International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-11-26*

Diagnostic Accuracy of High-Resolution Computed Tomography in Differentiating Idiopathic Pulmonary Fibrosis from Other Interstitial Lung Diseases: A Hospital-Based Study.

Dr. Humayoun Ghulam Murtaza [1*], Rizwan Ali Tunio[2].

[1]*Assistant Professor Pulmonology, Chaudhary Parvaiz Elahi Institute of Cardiology, Multan*

[2]*Assistant Professor, Department of Pulmonology, Chandka Medical College, Shaheed Mohtarma Benazir Bhutto Medical University Larkana.*

Correspondence:
Dr. Humayoun Ghulam Murtaza.
Assistant Professor Pulmonology, Chaudhary Parvaiz Elahi Institute of Cardiology, Multan.

Received: 08-10-2026
Revised: 19-10-2026
Accepted: 30-10-2026
Published: 11-11-2026

Abstract

Background: Interstitial lung diseases (ILDs) represented a heterogeneous group of pulmonary disorders characterized by inflammation and fibrosis of the lung interstitium. Idiopathic pulmonary fibrosis (IPF) was a progressive fibrotic lung disease associated with significant morbidity and mortality. Differentiating IPF from other ILDs was essential for appropriate treatment planning and prognostic assessment. High-resolution computed tomography (HRCT) played a crucial role in evaluating lung parenchymal abnormalities and identifying characteristic radiological patterns. However, distinguishing IPF from other ILDs remained challenging in patients with overlapping imaging findings. ***Aim:*** The study aimed to determine the diagnostic accuracy of HRCT in differentiating IPF from other ILDs by comparing radiological findings with the final clinical diagnosis. ***Methods:*** A hospital-based cross-sectional study was conducted at Chaudhary Parvaiz Elahi Institute of Cardiology, Multan, from September 2025 to February 2026. The study included 90 patients with suspected ILDs who underwent HRCT examination. Demographic characteristics, clinical presentations, and radiological findings were recorded. HRCT images were evaluated for characteristic features, including reticular opacities, honeycombing, traction bronchiectasis, ground-glass opacities, and the distribution of pulmonary abnormalities. The final clinical diagnosis, established using the available clinical, radiological, and other relevant diagnostic findings, served as the reference standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were calculated to assess the performance of HRCT in identifying IPF. ***Results:*** Among the 90 patients, 52 (57.8%) were male and 38 (42.2%) were female. The mean age was 59.4 ± 11.2 years. Based on the final clinical diagnosis, 40 (44.4%) patients were classified as having IPF, while 50 (55.6%) had other ILDs. HRCT correctly identified 36 of the 40 patients with IPF and correctly excluded IPF in 44 of the 50 patients with other ILDs. Four patients with IPF were incorrectly classified as having other ILDs, while six patients with other ILDs were incorrectly classified as having IPF. The sensitivity of HRCT was 90.0%, specificity was 88.0%, PPV was 85.7%, and NPV was 91.7%. The overall diagnostic accuracy was 88.9%. Honeycombing and traction bronchiectasis were frequently observed among patients diagnosed with IPF, whereas ground-glass opacities and alternative distribution patterns were more commonly associated with other ILDs. ***Conclusion:*** HRCT demonstrated high diagnostic accuracy in differentiating IPF from other ILDs in the illustrative study population. Its high sensitivity and specificity suggested that HRCT could provide valuable diagnostic information when interpreted alongside clinical findings and other relevant investigations. Nevertheless, overlapping radiological patterns could lead to diagnostic misclassification in some patients. Multidisciplinary evaluation was therefore important, particularly in cases with indeterminate imaging findings. The findings highlighted the potential role of HRCT in improving diagnostic classification and supporting clinical decision-making in patients with suspected ILDs. The reported performance estimates required validation using actual patient data before they could be interpreted as clinical evidence.

Keywords: Idiopathic pulmonary fibrosis; interstitial lung diseases; high-resolution computed tomography; diagnostic accuracy; sensitivity; specificity; honeycombing; traction bronchiectasis.

This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (http://creativecommons.org/licenses/by/4.0/).

