# Clinical presentation and etiology of pulmonary fibrosis among Sudanese patients

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**Abstract**

**Objective:** This study was performed to identify the clinical presentations and etiology of pulmonary fibrosis in adult Sudanese patients.

**Materials and Methods:** This descriptive cross-sectional hospital-based study was conducted at Alshaab Teaching Hospital from May 2013 to May 2014. One hundred patients with pulmonary fibrosis were included after they had provided informed written consent. We collected data using a closed-ended questionnaire containing items regarding demographic data and clinical symptoms (cough, shortness of breath, chest pain, and weight loss). We examined all patients for clubbing, inspiratory crackles, cyanosis, and evidence of pulmonary hypertension. Chest X-ray and high-resolution computed tomography (HRCT) images were reviewed for all patients. We performed echocardiography for all patients to check for evidence of pulmonary hypertension. Data were analyzed using SPSS version 22 (IBM Corp., Armonk, NY).

**Results:** The mean age of the patients was 52 years. The main presenting complaints were cough and dyspnea (89% and 84%, respectively). Clubbing and inspiratory crackles were found in 91% and 74% of the patients, respectively. The main causes of pulmonary fibrosis were idiopathic disease (49%) and tuberculosis (34%). X-rays showed reticular shadows in 95% of patients. Honeycombing, ground-glass, and nonspecific appearances were found on HRCT in 71%, 22%, and 7% of patients, respectively. Echocardiography showed pulmonary hypertension in 46% of patients.

**Conclusion:** Cough and dyspnea were the main presenting symptoms. A honeycombing appearance was found in most of the patients using HRCT, while pulmonary hypertension was the main echocardiographic finding.

**Keywords:** pulmonary fibrosis, reticular shadows, ground-glass appearance

## Introduction

Pulmonary fibrosis is a progressive and generally fatal disease characterized by scarring of the lungs, which thickens the lining of the lungs and leads to irreversible loss of tissues that transport oxygen[1]. Pulmonary fibrosis is one type of interstitial lung disease (ILD).

The various causes of pulmonary fibrosis include radiation and radiotherapy, which lead to radiation pneumonitis and fibrosis [2]. Environmental factors such as smoking or occupational exposure can affect the mucosal surfaces of the lung, leading to pulmonary fibrosis. Connective tissue disease may be difficult to rule out because the pulmonary manifestations occasionally precede the more typical systemic manifestations by months or years [3]. For example, clinical evidence of ILD is present in about half of patients with progressive systemic sclerosis. Rheumatoid arthritis, which affects more males than females, is another example; pulmonary manifestations occur in up to 20% of these patients [3]. Various sequelae and complications may occur in both primary and post-primary pulmonary tuberculosis, regardless of treatment [4]. Complications can be the presenting feature of pulmonary tuberculosis [5]. Additionally, pulmonary tuberculosis can present as unilateral destruction of the lung [6]. Several mutations have been identified in patients with familial pulmonary fibrosis, and these same mutations have been found in patients with sporadic idiopathic pulmonary fibrosis (IPF). Drug-induced pulmonary fibrosis is a diagnosis of exclusion. Several medications have been reported to cause this condition, including cytotoxic, cardiovascular, anti-inflammatory, antimicrobial, illicit, and miscellaneous medications [7]. IPF is also a diagnosis of exclusion. Many risk factors and medical conditions are associated with IPF, including smoking, farming, occupational hazards, and viral and bacterial infections [7].

Most symptoms of pulmonary fibrosis are nonspecific. Dyspnea, dry cough, and unexplained weight loss are the most common, and extrapulmonary symptoms are related to the underlying causes [6]. Physical examination findings include crackles or Velcro rales in addition to inspiratory squeaks, as in patients with traction bronchiectasis. Clubbing of the digits is also commonly found in patients with IPF [8]. Signs suggesting pulmonary hypertension and cor pulmonale may also be present in addition to extrapulmonary findings of systemic diseases.

