International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Comparison between Conventional Radiography and High - Resolution Computed Tomography (HRCT) in Interstitial Lung Disease

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Abstract: ***Background and Objectives: Interstitial lung diseases are a diverse group of diseases that predominantly affect the lung interstitium and share similar clinical and radiological manifestations. Most patients have nonspecific respiratory complaints and the first suggestion of the disease is usually a chest radiograph. However, many patients of interstitial lung disease can have a normal chest radiogram, in these patient's HRCT can detect abnormalities not visualized on the chest radiogram. This study attempts to compare conventional chest radiography and HRCT in the diagnosis of interstitial lung disease. Methods: The present study included 100 patients. After a detailed clinical work up, all the patients underwent both conventional radiography and HRCT. The images were evaluated and the findings were compared between chest radiography and HRCT. The results were tabulated, statistically analyzed and compared with previous studies. Results: The main result of the study was that HRCT was able to detect more abnormalities than conventional 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. Clinicians should therefore give the benefit of an HRCT examination even when the chest radiogram appears normal. Conclusion: The study thus concludes that HRCT can be regarded as an ideal noninvasive modality for assessment of Interstitial lung disease.***

Keywords: Interstitial lung disease, HRCT, sensitivity

1. Introduction

During the last decade, numerous radiologists have refined the art of interpreting plain chest radiographs to more precisely and correctly diagnose interstitial lung diseases. [1 - 5] Nevertheless, the artful skills of even the best radiologists are hampered by inherent limitations of the plain chest radiographs with their poor spatial resolution and the ever - present superimposition of various anatomic structures.

The advent of High - Resolution Computed Tomography (HRCT) has revolutionized our ability to detect and characterize interstitial lung diseases in vivo [6 - 10]. Structural changes in the lungs can often be detected in patients with a normal chest radiograph [11 - 13]. However even HRCT has its limitations. [14, 15] In the detection of interstitial lung diseases, its sensitivity is 100% and the limitations of sensitivity are not well established.10 - 20% of patients with interstitial lung diseases can have a normal HRCT. [16, 17]

This study therefore aims to compare conventional chest radiographs and HRCT in the evaluation of interstitial lung diseases.

Objectives:
1) To correlate the findings of conventional chest radiography and HRCT in interstitial lung diseases
2) To study the sensitivity and specificity of interstitial lung diseases by conventional radiography and HRCT
3) To study the different radiographic patterns evident in both conventional chest radiography and HRCT

2. Methodology

Source of data:
All the patients with clinical suspicion of interstitial lung disease who will be referred to the department of Radiodiagnosis, RRMC& RC for diagnosis and evaluation will be subjected to both conventional chest radiograph and HRCT. Diagnosis will be based on clinical and radiographic findings.

Inclusion criteria:
1) Patients presenting with collagen vascular diseases like SLE, rheumatoid disease, systemic sclerosis
2) Patients of systemic vasculitides like Wegener's granulomatosis
3) Pulmonary tuberculosis with disseminated disease status
4) Industrial exposure related diseases like asbestosis, silicosis, coal worker's pneumoconiosis, etc.
5) Medication, drugs and radiation exposure related cases
6) Cases of idiopathic interstitial pneumonias and hypersensitivity pneumonias
7) Cases of allergic bronchopulmonary aspergillosis, invasive aspergillosis and lymphangitic spread of tumors.

Exclusion criteria:
Pregnant ladies will not be taken in to study

Duration of the study:
The study was conducted for a period of 1 and half year.
1st November 2020 To May 2022 (18months)

Method of collection of data:
A cross sectional study was performed. All ages and both sexes were included in the study. It was a duration - based

study. A minimum of 100 patients were included in the study.
Both conventional chest radiographs (postero - anterior and Lateral views) as well as HRCT was performed for all the patients.
Lateral view - segmental localization of the lesion
PA view - (upper, middle and lower) zones
All the Chest radiographs and HRCT films were evaluated by me and senior consultants of the Dept of Radiodiagnosis, RRMC

Statistical Analysis:
Data collected was compiled using Microsoft Excel and analyzed using software SPSS version 26.0. Proportions and Correlation co - efficient was calculated from the data analyzed.