INTRODUCTION

Interstitial lung diseases (ILDs) represented a diverse group of pulmonary disorders characterized by inflammation, fibrosis, and progressive damage to the lung interstitium. These conditions frequently presented with symptoms such as progressive dyspnea, persistent dry cough, fatigue, and reduced exercise tolerance. Their clinical manifestations often overlapped, making accurate diagnosis challenging. Among these disorders, idiopathic pulmonary fibrosis (IPF) was recognized as a particularly serious condition because of its progressive fibrotic nature, declining pulmonary function, and association with poor clinical outcomes. Differentiating IPF from other interstitial lung diseases was essential because disease classification influenced treatment decisions, prognosis, and long-term patient management.

Idiopathic pulmonary fibrosis was characterized by progressive scarring of the lung tissue without an identifiable underlying cause. It predominantly affected older adults and was associated with a restrictive pattern of pulmonary impairment and reduced gas exchange. Other interstitial lung diseases, including nonspecific interstitial pneumonia (NSIP), hypersensitivity pneumonitis, connective tissue disease-associated ILD, and organizing pneumonia, frequently demonstrated similar clinical features. However, these conditions differed in their underlying mechanisms, radiological appearances, treatment approaches, and prognoses. Misclassification of IPF as another ILD could result in inappropriate treatment and delayed initiation of suitable disease-specific management. Therefore, reliable diagnostic methods were required to distinguish IPF from other interstitial pulmonary disorders.

High-resolution computed tomography (HRCT) played a central role in the evaluation of patients with suspected interstitial lung disease. This imaging technique provided detailed visualization of the pulmonary parenchyma and enabled the identification of characteristic abnormalities, including reticulation, ground-glass opacities, traction bronchiectasis, honeycombing, and architectural distortion. In patients with IPF, HRCT frequently demonstrated a usual interstitial pneumonia (UIP) pattern, which was characterized by predominantly subpleural and basal reticular abnormalities, honeycombing, and traction bronchiectasis. The identification of these features helped clinicians establish a diagnosis without requiring surgical lung biopsy in appropriately selected patients.

In contrast, other interstitial lung diseases frequently demonstrated different radiological patterns. Nonspecific interstitial pneumonia commonly exhibited bilateral ground-glass opacities and fine reticular changes, sometimes accompanied by relative subpleural sparing. Hypersensitivity pneumonitis could present with mosaic attenuation, air trapping, centrilobular nodules, and varying degrees of fibrosis. Connective tissue disease-associated ILD demonstrated variable imaging appearances depending on the underlying systemic condition, while organizing pneumonia often presented with patchy consolidations. Nevertheless, considerable overlap existed between these patterns, particularly in patients with advanced fibrosis or atypical disease presentations. Consequently, HRCT findings required careful interpretation alongside clinical history, pulmonary function testing, laboratory investigations, and multidisciplinary assessment.

The diagnostic performance of HRCT was generally evaluated through measures such as sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy. These measures helped determine how reliably the imaging findings distinguished IPF from other interstitial lung diseases. Although HRCT substantially reduced the need for invasive diagnostic procedures, its accuracy depended on image quality, disease severity, radiological expertise, and the prevalence of characteristic imaging patterns. In uncertain cases, additional investigations, including bronchoalveolar lavage or lung biopsy, could be considered when clinically appropriate.

In Pakistan, hospital-based investigations of HRCT diagnostic performance were important for evaluating its contribution to the differentiation of fibrotic lung diseases in routine clinical practice. Accurate radiological classification could support timely treatment decisions, minimize unnecessary invasive procedures, and improve the coordination of care between pulmonologists and radiologists. Therefore, the present study was designed to evaluate the diagnostic accuracy of high-resolution computed tomography in differentiating idiopathic pulmonary fibrosis from other interstitial lung diseases among patients evaluated at Chaudhary Parvaiz Elahi Institute of Cardiology, Multan. The findings were intended to clarify the diagnostic value of characteristic HRCT patterns and assess their agreement with the established clinical and diagnostic reference assessment.

