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STUDY ON CLINICO-RADIOLOGICAL FEATURES INDICATIVE OF INTERSTITIAL LUNG DISEASE WITH THE HELP OF SPIROMETRY, CHEST X-RAY AND HIGH RESOLUTION COMPUTED TOMOGRAPHY CHEST

Pulmonary Medicine

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ABSTRACT

Background: Interstitial lung disease (ILD), is a group of respiratory diseases affecting the interstitium of the lungs and is very common in our country. They exhibit wide variety of symptoms hence their diagnosis is challenging. We aim at studying the clinco-radiological features of ILD using chest x-ray, spirometry and HRCT without surgical and transbronchial lung biopsy. **Material and Methods:** Patients with clinic-radiological features suggestive of ILD that attended the OPD or were admitted to the wards of a tertiary care hospital between 2015 to 2016 were included in the study. The clinical details, demographics, chest x-ray, spirometry and HRCT findings, were recorded and analysed. **Results:** Fifty one patients, who were clinic-radiologically suggestive of ILD were included in the study. IPF constitutes the single largest disease accounting for 41.2% among all other ILD followed by connective tissue disorder associated ILD (31.4%). Reticulonodular shadows were the most common chest x-ray findings present in 36 (70.6%) patients of ILD. Restrictive pattern was found to be present in spirometry in 42 (82.3%) patients of ILD. Honeycombing and reticular opacities (60.8%) were the most common HRCT chest findings in patients of ILD followed by fibrosis (35.3%), diffuse ground glass opacities (33.3%), traction bronchiectasis (27.5%) and nodular opacities (5.9%). **Conclusion:** Surgical and transbronchial lung biopsy are widely used for the diagnosis of ILD but they possess several complications and risk factors like pneumothorax, bleeding in the airways, arrhythmias or untoward events during anaesthesia. Diligent examination of the clinic-radiological features using chest x-ray, spirometry and HRCT can successfully predict ILD thereby avoiding currently used invasive techniques.

KEYWORDS

Interstitial lung disease, Diagnosis, Spirometry, HRCT, x-ray

INTRODUCTION

Interstitial lung disease (ILD) is a diverse set of illnesses with varying etiology, clinical presentation, radiographic pattern, and histological appearance that affects the lung parenchyma and varies greatly in terms of prevention, management, and prognosis.[1] The diagnostic technique for a patient with ILD is based on the cause (known or unknown) and the dynamic time course (acute, subacute, chronic) as well as the medical context at presentation (presence of extrapulmonary or systemic disease manifestations).[1-3] Different diagnostic approach may have to be adopted for different clinical scenarios such as patient presented with clinical symptoms of cough and dyspnea, patient at risk of ILD due to known occupational exposure to different inorganic metal dusts, drugs and radiations, patient at risk due to family history, an asymptomatic patient later diagnosed on chest radiography, computed tomography, spirometry test (restrictive pattern).[4] Cough and dyspnea are nonspecific symptoms that may delay diagnosis unless the examining physician has a strong suspicion. A thorough history and physical examination, as well as specific laboratory and radiographic techniques (chest radiography and high resolution computed tomography of the chest and spirometry), are required for a definitive diagnosis. Lung biopsy may provide further insight into the cause, although they are not required. The present study aims at studying the clinic-radiological features suggestive of ILD with the help of spirometry, chest x-ray and high resolution computed tomography chest without the use of surgical and transbronchial lung biopsy.

METHODOLOGY

A prospective observational study was conducted on the data collected from patients with clinicoradiological features suggestive of interstitial lung disease that attended the OPD or were admitted to the wards of a tertiary care hospital during the period 2015 to 2016. A total of 925 suspected patients in the Department of Respiratory Medicine were screened with the help of clinical history, clinical signs and symptoms, chest x-ray, spirometry and HRCT chest out of which 51 patients who showed clinic-radiological features suggestive of ILD were included in the study. Patients who were not willing to give consent, with age less than 18 years and patients with complaints of progressive dyspnea and cough with normal chest x-ray, normal spirometry, normal HRCT chest findings and clinic-radiologically not suggestive of ILD were excluded from the study. Demographics, history, clinical details, physical examination and relevant investigation details were recorded. The recorded data were statistically analysed. Prior approval was taken from the ethics committee.

