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Research Article

High Resolution Computed Tomography Is Imaging Modality Of  
Choice For Interstitial Lung Disease

Dr G Mamtha, Dr Javaji Ravi Prasad, Dr Anil Kumar Shukla

<sup>1</sup> Former Post Graduate student, Department of Radiodiagnosis, Raja Rajeswari Medical College & Hospital, Mysore Road Kambipura, Bengaluru - 560 074 (Karnataka).

<sup>2</sup> Professor and Head, Department of Radiodiagnosis, Raja Rajeswari Medical College & Hospital, Mysore Road Kambipura, Bengaluru - 560 074 (Karnataka).

<sup>3</sup> Professor, Department of Radiodiagnosis, Raja Rajeswari Medical College & Hospital, Mysore Road Kambipura, Bengaluru - 560 074 (Karnataka).

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ABSTRACT

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**Objectives:** Is to evaluate if High Resolution Computed Tomography can detect abnormalities in patients with suspected interstitial lung diseases. To study different radiographic patterns evident in both conventional chest radiography and High Resolution Computed Tomography.

**Materials And Method:** We evaluated twenty patients with clinical suspicion of interstitial lung disease. All the patients were taken for High Resolution Computed Tomography with thin collimation of sub mm and high spatial frequency resolution with 120–140 KV (P) and 240 mA was used. Scans were obtained in the supine position; prone position was used if and necessary.

**Discussion:** Analysis suggests that High Resolution Computed Tomography findings can serve as a biomarker with physiologic, pathologic and prognostic significance. This study shows that the condition is disease of middle age group. The most common possible aetiology was exposure to grain dust. Among different chest radiograph and High Resolution Computed Tomography findings, ground glass opacities were most commonly seen.

**Conclusion:** Interstitial Lung Disease commonly occurs in the middle age, the presenting complaint being unremitting dyspnoea of long duration in most of the cases. High Resolution Computed Tomography is imaging modality of choice in the detection, diagnosis and follow-up of interstitial lung disease and very helpful in predicting prognosis.

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**Corresponding Author:** Dr Anil Kumar Shukla, Professor, Department of Radiodiagnosis, Raja Rajeswari Medical College & Hospital, Mysore Road Kambipura, Bengaluru - 560 074 (Karnataka).

## INTRODUCTION:

Interstitial Lung Disease (ILD) is a heterogeneous group of disorder that is characterized by a large group of more than 200 different entities that affect the alveoli of the lungs.<sup>(1,2)</sup>The incidence and prevalence in India is unknown.<sup>(3)</sup>Many factors such as environmental and occupational agents, infections, drugs, radiation and genetic predisposition have been implicated in pathogenesis of ILD.<sup>(4)</sup>Accurate diagnosis of ILD is a multifaceted task and requires a customized, patient-specific approach. This facilitates to attain remission or steady state of the disease. Diagnosis of ILD is a great challenge that is put forth before the healthcare professionals.<sup>(5)</sup>

In about 10% of patients, chest radiograph may appear entirely normal. But in such patients, biopsy establishes the diffuse lung disease of various causes. Even, there may be a impaired quality chest radiograph, especially of an obese patient which misleads the diagnosis of diffuse lung disease.<sup>(6)</sup>So, a specific approach for the diagnosis is needed. High Resolution Computed Tomography (HRCT) of the thorax is one of the standard diagnostic tests for ILD.<sup>(5)</sup> It is used to see fine detail of the interstitium that may not be visible on a chest x-ray.<sup>(7)</sup>

It is gold standard imaging modality in the diagnosis of ILD due to its highest sensitivity and specificity in imaging.<sup>(8)</sup>HRCT uses the thin-section of MDCT images (0.625–1.5 mm slice thickness) with a high-spatial frequency reconstruction algorithm, to detect and characterize diseases that affect the pulmonary parenchyma and small airways.<sup>(9)</sup>In many clinical diagnoses, HRCT helps to prevent the use of broncho-alveolar lavage or lung biopsy and

histopathological confirmation as HRCT findings provide the characteristic features of the disease condition.<sup>(10)</sup>

## MATERIALS AND METHODS

This study was done on 20 patients. All patients were referred to department of Radio-Diagnosis for HRCT thorax in clinically suspected patients from April 2015 to November 2017. Scans were performed with a 128 slice MDCT scanner, Siemens Perspective. In images collimation of 1–2 mm and high spatial frequency resolution with 120–140KV (P) and 240 mA was used.

