

# Original Article

## Functional profile of patients with tuberculosis sequelae in a university hospital\*

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### ABSTRACT

**Objective:** To describe data related to the pulmonary function of patients with sequelae of pulmonary tuberculosis, pleural tuberculosis or both. **Methods:** In the outpatient clinic of a university hospital, 218 patients were evaluated. Of those 218, 56 had sequelae of tuberculosis (pulmonary, pleural or both), and 162 had other types of tuberculosis. All patients were evaluated in the pulmonary function laboratory between February 2000 and July 2004, and 43 were found to be eligible for inclusion in the study. Patients with a history of asthma, chronic pulmonary obstructive disease, cardiac insufficiency, collagen diseases, silicosis or thoracic surgery, as well as those for whom spirometry yielded unacceptable results or was not performed, were excluded. The lung fields were divided into six zones, and radiographic results were classified by degree: I (involvement of only one zone with no cavitation); II (involvement of two or three zones or of one zone with cavitation); or III (extensive involvement of three or more zones with or without cavitation). **Results:** The final study sample comprised 50 patients, 44 (88%) of whom had pulmonary tuberculosis. The most prevalent form (17/50; 34%) was mixed ventilatory disturbance. Severe disturbances were more significant in degree III radiographs ( $p = 0.0002$ ) and normal pulmonary function was predominant among patients presenting degree I and II radiographs ( $p = 0.002$ ). **Conclusion:** The early discovery and treatment of tuberculosis contribute to reduce the number of cases, as well as the incidence of tuberculosis sequelae, thereby improving the quality of life of tuberculosis patients. Further studies, involving longitudinal, sequential analysis and larger samples of patients with tuberculosis sequelae, should be conducted in referral centers in Brazil.

**Keywords:** Tuberculosis, pulmonary/diagnosis; Tuberculosis, pleural/diagnosis; Respiratory function tests; Spirometry; Lung diseases/radiography

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## INTRODUCTION

Tuberculosis (TB) has accompanied man since prehistoric times, and, even today, more than a hundred years after Robert Koch identified the disease-causing agent (in 1882), TB still presents some of the highest rates of morbidity and mortality of any chronic infection.<sup>(1)</sup> Through a review of the literature, we observed that there are few studies of patients with TB sequelae. The number of patients is unknown, governmental costs have not been evaluated, and a limited number of professionals have experience in dealing with such patients.

Pulmonary TB can involve the airways, resulting in mucosal edema, hypertrophy/hyperplasia of the mucous glands, increased mucous secretion and smooth muscle hypertrophy. This affects the caliber of the airways, increases their resistance and decreases airflow. The mechanism of fibrotic scarring can also result in reduced total lung capacity.<sup>(2)</sup> Pleural TB leads to the thickening of the pleura due to tuberculous pleuritis. Therefore, delays in diagnosing TB have been shown to relate directly to the severity of pulmonary damage and the frequency of comorbidities, negatively affecting quality of life.<sup>(3)</sup>

Some authors have stated that obstructive ventilatory disorder as the most often found in patients with pulmonary TB sequelae, and the intensity usually varies in accordance with the extension of the lesion.<sup>(4)</sup> Other authors, however, have reported functional normality and mixed disorders. Nonetheless, the restrictive ventilatory disorder is predominant in the patients with pleural TB sequelae.<sup>(5)</sup>

Few studies have addressed TB sequelae in Brazil. Therefore, the objective of this study is to describe the functional profile of patients with pulmonary TB sequelae, pleuropulmonary and pleural, and correlate it with the radiographic images. Data were collected from patients treated at the Outpatient Tuberculosis Clinic and evaluated in the Pulmonary Function (PF) Laboratory of the Hospital das Clínicas of the Federal University of Minas Gerais between February of 2000 and July of 2004. The authors propose interventions that would decrease morbidity and improve the quality of life of these patients through the adoption of a prospective study protocol.

## METHODS

The Tuberculosis Outpatient Clinic at the Hospital das Clínicas of the Federal University of Minas Gerais is a tertiary-care referral center. As such, it has been receiving patients of higher complexity since 2000, and these patients are supervised in the Basic Health Clinic. For all outpatients, PF tests are routinely performed after treatment for pulmonary TB (pleural, pleuropulmonary or both). The PF laboratory receives patients from all outpatient clinics of the hospital and some from the Sistema Único de Saúde (Unified Health Care System). In this study, we documented the experience and profile of the clinic, using descriptive data for patients with TB sequelae, principally pulmonary sequelae.

Patients with a history of diseases such as asthma, chronic obstructive pulmonary disease, cardiac insufficiency, collagen diseases and silicosis, all of which could affect the results of the tests, were excluded, as were those who had been previously submitted to thoracic surgery, those who were not submitted to spirometry and those who were unable to satisfactorily perform the spirometry maneuvers.

Clinical and functional patient data were taken from the medical charts and from the PF laboratory standardized forms (when the diagnosis was TB sequelae). Additional data were collected from routine respiratory questionnaires filled out before each test, which included data on respiratory symptoms, dyspnea scoring, pulmonary diseases, work history and smoking, as well as from radiographic evaluations (when provided by the patient). All tests resulting in poor quality curves were repeated, and only those test results that met the criteria for acceptance and reproducibility were archived.<sup>(6)</sup> Environmental exposure, such as to pollution or to smoke from wood combustion, was not evaluated.

The functional evaluation was performed through spirometry and measurement of absolute lung volume using a Collins DS11a spirometer with a universal breathing valve, together with a Koko Spirometer model 92494. All tests were conducted in accordance with the 2002 Guidelines for Pulmonary Function Tests established by the Sociedade Brasileira de Pneumologia e Tisiologia (Brazilian Society of Pulmonology and Phthysiology).<sup>(6)</sup>

All test curves were re-evaluated by the authors.

