

ORIGINAL ARTICLE

Role of Lung Ultrasound (LU) in early diagnosis of Interstitial Lung Disease (ILD) in patients with Rheumatoid Arthritis (RA).

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ABSTRACT... Objective: To determine role of lung Ultrasound in Early Diagnosis of ILD in Patients with RA. **Study Design:** Observational Prospective study. **Setting:** Madina Teaching Hospital (MTH), University Medical and Dental College Faisalabad (UMDC). **Period:** July 2022 to December 2022. **Methods:** Adults with a diagnosis of RA and signs and symptoms of ILD in RA who were included. Lung function testing and diagnostic imaging were carried out. **Results:** The research comprised a total of 141 participants, consisting of 55 (39%) males and 86 (61%) females, with an average age of 51.92 ± 12.15 years. The majority of the participants were positive for Rh factor, namely 112 out of 79% of the individuals examined. Mean duration of rheumatoid arthritis was 15.8 ± 10.4 years. Analysis of the patients' medical records revealed that 51.1% individuals had a documented history of smoking. Of all the patients, 60 people (42.6%) were using glucocorticoids. ILD was detected by HRCT in 108 of the 141 patients in the study group, representing a 76.6% prevalence. The LUS detected symptoms of ILD in 101 out of 141 individuals, representing a percentage of 71.6%. Concordance among LUS and HRCT was 66.7%. The sensitivity for LUS was 75%, while the specificity was 39.39%. **Conclusion:** The results show that LUS is a valuable method for identifying ILD in RA patients and is capable of accurately predicting the occurrence of ILD in these patients. Larger cohorts, the test's cost-efficiency, and the usefulness of LUS in the follow-up of patients who have already been diagnosed with ILD should all be assessed in future research.

Key words: Interstitial Lung Disease (ILD), Lung Ultrasound, Rheumatoid Arthritis (RA).

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INTRODUCTION

Rheumatoid arthritis (RA) is a widespread inflammatory condition that may lead to permanent alterations in the joints, resulting in severe disability and reduced quality of life. The diagnosis is established using a combination of clinical and test characteristics. Approximately 1.3 million individuals in the US are affected with RA, which accounts for approximately 0.6% to 1% of the total population.¹ The pulmonary manifestations of RA may vary from pleuritis and ILD to pulmonary nodules and vasculitis.² ILD is an umbrella term for a group of illnesses that include inflammation along with scarring of the tissues of lung, namely the alveoli and interstitium. It is also often referred to as diffuse parenchymal lung disease.³ RA-ILD is believed to impact about 10% of individuals with RA, but research is scarce on this topic.⁴ The therapy for ILD is currently without effective medications, and the condition exhibits fast progression, posing a significant hazard to human health.

Historically, medical professionals have relied on imaging techniques like chest X-rays and HRCT scans to exclude or identify pulmonary symptoms.⁵ Nevertheless, CT scans involve the use of radiation and cannot be repeated, making them unsuitable for bedside examinations. Additionally, the costs associated with CT scans are prohibitively high. These problems are especially evident for patients who have restricted mobility, such as those in emergency and CCUs, as well as pregnant females with widespread lung disease and patients who need quick monitoring because their condition is progressing rapidly. Therefore, there is a want for an imaging technique that is uncomplicated, rapid, cost-effective, and devoid of radiation.^{5,6}

Considering the limitations of the aforementioned approaches, research has shown that lung ultrasonography (LUS) may serve as an alternative screening technique for CTD-ILD⁷.

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Ultrasound is often used in clinical settings. Furthermore, it is used to do US-guided procedure or biopsy treatments. But, in recent years, LUS has transformed from a traditional method to examine the lung tissue and has increasingly been used to evaluate illnesses including pulmonary edema and pneumonia. Physicians in intensive care units, thoracic departments, and emergency rooms often utilize it. Although research on LUS usage in CTD-ILD is in early phases.⁸ When comparing ultrasound to HRCT for the early identification of ILD in RA patients, Santos-Moreno et al. evaluated the effectiveness of LUS. HRCT was used to diagnose ILD in 60.9% of the study cohort's participants. 179 out of 192 people had ILD symptoms (Lines B) identified by the LUS, meaning that 93.2% of the population had these symptoms. There was 65.6% overall agreement between LUS and HRCT. LUS has a 98.3% sensitivity and a 14.7% specificity for HRCT.⁹ This research aimed to evaluate the effectiveness of LUS in relation to HRCT for the early identification of ILD in RA patients, especially in a community context where it is an affordable and easily accessible modality. The aim is to detect ILD early on so that patients who should get HRCT may be chosen more precisely.

