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**B Lines and Pleural Fractures on Lung Ultrasound as Indicators of Severity in UIP and NSIP Patients: A Comparative Study with HRCT and PFT**

# Abstract

## Background:

Usual Interstitial Pneumonia (UIP) and Non-Specific Interstitial Pneumonia (NSIP) are distinct yet related forms of interstitial lung diseases (ILD). This study aims to compare the lung ultrasound findings versus High-Resolution Computerized Tomography (HRCT) and Pulmonary Function Tests (PFT) for detecting severity of lung involvements in UIP and NSIP.

## Methods:

In this cross-sectional study at a referral hospital in 2022, 60 participants with confirmed UIP (N=30) and NSIP (N=30) were enrolled. Exclusion criteria encompassed other interstitial lung diseases and significant comorbidities. HRCT scans were employed for patient categorization and lung involvement assessment, independently reviewed by two radiologists. Pleural Sonography was performed at six lung sites for the following variables: number of B lines, pleural fractures, and pleural thickness. PFTs were assessed using a spirometer.

## Results:

In a 60-participant study (56.7 ± 8.9 years, 61.7% male), differences were identified between UIP (n=30) and NSIP (n=30). B line variations were observed (Right: 13.4 ± 3.3 vs. 10.7 ± 4.25, p=0.007; Left: 12.4 ± 2.7 vs. 9.6 ± 4.7, p=0.008; Total: 25.9 ± 5.4 vs. 20.3 ± 8.5, p=0.004). The proportion of UIP patients with over 18 B-lines (90%) was significantly higher than in NSIP patients (56.7%) (P=0.004). Additionally, UIP patients exhibit a significant occurrence of 3 or more pleural fractures on ultrasound compared to NSIP patients (40% vs. 13.3%, P= 0.02).

In 30 UIP subjects, differences were identified in B line variations. Over 18 B-Lines on ultrasound showed more than 50% HRCT lung involvement (63% vs 37%, p=0.037), with no widespread involvement at 18 or fewer B-Lines. With pleural fractures in ≥3 lung areas, >50% HRCT lung involvement was found (91.7% vs 33.3%, P=0.002). Those with 18 or fewer B-Lines on ultrasound displayed mild or moderate DLCO impairment whereas those with more than 18 B-Lines had significant DLCO impairment (37.5% vs. 73.7%, P=0.014). Other PFT indices and B-Line number did not exhibit a significant relationship (P>0.05). More than 21 B-lines resulted in 100% sensitivity and 38.5% specificity (optimal cut off point=26.5, AUC=0.729 [0.544, 0.913], P=0.035) for >50% lung involvement. Sensitivities and specificities for >50% HRCT involvement considering pleural fracture>2 was 64.7% and 92.3%, respectively. For severe DLCO considering B-line>18, the sensitivity was 73.6% and specificity 100%.

In NSIP subjects, B line variations were observed, but no correlation with over 50% lung involvement on HRCT (52.9% vs 47.4%, P=0.177). A significant correlation with FVC and TLC indices was found (Rho=0.630, P=0.001; Rho=0.414, P=0.035). Over 18 B-Lines was linked to severe TLC (64.3% vs. 23.1%, P=0.031), and increased counts of B lines were linked to greater FVC severity versus lower counts (85.7% vs. 23.1%, P=0.001). The sensitivities and specificities were 9.1% and 84.2% for identical HRCT measurements, and 45.5% and 76.9% for severe DLCO considering B-line>18.

## Conclusion:

B lines and US wave fractures are key indicators in monitoring severity for UIP and NSIP patients. In UIP, B lines diagnose >50% HRCT involvement with 100% sensitivity. US wave fractures in over 2 sites distinguish >50% lung involvement in UIP and NSIP with high specificity, while B lines predict extensive DLCO impairments in UIP with high accuracy. The study suggests pulmonary sonography as a method for detecting severe lung involvements in UIP patients.