Journal of Cardiovascular Disease Research

ISSN:09758309762833. VOL14.ISSUE 07.2023

Comparative study of chest radiograph versus high-resolution computed tomography in evaluation of interstitial lung disease

[1]Dr. Adarsh AD [2]Dr. Mohd Talha, [3]Dr. Simran Gupta, .[4]Dr. Sagar Dubey, . [5]Dr. Iman Ikram, .[6]Dr. Bhoopchand Maurya, .[7] Dr Lalit Kumar , [8] Dr Deeksha Singh, [9]Dr. sarita yadav

[1]Associate professor Department of Radio diagnosis Rohil khand medical college ,Bareilly
[2]Senior Resident Department of Radio diagnosis Rohil khand medical college, Bareilly
[3]Junior Resident Department of Radio diagnosis Rohi lkhand medical college, Bareilly
[4]Junior Resident Department of Radio diagnosis Rohil khand medical college, Bareilly
[5]Doctoral Student, School of Communication Studies, Scripps College of Communication Ohio University, Athens, Ohio, USA
[6]Junior Resident Department of Radio diagnosis Rohil khand medical college ,Bareilly
[7]Professorand HOD Department of Radio diagnosis Rohil khand medical college, Bareilly
[8]JuniorResidentDepartmentofRadiodiagnosis Rohilkhand medical college, Bareilly
[9]Junior Resident Department of Radio diagnosis Rohilkhand medical college, Bareilly

Corresponding author:Dr. Adarsh A D

Article History: **Received:** 13.05.2023 **Revised:**07.06.2023 **Accepted:** 15.06.2023

Abstract

Aim and objectives: To assess the comparative evaluation of chest radiograph and high-resolution computed tomography in diagnosis of interstitial lung disease.

Materials and method: This cross-sectional study was carried out in the department of Radio-diagnosis, RMCH, Bareilly. X-ray chest PA view and High-Resolution Computed Tomography was done for all the included patients.

Results: Female predominance was observed in our study. It was observed that more number of patients with reticular opacities, nodular opacities, septal thickening, honeycombing, traction bronchiectasis and mosaic attenuation were detected in HRCT method compared to X-ray method, the difference amongst the two methods was statistically significant (P<0.05).

Conclusion: Clinical indicators of interstitial lung disease (ILD) are frequently ignored, and its respiratory symptoms are frequently mistaken for those of more prevalent pulmonary disorders like COPD, which delays diagnosis. As a result, HRCT is crucial for the diagnosis, treatment, and follow-up of diffuse lung diseases cases.

Keywords: Radiograph, HRCT, Interstitial lung disease

Introduction

Interstitial lung disease (ILD) refers to a category of disorders that affect the diffuse parenchymal tissue of the lungs. They are a diverse group of conditions that affect the pulmonary interstitium and are characterized by restrictive physiology, impaired gaseous exchange, acute and chronic pulmonary inflammation, and generally irreversible fibrosis. These conditions are caused by a combination of genetic and environmental factors.[1,2] The pulmonary interstitium is the connective tissue space that is sandwiched between the alveolar epithelial lung cells and the endothelial cells of the interstitial capillaries. In the vast majority of cases, the pathology that is at the root of the disease can be found within the pulmonary interstitium.[3] It is well established that patients with interstitial lung disease have anatomical abnormalities in their peripheral airways and interstitium. They begin with a stage known as alveolitis and are then followed by a stage known as fibrosis. The natural history of idiopathic pulmonary fibrosis suggests that there is gradual and increasing destruction to the alveolar capillary functional units, which often results in respiratory failure and, eventually, the patient's death.[3,4] Because of the general nature of their clinical manifestations, such as a dry cough and shortness of breath while doing activities, it is possible that they may go misdiagnosed and untreated for a considerable amount of time. Adults, as opposed to children, have a much higher incidence of having ILDs.[5,6] A extremely bad prognosis is associated with idiopathic pulmonary fibrosis, which is the most prevalent form of interstitial lung disease seen in adults.[7]Despite the fact that it is more common in adults, some kinds of pneumonia, such as hypersensitivity pneumonitis and idiopathic interstitial pneumonias, may also be seen in younger patients.[8] In children, diseases that are associated with interstitial lung disease include viral respiratory tract infections (RSV, par influenza,

