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Original Research Article

# Comparative study of HRCT thorax with plain chest radiograph in evaluating the patients with interstitial lung diseases

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**Abstract:** Diffuse interstitial lung disease encompasses a large number of disorders that are characterized by cellular infiltrates in a peri acinar location. Many patients come with various respiratory complaints. Chest radiograph is usually first line investigation for such patients. Sometimes Chest radiograph results are inconclusive or they may even appear normal then we do HRCT Thorax, which helps to diagnose and visualize findings which are not visualized on chest radiograph. This study tries to compare findings of HRCT lung and Chest radiograph in interstitial lung diseases. Chest radiographs and high resolution computed tomography were done in patients with clinical suspicion of interstitial lung disease. 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%). We conclude that HRCT seems to be the investigation of choice in evaluating patients of interstitial lung disease. Chest radiography is relatively insensitive and all patients with a clinical suspicion of interstitial lung disease should benefit from an HRCT examination of the chest.
**Keywords:** Lung Diseases, Interstitial, Computed Tomography, Chest, and Radiograph

## INTRODUCTION:

Interstitial lung diseases are a diverse group of diseases which affect the lung interstitium 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 and a generally irreversible and relentless process of fibrosis in the interstitium and the alveolar walls [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].

The principal causes of diffuse interstitial lung disease are:

- Fibrosing alveolitis
- Inhalation disorders(asbestos, silica)
- Drug induced lung disorders
- Interstitial pneumonias
- Hypersensitivity pneumonitis
- Connective tissue disorders/ collagen vascular diseases.

Idiopathic pulmonary fibrosis is the most common interstitial lung disease in adults and generally has a poor 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].

**IMAGING FEATURES OF INTERSTITIAL LUNG DISEASES:**

Plain chest radiograph mostly shows reticular or reticulonodular opacities with collapsed lung. HRCT is valuable to differentiate between the pathology which shows same plain chest radiograph findings.

The basic pattern of interstitial lung diseases on plain chest radiograph is:

- Air space or alveolar consolidation
- Linear or septal
- Reticular
- Nodular
- Reticulonodular
- Ground glass opacity [7].

HRCT findings of interstitial lung diseases can be classified into 5 large categories based on their appearances:

- Reticular Opacities
- Nodular Opacities
- Increased Lung Opacities
- Cystic Lesions/ Decreased Lung Attenuation
- Mosaic Perfusion[7]

As there is no superimposition of structures, HRCT allows better assessment of parenchyma abnormalities than plain radiograph.

The indications for HRCT are as follows:

- To confirm or exclude diffuse lung disease in patients with normal or equivocal radiographic appearances and/or functional abnormalities.
- To narrow the differential diagnosis or make a histospecific diagnosis in patients with obvious but nonspecific radiographic abnormalities.
- To guide the type and site of lung biopsy.
- To investigate patients presenting with hemoptysis.
- To investigate patients with suspected bronchiectasis or unexplained severe obstructive airways disease.
- To assess the distribution of emphysema in patients considered for lung volume reduction surgery
- To evaluate disease reversibility, particularly in patients with fibrosing lung disease [8, 9].

**AIMS ANDS OBJECTIVES:**

1. To correlate the findings of conventional chest radiography and HRCT in interstitial lung diseases
2. To study if HRCT can detect pulmonary abnormalities in patients with suspected interstitial lung diseases but with a normal chest radiograph.
3. To study 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 Radio diagnosis, DVVPF'S Medical College, Ahmednagar, 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 LIGHTSPEED XTRA 16 Slice CT machine in suspended inspiration using a kVp of 130 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:**

The study was performed out at the Department of Radio-Diagnosis, Dr. Vithalrao Vikhe Patil Foundation's Medical College, and Ahmednagar. A total of 30 patients were selected for the study between the time periods of September 2015 to September 2016.

