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Original Research Paper

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# ROLE OF HRCT IN INTERSTITIAL LUNG DISEASE

**Dr. Uday. M Surana** — Associate Professor, Department of Radiology, Kiran Hospital and Medical College, Surat, 395004, Gujrat, India.

**Dr. Adarsha** — Ex DNB Radiology Resident, Department of Radiology, Kiran Hospital and Medical College, Surat, 395004, Gujrat, India.

**Dr. Saiprasad. Gawde** — Assistant Professor, Department of Radiology, Kiran Hospital and Medical College, Surat, 395004, Gujrat, India.

## ABSTRACT

**Introduction-** Interstitial lung diseases (ILDs) are diverse set of lower respiratory tract disorders defined by acute and chronic inflammation, often irreversible fibrosis of the interstitium and alveolar wall. Diagnosis involves a multidisciplinary approach, with high-resolution computed tomography (HRCT) playing a pivotal role in detecting and characterizing ILD, especially when chest X-rays are inconclusive. **Objectives-** To assess the role of HRCT in differentiating various types of interstitial lung diseases and to analyze characteristic CT patterns and the distribution of the disease process in ILD patients. **Methods-** This prospective observational study was conducted to evaluate imaging findings in patients suspected of having ILD, with study subjects meeting inclusion criteria and exclusion criteria. Demographic data were recorded and radiographic examinations were conducted (Chest X-ray and HRCT) with specified settings. Comparison of quantitative variables between the study groups was done and results were considered statistically significant at a P-value ≤0.05. **Results-** Among the 100 study participants, 58% were male, and 42% were female, with the majority (46%) aged between 61 and 80 years. HRCT findings revealed traction bronchiectasis (63%), honeycombing (58%), and ground-glass opacities (57%) as the mostprevalent patterns. Usual Interstitial Pneumonia (23%) as well as Fibrotic Hypersensitivity Pneumonitis (23%) were frequent ILD subtype, followed by Respiratory Bronchiolitis-Associated ILD (15%). **Conclusion-** This study emphasizes HRCT's vital role in diagnosing ILDs, highlighting key imaging patterns such as traction bronchiectasis, honeycombing, and ground-glass opacities. The variability in imaging patterns observed among other subtypes,such as fibrotic hypersensitivity pneumonitis and respiratory bronchiolitis-associated ILD, underscores the pivotal role of HRCT in identifying distinct radiological signatures.

**KEYWORDS :** Interstitial Lung Disease (ILD), High-Resolution Computed Tomography (HRCT), Bronchiectasis, Honeycombing.

## INTRODUCTION

Interstitial lung diseases (ILDs) are a diverse set of lower respiratory tract disorders defined by acute and chronic inflammation, as well as gradual, often irreversible fibrosis of the interstitium and alveolar wall. According to numerous studies conducted worldwide, the crude annual incidence of ILDs varies between 1 and 70.1 per 100,000 individuals, while the prevalence varies between 6.27 and 97.9 per 100,000.[1] According to estimates, the prevalence of ILD is 67/100,000 in women and 81/100,000 in men.[2] Based on etiology, ILDs can be classified into five major categories: Primary diseases-associated (sarcoidosis, eosinophilic pneumonia), Environmental exposure-associated (pneumoconiosis and chronic hypersensitivity pneumonitis), drugs-, chemicals- or radiation-associated ILD, systemic sclerosis (SSc-ILD), Sjogren's disease, inflammatory myopathies, anti-synthetase syndrome, systemic lupus erythematosus (SLE), and mixed connective tissue disease (MCTD-ILD)), the idiopathic interstitial pneumonias which include idiopathic pulmonary fibrosis (IPF) and nonspecific interstitial pneumonias (NSIP)[3,4]. Interstitial lung disorders cause a protracted succession of complications that can be life-threatening for individuals since they involve numerous systems.[5] Chest radiography (CXR) remains a valuablescreening tool in patients with suspected ILD. Computed tomography (CT) considerably improved imaging by allowing for greater visualisation of lung tissue with an 8-10 mm collimation scan.[6,7] HRCT displays different radiologic patterns such as ground-glass opacities, honeycombing, and reticulations, allowing for a full assessment of disease, subtype characterisation, activity changes, biopsy site localisation, and response to therapy. Despite this major development, conventional CT played only a small role in evaluation of ILDs until the invention of high-resolution computed tomography (HRCT).[8] With this backdrop, the present study was designed to determine the role of HRCT in symptomatic patients with ILD.

