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The Role of HRCT in Interstitial Lungs Disease in Males

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KEYWORDS

Interstitial Lung diseases, HRCT, Ground glass opacities, Honeycombing, Nodules.

ABSTRACT:

Introduction: Interstitial lung diseases (ILD's) are a category of diverse illnesses that damage the lung parenchyma and are characterized by fibrosis, scarring, and inflammation. High resolution computed tomography (HRCT) has become a leading diagnostic tool in the field of parenchymal lung diagnosis.

Objectives: The purpose of this study is to investigate the use of HRCT for lung pattern visualization and ILD diagnosis.

Methods: This study was carried out at SGT Hospital in Gurugram, specifically in the Department of Radiology. The study included 500 male patients aged between 14 and 85 years, as per the inclusion criteria. These patients had visited the department for thoracic CT scans between 2021 and 2023. All of them had been clinically and radiologically diagnosed with various lung abnormalities stemming from different causes. The patients underwent HRCT examinations to assess interstitial lung diseases.

Results The incidence of interstitial lung diseases was highest (41.86% of patients) among the age group of 60-80 year. The majority of the patients showed a pattern of lesion or nodule with a ratio of 38.10% among all age groups.

Conclusions: The diagnosis and treatment of interstitial lung diseases in men greatly benefit from the use of HRCT. With the use of HRCTs sophisticated imaging capabilities, medical practitioners may accurately diagnose and describe a wide range of ILDs, enabling prompt and focused therapies. The gender-specific emphasis on men illustrates how crucial it is to identify the distinct patterns and symptoms of ILDs in this community.

1. Introduction

High-resolution computed tomography is a form of CT that uses particular methods to improve image resolution. It is a CT approach that uses a high-spatial-frequency reconstruction algorithm to create thin-slice (<1.5mm) chest images. The reign of CT started when sir Godfrey Newbold Hounsfield built their first clinical CT scanner in 1971. It identified a brain tumour in a patient who was a 41-year-old female and was simply intended to capture photos of the brain. The first full-body CT scanner was created in 1975[1]. In interstitial lung disease, high-resolution computed tomography has transformed diagnosis, prognosis, and, in some circumstances, therapy response prediction [2]. A series of respiratory conditions known as diffuse parenchymal lung disease or interstitial lung disease affect the interstitial, the tissue and area surrounding the lungs alveoli (air sacs) [3]. Our capacity to breathe and receive adequate oxygen into our bloodstream is eventually affected by the scarring brought on by interstitial lung disease. Lung interstitial disease may result from prolonged exposure to hazardous chemicals like asbestos. There are several autoimmune diseases, such rheumatoid arthritis, that can also cause interstitial lung disease. But occasionally, the root causes are still a mystery. An ILD can be categorised based on whether its cause is recognised (secondary) or unknown [4]. When the chest radiograph is normal or nearly

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normal, abnormal findings on CT or high-resolution CT (HRCT) have been reported in a numerous interstitial lung condition, such as asbestosis, sarcoidosis, lymphangitis, fibrosing alveolitis, lymphangia leiomyomas, and desquamative interstitial pneumonia DIP [5].

2. Objectives

This study's objective is to assess the effectiveness of HRCT in excluding interstitial lung disorders and also check the extent of diseases in different age groups based on their history and age

3. Methods

Source of data: Patients who were referred in the Department of Radio-Diagnosis of SGT medical college, hospital & Research Institute for CT examination and diagnosed with interstitial lung diseases. Study duration: This study was carried out over a period of 2 years. The data was collected from September 2022 to March 2023 in the Department of Radio-Diagnosis of SGT medical college, hospital & Research Institute, Gurugram, using 16 slice CT Scan equipment. Study type and design: Prospective study was carried out including total number of 500 patients will be taken in this study in which only male patients will be included, irrespective of age of the patients will be taken in this study.

