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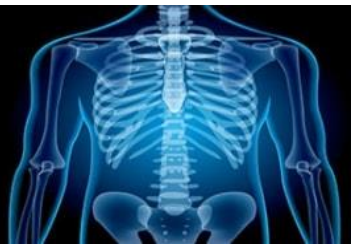

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Characterization of interstitial lung disease using HRCT in clinically suspected cases

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Abstract
Interstitial lung diseases are characterized by anatomical distortion of peripheral airways and interstitium, determined by a first stage of alveolitis followed by a stage of fibrosis. The natural history of several interstitial lung diseases is characterized by slow and progressive destruction of alveolar-capillary functional units, often with respiratory failure and death. For their smoldering evolution and non-specificity of symptoms (exertional dyspnea and cough), they may remain undiagnosed and not treated for a long time. Each patient underwent a thorough clinical evaluation including a detailed history and physical examination. The duration of the complaints were noted in each patient. All the patients were made to undergo HRCT scan as the radiological examination after taking an informed consent for the same. Out of total of 40 patients 22(55.0%) patients showed HRCT pattern reflecting UIP and IPF, 8(20.0%) patients showed NSIP, 6(15.0%) patients had HSP as well as 3(7.5%) patients had COP while only 1(2.5%) patient showed changes of RB-ILD. The findings of this study correlate well with many other studies reported in literature.

Keywords: Interstitial lung disease, HRCT, clinically suspected cases

Introduction
Interstitial lung diseases are a diverse group of diseases which affect the lung interstitium and share similar clinical and radiological manifestations. They are 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 interstitium refers to tissues of the alveolar wall between the capillary endothelium and the alveolar epithelium and it is the site of primary injury. The term “interstitial” can be misleading as most of these conditions also affect the airway spaces and even the blood vessels, but it is the predominant and primary involvement of the interstitium that characterizes those [2].

The interstitial lung diseases are a heterogenous group of many acute and chronic pulmonary disorders. Though individually rare, as a group, they are a common clinical problem. Though they are grouped together, there are great variations in the risk factors for their development, their pathological processes, the relevant therapies and the associated prognosis, making an accurate diagnosis very essential [3].

The last century experienced remarkable advances in the classification, diagnosis and understanding of the pathogenesis of the interstitial lung disease s. Technological advances, particularly physiologic testing, lung imaging studies, bronchoalveolar lavage, surgical lung biopsy and histopathologic assessment improved our understanding of these entities. In particular, the advent of high-resolution computed tomography, the narrowed pathologic definition of usual interstitial pneumonia, and recognition of the prognostic importance of separating usual interstitial pneumonia from other idiopathic interstitial pneumonia patterns have profoundly changed the approach to these processes. Most recently, genetic medicine, the use of new technologies (e.g. microarrays, mass spectroscopic analysis of proteins, and laser capture microdissection) and the development of animal models have had a major impact on understanding the pathogenesis and potential molecular targets for interfering with fibrogenesis [4].

Interstitial lung diseases are characterized by anatomical distortion of peripheral airways and interstitium, determined by a first stage of alveolitis followed by a stage of fibrosis. The natural history of several interstitial lung diseases is characterized by slow and progressive

destruction of alveolar-capillary functional units, often with respiratory failure and death. For their smoldering evolution and non-specificity of symptoms (exertional dyspnea and cough), they may remain undiagnosed and not treated for a long time [5]. Herein lies the importance of HRCT and other investigations in aiding for an early diagnosis.

To date, numerous reports have documented that HRCT is more sensitive and specific than chest radiography in establishing a diagnosis in diffuse lung diseases. HRCT has proved particularly accurate in establishing the diagnosis of silicosis, idiopathic pulmonary fibrosis, lymphangitic carcinomatosis, and sarcoidosis. In general, the accuracy of plain film diagnosis in the same disorders was much lower. Mathieson *et al.* analyzed the accuracy of HRCT and chest radiography in establishing a specific diagnosis in patients with chronic diffuse infiltrative lung disease. Three different observers independently interpreted plain chest films and HRCT scans, listed the three most likely diagnoses, and assigned a degree of confidence for the first- choice diagnosis. The highest confidence level was reached with 49% of CT scans and 23% of plain chest films, and a correct diagnosis was made with 93% and 77%, respectively. In a large study of patients with chronic diffuse infiltrative lung disease, Grenier *et al.* demonstrated that high resolution CT was of particularly high value when CT images were analyzed together with clinical and radiographic information. Based on clinical information alone, a confident correct diagnosis could be made in 29% of the cases. Combined interpretation of clinical data and plain film findings increased the confidence in a correct diagnosis to 54%, and to 80% when clinical, radiographic, and HRCT findings were analyzed together. Consequently, most patients with a diagnosis of diffuse lung disease based on plain films will proceed to HRCT to narrow down the differential diagnosis or even to establish a specific diagnosis and to do so with a higher confidence level [6]. Moreover, although there have been numerous studies comparing conventional radiography and HRCT in the diagnosis of specific interstitial diseases, very few studies have incorporated the whole gamut of interstitial lung diseases in a single study.