METHODS

This research was done at MTH, UMDC, Faisalabad from July 2022 to December 2022 after approval from ethical committee (UMDC/RERC/2022/040). Patients aged 18 years or older who have been diagnosed with RA and exhibit signs and symptoms of ILD associated with RA, were eligible for inclusion. Respirational signs are shortness of breath, particularly during physical activity, weariness and weakness, reduced hunger, persistent dry cough without producing phlegm, chest tightness, and prolonged shortness of breath (not attributable to any other ailment) lasting more than two months. The respiratory symptoms mostly consisted of the detection of crackles during auscultation during medical consultations. Patients with COPD, pleural effusion, atelectasis, or other forms of prior connective tissue disease-related pulmonary interstitial involvement, recently received a diagnosis of pneumonia were excluded. Sample size of 141 was determined based on the sensitivity of LUS as 98.3%⁹, specificity as 14.70%⁹ by sensitivity at

95% confidence level. Following the ACR/EULAR criteria, as well as the recommendations of the ATS, diagnostic images and lung function tests were conducted using standard equipment after gathering information on a pre-designed proforma. A CT scan using dual sources was carried out, using a 5.1 mm scan pitch and a 5 mm layer thickness. A colour Doppler ultrasound machine was equipped with a line array probe. The operator separated the lungs portions and chose lateral or sitting posture based on the situation. The whole eight-zone LUS evaluation takes into account the four chest regions on each side. All patients' pulmonary imaging results were documented. Pneumologist performed blind interpretations of LUS, CXR, and HRCT imaging. Following an ILD diagnosis, patients received normal medical care along with appropriate follow-up.

SPSS 25.0 was used to enter and evaluate the data. Age and BMI were among the numerical variables for which mean + SE was computed. For categorical factors including gender, medical history, current RA therapy, and recent respiratory symptoms, frequency and percentage were computed. A P-value of less than 0.05 was deemed statistically significant.

RESULTS

Total of 141 subjects were enrolled in the study that included 55(39%) men and 86(61%) women with a mean age of 51.92 ± 12.15 years. 112(79%) were positive for rheumatoid factor. Mean duration of RA was 15.8 ± 10.4 years. Medical history of patients showed that 72(51.1%) were smokers and 60(42.6%) were using Glucocorticoids.

HRCT detected ILD in 108 (76.6%). and LUS in 101 (71.6%). Concordance between LUS and HRCT was 66.7%. Concerning LUS, the specificity was 39.39% and the sensitivity was 75% as shown in Table-II.

DISCUSSION

ILD is a severe complication that may occur in individuals with connective tissue disorders (CTD), and it has a substantial impact on the prognosis of these patients. Recently, LUS has gained popularity as a non-invasive and simple approach for evaluating lung parenchymal abnormalities. It does not use ionizing radiation.¹⁰

TABLE-I

Demographic characteristics of the study population

	Frequency (%)
Age	51.92±12.15
Gender	
Male	55 (39.0)
Female	86 (61.0)
Medical History	
Smoking	72 (51.1)
Arterial hypertension	39 (27.7)
Diabetes mellitus	17 (12.1)
Cardiovascular disease	10 (7.1)
Other	3 (2.1)
Recent respiratory symptoms	
Dyspnea,	46 (32.6)
Chronic cough	54 (38.3)
Fatigue	41 (29.1)
Current treatment of RA	
Methotrexate	29 (20.6)
Analgesics	52 (36.9)
Glucocorticoids	60 (42.6)
Total	141 (100.0)

TABLE-II

Diagnostic Usefulness of LUS compared to HRCT

Positive		ILD on HRCT		P-Value
		Negative		
ILD on LUS	Positive	81 (75.0%) (TP)	20 (60.6%) (FP)	0.085
	Negative	27 (25.0%) (FN)	13 (39.4%) (TN)	
Total		108 (100.0%)	33 (100.0%)	

Sensitivity=75.00% , PPV= 80.20% , Specificity=39.39% ,
TNP= 32.50% , Accuracy= 66.67%

The objective of this research was to investigate the effectiveness of LUS in identifying various types of CTD-ILDs in patients with rheumatoid arthritis (RA). The research comprised a total of 141 participants, consisting of 55 (39%) males and 86 (61%) females, 51.92±12.15 years of age.