3. Results

A total of 100 patients were enrolled in this study from November 2020 to May 2022 at Rajarajeswari Medical College Hospital, Bangalore.

All the patients were subjected to both conventional chest radiograph and HRCT scan thorax and a detailed work up of these patients was performed; their clinical history, relevant past and occupational history and any laboratory data recorded. Figure 1 shows that out of the 100 patients, The age of the patients ranged from 18 years to 78yearsThe mean age was 45.67 SD +14.8 years. The elderly age group was affected more. Less than 45years we had 29% of the cases, p value 0.02

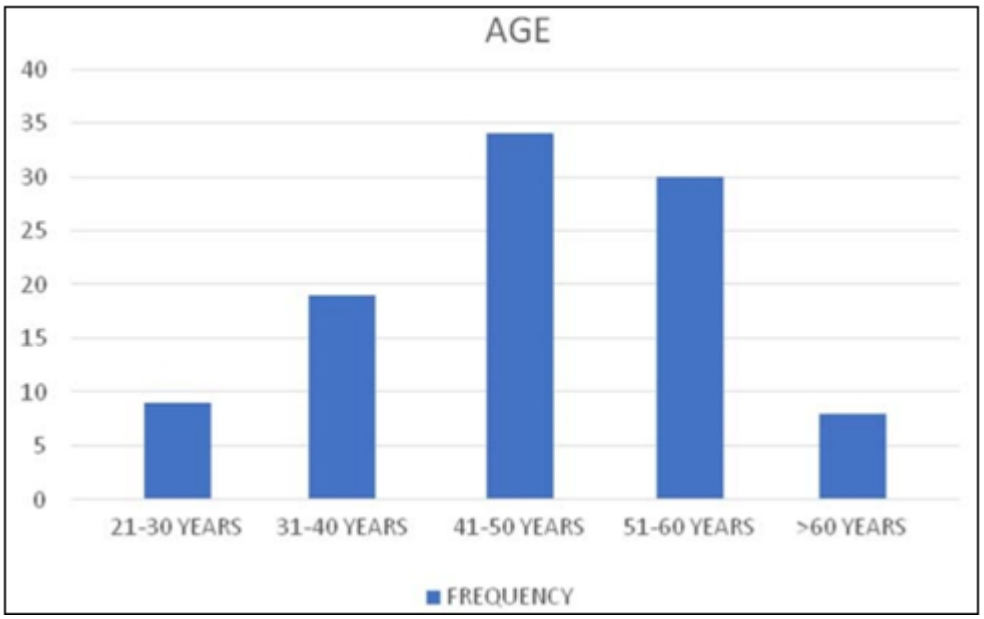

Figure 1

We had 65% females and 35 % males as shown in Figure - 2. The gender difference was statistically significant with a p value <0.02

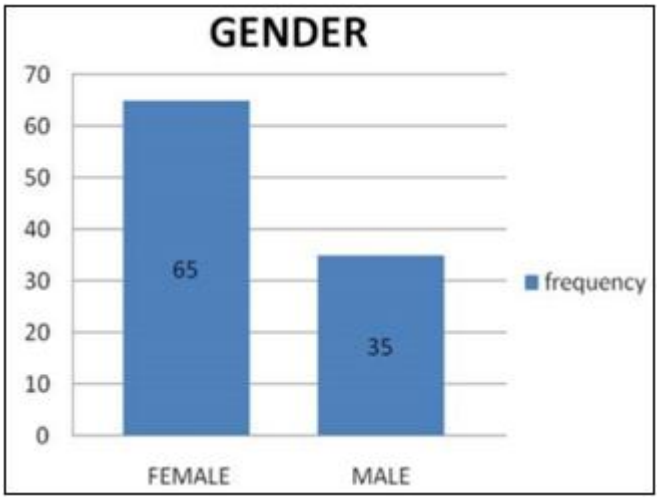

Figure 2

Figure - 3 shows that housewives were the commonest affected with 23 % due to the household smoke emitted while cooking, accounting for almost one fourth of the study population, chi square 0.046

