Original Article :

High Resolution Computerized Tomography Findings in Patients with a Clinical Feature of Diffuse Lung Diseases

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Abstract

Background and Aims:

High-Resolution Computerized Tomography (HRCT) is the most powerful tool used to assess the lung parenchyma for diffused lung diseases, it has been accepted as the gold standard for early detection and diagnosis. HRCT of the lung is a key component of the multidisciplinary approach to diagnosis in diffuse lung disease (DLD). The aim of the study is to investigate the most common HRCT findings in clinically suspected cases of diffuse lung diseases, that cannot be determined from clinical history and other diagnostic tests, such as pulmonary function tests.

Methods:

A retrospective study was conducted in Jazan public hospitals (Abu Arish, Sabia, and Prince Mohmed Bin Nasir hospitals) CT scan department, in the period from October 2020 to June 2021. The sampling includes a CT report of 73 patients, with clinical suspicion of diffuse lung disease evaluated and analyzed. The data was collected by data collection sheet and analyzed using the SPSS version 23.

Results:

Mean age of the study sample was 52.97 years, 58.9% were male. Most common CT finding in patients with diffuse lung diseases was ground-glass appearance in (38.4%), followed by tree-in-bud opacity, and honeycombing, COVID-19 pneumonia and pleural effusion. A significant correlation was found between CT findings and type of diffuse lung diseases found, with (P- value< 0.01).

Conclusions:

HRCT findings in positive COVID-19 patients showed that; ground-glass opacity, was the common finding followed by crazy paving pattern, and diffuse alveolar damage, while, tree in bud opacity found in all cases who had pulmonary tuberculosis.

Keywords:

High-resolution computed tomography; interstitial lung disease; DLD; COVID-19 pneumonia; GGO; tree in bud opacity; honeycombing

Introduction:

Diffuse lung disorders (DLD) are classified as having decreased or enhanced lung attenuation. Emphysemas and all the other forms of a cystic pattern, sometimes known as holes in the lung, are examples of diseases with diminished attenuation. There are several patterns of diffuse lung diseases with increasing density. Septal, reticular, and nodular patterns, as well as ground glass opacities and consolidation, are examples[1]. The HRCT has excellent ability to provide sufficient morphological detail of normal and abnormal lung parenchyma is based on high quality examination. With optimal scanning technology, the spatial resolution is only 0.5 mm. The high contrast of the lung parenchyma enables the visualization of structures as small as 0.2 mm[1].

HRCT scans are an important aspect of the examination of patients with DLD because they overcome the inadequacies seen in chest X-rays, allowing more agreement between and among radiologists about the patterns seen. CT scans are used not only to diagnose pulmonary abnormalities but also to determine prognosis and track the course of lesions[2]. Because of the variety of radiological signs and the overlap of radiological findings across numerous diseases, the differential diagnosis of diffuse lung disease is sometimes complex and takes a great deal of expertise and knowledge[3].

The combination of lower-lung honeycombing and upper-lung irregular lines has been shown to have an 81% specificity for typical interstitial pneumonitis4, whereas honeycombing alone has an 86% specificity.[5] A mosaic pattern, on the other hand, has been linked to a variety of disorders ranging from small-airway disease to patchy interstitial lung disease, airway obstruction (bronchiectasis, emphysema, bronchiolitis) and pulmonary thromboembolic disease[1,6]. Ground-glass opacity (GGO) is linked to a variety of viral and inflammatory disorders, as well as edema and pulmonary hemorrhage. Consolidation is related to hemorrhage, infection or inflammation. In the setting of chronic diffuse infiltrative lung disease, consolidation is seen in chronic eosinophilic pneumonia (CEP), bronchiolitis obliterans organizing pneumonia or cryptogenic organizing pneumonia (COP), bronchioloalveolar carcinoma, and lymphoma. Acute consolidations are commonly caused by pulmonary edema, hemorrhage, extrinsic allergic alveolitis, infarction, or infectious pneumonia[6].