### Objectives

- To assess the role of HRCT in differentiating various types of interstitial lung diseases.
- To identify and analyze characteristic CT patterns and the distribution of the disease process in ILD patients.

### Methodology

A prospective observational study was conducted at the Department of Radiology of Kiran multi-superspeciality hospital, a tertiary care hospital in western India, between April 2023-March 2025.

The study population were included based on the following criteria:

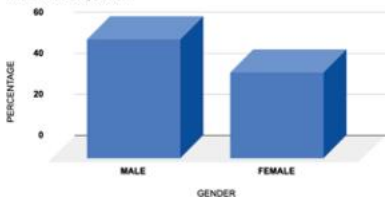
**Inclusion Criteria:** 1)Age > 18 years 2)Patients Suspected with ILD 3)Patients giving consent to enroll in the study. **Exclusion Criteria:** 1)Pregnant females 2)Patients with active tuberculosis 3)Known cases of infective etiology (Tuberculosis, HIV), chronic obstructive pulmonary disease, congestive cardiac failure, lung malignancy, hemo-dynamically unstable patients.

Hence, study was conducted over 100 patients fulfilling the inclusion and exclusion criteria. Demographic details of the patient like age, sex, weight, height, comorbidities and history of the patient were recorded. All the pateints underwent radiographic examination. The radiographs were carried out on RMS (500 mAs) Computed Radiograph System and ProRad 3NC Digital Radiograph System in standard erect position and in full inspiration in PA view. 60 - 80 KVP and 15 - 20 mAs were used with a film focus distance of 180 cm. HRCT chest was performed using a helical CT scanner with imaging parameters chosen so as to maximize spatial resolution. Narrow slice thickness of 1 mm was taken from lung apices to lung bases with interslice distance of 1 cm resulting in images

representative of the lungs. Window level of (–750 H U) and window width of (+1500 H U) was used for proper assessment of the patients. Scans were performed at full inspiration in supine position. Prone positioning helped in distinguishing gravity dependent atelectasis in the lung bases seen on supine images from early changes of idiopathic lung fibrosis. In patients with suspected airway disease, additional scans were obtained during expiration for detection of air trapping. The data was collected using a predesigned template and the collected data variables obtained was compiled using an excel spreadsheet. The outcome data was descriptively analysed. The baseline patient characteristics were presented as frequencies for the categorical variables and as the means and standard deviations or medians for continuous variables. After appropriate data filtration, the datasheet was analyzed using Graphpad Prism (vs. 9.2.0). Comparison of quantitative variables between the study groups was done using Student t-test and One-way Analysis of Variance (ANOVA) test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test or fishers exact test was performed. Results were considered statistically significant at a P-value $\leq 0.05$.

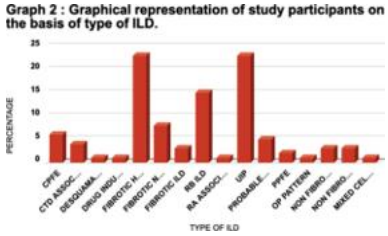
## RESULTS

Graph 1: Graphical representation of study participants on the basis of gender.



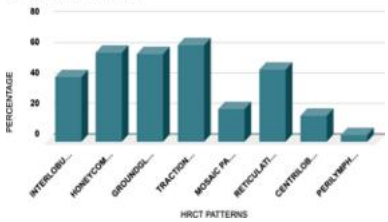

Among the total 100 participants, 58% were male, while 42% were female, indicating a predominance of male participants in the study population.

Graph 2 : Graphical representation of study participants on the basis of type of ILD.



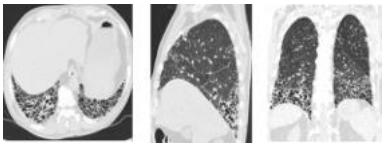

The most prevalent ILD subtypes were Fibrotic Hypersensitivity Pneumonitis (Fibrotic HSP) and Usual Interstitial Pneumonia (UIP), each accounting for 23% of the cases.

Graph 3: Graphical representation of study participants on the basis of HRCT Patterns.

