Section: Pulmonology

Original Research Article

A STUDY OF CLINICORADIOLOGICAL PROFILE WITH HRCT PATTERN CORRELATION IN PATIENTS WITH INTERSTITIAL LUNG DISEASE

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Abstract

Background: ILD can develop as a standalone condition or as a component of a multi-organ process, as in the case of collagen vascular disorders. In a patient with ILD, the diagnosis is made after taking into account the disease's dynamic time course (acute, subacute, or chronic), its origin (known or unknown), and its setting at presentation (the presence of extrapulmonary or systemic disease signs). **Objectives:** Clinical study of patients with Interstitial lung disease. To correlate the clinical findings with conventional chest radiography and HRCT in patients with ILD. To study the different radiographic patterns evident in both conventional chest radiography and HRCT. **Materials and Methods:** Study Design: Prospective hospital based observational study. Study area: The study was carried out in the Department of Pulmonary Medicine, Kamineni Academy of Medical Sciences and Research Center, L. B. Nagar, Hyderabad. Study Period: June 2022 – April 2023. Study population: 100 patients attended to Department of Pulmonary Medicine. Sample size: study consisted of 100 subjects. Sampling method: Simple random Sampling Technique. **Results:** The incidence of reticular pattern on Chest X-ray is 62% and on HRCT it is 79%. There is a statistical significance with p value < 0.000 (Pearson Chi – Square test). The incidence of ground glass opacities (GGO 's) on chest x-ray is 27% and on HRCT is 58%. There is a statistical significance with p value < 0.000. The incidence of nodular pattern on chest x-ray is 10% and on HRCT is 17%. There is a statistical significance with p value < 0.000. **Conclusion:** In most of the cases, Proper history, Clinical examination with significant Radiological findings on Chest X-ray and HRCT chest will achieve a diagnosis of Interstitial Lung Diseases. HRCT lung is a noninvasive investigation of choice in clinically suspected cases of interstitial lung disease as it is very effective in visualizing the distorted architecture of lung parenchyma.

INTRODUCTION

Interstitial Lung Diseases (ILD) is the term for a diverse group of more than 100 different lung illnesses that are frequently combined because they have similar clinical, radiological, and pathologic characteristics.[1]

When referring to these conditions, the term diffuse parenchymal lung diseases (DPLD) is used to emphasise that not just the interstitium is impacted. A filling process in the alveoli can be brought on by conditions like organising pneumonia or pulmonary alveolar proteinosis. This compartment may also be involved in respiratory bronchiolitis and chronic hypersensitivity pneumonitis.[1]

ILD can develop as a standalone condition or as a component of a multi-organ process, as in the case of collagen vascular disorders.[2] In a patient with ILD, the diagnosis is made after taking into account the disease's dynamic time course (acute, subacute, or chronic), its origin (known or unknown), and its setting at presentation (the presence of extrapulmonary or systemic disease signs).[3-5]

Plain chest radiographs remain the cornerstone of the basic imaging in ILDs because the clinical presentation of the majority of these diseases is similar (dyspnea and cough), even though in the early stages the chest films can be normal, nonspecific, and typically does not allow a specific diagnosis. Additionally, it is an effective way to

track the development of the illness and how well the treatment is working. Additionally, it can offer some diagnostic hints for potential aetiologies. Thus, HRCT becomes a useful technique for reducing the range of possible diagnoses. Compared to chest radiography, an HRCT scan is more sensitive and capable of abnormality detection. For the early identification and confirmation of suspected diffuse lung disorders, HRCT is more effective than a standard chest X-ray.

In many situations, HRCT may make tissue analysis unnecessary. When a chest radiograph is normal, structural abnormalities in the lungs can frequently be found by HRCT in the patient. A more accurate assessment of the disease's breadth and distribution is made possible by HRCT. The goal of this study is to evaluate clinical, traditional chest radiography, and HRCT findings in the evaluation of ILDs because 10–20% of patients with ILDs can have a normal HRCT. In particular for ILDs that respond to treatment, early diagnosis of ILDs is essential to halting or delaying the progression to irreparable lung damage.

Clinical and radiological data were used in the current investigation to compile a complete profile of patients who were suspected of having ILD, and the diagnosis of ILD was made using this information. This assurance attempts to defer the requirement for an open lung biopsy so that less trauma and related problems can be avoided.

Objectives

1. Clinical study of patients with Interstitial lung disease.
2. To correlate the clinical findings with conventional chest radiography and HRCT in patients with ILD.
3. To study the different radiographic patterns evident in both conventional chest radiography and HRCT.