The evaluation of patients with pulmonary fibrosis initially aims to identify the cause and severity of the disease. The findings of laboratory, radiographic, and pulmonary function tests guide clinicians' decision about whether to pursue bronchoalveolar lavage and/or trans-bronchoscopic, thoracoscopic, or open lung biopsy.

A reticular pattern is the most common finding in chest X-rays of patients with pulmonary fibrosis. The radiographic pattern and disease stage are poorly correlated; the only exception is a honeycombing appearance, which is predictive of a poor prognosis. A diffuse ground-glass pattern is often observed early in the course of ILD, followed by progression to reticular (linear) infiltrates with nodules (reticulonodular infiltrates) [9].

Because of its increased sensitivity and ability to distinguish active, reversible areas of lung disease from irreversible fibrotic and honeycomb changes, high-resolution computed tomography (HRCT) is essential in both the diagnosis and staging of ILD [9,10].

Most patients with pulmonary fibrosis have low lung volume and capacity [11].

A surgical lung biopsy is indicated in the absence of a typical usual interstitial pneumonia pattern on HRCT according to the updated 2011 guidelines [9].

Complications include pulmonary hypertension, cor pulmonale, respiratory failure, and lung cancer [12,13].

Although pulmonary tuberculosis is prevalent in Sudan and is one of the etiologies of lung fibrosis, there are no published data regarding the clinical presentations of lung fibrosis in Sudan. This study was performed to identify the clinical presentations and etiologies of pulmonary fibrosis among adult Sudanese patients treated at Alshaab Teaching Hospital from May 2013 to May 2014.

## Materials and Methods

This descriptive, cross-sectional, hospital-based study was conducted at Alshaab Teaching Hospital Khartoum Sudan from May 2013 to May 2014. We included all (n = 100) patients aged ≥18 years who had been diagnosed with pulmonary fibrosis at Alshaab Teaching Hospital during the study period. We excluded patients aged <18 years and those who refused to participate. Data were collected by a predesigned questionnaire containing items on demographic data (name, age, residence, and occupation) and symptoms (cough, shortness of breath, chest pain, and weight loss). Clinical examination was performed to check for clubbing, inspiratory crackles, cyanosis, and evidence pulmonary hypertension. The chest X-rays and HRCT scans of all patients were reviewed by expert radiologists. Echocardiography was performed for all patients by expert cardiologists to check for evidence of pulmonary hypertension (defined as a mean pulmonary artery pressure of >25 mmHg at rest and >30 mmHg with exercise), assess the right ventricle diameter and left ventricular function, and check for valvular lesions.

We used the following criteria to diagnose pulmonary fibrosis:

1. Clinical symptoms and signs (progressive exertional breathlessness, nonproductive cough, inspiratory crackles, and finger clubbing).
2. Abnormal lung functions (reduced vital capacity with an increased ratio of forced expiratory volume in 1 second to forced vital capacity [FEV1/FVC]).
3. Chest CT scan findings (reticular abnormalities with ground-glass opacities and honeycombing appearance).

We also assessed the patients' causes of pulmonary fibrosis and any comorbid conditions. Ethical approval was obtained from the ethics committee of Alshaab Teaching Hospital.

We obtained written informed consent from all patients after thoroughly explaining the aim of the study and assured the patients that their data will be confidential and used only for the study purposes.

Data were analyzed using SPSS version 22 (IBM Corp., Armonk, NY). The chi-square test was used to analyze group differences in categorical variables. Student's t-test was used for continuous variables. A *p*-value of <0.05 was considered statistically significant.

## Results

We studied 100 patients aged 18 to 80 years (mean, 52.4 ± 14.7 years). Most patients (86%) were >40 years of age. The patients comprised more females than males (56% and 44%, respectively).

Cough and shortness of breath were the most common presenting symptoms (Figure 1). Inspiratory crackles and clubbing were the main clinical signs, either alone or in combination (Figure 2).