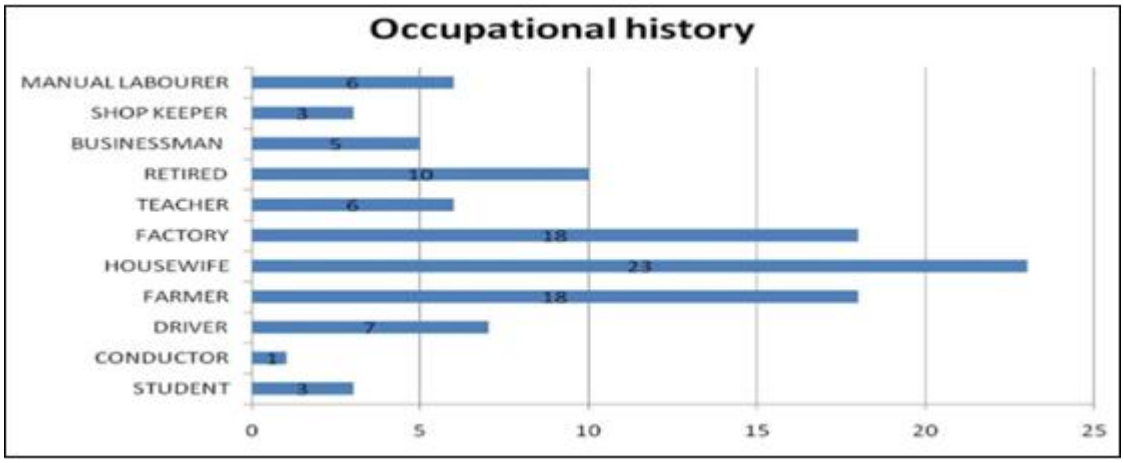

Figure 3

Figure - 4 shows that 23% had a history of allergy, chi square 0.046.

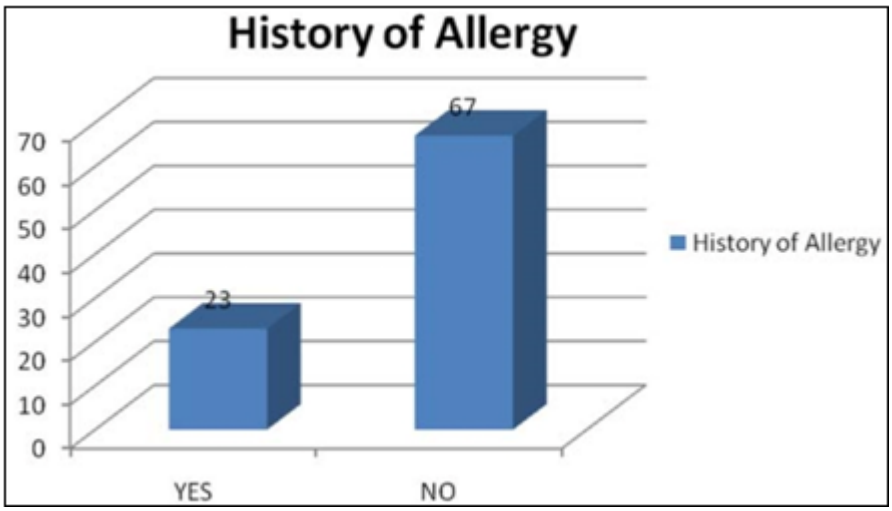

Figure 4

Figure - 5 shows different clinical diagnosis. Hypersensitivity pneumonitis was seen in 33.00%, Rheumatoid arthritis was seen in 21.00%, Tuberculosis was seen in 12.00%, Allergic bronchopulmonary aspergillosis was seen in 2.00% and Lymphangitis carcinomatosis, Idiopathic pulmonary fibrosis, Sarcoidosis and silicosis was seen in 1.00% each.