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

**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.

**Table 1: Sex Distribution**

| **Gender** | **n** | **%** |
|---|---|---|
| **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** | $\chi^2$ | **Total** |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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 | $\chi^2$ | TOTAL |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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**

| | HRCT | | XRAY | | Total | $\chi^2$ | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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 | | XRAY | | Total | $\chi^2$ | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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 Bronchectasis | HRCT | | XRAY | | Total | $\chi^2$ | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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 | | XRAY | | Total | $\chi^2$ | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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 | | XRAY | | Total | $\chi^2$ | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| 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 | | XRAY | | Total | $\chi^2$ | Total |
|---|---|---|---|---|---|---|---|
| | n | % | n | % | | | |
| **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).

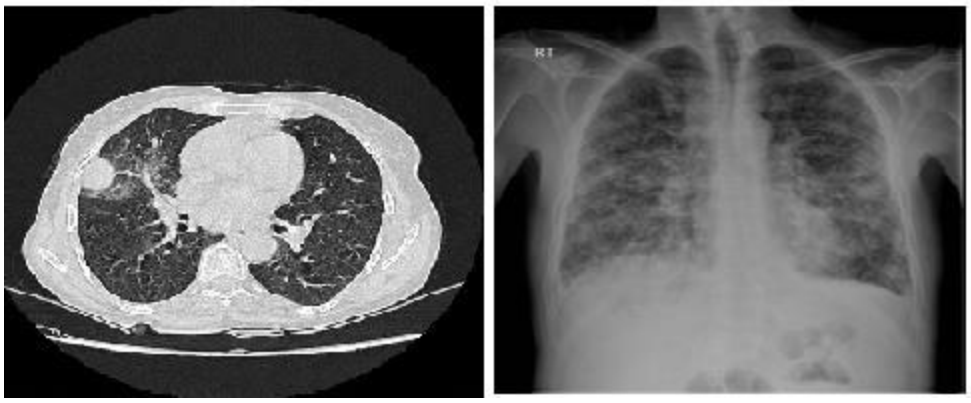

