patients when compared with males in acute decompensated heart failure.

Abstract Image

Bedside Lung Ultrasound in patients with Acute Decompensated Heart Failure- An Observational study

Dyspnea is one of the most common presenting problem in the emergency department and one of the common cause of hospitalization in the intensive care unit. Lung ultrasound (LUS) has become an essential part in the evaluation of acute onset shortness of breath, demarcating between acute decompensated heart failure and other non-cardiac causes of dyspnea, mostly the acute exacerbation of COPD.

This study is done in a tertiary care centre as an observational cross sectional study with a study period of 3 months



LUS findings (N=43)	Duration of hospital stay in days	P value
Kerley A lines (N=8)	Mean: 7.75	0.19
	Standard deviation: 3.11	
Kerley B lines (N=35)	Mean: 6.14	
	Standard deviation: 2.01	

This study concluded that Kerley A lines had longer duration of hospital stay even though it was statistically insignificant. NT pro BNP were higher in female patients when compared to males in Acute Decompensated Heart Failure. Bedside LUS is also cost effective compared to the NT pro BNP test.

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Introduction

Dyspnea is one of the most common presenting problems in the emergency department and one of the common causes of hospitalization in the intensive care unit. The initial evaluation that is based on history, clinical examination, electrocardiography, X-ray chest, and BNP or NT pro-BNP (N-terminal pro-brain natriuretic peptide) levels is important in the dyspnea evaluation.¹ Over the past 20 years, lung ultrasound (LUS) has become an essential part in the evaluation of acute onset shortness of breath, demarcating between acute decompensated heart failure, and other noncardiac causes of dyspnea, mostly the acute exacerbation of chronic obstructive pulmonary disease (COPD).¹ LUS also has many advantages over classical evaluation. It is a quick, easily available noninvasive tool done at bedside by clinicians with portable machine.¹ The standard of care has been improved by LUS in the diagnosis and monitoring of acute decompensated heart failure, and it should be used in routine practice to incorporate clinical examination and common investigations.¹

In the past years, LUS has gained wider applications.¹ While performing the LUS, pleural line is visible just beneath the soft tissue of the chest wall. Under normal circumstances, the layers of pleura move upon each other; this hyperechoic line makes a horizontal “sliding” movement, which is synchronous with respiratory movements. A homogenous “foggy-like” image interrupted by several horizontal reverberations of the pleural line is divided by a fixed period (Kerley A lines). The vertical reverberations called Kerley B lines appear when the volume of air in the lungs decreases due to interstitial accumulation, deposition of blood or collagen. The objective of the study is to evaluate the bedside LUS findings in patients with acute decompensated heart failure.

Materials and Methods

This study was done in a tertiary care center as an observational cross-sectional study with a study period of 3 months, from July 2021 to September 2021. The study population included all the patients admitted to intensive coronary care unit (ICCU) with acute decompensated heart failure. Patients with age over 18 years were included in the study. Exclusion criteria included patients with age less than 18 years, patients with prior history of lung disorders such as COPD, interstitial lung diseases, bronchiectasis, and pneumothorax, and patients with post cardiopulmonary resuscitation.

All patients satisfying inclusion and exclusion criteria were taken into study. Bedside LUS was performed and findings were recorded. The study was done in ICCU, Nizam's Institute of Medical Sciences, on random day during patient's hospital stay. The LUS findings primarily focused on Kerley A and Kerley B lines that were correlated with hospital stay duration and statistical analysis was performed using mean and standard deviation. Analysis was also done between sex of the patient and the levels of NT pro-BNP.

