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Clinical, Radiological and Functional Profile of Patients with Diffuse Parenchymal Lung Disease (DPLD)

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Abstract

Introduction: Diffuse parenchymal lung disease (DPLD) can be caused by connective tissue diseases and exogenous factors such as inhalation of organic or inorganic dust of environmental, domestic, or occupational origin. However, a genetic predisposition has been regularly evoked in the genesis of DPLD, and a large group remains idiopathic. We in the current study tried to evaluate the clinical, radiological, and functional profile of patients with diffuse parenchymal lung disease (DPLD).

Methods: This cross-sectional prospective study was conducted in the Department of Respiratory Medicine, Shaheed Monsur Ali Medical College Hospital, Dhaka, Bangladesh from January to June 2023. A total of n=100 cases were included in the present study based on the inclusion and exclusion criteria. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language. Spirometry with measurement of the carbon monoxide diffusion capacity (DLCO), six-minute walk distance (6MWD), post-exercise desaturation, and radiological investigations like chest roentgenograms (CXR) and high-resolution computerized tomography (HRCT) thorax were reported.

Results: A total of n=100 cases were included in the present study based on the inclusion and exclusion criteria. The age of distribution of cases was from 25 years to 77 years. The maximum number of cases was from the age group 51 – 60 years. The mean age of the cases in the study group was 54.5 ± 10.25 years. Average duration of symptoms in patients was 42.54 (6.1) months. End-inspiratory Velcro crackles were the most common examination finding in 93 (93.0%) followed by clubbing in 55 (55.0%). Post-exercise desaturation was found in n=89 patients (89.0%). The common diagnosis was idiopathic interstitial pneumonias (IIP) n=58 (58.0%). Other common etiologies were granulomatous diseases like sarcoidosis in n=7 (7.0%) hypersensitivity pneumonitis in n=7 (7.0%) and connective tissue disease associated with DPLD in n=17 (17.0%). Rest n=3 cases included occupational DPLD, drug- induced DPLD, and topical pulmonary eosinophilia.

Conclusion: Diffuse parenchymal lung disease (DPLD) is a chronic respiratory disease, and its diagnosis must be done with a multidisciplinary approach without the requirement of a lung biopsy. Interstitial pulmonary fibrosis has a poorer prognosis compared to Nonspecific interstitial pneumonia despite optimal treatment. Cases with connective tissue disease-associated DPLD, hypersensitivity pneumonitis and sarcoidosis show exceptional response to therapy.

Keywords: Diffuse Parenchymal Lung Disease (DPLD), Pneumonia, Interstitial Pulmonary Fibrosis, Nonspecific Interstitial Pneumonia

