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Evaluation of Diffuse Lung Diseases by HRCT and Correlation with Chest Radiography

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Abstract: ***Introduction: The term DILD is a convenient "catch - all" for a heterogeneous group of disorders. The DILDs have been subcategorized as follows: (a) DILDs that have a known etiology (e. g., secondary to exposure to certain drugs or a connective tissue disorder); (b) the idiopathic interstitial pneumonias (which themselves have undergone classification and a more recent update; (c) the granulomatous DILDs; and (d) a group of diffuse lung diseases that include Langerhans cell histiocytosis and Lymphangioleiomyomatosis. Aim: To determine the diagnostic accuracy of chest radiography in DLD/ILD confirmed by chest HRCT. Materials and Methods: 30 patients with signs & symptoms of DLD were included in study. Findings like ground glass haze (GGO), reticular opacities, nodular opacities, fissure thickening, emphysematous changes, fibrotic changes, architectural distortion, honeycombing, septa thickening, consolidation, bronchiectasis, hilar & mediastinal lymphadenopathy, pleural effusion were documented in them and comparison was done between chest radiography & HRCT. Results: The correlation between X ray and HRCT among the study subjects having symptoms of diffuse lung disease. Approximately similar distribution of reticular opacities and emphysematous changes was revealed on X ray as well as HRCT. HRCT revealed more cases of GGO/haziness, septal thickening, nodular opacities, bronchiectatic changes, Hilar & mediastinal lymphadenopathy, fibrotic lesions and NHO/Consolidation as compared to X ray with statistically significant difference as p<0.05. Conclusion: This study concluded that HRCT of the chest has proven to be better method for evaluating & diagnosing the patients with diffuse lung disease than conventional chest radiography. Chest HRCT scan is essential for diagnostic workup; However, chest radiography serves as initial investigation for screening the patients & for their follow up.***

Keywords: Diffuse lung diseases, Interstitial lung diseases, Consolidation, Ground glass haze, usual interstitial pneumonia, non - specific interstitial pneumonia, lymphoid intestinal pneumonia, Idiopathic pulmonary fibrosis

1. Introduction

Background

Diffuse/Interstitial lung diseases (ILDs) are a diverse group of lung diseases that vary widely in their causes, symptoms, clinical manifestations, imaging, pathologic features, and natural history. Based on epidemiological studies[2], ILD, once uncommon, is now very common due to a variety of environmental factors. ILD diagnosis can be delayed when doctors ignore early symptoms or attribute them to more common lung diseases such as chronic obstructive airway disease (COPD) [1].

ILD mainly affects adults, but can also be seen in children. A few ILDs, such as sarcoidosis, pulmonary Langerhans cell histiocytosis, and autoimmune lung disease, occur at a younger age, while idiopathic pulmonary fibrosis (IPF) usually develops between 40 and 70 years of age.

Familial IPF involving two or more first - degree relatives, with the onset of fibrosis at a relatively young age. The incidence and mortality of interstitial lung disease are directly proportional to age[3 - 4]. Chest X - ray is the first test to evaluate lung diseases. In recent years, many advances have been made in the interpretation of plain chest radiographs to diagnose interstitial lung disease more accurately. However, reliable diagnosis of ILD is hampered by the inherent limitations of chest radiography, with limited spatial resolution and superimposition of different structures[5].

Chest radiography (CXR) is inexpensive and widely used noninvasive test, but its sensitivity, specificity, and accuracy in diagnosing interstitial lung disease are 47, 82, and 77%, respectively, as shown by Padley SPG et al[6]. Due to the discrepancy between national and international data, this survey was designed to generate more local data. This study helped determine the diagnostic accuracy of CXR in ILD in our population.

This determined the diagnostic accuracy in local populations, most of whom were of low socioeconomic status and could not afford HRCT, although previous studies showed it to be very low. These patients may be offered a simple, noninvasive, economical, and ready - to - use alternative to HRCT with the advantages of significantly reducing patient radiation dose and early diagnosis and treatment.