MATERIALS AND METHODS

Study Design Prospective hospital based observational study.

Study Area The study was carried out in the Department of Pulmonary Medicine, Kamineni Academy of Medical Sciences and Research Center, L. B. Nagar, Hyderabad.

Study Period June 2022 – April 2023.

Study Population 100 patients attended to Department of Pulmonary Medicine, Kamineni Academy of Medical Sciences and Research Center, L. B. Nagar, Hyderabad.

Sample Size study consisted of 100 subjects.

Sampling method Simple random Sampling Technique.

Inclusion Criteria

1. Patients with cough and Breathlessness on exertion with or without extra thoracic manifestations like arthralgia, skin rashes or pigmentation or tightness, dry mouth, dry eyes and features suggestive of raynaud‘s phenomenon(pain in the fingers and turning blue on exposure to cold) etc.
2. Patients with Velcro crackles on clinical examination suggestive of ILD on respiratory system examination.
3. Radiological features suggestive of ILD.
4. Known cases of Connective Tissue Diseases (CTDs) presenting with respiratory complaints or chest X-ray changes suggestive of ILD.

Exclusion Criteria

1. ILD like infections e.g. Miliary tuberculosis and Pneumocystis jirovecii pneumonia (PJP).
2. ILD like malignancies e.g.Lymphangitis carcinomatosis or miliary carcinomatosis.
3. Pulmonary Koch‘s co-existing with ILD.

Ethical Consideration

Institutional Ethical committee permission was taken prior to the commencement of the study.

Study tools and Data collection procedure:

All the patients were thoroughly examined with respect to history, clinical examination, radiological examination, and Laboratory investigations.

The history included symptoms like cough, shortness of breath, chest pain, reflux symptoms, and were also enquired regarding any extra thoracic symptoms like dry eyes, dry mouth, Raynaud‘s phenomenon (pain of the fingers and turning blue on exposure to cold), arthralgia, redness and pain at the joint sites etc.

Smoking history and Family history were taken in detail. Occupational history enquiring into any exposure to carpentry, automotive mechanics, painting, sand blasting , stone crushing, foundry work, welding, insulation, farming , heavy dust or smoke etc. History of any exposure to birds like pigeons, doves, ducks, chickens, geese were taken. Any history of drug intake was also given importance.

A thorough clinical examination was done in all cases. Any positive findings like clubbing, peripheral lymphadenopathy, abnormal breath sounds and added sounds like Velcro crackles were noted. Examination of the cardiovascular system was done for any loud P2 and features of Cor-Pulmonale. A 2D-ECHO was done in cases suspected to be having cardiovascular co-morbidity apart from conducting a detailed examination of the respiratory system. Examination of the musculoskeletal system was done for detecting any abnormal joint manifestations. Examination of the nervous system, eye and GIT were done to look for any co-existent abnormalities.

A special emphasis was laid in the examination of the skin to look for any Cutaneous manifestations like rashes, subcutaneous nodules, skin tightening, pigmentation, nail and nail bed abnormalities. Routine laboratory Investigations were done in all cases that include Hb%, Total leukocyte and Differential leukocyte counts, blood urea, serum creatinine, AEC, RBS, and a complete urine examination.

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A Mantoux test with 5 TU was done in all cases. A sputum examination for acid fast bacilli was done in 2 samples. An FNAC of any palpable and significant lymphadenopathy or mass was done to rule out tuberculosis and other diseases.

A chest x-ray and a HRCT chest scan were done in all cases. The patterns of lung damage associated with various types of ILD are often identifiable on chest x-rays. Chest x-rays may also be used to track the progression of ILD. Computed tomography (CT), including a specific technique known as high resolution CT, is used to see fine detail of the interstitium that may not be visible on a chest x-ray . In some cases, a specific diagnosis (such as idiopathic pulmonary fibrosis) can be confirmed based on the CT appearance, potentially avoiding the need for lung biopsy. A CT scan can also often help determine the extent of damage to the lungs.

FOB was done in cases wherever necessary. A thorough examination of the trachea-bronchial tree was done with inspection of all the accessible segments on both sides. Bronchial washings or BAL were collected from the most appropriate segments guided by HRCT scan in each case. BAL was subjected to total and differential counts in all cases and other special investigations wherever felt appropriate.