ISSN:09758309762833. VOL14.ISSUE 07.2023

etc.), gastroesophageal reflux disease (GERD), idiopathic pulmonary fibrosis, pulmonary hemosiderosis, eosinophilic pneumonia, pneumonitis associated with AIDS, and so on.[9] It has been determined that factors such as smoking, aspiration, drug and radiation exposure, malignancies, systemic diseases (such as rheumatoid arthritis and sarcoidosis), occupationally related (contact to silica dust, asbestos, etc.), environmental exposure, and aspiration are all associated with approximately 33 percent of the cases of ILDs that have been reported.[10] On the other hand, 67 percent of the reported instances do not reveal any evidence of such a relationship. Idiopathic pulmonary fibrosis, sarcoidosis, and connective tissue disease-related interstitial lung illnesses still only account for more than 90 percent of all interstitial lung disorders, despite the fact that there are so many different types of interstitial lung diseases.[3] Hence, proper understanding of these diseases is of great importance in obtaining a correct diagnosis. The present study was done for the comparative evaluation of chest radiograph and high-resolution computed tomography in diagnosis of interstitial lung disease.

Materials and method

This cross-sectional study was carried out in the department of Radio-diagnosis, RMCH, Bareilly. Sample Size: A pilot study was done in the radiology department of RMCH, Bareilly by taking in account the departmental records from march 2019 to march 2020. The sample in this study consisted of 50 patients which was calculated using PASS (Power analysis and sample size) software.[11,12] Study population The study included both male and female patientswho were referred to the Department of Radiology, RMCH, Bareilly for chest x- ray and HRCT thorax investigations with lesions in the lung, Previously diagnosed cases of interstitial lung diseases requiring follow up radiological investigations who were referred to Department of Radiology and Patients with clinically suspected pulmonary disorders who presented with normal chest x-rays. The study excluded pregnant females. In our study, X-ray chest PA view and High-Resolution Computed Tomography was done for all the included patients. Statistical analysis SPSS version 25.0 analyzed the Excel data when it was loaded. Qualitative data was represented in the form of frequency and percentage. The association between qualitative variables was assessed by chi-square test. If p0.05, it was statistically significant.

Results

Table 1 : showing the distribution as per age, gender and disease

		Number	Percentage (%)
Age (in years)	30-40	8	16.0%
	41-50	11	22.0%
	51-60	15	30.0%
	61-70	11	22.0%
	71-80	4	8.0%
	81-90	1	2.0%
Gender	Male	21	42.0%
	Female	29	58.0%
Disease	Idiopathic Pulmonary Fibrosis (IPF)	19	38.0%
	Nonspecific Interstitial Pneumonia (NSIP)	16	32.0%
	Scleroderma	5	10.0%
	Organizing Pneumonia (OP)	3	6.0%
	Respiratory Bronchiolitis (RB-ILD)	2	4.0%
	Occupational-ILD	2	4.0%
	Sarcoidosis	1	2.0%
	Combined Pulmonary Fibrosis and emphysema (CPEF)	1	2.0%
	Rheumatoid Arthritis (RA)	1	2.0%

Majority of the patients belonged to 41-50 years (22.0%), 51-60 years (30.0%) and 61-70 years (22.0%). There were 42.0% males and 58.0% females. The spectrum of diseases that were a part of the study were IPF (UIP pattern) (38%), idiopathic NSIP (32%), scleroderma (10%), organizing pneumonia (6%), smoking related interstitial lung disease (RB-ILD) (4%), occupational ILD (4%), sarcoido sis (2%), CPEF (2%)and rheumatoid arthritis (2%).

Table: 2

ISSN:09758309762833. VOL14.ISSUE 07.2023

	HRCT		X-RAY		p-value
	Number	%	Number	%	
Reticular opacities	40	80%	30	60%	0.0290*
Nodular opacities	30	60%	17	34%	0.009*
Septal thickening	45	90%	10	20%	0.001*
Honey combing	26	52%	10	20%	0.001*
Traction bronchiectasis	35	70%	20	40%	0.002*
Consolidation	9	18%	7	14%	0.585#
Ground glass opacity	25	50%	20	40%	0.314#
Lymphadenopathy	25	50%	18	36%	0.157#
Mosaic attenuation	2	4%	0	0%	0.001*
Pleural effusion	2	4%	2	4%	1.000#

It was observed that more number of patients with reticular opacities, nodular opacities, septal thickening, honeycombing, traction bronchiectasis and mosaic attenuation were detected in HRCT method compared to X-ray method, the difference amongst the two methods was statistically significant (P<0.05).