Aim and Objectives

1) To determine the diagnostic accuracy of chest radiography ininterstitial lung disease confirmed by chest HRCT

2) Correlation of conventional Chest Radiograph and HRCT findings in interstitial lung disease.
3) To evaluate whether HRCT can detect pulmonary abnormalities in patients with suspected interstitial lung disease and normal Chest Radiograph

2. Materials and Methods

The hospital based prospective observational study was conducted in department of radiodiagnosis & Imaging, Muzaffarnagar medical college, UP, for eighteen months with 12 months for data collection & 6 months for data analysis. Total of 30 patients of varied age group presenting with symptoms & signs of diffuse lung disease referred from department of chest &TB, Medicine, causality was studied.

Inclusion criteria:
1) Patients suspected of interstitial lung disease in the chest radiograph,
2) Patients with clinical suspicion of ILD with normal or suspicious radiographs
3) Known cases of interstitial lung disease (to quantify the degree of interstitial lung disease in order to evaluate the effectiveness of treatment).

Exclusion criteria:
1) Pregnant patients.
2) Children's < 15 years.
3) Patients who do not wish to participate in the study

3. Procedure

1) All the patients with clinical suspicion of interstitial lung disease who are referred to the Department of Radiodiagnosis, for diagnosis and evaluation are subjected to both conventional radiograph and HRCT. Diagnosis is based on clinical and radiological findings.
2) Appropriate informed consent was obtained before imaging in the radiology department.
3) Taking a brief history of the patient from the patient or caregiver.
4) HRCT scan was performed in the supine position using Siemens Somatom Emotions 16 - slice CT machine with breath holding using KVP 130 and mA 60 - 70. The window width is set between 1200 and 1500 and the window level between - 600 and - 700. The matrix used is 512x512 and the pitch is set to 1: 1.
5) The Patients also underwent Chest radiograph PA/AP view at 60 - 70 KVP & 20 mA using an 800 mA Allengers x - ray machine with IITV and fluoroscopy and processed by using Konica Minolta digital radiography unit.

Statistical analysis: The collected data were summarized in an excel sheet with the guidance of a statistician. The mean and standard deviation of the measurements in each group were used for statistical analysis (SPSS 22.00 in Windows; SPSS inc, Chicago, USA). Chi - square test was used to determine the difference between the two groups, and the significance level was $p<0.05$.

Statistical analysis in the present study was performed using the following formula:
1. Chi - square test: Chi - square test (also called chi - square test) is a statistical hypothesis test in which the distribution of the statistical sample of the test is the chi - square distribution if the null hypothesis is true. The chi - square test is used to determine whether there is a significant difference between the expected and observed frequencies for one or more categories.

4. Tables & Images

Table 1: Age & Gender distribution among the study subjects

Age Group (in years)	Male	Female	Total	Percentage
10 - 20	0	1	1	6.62%
21 - 30	0	4	4	13.33%
31 - 40	1	3	4	13.33%
41 - 50	5	4	9	30%
51 - 60	3	2	5	16.67%
>60	5	2	7	23.33%
Total	`14	16	30	100%
Percentage	46.67%	53.33%	100%	

Table 2: Various disorders among the study subjects

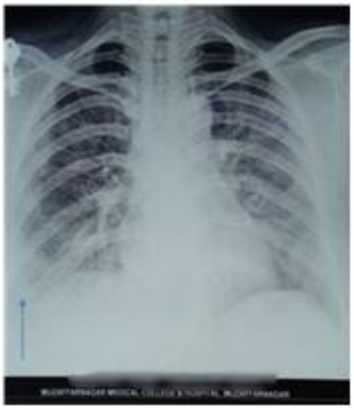
Variables	N	%
NSIP	2	6.67
UIP	2	6.67
SLE	1	3.33
SARCOIDOSIS	1	3.33
LIP	1	3.33
MILLARY TB	1	3.33
P. EDEMA	1	3.33
ARDS	1	3.33
Not otherwise specified	20	66.7