The majority of them showed positive results for rheumatoid factor 112 (79%). The average duration of rheumatoid arthritis (RA) was 15.8 ± 10.4 years. Analysis of the patients' medical records revealed that 72 individuals, accounting for 51.1% of the overall patient population, had a documented history of smoking. In terms of therapy, Glucocorticoids were used in 60 cases, accounting for 42.6% of the total. These findings are consistent with prior research.¹¹ In another study, 78.6% of the patients were women.⁹ The male to female ratio for this identical illness has been reported in other papers as 2:1.¹²

HRCT identified ILD in 108 out of 141 patients in the research group, with a prevalence of 76.6%. The LUS detected symptoms of ILD in 101 out of 141 individuals, which accounts for 71.6% of the total. The concordance between LUS and HRCT was 66.7%. The sensitivity for LUS was 75%, while the specificity was 39.39%. The heightened sensitivity of LUS in ILD has been previously shown in various research investigations. The overall number of B lines, namely 11.5, exhibited the highest level of discriminating balancing, with a sensitivity of 93%. Research has shown that ultrasonography may be more effective than HRCT in diagnosing RA-ILD.^{13,14} Other researchers have also reported a poor sensitivity of 62.2%.¹⁵ Despite a significant number of false-positive results, the agreement between LUS and HRCT was 66.7%. This may provide guidance for using LUS as a first method to assess the lung tissue in individuals with probable RA-associated ILD. Nevertheless, HRCT is considered the most reliable method for assessing the presence and extent of interstitial involvement in the lung parenchyma in individuals suspected of having ILD.¹⁵

A different research found that the sensitivity and specificity of LUS compared to HRCT were 93.55% and 90.91%, respectively.¹⁶ Cogliati et al. conducted LUS on 39 RA patients who were receiving HRCT of the lungs due to clinical suspicion of DPLD. Sensitivity and specificity of LUS were determined to be 92% and 56%, respectively.¹³

TABLE-III

Characterization of subjects for interstitial lung disease at LUS

		True Positive	False Positive	True Negative	False Negative	
Gender						
Male		33	12	4	6	0.028
		41.3%	63.2%	28.6%	21.4%	
Female		47	7	10	22	
		58.8%	36.8%	71.4%	78.6%	
Medical History						
Smoking		47	9	7	9	0.275
		58.8%	47.4%	50.0%	32.1%	
Arterial hypertension		19	6	4	10	
		23.8%	31.6%	28.6%	35.7%	
Diabetes mellitus		7	4	1	5	
		8.8%	21.1%	7.1%	17.9%	
Cardiovascular disease		4	0	2	4	
		5.0%	0.0%	14.3%	14.3%	
Other		3	0	0	0	
		3.8%	0.0%	0.0%	0.0%	
Recent Respiratory Symptoms						
Dyspnea,	25	2	8	11		0.142
	31.3%	10.5%	57.1%	39.3%		
Chronic cough	33	10	3	8		
	41.3%	52.6%	21.4%	28.6%		
Fatigue	22	7	3	9		
	27.5%	36.8%	21.4%	32.1%		
Total	80	19	14	28		
	100.0%	100.0%	100.0%	100.0%		

CONCLUSION

The results show that LUS is a valuable method for identifying ILD in RA patients and is capable of accurately predicting the occurrence of ILD in these patients. Larger cohorts, the test's cost-efficiency, and usefulness of LUS in the follow-up of patients who have previously been diagnosed with RA-ILD should all be assessed in future research.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Mahpara Munir: Data collection, analysis, writing.
2	Khalid Parvez: Discussion writing.
3	Muhammad Ammar Khan: Writing.
4	Salman Azhar: Literature review, data entry.