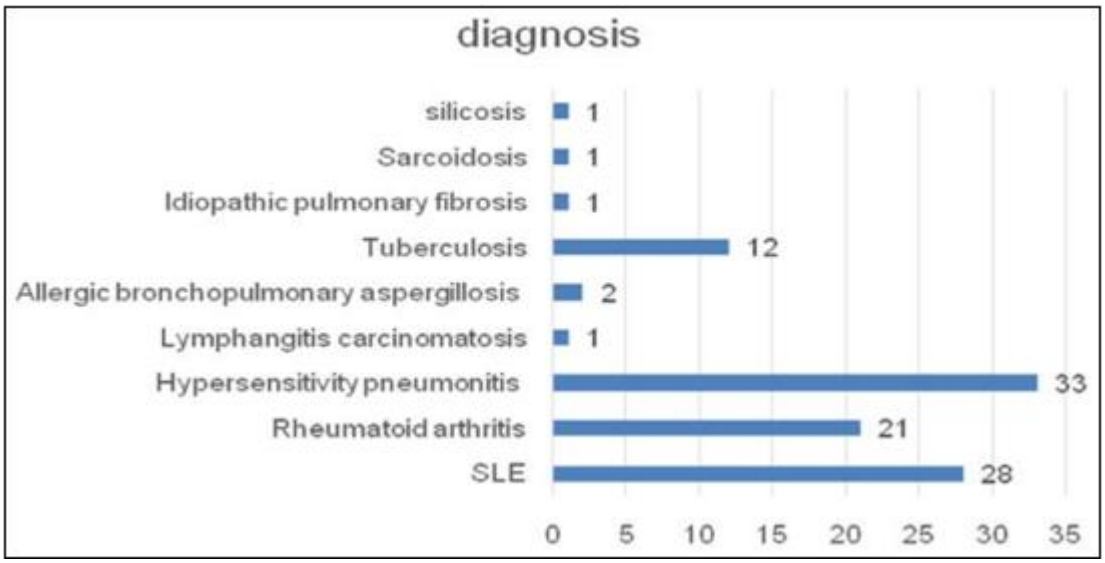

Figure 5: Clinical Diagnosis

There was a statistically significant difference between the two modalities based on the imaging finding with respect to all findings except the Ground glass opacity. X ray could correctly identify 57 lesions and HRCT imaging 98% of lesions and was more helpful in contributing towards the diagnosis as shown in Figure - 6.