**Fig-1: HRCT and X-ray of lymphangiotis carcinomatosa**

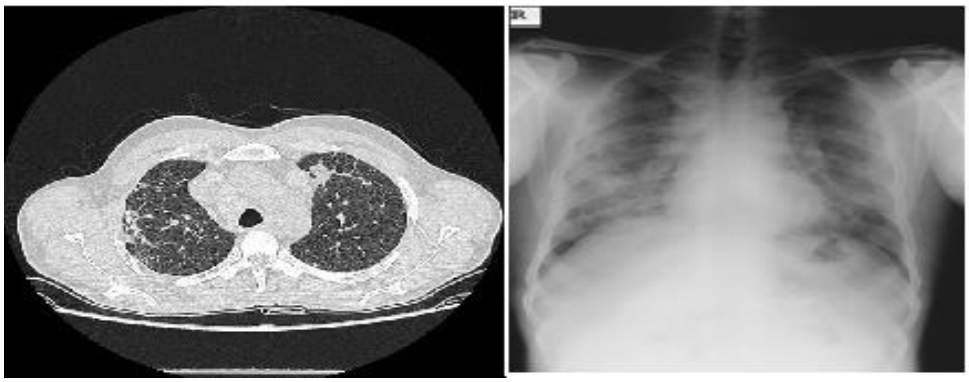

**Fig-2: HRCT and Radiograph of case of silicosis**

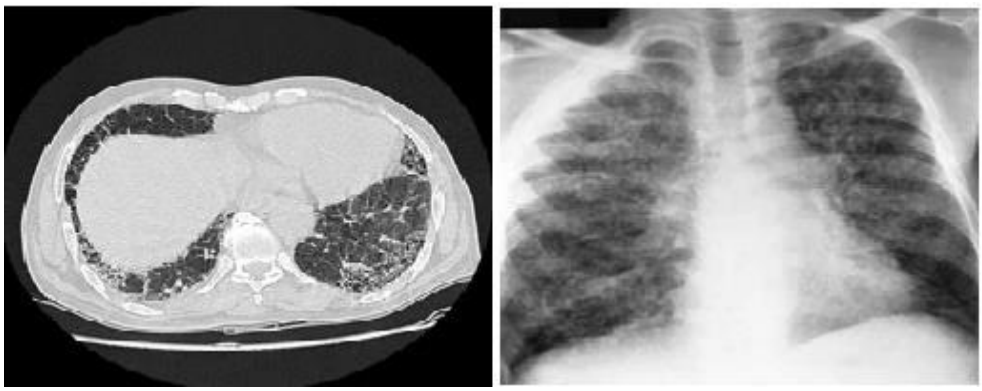

**Fig-3: HRCT and Radiograph of Usual Interstitial Pneumonia**

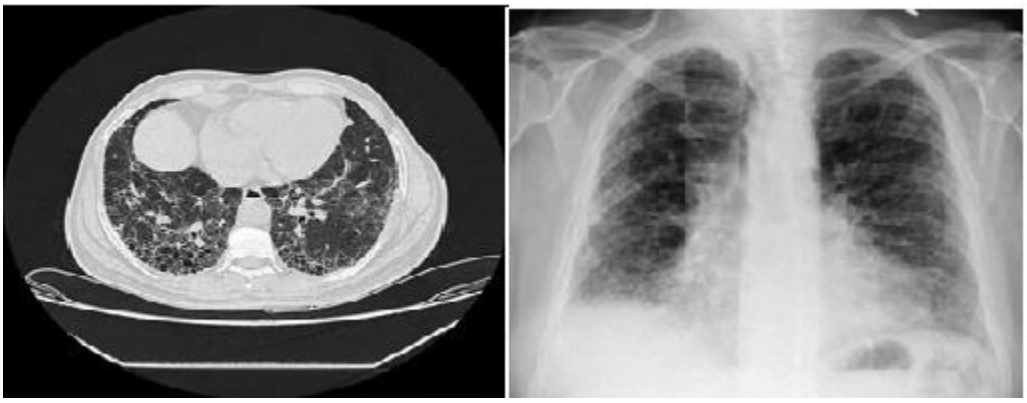

**Fig-4: HRCT and Radiograph of idiopathic pulmonary fibrosis**

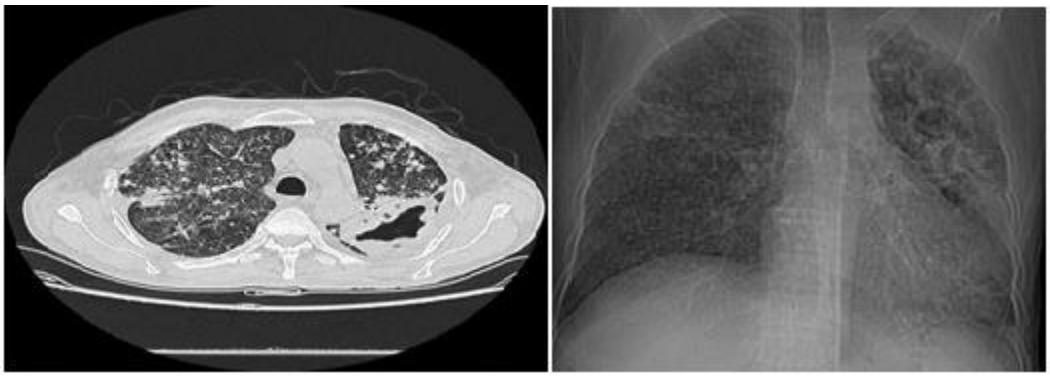

**Fig-5: HRCT and Radiograph of disseminated tuberculosis**

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. Therein 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 diagnosis of interstitial lung disease (ILD) is most of the times delayed because clinical findings are neglected and respiratory symptoms are thought to be of more common pulmonary diagnoses 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 very few or even when the chest radiograph appears completely normal. Chest radiography is a relatively insensitive modality of investigation for the diagnosis of ILDs. Ultimately all patients with clinical suspicion of ILDs should benefit from an HRCT scan of the thorax. High resolution computed tomography (HRCT) chest scans are very 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. When HRCT findings are characteristic in appropriate clinical settings, HRCT may even obviate the need for a lung biopsy

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