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Original Article

Sonological Findings of Interstitial Lung Disease and Its Comparison with HRCT in Bhopal, India

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Abstract

Introduction: Interstitial lung disease (ILD) refers to a group that is characterized by varying combinations of inflammation and fibrosis involving the space between the epithelial and endothelial basement membranes.

Aim and Objective: This study was conducted to the comparison of B line distance (vertical hyperechoic reverberation artefacts) in high-frequency sonography in ILD with high-resolution computed tomography (HRCT).

Materials and Methods: Prospective analytical cross-sectional study conducted on patient ILD, thoracic sonography, and HRCT were included in our study. USG was performed through intercostals space on all patients using a 7.5–10 MHz linear probe for lung. HRCT studies were performed with 128-MDCT scanner. USG B line distance compare with HRCT scans were assessed for the presence of consolidation, ground-glass opacity, nodular, reticular, reticulonodular, bronchiectasis, and honeycomb appearance. Student's *t*-test and ANOVA were used to compare the means. Chi-square test was used to compare the categorical data. *P*-value of < 0.05 is considered as statistically significant.

Results: In the present study, ILD was more prevalent in the age between 51–60 (31%) and 61–70 years (31%) followed by 41–50 years (16%). Study on USG findings, it was found that all patients had B line (100%). Negative correlation between B line distance and consolidation, ground-glass appearance with HRCT finding. Positive correlation between B line distance and reticular pattern, reticulonodular pattern, bronchiectasis, and honeycombing pattern with HRCT findings.

Conclusion: Ultrasound is useful in situations where HRCT is not available or undesirable, as in pre-hospital emergencies and in pregnancy and when a patient cannot be transported out of the intensive care unit because of severe disease.

Key words: B line, High frequency USG, High-resolution computed tomography, Interstitial lung disease

INTRODUCTION

Interstitial lung disease (ILD) refers to a group of disorders that are characterized by varying combinations of inflammation and fibrosis involving the space between the epithelial and endothelial basement membranes. ILD has different etiologies, clinical presentations, radiological patterns, and histological appearance.[1]

The causes of ILD can be classified into one of the following four categories: (1) Diseases associated with the condition that affects other parts of the body (e.g., autoimmune or collagen vascular disease), (2) diseases associated with specific exposure to an agent known to damage the lungs (e.g., medications such as bleomycin, occupational exposures such as asbestos, tobacco smoke, or agents in the environment that causes an immune reaction called hypersensitivity pneumonitis), (3) diseases associated with known genetic abnormalities (e.g., Hermansky–Pudlak syndrome), and (4) idiopathic diseases (diseases of an unknown cause). The most common ILDs are idiopathic.[2]

ILD may be idiopathic or caused by exposure to organic and inorganic substances (hypersensitivity pneumonitis and pneumoconiosis), medical conditions such as connective tissue diseases (CTDs), multisystemic diseases and obstructive sleep apnea, drugs, infection, and radiation therapy. The overall estimated prevalence of ILD is about

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25–74/100,000 population and up to 80.9 per 100,000 in men and 67.2 per 100,000 in women.[3]

Diagnosis of ILD is usually made based on a combination of clinical, functional, radiological, and histological data.

Reticular pattern involving the subpleural regions, ground-glass opacities, nodular and micronodular pattern, and honeycombing are the common high-resolution computed tomography (HRCT) signs of pulmonary fibrosis.[4]

Chest ultrasonography has many uses, both diagnostic and interventional. It is used in the diagnosis of diseases of the pleural space such as pleural effusion, pleural thickening, pleural masses, and pneumothorax. It is also used in the diagnosis of diseases caused by lung parenchymal lesions such as pneumonia, lung abscesses, neoplasms, pulmonary embolism, and arteriovenous malformations.[5]

However, some studies have demonstrated that transthoracic sonography (TS), as a consequence of its well-known advantages (absence of radiation exposure, ready availability, and cost-effectiveness), can play a complementary role in the diagnosis of ILD, especially when chest radiography or HRCT is not readily available or undesirable for instance during pregnancy. Moreover, TS can be useful in monitoring the course of the disease in patients with confirmed ILD (thus avoiding unnecessary overload of radiation exposure).[6]

Diffuse parenchymal lung diseases as pulmonary fibrosis, characterized by the presence of multiple diffuse bilateral B-lines that appear as discrete laser-like vertical hyperechoic reverberation artifacts that arise from the pleural line, extend to the bottom of the screen without fading, and move synchronously with lung sliding.[7]

The ultrasound assessment of ILD is determined by the presence and quantification of B-lines, which consist of tails generated by the reflection of the ultrasound beam from thickened subpleural interlobar septa at the lung surface interface.[8]

In radiologic imaging, the term "artefact" describes any part of an image which does not accurately represent the anatomic structures present within the subject being evaluated. B-lines are defined as discrete laser-like vertical hyperechoic reverberation artefacts that arise from the pleural line, extend to the bottom of the screen without fading, and move synchronously with respiration.[7]

B-lines are visible when the lung parenchyma air content is partially decreased and/or the interstitial space is volumetrically expanded, such as in pulmonary edema of various etiologies and ILD. It is important to underline that B-lines cannot be clearly correlated to a specific anatomical structure, but rather they are correlated to the changes in the physical properties of the lung.[8]

The present study is an attempt to evaluate high-frequency sonological findings in ILD and its comparison with HRCT.

Aims and Objectives

The aim of the study was as follows:

- To evaluate high-frequency sonological findings in ILD
- To compare these sonological signs with HRCT.

MATERIALS AND METHODS

This study was prospective analytical cross-sectional study type.

Study Place

This study was conducted at Gandhi Medical College, Hamidia Hospital, Bhopal.

Study Duration

This study duration was 18 months.

Methodology

One hundred adult patients with ILD who were referred to our department form TB and chest department for thoracic sonography and HRCT were included in our study.

