Original Research Article

High-resolution Computed Tomography and chest radiography findings in clinically suspected interstitial lung diseases

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Abstract

Background: Interstitial lung diseases are a diverse group of diseases that predominantly affect the lung interstitium and share similar clinical and radiological manifestations. **Objective:**to compare conventional chest radiography and HRCT in the diagnosis of interstitial lung disease with clinical correlation**. Materials and Methods:**The present study included 53 patients. After a detailed clinical work up, all the patients underwent both conventional chest radiography and HRCT. The images were evaluated and the findings compared between chest radiography and HRCT. **Results:** The main result of the study was that HRCT was able to detect more abnormalities than conventional chest radiogram in the diagnosis of interstitial lung diseases. The differences between the two modalities were found to be statistically significant in certain findings. **Conclusion**-HRCT appears to be a better modality of investigation than conventional chest radiography in the diagnosis of interstitial lung diseases. HRCT was able to detect abnormalities even in cases when the chest radiogram was normal, thereby emphasizing the inherent lack of sensitivity of chest radiography.

Keywords: Interstitial lung disease (ILD), Chest radiography, High-resolution Computed Tomography HRCT,

Introduction

The Interstitial lung disease (ILD) are a heterogeneous group of non-neoplastic disorders resulting from damage to the lung parenchyma by varying patterns of inflammation and fibrosis in the inetrstitium and alveolar walls[1]. The interstitium refers to the space between the epithelial and endothelial basement membranes and it is the primary site of injury in the IIPs. However, these disorders frequently affect not only the interstitium, but also the airspaces, peripheral airways, and vessels along with their respective epithelial and endothelial linings, but it is the predominant and primary involvement of the interstitium that characterizes them[2].

The prominent feature in ILD is fibrosis in the interstitium, leading to derangement of alveolar architecture and loss of functional alveolar capillary units. It may occur when an injury to the lungs triggers an abnormal healing response.

Many ILDs have similar clinical features and are not easily distinguished on examination. Symptoms are Exertional breathlessness (dyspnea) and a nonproductive cough is the most common reasons patients seek medical attention. If the patient also has prominent non-respiratory symptoms such as myalgia, arthralgia, or sclerodactyly, ILD might be the result of underlying connective tissue disease.

Diagnosis can be made by the combination of clinical and roentgenographic features and pulmonary function tests.

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Histopathological confirmation of the diagnosis may be required in some cases.Initially ILD was consider as a rare disease however, in the last few decades scattered case reports have emerged including various etiological factors responsible for ILDs from India.Hence the objective of this study was to compare conventional chest radiography and HRCT in the diagnosis of interstitial lung disease with clinical correlation

Material and Methods

All the patients with clinical suspicion of interstitial lung disease who were referred to the Department of Respiratory Medicine, JJMMC Davangere for diagnosis and evaluation were subjected to both conventional chest radiograph and HRCT. Diagnosis was based on clinical and radiographic findings.

Method of collection of data

A cross sectional study was performed. All ages and both sexes were included in the study. 53 patients was included in the study. Study period was from Aug 2015 to Aug 2017

Sample size

Intended to study minimum 50 patients

Inclusion criteria

Cases clinically suspected of ILD with the below criteria

a) Age>20 years of both sex.

b) Both in patients and out patients with symptoms suggestive of ILD

c) Abnormal pulmonary function test results including evidence of restriction, impaired gas exchange (at rest or upon exertion)

d) Patients with Bibasilar dry inspiratory crackles

Exclusion criteria

a. Patients who were not willing to participate
b. Pregnant female
c. HIV patients

Equipment

High resolution Computed Tomography imaging will be performed on TOSHIBA Activion 16 slice MDCT machine.

Chest radiograph Posteroanterior view performed with X RAY tube of anode type , kV(p) minimum upto 100,mA-20mA or higher

Statistical analysis

Comparative statistical analysis was done using appropriate technique.

Result

The study was carried out at the Department of Respiratory medicine, JJM Medical college Davangere. A total of 53 patients were selected for the study between the time period of august 2015 to august 2017. These 53 patients were subjected to both conventional chest radiograph and HRCT scan thorax and a detailed work up of these patients were performed: their clinical history, relevant past and occupational history and any laboratory data recorded.

The results of our investigation were evaluated using proportions and chi squared test.

P value <0.05 was considered statistically significant

Decision Criterion: We compare the P-Value with level of significance. If P<0.05, we reject the null hypothesis and accept the alternate hypothesis. If P≥0.05, we accept the null hypothesis.