Spirometry

Forced vital capacity (FVC), forced expiratory volume in the first second (FEV1) and their ratio (FEV1/FVC) were recorded along with percentage predicted values (FVC%, FEV1%) were recorded via computerized spirometer (Spirolab III-MIR-S/N A23-053), in spirolab of respiratory medicine OPD. Patterns of spirometric curves obtained were interpreted.

HRCT Chest

The HRCT Chest scan was performed using GE FXI HI SPEED helical CT equipment for patients who met the inclusion criteria on Wipro GE Healthcare FXI Hi speed CT equipment. A single slice HRCT thorax was conducted with narrow collimation, typically on the order of 1 mm in full inspiration every 10 to 20 mm throughout the thorax while the patient was supine. Reconstruction used transaxial and entire thorax with at least one consistent lung window and mean/width values of 600 - 700 HU/1000 - 1500 HU.

Chest X-Ray

The patients underwent digital radiography in P-A projection (BPL M Rad 100). Images were obtained with standing or orthostatism at full inspiration (70 KV, 10 mAs depending on patient's size)

Statistical Analysis

Data were analyzed via SPSS 20.0 (SPSS Inc., Chicago, IL, USA) software. Results were expressed as number, percentage, mean, median and standard deviation. The statistical analysis of quantitative data (Mean+-SD) and qualitative data (n %) between the groups were done by student't' test and Chi-square/Fischer exact test respectively. P-value <0.05 was considered to be statistically significant.

RESULTS

A total of 51 patients were included in the study. The majority of the patients were male (56.9%). Patients in the age group 46 – 67 represented around 80 % of the study population with a mean (SD) age being 57.1 (6.2). Nearly three-fourth of patients was non smokers. Connective tissue disorders were present in 31.4% of the study population, out of which 17.6% were having Rheumatoid arthritis followed by 9.8% Systemic sclerosis and scleroderma. The ANA profile was positive in 13.8% of the study population, with 9.8% positive for anti-Scl-70, 2% each for positive for anti-SM/anti-dsDNA, and anti-RNP while RA factor was positive in 17.7%. Connective tissue disorders affected 31.4% of the study population, with 17.6% having Rheumatoid arthritis, 9.8% having Systemic

sclerosis and scleroderma, 2% having Mixed connective tissue illness, and 2% having systemic lupus erythematosus. **(Table 1)** Dyspnea and bilateral crepts was observed in all patients enrolled for the study. Other major symptoms were cough (84.3%), clubbing (54.9%) followed by Joints pain (21.6%), skin thickening (7.8%), Dysphagia (5.9%), Malar rash (2%) and Raynauds phenomenon (2%). **(Table 2)**

Table 1:- Demographic and serological tests distribution of study group

Variable	n (%)
Age (years)	
≤ 50	10(19.6)
>50	41(80.4)
Sex	
Male	29(56.9)
Female	22(43.1)
Smoking Habit	
Yes	14(27.5)
No	37(72.5)
History of Dust Exposure	
Yes (Mineral dust)	3(5.9)
No	48(94.1)
History of CTD	
No	35(68.6)
Systemic sclerosis & Scleroderma	5(9.8)
R. Arthritis	9(17.6)
MCTD	1(2.0)
SLE	1(2.0)
ANA profile	
Positive (anti-Scl-70)	5(9.8)
Positive (anti-RNP)	1(2.0)
Positive (anti-SM, anti-dsDNA)	1(2.0)
Negative	44(86.2)
RA factor	
Positive	9(17.7)
Negative	42(82.3)

Table 2:- Distribution of presenting signs and symptoms in the study population

Symptoms & Signs	n (%)
Dyspnea	51(100)
Cough	43(84.3)
Dysphagia	3(5.9)
Skin thickening	4(7.8)
Joints pain	11(21.6)
B/L crepts	51(100)
Clubbing	28(54.9)
Malar rash	1(2)
Raynauds phenomenon	1(2)

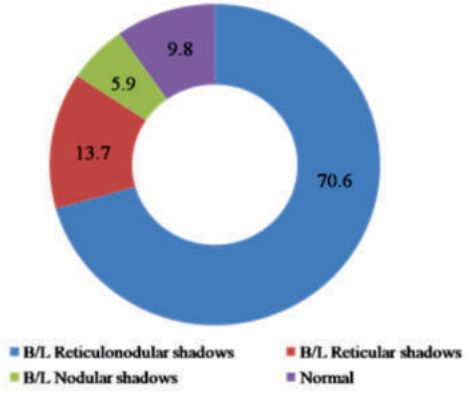

Figure 1:- Distribution of Chest X-ray findings in the study population
The most prevalent Chest X-ray findings in the study group were Reticulonodular shadows (70.6%), followed by Reticular shadows (13.7%), Normal chest X-ray (9.8%), and Nodular shadows (5.9%). **(Figure 1)**