All ages and both sexes were included in the study. Demographic details, occupational history, smoking history and other history of risk factors, symptomatology, history of associated co-morbidities and conditions, relevant investigations like chest radiograph finding, pulmonary function tests, arterial blood gas and clinical provisional diagnosis were noted after an oral consent was taken from the patient. Acute lung injury, acute respiratory distress syndrome, acute respiratory tract infection, chronic infection like tuberculosis, bronchial asthma, chronic obstructive airway disease, dyspnoea due to cardiac or renal causes and primary or secondary neoplasm of lungs were excluded from the study.

## RESULTS

We have made the following observations – In our study age of patients ranged from 3<sup>rd</sup> to 9<sup>th</sup> decade. The mean age group of these cases was around 55 years which shows that the condition is a disease of the late middle age group (Table 1).

*Table 1: Distribution of cases based on various age groups (in years)*

Age	Number of Cases	Percentage
30-40	6	30%
41-60	9	45%
61-80	3	15%
80-90	2	10%
Total	20	

Out of 20 patients 11 were females and 9 were males which shows that the condition is prevalent among females, possibility due to chronic exposure to environmental aetiologies (Table 2).

*Table 2: Gender distribution*

Gender	Number of Cases	Percentage
Male	9	45%
Female	11	55%
Total	20	

Among occupation ,farming was popular among the study group 10 cases with poultry business 4 cases,

house wife -4 cases and industrial worker being 2cases (Table 3).

*Table 3: Occupation Distribution*

Occupation	Number of Cases	Percentage
Farmer	10	50%
Housewife	4	20%
Industrial Worker	2	10%
Poultry	4	20%
Total	20	

The most common indications for performing HRCT by the physicians were history of chronic cough and dyspnoea - 16 cases had suspicion or clinically diagnosed ILD, 70% of cases had abnormal chest

radiography as an indication for HRCT, 12 cases had history of exposure to organic or inorganic dust 10 cases had abnormal pulmonary function test (PFT)(Table 4).

*Table 4: Indications for performing HRCT*

Indications	Number of Cases	Percentage
Known or Suspected ILD	16	80%
H/O chronic dyspnoea and or productive cough	16	80%
H/O exposure to organic/inorganic dust	12	60%
known case of collagen vascular disease	0	0%
Abnormal PFT	10	50%
Abnormal Chest Radiography	14	70%

The study group had 08 cases of smokers. Among the possible etiologies thought to develop this condition, exposure to grain dust in 50% cases (10

cases), exposure to bird or animal dropping in 20% cases (4cases) and no inorganic dust exposure no cases were found (Table 5).

*Table 5: Distribution of Etiology*

Etiology	Number of Cases	Percentage
Inorganic Dust exposure	0	0%
Bird/Animal drop	4	20%
Grain dust exposure	10	50%
CVD	0	0%
Others	0	0%

The commonest chest radiographic features appreciated was ground glass opacity in 40% cases (8

cases), followed by reticular shadows in 35% cases (7 cases), reticulo-nodular in 25% cases (5 cases) and

normal in 25% cases (5 cases). Less commonly noted features were honeycombing in 5% cases (1 case),

pleural thickening (1 case, 5%) and hilar lymph nodes (1 case, 5%) (Table 6).