Table 1: Various diagnoses found among patients of interstitial lung diseases

Disease	No. Of Patients	Percentage
Idiopathic pulmonary fibrosis (I.P.F.)	29	54.76%
Sarcoidosis	1	1.8%
Hypersensitivity pneumonitis (H.P.)	9	16%
Non Specific Interstitial pneumonias (N.S.I.P.)	6	11%
Cryptogenic Organizing Pneumonias (C.O.P.)	2	3%
Connective Tissue Disorder (C.T.D.) Associated ILD	5	9.4%
LAM	1	1.8%
Total	53	100%

Out of 53 patients of interstitial lung diseases examined, Idiopathic pulmonary fibrosis (IPF) pattern was present in maximum number of patients (29) followed by Hypersensitivity pneumonitis (9) Non Specific Interstitial pneumonias (6) Connective Tissue Disorder (C.T.D.) Associated ILD (5) sarcoidosis (1), and Cryptogenic Organizing Pneumonias (C.O.P.) 2 case. LAM (1) case. Table 1

Of 53 patients , 30patients were males(56.65%) and 23(43.39%) were females. The age of the patients ranged from 20 to 75 yrs.

Prevalence of cough in various interstitial lung diseases

In ILD patients, 98.11% presented with cough, among which 37.73% had expectoration, while 60.37% patients had dry cough. 0.2% of patients didn't have cough as a presenting symptoms (p=0.0624). Dry cough was more common in patients with I.P.F and CTD assoc. ILD (72.4% and 60% respectively), whereas expectoration was more common in NSIP (83.3%) and H.P. (55%). Table 2

Table 2:Prevalence of cough in various interstitial lung diseases

Symptoms	IPF n= 29	Sarcoidosis n=1	H.P. n=9	NSIP n=6	COP n=2	CTD ILDs n=5	LAM n=1	Total
Cough with expectorant	**8** 27.6%	**0**	**5** 55%	**5** 83.3%	**1** 50%	**1** 20%	**0**	**20** 37.73%
Dry cough	**21** 72.4%	**1** 100%	**4** 45%	**1** 16.6%	**1** 50%	**3** 60%	**1** 100%	**32** 60.37%
No cough	**0**	**0**	**0**	**0**	**0**	**1** 20%	**0**	**1** 0.2%

Table 3:Prevalence of various physical signs in ILD

Signs	IPF (n=29)	Sarcoidosis (n=1)	H.P. (n=9)	NSIP (n=6)	COP (n=2)	CTD;ILDs (n=5)	LAM (n=1)	Total
Skin changes	**0**	**0**	**0**	**0**	**0**	**3** 60%	**0**	**3** 5.6%
Pallor	**14** 48.1%	**0**	**5** 55%	**2** 33.3%	**1** 50%	**3** 60%	**0**	**25** 47.1%
Clubbing	**20** 68.9%	**0**	**6** 66.6%	**2** 33%	**0**	**3** 60%	**0**	**31** 58.49%
Bibasilar crepts	**29** 100%	**1** 100%	**9** 100%	**6** 100%	**2** 100%	**5** 100%	**1** 100%	**53** 100%
Wheeze	**3** 10.3%	**0**	**00**	**1** 16%	**00**	**00**	**00**	**4** 7.54%

Bibasilar crepitation was the most consistent sign (100%), clubbing and pallor were present in 58.49% and 47.1% of ILD patients. Wheeze (7.54) and skin changes (5.6%) were relatively infrequent. 33.3% of patients with NSIP and 3 out of 5 cases of CTD associated ILDs had pallor. Clubbing was a common finding in IPF,Hypersensitivity pneumonitis. On auscultation, wheeze was present in 16% of patients with NSIP and 10.3% of IPF cases.

Table 4:Spirometry patterns in various types of ILDS

Patterns	IPF n= 29	Sarcoidosis n=1	H.P. n=9	NSIP n=6	COP n=2	CTD; n=5	LAM n=1	Total
Normal	**1** 3.4%	**1** 100%	**0**	**2** 33.3%	**0**	**0**	**0**	**4** 7.54%
Obstructive	**1** 3.4%	**0**	**0**	**0**	**0**	**0**	**0**	**1** 1.8%
Restrictive	**21** 72.41%	**0**	**8** 88.8%	**4** 66.6%	**2** 100%	**4** 80%	**2** 100%	**41** 77.35%
Mixed	**6** 20.68%	**0**	**1** 11.1%	**0**	**0**	**1** 20%	**0**	**8** 15.09%

Most common abnormality among ILD patients in Spirometry was restrictive pattern (77.35%), obstructive pattern was observed in single case of IPF while mixed pattern was observed in 20.68% cases. Spirometry was normal in 7.54%cases.All patients of COP and 4 out of 5 CTD associated ILDs had restrictive pattern on Spirometry.

Pulmonary hypertension was seen in 37.7% of total ILD cases, most frequent in IPF and CTD associated ILDs.