Restrictive pattern was observed in 82.3% (n=42) while only 2 % (n=1) showed obstructive pattern in FVC measurements. Detailed information is given in figure. **(Figure 2)**

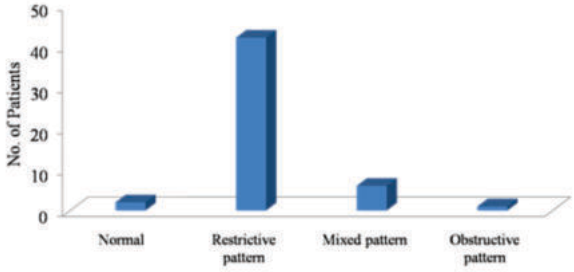

Figure 2:- Distribution of Spirometry findings in the study population
Honeycombing and reticular opacities were seen 60.8% on HRCT while fibrosis in 35.3%, minimal ground glassing in 33.3 % and traction bronchiectasis in 27.5%. Only 5.9 % exhibited nodular opacities. **(Figure 3)**

Idiopathic pulmonary fibrosis accounted for 41.2% of all cases of interstitial lung disease, followed by Connective Tissue Disorder associated ILD in 31.4%, nonspecific interstitial pneumonia in 21.5%, and Occupation ILD Silicosis in 5.9%. **(Figure 4)**

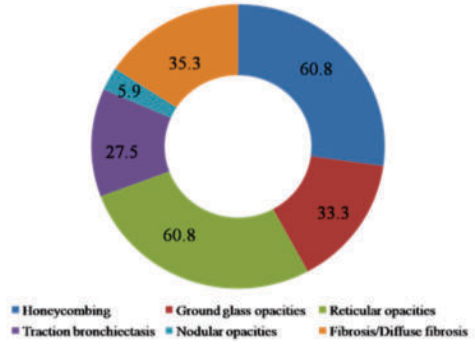

Figure 3:- Distribution of findings of HRCT chest in the study population

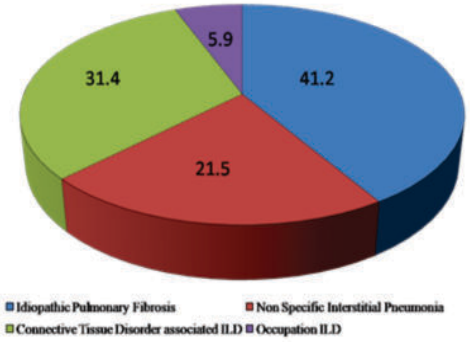

Figure 4:- Distribution of various forms of Interstitial Lung Diseases

DISCUSSION

In this prospective observational study we included 51 patients who showed clinic-radiological features suggestive of interstitial lung disease (ILD). The aim was to study the clinic-radiological features suggestive of interstitial lung disease with the help of spirometry, xhest X-ray and high resolution computed tomography chest without surgical and transbronchial lung biopsy.

The mean age of the study group was 57.1 ± 6.2 with a significant prevalence of those above 50 years age (80.4%). Our findings matched the study conducted by H J. Gayathri Devi et al[5] where the mean age of ILD patients was 66 years while Abhishek Tiwari et al[6] and Tiyas Sen et al[7] reported a mean age of 48 years. The trend in our study could be explained by the fact that the current study was conducted in a tertiary care hospital in Chhattisgarh, where patients were frequently referred late from primary health care centres, as well as due to the patients' low socioeconomic status and lack of awareness about the disease and its symptoms, resulting in late presentation. Another factor to be noted is that the majority of the ILD patients in the current study had Idiopathic pulmonary fibrosis, which has an average age of nearly 60 years at the time of diagnosis, resulting in a mean age of 57.1 6.2 years in the ILD patients in the current study.

