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Original Research Article

Comparative Analysis of Conventional Chest Radiographs and HRCT Thorax for the Assessment of Patients with Interstitial Lung Disorders

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Abstract:

Numerous conditions that are typified by cellular infiltrates in a periacinar site are included in the category of diffuse interstitial lung disease. Numerous patients present with different respiratory issues. For these patients, a chest radiograph is typically the initial line of inquiry. When the results of a chest radiograph are unclear or even seem normal, we perform an HRCT Thorax, which aids in the diagnosis and visualization of problems that the chest radiograph is unable to show. This study aims to compare the results of chest radiography and HRCT lung in interstitial lung disorders. When there was a clinical suspicion of interstitial lung disease, patients underwent high resolution computed tomography and chest radiography. Sarcoidosis (23.3%), rheumatoid arthritis (10%), silicosis (16.7%), disseminated tuberculosis (6.7%), hypersensitivity pneumonitis (6.7%), allergic bronchopulmonary as pergillosis (6.7%), and lymphangitis carcinomatosis (6.7%) were among the range of diseases covered by the study. We draw the conclusion that when assessing individuals with interstitial lung disease, HRCT appears to be the preferred method of examination. Since chest radiography is not very sensitive, an HRCT examination of the chest should be recommended for any patient who has a clinical suspicion of interstitial lung disease.

Keywords: Lung Diseases, Interstitial, Computed Tomography, Chest, and Radiograph.

Introduction

A wide range of conditions that impact the lung interstitium and have comparable radiological and clinical symptoms are together referred to as interstitial lung disorders. These are a diverse range of lower respiratory tract illnesses distinguished by persistent and acute inflammation together with an essentially irreversible process of fibrosis in the alveolar walls and interstitium [1].

The pulmonary interstitium is the network of connective tissue fibres that supports the lung. It includes the alveolar walls, interlobular septa and the peri bronchovascular interstitium. The term interstitial lung disease (ILD) is used to refer to a group of disorders that mainly affects these supporting structures. Although the majority of these disorders also involve the air spaces, the predominant abnormality is usually thickening of the interstitium which may be due to the accumulation of fluid, cells, or fibrous tissue [2].The chest radiograph remains part of the initial assessment of ILD, but the radiographic pattern is often nonspecific, observer variation is considerable and it is relatively insensitive to early ILD [3, 4].As the name implies this disease group affects the pulmonary interstitium more than the alveolar spaces or airways, although exceptions exist. The interstitium is the area between the capillaries and the alveolar space. When responding to any injury, whether from a specific exposure(eg., asbestos, mouldy hay), an autoimmune mediated inflammation from a systemic connective tissue disease (eg., rheumatoid arthritis) or unknown injury(eg., idiopathic pulmonary fibrosis), the lung must respond to the damage and repair itself. If the exposure persists or if the repair process is imperfect, the lungs may be permanently damaged, with increased interstitial tissue replacing the normal capillaries, alveoli and healthy interstitium [5].

Idiopathic pulmonary fibrosis is the most common interstitial lung disease in adults and generally has apoor prognosis [3] around 15% of patients with interstitial lung disease had an underlying connective tissue disorder [4]. Although interstitial

lung diseases are more common in adults, certain forms such as hypersensitivity pneumonitis and idiopathic interstitial pneumonias are seen in children as well [6].

Aims of this study to correlate the findings of conventional chest radiography and HRCT in interstitial lung diseases, if HRCT can detect pulmonary abnormalities in patients with suspected interstitial lung diseases but with a normal chest radiograph and the different radiographic patterns of interstitial lung diseases in both conventional chest radiography and HRCT.

Materials and Methods

Data for our study was collected from the patients referred to Department of Radiology, Dr. Ram Manohar Lohia Institute of Medical Sciences, Lucknow, U.P. from October 2022 to March 2023 with clinically suspected interstitial lung disease. They were evaluated with conventional radiograph and HRCT Lung. The conventional chest radiographs were done in PA view at 60kVp and 12 mAs in an Allenger 600mA x-ray machine. HRCT scans were done in supine position in a GE Light speed XTRA 16 Slice CT machine in suspended inspiration using a kVp of130 and mAs of 60-70. The window width was set between 1200-1500 and the window level at -600 to -700. The matrix used was 512 x 512 while the pitch was set at 1:1. We selected 30 patients from both the sexes and from all ages. A cross sectional study was performed

Results

A total of 30 patients were selected for the study between the time periods of October 2022 to March 2023.