Chest X-rays showed reticular shadows in 95% of patients, while 5% had normal chest X-rays. On HRCT, 71% showed honeycombing, 22% showed a ground-glass appearance, and 7% showed a nonspecific appearance. All patients with a nonspecific appearance on HRCT had tuberculosis, and 86% of them had extensive lesions.

Echocardiographic findings comprised pulmonary hypertension, a dilated right ventricle, impaired left ventricular function, and tricuspid regurgitation in 46%, 39%, 13%, and 44% of patients, respectively, either alone or in combination.

We found that idiopathic lung fibrosis (49%) and tuberculosis (34%) were the main causes of lung fibrosis in the study group (Table 1).

Comorbid conditions with pulmonary fibrosis in the study group were diabetes mellitus, hypertension, and ischemic heart disease in 10%, 10%, and 6% of patients, respectively.

## Discussion

This study represents a preliminary survey regarding the clinical presentation and etiology of lung fibrosis in Sudan because there are no published data in this regard. We included 100 patients diagnosed with pulmonary fibrosis during the study period; 56% of them were females, which is in contrast to previous findings that males are more often affected than females[13,14]. This could be because previous studies included only patients with IPF, while we included patients with all causes of pulmonary fibrosis.

Additionally, connective tissue disease occurred in 13% of patients in our study and was also more prevalent in females.

The mean age at presentation was 52.4 ± 14.7 years, which is lower than that reported by King et al. [14] and Douglas et al. [15]. Forty-seven percent of our patients had tuberculosis and connective tissue disease, which occurred at a younger age and could thus explain the lower mean age.

In our study, cough and dyspnea were the most common presenting symptoms (89% and 84%, respectively). This is consistent with the findings of a study performed in Tehran showing that the most common presenting symptoms were cough and dyspnea, which are the cardinal symptoms of pulmonary fibrosis [16].

Clubbing was found in 74% of our patients, which is higher than that reported in the literature [14-16].

Because Sudan is a tropical country with a high prevalence of tuberculosis, we expected tuberculosis to be the most common etiology of pulmonary fibrosis in this study. However, we found that tuberculosis was the second most common cause after idiopathic pulmonary fibrosis (34% and 49%, respectively). This could be due to the fact that only patients with complicated

cases of tuberculosis are referred to Alshaab Teaching Hospital; most cases are treated in health centers or other hospitals. Additionally, medications are distributed free of charge, which may reduce the rate of progression of tuberculosis.

A reticular pattern is the most common finding in chest X-rays of patients with pulmonary fibrosis [9,14]. We obtained the same finding in our study (95%).

Most of our patients showed honeycombing on HRCT images, which reflects advanced disease, while all nonspecific appearances were due to pulmonary tuberculosis.

Although right heart catheterization is the gold standard investigation for the diagnosis of pulmonary hypertension, we used echocardiography to assess pulmonary hypertension because it is a noninvasive procedure. We found that 46.0% of patients had pulmonary hypertension, while Lettieri et al. [12] found that only 31.6% of their patients had pulmonary hypertension. This could be because they used right heart catheterization for the diagnosis of pulmonary hypertension, which is more sensitive.

**Conclusion**

Despite the fact that Sudan is a tropical country with a high prevalence of tuberculosis, IPF is still the most common cause of pulmonary fibrosis in this country. Moreover, despite different etiologies, cough and dyspnea were the main presenting symptoms.

**Recommendations**

We recommend further large multicenter studies of pulmonary fibrosis in Sudan with a special focus on the correlation between symptoms and etiologies.