Inclusion Criteria

The following criteria were included in the study:

- Patients with complaints of ILD and referred from the TB and chest and medicine department.

Exclusion Criteria

The following criteria were excluded from the study:

- Patients with lung neoplasm
- Patients other than ILD.

Sample Size

This study was 100 patients.

Procedure

USG chest

It was performed in our Department of Radiodiagnosis Gandhi Medical College, Bhopal, on all patients using a 7.5–10 MHz linear probe for lung and pleural examinations.

HRCT chest

All chest HRCT studies were performed in the Department of Radiodiagnosis Gandhi Medical College Bhopal with a 128-MDCT scanner.

Volumetric 1.25 mm slice thickness HRCT chest acquisition was done with the patient supine in the cranial-to-caudal direction during a single breath-hold.

From the volumetric CT, data set a series of contiguous thin-collimation 1.25 mm axial HRCT images were reconstructed using a high spatial resolution algorithm.

Investigations

HRCT is the gold standard for ILD diagnosis. HRCT scans were assessed for the presence of consolidation, pleural effusion, ground-glass opacity, nodular, reticular, reticulonodular, bronchiectasis, and honeycomb appearance.

Thoracic US examinations were performed on all patients. Patients were investigated in the supine or sitting position with their arms raised above heads to widen the intercostal space. Lung ultrasonography was performed in a series of scan lines along the chest wall with the transducer oriented either perpendicular or transverse to the chest wall. The anterior chest: Along the para-sternal lines, along the mid-clavear, anterior axillary, and mid-axillary lines; for the posterior chest: Along the paravertebral, subscapular, and posterior axillary lines. It was done using grayscale (B-mode) and time-motion (M-mode).

Lung Ultrasound Technique

Investigations

History – Detailed chronological history was taken from patients about inflammatory lung disease.

Physical examination – Comprising systemic and local examination. Radiological examination

1. High-frequency ultrasonography chest
2. HRCT chest.

Statistical Analysis

Student's *t*-test and ANOVA were used to compare the means. Chi-square test was used to compare the categorical data. $P < 0.05$ is considered as statistically significant.

DISCUSSION

ILDs represent a heterogeneous group of lung disorders that may be acute or chronic and characterized by diffuse involvement of the interstitium and impairment of the gas exchange capacity through the alveolocapillary membrane, which may lead to respiratory failure. LDs have different etiologies, clinical presentations, radiological patterns, and histological appearance. HRCT is considered the concurrent gold standard for the diagnosis of ILD as it a sensitive method to assess the extent and the pattern of pulmonary fibrosis.[9,10] Reticular pattern involving the subpleural regions, ground-glass opacities, nodular and micronodular pattern, and honeycombing are the common HRCT signs of pulmonary fibrosis.[4]

In ultrasonographic examination, the presence of a marked difference in acoustic impedance between an object and its surroundings leads to the appearance of B-line artifacts.[11] Normal lung contains much air and little water, so no reflection of the ultrasonographic beams occurs and normally, no B-line artifacts appear. When subpleural septae are thickened by water or fibrosis, a high impedance gradient occurs between these structures and the surrounding air, causing reflection of the beams, which create a phenomenon of resonance. The beam seems to be trapped in a closed system, resulting in endless to-and-fro echoing and yielded on the screen as a narrow-based laser-like ray extending from the lung surface to the edge of the screen.[12,13] In the present study, we evaluated high-frequency sonological findings in ILD and compared these sonological signs with HRCT.

In the present study, ILD was more prevalent in the age between 51–60 (31%) and 61–70 years (31%) followed by 41–50 years (16%). In a similar study, the age distribution of ILD patients was recorded as 54 ± 13 years by Gargani *et al.*[14] Cömert *et al.* also recorded a similar distribution of age, that is, 59.2 ± 14.2 years.[15] In Rotondo *et al.* study observed that mean age was 56.2 ± 13.8.[16]

In the present study, ILD was more prevalent in male patients (71%) followed by 29% females. Sperandeo *et al.* in a similar study found the male (61%) preponderance over female (39%) gender.[17] In Fessi *et al.* study of ILD patients also found the male (43%) to female (57%) ratio as 1:1.3 which is contrasting to our result, this could be due to sample selection and inclusion criteria applied.[10] The preponderance of male in our study may be due to the higher prevalence of smoking habits and exposure to pollution.

Most common presenting symptom in the present study was cough which was present in all the patients (100%), the productive cough was present in 43%, nonproductive cough was reported in 37% patients, 115 had blood in cough, more than half of the patients (53%) had breathlessness, 17% breathlessness during rest, 27% had breathlessness during walking, and 48% had breathlessness during exercise. In a similar meta-analysis by Carvajalino *et al.* reported that the highest prevalence was that for breathlessness (54–98%) and cough (59–100%) followed by heartburn (25–65%) and depression (10–49%).[18] Alhamad *et al.* reported a cough in the majority of the patients (82%) with ILD.[19] Araki *et al.* reported cough in 93% and dry cough in 45% of patients.[20] Bajwah *et al.* reported dyspnoea in 93%; cough in 60%; fatigue in 29%; insomnia in 6%;

and dyspepsia 4%.[21] All these studies are in line with the present study findings.