*Table 6: Features on the chest radiograph*

Features	Number of Cases	Percentage
Ground Glass Opacities	8	40%
Honey Combing	1	5%
Honey combing/Ground Glass Opacities	2	10%
HLN	1	5%
Normal	5	25%
Pleural Thickening	1	5%
Reticulo Nodular opacities	5	25%
Reticular Shadows	7	35%

The commonest HRCT features appreciated was ground glass opacity in 75% cases (15cases), reticular shadows in 50% cases (10cases) followed by honey combing in 45% cases (9 cases) and interlobular thickening in 30% cases (6 cases).Pleural

thickening in 40% cases (8 cases), reticulo-nodular in 20% cases (4 cases).Less commonly noted features were pleural effusion in 10%(2 cases) (Table 7)(Figure – 1,2,3,4,5).

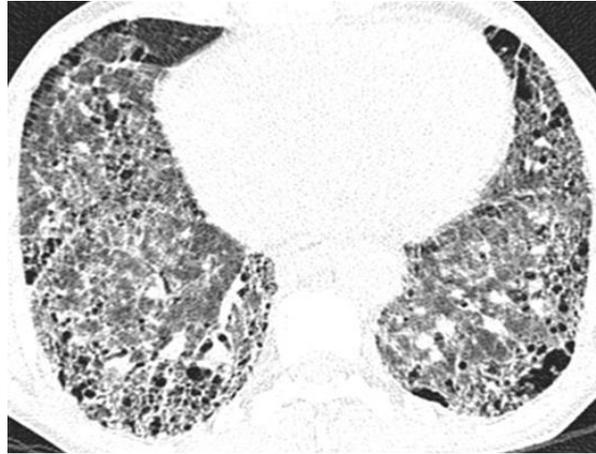
*Table 7: Features on HRCT*

Features	Number of Cases	Percentage
Ground Glass Opacities	15	75%
Honey Combing	9	45%
Reticular Shadows	10	50%
Interlobular Thickening	6	30%
PE	2	10%
Pleural Thickening	8	40%
Reticulo Nodular opacities	4	20%

## DISCUSSION

The clinical value of HRCT in the evaluation of suspected patients with diffuse ILD is no longer in doubt.<sup>(11)</sup>It is not merely the increased confidence that this technique brings to the confirmation or exclusion of the diagnosis of ILD, it is the added information about the likely histological diagnosis, precise extent of the disease, the optimal site for biopsy when indicated and in some cases the state of the disease activity.<sup>(12)</sup>An accurate diagnosis of Ideopathic Pulmonary Fibrosis (IPF) and ILD is vital not only to direct appropriate therapy and determine prognosis,

but also to design studies and clinical trials of IPF and other ILD's. Leland L. Fan et al states that ILD are rare in children.<sup>(13)</sup> The mean age group in this study was around 55 years. HRCT showed a range of abnormalities among patients thought to have ILD. On HRCT, 50% of cases showed reticular striations. In the series by Zerhouni et al, reticular striations were noted in 89% of their patients. 75% of cases of this study showed ground glass opacity while Leung An et al, noted 54% of patients who had ground glass opacity had primarily interstitial abnormality [Figure-1,2].<sup>(14)</sup>



*[Figure 1]: Ground glass opacities ,reticular opacities and honey combing with thin wall cysts in right middle , left lingula and bilateral lower lobes.*



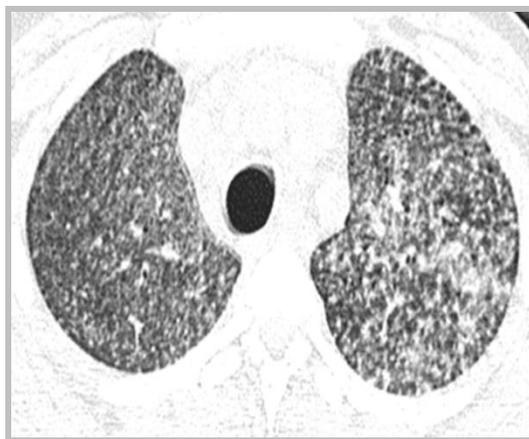
*[Figure- 2]: Ground glass opacities with honey combing and reticular opacities in bilateral lower lobes*