Methodology

Study area

Study was carried out in the Department of Radiology & Imaging at Teaching and General Hospital.

Study population

All the patients (outpatient as well as inpatient) referred for HRCT of chest study will constitute the study population.

Study design: This is a cohort descriptive and observational study.

Sample size: 40 patients with positive findings of interstitial lung disease (In patients and Out patients)

Inclusion criteria

- All the patients with clinically suspected interstitial lung disease referred for HRCT were included in the study after taking their informed consent.
- All age groups and both the sexes, including children, adult and old age patients will be included in study.

Exclusion criteria

The following patients will be excluded from the study -

- Patients with associated lung pathology like consolidation, mass or any other significant lung pathology.
- Hemodynamically unstable and unconscious patients.
- All patients who will not consent to be a part of the study.

Data collection procedure

Each patient underwent a thorough clinical evaluation including a detailed history and physical examination. The duration of the complaints were noted in each patient.

All the patients were made to undergo HRCT scan as the radiological examination after taking an informed consent for the same.

Results

Table 1: Showing distribution of 40 patients who had underwent HRCT according to age group

Age (years)	No. of patients	Percentage
30 - 39	2	5.0%
40 - 49	5	12.5%
50 - 59	8	20.0%
60 - 69	16	40.0%
70 - 79	7	17.5%
80 - 89	2	5.0%
Total	40	100.0%

The age group of patients ranged from 30 to 90 years and most (40.0%) were found in the age group of 60-69 years followed by 17.5% in 70-79 and 20.0% in 50-59 year age groups.

Table 2: Showing distribution of 40 patients who had underwent HRCT according to chief complaints

Chief Complaints	No. of patients	Percentage
Breathlessness	11	27.50%
Cough	16	40.00%
Cough + Fever	3	7.50%
Dry Cough	10	25.00%
Total	40	100.00%

Out of total of 40 patients 16(40.0%) patients came with cough, 11(27.5%) with breathlessness, 10(25.0%) with dry cough and 3(7.5%) with cough and fever.

Table 3: Showing distribution of 40 patients who had underwent HRCT according to HRCT features

HRCT Features	No. of patients	Percentage (n=40)
Bronchiectasis	32	80.00%
Reticulation	29	72.50%
Ground Glass Opacities	19	47.50%
Honeycombing	16	40.00%
Consolidation	3	7.50%

Out of total of 40 patients maximum no of patients had bronchiectasis 32(80.0%), while only 3(7.5%) patients had consolidation.

Table 4: Showing distribution of 40 patients who had underwent HRCT according to honeycombing.

Honeycombing	No. of patients	Percent
Yes	16	40.00%
No	24	60.00%
Total	40	100.00%

Table 5: Distribution of Idiopathic Interstitial Pneumonias (IIPs)

HRCT Diagnosis	No. of patients	Percentage
UIP	22	55.00%
NSIP	8	20.00%
HSP	6	15.00%
COP	3	7.50%
RB ILD	1	2.50%
Total	40	100.00%

Out of total of 40 patients 22(55.0%) patients showed HRCT pattern reflecting UIP and IPF, 8(20.0%) patients showed NSIP, 6(15.0%) patients had HSP as well as 3(7.5%) patients had COP while only 1(2.5%) patient showed changes of RB-ILD.

Table 6: Showing distribution of 40 patients who had underwent HRCT according to consolidation

Consolidation	No. of patients	Percentage
Yes	3	7.50%
No	37	92.50%
Total	40	100.00%

Table 7: showing treatment response among the study population

HRCT Diagnosis	No follow-up	Progression	Regression	Total
UIP	0	21	1	22
NSIP	0	2	6	8
HSP	0	2	4	6
COP	0	0	3	3
RB ILD	1	0	0	1
Total	1	25	14	40

Out of total of 40 patients, only 1(4.45%) patient shows regression in UIP in follow-up scan, while others show progression 21 (95.55%). 2 each shows progression in HSP (33.33%) and NSIP (33.33%), however in COP (100%) all patients show regression.

Discussion

High resolution computed tomography (HRCT) has revolutionized the imaging of interstitial lung disease (Idiopathic Interstitial Pneumonias) as it enables early detection of disease, allows a histospecific diagnosis to be made in certain cases and provides insight into disease reversibility and prognosis.

Idiopathic interstitial pneumonias have been classified into 7 subtypes: usual interstitial pneumonia (UIP), nonspecific interstitial pneumonia (NSIP), desquamative interstitial pneumonia (DIP), respiratory bronchiolitis-associated interstitial lung disease (RB-ILD), cryptogenic organizing pneumonia (COP), acute interstitial pneumonia (AIP) and lymphoid interstitial pneumonia (LIP) [7].

