

Role of HRCT in Interstitial Lung Disease and its Spectrum: A Study of 100 Patients

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Abstract: *Background:* The spectrum of interstitial lung diseases (ILDs) has mainly been reported from the developed countries; data from developing countries is sparse and conflicting. Rise in incidence of ILDs been noted in India due to pollution, certain drugs and radiational factors. The aim of this study is to describe the distribution of various ILDs from a developing country and show the role of HRCT in diagnosis of ILDs. HRCT scan of 100 patients symptoms and conventional radiographs suggestive of interstitial lung disease were analyzed and findings of HRCT were correlated with relevant clinical history/investigations pertaining to patient's complaint and was evaluated for diagnosis from the case records/registers. A total of 100 subjects, majority of patients in our study group belonged to 6th and 7th decade (30 %). With males more commonly affected as compared to females enrolled between January 2020 to August 2021. Idiopathic interstitial pneumonia (IIP) were the most common interstitial lung disease (ILD) (70%) followed by Unclassifiable (10%). Among the IIPs, UIP/IPF is the most common pattern (57%) followed by NSIP (24%) and CPFE (8%). Collagen vascular disease related ILDs (CVD-ILDs), Lymphangitic carcinomatosis (LAC), sarcoidosis and hypersensitivity pneumonitis (HP) are equally prevalent (4-5%). Cystic ILDs such as Pulmonary Langerhans cell histiocytosis (LCH) and Lymphangiomyomatosis (LAM) are least common ILDs (2%). Least common IIP include the RB-ILD. Chronic breathlessness (79%) followed by cough (68%) was the most common symptom and the most common finding revealed on physical examination is clubbing in extremities (60%). Among 100 patients with abnormal HRCT findings suggestive of ILDs, 69 patients had abnormal radiographs. IPF was the most common ILDs seen in our study which was not in line with studies conducted in other countries, reasons for which might need further emphasis. Since HRCT is the radiological imaging technique that most closely reflects changes in lung structure, it is the method of choice for the diagnostic work-up of patients with known or suspected DILD. The combination of the various HRCT findings, together with their anatomical distribution, can suggest the most likely diagnosis. HRCT can confirm the location, extent of disease, assessing the disease reversibility. Therefore, HRCT is the investigation of choice for the diagnosis and follow-up of the cases of Interstitial lung diseases.

Keywords: HRCT, Interstitial Lung Disease in Gujarat, Chest X-Ray, Ground Glass Opacity, Honeycombing

1. Introduction

Interstitial lung diseases (ILDs), also known as diffuse parenchymal lung disease (DPLD), are a diverse group of chronic pulmonary disorders that mainly involves lung interstitium. ILDs are a large group of diseases that cause scarring of lung tissue. They may cause considerable morbidity and mortality and thus recognized as a crucial health issue. With several hundred conditions causing diffuse lung disease, a multidisciplinary approach including clinical, pathological and radiological correlation is required to reach an accurate early diagnosis, to plan the proper management and to monitor the disease progress and treatment response.

Several studies have reported different incidence and prevalence of ILD. However, majority are from developed nations and very few from western Indian population. [1, 2] Few studies from central India indicate hypersensitivity pneumonitis, IPF and Sarcoidosis as the most common ILDs. [3-5]

2. Materials and methods

Data was collected retrospectively over one year (January 2020 to August 2021.) conducted in the Department of

Radio diagnosis and Imaging of G G Hospital, Jamnagar. The Institute Ethics Committee approved the study protocol, and a written informed consent was obtained from all subjects. High Resolution Computed Tomography imaging was performed on Dual source 16 slice computed tomography scanner.

A detailed history of the patient including signs and symptoms, detailed physical examination, and radiological investigations was included and chest x-ray were recorded. Patients with clinical suspicion of recent or active infection (fever, new-onset cough, leukocytosis, loss of appetite, weight loss, and/or a clinical and/or laboratory impression of appearing ill with bacterial infection and/or tuberculosis), including tuberculosis, suspicion of acute COVID-19 and patients with symptoms in post COVID period were excluded.

Imaging findings

There are four general patterns of HRCT abnormality that are fundamental to the interpretation of HRCT scans[23], [25]:

- 1) Reticular opacities
- 2) Nodules
- 3) Increased lung opacity
- 4) Decreased lung opacity.