To the author's knowledge, there are no previous studies that demonstrate the finding of HRCT in DLD. This study's aim was to determine the common HRCT features in DLD and to correlate findings

with disease type.

Materials and Methods:

This is a retrospective study conducted in Jazan public hospitals (Abu Arish, Sabia, and Price Mohmed Bin Nasir hospitals) CT scan department. The data was taken from the PACS systems, the HRCT report of 73 patients with clinical suspicion of DLD, and any report with no demographic or clinical data for DLD excluded. The data was collected after getting approval from the DRD department- Jazan University and Head of Jazan public hospitals (IRB; Log No;23:0081). HRCT was performed in a supine position and breathing hold at full inspiration using a dual slice CT scanner. The parameters used were 1.5 mm collimation, 10 mm interspace, high spatial frequency reconstruction, and window settings (-700/1000, -600/1500 & 50/350 HU)

Statistical analysis:

The data was properly coded in Microsoft Excel according to age, gender, clinical indications, HRCT findings, and diagnosis, then analyzed by SPSS version 23, frequency and percentage were used for categorical values, mean, and STD for age, then chi-square test to assess the relation between the variables, P– value ≤ 0.05 was statistically significant.

Results:

This study found that the most affected age group by lung diseases was 51-70 years and 31-50 years, with 37% and 26% respectively, the mean age of study sample was 52.53 years, 58.9% of them were male. Most of the patients complain of short of breathing (SOB) and cough 28.8 %, 4.1% suffer from fever, 4.1% complain of leukemia, and 2.7% suffer from pain and dyspnea respectively (Figure 1).

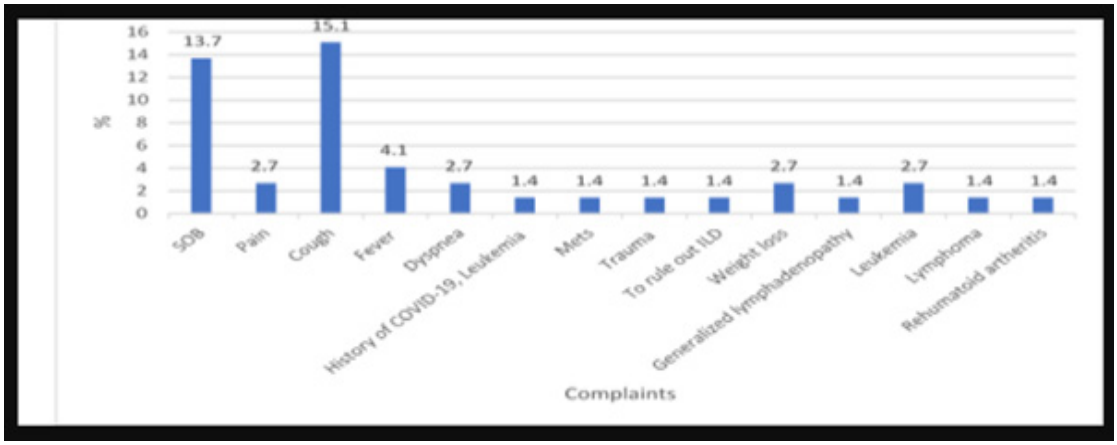


Figure 1: Complaints among the patients.

In this study the most CT feature noted was GGO and tree in bud opacity (42.5% and 20.5%), followed by honeycomb appearance and consolidation (9.6% and 5.5%), then crazy paving pattern (2.7%) (Table 1).

Table1: HRCT feature of patients with clinical features of diffuse lung diseases (DLD) cited.

Diagnosis	Frequency	Percent %
COVID-19 pneumonia	12	16.4
Pleural effusion	10	13.7
Infection	8	11.0
Interstitial lung disease	6	8.2
Tuberculosis	5	6.8
Pulmonary fibrosis	4	5.5
Small airways disease	4	5.5
Atelectasis	2	2.7
Surgical emphysema	2	2.7
Others	14	19.2
Normal	6	8.2
Total	73	100.0

A significant correlation was found between final diagnosis and gender, P-value =0.05, interstitial lung diseases, COVID-19, atelectasis, and TB were more predominant in males, while plural effusion and small airway diseases were more in females. No significant correlation between age and final diagnosis, p-value> 0.05 (Table 2).