Majority of our study group constituted male population (56.9%) which could be attributed to the fact that the most of the ILDs diagnosed clinicoradiologically in the current investigation were individuals with Idiopathic pulmonary fibrosis, a male-predominant condition. Dyspnea (100%), cough (84.3%), and joint discomfort (21.6%) were the most common symptoms encountered in this study. These results are explained by the fact that dyspnea and cough are the most prevalent signs and symptoms that can be used to detect and diagnose interstitial lung disease based on chest x-ray, spirometry, and HRCT results in conjunction with clinical complaints. In individuals with connective tissue disorder associated ILD, joint pain often coexists with dyspnea and cough. Skin thickening (7.8%) and dysphagia (5.9%) is observed in cases of Scleroderma and Systemic sclerosis, a form of connective tissue disorder associated ILD. Similar symptoms were reported in the studies by, HJ. Gayathri Devi et al[5] and Tiyas Sen et al[7], Dr. K. Venkata Ramana.[8]

Idiopathic pulmonary fibrosis was found to be present in 41.2% of the ILD patients, making it the most prevalent form followed by connective tissue disorder associated ILD in 31.4%, nonspecific interstitial pneumonia in 21.5%, and occupational ILD (silicosis) in 5.9% of the ILD patients. This can be explained by findings of clinical history, signs and symptoms, chest x-ray, spirometry and HRCT chest.

Standard chest radiographs of interstitial lung disorders typically shows the presence of diffuse or focal reticular, nodular, or reticulonodular opacities, which are typically more prominent in the lower lobes.[4,9] In our study, Reticulo-nodular pattern (70.6%) and Reticular pattern(13.7%) were the chest x-ray patterns found in the majority of patients, and Nodular pattern(5.9%) was found in three patients; therefore, interstitial lung disease was suspected along with clinical symptoms and diagnosed using HRCT chest and spirometry findings. Normal chest X-ray was found in 9.8 %. Even if a chest x-ray is normal, it does not rule out ILD. In fact, a chest x-ray can sometimes be normal even in histologically proven ILD.[10] Most of the patients in this study with ILD and a normal chest x-ray (n=5, 5.8%) have CTD-ILDs like rheumatoid arthritis or scleroderma followed by IPF and NSIP. On an HRCT chest scan, these patients had only a small amount of reticular changes, honeycombing, and ground glass opacities in the base, which is an early stage of disease that can't be seen on a chest x-ray. Due to these limitations with the chest x-ray, HRCT of the chest is now an important part of the evaluation of ILD patients. This finding is corroborated by the research conducted by Hala A. Mohammad et al[11] in which HRCT revealed abnormalities in 32 individuals, as opposed to chest X-ray, which revealed abnormalities in only 22 patients, and HRCT was found to be more sensitive than plain chest X-ray in the diagnosis of ILD, pleural affection, and pneumonia, as 26 (52%) patients exhibited ILD pattern on HRCT compared to 4 (8%) patients on plain chest x-ray.

Most common spirometry findings in our study were restrictive pattern and mixed pattern, which were present in 82.3% and 11.8% respectively. Normal spirometry was found in 3.9% while obstructive pattern was found in 2%. Restrictive pattern in spirometry of ILD patients represents end stage disease or fibrosis, which can be explained by the fact that in the present study, the majority of ILD patients had changes of fibrosis, honeycombing, and traction bronchiectasis, all of which indicate end stage disease, as well as increased lung stiffness and resistance to inflation due to fibrosis.

HRCT chest findings showed honeycombing and reticular opacities in majority of patients (60.8%). These findings can be explained by the fact that honey combing and reticular opacities are most commonly found in UIP pattern of HRCT chest, which were later diagnosed in the study either as IPF or as CTD-ILD. Majority of ILD's in the present study were IPF and CTD-ILD, which might be responsible for the presence of honey combing and reticular opacities in high number of patients.[4,12-15] Traction bronchiectasis (27.5%) and fibrosis (35.3%) observed in the present study were associated with UIP pattern (HRCT chest), while Ground glass opacities (33.3%) was most commonly found in NSIP pattern of HRCT chest, and nodular opacities (5.9%) was seen in patients of occupational ILD.

CONCLUSION

According to the findings of this study, ILDs are not rare in India. The study comprised 51 patients who had clinicoradiological evidence of Interstitial lung disease (ILD). Idiopathic pulmonary fibrosis (IPF) is the most common interstitial lung disease of all interstitial lung illnesses, followed by Connective tissue disorder. Our study suggests that studying the clinic-radiological features of non invasive techniques like chest x-ray, spirometry and HRCT were instrumental in predicting ILD without surgical and transbronchial lung biopsy.

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