Webb WR et al, quotes honey combing produces a characteristic cystic appearance on HRCT that allows a definitive diagnosis of lung fibrosis.<sup>(15)</sup> In this study, 30% of cases showed interlobular septal

thickening, according to Webb, Muller and Naidich, presence of numerous clearly visible interlobular septa on HRCT always indicate the presence of an interstitial abnormality, as only a few septa should be visible in normal patients[Figure 3,4,5].<sup>(16)</sup>



*[Figure 3]: Thickened interlobular septa with multiple nodules in both upper lobes.*



*[Figure- 4]: Reticulonodular opacities in both upper lobes with groundglass opacities.*



*[Figure- 5]: Groundglass opacities with inter and intra lobular interstitial thickening both lungs with relative sparing of left lower lobe.*

Chest radiologist was unable to make a specific diagnosis of new-onset ILD in 25% of cases based on chest radiographic features alone.<sup>(14)</sup>Epler et al, and Carrington and Gaenster et al, showed 10% of patients with diffuse infiltrative lung disease whose chest radiograph were normal.<sup>(17)</sup> According to King TE Jr et al, 14% of patients with biopsy proven interstitial lung disease can have normal chest radiograph. HRCT here was proved superior to chest radiograph. Smoking can be related to causation of the disease, either directly or in conjunction with other processes.<sup>(18)</sup>

Regarding bronchiectasis HRCT had emerged as the imaging modality of choice for evaluation of bronchiectasis, HRCT has all, but eliminated the use of bronchography. Grenier et al utilized 1.5 mm thick sections obtained every 10 mm compared to conventional CT and bronchography in 44 lungs in 36

patients found that HRCT confirmed the diagnosis of bronchiectasis with sensitivity of 97% and specificity of 93%.<sup>(19)</sup>We note that the clinical suspicion of ILD was accurate when confirmed to the radiological diagnosis by HRCT in only 67% of cases, for both IPF and other types of ILD.<sup>(20)</sup> Although one may point out a referral bias in this study, the low sensitivity of the diagnosis made by the clinician and chest radiographs alone lends support to the need for HRCT to make an accurate diagnosis of new-onset ILD.

Clearly, it is difficult or nearly impossible to make specific diagnosis based on histologic subsets such as lymphocytic interstitial pneumonia or Nonspecific interstitial lung disease on clinical grounds and/or HRCT findings prior to initiation of treatment. Because of the differential prognostic significance and treatment regimen in this subset of patients, a pathologic diagnosis is required to make an accurate diagnosis of ILD and predict therapeutic

response before a treatment regimen is initiated.<sup>(21)</sup> Our study has several limitations, including referral bias. The study was performed in one center only, with a relatively small number of patients. Also, we used only one investigator/expert per arm, and did not assess interobserver variability in the diagnosis of ILD. Although there are clear merits of a multicenter study with an expert panel of ILD clinicians, chest radiologists, and pulmonary pathologists, such a panel would not be able to evaluate the data as directly; in the present study, the data were evaluated at the bedside. In our study, an experienced clinician assessed both subjective (patient's) and objective measurements. Our clinician had the advantage of eliciting the medical history directly and personally reviewing all the clinical variables, in the direct context of that given patient immediately after examining him or her. In this regard, our findings may indeed be applicable to patients evaluated by prudent pulmonologists.

## CONCLUSION

Interstitial lung disease (ILD) comprises more than 200 separate disease entities, each having its separate and often unique radiological manifestations. Because the clinical presentation of most of these diseases is similar (dyspnea and cough) HRCT becomes a valuable tool in narrowing the differential diagnosis. HRCT accurately demonstrate the pattern, distribution and extent of diffuse infiltrative lung disease. HRCT is able to pick up changes within the interstitium even when chest radiograph is normal in suspected cases of ILD. It is far superior to chest radiograph in making a more definitive diagnosis. Even with equivocal results, HRCT can guide surgeon for lung biopsy site and aid in the diagnosis of ILD. HRCT can be reliably used for assessing the prognosis during patient follow up and assist their management.

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