A comprehensive serological profile test which included ANA, Rheumatoid factor, CRP, Anti SS-A, Anti SS-B, Anti Scl-70, Anti ds DNA, Anti Smith(Sm), Anti nRNP/Sm , Anti PM-Scl, Anti Jo-1, Anti Centromere, Anti Ribosomal P Protein, Anti Nucleosomes, Anti Histones, Anti AMA-M2 , Anti PCNA, Anti U1-snRNP and Anti Ro-52 in required cases. These tests may help identify autoimmune diseases, such as scleroderma and rheumatoid arthritis, which can be associated with interstitial lung disease.

Statistical analysis:

For statistical calculations, data is spread in excel sheet descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. A p value ≤ 0.05 was considered statistically significant. The Statistical software namely SPSS 21.0 was used for the analysis of the data.

RESULTS

Table 1: Sex Distribution of the Study Group

SEX	NUMBER	PERCENTAGE
MALES	58	58%
FEMALES	42	42%

Table 2: Age Distribution of the Study Group

AGE GROUP(Yrs)	NO. OF PATIENTS	PERCENTAGE
20-30	4	4%
31-40	4	4%
41-50	16	16%
51-60	39	39%
61-70	32	32%
>71	5	5%

The Predominant age groups involved are 51-60yrs (39%) & 61-70yrs (32%). ILD‘S are uncommon below 40yrs.

Table 3: Chief Complaints Among the Study Group

CHIEF COMPLAINTS	NUMBER OF PATIENTS	PERCENTAGE
DYSPNEA	100	100%
COUGH	92	92%
GERD	24	24%
JOINT PAINS	8	8%
SKIN LESIONS	3	3%
DYSPHAGIA	3	3%
XEROPHTHALMIA AND XEROSTOMIA	1	1%

The most common symptom is Dyspnea (100%) followed by Cough (92%).

Smoking history is present in 55% of the study group. 87.27% of smokers are males and 12.73% of smokers are females Though ILDs are almost as common in non-smokers as smokers, Males predominate among smokers.

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Out of 55 smokers with ILD, 37 smokers (67.27%) are having IPF. Out of 7 female smokers with ILD, 6 smokers (85.71%) are having IPF. Out of 48 male smokers with ILD, 31 smokers (65%) are having IPF. Out of 47 IPF patients, 78.72% are smokers and 21.28% are nonsmokers. Males with smoking history with IPF seen in 83.78% of cases while Female with smoking history with IPF seen in 16.22% of cases.
Clubbing is present in 46% of the study group. In IPF patients, clubbing is present in 68.09% while absent in 31.91% of cases. In non-IPF patients, clubbing is present in 26.42% while absent in 73.58% of cases.

Table 4: X-Ray Pattern in the Study Group

X-RAY PATTERN	NO.OF PATIENTS	PERCENTAGE
RETICULAR	62	62%
GGO	27	27%
REDUCED LUNG VOLUMES	20	20%
NORMAL X-RAY	18	18%
CONSOLIDATION	12	12%
NODULAR	10	10%

Reticular pattern is the most common pattern in chest x-ray seen in 62% of cases.

Table 5: HRCT Pattern in the Study Group

HRCT PATTERNS	NO.OF PATIENTS	PERCENTAGE %
RETICULAR OPACITIES	79	79%
GGO	58	58%
TRACTION BRONCHIECTASIS	55	55%
HONEYCOMBING	46	46%
SEPTAL THICKENING	40	40%
NODULES	17	17%
CONSOLIDATION	12	12%

The common pattern on HRCT is Reticular Opacities seen in 79% of cases followed by GGO‘s and traction bronchiectasis.

Table 6: Diagnosis of Ild Based On HRCT Findings

DIAGNOSIS OF ILD BASED ON HRCT FINDINGS	NO.OF PATIENTS	PERCENTAGE %
UIP	51	51%
NSIP	28	28%
HSP	9	9%
COP	6	6%
AIP	4	4%
RB-ILD	2	2%

Common diagnosis based on HRCT pattern is UIP present in 51% of cases. The common zone involved is lower zones seen in 68% of cases.

Table 7: Diagnosis of Ild Based On Revised American Thoracic Society/European Respiratory Society Classification of Interstitial Lung Diseases

	NO.OF PATIENTS	PERCENTAGE
ILD OF KNOWN CAUSE (CTD-ILD)	12	12%
IPF	47	47%
NSIP	20	20%
COP	6	6%
RB-ILD	2	2%
GRANULOMATOUS ILD (HSP)	9	9%
AIP	4	4%

IPF (47%) is the most common ILD diagnosed followed by NSIP (20%) and CTD –ILD (12%).