4. Results

This study incorporates 500 patients who underwent HRCT chest examinations across diverse age groups, referred to SGT Medical College. The research observed the medical history and examinations of male patients spanning all age categories. Specifically, patients referred for HRCT thorax and those diagnosed with interstitial lung diseases (ILDs) were examined. A multidetector CT with high-resolution techniques was employed to identify pathologies within the lung parenchyma. Additionally, patients with a history of trauma were included to assess the subsequent impact on lung tissue

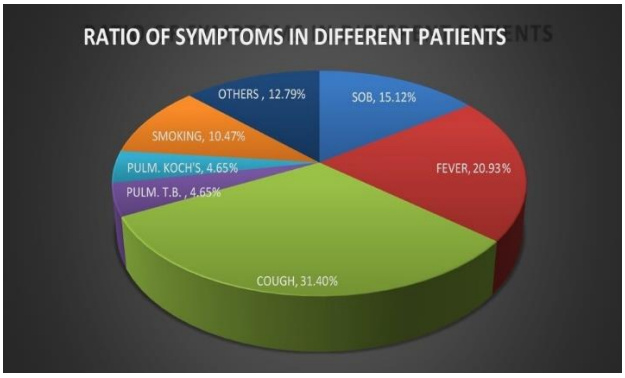

Fig-5.1 Ratio of symptoms based on different Patient.

Fig. 5.1 shows the classification based on the prevalence of symptoms in different patients whose history was collected prior to the examination. A total of 500 patients were taken which belonged to the age group of 7 years to 85 years. We grouped the symptoms of different patients separately and observed which symptom is present in the highest ratio. It was found that in all groups the most widespread symptom present was cough which formed a leading source of ILD's. the different symptoms included were cough, shortness of breath (SOB), fever, pulmonary tuberculosis, pulmonary Koch's, smoking and others. Among this cough constituted 31% of the patients while others constituted 15%, 20.93%, 4.65%, 4.65% 10.47% and 12.79% respectively.

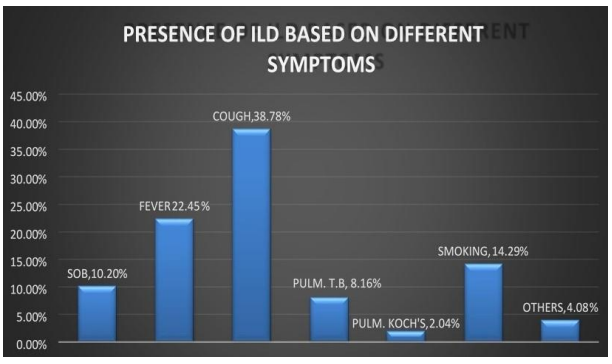

Fig-5.2 Presence of ILD based on different symptoms

Fig. 5.2 shows the presence of interstitial lung diseases based on different symptoms of the patients. After the examination was done and the patients scans were checked it was seen that patients with symptoms of

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cough were affected more with the ILD's than any other symptoms. Cough constituted a value of 38.78% among all symptoms.

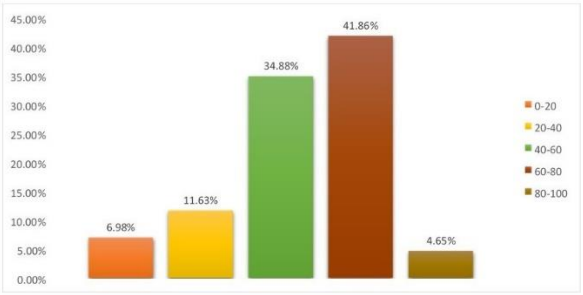

Fig-5.3 Presence of ILD in different age group

FIG. 5.3. This figure shows the of presence of ILD's in different age groups of male patients. Among the patients taken for the study it was observed that after going through the HRCT results the highest affected age group was 60-80 which showed a percentage of 41.86%. That implies that the patients of this age group are mostly involved in lung parenchyma abnormalities. Also, it has been seen that these patients are having highest ratio of symptoms that means this age group is most likely going to have abnormalities related to the interstitium of the lung. It was seen that after the age of 60 a person's lung parenchyma gets damaged and he becomes more prone to infections which lead to progression of infections to interstitial lung diseases.