In the present study, 46% were smokers and 54% were non-smokers. There are strong associations between RA-ILD and older age, male sex, cigarette smoking, high rheumatoid factor titers, and increased anti-citrullinated protein antibody levels.[22] Fraig *et al.* evaluated 156 surgical lung biopsies, and they found 109 cases of RB, corresponding 98% of cases to smoker patients.[23] In the same way, Remy-Jardin *et al.* studied the parenchymal lesions of 41 smokers and they found the presence of pigmented macrophages in 69% of the patients.[24] Cottin it observed diagnosis of ILD in 88.6% of smoker patients who were operated for spontaneous pneumothorax.[12]

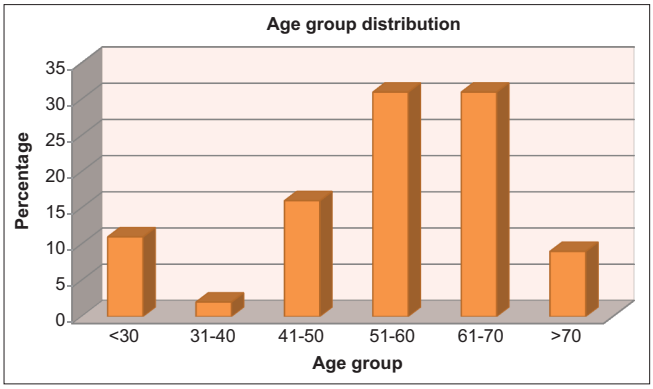
According to the International Consensus Conference on Pleural and Lung Ultrasound, B-lines are described as a discrete laser-like vertical hyperechoic lines arising from the pleural plane, extending to the bottom of the screen without fading and moving synchronously with the lung sliding. The presence of ≥3 B-lines between two ribs in a single scan is indicative for the presence of sonographic interstitial syndrome.[7]

In the present study on USG findings, it was found that all patients had B line (100%), the majority had distance between B lines of 7 mm (23%) followed by 5 mm (20%) and 4 mm (19%). Sliding pleura was abolished in 16% of patients. In a similar study by Hasan and Makhlouf reported that the distance between each of the two adjacent B lines correlated with the severity of the disease on chest HRCT where B3 (the distance was 3 mm) correlated with ground-glass opacity and B7 (the distance was 7 mm) correlated with extensive fibrosis and honeycombing. Furthermore, the distance between B-lines inversely correlated with FVC ($r = -0.848$, $P < 0.001$), TLC ($r = -0.664$, $P < 0.001$), DLCO ($r = -0.817$, $P < 0.001$), and PaO2 ($r = -0.902$, $P < 0.001$).[25] Our results are comparable with Lichtenstein, who reported the average distance between B-lines due to thickened interlobular septa by well-established fibrosis (7 mm) was wider may be due to the early stage of alveolar–interstitial affection and ground-glass attenuation (3 mm).[12] Bouhemad *et al.* found that multiple B-lines 7 mm apart are caused by thickened interlobular septa in 30% patients and B-lines at 3 mm or less apart are caused by in 19%.[26]

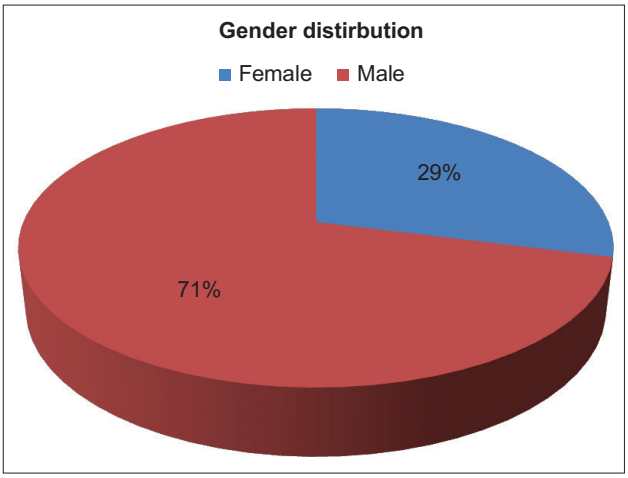
In the present study, pleural effusion was seen in 6 patients, ground-glass appearance in 45%, reticular pattern in 55 patients, nodular pattern in 25%, reticulonodular pattern in 25%, consolidation in 12%, honeycombing pattern in 40%, bronchiectasis in 37%, pleural thickening in 31%, and fibrotic band in 37% patients. Travis *et al.* reported similar findings in ILD patients, HRCT scan, the lower lung zones were predominantly involved in 92% of cases; 46% had a peripheral distribution; and 47% were diffuse. Most showed a reticular pattern (87%) with traction bronchiectasis (82%) and volume loss (77%). (Travis *et al.*) Giudice *et al.* in their study revealed "comet-tail" artifacts in the anterolateral lung fields in 31 (56.36%) patients and mixed patterns consisting in increased density associated with ring-down artifacts in 24 (46.64%). Pleural involvement was also observed in 34 cases (61.82%). Thoracic US appears to be a useful adjunct to clinical, laboratory, and radiological studies in patients suspected of having infectious interstitial pneumonia.[27] Sperandeo *et al.* reported that most common USG findings as subpleural cysts seen in 57/84 (68%), reduction in physiological "gliding sign" related to disease severity (observed in 33/84–39% cases), and increased number of horizontal (and to a lesser extent vertical) reverberation artifacts (seen in 41 patients with advanced fibrosis, 34% of the total series).[17] Sayeda *et al.* reported similar findings as sonographic features among ILD patients were B lines in 73.8%, abolished lung sliding in 23.8%, irregular and thickened pleura in 47.6% and 35.7%, respectively, and subpleural lesions in 38.1%. Increasing distance between the B lines was negatively correlated with both forced vital capacity % predicted, ground-glass opacities, and positively correlated with reticular opacities patterns on MDCT chest.[28]

The present study found a positive correlation between B line distance and pleural effusion, where the correlation coefficient is $r = 0.154$ with insignificant $P = 0.128$. No significant correlation was obtained.