UIP is the most common of the IIPs. NSIP is the next most frequent, followed by COP, DIP, RB-ILD and AIP are less common, while LIP is rare.

In this present study of 40 patients, who were clinically suspected of having interstitial lung disease (Idiopathic Interstitial Pneumonias) were included. The age group of the subjects ranged from 30 to 89 years and most (40.0%) were found in the age group of 60-69 years.

In the present study of 40 patients, 23(57.5%) were male and 17(42.5%) were female.

In that, UIP 13(56.6%) and HSP 4(17.4%) were common in men, while NSIP 5(29.4%) were female. The p-value is 0.00612, which is significant.

Out of total of 40 patients, maximum no of smoker 10(66.67%) had UIP, but patients with NSIP had no smoking history. The p-value is 0.03300, which is significant.

Out of the total of 40 patients, 22(55.0%) patients showed changes of UIP, 8(20.0%) patients showed changes of NSIP. HSP was present in 6(15.0%) patients and 3(7.5%) patients showed changes of COP as well as 1(2.5%) patient had changes of RB-ILD. DIP, AIP and LIP were not seen in any of the 40 patients.

Out of total of 40 patients, maximum no of patients 8(80.0%) with dry cough had UIP, 4(25.0%) with cough and (36.4%) with breathlesness had NSIP, 3(18.8%) with cough had HSP and 3(100%) patients with cough and fever had COP.

UIP is characterized by a variegated pattern with foci of normal lung, interstitial cellular infiltrates and zones of active fibrosis [8]. The characteristic thin-section CT findings of UIP consist of intralobular linear areas of increased attenuation and honeycombing that predominantly involves the basal and subpleural regions [9]. In this study, 16(40.0%) had honeycombing and 24(60.0%) were not associated with honeycombing. Only UIP was associated with honeycombing. Out of total of 22 patients of UIP, only 1(4.54%) patient showed regression in follow-up scan, while others showed progression 21(95.55%). The regression was seen in ground glass opacities but honeycombing was still persisting. The alveolitis had regressed but other changes had not regressed.

UIP are more common in smokers and ex-smokers than in non-smokers and more common in men than women. In this present study the 10(66.67%) patients out of a total of 22 patients with UIP were smokers.

The HRCT manifestations of NSIP usually consist of predominantly ground glass opacities often with a basal and peripheral predominance with or without associated reticulation and/or traction bronchiectasis [10]. In the present study 32(80.0%) had bronchiectasis and 8(20.0%) were not associated with bronchiectasis. Maximum no of patients with UIP 20(62.5%) and NSIP 8(25.0%) associated with bronchiectasis. The p-value is 0.0010, which is significant.

Most of the patients having NSIP with reticulation show changes of bronchiectasis and bronchiolectasis. In the present study all patients (100%) with NSIP showed areas of bronchiectasis with 2 patients showing ground glass opacities with bronchiectasis in the absence of reticulation. Out of 8 patients of NSIP, 2(25%) show progression, while the rest show regression 6(75%). The progression had seen in fibrotic changes, which is seen in subpleural and peribronchovascular locations.

HSP is characterized by diffuse areas of ground glass opacities with areas of air trapping. Out of total of 40 patients, 19(47.5%) had ground glass opacities and 21(52.5%) were not associated with ground glass opacities. Maximum no of patients with HSP 6(31.6%) and NSIP 6(31.6%) associated with ground glass opacities. The p-value is 0.0000, which is significant. Out of 6 patients of

HSP, 2(33.3%) showed progression in follow-up scan, while the rest showed regression 4(66.7%). The 2 patients with subacute HSP were progressed into the chronic HSP.

COP is characterized by consolidation in 90% with a subpleural or peribronchial distribution in up to 50% of cases. Ground-glass opacities are present in all of cases. In this study 3 patients presented with COP and showed patchy area of consolidation with ground glass opacities. In the present study, 3(7.5%) had consolidation and 37(92.5%) were not associated with consolidation. Only patients with COP 5(100%) associated with consolidation. The p-value is 0.0000, which is significant. In follow up scan, all showed regression.

RB-ILD is characterized by ground glass opacities with centrilobular nodules. In this study only 1 patient presented with RB-ILD, which has ground glass opacities with nodules.

The findings of this study correlate well with many other studies reported in literature.

Conclusion

Thus high resolution computed tomography is very effective in visualizing the interstitial changes in Idiopathic Interstitial Pneumonias. Based on the HRCT features a histospecific diagnosis can be reached in most cases of Idiopathic Interstitial Pneumonias obviating the need for biopsy. The disease activity can also be depicted, thereby guiding the treatment strategy.

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