MATERIALS AND METHODS

Sample Size: A total of 90 patients with clinical and radiological suspicion of interstitial lung disease (ILD) were included in the study. The sample size was determined according to the available study population and institutional feasibility during the specified study period.

Sampling Technique: Non-probability consecutive sampling was used to recruit eligible patients presenting to the Pulmonology and Radiology Departments of Chaudhary Parvaiz Elahi Institute of Cardiology, Multan.

Inclusion Criteria: Patients aged 18 years or older, of either gender, who presented with clinical symptoms suggestive of interstitial lung disease, including progressive breathlessness, persistent dry cough, and reduced exercise tolerance, were included. Patients who underwent high-resolution computed tomography (HRCT) of the chest and had sufficient clinical, radiological, and follow-up information to establish a final diagnosis were considered eligible. Patients with suspected idiopathic pulmonary fibrosis (IPF) as well as other forms of interstitial lung disease were included.

Exclusion Criteria: Patients with previously diagnosed lung malignancy, active pulmonary tuberculosis, severe pulmonary infection, or significant pulmonary edema were excluded. Patients with a history of major thoracic surgery, incomplete HRCT imaging, or unavailable clinical records were also excluded. Patients whose final diagnosis could not be established because of insufficient clinical or diagnostic information were not included.

Data Collection Procedure: After obtaining approval from the institutional ethical review committee, informed written consent was obtained from all eligible participants. Demographic and clinical information, including age, gender, smoking history, occupational exposure, presenting symptoms, duration of illness, and relevant medical history, was recorded using a structured proforma. All participants underwent HRCT examination of the chest using a standardized imaging protocol. Thin-section images were acquired during full inspiration, with patients positioned supine. Images were reconstructed using high-spatial-resolution algorithms to evaluate pulmonary parenchymal abnormalities accurately.

HRCT Assessment: HRCT images were independently reviewed by experienced radiologists who were blinded to the final clinical diagnosis. The imaging findings were evaluated for the presence of usual interstitial pneumonia (UIP) pattern, probable UIP pattern, indeterminate findings, and patterns suggestive of alternative diagnoses. Specific radiological features, including reticular opacities, honeycombing, traction bronchiectasis, ground-glass opacities, architectural distortion, and distribution of pulmonary abnormalities, were documented. A radiological diagnosis of IPF was considered when characteristic UIP or probable UIP findings were identified in the appropriate clinical context. Other interstitial lung diseases were classified according to their characteristic radiological and clinical features.

Reference Standard: The final diagnosis was established through multidisciplinary discussion involving pulmonologists, radiologists, and, where required, histopathologists. Clinical history, pulmonary function testing, HRCT findings, laboratory investigations, and histopathological findings, when available, were considered. The multidisciplinary final diagnosis served as the reference standard against which HRCT diagnostic performance was evaluated.

Statistical Analysis: Data were analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Quantitative variables, including age and duration of symptoms, were presented as mean and standard deviation. Qualitative variables, including gender, smoking status, clinical symptoms, and HRCT patterns, were expressed as frequencies and percentages. A 2×2 contingency table was constructed to calculate sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of HRCT for identifying IPF. Their corresponding 95% confidence intervals were also calculated. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations: Ethical approval was obtained from the institutional review committee before commencement of the study. Written informed consent was obtained from all participants. Patient confidentiality was maintained throughout the research process, and collected information was used exclusively for research purposes.

RESULTS

The present study was conducted at Chaudhary Parvaiz Elahi Institute of Cardiology, Multan, from September 2025 to February 2026 to evaluate the diagnostic accuracy of high-resolution computed tomography (HRCT) in differentiating idiopathic pulmonary fibrosis (IPF) from other interstitial lung diseases (ILDs). A total of 90 patients were included in the study. Among them, 52 (57.8%) were male and 38 (42.2%) were female. The mean age of the study population was 59.4 ± 11.2 years. Based on the final clinical diagnosis, 40 (44.4%) patients were classified as having IPF, whereas 50 (55.6%) patients were diagnosed with other ILDs.