Within each of these patterns, other features of the images can help narrow the differential diagnosis, such as the

distribution of abnormalities in the axial and coronal planes, as well as the co-occurrence/overlap of patterns.

3. Results

In this study 100 patients with diagnosis of Interstitial lung disease were observed.

Table 1: Distribution of abnormal HRCT patterns according to Age and Sex of patients:-

Age (years)	Male	Female	Total	% of male patients in specified age group	% of female patients in specified age group
<20	2	1	3	3	3
21-30	2	3	5	3	10
31-40	6	5	11	9	16
41-50	11	3	14	16	10
51-60	13	4	17	19	13
61-70	21	9	30	30	29
71-80	12	4	16	17	13
>80	2	2	4	3	6
Total	69	31	100	100	100

Of these 69 % were males while 31 % were females and ILDs was most common in the age group of 61-70 years (30%) followed by 6th and 8th decade. ILDs are more

common in male patients in all age groups except in the younger age group (<41 years where ILDs are more common in females when compared to males.

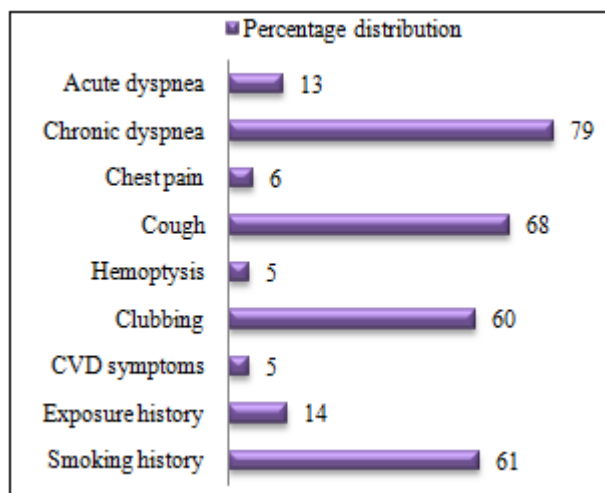


Figure 1: Distribution of symptoms among patients

The most common symptoms include chronic breathlessness (79%) followed by cough (68%) and the most common finding revealed on physical examination is clubbing in extremities (60%). Among associated factors, smoking is the most common factor accounting for about 61%.

Table 2: Comparison of Chest radiographs and HRCT in diagnosing ILDs:

Abnormal chest radiographs	Abnormal HRCT patterns
69	100

Among 100 patients with abnormal HRCT findings suggestive of ILDs, 69 patients had abnormal radiographs

Table 3: Abnormal findings on HRCT

HRCT finding	Number of cases	Percentage
Interlobular septal thickening	87	87
Honeycombing	58	58
Perilymphatic nodules	11	11
Centrilobular nodules	11	11
Random nodules	13	13
Traction bronchiectasis	60	60
Ground glass opacity	49	49
Consolidation	11	11
Lung cysts	20	20
Mosaic attenuation	13	13
Fibrous bands	9	9
Emphysematous changes	31	31
Mediastinal lymphadenopathy	34	34
Changes of Pulmonary hypertension	3	3
Cardiomegaly	5	5
Pleural thickening	6	6