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Figure 1. Distribution of symptoms in patients with lung fibrosis at Alshaab Teaching Hospital (May 2013–May 2014)

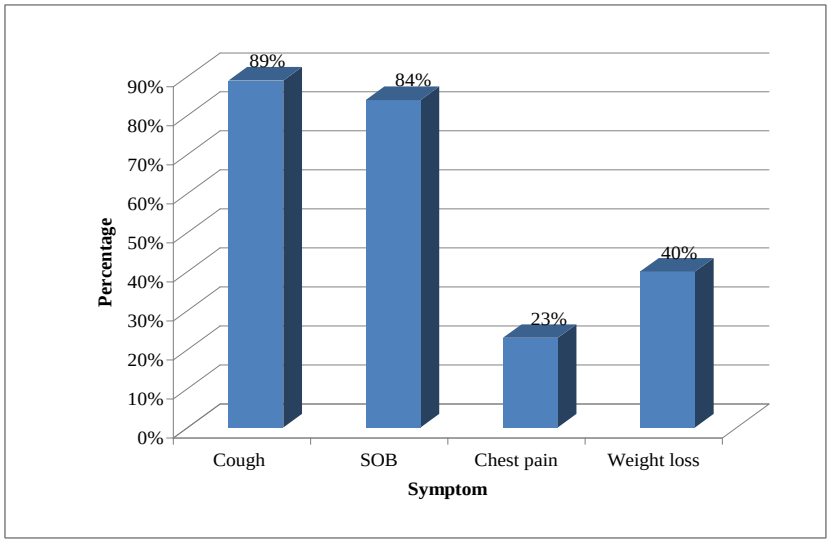


Figure 2. Distribution of signs in patients with lung fibrosis at Alshaab Teaching Hospital (May 2013–May 2014)

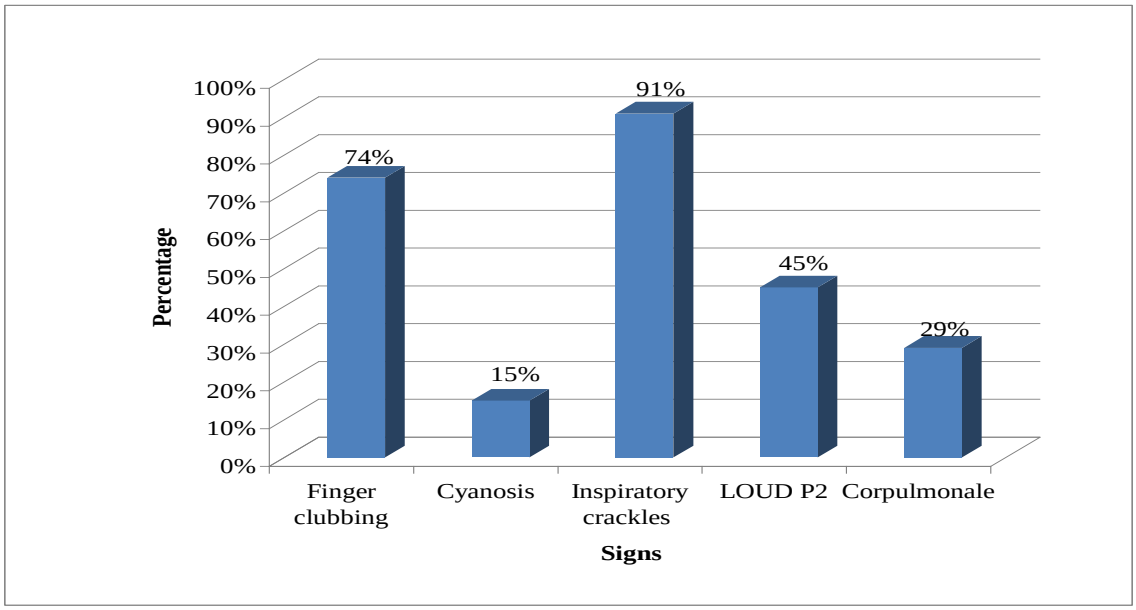

Table 1. Etiologies of pulmonary fibrosis

| Etiology | Percentage of patients |
|---|---|
| Idiopathic pulmonary fibrosis | 49% |
| Tuberculosis | 34% |
| Connective tissue disease | 13% |
| Drugs | 3% |
| Familial | 1% |
| Total | 100% |

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