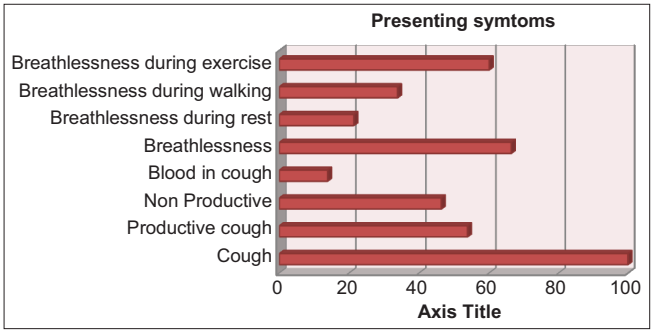
The present study found a negative correlation between B line distance and ground-glass appearance, where the correlation coefficient is $r = -0.770$ with significant $P < 0.001$. This means as the distance between B line increases and ground-glass appearance decreases. Hasan and Makhlouf, in 61 patients with different CTDs, showed that the severity of ILD had a positive correlation between B-lines on LUS and the findings on chest HRCT in terms of ground-glass opacity.[25] Early stages of ILD, even before the thickening of the subpleural interlobular septa, give ground-glass areas in HRCT. Ultrasound examination of these areas gives numerous B-lines with a narrow distance between them (3 mm), making the surface of the lung more hyperechoic, giving the description of the white lung. This may be due to the affection of the alveolar wall by inflammatory cells and edema, making it about the pleural surface between two septa giving numerous artifacts with a narrow distance between them. Bouhemad et al. found that multiple B-lines 7 mm apart are caused by thickened interlobular septa, characterizing interstitial edema, while



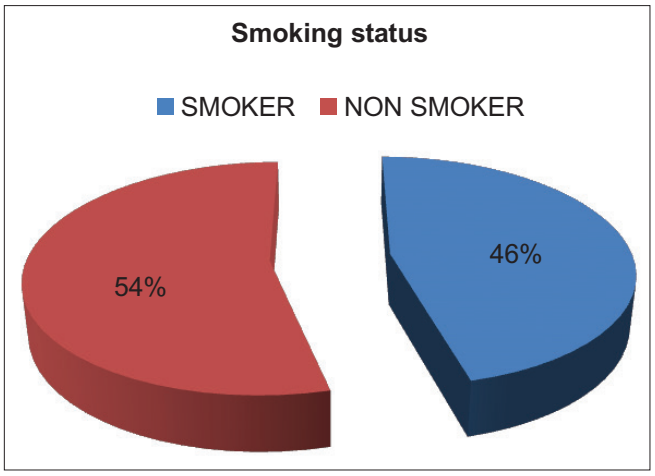
Graph 1: Age group distribution



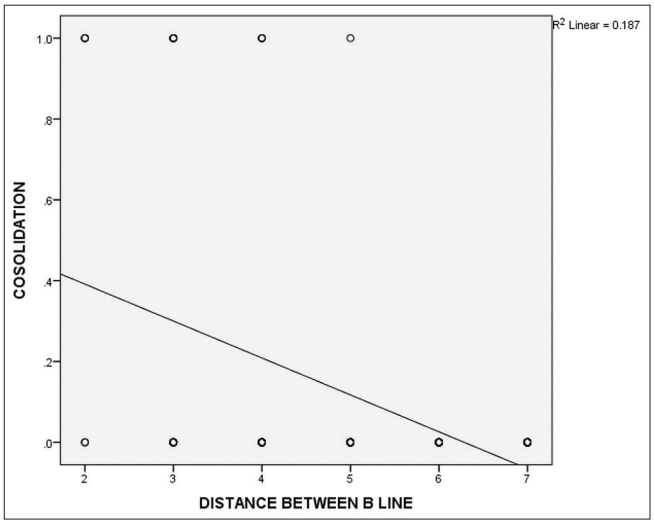
Graph 2: Gender distribution



Graph 3: Presenting symptoms



Graph 4: Smoking status



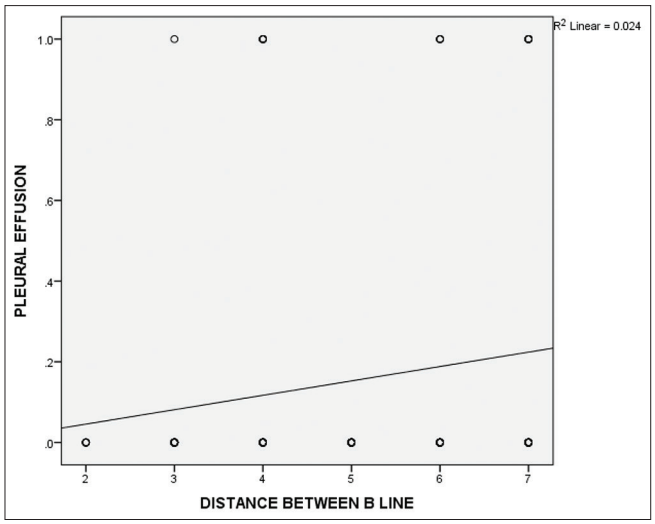
Graph 5: This graph shows a negative correlation between B line distance and consolidation, where the correlation coefficient is r = –0.133 with insignificant *P* = 0.365. No significant correlation was obtained

B-lines 3 mm or less apart are caused by ground-glass areas characterizing alveolar edema.[26]

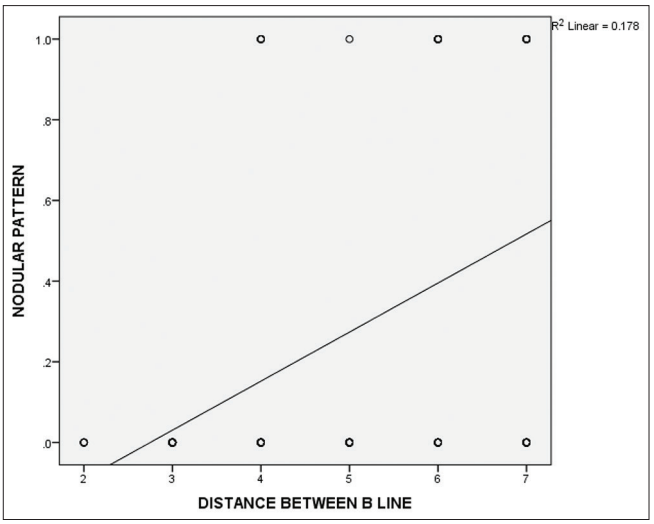
The present study found a positive correlation between B line distance and pleural effusion, where the correlation coefficient is r = 0.122 with insignificant $P = 0.241$. No significant correlation was obtained. Sayeda *et al.* reported pleural abnormalities, thickened pleura, and pleural effusion were significantly higher among patients than among controls (35.7 vs. 0%, $P = 0.002$, 33.3 vs. 0%, $P = 0.001$, respectively). The subpleural parenchymal lesions were significantly higher in ILD patients compared with controls (38.1 vs. 0%, $P = 0.007$). Their sizes ranged from 15 to 20 mm.[28]