Discussion

The study was carried out in the Department of Radiology, Rohil khand medical college and hospital Bareilly. 50 patients in all had a thorough work-up that included both a conventional chest radiograph and an HRCT scan of the thorax. In our study of 50 patients, 21 patients were males (42 %) and 29 females (54%) which is in accordance to study conducted by *Patel T et al*.[13]However some studies were in disagreement with these findings and showed male predominance like studies done by *Shah AK et al*.[14]and *Rentia M et al*.[15]*Akram et al*.[17] reported that the male to female ratio of 2:1 was achieved since there were a total of 40 males (66.7 percent) and 20 females (33.3 percent). The age of the patients ranged from 30 - 80 years amongst which the highest occurrence was in the age group of 51-60 years which is in accordance with the study conducted by Muller et al.[17]Akram et al.[16] reported that the average age of participants in the research was 47.18 6.90 years, with a range of ages between 36 and 60 years. These results were consistent with those reported in the research conducted by Baskey *et al*. and Afzal et al., who had discovered a mean age range of 41–50 years and a mean age of 40.21±2.29 years, respectively.[18,11]Because the majority of idiopathic limb dystrophies have a lengthy natural history, older persons in their fifth or larger decade of life are often the ones who first exhibit symptoms of the condition. A number of hereditary lung diseases, such as sarcoidosis, connective tissue disease-associated lung disease, and inherited forms of lung disease may be seen in younger persons.[13] The spectrum of diseases that were a part of ourstudy were IPF (UIP pattern) (38%), idiopathic NSIP (32%), scleroderma (10%), organizing pneumonia (6%), smoking related interstitial lung disease (RB-ILD) (4%), occupational ILD (4%), sarcoidosis (2%), CPEF (2%)and rheumatoid arthritis (2%). The study's key conclusion was that HRCT detected a larger number of samples with findings than conventional radiography. Even when both imaging modalities were successful in identifying the results, HRCT was able to delineate the site of the abnormality significantly & more precisely. Patients suffering from interstitial lung disorders may have a fully normal-looking chest radiograph, herein lays the fundamental incapacity of conventional chest radiography to accurately diagnose the diseases. In our study, 3 out of 50 patients or 6%, had no chest radiographic findings, but HRCT revealed localized radiological features in these patients, including thickened alveolar, reticular, and nodular opacities. On chest radiography, the reticular pattern was the most frequent finding seen in 50% of the cases. However, HRCT revealed reticular patterns in 80% of the cases, indicating a substantially higher sensitivity for reticular patterns in ILD. In a study conducted by *Jardin MR et al*.,[19]reticular opacities were identified by HRCT in 90% of all cases & in 73% of cases by conventional chest radiography. Similar results were also noted in a study conducted by Patel T et al.[13]which showed reticular opacities in 50% of the cases on chest x-ray and in 75% of cases on HRCT. The second most common manifestation in our study was nodular opacities, 34% patients