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Introduction

Diffuse parenchymal lung disease (DPLD) can be caused by connective tissue diseases and exogenous factors such as inhalation of organic or inorganic dust of environmental, domestic, or occupational origin [1-3]. However, a genetic predisposition has been regularly evoked in the genesis of DPLD [4], and a large group remains idiopathic. The main consequence of DPLD is impaired gas exchange, causing shortness of breath, reduced exercise tolerance, and impaired quality of life, and can be life threatening. Although significant progress has been made in understanding the mechanisms and causes of diffuse parenchymal lung disease (DPLD), their diagnosis requires expertise in the management of diffuse parenchymal lung disease (DPLD) and multidisciplinary collaboration between a pulmonologist, radiologist, rheumatologist, and pathologist [1]. Diffuse parenchymal lung disease (DPLD) is a heterogeneous group of rare diseases with different underlying pathophysiology. Most interstitial lung diseases are characterized by inflammation or fibrosis of the interstitial space [1] and damage to the lung parenchyma through different types of inflammation and fibrosis, resulting in a large, heterogeneous group of interstitial lung diseases. The diagnosis of DPLD is based on a set of clinical, radiological, and pathological data. Few studies focus on the etiologies and risk factors of Diffuse parenchymal lung disease (DPLD), particularly in Africa, and the existing studies show great disparities in the incidence and prevalence of the different causes of DPLD between countries and sometimes within the same country [2,5,6]. The pulmonary interstitium is not visible usually on radiographs. It is visualized only when it is involved by a disease process. The inflammation and scarring of the lung tissue makes it stiff, making breathing difficult. Early detection of DPLD is essential to prevent the pulmonary fibrosis and starting proper treatment. In majority of cases, roughly 30 % of the cause of interstitial lung disease remains idiopathic. Extensive work up is needed for the diagnosis of interstitial lung disease. Rather, in some cases a positive history of cigarette smoking, aspiration, certain drugs, radiation therapy, cancer, systemic diseases, environmental and occupational factors have been reported in association with the interstitial lung disease. Recently, smoking has been identified as a potential cause of interstitial lung disease. Chest radiograph (CXR) might be inconclusive during early course of the disease and shows not many changes thus incapable to distinguish the particular aetiology of interstitial lung disease. With the introduction of modern diagnostic techniques, such as high-resolution computed tomography, a histological diagnosis is no longer necessarily required for the diagnosis of the disease. Unfortunately, the majority of patients still struggle to find the appropriate treatment, which frustrates both patients and doctors because illness often worsens, and problems arise despite immunosuppressive treatments. [4] In the majority of instances, histopathological confirmation of the diagnosis is not necessary. The advent of less intrusive techniques has led to a renaissance in interest in the study of these illnesses. The goal of this study is to better understand DPLD in the Bangladeshi setting by analyzing the range of DPLD, their common presentations, radiological characteristics, and comorbidities. Therefore, we decided to research the clinical characteristics of our institute's patients with diffuse parenchymal lung disease (DPLD).

Materials and Methods

This cross-sectional prospective study was conducted in the Department of Respiratory Medicine, Shaheed Monsur Ali Medical College Hospital, Dhaka, Bangladesh from January to June 2023. A total of n=100 cases were included in the present study based on the inclusion and exclusion criteria. Written consent was obtained from all the participants of the study after explaining the nature of the study in the vernacular language. The cases included those who were referred to the pulmonary medicine department and were evaluated as per guidelines with multidisciplinary modality diagnosis of interstitial lung diseases [1, 2].

Inclusion criteria

- Aged above 18 years
- Males and females
- With the diagnosis of DPLD
- Voluntarily willing to participate in the study

Exclusion criteria

- Patients diagnosed with malignancy
- Patients with active tuberculosis
- Not willing to participate in the study

The case records form was used to record information about the patient's demography, history, clinical data, and investigation findings. A thorough medical history was obtained, followed by a comprehensive clinical examination. A complete hemogram, blood suga levels, renal function tests, arterial blood gas analysis with calculation of the alveolo-arterial (Aa) gradient, spirometry with measurement of the carbon monoxide diffusion capacity (DLCO), six-minute walk distance (6MWD), post-exercise desaturation, and radiological investigations like chest roentgenograms (CXR) and high-resolution computerized tomography (HRCT) thorax were reported (Figure 1, 2, 3, 4). Pulmonary function tests were performed on a computerized spirometer. Following recommendations [1, 2] a few individuals who agreed to a surgical lung biopsy were assessed. According to the updated American Thoracic Society (ATS)/European Respiratory Society (ERS) 2013 classification of idiopathic interstitial pneumonias, idiopathic interstitial pneumonias

were further divided into categories. [2] Patients were treated with medication and pulmonary rehabilitation in accordance with recommendations. Where available, a six-month follow-up was documented.