The present study found a positive correlation between B line distance and bronchiectasis, where the correlation coefficient is r = 0.182 with an insignificant $P = 0.681$. No significant correlation was obtained. Barakat reported that the maximum number of B-lines seen in any positive zone was significantly correlated with type of bronchiectasis on chest HRCT (r = 0.729; $P < 0.0001$), and extent of bronchiectasis on chest HRCT (r = 0.640; $P < 0.0001$).[29]

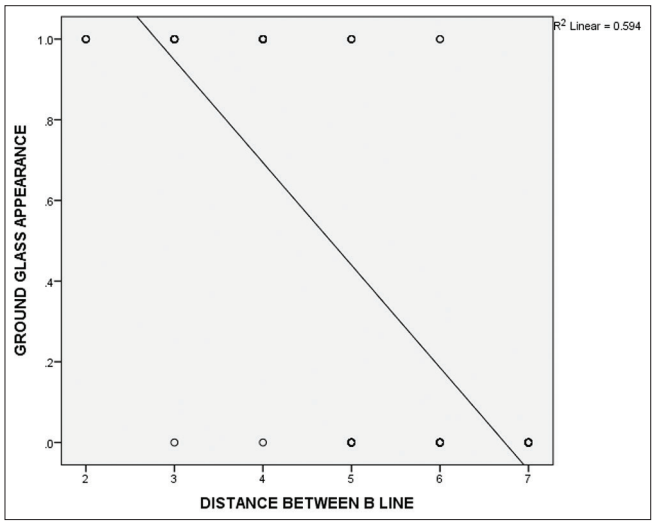
The present study found a positive correlation between B line distance and pleural thickening, where the correlation coefficient is r = −0.164 with insignificant $P = 0.104$. No significant correlation was obtained. Sperandeo *et al.*



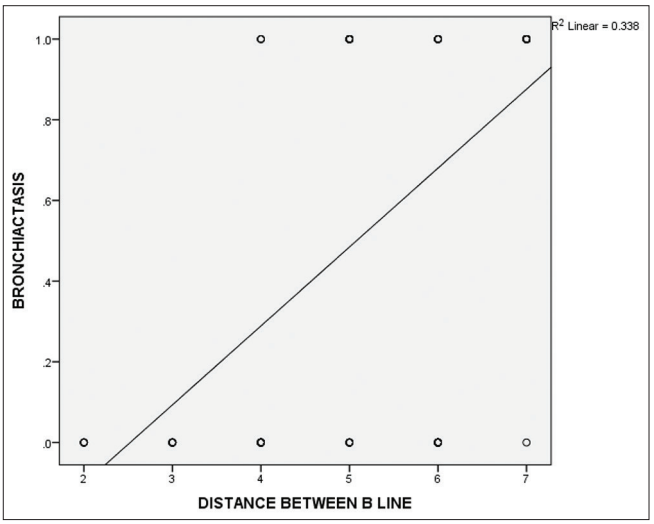
Graph 6: This graph shows a positive correlation between B line distance and pleural effusion, where the correlation coefficient is r = 0.154 with insignificant *P* = 0.128. No significant correlation was obtained



Graph 8: This graph shows a positive correlation between B line distance and pleural effusion, where the correlation coefficient is r = 0.122 with insignificant *P* = 0.241. No significant correlation was obtained



Graph 7: This graph shows a negative correlation between B line distance and ground-glass appearance, where the correlation coefficient is r = –0.770 with significant *P* < 0.001. This means as the distance between B lines increases ground-glass appearance decreases



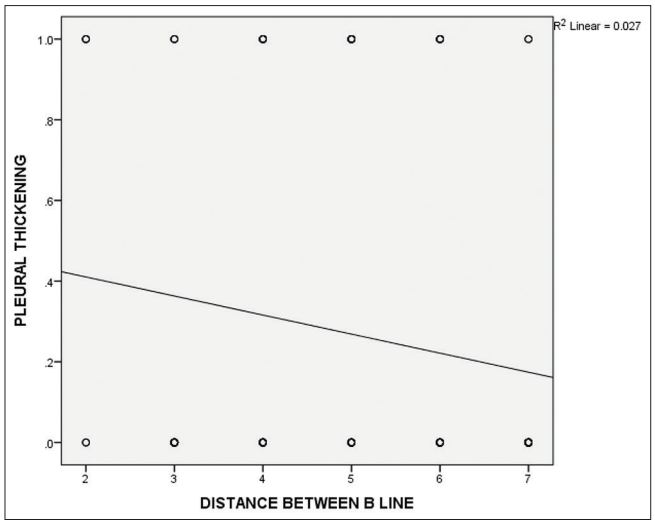
Graph 9: This graph shows a positive correlation between B line distance and bronchiectasis, where the correlation coefficient is r = 0.182 with insignificant *P* = 0.681. No significant correlation was obtained

enrolled 175 ILD patients who underwent LUS examination and chest HRCT. They found a good correlation between pleural and subpleural irregularities and nodules on LUS and the HRCT findings.[17]