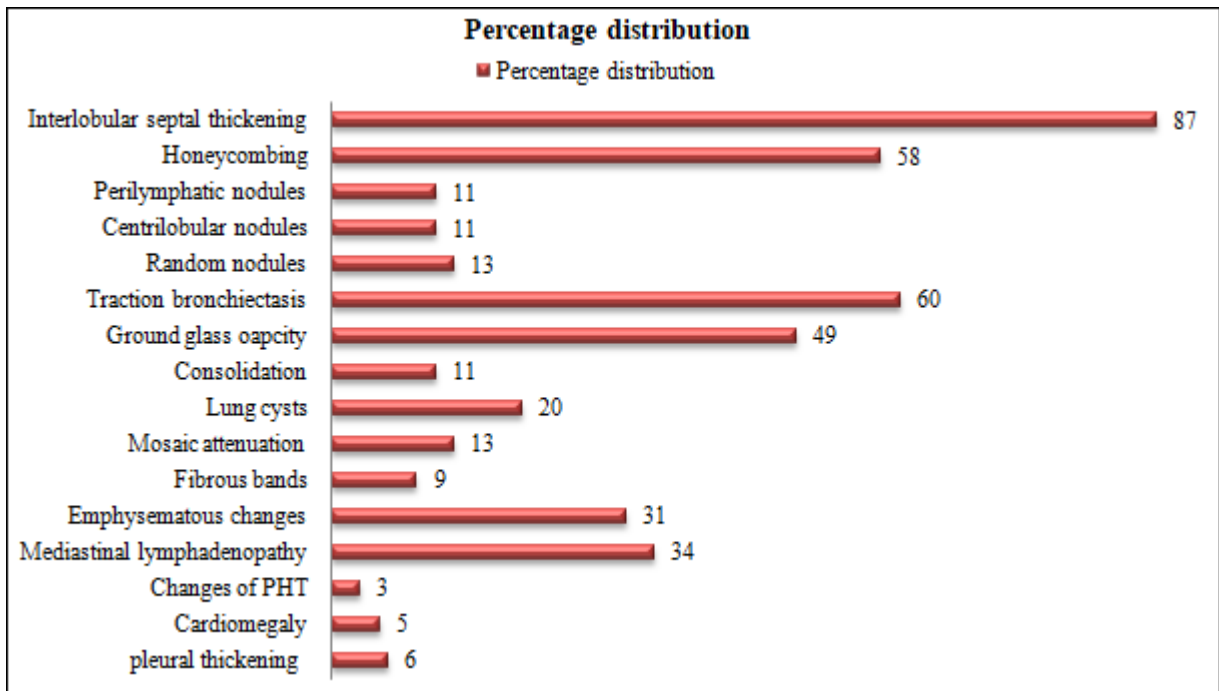


Figure 2: Distribution of various HRCT findings:

Among the HRCT findings, the most common finding is the Interlobular septal thickening (87%), followed by traction bronchiectasis (60%), honeycombing (58%) and ground

glass opacity (49%). Less common findings in accordance to ILDs include the nodules, consolidation and mosaic attenuation.

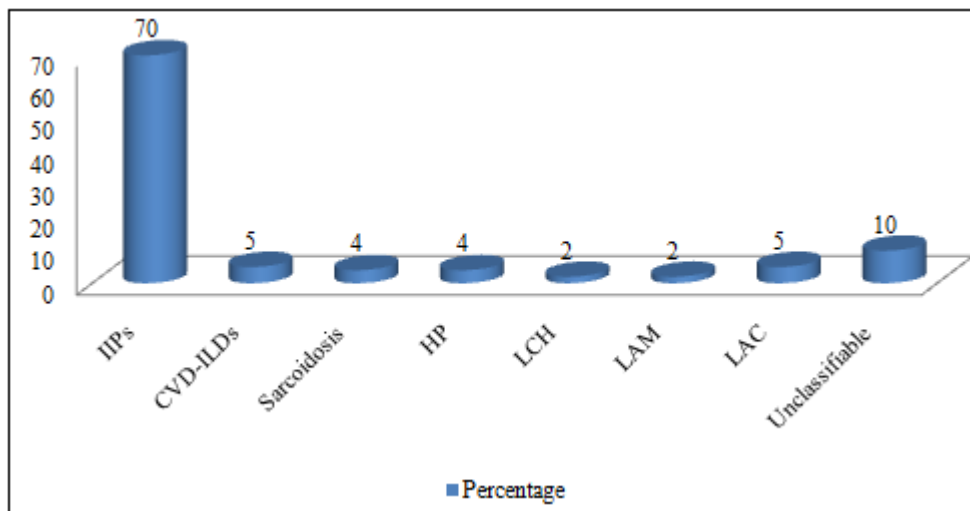


Figure 3: Percentage distribution of various ILDs

In our study, the IIPs are the most common ILDs (70%) followed by Unclassifiable (10%). Collagen vascular disease related ILDs (CVD-ILDs), Lymphangitic carcinomatosis (LAC), sarcoidosis and hypersensitivity pneumonitis (HP)

are equally present in our study (4-5%). Cystic ILDs such as Pulmonary Langerhans cell histiocytosis (LCH) and Lymphangioleiomyomatosis (LAM) are least common ILDs (2%).