DISCUSSION

ILD is not well understood in India due to underrecognition, which is linked to ignorance, a lack of diagnostic resources, as well as the broad range that this entity covers. ILD incidence and prevalence have increased recently, according to reports from western literature6. However, there is a dearth of information from India on the clinical manifestation and diagnosis of the range of ILDs.
In the present study, 39% of patients are in 51-60 yrs age group, 32% are in 61-70 yrs age group, 16%

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are in 41-50 yrs age group, 5% are of > 71yrs age, 4% are in 31-40yrs age group, and the remaining 4% are in 21-30yrs age group. ILD's are uncommon below 40yrs.

The mean age group in the present study is 51-70 yrs. Earlier Indian studies of Maheshwari U et al.[7] Muhammed SK et al8 showed the age of presentation a decade earlier (40-60yrs) than western study of Aziz ZA , et al.[9] (60-80years). The age group of our patients is in variance with previously published Indian studies and showing a trend towards western study. This might suggest a change in the Indian life styles towards more westernization, small sample size of the study population.

The common age group among males and females is 51-60 yrs age group comprising around 39.65% and 38.09% respectively followed by 61-70 yrs age group comprising around 32.76% and 30.95% respectively. In the present study, peak incidence was found between 51- 60 years age group and then 61-70 years age group. Jindal et al.[10] study slightly correlate with this study with peak incidence between 30 to 59 years.

Most commonly the disease was seen in males. The male to female ratio being 1.38:1. In the present study, males accounted for 58% and females accounted for 42% of the study group. In Mahasur et al.[11] study, out of 161 cases,86 (53.41%) were male and 75 (46.59 %) were female. The incidence of males and females in this study closely resembles to the present Study, where out of 100 cases, 58% were males and 42% were females. In Muhammed Shafeeq K et al.[8] study out of 70 patients 34(48.6%) were males and 36 (51.4%) were females while in the present study, the incidence of males and females is 58% and 42% respectively.

In Abhishek Tiwari et al.[12] study, out of 50 patients , 23 (46%) were males and 27 (54%) were females. This study observed increased prevalence in females so the majority of that study population consisted of sarcoidosis and NSIP which are female preponderant diseases, while the present study observed an increased prevalence in males which is similar to the most other studies.

In Jindal et al10 study, Male and female incidence was 42.4% and 57.4% respectively, while in the present Study, it is 58% and 42% respectively. As there were more female patients in Jindal et al.[11] study, collagen vascular disease group is more (50.8%) compared to present study (12%). Male predominance in the present study raises possibility of more smoking history and more exposure to air pollution.

In our study, dyspnea is present in 100% of cases, cough is present in 92% of cases, GERD is present in 24% of cases, joint pains in 8% of cases, skin lesions in 3% of cases, dysphagia in 3% of cases and xerophthalmia and xerostomia in 1%. The most common symptom in the present study is dyspnea (100%) followed by cough (92%). Dyspnea in interstitial lung diseases is believed to be due to altered mechanics of breathing involving increased work of ventilation. Cough is due to stimulation of cough receptors in the lung which are sensitive not only to mucosal and pleural stimuli, but also changes in the mechanism of lung expansion.

In our study, dyspnea is present in 100% of cases and cough is present in 92% of cases of ILD which is similar to Muhammad shafeeq K et al.[8] study in which 97.2% of patients had dyspnea and 90% had cough. In Badarkhe –Patil et al.[13] study, dyspnea was present in 96% of the cases which is similar to our study, cough present in 74% of the cases while in the present study it seen in 92% of the cases and joint pains in 44% of the cases. Dyspnea was present in 100% cases in present study which is similar to Jindal et.al.[10] Mahasur et al.[14] and J. Fulmer et al.[15] and closely resemble (92%) in M. Turner et.al.[16] study.

Cough was usually dry. Incidence of cough in different studies are Mahasur et.al.[14] --82%, M. Turner et.al.[16], -73%, J. Fulmer et al15., -86%. In our study, cough is present in 92% of cases which closely resembles the above studies. In Jindal et.al.[11] study, cough is present in 65.6% of cases.

Incidence of smoking in Muhammed Shafeeq K et al.[8]., study was 35.7% , in Badarkhe-Patil et al.[13] study it was 18% , in Abhishek Tiwari et al.[12]., study it was 16% while in the present study it was 55% . Incidence of smoking is less in those studies which might be due to more females in those study groups.

Reticular pattern is the most common pattern in the chest x-ray which is seen in 62% of the study group, followed by, incidence of GGOs which is seen in 27%, incidence of reduced lung volumes seen in 20%, incidence of normal chest x –ray seen in 18%, incidence of consolidation seen in 12%, incidence of nodular pattern seen in 10% of the study group.