ISSN:09758309762833. VOL14.ISSUE 07.2023

showed nodular opacities in chest radiograph. However, when we performed HRCT scan for nodular opacities, we got 60% patients who had nodular opacities. Nodules distinguishing characteristics, such as their appearance, anatomical location, and various forms, such as interstitial or air space nodules, were also provided by HRCT. Based on how they are distributed on HRCT, nodules can be categorized as centrilobular, random, or perilym pahtic. In clinical settings, perilympahtic nodules are associated with lung lymphatics and are typically brought on by sarcoidosis. This perilympahtic location of sarcoidosis nodules was clearly recognized in our investigation. Random nodules are also indicative with hematogenous metastases, fungal infections, and military tuberculosis. Only on HRCT and not on chest radiography was it feasible to narrow down the differential diagnosis based on the nodule distribution. Chest radiography could only display the nodule's subpleural spread at most in this situation. This demonstrates how specificity of HRCT is higher than that of conventional radiography. The third most common finding noted was septal thickening which was noted in 20 % of the patients on chest x-rays and in 90% on HRCT, so sensitivity for septal thickening was much higher on HRCT in comparison to Xray, making it the modality of choice. In most of interstitial lung disorders, interlobular septal thickening is an early indication of fibrosis. The pulmonary vein and lymphatics are contained within the normal interlobular septum, which borders a portion of a secondary pulmonary lobule. On typical HRCT scans, these septae, which are 0.1 mm thick, can occasionally be observed. Always visible on HRCT, they thicken throughout time. Honeycombing is a feature of the interstitial lung disease terminal stage. It has a distinctive reticular look because of severe lung fibrosis and alveolar damage. Individual lobules are no longer discernible on HRCT due to the severe distortion of the lung anatomy. In our study, chest radiography could only detect such honeycombing in 20% of instances, but HRCT revealed it in 52% of cases. Thick walled, air-filled cysts, often reaching one to three centimeter in diameter & typically appearing in multiple layers at the pleural surface, were significantly more reliably used to detect honeycombing on HRCT. The occurrence of honeycombing strongly suggests the diagnosis of typical interstitial pneumonia, hence its detection has significant clinical implications. Additionally, it denotes end-stage disease, where a lung biopsy would be unnecessary and would not benefit the patient at all. Additionally, HRCT clearly outperforms conventional radiography in this situation.

On chest radiography, traction bronchiectasis or bronchial dilatation brought on by lung fibrosis could be seen in 40% of the cases. They were frequently connected to reticular opacities and occasionally to honeycombing. However, seventy percent of patients with traction bronchiectasis were detected by HRCT. In these situations, the bronchiectasis was often accompanied with a lack of mucus clogging or fluid in thebronchi. Contrary to conventional radiography, HRCT provided a far better understanding of this finding.Similar findings related to honeycombing & traction bronchiectasis were also reported in a study conducted by *Rentia M et al*.[19] Akram et al.[16]a chi-square test of significance was carried out, and the result that it produced for the diagnostic accuracy of CXR for ILD in comparison to HRCT was 0.51. The diagnostic ODDs ratio and Youden's Index both produced the same results: values of 0.145 and 47.37 percent, respectively. According to the findings of the research conducted by *Afzal and colleagues*.,[11]the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of chest x-rays for the diagnosis of ILD are respectively 80.0 percent, 82.98 percent, 90.0 percent, 68.4 percent, and 81.02 percent. Although they claimed that CXR was a suitable alternative to HRCT of the chest, our findings are in direct opposition to their conclusions. 18 The sensitivity of the x-ray diagnosis of interstitial lung disease was found to be 70 percent, the specificity of which was found to be 90 percent, and the positive and negative predictive values were found to be 62.3 percent and 93 percent respectively in another study that was conducted by Coutinho et al.[20] When compared to conventional radiography, HRCT was more effective at detecting ground glass opacities, consolidation, pleural effusion, air trapping (mosaic attenuation), and lympha denopathy. From this study, we may deduce that HRCT is significantly more sensitive than conventional chest radiography for evaluating and diagnosing individuals with interstitial lung disorders. Therefore, it appears that HRCT is the investigation of choice for assessment of parenchymal anomalies in interstitial lung illnesses, allowing for a more precise and thorough diagnosis of the particular disease.

Conclusion

Clinical indicators of interstitial lung disease (ILD) are frequently ignored, and its respiratory symptoms are frequently mistaken for those of more prevalent pulmonary disorders like COPD, which delays diagnosis. Male predominance is seen and it primarily affects middle-aged people, although in our study, female predominance was observed. The cause of diffuse interstitial lung disorders is linked to smoking. Additionally, it has been linked to a number of connective tissue problems. As a result, HRCT is crucial for the diagnosis, treatment, and follow-up of diffuse lung diseases cases.