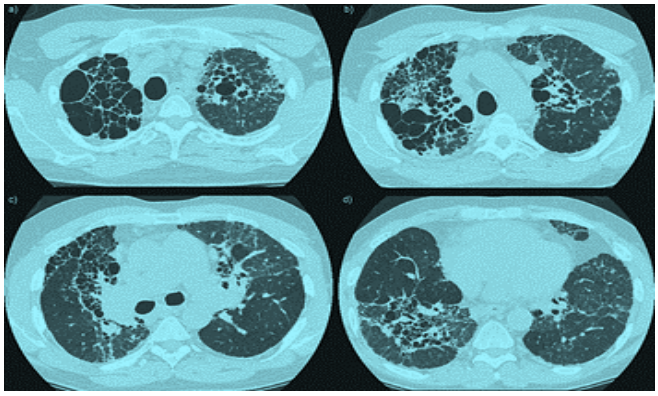


Figure 1: CT Findings of Sarcoidosis Stage 4 Suggestive of Pulmonary Artery Hypertension and Pulmonary Fibrosis

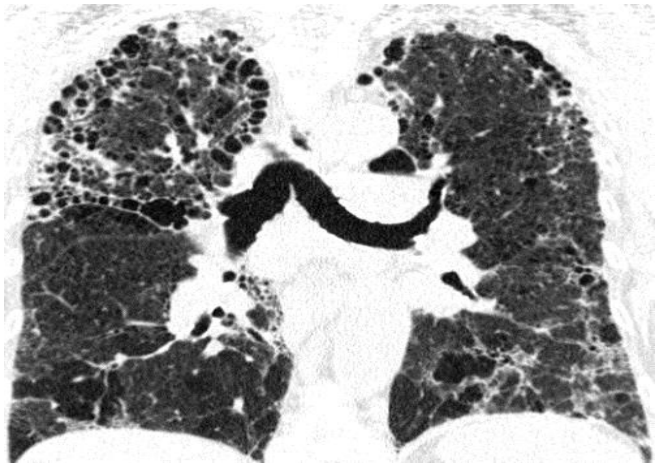


Figure 2: CT Findings suggestive of Chronic Hypersensitivity Pneumonitis

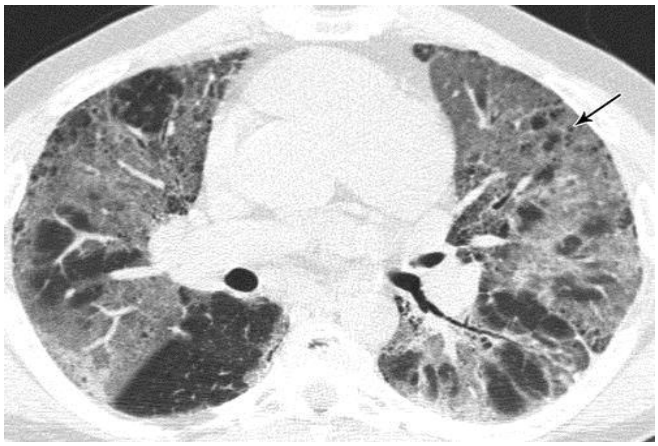


Figure 3: CT findings suggestive of NSIP pattern in CTD related DPLD

Statistical analysis: Frequencies and percentages were used in the analysis of qualitative data. The distribution of ages and sexes, the prevalence of different DPLD subtypes, and the prevalence of different clinical and radiological variables were all examined as diverse clinical characteristics of interstitial lung disorders.

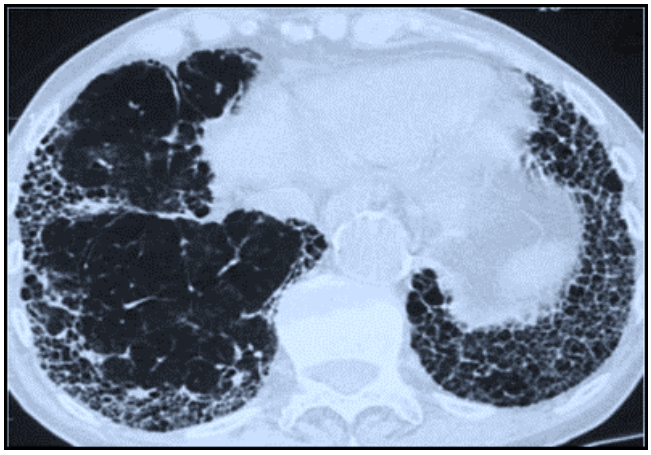


Figure 4: CT findings suggestive of UIP pattern in IPF

Results

A total of n=100 cases were included in the present study based on the inclusion and exclusion criteria. The age of distribution of cases was from 22 years to 75 years. The maximum number of cases was from the age group 51-60 years. The mean age of the cases in the study group was 52.5 ± 10.25 years. In this study n=60 patients were males and n=40 were females. The detailed distribution of cases in the study has been depicted in table 1.