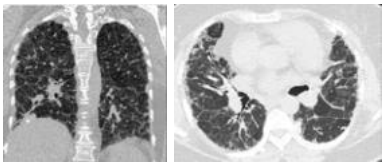



HRCT (High-Resolution Computed Tomography) patterns observed among the study participants, shows that Traction bronchiectasis (63%) was the most prevalent finding, followed by honeycombing (58%).

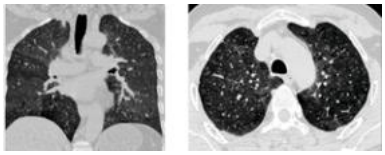
### Case Illustrations



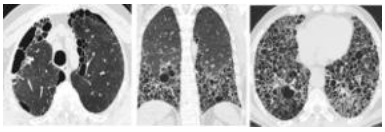
A case of usual interstitial pneumonia – A 70-year-old male came with complaints of dyspnea. HRCT showing bilateral basal predominant subpleural honeycombing with traction bronchiectasis.



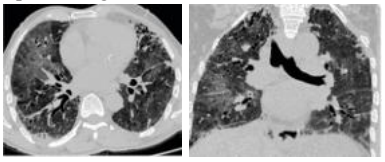
A case of Fibrotic Hypersensitivity pneumonitis: A 68-year-old female presented with complaints of chronic cough and dyspnea. HRCT showing diffuse interstitial septal thickening with reticulations and multifocal areas of mosaic attenuation.



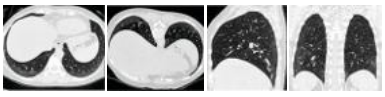
A case of RB-ILD: A 58-year-old male who was a chronic smoker presented with throat pain and change in voice. HRCT showing multiple tiny centrilobular ground glass nodules diffusely scattered in both lungs.



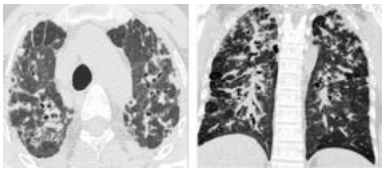
A case of Combined pulmonary fibrosis and emphysema: A 62-year-old male presented with cough and dyspnea. HRCT showing paraseptal emphysema in both upper lobes and diffuse honeycombing in both lower lobes.



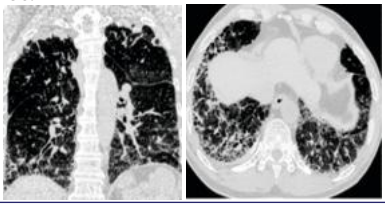
A case of Desquamative interstitial pneumonia: A 71-year-old male who was a chronic smoker came with complaints of cough and dyspnea. HRCT showing diffuse patchy ground glass opacities in both lungs with irregular interstitial thickening peripherally and peribronchial region.



A case of Non-fibrotic NSIP: A 38-year-old female who is a known case of scleroderma and MCTD overlap came with complaints of breathlessness. HRCT showing ill-defined ground glass opacities in both lower lobes with subpleural sparing. No changes in ground glass opacities in supine and prone positions.



A case of Organizing Pneumonia pattern in a 29-year old female who presented with cough, weight loss and breathlessness.HRCT showing multifocal nodular consolidative opacities in both lungs predominantly upper lobes, subpleural region with clusters of peribronchial micronodules.



A case of Pleuro-parenchymal fibroelastosis in a 65-year old male who presented with complaints of cough and dyspnea. HRCT showing diffuse pleural thickening in both upper lobes with mild volume loss. Interstitial thickening with reticulations and traction bronchiectasis in both lower lobes.

## CONCLUSION

This study emphasizes HRCT's vital role in diagnosing and ILDs, highlighting key imaging patterns such as traction bronchiectasis, honeycombing, and ground-glass opacities. This study reinforces the predominance of usual interstitial pneumonia as a central subtype of ILD, distinguished by its hallmark imaging features, including honeycombing and traction bronchiectasis. The variability in imaging patterns observed among other subtypes, such as fibrotic hypersensitivity pneumonitis and respiratory bronchiolitis-associated ILD, underscores the pivotal role of HRCT in identifying distinct radiological signatures. Furthermore, the findings highlight the characteristic involvement of the lower lobes and peripheral regions of the lungs in ILDs, aligning with established pathophysiological mechanisms.

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