Table 3: Correlation between X ray and HRCT Findings

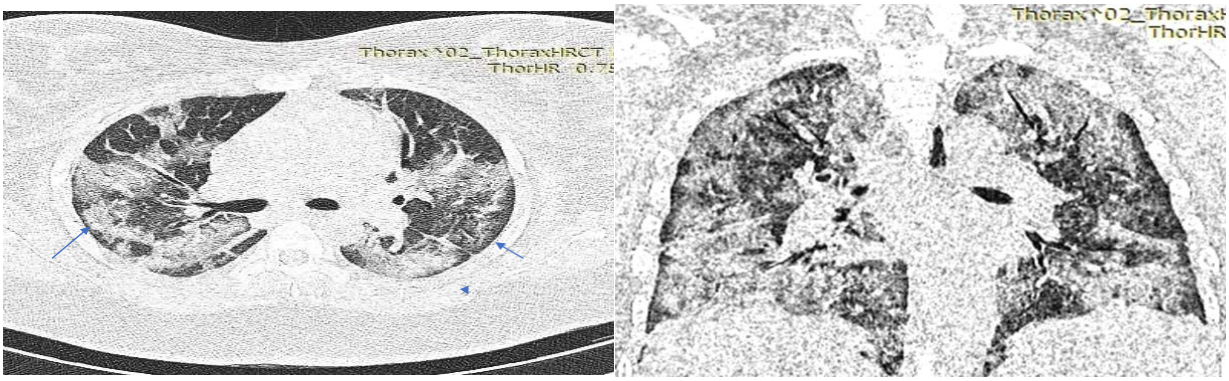
Parameters	Xray		HRCT		p value
	N	%	N	%	
GGO/Haziness	21	70	26	86.67	0.008*
Septal Thickening	0	0	7	23.33	<0.01*
Reticular Opacities	7	23.33	9	30	0.17
Nodular Opacities	1	3.33	8	26.67	<0.01*
Fissural Thickening	0	0	2	6.67	0.29
Bronchiectatic Changes	0	0	8	26.67	<0.01*
Emphysematous Changes	1	3.33	2	6.67	0.42
Hilar & Mediastinal Lymphadenopathy	1	3.33	16	53.33	<0.01*
Pleural Thickening	0	0	2	6.67	0.29
Fibrotic Lesions	0	0	6	20	0.009*
Pleural Effusion	4	13.33	6	20	0.14
NHO/Consolidation	5	16.67	12	40	0.002*
Architecture Distortion	0	0	1	3.3	0.71
Honeycombing	0	0	2	6.67	0.29

*: statistically significant

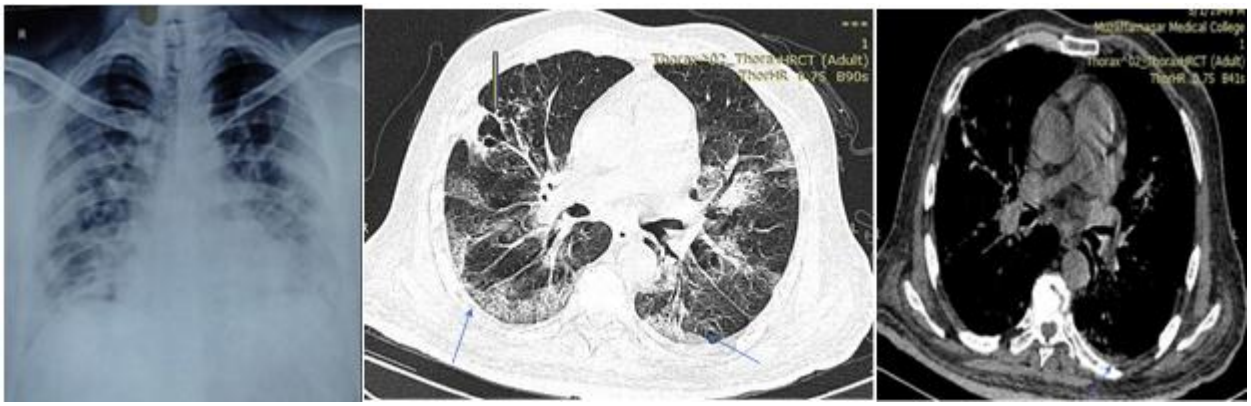
Imaging Glossary



Case 4: CXR PA VIEW shows hazy opacities in B/L lung fields predominantly in B/L mid & lower zones with blunting of right Costophrenic angle (blue arrow)



Case 4: HRCT Chest A) Axial B) Coronal section shows multifocal areas ground glass opacities involving all the segments of bilateral lungs with peripheral & basal predominance more in lower lobes with associated interstitial thickening & small patchy areas of consolidation (blue arrows)