Table 1: Age-wise distribution of cases in the study

Age group	Frequency	Percentage
21 – 30	7	7
31 – 40	10	10
41 – 50	10	10
51 - 60	38	38
61 - 70	25	25
≥70	10	10
Sex		
Male	60	60
Female	40	40

The average duration of symptoms in patients was 42.54 (6.1) months. N=34 (34.0%) patients were smokers, cough and progressive breathlessness were the most common symptoms seen in n=89 (89.0%) and n=93 (93.0%) cases while other symptoms such as fever and chest pains were found in a few cases. End-inspiratory Velcro crackles were the most

common examination finding in 93 (93.0%) followed by clubbing in 55 (55.0%). Post-exercise desaturation was found in n=89 patients (89.0%) details of signs and symptoms have been depicted in table 2.

Spirometry was done in all cases the mean forced vital capacity was 57.0% and FEV1 was 45.0%. The forced expiratory volume FEV1 / FVC ratio was 1.0 the mean diffusion capacity of lungs for carbon monoxide (DLCO) was 34.0%. The average 6-meter walking distance was 177.0 meters. On ABG, the average PaO2 was 76.0 (10.0) mmHg, PaCO2 was 35.0 (SD) mmHg and Aa gradient was 29.0 (12.0) depicted in table 3.

Table 2: Clinical signs and symptoms recorded in the cases of the study.

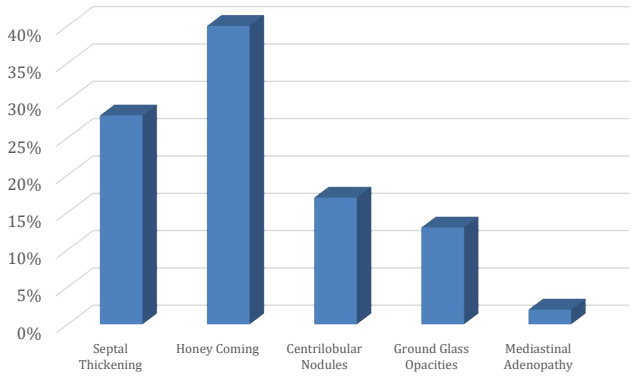
Clinical symptoms	Frequency	Percentage
Breathlessness	93	93
Cough	89	89
Fever	10	10
Chest pain	17	17
Clinical signs		
Clubbing	55	55
Crackles	93	93
Post-exercise desaturation	89	89

Table 3: Spirometry and other parameters recorded in the cases of the study

Parameters	Mean± SD
Forced Expiratory Volume (FEV1) in first second (%)	57.0±12.59
Forced vital capacity (%)	45.0±25.17
Forced Expiratory Volume in first second / Forced Vital Capacity ratio	1.0±0.04
Diffusion capacity of lungs for CO (%)	34.0±22.14
Six-minute walking distance (meters)	177.5±56
CRP (mg/dl)	2.2±1.6

Chest X-ray abnormality in the form of bilateral reticulonodular opacities was seen in all cases. The most common HRCT thorax findings were interlobular, intralobular, and septal thickening in n=28 (28.0%) followed by honey coming in n=40 (40.0%), centrilobular nodules in n=17 (17.0%) Ground glass opacities in n=13 (13.0%) and mediastinal adenopathy in n=2(2.0%) depicted in Finger 5.

