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Comparative Analysis of Interstitial Lung Diseases on Chest Radiographs and HRCT

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Abstract **Original Research Article**

Introduction: Interstitial lung diseases are a diverse group of diseases which affect the lung interstium and share similar clinical and radiological manifestations. Although there are several interstitial lung diseases, only a few handful of about 10-12 account for more than 90% of them. Hence, proper knowledge and understanding of these common entities is pertinent in diagnosing them and in including them in the differential diagnosis. ***Aims and Objectives***: The study aims to diagnose study and compare Interstitial Lung Diseases using HRCT and Chest X-Ray by using a prospective and observational study model. ***Results***: HRCT showed statistically significant difference in diagnosis of Interstitial Lung Disease as compared to Chest X-Ray as p value was significant in 4 out of 6 assessed parameters. Hence, CT scan was found essential in evaluation of Interstitial Lung Diseases. ***Conclusion****:* 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 a confident diagnosis can often be arrived at by HRCT alone or in correlation with the clinical symptoms.

Keywords: Lung Diseases, Chest, HRCT.

INTRODUCTION

Interstitial lung diseases are a diverse group of diseases which affect the lung interstium and share similar clinical and radiological manifestations. They are a heterogeneous group of disorders of the lower respiratory tract that are characterized by both acute and chronic inflammation with generally an irreversible and relentless process of fibrosis in the interstitium and the alveolar walls [1].

The interstitium refers to tissues of the alveolar wall between the capillary endothelium and the alveolar epithelium and it is the site of primary injury. The term “interstitial” can be misleading as most of these conditions also affect the airway spaces and even the blood vessels, but it is the predominant and primary involvement of the interstitium that is a specific characteristic [2]. Though they are grouped together, there are great variations in the risk factors for their development, their pathological processes, the relevant therapies and the associated prognosis, making an accurate diagnosis very essential [3].

Although there are several interstitial lung diseases, only a few handful of about 10-12 account for more than 90% of them. Among the well over 100 distinct entities of ILDs, a limited number of disorders, including idiopathic pulmonary fibrosis, sarcoidosis, and connective tissue disease-related ILDs, account for most diseases encountered clinically [3]. Hence, proper knowledge and understanding of these common entities is pertinent in diagnosing them and in including them in the differential diagnosis.

MATERIAL AND METHOD

The study aims to diagnose, study and compare Interstitial Lung Diseases using HRCT and Chest X-Ray by using a prospective and observational study model.

Inclusion Criteria:

1. Patients referred to the Radiology Department for X-RAY and/or CT scan thorax and found to have Interstitial Lung Diseases.
2. Patients with known history of Industrial Exposure or Certain Drug Exposures.

Exclusion Criteria:

1. Patients presenting to radiology department who are pregnant.
2. Patients unwilling to participate.

Protocol Used to Perform HRCT on GE Brightspeed MDCT

1. Scanogram
2. 5mm mediastinal window cuts.
3. Full inspiration1.5 mm lung window cuts in axial section
4. Suspended full expiration scans at levels-aortic arch, tracheal bifurcation and above diaphragm
5. Prone scans in lung window 1.5 mm cuts if indicated.

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

Decision Criterion: We compare the P-Value with the level of significance. The level of significance was 0.05. If $P<0.05$, we reject the null hypothesis and accept the alternate hypothesis. If $P\geq0.05$, we accept the null hypothesis.

RESULTS AND DISCUSSION

The study was carried out at the Department of Radiology, Suyash Hospital, Indore. A total of 48 patients were selected for the study between the time period of April 2022 and December 2022.

Higher numbers of samples with findings 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 [4-6].

The Chest X-Ray can appear completely normal in patients suffering from Interstitial Lung Diseases. In our study, 2 of the 48 patients (4.16%) had no abnormalities in their chest radiographs. However HRCT was able to show changes in these patients [7].

The most common abnormality seen on chest radiographs was reticular opacities which were observed in 89% of the cases. However HRCT managed to detect reticular opacities in 98% of the cases, thereby implying a much greater sensitivity in the identification of these densities 8].

In our study 10% had nodular opacities on their Chest X-Ray. While HRCT showed evidence of nodular opacities in 16.5% of the cases. Furthermore, the location and distribution of nodules in relation to lung structures is a key determinant in narrowing down the differential diagnosis [9].

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 52% of the cases on HRCT while chest radiography could detect them in only 31% [10-14].

Traction bronchiectasis or bronchial dilatation resulting from lung fibrosis was visible in 27% 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 54% [15].

HRCT showed statistically significant difference in diagnosis of interstitial lung disease as compared to Chest X-ray as p value was significant in 4 out of 6 parameters. Hence, CT scan was found useful in complete evaluation of interstitial lung diseases.

Table 1: Incidence of diseases depending on the Occupation

Sr. No	Occupation	Cases	%
1	Driver	05	10.41
2	Farmer	12	25
3	Housewife	13	27.08
4	Construction site worker	02	4.16
5	Daily wage laborer	04	8.33
6	Basket weaving	01	2.08
7	Bangle maker	01	2.08
8	Flour mill worker	03	6.25
9	Fisherman	01	2.08
10	Jute bag factory worker	02	4.16
11	Cloth mill worker	03	6.25
12	Shopkeeper	01	2.08
	Total	48	100

Table 2: Incidence of various patterns in this cross section of population

Sr. No	Pattern	Cases	%
1.	Usual Interstitial Pneumonitis	22	45.8
2.	Non Specific Interstitial Pneumonitis	10	20.8
3	Nodular	02	4.16
4.	Asbestosis	02	4.16
4.	Lymphangitic Spread	04	8.33
5.	Desquamative Interstitial Pneumonia	01	2.08
6.	Lymphangioleiomyomatosis	01	2.08
7.	Cryptogenic Organizing Pneumonia	02	4.16
8.	Respiratory Bronchiolitis-Interstitial Lung Disease	01	2.08
9.	Others	03	6.25

Table 3: Results for Detection of HRCT Findings

	$\chi 2$	P value
Honeycombing	4.28	0.03
Reticular Opacities	2.84	0.09
Nodular Opacities	3.94	0.04
Bronchiectasis	7.29	0.06
Emphysema	4.06	0.03
Consolidation	2.87	0.21

Fig 1: Usual Interstitial Pneumonitis

Chest X Ray shows reticular thickening with minimal honeycombing in lower zones HRCT shows classical subpleural and peripheral honeycombing.