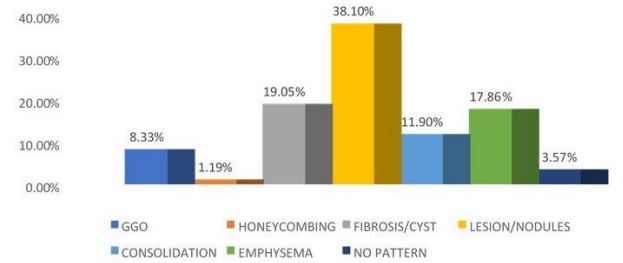

FIG. 5.4. Percentage of patterns of lung parenchymal disorders shown on HRCT

FIG. 5.4 shows the pattern of pathology as seen on the HRCT scans. After the scans were done the images were evaluated and a homogenous appearance with fine reticular opacities (interstitial marks) that follow the pulmonary vascular structures can be seen on HRCT pictures of normal lung parenchyma. These interlobular septa-corresponding reticular opacities do not considerably obscure the underlying lung architecture. Normal lung parenchyma has Broncho vascular lines that are still visible and seem transparent. Most observed lung patterns included ground glass opacities, honeycombing, fibrosis or cystic pattern, lesion or nodule like, consolidation and emphysema. In our study it was seen that in most of the cases a lesion/nodule like pattern mimicking bud pattern was present. It comprised about 38.10% of the total cases and was followed by fibrosis/ cystic pattern with a ratio of 19.05%. there were 3.57% of the cases that were seen with no pattern at all but had other anatomical disorders.

A variety of several illnesses that damage the lung parenchyma and cause fibrosis and inflammation are referred to as interstitial lung disease. ILD has a wide range of potential causes, and its clinical manifestations often overlap, making diagnosis difficult. A crucial imaging technique in the assessment and treatment of ILD, HRCT enables doctors to evaluate disease patterns, direct treatment choices, and enhance patient outcomes [6]. This study is focused on the function of HRCT in ILD, highlighting the significance of taking the patient's medical history to the definitive diagnosis. The differential diagnosis of ILD is crucially framed by HRCT patterns. Most common patterns found are interstitial pneumonia, nonspecific interstitial pneumonia, organizing pneumonia, cryptogenic organizing pneumonia, and other types. Each pattern is linked to distinct histological and clinical traits, making it easier to make a precise diagnosis. The patient's medical history is essential in identifying possible factors that might lead to the development of ILD. The diagnosis of ILD can be supported by HRCT results in conjunction with a thorough history of shortness of breath (SOB), fever, cough, tobacco chewing or smoking, pulmonary tuberculosis (TB), pulmonary Koch's and other factors. Many studies have been done to evaluate the role of HRCT in finding out ILD'S. A study done by Renata Fragomeni Almeida et. al. included 244 patients in his study in the age group of 68 ± 13 years having a ratio of 52.5% male patients. A total of 106 patients with the usual UIP pattern received a multidisciplinary diagnosis of IPF in 62% of them, chronic hypersensitivity pneumonitis in 20%, and connective tissue disease-related ILD in 10% of them [7]. The percentages of CTD-ILD, IPF, desquamative interstitial pneumonia, drug-related lung illness, and CHP among the 114 patients