References

ISSN:09758309762833. VOL14.ISSUE 07.2023

1. Behr J, Ryu JH. Pulmonary hypertension in interstitial lung disease. European respiratory journal. 2008; 31(6):1357-67.
2. American thoracic society. Idiopathic pulmonary fibrosis: diagnosis and treatment. International consensus statement. American thoracic society (ATS) and the European Respiratory Society (ERS). Am J Respir Crit Care Med. 2000; 161:646-64.
3. Ryu JH, Daniels CE, Hartman TE, Eunhee SY. Diagnosis of interstitial lung diseases. In Mayo Clinic Proceedings 2007 ;82(8): 976-986.
4. Crystal RG, Fulmer JD, Roberts WC, Moss ML, Line BR, Reynolds HY. Idiopathic pulmonary fibrosis: clinical, histologic , radiographic, physiologic, scintigraphic, cytologic, and biochemical aspects. Annals of internal medicine. 1976; 85(6):769-88.
5. Mazzoccoli G, Carughi S, De Cata A, Giuliani A, Masciale N, La Viola M, Puzzolante F, Balzanelli M. Interstitial lung diseases. Recentiprogressi in medicina. 2003; 94(5):227-37.
6. Mazzoccoli G, De Cata A, De Pinto GD, De Matthaeis A, Vendemiale G. Immunopat hogenetic and pharmacological aspects of interstitial lung diseases. International journal of immunopathology and pharmacology. 2010;23(3);971-980.
7. Brown KK, Fibrosis MI. Current approach to diagnosis and therapy. MedSci update. 2004; 21:1-3.
8. Bokulic RE, Hilman BC. Interstitial lung disease in children. Pediatric clinics of North America. 1994; 41(3):543-67.
9. Dinwiddie R, Sharief N, Crawford O. Idiopathic interstitial pneumonitis in children: a national survey in the United Kingdom and Ireland. Pediatric pulmonology. 2002; 34(1):23-9.
10. Johnston IA. The diagnosis, assessment and treatment of diffuse parenchymal lung disease in adults: British Thoracic Society recommendations. Thorax. 1999; 54.
11. Afzal F, Raza S, Shafique M. Diagnostic accuracy of x-ray chest in interstitial lung disease as confirmed by high resolution computed tomography (hrct) chest. PAFMJ. 30Aug.2017;67(4):593-8.
12. Gupta S, Mohd Ilyas, Gupta V, Dev G. High resolution computed tomography in the evaluation of interstitial lung diseases: Imaging perspective revisited with review of literature. Int J Med Res Rev 2017;5(04):412-420.
13. Patel T, I langovan G, Balganesan H. Comparative Study of X-ray and High Resolution Computed Tomography in the Diagnosis of Interstitial Lung Disease. International Journal of Contemporary Medicine Surgery and Radiology. 2020;5(1):A263-A267.
14. Shah AK, Kushwah APS, Pandey S, et al. Role of hrct in interstitial lung disease with radiographic correlation. J Evid Based Med Healthc 2020; 7(44), 2573- 2578.
15. Rentia M, Singla H, Malpani D, Vaishnav T, Jhala P. Radiological analysis of interstitial lung diseases. IAIM, 2015;2(6):69-76.
16. Akram F, Hussain S, Ali A, Javed H, Fayyaz M, Ahmed K. Diagnostic Accuracy Of Chest Radiograph In Interstitial Lung Disease As Confirmed By High Resolution Computed Tomography (HRCT) Chest. J Ayub Med Coll Abbottabad. 2022;34(1):S1008-S1012.
17. Muller NL. Clinical value of High resolution CT in chronic diffuse lung disease. AJR Am J Roentgenol 1991;157(6):1163-1170.
18. Baskey S, Mohan C, Toppo SK. High Resolution Computed Tomographic Evaluation Of Patients Suspected of Having DiffuseInterstitial Lung DiseasesWith Radiographic Correlation.J Dent Med Sci. 2018;17(4):21–33.
19. Remy-Jardin M, Remy J, Deffontaines C, Duhamel A. Assessment of diffuse infiltrative lung disease: comparison of conventional CT and high-resolution CT. Radiology. 1991; 181(1):157-62.
20. Coutinho GF, Pancas R, Magalhães E, Bernardo JE, Eugénio L, Antunes MJ. Diagnostic value of surgical lung biopsy: comparison with clinical and radiological diagnosis. Eur J Cardiothorac Surg. 2008 May;33(5):781-5.