CASE 28 CXR PA VIEW shows hazy opacities in B/L lung fields with blunting of Left Costophrenic angle (blue arrow)
CASE 28 - HRCT CHEST A) Axial sections shows multifocal areas of ground glass opacities involving all the segments of B/L Lungs with peripheral & basal predominance more in lower lobes with associated interstitial thickening and patchy areas of consolidation& left side minimal pleural effusion (blue arrows). Consolidation with cavitatory area noted in right middle lobe with tractional bronchiectasis (Orange arrow)

5. Results & Discussion

Year

In this study mostly affected individual are of age group 41 - 50 years old (30 percent), followed by people over 60 years old (23.33 percent) (Table1). Similar results are seen in various studies like in S. Annapurna et al[7], Bhat and colleagues[8], Anu smriti Pal et al[9] (age 85 - 22 years (mean = 53.5 years).

Sex

Men and women constituted 46.67% and 53.33% of the people, respectively. Therefore, the number of women and men in this study was almost equal (Table 1). A similar type of gender distribution was observed in the study of S. Annapurna et al[7] (female > male) and Bhat et al[8] (56% female), Anu smriti Pal et al[9] (almost equal number). In contrast, studies by Siddhant S. Lolge et al[10] (60% male) and Agrawal MK et al[11] (65% male), P. Madhu[12] showed a male predominance, unlike the present study

Correlation between X - ray and HRCT

On comparing the imaging findings of HRCT & chest radiography in this study we find that approximately similar distribution of reticular opacities and emphysematous changes was revealed on X ray as well as HRCT. However, HRCT revealed more cases of GGO/haziness, septal thickening, nodular opacities, bronchiectatic changes, Hilar & mediastinal lymphadenopathy, fibrotic lesions and Consolidation as compared to X ray with statistically significant difference as $p<0.05$. (Table 3).

Similarly, S. Annapurna et al[7,] Anu smriti Pal[9], Madhu P et al[12], C. K Onyambu[13], in their study found p - values less than 0.05 for the detection of nodular opacity and septal thickening, and all the other findings are better appreciated on HRCT as compare to chest radiography with statistically significant difference. . The most common abnormality seen in chest radiography and HRCT was reticular opacities.

Various disorders in this study include, NSIP and UIP which was revealed in 6.67% of the subjects each. SLE, sarcoidosis, LIP, Millary TB, P. Edema and ARDS was found in 3.33% of the subjects each& most of the symptoms are not classified in any particular group of diseases so they are included in Not otherwise specified group accounts for 66.7% (Table 2)

The range of diseases included in the study by Agrawal MK et al[11] included IPF (25%), HP (17.5%), sarcoidosis (15%), RA (10%) and silicosis (10%).

In the study of Miraj Rentia et al.1[4], the range of diseases was IPF (25%), idiopathic NSIP (16.5%), RA (14.5%), carcinomatous lymphangitis (8.33%), asbestosis (6.25%), HP (6.25%). %. Of those 48 patients, 2 (4.16%) had normal CXR.

A study by Florence Janney et al[15] showed that CXR can helps in the diagnosis of ILD.10–40% of patients appear normal, with a diagnostic yield on radiography of 23% compared with 49% on HRCT for ILD[6].

In 2008, Sun J et al[16] reported that HRCT was more reproducible and accurate than radiography regardless of smoking or chronic bronchitis. However, these data do not support the hypothesis that HRCT is more sensitive than chest radiography in the early diagnosis of silicosis. Concordance between chest radiography and HRCT in early stages of silicosis was poor.

6. Conclusion

This study concluded that HRCT of the chest has proven to be better method for evaluating & diagnosing the patients with diffuse lung disease than conventional chest radiography. Approximately similar distribution of reticular opacities and emphysematous changes was revealed on X ray as well as HRCT. HRCT revealed more cases of GGO/haziness, septal thickening, nodular opacities, bronchiectatic changes, Hilar &mediastinallymphadenopathy, fibrotic lesions and NHO/Consolidation as compared to X ray with statistically significant difference as $p<0.05$. However, chest radiography serves as initial investigation for screening the patients & for their follow up.

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