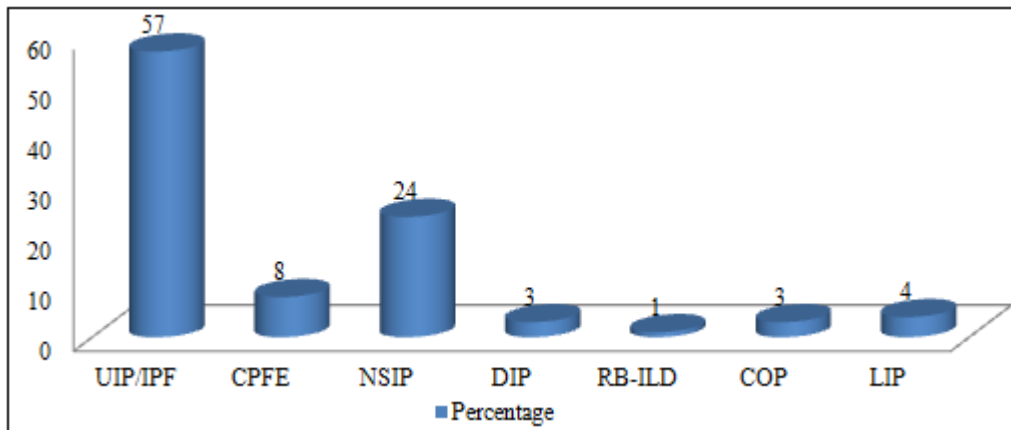


Figure 4: Percentage distribution of various IIPs

Among the IIPs, UIP/IPF is the most common pattern (57%) followed by NSIP (24%) and CPFE (8%). Least common patterns include the RB-ILD (1%).

Table 4: Type of ILD in relation to predominant location and HRCT findings

HRCT diagnosis		Predominant Location	HRCT Findings
Idiopathic Interstitial Pneumonias (IIPs) (70 %)	UIP	Peripheral (96%) and basal	Honeycombing (100%)
	CPFE	Apical lobe (100%)	Emphysema and interlobular septal thickening (100%)
	NSIP	Lower lobes (93%)	Ground glass opacity (73%) and interstitial septal thickening
	COP	Lower lobes (50%)	Ground glass opacity and Consolidation (100%)
Sarcoidosis (4)		Right upper and middle and left lower lobe (100%)	Peri-lymphatic nodules (100%)
Hypersensitivity pneumonitis (4)		Lower lobes	Ground glass opacities, and centrilobular nodules.
Unclassifiable (10)		Lower lobe (100%)	Interlobular septal thickening (100%)

4. Discussion

This was a hospital based descriptive study to describe the role of HRCT in the evaluation of interstitial lung diseases. 100 cases of interstitial lung disease were identified. 69 cases were male and 31 were female. In our study, ILDs are most common in the age group of 61-70 years (30%) followed by 6th decade. ILDs are more common in male patients in all age. In a study by Shah et al in 2020, incidence of interstitial lung disease was maximum in the middle age group of 51- 60 years (38 %) with male predominance (58 %) which were in accordance with our study [3].

Table 1: Comparison with Shah et al study for most common age group and gender in ILD

ILD most common age group and gender	Shah et al	Our study
	51 – 60 years, male patients	61 – 70 years, male patients

The most common symptoms include chronic breathlessness (79 %) followed by cough (68%) and the most common finding revealed on physical examination is clubbing in extremities (60%). Our study correlated with the study of Carvajalino et al, 2018 who reviewed 23 studies and concluded that the highest prevalence was that for breathlessness (54–98%) and cough (59–100%) followed by heartburn (25–65%) and depression (10–49%) [6].

Table 2: Comparison with Carvajalino et al study for most common symptom in ILD

Most common Symptom in ILD	Carvajalino et al	Our study
	Breathlessness (54-98%)	Chronic breathlessness (79 %)

In our study, chest radiographs showed abnormalities in 69 % of patients. The average sensitivity results of several studies [7] and a study by Shah et al [3] showed that HRCT have sensitivity of approximately 94 % compared to the chest radiography which has 76 % which matches with our study. The inference that can be drawn from this study is that HRCT is much more sensitive than that of conventional chest radiography for assessing and diagnosing the patients with interstitial lung diseases.