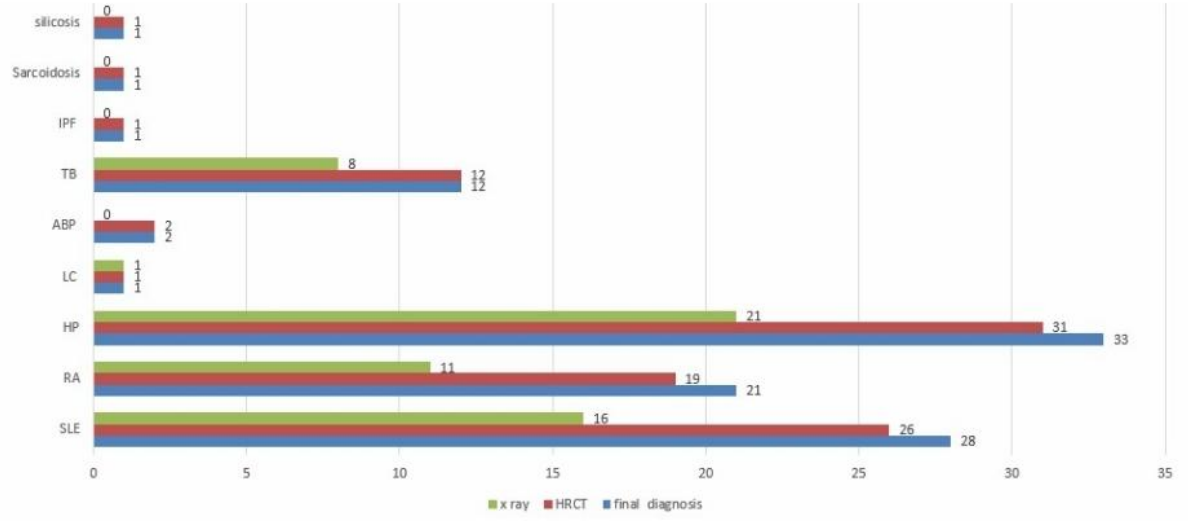

Figure 6: Final Diagnosis with Imaging Findings

4. Discussion

The chest radiograph can appear completely normal in patients suffering from interstitial lung diseases. Therein lies the inherent lack of sensitivity of conventional chest radiography in the diagnosis of the conditions. In our study, 2 of the 30 patients (6.7%) had no abnormalities in their chest radiographs. However, HRCT was able to show reticular changes in these patients.

The most common abnormality seen on chest radiographs was reticular opacities which was observed in 73% of the cases. However, HRCT managed to detect reticular opacities in 90% of the cases, thereby implying a much greater sensitivity in the identification of these densities. Furthermore, in the detection of these reticular opacities although conventional chest radiography was able to differentiate between medium and coarse opacities, their detection of fine reticular densities was a cause of concern. HRCT detected fine reticular opacities in the lungs when the chest radiograph revealed no such abnormalities.

Nodular opacities are another very common manifestation of interstitial lung diseases. In our study 35% had nodular opacities in their chest radiographs. While HRCT showed evidence of nodular opacities in 42% of the cases. The appearance of the nodules themselves can be an indicator as to whether they are interstitial or air space nodules. Interstitial nodules tend to be sharply marinated while air space nodules poorly defined. This distinction of nodules is much better appreciated on HRCT scans than on chest radiographs.

Furthermore, the location and distribution of nodules in relation to lung structures is a key determinant in narrowing down the differential diagnosis. Nodules can be classified as perilympahtic, random and centrilobular based on their distribution on HRCT. Perilympahtic nodules occur in relation to lung lymphatics and in clinical practice are usually the result of sarcoidosis. In our study this perilymphatic distribution of nodules in sarcoidosis was well appreciated. Similarly, random nodules are most typical of military tuberculosis, fungal infections or hematogenous metastases. Such narrowing down of the differential diagnosis based on the nodule distribution was possible only on HRCT and not on chest radiography. The maximum that chest radiography could offer in this context was to show a subpleural distribution of the nodule. This highlights the increased specificity of HRCT over conventional radiography.

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 28% of the cases on HRCT while chest radiography could detect them in only 13%. On HRCT, honeycombing was much more accurately diagnosed by the presence of thick walled, air filled cysts, usually measuring 3mm to 1cm in diameter, typically occurring in several layers at the pleural surface.

Detection of honeycombing has great clinical significance as its presence strongly suggest the diagnosis of usual interstitial pneumonia. It also indicates end stage disease, whereby the patient will gain little from a lung biopsy and hence avoid it. Even In this context, HRCT definitely scores over conventional radiography.

Traction bronchiectasis or bronchial dilatation resulting from lung fibrosis was visible in 1% 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 6%. The bronchiectasis in these cases was typically associated

with an absence of mucous 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.

5. Conclusion

The diagnosis of interstitial lung disease (ILD) is frequently delayed because clinical clues are neglected and respiratory symptoms are ascribed to 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 minimal 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 essential to the diagnostic work - up since each ILD form is characterised 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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