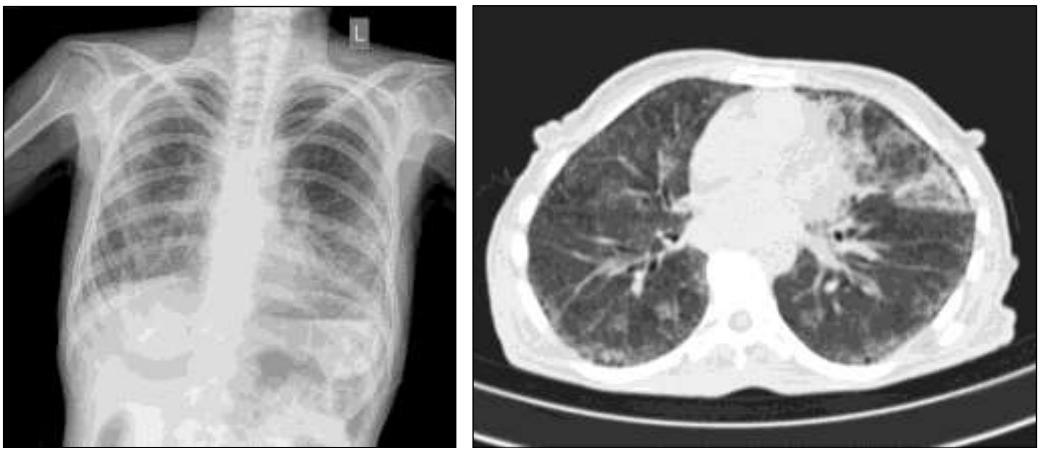

Fig 2: Non Specific Interstitial Pneumonitis

Chest X Ray shows reticular thickening in the lower zones. HRCT shows reticular thickening with ground glass opacities and sub pleural sparing of lung.

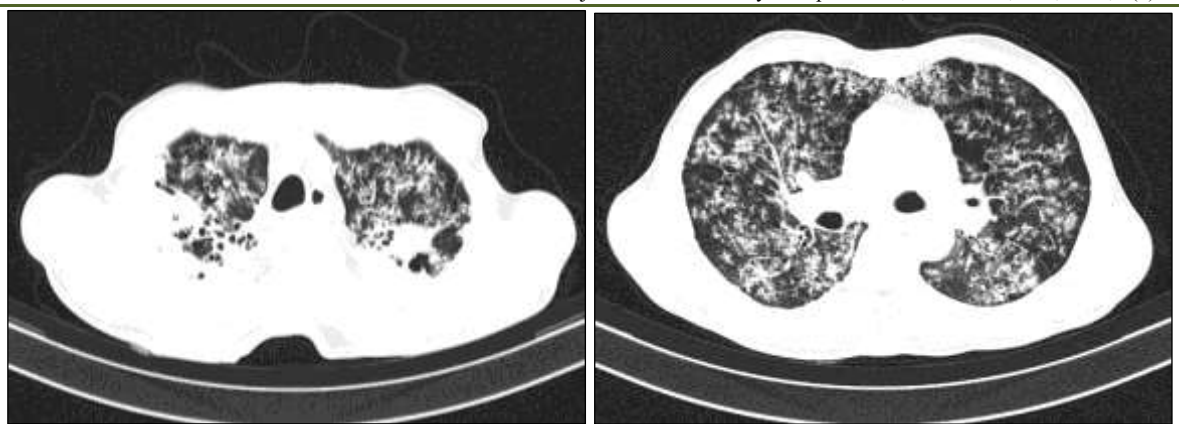

Fig 3: Sarcoidosis

Chest X Ray shows nodular opacities in perilymphatic distribution involving upper and middle zone.

Fig 4: Hypersensitivity Pneumonitis

Chest X Ray show centrilobular nodules and ground glass opacities sparing the costophrenic angles.

Fig 5: Lymphangioleiomyomatosis

HRCT shows multiple intraparenchymal cysts with ground glass haziness. CT Brain shows multiple calcified subependymal calcified nodules. Coronal section of CT Abdomen shows a large multiple angiomyolipomas in both the kidneys.

Fig 6: Rheumatoid associated ILD

Chest X Ray shows reticular thickening in mid and lower zones. HRCT shows honeycombing in basal and subpleural region suggestive of UIP pattern. A case of rheumatoid arthritis as shown with changes seen in hands – juxta articular osteopenia, reduced intercarpal joint space with fusion of carpals.

CONCLUSIONS

Chest X-ray is a primary modality used to screen patients with lung pathologies, being cheap and easy to perform. HRCT is the modality of choice for diagnosis of Interstitial Lung Diseases. There are statistically significant differences in diagnosis between the two modalities.

Normal chest x-ray does not rule out diagnosis of interstitial lung disease. 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 a confident diagnosis can often be arrived at by HRCT alone or in correlation with the clinical symptoms.

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Conflict of interest: None

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