Table 3: Comparison with Shah et al study for Sensitivity of chest radiograph in ILD

Sensitivity of chest radiograph in ILD	Shah et al	Our study
	76%	69%

Among the HRCT findings, the most common finding is the septal thickening (87%), followed by traction bronchiectasis (60%), honeycombing (58%) and ground glass opacity (49%). Less common findings in accordance to ILDs include the nodules, consolidation and mosaic attenuation. Zerhouni et al also said that Septal thickening were found in 89 % of cases in a series. The Septal thickening is associated with a large group of interstitial lung diseases [8].

Table 4: Comparison of most common HRCT findings in ILD with Zerhouni et al study

HRCT findings in ILD	Zerhouni et al	Our study
Most common finding	Septal thickening	Septal thickening
%	89 %	87%

In our study, the IIPs are the most common ILDs (70 %) followed by Unclassifiable (10 %). Collagen vascular disease related ILDs (CVD-ILDs), Lymphangitic carcinomatosis (LAC), sarcoidosis and hypersensitivity

pneumonitis (HP) are equally present in our study (4-5%). Cystic ILDs such as Pulmonary Langerhans cell histiocytosis (LCH) and Lymphangiomyomatosis (LAM) are least common ILDs (2%). Among the IIPs, UIP is the most common pattern (57 %) followed by NSIP (24 %) and CPFE (8%). Least common patterns include the RB-ILD (1%). In a retrospective study in a tertiary care hospital in India between 1994 and 2001 which included 274 biopsy proven ILD patients, Idiopathic pulmonary fibrosis (43%), sarcoidosis (22%), ILDs secondary to collagen vascular disease (19%) and extrinsic allergic alveolitis, among others, were the most common aetiological causes of ILD [9]. In a prospective study by Singh et al, adult patients of Indian origin living in India with new-onset ILD (27 centers, 19 Indian cities, March 2012–June 2015) without malignancy or infection were included in the study. A total of 1,084 patients were recruited. Hypersensitivity pneumonitis (47.3%) was the most common new-onset ILD in India,

followed by CTD-ILD (13.9%) and idiopathic pulmonary fibrosis (13.7%) [4]. Dhooria et al in 2018, conducted a prospective analytical study on 803 subjects in a tertiary care hospital in India, of which 566 (70.5%) were diagnosed during the study period (incident cases). Sarcoidosis (42.2%), idiopathic pulmonary fibrosis (IPF, 21.2%), connective tissue disease (CTD)-related ILDs (12.7%), hypersensitivity pneumonitis (10.7%), and non-IPF idiopathic interstitial pneumonias (9.2%) were the most common ILDs in a developing country [5]. Musellim et al, in their study stated that sarcoidosis was the most common disease followed by idiopathic pulmonary fibrosis (IPF) constituted 19, 9% of patients. [2]. Thomeer MJ et al, conducted a comparative study from three European countries and found sarcoidosis, idiopathic pulmonary fibrosis, hypersensitivity pneumonitis were the most common ILDs with male predominance [1].

Table 5: Comparison with Singh et al, Dhooria et al, Musellim et al and Thomeer MJ et al studies for most common type of ILD

Most common type of ILD	Singh et al	Thomeer MJ et al	Musellim et al	Dhooria et al	Our study
	Hypersensitivity pneumonitis (47.3%)	Sarcoidosis (31 %)	Sarcoidosis (37.4 %)	Sarcoidosis (42.2%)	IIPs (70%)

The variation in most common ILD in different studies is due to scarcity of data regarding disease burden and demographics for patients from India and South Asia. All previous studies in India were single-center retrospective studies with 275 or fewer patients. Some studies in India have found IPF most common and others CTD-ILD.

5. Conclusion

IPF was the most common ILDs seen in our study which is different from other studies conducted in Europe, central India and Middle Eastern countries. Among IPF's, Usual interstitial pneumonia was the most common finding by far, possibly due to differences in the genetic profile, environmental factors, occupational exposures, smoking habits, socio-cultural and farming practices in developing countries. Since HRCT is the radiological imaging technique that most closely reflects changes in lung structure, it is the method of choice for the diagnostic work-up of patients with known or suspected DILD. The combination of the various HRCT findings, together with their anatomical distribution, can suggest the most likely diagnosis. HRCT can confirm the location, extent of disease, assessing the disease reversibility. Therefore, HRCT is the investigation of choice for the diagnosis and follow-up of the cases of Interstitial lung diseases.

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