Incidence of Reticular pattern is 62% in the present study as compared to 51% in Johnston et al study91 and 43% in Muhammed shafeeq k et al8., study. In the present study, selection of patient done mainly on clinical features, typical chest X ray finding while in Johnston et al study.[17], patients with normal and ill-defined opacities on chest X ray also included. In Abhishek Tiwari et al.[12]., study, out of 50 cases, 41 patients have Reticular/Reticulonodular pattern in the chest x-ray accounting for 82% of the study group, which is similar to the present study where the incidence of Reticular/Reticulonodular pattern is 72%.

Incidence of nodular pattern is 10% and incidence of consolidation is 10% of the study group in Muhammed Shafeeq k et al.[8] study, which is similar to the present study where the incidence of nodular pattern is 10% and the incidence of consolidation is 12%.

The involvement of both mid and lower zones is seen in 38% of the study group, followed by involvement of lower zone only is seen in 30%, middle zones only in 10%, upper zones only in 8%, and all zones are involved in 14% of the study

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group. The common zone involved is lower zone seen in 68% of cases. An abnormal chest radiograph is often the first indication of underlying ILD. The pattern and distribution of abnormalities often help in formulating a differential diagnosis.[1] The chest radiograph is also helpful for assessing lung volumes. IPF, CTD – associated ILD, NSIP, Acute HSP are lower lobe predominant.

Incidence of reticular pattern in HRCT is 79% of the study group, followed by the incidence of GGOs which is 58%, traction bronchiectasis - 55%, honeycombing - 46%, septal thickening - 40%, incidence of nodular pattern - 17% and consolidation - 12% of the study group. The common pattern on HRCT is Reticular opacities which is seen in 79% of cases. Incidence of reticular opacities on HRCT in the present study correlated with incidence in different studies, 64% in Badarkhe –Patil et al.[13]., study and 52% in the Abhishek Tiwari et al.[12]., study. In Abhishek Tiwari et al.[12] study, fibrosis seen in 52%, ground glass opacity in 38%, honey combing in 34%, traction bronchiectasis in 18%, nodular pattern in 6%.

The incidence of reticular pattern on Chest X-ray is 62% and on HRCT it is 79%. There is a statistical significance with p value < 0.000 (Pearson Chi – Square test). The incidence of ground glass opacities (GGO ‘s) on chest x-ray is 27% and on HRCT is 58%. There is a statistical significance with p value < 0.000. The incidence of nodular pattern on chest x-ray is 10% and on HRCT is 17%. There is a statistical significance with p value < 0.000.

Incidence of UIP in the present study is 51% of the study group, followed by incidence of NSIP which is 28%, hypersensitivity pneumonitis(HSP) is 9%, cryptogenic organizing pneumonia(COP) is 6%, Acute interstitial pneumonia (AIP) is 4% and Respiratory Bronchiolitis – ILD (RB-ILD) is 2%. High-resolution CT findings consist of ground glass opacities and/or consolidative areas distributed along the bronchovascular bundles and along the subpleural lungs. These findings suggestive of COP were as per study done by Ju Won Lee et al.[18] Diffuse involvement was noted on HRCT in HSP which include tiny centrilobular nodules with ground glass haziness and predominance in upper lobes. These findings were correlated with study done by DA lynch et al.[19]

In the present study, Connective tissue disease associated ILD (CTD – ILD) is seen in 12 patients. The most common CTD-ILD in the present study is Rheumatoid arthritis(RA) which is 4% followed by systemic sclerosis and SLE with the same incidence which is 3% each, followed by sjogrens syndrome and MCTD (Mixed connective tissue disease) which is 1% each. In the study conducted by Muhammed Shafeeq K et al.[8] 29% of the study population tested serologically positive for connective tissue disorder, in Badarkhe –Patil et al study.[13] 19 patients (38%) out of 50 patients were serologically positive for connective tissue disorder. In the present study, 12 patients out of 100 patients were serologically positive for connective tissue disorder. This might have happened due to more females were included in the study population, limited sample size and referral bias in Muhammed Shafeeq K et al., study8 and Badarkhe Patil et al., study.[13]

CONCLUSION

In most of the cases, Proper history, Clinical examination with significant Radiological findings on Chest X-ray and HRCT chest will achieve a diagnosis of Interstitial Lung Diseases. HRCT lung is a noninvasive investigation of choice in clinically suspected cases of interstitial lung disease as it is very effective in visualizing the distorted architecture of lung parenchyma. In such cases, surgical lung biopsy can be dispensed as it is associated with high expertise and more complications like pneumothorax and hemothorax.

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