Most of the cases in the study were belonging to idiopathic interstitial pneumonias (IIP) n=58(58.0%). Other common etiologies were granulomatous diseases like sarcoidosis in n=7 (7.0%) hypersensitivity pneumonitis in n=7 (7.0%) and connective tissue disease associated with DPLD in n=17 (17.0%). Rest n=3 cases included occupational DPLD, drug-induced DPLD, and topical pulmonary eosinophilia. Among the IIP cases, idiopathic pulmonary fibrosis was a common diagnosis in n=27 (27.0%) followed by nonspecific interstitial pneumonia in n=24 (24.0%) and respiratory bronchiolitis-associated DPLD in n=7 (7.0%). No cases in this study were diagnosed with desquamative interstitial pneumonia, cryptogenic organizing pneumonia, and acute interstitial pneumonia. The connective tissue disease associated with DPLD was n=6 out of which rheumatoid arthritis was n=3 and n=3 had mixed connective tissue disease details depicted in table 4.



Finger 5: Radiological abnormalities on computed tomography of the thorax

Table 4: Distribution of various types of interstitial lung diseases in the cases of the study

CT abnormalities	Frequency	Percentage
Idiopathic pulmonary fibrosis	27	27.0
Nonspecific interstitial pneumonia	24	24.0
Sarcoidosis	7	7.0
CTD associated DPLD	17	17.0
Hypersensitivity pneumonitis	7	7.0
Respiratory bronchiolitis DPLD	7	7.0
Occupational DPLD	3	3.0
Drug-Induced DPLD	3	3.0
Topical pulmonary eosinophilia	3	3.0

Discussion

Recent advances in the classification of IIPs and the development of multidisciplinary approaches have improved the diagnostic accuracy in most cases. Nevertheless, a significant proportion of patients with DPLD remain unclassifiable in clinical practice, with a reported prevalence ranging from 10% to 25% in the published literature. [7-13] This wide variation is due to inconsistent definitions of unclassifiable cases among studies, mainly differing on whether a surgical lung biopsy was required in the diagnostic work-up. In our cohort, unclassifiable DPLD accounted for 17.8% of cases, making this the second most common diagnosis after IPF. Most of these patients with unclassifiable