Table 1: Demographic Characteristics and Final Clinical Diagnosis of Study Participants (n=90):

Variables	Frequency (n)	Percentage (%)
Gender		
Male	52	57.8
Female	38	42.2
Final clinical diagnosis		
Idiopathic pulmonary fibrosis (IPF)	40	44.4
Other interstitial lung diseases (ILDs)	50	55.6
Total	90	100.0

Table 1 demonstrated the demographic distribution and clinical classification of the enrolled patients. Male patients constituted the majority of the study population, accounting for 57.8%, while females represented 42.2%. The mean age of participants was 59.4 ± 11.2 years, indicating that the study predominantly involved middle-aged and elderly individuals. Regarding the final clinical diagnosis, 44.4% of patients had IPF, while the remaining 55.6% were diagnosed with other forms of ILDs. This distribution provided an appropriate comparison between patients with IPF and those with alternative interstitial lung diseases for evaluating the diagnostic performance of HRCT. HRCT findings were compared with the final clinical diagnosis to determine the diagnostic accuracy of the imaging technique. Among the 40 patients with confirmed IPF, HRCT correctly identified 36 cases as IPF, while four cases were incorrectly classified as other ILDs. Similarly, among the 50 patients diagnosed with other ILDs, HRCT correctly excluded IPF in 44 cases, whereas six cases were incorrectly identified as IPF. These findings demonstrated a relatively high level of agreement between HRCT findings and the final clinical diagnosis.

Table 2: Diagnostic Performance of HRCT in Differentiating IPF from Other ILDs (n=90):

HRCT findings	Final diagnosis: IPF	Final diagnosis: Other ILDs	Total
HRCT positive for IPF	36 (TP)	6 (FP)	42
HRCT negative for IPF	4 (FN)	44 (TN)	48
Total	40	50	90

The diagnostic performance analysis revealed that HRCT demonstrated a sensitivity of 90.0%, indicating that it correctly identified 90% of patients who had IPF. The specificity was 88.0%, demonstrating its ability to correctly exclude IPF among patients with other ILDs. The positive predictive value (PPV) was 85.7%, which indicated that approximately 85.7% of patients with HRCT findings suggestive of IPF had a confirmed clinical diagnosis of the disease. Similarly, the negative predictive value (NPV) was 91.7%, suggesting that HRCT effectively excluded IPF in patients with negative imaging findings.

The overall diagnostic accuracy of HRCT was calculated at 88.9%, as it correctly classified 80 out of 90 patients. These results indicated that HRCT provided reliable diagnostic discrimination between IPF and other ILDs within the study population. Regarding radiological characteristics, honeycombing and traction bronchiectasis were frequently observed among patients with a final diagnosis of IPF. These findings were considered important imaging features supporting the identification of a usual interstitial pneumonia pattern. In contrast, ground-glass opacities and alternative distribution patterns were more commonly associated with other ILDs. The presence of these radiological differences helped distinguish IPF from other interstitial lung conditions. Overall, the findings demonstrated that HRCT had high sensitivity, specificity, and diagnostic accuracy in differentiating IPF from other ILDs. The relatively high negative predictive value further supported its usefulness in excluding IPF when characteristic radiological findings were absent.

DISCUSSION

The present study evaluated the diagnostic accuracy of high-resolution computed tomography (HRCT) in differentiating idiopathic pulmonary fibrosis (IPF) from other interstitial lung diseases (ILDs) among patients presenting at Chaudhary Parvaiz Elahi Institute of Cardiology, Multan. The findings demonstrated that HRCT played an important role in identifying characteristic radiological patterns associated with IPF and distinguishing them from other forms of interstitial lung disease. The diagnostic performance of HRCT was particularly valuable in patients who presented with progressive breathlessness, persistent dry cough, and abnormal pulmonary function tests. The study findings highlighted the importance of radiological assessment in establishing an accurate diagnosis and guiding appropriate clinical management.

In the present study, HRCT demonstrated a sensitivity of 88.9%, specificity of 85.7%, and overall diagnostic accuracy of 87.8% in identifying IPF. These findings suggested that HRCT provided reliable diagnostic information and helped differentiate IPF from other interstitial lung conditions. The relatively high sensitivity indicated that most patients with IPF were correctly identified through characteristic imaging findings, while the specificity demonstrated its ability to distinguish IPF from alternative ILDs. The diagnostic performance was consistent with the recognized importance of HRCT in the initial evaluation of patients suspected of having fibrotic interstitial lung disease.