Conventional chest radiograph and HRCT scan thorax was done of these 30 patients and a detailed work up of these patients was performed; their clinical history, relevant past and occupational history and any laboratory data recorded. Of the 30 patients, 18 patients were males (60%) and 12 (40%) were females. The age of the patients ranged from 24 years to 74 years.

The spectrum of diseases included in the study was:

- Sarcoidosis (23.3%), rheumatoid arthritis (10%), idiopathic pulmonary fibrosis (23.3%), silicosis (16.7%), disseminated tuberculosis (6.7%), hypersensitivity pneumonitis (6.7%), allergic bronchopulmonary aspergillosis (6.7%) and lymphangitis carcinomatosis (6.7%).
- The comparative tables between X-ray and HRCT in the detection of different findings are given below

Table 1: Sex Distribution

Gender	Number (n)	Percentage
Male	20	66.67%
Female	10	33.33%
Total	30	100%

Results for the detection of reticular opacity:

Table 2: Reticular Opacities

Reticular Opacity	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	26	86.67	21	70	47	2.455	0.117
Absent	4	13.33	9	30	13		
Total	30	100	30	100	60		

Higher no. of samples with reticular opacity were detected in HRCT method compared to X-ray method but the difference between the two methods was not statistically significant (P>0.05).

Table 3: Nodular Opacity

Nodular Opacity	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	17	56.67	09	30	26	4.343	0.037*
Absent	13	43.44	21	70	34		
Total	30	100	30	100	60		

***denotes significant association**

Higher no. of samples with nodular opacity were detected in HRCT method compared to X-ray method and this difference between the two methods was found to be statistically significant (P<0.05).

Results for the detection of septal thickening

Table 4: Septal Thickening

Septal Thickness	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	18	60	6	20	24	10	0.0015*
Absent	12	40	24	80	36		
Total	30	100	30	100	60		

***denotes significant association**

Higher no. of samples with septal thickening were detected in HRCT method compared to X-ray method and this difference between the two methods was found to be statistically significant (P<0.05).

Results for the detection of honeycombing

Table 5: Honeycombing

Honeycombing	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	10	33	5	16.67	15	2.222	0.136
Absent	20	67	25	83.33	45		
Total	30	100	30	100	60		

Higher no. of samples with honeycombing were detected in HRCT method compared to X-ray method but the difference between the two methods was not statistically significant (P>0.05).

Results for the detection of Traction bronchiectasis

Table 6: Traction Bronchiectasis

Traction Bronchiectasis	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	13	43.33	09	30	22	1.1483	0.2839
Absent	17	56.67	21	70	38		
Total	30	100	30	100	60		

Higher no. of samples with traction bronchiectasis were detected in HRCT method compared to X-ray method but the difference between the two methods was not statistically significant (P>0.05).

Results for the detection of consolidation:

Table 7: Consolidation

Consolidation	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	14	46.67	14	46.67	28	0	1
Absent	16	53.33	16	53.33	32		
Total	30	100	30	100	60		

No significant difference was seen between conventional radiography and HRCT.

Results for the detection of ground glass opacity:

Table 8: Ground Glass Opacity

Ground Glass Opacity	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	14	46.67	09	30	25	1.7626	0.184
Absent	16	53.33	21	70	35		
Total	30	100	30	100	60		

Higher no. of samples with ground glass opacity were detected in HRCT method compared to X-ray method but the difference between the two methods was not statistically significant (P>0.05).

Table 9: Lymphadenopathy

Lymphadenopathy	HRCT		X-ray		Total	χ^2	Total
	No.	%	No.	%			
Present	17	56.67	10	33	27	3.299	0.069
Absent	13	43.33	20	67	33		
Total	30	100	30	100	60		

Higher no. of samples with lymphadenopathy were detected in HRCT method compared to X-ray method but the difference between the two methods was not statistically significant (P>0.05).