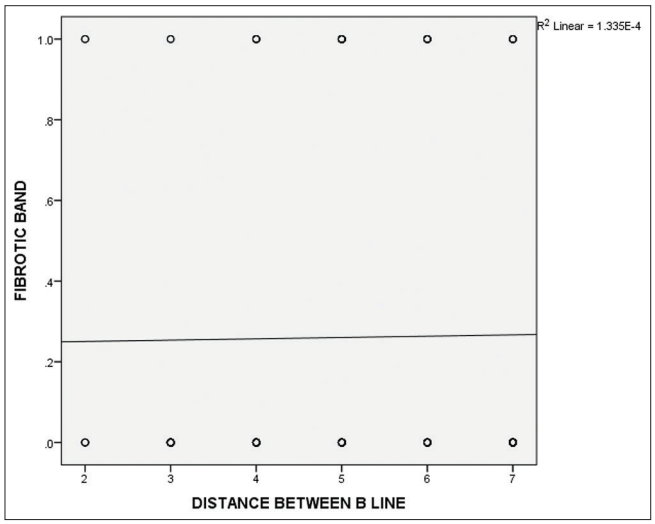
The present study found a positive correlation between B line distance and fibrotic band, where the correlation coefficient is r = 0.012 with insignificant *P* = 0.909. No significant correlation was obtained. Song *et al.* supported these data showing that the number of B-lines had a good correlation with the HRCT fibrosis pattern and good diagnostic accuracy in terms of sensitivity (91.5%) and specificity (81.3%) (35).[30]

The present study found a positive correlation between B line distance and honeycombing pattern, where the correlation coefficient is r = 0.212 with significant *P* = 0.562. No significant correlation was obtained. Hasan and Makhlouf, in 61 patients with different CTDs, showed that the severity of ILD had a positive correlation between B-lines on LUS and the findings on chest HRCT honeycombing.[25]

The present study found a positive correlation between B line distance and reticulonodular pattern, where the correlation coefficient is r = 0.061 with significant *P* < 0.781. No significant correlation was obtained. Sayeda



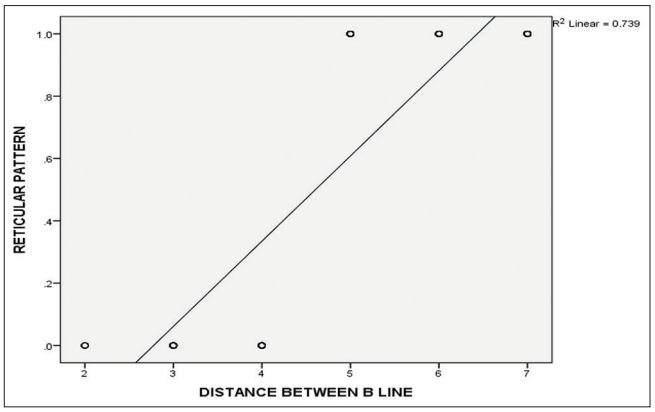
Graph 10: This graph shows a positive correlation between B line distance and pleural thickening, where the correlation coefficient is r = –0.164 with insignificant *P* = 0.104. No significant correlation was obtained



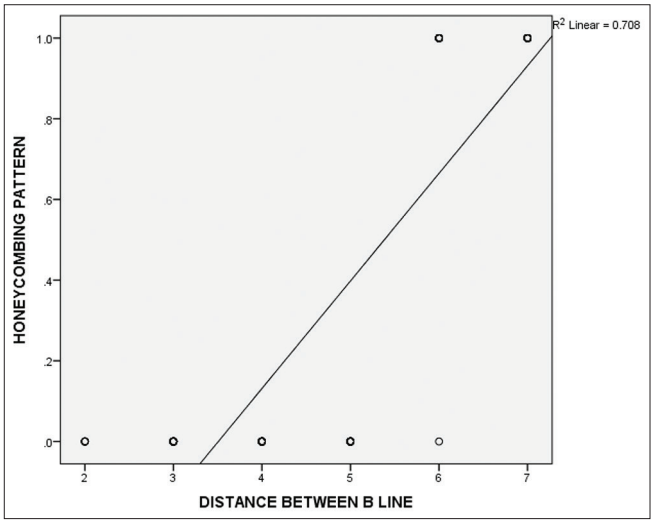
Graph 11: This graph shows a positive correlation between B line distance and fibrotic band, where the correlation coefficient is r = 0.012 with insignificant *P* = 0.909. No significant correlation was obtained

et al. reported the sonographic features among ILD patients were B lines in 73.8%, abolished lung sliding in 23.8%, irregular and thickened pleura in 47.6% and 35.7%, respectively, and subpleural lesions in 38.1%. Increasing distance between the B lines was negatively correlated with both of forced vital capacity % predicted, ground-glass opacities, and positively correlated with reticular opacities patterns on MDCT chest.[28]

Cross-sectional nature and small sample size are the main limitations of the present study, a large randomized clinical trial is required to provide strength to present study findings.



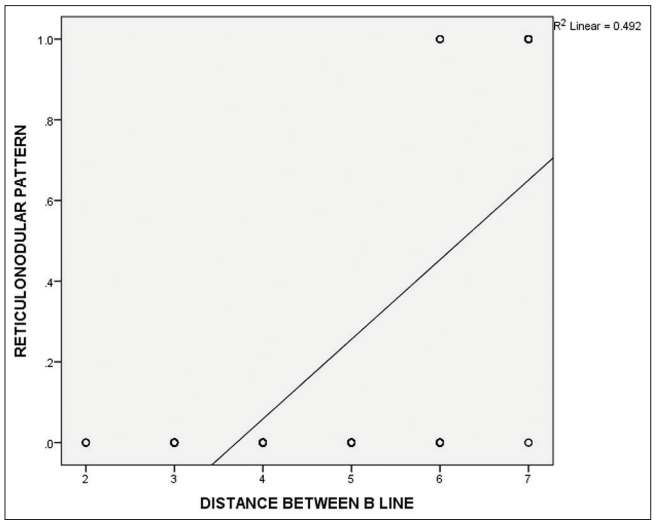
Graph 12: This graph shows a positive correlation between B line distance and reticular pattern, where the correlation coefficient is r = 0.859 with significant *P* < 0.001. This means as the distance between B lines increases reticular pattern also increases