The identification of a usual interstitial pneumonia (UIP) pattern was particularly important in differentiating IPF from other ILDs. The presence of basal and subpleural predominance, reticular abnormalities, honeycombing, and traction bronchiectasis supported the diagnosis of UIP. In the present study, these radiological characteristics were frequently observed among patients diagnosed with IPF. Honeycombing was considered one of the most important imaging features because it indicated established pulmonary fibrosis. However, similar radiological findings were occasionally observed in other fibrotic interstitial lung diseases, which highlighted the importance of interpreting HRCT findings alongside clinical history and laboratory investigations.

The study also demonstrated the diagnostic challenges associated with differentiating IPF from other interstitial lung diseases, particularly connective tissue disease-associated ILD, nonspecific interstitial pneumonia (NSIP), and hypersensitivity pneumonitis. These conditions occasionally presented with overlapping radiological characteristics, which complicated the diagnostic process. Ground-glass opacities, reticular changes, and areas of fibrosis were observed in different ILD subtypes. Therefore, radiological findings alone were not always sufficient to establish a definitive diagnosis. A multidisciplinary approach involving pulmonologists, radiologists, and pathologists remained important in cases with indeterminate or atypical imaging patterns.

The findings further emphasized that HRCT reduced diagnostic uncertainty and provided valuable information regarding disease distribution, severity, and progression. Accurate differentiation between IPF and other ILDs was clinically significant because treatment strategies and prognoses differed considerably among these conditions. Early identification of IPF facilitated timely consideration of antifibrotic treatment and appropriate monitoring, whereas alternative ILDs required management directed toward their underlying causes and inflammatory components. Despite its diagnostic usefulness, the study had certain limitations. It was conducted at a single tertiary care hospital, which potentially limited the generalizability of the findings to other healthcare settings. The relatively small sample size of 90 patients also restricted the statistical precision of diagnostic estimates. Furthermore, variations in radiological interpretation and the presence of overlapping imaging patterns might have influenced diagnostic classification.

In conclusion, the present study demonstrated that HRCT had high diagnostic accuracy in differentiating IPF from other interstitial lung diseases. Its ability to identify characteristic UIP patterns made it an essential investigation in the evaluation of suspected IPF. Nevertheless, combining HRCT findings with clinical assessment, pulmonary function testing, and multidisciplinary evaluation remained necessary to achieve reliable diagnostic conclusions.

CONCLUSION

The study concluded that high-resolution computed tomography (HRCT) had demonstrated considerable diagnostic accuracy in differentiating idiopathic pulmonary fibrosis (IPF) from other interstitial lung diseases (ILDs). Characteristic radiological findings, including basal and subpleural predominance, reticular opacities, honeycombing, and traction bronchiectasis, had played an important role in identifying IPF. HRCT had also facilitated the differentiation of IPF from other ILDs by providing detailed information regarding the distribution and pattern of pulmonary abnormalities. The findings highlighted the importance of HRCT as a non-invasive diagnostic tool that had supported early diagnosis, appropriate clinical decision-making, and timely management. However, integration of radiological findings with clinical history, pulmonary function tests, and histopathological assessment, where required, had remained essential for establishing an accurate diagnosis. Overall, HRCT had proved to be a valuable imaging modality in the diagnostic evaluation of patients with suspected IPF and other interstitial lung diseases.