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DPLD did not undergo a lung biopsy; thus, a specific diagnosis of DPLD could not be confidently established based only on clinical data. A total of n=100 cases were included in the present study based on the inclusion and exclusion criteria. The age of distribution of cases was from 22 years to 75 years. The maximum number of cases was from the age group 51-60 years. The mean age of the cases in the study group was 52.5 ± 10.25 years. In this study n=60 patients were males and n=40 were females. The findings of the current study were in concordance with several western studies and a few Indian studies in this field. [14-16] This study found no male preponderance for DPLD similar reports have been published by Turner et al., [17] Sharma SK et al., [18] and Mahasur et al., [6] In this study we found n=17 (17.0%) patients have a history of smoking. Smoking has been linked to many DPLD, including IPF, RBDPLD, DIP, and CPFE. Unclassifiable DPLD represents a heterogeneous collection of Diffuse parenchymal lung disease (DPLD), including both IPF and non-IPF conditions. In this series, the majority of unclassifiable patients did not have radiologic features of UIP; 89% were inconsistent with a UIP pattern and in a possible UIP pattern was found in only 12%. In addition to the significantly lower age at diagnosis compared with IPF, these findings suggest that most of our cohort of patients with unclassifiable DPLD had non-IPF conditions. A high degree of suspicion is kept for diagnosing this condition. Multiple anti-TB therapy regimens, including those for multidrug-resistant tuberculosis, are frequently administered to DPLD patients. The prevalence of DPLD is increasing, according to several pieces of research conducted in western countries. [5, 19-21] Therefore, it is clear that the condition was previously both underdiagnosed and misdiagnosed. It is crucial to raise awareness of this illness among medical professionals and the general population. Hence, we conducted the present study. Patients who participated in our study received a customized DPLD diagnosis based on their unique clinical and radiological characteristics. Most of the cases in the study were belonging to idiopathic interstitial pneumonias (IIP) n=58(58.0%). Other common etiologies were granulomatous diseases like sarcoidosis in n=7 (7.0%) hypersensitivity pneumonitis in n=7 (7.0%) and connective tissue disease associated with DPLD in n=17 (17.0%). Rest n=3 cases included occupational DPLD, drug- induced DPLD, and topical pulmonary eosinophilia. Among the IIP cases, idiopathic pulmonary fibrosis was a common diagnosis in n=27 (27.0%) followed by nonspecific interstitial pneumonia in n=24 (24.0%) and respiratory bronchiolitis-associated DPLD in n=7 (7.0%). No cases in this study were diagnosed with desquamative interstitial pneumonia, cryptogenic organizing pneumonia, and acute interstitial pneumonia. The results of the current study were similar to studies done by Kalra et al., [22] and Sen T et al., [18] and the western study by Coulltas et al., [23]. In this study, we found dry cough and breathlessness were the common symptoms and constitutional symptoms such as fever and chest pain were less in a few patients. The important features of examination in cases of DPLD are clubbing, fine end-inspiratory Velcro crackles, and post-exercise desaturation. Several studies have found that clubbing may exist in up to 50% of cases and Velcro crackles in up to 80% of cases of DPLD. [24,25] The average duration of symptoms in patients was 42.54 (6.1) months. N=34 (34.0%) patients were smokers, cough and progressive breathlessness were the most common symptoms seen in n=89 (89.0%) and n=93 (93.0%) cases while other symptoms such as fever and chest pains were found in a few cases. End-inspiratory Velcro crackles were the most common examination finding in 93 (93.0%) followed by clubbing in 55 (55.0%). Post-exercise desaturation was found in n=89 patients (89.0%) details of signs and symptoms. Similar observations have been reported by other studies. [6] The majority of DPLD may be diagnosed and classified using a multidisciplinary approach that includes clinical and radiographic correlation. Radiology is a crucial diagnostic tool. The requirement for surgical lung biopsy has been eliminated by more recent developments in imaging techniques. Some patients' chest radiographs may be normal. Reticulonodular opacities, the most typical CXR abnormality, were seen in every patient in our investigation. Chest X-ray abnormality in the form of bilateral reticulonodular opacities was seen in all cases. The most common HRCT thorax findings were interlobular, intralobular, and septal thickening in n=28 (28.0%) followed by honey coming in n=40 (40.0%), centrilobular nodules in n=17 (17.0%) Ground glass opacities in n=13 (13.0%) and mediastinal adenopathy in n=2(2.0%) depicted. V Ramana et al., [20] in their study found septal thickening in 42% of cases, honeycombing in 38%, and ground glass opacities in 20%. The most characteristic spirometry abnormality in DPLD is a restrictive abnormality with decreased DLCO. Due to its easy availability, spirometry can be a very useful aid in the diagnosis, prognostication, and assessing response to therapy. In our study, all the patients showed a restrictive abnormality. Spirometry can be a highly helpful tool in the diagnosis, prognosis, and evaluation of therapeutic response due to its accessibility. In our investigation, restricting anomaly was present in every patient. DPLD management begins with counseling on this chronic condition. The same advice was given to our patients and relatives' families. Pharmacotherapy for DPLD aims to stop the disease's development rather than treat it. Newer research, however, has shown this treatment ineffective for IPF. Pirfenidone, an antifibrotic medicine, is one of the more recent medications used to treat IPF. Treatment with oral corticosteroids combined with immunosuppressive medications has been successful in treating non-IPF DPLD in diseases like NSIP and CTD-related DPLD.

Conclusion

Interstitial lung disease is often a neglected lung condition. The most common interstitial lung disease observed is usual interstitial pneumonia. This finding was also the most common pattern seen with rheumatoid arthritis. Interstitial lung disease should be ruled out in patients with progressive dyspnoea, as this is the most common complaint in such patients. Cases with connective tissue disease-associated DPLD, hypersensitivity pneumonitis and sarcoidosis show exceptional response to therapy. Patients with DPLD required in-depth counseling that includes an explanation of the condition's natural course, treatment alternatives, side effects, and the best way to manage any treatable comorbidities that may be present.

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