Graph 13: This graph shows a positive correlation between B line distance and honeycombing pattern, where the correlation coefficient is r = 0.212 with significant *P* = 0.562. No significant correlation was obtained

RESULTS

1. In the present study, majority of the patients had an age between 51–60 (31%) and 61–70 years (31%) followed by 41–50 years (16%)
2. In the present study, majority of the patients were males (71%) followed by 29% females
3. Most common presenting symptom in the present study was cough which was present in all the patients (100%), productive cough was present in 43%, nonproductive cough was reported in 37% patients, 115 had blood in cough, more than half of the patients (53%) had breathlessness, 17% breathlessness during rest, 27% had breathlessness during walking, and 48% had breathlessness during exercise



Graph 14: This graph shows a positive correlation between B line distance and reticulonodular pattern, where the correlation coefficient is r = 0.061 with significant *P* < 0.781. No significant correlation was obtained

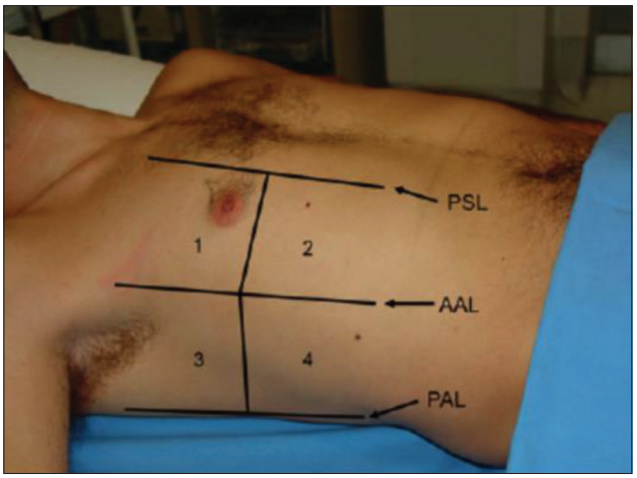


Figure 1: Markings

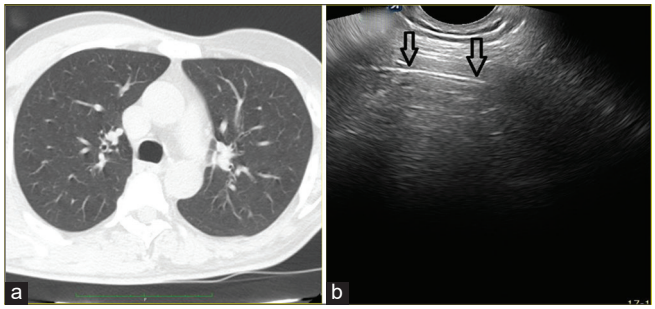


Figure 2: (a) High resolution computed sonography: Normal. (b) Transthoracic ultrasonography: Normal hyperechoic pleural line (black arrow). No B-lines visible

4. In the present study, 46% were smokers and 54% were non-smokers
5. In the present study on USG findings, it was found that all patients had B line (100%), majority had distance between B lines of 7 mm (23%) followed by 5 mm (20%) and 4 mm (19%). Sliding pleura was abolished in 16% of patients
6. In the present study, pleural effusion was seen in 6 patients, ground-glass appearance in 45%, reticular pattern in 55 patients, nodular pattern in 25%, reticulonodular pattern in 25%, consolidation in 12%, honeycombing pattern in 40%, bronchiectasis in 37%, pleural thickening in 31%, and fibrotic band in 37% patients
7. Correlation between B line this graph shows a negative correlation between B line distance and consolidation, where the correlation coefficient is r = □0.133 with an insignificant *P* = 0.365. No significant correlation was obtained, with HRCT finding.
8. This graph shows a positive correlation between B line distance and pleural effusion, where the correlation coefficient is r = 0.154 with insignificant *P* = 0.128. No significant correlation was obtained
9. This graph shows a negative correlation between B line distance and ground-glass appearance, where the correlation coefficient is r = −0.770 with significant *P* < 0.001. This means as the distance between B line increases ground-glass appearance decreases
10. This graph shows a positive correlation between B line distance and nodular pattern, where the correlation

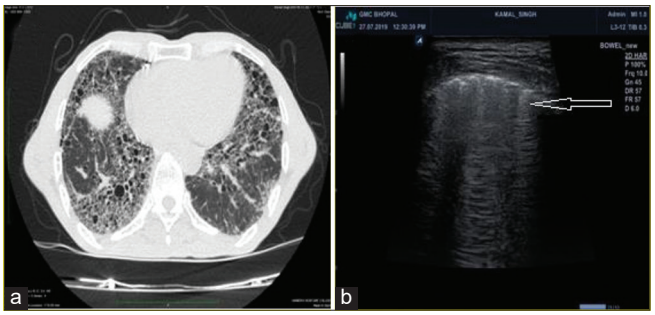


Figure 3: (a) High resolution computed tomography of the chest showing bilateral subpleural reticular and honeycomb shadows in a patient. (b) Transthoracic sonography shows B lines (white arrow) arising from the pleural line with a distance between the two B lines of about 7 mm

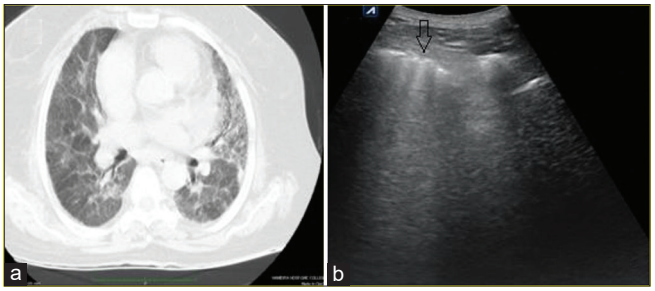


Figure 4: (a) High resolution computed tomography of the chest in a patient with interstitial lung disease showing left lung ground-glass opacity. (b) Transthoracic sonography of the same patient showing multiple B lines arising from a thickened and irregular pleural line (black arrow)