Table 2: Correlation between age and diagnosed.

Diagnosis	Age groups				Total	P-value
	12-30	31-50	51-70	more than 70		
Atelectasis	0	1	1	0	2	0.172
COVID-19 pneumonia	0	3	6	3	12	
Infection	2	1	2	3	8	
Interstitial lung disease	0	1	1	4	6	
Normal	3	2	0	1	6	
Others	3	3	7	1	14	
Pleural effusion	4	3	2	1	10	
Pulmonary fibrosis	0	1	3	0	4	
Small airways disease	0	1	2	1	4	
Surgical emphysema	1	1	0	0	2	
TB	0	2	3	0	5	
Total	**13**	**19**	**27**	**14**	**73**	

A significant correlation was found between CT features and the final diagnosis, as ground glass opacity is a feature associated with a group of pathological conditions such as atelectasis, COVID-19, pleural effusion, surgical empyema, and ISLD, while a tree bud appearance is associated with infection and TB, COVID-19, and small airway diseases, the crazy paving pattern is CT feature found in COVID -19 and IN small airway diseases, mosaic pattern and airway wall thickening is a feature commonly found in interstitial lung diseases. (Figure 2)

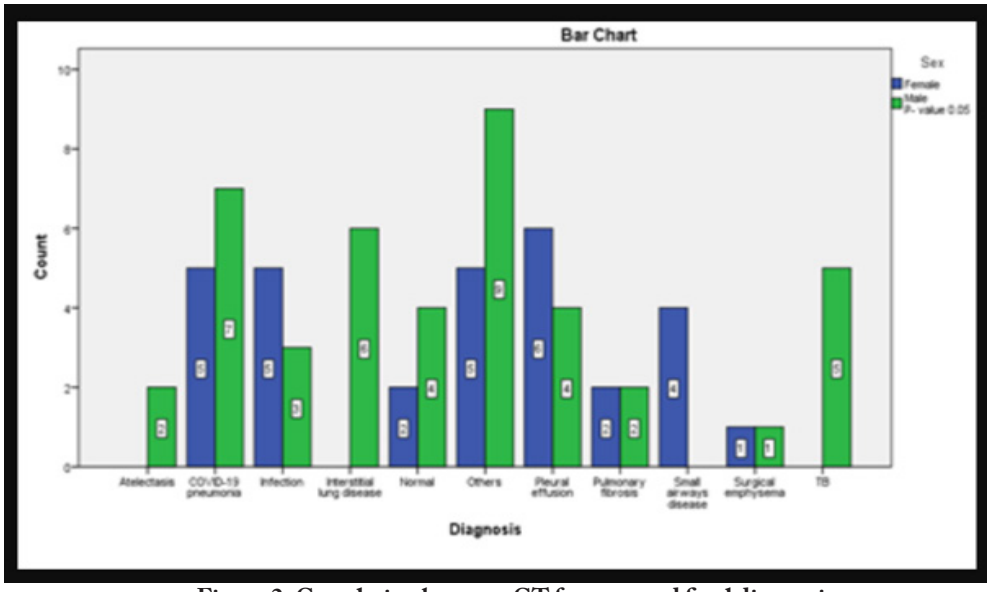


Figure 2: Correlation between CT features and final diagnosis

Discussion:

Diffuse lung diseases are the diseases that affect the entire lungs and can present in a patchy way or uniformly. HRCT features plays an Important role in detecting DLD. This study found that the DLD is occurs more in males than females, in the literature overall it was noticed that most lung diseases are more commonly found and severe in females than in males[7]. It was noticed that in this study there was significant differences in gender and type of diffuse lung diseases, in this study COVID-19 pneumonia, TB affect males more than females , Scully et al.[8] stated that COVID-19 was more common in male, furthermore in all countries males were more affected by TB than females and in India the ratio was 2:1[9]. The associated pleural effusion and lung infection in this study was noticed in female's participants. In this study the age group 51-70 years is the most affected age group by lung diseases, one study stated that increased age is correlated with increased vulnerability to many chronic lung diseases. The incidence of lung diseases such as idiopathic pulmonary fibrosis has been found to increase substantially with age[10]. In this study insignificant correlation was noted between age and final diagnosed in CT. As known that decreasing lung elasticity ,weakend rispiratory musles,chronic diseases and age related physiological changes decline in lung fuction[11].

In this study the most CT feature shown in DLD was GGO and tree in bud opacity followed by honeycomb appearance and consolidation , then crazy paving pattern , and there was a significant correlation be-

tween findings and CT final diagnosed, in this study the honeycombing pattern is characteristic features of overall cases of pulmonary fibrosis, the study finding is consistent with Schettino et al.[12] and Lynch et al.[13] who reported a high prevalence of honeycombing pattern in idiopathic pulmonary fibrosis. GGO is associated finding with several disorders so it was not specific for one pathology, in this study it was noted in patients with COVID-19 pneumonia, atelectasis, in associated plural effusion, infection, emphysema and interstitial diseases.

It has been reported that GGO poor in differentiating underline lung diseases that cause it[14,15]. One study found that found that in 54% of the patients with GGO there is lung fibrosis and in 65% of patients with GGO there is lung inflammation, another study found mention that GGO is the most common appearance of COVID-19[15,16]. All cases of TB in our study is associated with tree in bud appearance, the frequency of tree-in-bud opacities in the clinical setting assessed by Miller and Panosian. The most common causes were lung infections about 72% and most commonly caused by mycobacterium[17,18].

Areas of variable lung attenuation forming a "mosaic pattern" are infrequently appears on HRCT of the lungs, it is a nonspecific finding that can reflect the presence of vascular disease, airway abnormalities, or ground-glass interstitial or air-space infiltrates in this study it was found that mosaic pattern and tree in bud appearance are seen in small air way diseases[19].

This study demonstrates that there are several CT finding aid in diagnosing of DLDs, most of these findings are non-specific and notice in several disorders, the most common finding in patients presenting with clinical features of DLD in this study were GGOs, tree in bud opacity and honeycombing then crazy paving pattern, mosaic perfusion and nodular distribution, significant association between these findings and types of DLD and with final diagnosed and gender.

The study demonstrate that CT, particularly high-resolution CT (HRCT), is crucial in diagnosing diffuse lung diseases because of its ability to produce highly detailed images of the lung parenchyma. It allows for early detection, accurate diagnosis, and precise differentiation between various types of interstitial lung diseases[20]. CT also plays a vital role in monitoring disease progression, evaluating treatment response, and detecting complications, making it indispensable in the management of these conditions. Although it involves radiation exposure, the detailed information it provides far outweighs the risks, especially in diagnosing complex and

potentially life-threatening lung diseases[21].

Conclusion:

This study revealed that DLD was common in male gender, age group 51-70 years was most affected one. Common CT findings in a patient with DLD were GGO, tree-in-bud features-honeycomb features, followed by consolidation, and crazy paving pattern. The most common pathology was COVID-19 pneumonia, a significant correlation was found between CT features and gender with the type of DLD. HRCT findings in positive COVID-19 patients showed that; ground-glass opacity, was the common finding followed by crazy paving pattern, and diffuse alveolar damage, while, tree in bud opacity found in all cases who had pulmonary tuberculosis.

Ethical Approval:

The data was collected after getting approval from the DRD department- Jazan University and Head of Jazan public hospitals(IRB; Log No ;23:0081).

Conflicts of interest:

The authors report no conflicts of interest in this work..

Informed Consent:

Informed consent was attained from all participants within the study.

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