The comparative tables between CXR and HRCT in the detection of different findings are given below

Table 5:Prevalence of various radiological finding in ILD

Findings	IPF n= 29	H.P. n=9	NSIP n=6	CTD asso ILD n=5	BOOP (n=2)	LAM (n=1)	SARCO IDOSIS (n=1)	Total
Inter Septal Thickening	100%	100%	83.33%	100%	50%	100%	00	66.6%
Reticulation	100%	77.7%	83.33%	100%	00	100%	00	65.85%
Honey combing	89.6%	44.4%	16.6%	100%	00	00	00	27.2%
Brochiectasis	86.2%	55.5%	16.6%	40%	00	00	00	28.3%
Cyst	3.4%	00	00	00	00	100%	00	14.7%
Nodules	3.4%	33.3%	00	00	00	00	00	5.24%
Air trapping	3.4%	22.2%	16.6%	40%	00	00	00	11.7%
Consolidation	24.1%	00	16.6%	00	100%	00	00	20.1%
Ground glass opacity	27.5%	66.6	100%	100%	50%	00	00	49.5%
Intrathoracic lymph node	24.3%	11.1%	00	40%	00	00	100%	25.05%

Interstitial septal thickening was the most consistent radiological finding, seen in 66.6% cases. Reticulation, ground glass opacity, and bronchiectasis were seen in 65.85%, 49.5% and 28.3% cases respectively.

Interstitial septal thickening was seen in all cases of IPF and 83.3% of patients with NSIP. Reticulation, honey combing and tractional bronchiectasis were very consistent with IPF, observed in 100%, 89.6%, and 86.2% respectively. Ground glass opacity was present in all cases of NSIP and CTD associated ILDs.Intra thoracic lymphadenopathy was a very important feature of sarcoidosis and 2 out of 5 cases of CTD associated ILDs.

Table 6: Comparison of various radiological findings of ILD between chest radiograph and HRCT

FINDINGS	HRCT	CXR
Inter Septal Thickening	94.33%	52.83%
Reticulation	79.24%	47.16%
Honey combing	67.92%	11.32%
Brochiectasis	62.96%	15.09%
Nodules	7.54%	1.88%
Consolidation	9.43%	5.66%
Ground glass opacity	49%	18.86%
Intrathoracic lymph node	20.75%	1.88%

In our study out of 53 patients, 8 patients (15.09%)had normal chest radiograph with clinical history suspicious of ILD .In such patients HRCT could detect many abnormalities such as reticular opacities ,interseptal thickening ,tractional bronchiectasis and honey combing.

Discussion

The main observation in our study was the higher number of samples with the finding were detected by HRCT as compared to conventional radiography. Even when both modalities were able to detect the findings, HRCT could characterize the abnormality and specify its location much more accurately.The chest radiogram can appear completely normal in patients suffering from interstitial lung diseases. There in lies the inherent lack of sensitivity of conventional chest radiography in the diagnosis of ILD. In our study 8 out of the 53 patients (15.09%) had no abnormalities in their chest radiographs. However HRCT was able to show reticular changes in these patients.Out of 53 patients, 30 were male (56.6%) and 23 were females (43.39%). **Gagiyaashok K. et al (2012)** showed male preponderance (66.5%) while 33.5% were female[3]. **Jindal et al (1979)**study, 66.50% male and 33.50% female[4].

The most common abnormality seen on chest radiographs was reticular opacities which was observed in 47% of the cases. However HRCT managed to detect reticular opacities in 79% of the cases, thereby implying a much greater sensitivity in the identification of these densities. HRCT detected fine reticular opacities in lungs when the chest radiograph revealed no such abnormalities.

Nodular opacities are another manifestation of interstitial lung diseases. In our study 2% had nodular opacities in their chest radiographs. While HRCT showed evidence of nodular opacities in 8% of the cases. The appearance of the nodules themselves can be an indicator as to whether they are interstitial of air space nodules. Interstitial nodules tend to be sharply marginated while air space nodules poorly defined. This distinction of nodules is much better appreciated on HRCT scans than on chest radiograms.

The end stage of interstitial lung disease is characterized by honeycombing. It reflects extensive lung fibrosis with alveolar destruction, thereby resulting in a characteristic reticular appearance. On HRCT, it is associated with gross distortion of lung architecture, where individual lobules are no longer visible. In our study, such honeycombing was seen in 68% of the cases on HRCT while chest radiography could detect them in only 11%. Detection of honeycombing has great clinical significance as its presence strongly suggest the diagnosis of usual interstitial pneumonia. It also indicates end stage disease.In this context also, HRCT definitely scores over conventional radiography.