Table 1: Age group distribution

Age group	Frequency	Percent
<30	11	11
31–40	2	2
41–50	16	16
51–60	31	31
61–70	31	31
>70	9	9
Total	100	100

In the present study, majority of the patients had an age between 51–60 (31%) and 61–70 years (31%) followed by 41–50 years (16%)

Table 2: Gender distribution

Gender	Frequency	Percent
Female	29	29
Male	71	71
Total	100	100.0

Table 3: Presenting symptoms

	No of patients	Percentage
Cough	80	100
Productive cough	43	53.8
Non-productive	37	46.3
Blood in cough	11	13.8
Breathlessness	53	66.3
Breathlessness during rest	17	21.3
Breathlessness during walking	27	33.8
Breathlessness during exercise	48	60

Table 4: Smoking status

		Frequency	Percent
Smoker	Yes	46	46
Non-smoker	Yes	54	54

In the present study, 46% were smokers and 54% were non smokers

Table 5: USG findings

	Frequency	Percent
USG findings		
A line	00	00
B line	100	100
Distance between B line (mm)		
2	5	5
3	16	16
4	19	19
5	20	20
6	17	17
7	23	23
Sliding pleura		
Abolish	16	16
Yes	84	84

In the present study on USG findings, it was found that all patients had B line (100%), majority had distance between B lines of 7 mm (23%) followed by 5 mm (20%) and 4 mm (19%). Sliding pleura was abolished in 16% of patients

Table 6: HRCT finding

Variable	No of patients	Percentage
Pleural effusion		
No	94	94
Yes	6	6
Ground-glass appearance		
No	55	55
Yes	45	45
Reticular pattern		
No	45	45
Yes	55	55
Nodular pattern		
No	75	75
Yes	25	25
Reticulonodular pattern		
No	75	75
Yes	25	25
Consolidation		
No	88	88
Yes	12	12
Honeycombing pattern		
No	60	60
Yes	40	40
Bronchiectasis		
No	63	63
Yes	37	37
Pleural thickening		
No	69	69
Yes	31	31
Fibrotic band		
No	63	63
Yes	37	37

coefficient is r = 0.122 with insignificant $P = 0.241$. No significant correlation was obtained

11. This graph shows a positive correlation between B line distance and bronchiectasis, where the correlation coefficient is r = 0.182 with insignificant $P = 0.681$. No significant correlation was obtained
12. This graph shows a positive correlation between B line distance and pleural thickening, where the correlation coefficient is r = −0.164 with insignificant $P = 0.104$. No significant correlation was obtained
13. This graph shows a positive correlation between B line distance and fibrotic band, where the correlation coefficient is r = 0.012 with insignificant $P = 0.909$. No significant correlation was obtained
14. Correlation between reticular pattern with B line: This graph shows a positive correlation between B line distance and reticular pattern, where the correlation coefficient is r = 0.859 with significant $P < 0.001$. This means as the distance between B lines increases reticular pattern also increases
15. This graph shows a positive correlation between B line distance and honeycombing pattern, where the correlation coefficient is r = 0.212 with significant $P = 0.562$. No significant correlation was obtained
16. This graph shows a positive correlation between B line distance and reticulonodular pattern, where the correlation coefficient is r = 0.061 with significant

Table 7: Correlation between B line with HRCT finding

	Distance between B line
Consolidation	
Pearson correlation	–0.133
Sig. (2-tailed)	0.365
n	100
Pleural effusion	
Pearson correlation	0.154
Sig. (2-tailed)	0.128
n	100
Ground-glass appearance	
Pearson correlation	–0.770
Sig. (2-tailed)	<0.001
n	100
Nodular pattern	
Pearson correlation	0.122
Sig. (2-tailed)	0.241
n	100
Pleural thickening	
Pearson correlation	–0.164
Sig. (2-tailed)	0.104
n	100
Fibrotic band	
Pearson correlation	0.012
Sig. (2-tailed)	0.909
n	100
Bronchiectasis	
Pearson correlation	0.182
Sig. (2-tailed)	0.681
n	100

Table 8: Correlation between reticular, reticulonodular pattern, and honeycombing pattern with B line

Reticular pattern	
Pearson correlation	0.859
Sig. (2-tailed)	<0.001
n	100
Honeycombing pattern	
Pearson correlation	0.121
Sig. (2-tailed)	0.562
n	100
Reticulonodular pattern	
Pearson correlation	0.061
Sig. (2-tailed)	0.784
n	100

$P < 0.781$. No significant correlation was obtained [Tables 1-8, Figures 1-4 and Graphs 1-14].

CONCLUSION

Results of the present study showed that the elder male population had a high prevalence of ILD. Cough mainly productive cough represents the most common clinical symptoms in ILD patients along with breathlessness. Smoking has a stroke association with the progression of ILD to its severe form as in all the patients, B lines are clearly visible. The majority having 7 mm size.

Ground-glass appearance, reticular pattern, nodular pattern, reticulonodular pattern, consolidation, honeycombing pattern, bronchiectasis, etc., were the common presentations of ILD.

B line distances were positively correlated with reticular pattern and negatively correlated with ground glass appearance.

Based on the results, we conclude that transthoracic lung ultrasound has many advantages over HRCT; it is a bedside procedure widely available, easily performed, inexpensive, requires neither ionizing radiation nor a contrast medium, and is therefore readily and largely accepted by the patient. In addition, the surface of the lung can be easily studied by the US; therefore, the B-lines are quickly detected using either low-frequency or high-frequency transducers. In critically ill patients, portable machines even without Doppler power can be sufficient for a complete and detailed lung assessment. Finally, ultrasound is useful in situations where HRCT is not available or undesirable, as in pre-hospital emergencies and in pregnancy and when a patient cannot be transported out of the intensive care unit because of severe disease.

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