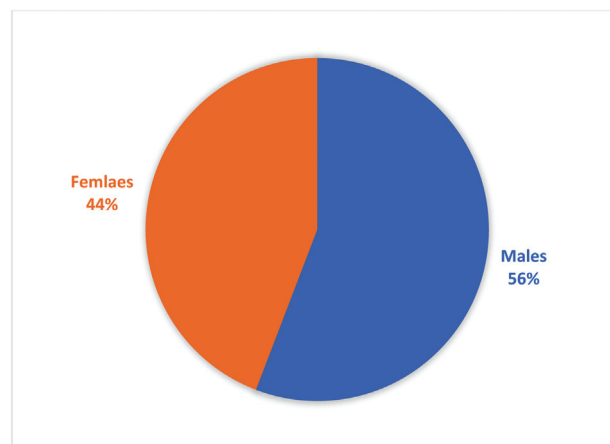


Fig. 1 Pie diagram showing distribution of cases according to sex.

Statistical Analysis

Statistical analysis was done in MS Excel 2021. Results on continuous variables will be presented as mean and standard deviation. *t*-test will be used for statistical analysis. $p < 0.05$ will be considered as statistically significant.

Results

Demographic Profile

The average age of presentation in males and females were 58.5 and 60 years, respectively. Out of 43 patients with acute decompensated heart failure, 24 were males (56%) and 19 were females (44%), as shown in ► **Fig. 1**.

LUS findings for Kerley A and Kerley B lines were recorded on 43 patients with acute decompensated heart failure. The Kerley A and Kerley B lines were correlated with hospital stay duration. Kerley A lines were found in 8 out of 43 patients, which were correlated with the duration of hospital stay (mean: 7.75 days, standard deviation: 3.11 days). Kerley B lines were found in 35 out of 43 patients, which were correlated with the duration of hospital stay (mean: 6.14 days, standard deviation: 2.01 days). *p*-Value obtained was 0.19 that was statistically insignificant (► **Table 1**). Further analysis was done between sex of the patient and the NT pro-BNP levels. NT pro-BNP values were analyzed from 7 males and females. Males had a mean NT pro-BNP levels of 5,146 and standard deviation of 2,389.9. Females had a mean NT pro-BNP levels of 8,666 and standard deviation of 7,288.

Table 1 Correlation of LUS findings with duration of hospital stay

LUS findings (n = 43)	Duration of hospital stay in days	<i>p</i> -Value
Kerley A lines (n = 8)	Mean: 7.75	0.19
	Standard deviation: 3.11	
Kerley B lines (n = 35)	Mean: 6.14	
	Standard deviation: 2.01	

Abbreviation: LUS, lung ultrasound.

Table 2 Correlation between sex and NT pro-BNP levels in patients with acute decompensated heart failure

Sex	NT pro-BNP levels	p-Value
Males (n = 7)	Mean: 5,146	0.264
	Standard deviation: 2,389.9	
Females (n = 7)	Mean: 8,666	
	Standard deviation: 7,288	

Abbreviation: NT pro-BNP, N-terminal pro-brain natriuretic peptide.

Calculated *p*-value was 0.264 that was statistically insignificant (►Table 2).

Discussion

According to Praveen et al, the mean Kerley B lines were higher among the patients who were admitted for more than 10 days at the time of admission.² None of the other studies were available to compare these results. Males outnumbered females in this study. About 55.8% (*n* = 24) patients were males and 44.1% (*n* = 19) were females. In a study by Miglioranza et al, ~61% of all the patients with heart failure were males.³ Coiro et al also observed similar results in their study.⁴ In a study by Prosen et al, ~73% of the patients with acute heart failure-related dyspnea were males.⁵ In a study by Platz et al, ~71% of the patients were males.⁶ In a study by Mar Domingo et al, 72% of the patients were males.⁷