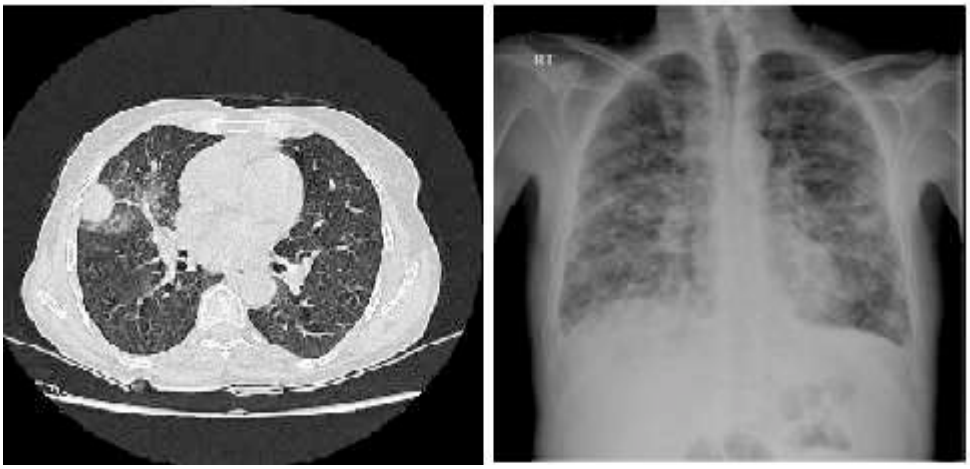

Figure 1: HRCT and X-ray of lymphangiotis carcinomatosa

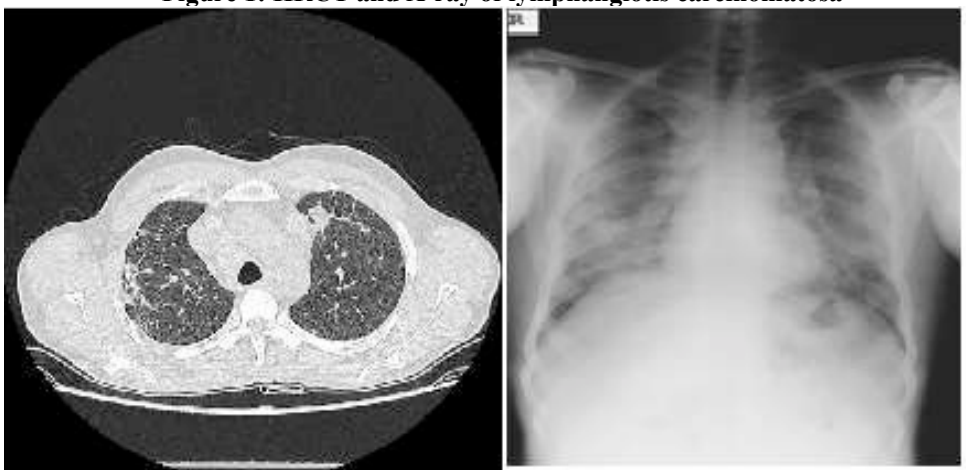

Figure 2: HRCT and Radiograph of case of silicosis

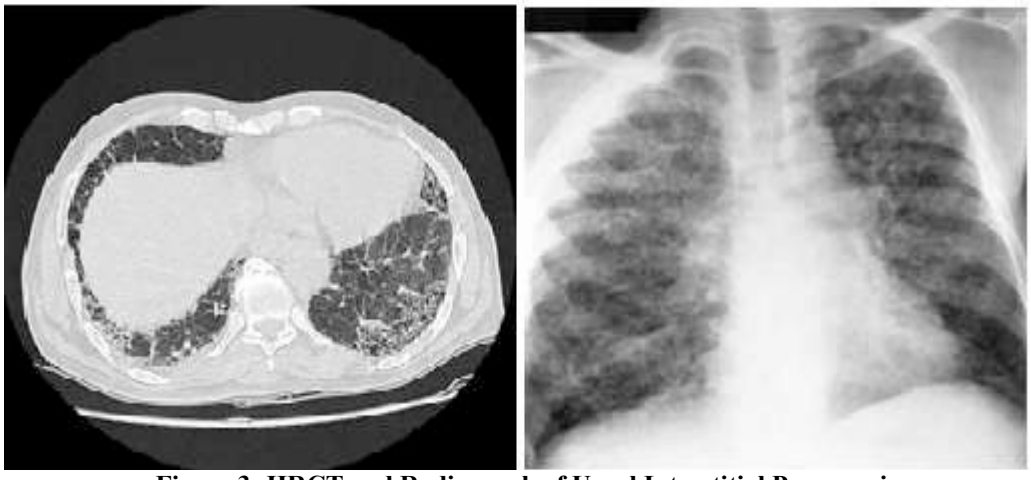

Figure 3: HRCT and Radiograph of Usual Interstitial Pneumonia

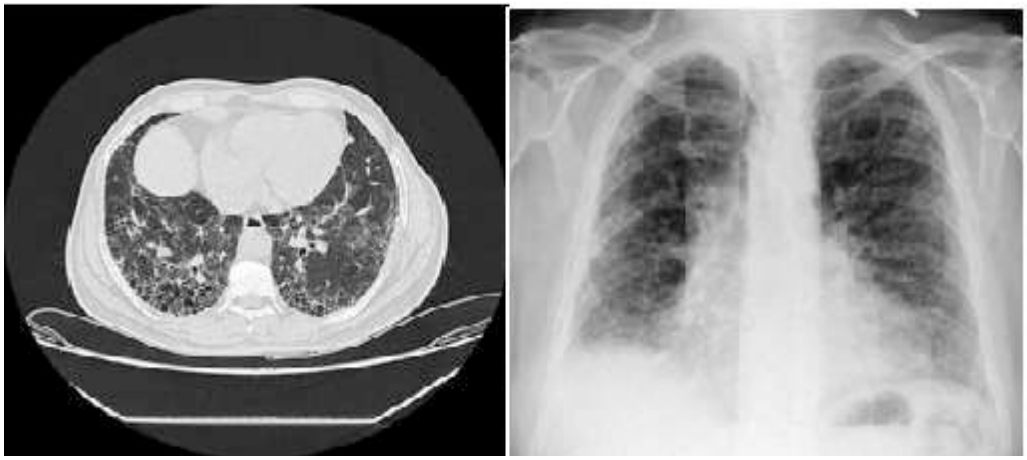

Figure 4: HRCT and Radiograph of idiopathic pulmonary fibrosis

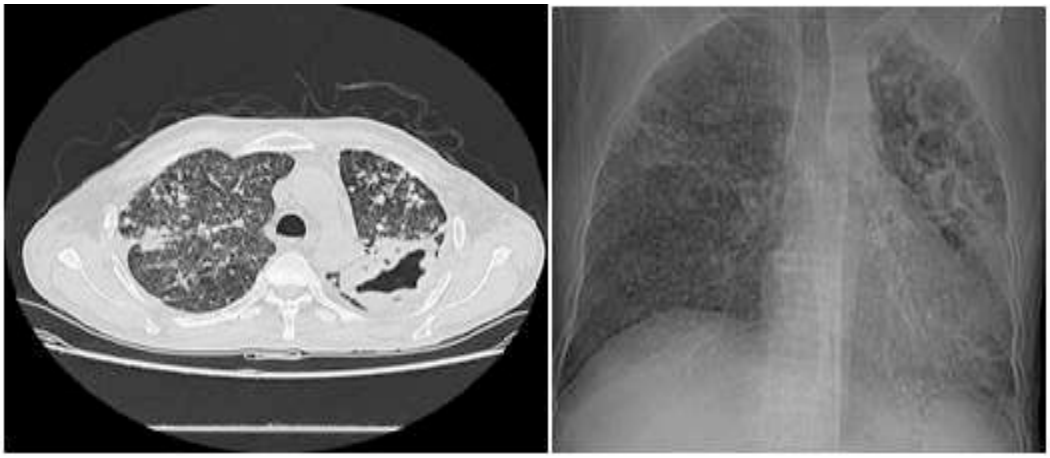

Figure 5: HRCT and Radiograph of disseminated tuberculosis

Discussion

The results of our investigation were evaluated using proportions and chi squared test. The level of significance was 0.05.

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

Computations: The tables below give us the various computations and the P-Value.

Gender distribution in the study sample. The main observation in our study was that 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.

The chest radiogram can appear completely normal in patients suffering from interstitial lung diseases. There in lays the inherent lack of sensitivity of conventional chest radiography in the diagnosis of the conditions. In our study, 3 of the 30 patients (6.7%) had no abnormalities in their chest radiographs. However, HRCT was able to show reticular changes in these patients.

Conclusion

The majority of the time, respiratory symptoms is misdiagnosed as chronic obstructive pulmonary disease (COPD) in primary care settings, and clinical findings are disregarded, delaying the diagnosis of interstitial lung disease (ILD). Even while ILD cases eventually need to be sent to a pulmonologist, HRCT can assist detect many cases early on.

Even in cases where a patient exhibits very few clinical indicators or a perfectly normal chest radiograph, HRCT can nevertheless identify anomalies in these people.

For the diagnosis of ILDs, chest radiography is a rather insensitive method of examination. Ultimately, an HRCT scan of the thorax should be beneficial for all patients with a clinical suspicion of ILDs. Chest scans using high resolution computed tomography (HRCT) are crucial for the diagnostic process since every ILD form has a unique pattern of abnormalities, and HRCT alone or in conjunction with clinical symptoms can frequently lead to a definitive diagnosis. In certain

clinical contexts, HRCT can even eliminate the necessity for a lung biopsy if the results are consistent.

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