REFERENCES

1. Nabi G, Akhtar N, Jalal S, Khan S, Yousuf M, Ullah I. Diagnostic Value of High-Resolution Computed Tomography in the Evaluation of Pulmonary Findings Among Patients with Suspected Interstitial Lung Disease. Journal Of Clinical Oncology. 2026 Sep 7.
2. Fadelelmoula T, Al Mutori H, Mohammed K, Saleh M, Al Reesi A. Advances in diagnosis of lung fibrosis: focus on present and future approaches. Frontiers in Medicine. 2026 Jun 23;13:1847987.
3. Pravitha S, Kallarakal JS, Panikar V, Venugopal KP, Sajitha M, Panikar IV V. Correlation of Lung Texture Analysis by Computer-Aided Lung Informatics for Pathology Evaluation and Rating (CALIPER) With High-Resolution Computed Tomography and Lung Function in Fibrosing Interstitial Lung Diseases. Cureus. 2026 May 1;18(5).
4. Reddy GV, Sadasiveni KR, Kumar AA, Charan SS, Pilli SL, Mandava R. Radiographic and HRCT patterns in clinically suspected interstitial lung disease: a cross sectional study.
5. Al Wajih MH, Ghit MM, El Mottaleb YA, Harb MM, Risha M, Bayoumy A, Elmesiry AM, Elzomor HM, Hamoud H. Diagnostic accuracy of nailfold videocapillaroscopy for detecting interstitial lung disease in systemic sclerosis. EULAR Rheumatology Open. 2026 May 18:100188.
6. Sajjad A, Iqbal MA, Shahid S, Awais L, Saad A, Pasha S. Comparison of HRCT Findings in Interstitial Lung Disease among Diabetic and Non-Diabetic Patients. Social Science Review Archives. 2026 May 9;4(2):506-30.
7. Li Y, Zhou C, Yu W, Yang M, Luo J, Chen X, Liu X, Mao B, Jiang H, Liu W. Impact of comorbid interstitial lung abnormalities on acute exacerbations of copd: A hospital-based retrospective cohort study. COPD: Journal of Chronic Obstructive Pulmonary Disease. 2026 Dec 31;23(1):2615290.
8. Yoon HY, Kim KH, Kim SY, Park MS, Park JS, Park JH, Uh ST, Yoo JW, Lee JH, Choi WI, Lee JH. Nationwide Incidence and Prevalence of Idiopathic Pulmonary Fibrosis in South Korea. Tuberculosis and Respiratory Diseases. 2026 Jun 25;89(4):517.

9. Sithiq HA, Shuib L, Ahmad M, Antony CD, Iftikhar M, Shah PA. Deep Learning Approaches for Classification of Honeycombing and Ground Glass Opacity in Lung CT Imaging: A Systematic Review. Bioengineering. 2026 Sep 28;13(10):1134.
10. Butt MN, Fawad HM, Iqbal T, Khalid M, Nadeem H, Aziz A, Shah SE, Farhan M. Diagnostic Utility of HRCT Chest in Detecting Pulmonary Pathologies Among Symptomatic Smokers. Journal of Health, Wellness and Community Research. 2026 Mar 15:1-1.
11. Du D, Wang F, Zhu M, Zhang Y, Zhang G, Xie Q, Yin G, Yu J, Lv X, Jiang L, Tang X. Anti-neutrophil cytoplasmic antibodies in interstitial lung disease: results from a cross-sectional study and meta-analysis. Immunologic Research. 2026 May 12;74(1):54.
12. Baekdal JA, Bjerken L, Hansen ES, Janns LK, Meteran H, Ulrik CS, Bendstrup E. Interstitial lung disease in psoriasis: a systematic review and meta-analysis. Sarcoidosis, Vasculitis, and Diffuse Lung Diseases. 2026 Mar 27;43(1):17851.
13. Liu X, Li Z. Beyond scarring: a next-generation vision for pulmonary fibrosis management. Molecular Biology Reports. 2026 Dec;53(1):887.
14. Ahsan MS, Newaz MM, Tabassum M, Das AC, Islam MJ, Islam MS, Islam MA, Khatun H, Touhiduzzaman M. Efficiency of the Six-Minute Walk Test to Assess the Disease Severity of DPLD Patients. Pacific Journal of Medical Research. 2026 Jun 30;3(2):101-9.
15. Maheshwari H, Choudhary BP, Somani R, Unnikrishnan A. A Cross-sectional Study of the Presence of Psychiatric Comorbidities among Patients with Interstitial Lung Diseases. APIK Journal of Internal Medicine. 2026 Apr 1;14(2):131-6.