In our study, NT pro-BNP levels were higher in females with mean of 8,666 and standard deviation of 7,288, when compared with males with mean of 5,146 and standard deviation of 2,389. Calculated *p*-value was 0.26 that was statistically insignificant. In a study done by Hack-Lyong Kim et al, NT pro-BNP levels were significantly higher in patients with events compared with those without, in both genders (*p* < 0.001 for each).⁸ A higher NT pro-BNP level was an independent predictor of events (highest vs. lowest tertile: hazard ratio, 1.74; 95% confidence interval, 1.25–2.43; *p* = 0.001) in men, even after controlling for potential confounders.⁸ The NT pro-BNP level seems to be a more valuable marker in the prediction of heart failure readmissions and long-term mortality in men than in women.⁸ LUS is being used commonly in the approach for patients with heart failure because it has proven to have high diagnostic accuracy, nevertheless we must follow a structured and standardized protocol to report the same findings.^{9,10}

Conclusion

This study was done to evaluate the LUS findings such as Kerley A and Kerley B lines and the correlation between them with the duration of hospital stay, where patients with Kerley A lines had longer duration of hospital stay even though it was statistically insignificant. NT pro-BNP levels were higher in female patients when compared with males in acute decompensated heart failure. Bedside

LUS was also cost-effective in compared with the NT pro-BNP test.

Limitations of the Study

1. This study was a cross-sectional study and lacked follow-up analysis and evaluation.
2. NT pro-BNP levels were not analyzed in all patients.

Audio 1

Online content including video sequences viewable at: <https://www.thieme-connect.com/products/ejournals/html/10.1055/s-0042-1744278>.

Conflict of Interest

None declared.

References

- 1 Lichtenstein DA, Mezière GA. Relevance of lung ultrasound in the diagnosis of acute respiratory failure: the BLUE protocol. *Chest* 2008;134(01):117–125
- 2 Praveen MP, et al. Evaluation of lung ultrasound with clinical congestion score in diagnosis and clinical outcome of patients with acute left ventricular failure prospective study. *Int J Adv Med* 2020;7(05):764–769
- 3 Miglioranza MH, Gargani L, Sant'Anna RT, et al. Lung ultrasound for the evaluation of pulmonary congestion in outpatients: a comparison with clinical assessment, natriuretic peptides, and echocardiography. *JACC Cardiovasc Imaging* 2013;6(11):1141–1151
- 4 Coiro S, Rossignol P, Ambrosio G, et al. Prognostic value of residual pulmonary congestion at discharge assessed by lung ultrasound imaging in heart failure. *Eur J Heart Fail* 2015;17(11):1172–1181
- 5 Prosen G, Klemen P, Štrnad M, Grmec S. Combination of lung ultrasound (a comet-tail sign) and N-terminal pro-brain natriuretic peptide in differentiating acute heart failure from chronic obstructive pulmonary disease and asthma as cause of acute dyspnea in prehospital emergency setting. *Crit Care* 2011;15(02):R114
- 6 Platz E, Lewis EF, Uno H, et al. Detection and prognostic value of pulmonary congestion by lung ultrasound in ambulatory heart failure patients. *Eur Heart J* 2016;37(15):1244–1251
- 7 Domingo M, Conangla L, Lupón J, et al. Prognostic value of lung ultrasound in chronic stable ambulatory heart failure patients. *Rev Esp Cardiol (Engl Ed)* 2021;74(10):862–869
- 8 Hack-Lyong Kim, Myung A-Kim, Dung-Ju Choi, et al. Gender difference in the prognostic value of N-terminal pro-B type natriuretic peptide in patients with heart failure—a report from the Korean Heart Failure Registry (KorHF). *J-Stage* 2017;81(09):1329–1336
- 9 Girerd N, Seronde MF, Coiro S, et al; INI-CRCT, Great Network, and the EF-HF Group. Integrative assessment of congestion in heart failure throughout the patient journey. *JACC Heart Fail* 2018;6(04):273–285
- 10 Platz E, Jhund PS, Girerd N, et al; Study Group on Acute Heart Failure of the Acute Cardiovascular Care Association and the Heart Failure Association of the European Society of Cardiology. Expert consensus document: reporting checklist for quantification of pulmonary congestion by lung ultrasound in heart failure. *Eur J Heart Fail* 2019;21(07):844–851