Traction bronchiectasis or bronchial dilation resulting from lung fibrosis was visible in 15% of the cases on chest radiography. They were typically associated with reticular opacities and in some cases with honeycombing. HRCT however managed to detect traction bronchiectasis in 63%. The bronchiectasis in these cases was typically associated with an absence of mucus plugging or fluid within the bronchi. This finding or the absence of it was much better appreciated on HRCT than conventional radiography.

The detection of associated air trapping and lymphadenopathy was also greater with HRCT than with conventional radiography.

In our study Interstitial septal thickening was most consistent radiological finding, seen in 94.53% of the cases other findings were reticulation (79.24%), ground glass opacity (49.05%)), tractional bronchiectasis (62.26%), honey combing(67.92%) Intrathoracic lymphnode(20.75%),nodules(7.54%),consolidation(9.43%).

Muhammed Shafeeq K. et al. (2011) studied HRCT Thorax of 70 DPLDs cases and they found Ground glass opacity 46% Septal thickening 69% Honey combing 43% Nodules 16% Mediastinal nodes 11.4% cases[5]. **Rajkumar et al (2014)** studied and find the overall patterns documented on HRCT (n=289) were interstitial fibrosis (49.9%), honeycombing (37.71%), ground glass opacities (34.25%), intrathoracic lymphadenopathy (20.76%), traction bronchiectasis (17.64%) and pleural fibrosis (5.8%). Honeycombing was present in 4.62% cases of sarcoidosis, 31.08% cases of NSIP and in all IPF cases[6]. **U Maheshwari et al(2004)** studied HRCT thorax of 69 IPF cases and find all patients had features suggestive of diffuse interstitial fibrosis. Other abnormalities noted on HRCT chest included honeycombing (88.4%), ground glass haziness (23.2%), parenchymal nodules (7.2%) and mediastinal lymphadenopathy (5.7%). Mild air trapping was observed in three patients[7].**Abhishek et al** 2016 [8] studied HRCT thorax of 50 cases ,common HRCT findings were fibrosis(52%),interstitial infiltrates(40%),ground glass opacity(38%) ,honey combing(34%),tractional bronchiectasis (18%), nodules (6%),lymphadenopathy.In our study Among the 53 cases, Idiopathic pulmonary fibrosis (IPF) was present in maximum number of patients (54.03%), followed by Hypersensitivity pneumonitis (16.9%), Non Specific Interstitial pneumonias(11.3%) and Connective tissue disorder associated ILDs in 9.43% cases. **Tiyas Sen et al (2009)** observed Idiopathic pulmonary fibrosis (43%), sarcoidosis (22%), ILDs secondary to connective tissue disorder (19%) and extrinsic allergic alveolitis, among others, in their study[9].Bibasilar fine end inspiratory crepitations was the most common sign seen in this study and it was found in 100% cases. In various other studies crepitations were seen in 92.9% (**Muhammed Shafeeq K et al 2011)** 63.29% **(Gagiya Ashok K. et al, 2012)**, 43% (**Tiyas Sen et al, 2009)** 43.8% cases[6,9,8].Most common pattern in spiromery in ILD is restrictive**.** In our study it was seen in (77.35%) cases. In various other studies restrictive pattern was observed in 98% in **Muhammed Shafeeq K et al (2012) [13]**, 96% in **(Gagiya Ashok K. et al, 2012) [14]** cases[10,11].The inference that we draw this study is that HRCT is much more sensitive than conventional chest radiography in the assessment and diagnosis of patients with interstitial lung diseases. Hence, HRCT seems to be the investigation of choice for the evaluation of the parenchymal abnormalities in interstitial lung diseases and thereby make a more specific and accurate diagnosis of the particular disease.

Conclusion

The diagnosis of interstitial lung disease (ILD) is frequently delayed because clinical clues are neglected and respiratory symptoms are described to more common pulmonary diagnosis such as chronic obstructive pulmonary disease (COPD) in the primary care setting.

While ILD cases ultimately require referral to a pulmonologist, many cases can be diagnosed in the early stages with the help of HRCT. HRCT is able to detect abnormalities In patients when the clinical signs are minimal or even when the chest radiograph appears completely normal.

High resolution computed tomography (HRCT) chest scans are essential to the diagnostic work up since each ILD form is characterized by a specific pattern of abnormalities and confident diagnosis can often be arrived at by HRCT alone or in correlation with the clinical symptoms. When HRCT findings are characteristic in appropriate clinical settings, HRCT may even obviate the need for lung biopsyChest radiograph is a relatively insensitive modality of investigations for the diagnosis of ILDs. Ultimately all patients with clinical suspicion of ILDs should benefit from an HRCT scan of thorax

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Ethical approval

Ethical clearance has been obtained from the Research and Dissertation Committee/Ethical Committee of the institution for this study.

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