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with suspected UIP were respectively 39%, 31%, 9%, 11%, 8%, and 9%. Desquamative interstitial pneumonia came in second (21%), followed by IPF (13%), in the 24 patients with CT indeterminate for UIP. CTDILD was the ultimate diagnosis in 33% of these cases. During the follow-up, patients with typical UIP had higher mortality rates (17.9%) and transplantation rates (11.3%). While working on the pathologies a researcher Baskaran Sundaram et. al. used CT to find out the dominant pathologies shown in the scans. They took a group of 100 people who underwent HRCT for visualizing their appearances of diffuse lung patterns. High-resolution CT pictures were examined separately and blindly by three thoracic radiologists for patterns of abnormality. They then listed their top three diagnosis and the degree of confidence they had in each one [8]. The accuracy of GGO as a dominating pattern was questionable, but it became more accurate when paired with either honeycombing or lower-lung distribution. Prashant K. Rohatgi in his study observed interstitial lung patterns in different patients on x-ray and CT and highlighted the key benefits and accuracy of HRCT over conventional radiography [16]. In his study he discussed about how the lung parenchyma segmentation creates a hinderance in visualizing the pathology in conventional radiography which is overcomed by using thin slice and high-resolution technique of computed tomography. He added that by the use of two-dimensional HRCT, patterns connected to DILD may be automatically identified and quantified with an 89% overall accuracy [9]. Early results with automated DILD progression or regression detection on two-dimensional HRCT employing the dissimilarity-based feature technique performed well when compared to radiologist interpretation and attained an 80% reliability rate [10]. It is now feasible to completely outsource the separation of the lungs in DILD, identify radiographic patterns related to DILD, and sequentially assess the development of DILD thanks to the integration of multidetector HRCT, the support vector machine classifier, and numerous computational techniques. In this study we have worked on male patients of all age groups. HRCT provides a detailed images of lung parenchyma with a wide range of patterns on the image which allow us to assess various pathologies and disease [11]. The most highlighted patterns are ground glass opacities, honeycombing, consolidation nodules and others. We observed that the patients that came for the examination were mostly presented by a variety of symptoms. We first collected the data of the symptoms from each patient and then we analyzed the data from each and every patient. We found that most of the patients presented were having symptoms of shortness of breath, fever, cough, smoking and previous symptoms like history of TB. When we calculated the ratio of these symptoms, we found out that cough was a major symptom present in the patients. Further we also grouped the patients on the basis of their age where we observed the age-related existence of interstitial lung diseases. We found out that among all the age groups of our study the most affected age group was 60-80, where there was more rate of presence of ILD's. a calculated ratio showed that 41.86% of total patients were those that belonged to this age group.

Our main purpose was to check the efficiency of high-resolution CT in visualizing lung parenchyma patterns in different diseases. While analyzing the patients on HRCT, the pattern of ILDs was observed and was divided into several groups based on their Hounsfield units (HU). Emphysema, honeycombing, fibrosis or cystic pattern, lesion or nodule-like, consolidation, and ground glass opacities were among the classifications [12]. This study suggests that the main source of interstitial illnesses is male individuals, who show the largest range of lesions or nodules on their CT scans. After the arrival of covid-19 HRCT has proved to be the best and the most convenient tool in diagnosing pathologies related to the lung interstitium. It was the preferred technique of diagnosis after RTPCR showing the effect of the diseases as increased ground glass opacities or honeycombing. With the evolution of the acquisition techniques and the kernel system in CT it will be possible to achieve the best information of patient's body [13].

5. Discussion

High-resolution computed tomography (HRCT) is pivotal in diagnosing interstitial lung disorders (ILDs), providing detailed imaging for pattern recognition. Distinct patterns on HRCT, such as ground-glass opacities indicating inflammatory diseases and reticular opacities signifying fibrosis, aid in categorizing ILDs. Honeycombing suggests end-stage fibrosis, impacting prognosis. HRCT simplifies the diagnosis, categorization, and management of ILDs, offering

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valuable insights into various lung patterns. Clinicians use it to assess disease severity, monitor treatment response, and guide patient care. In conclusion, HRCT is indispensable for diagnosing and treating ILDs, allowing non-invasive identification of specific patterns associated with various ILD types. The open nature of the study acknowledges potential variations based on location or data type.

6. Ethical Consideration

Conflict of Interest: None

Source of Funding: None

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