The X-rays were analyzed by one radiologist and two pulmonologists, who graded the alterations according to Willcox et al.<sup>(4)</sup> The lung fields were divided into six zones, and the X-rays were classified as degree I (minimum involvement in only one zone, without cavitation), degree II (involvement of two or three zones or one zone with cavitation) or degree III (severe involvement in more than three zones with or without cavitation).

The data were stored and analyzed using the Epi Info program for Windows, version 3.2.2. The program was used for all statistical analyses. The chi-square test and Fisher's exact test were used, and the level of statistical significance was set at 0.05 for the entire study.

## RESULTS

The study was carried out from February 2000 to July 2004. The TB outpatient clinic treated 218 patients. Of those, 56 presented pulmonary TB sequelae (pleural, pleuropulmonary or both), and 162 presented TB in the lymph nodes, kidneys, eyes, skin, bone, peritoneum, genitals or intestines, as well as miliary TB. In the PF laboratory, 43 patients were found to be eligible for inclusion in the study.

Of the 56 outpatients who presented pulmonary TB sequelae, 24 (42%) were included in the study.

Of the 32 (58%) who were excluded, 18 (56%) were excluded because they had a history of other diseases (2 having been submitted to lung surgery), 12 (37%) because they had not been submitted to spirometry and 2 (7%) because their spirometric curves did not meet the criteria for acceptance.

Of the 43 patients classified as eligible in the PF laboratory, 26 (60%) were included in the study, and 17 (40%) were excluded: 16 (94%) due to previous diseases (3 having had lung surgery) and 1 (6%) due to presenting curves that did not meet the criteria for acceptance.

The total number of patients included was 50: 44 (88%) had pulmonary TB; 4 (8%) had pleuropulmonary TB, and 2 (4%) had pleural TB. A greater number of women than men were included (30 = 60% vs. 20 = 40%). Mean age was 30 years.

We found that 27 (54%) were nonsmokers, 14 (28%) were former smokers, and 9 (18%) were smokers. Among the smokers, the mean number of pack-years was 14.8. When comparing the PF results, we did not observe a significant difference between the smokers and nonsmokers ( $p = 0.926$ ).

Of the 50 patients, 36 (72%) presented symptoms such as cough, wheezing, expectoration or dyspnea, although the presence of symptoms was not a predictive factor for altered PF results (Fisher's exact test,  $p = 0.18$ ).

TABLE 1

Pulmonary function in patients with TB sequelae

	Pleural TB	Pleuropulmonary TB	Pulmonary TB	Total
Pulmonary function				
MVD	0	0	17/50 (34%)	17 (34%)
OVD	0	1/50 (2%)	11/50 (22%)	12 (24%)
RVD	1/50 (2%)	1/50 (2%)	7/50 (14%)	9 (18%)
Normal	1/50 (2%)	2/50 (4%)	9/50 (18%)	12 (24%)
Total	2/50 (4%)	4/50 (8%)	34/50 (88%)	50(100%)

TB: tuberculosis; MVD: mixed ventilatory disorder; OVD: obstructive ventilatory disorder; RVD: restrictive ventilatory disorder.

TABLE 2

Pulmonary function test results by severity and radiological degree

Result	Radiograph			Total
	Degree I	Degree II	Degree III	
Normal	4/34 (11.7%)	5/34 (14.7%)	0	9 (26.4%)*
Mild	7/34 (20.6%)	2/34 (5.4%)	1/34 (3.4%)	10 (29.4%)
Moderate	1/34 (3.4%)	4/34 (10.8%)	2/34 (5.4%)	7 (22.6%)
Severe	0	1/34 (3.4%)	7/34 (20.6%)	8 (23.6%)**
Total	12(35.7%)	12 (34.3%)	10(29.4%)	34 (100%)

\*Fisher's test = 0.02; \*\*chi-square,  $p = 0.0002$

As can be observed in Table 1, mixed ventilatory disorder was the most prevalent TB sequelae, being present in 17 cases (34%), followed by obstructive ventilatory disorder with normal function (24%) and restrictive ventilatory disorder (18%).

Chest X-rays were available for 37 patients (74%), and they were classified according to the method previously described. The mean time between the PF testing and the chest X-ray was seven months. There was no difference in the frequency of radiological involvement among the degrees: degree I - 14/37 (38%); degree II - 13/37 (35%); and degree III - 10/37 (27%).

Table 2 shows that severe disorders are more prevalent in patients presenting degree III X-rays (23.6%,  $p = 0.0002$ ) and that normal results are predominant in patients presenting degree I or II X-rays (26.4%,  $p = 0.02$ ).

Only three patients presented significant variation after the use of bronchodilator: one with acute mixed ventilatory disorder, one with moderate obstructive ventilatory disorder and one with light obstructive ventilatory disorder.

## DISCUSSION

The limitations of descriptive studies and the difficulties inherent to extracting information from medical charts, as well as the fact that the present study involved only one health facility with its peculiarities, should be taken into consideration.

A great number of patients were excluded due to with a history of other diseases (related to the status of the facility as a tertiary-care outpatient clinic). The fact that some patients did not report to the PF laboratory to perform the tests could be explained by the distance or financial difficulties in paying for transportation. It is even possible that these patients considered themselves cured and therefore did not feel the need to be tested further.

The greater number of patients with pulmonary sequelae (88%) is unsurprising since TB principally affects the lungs (85%).<sup>(1,8)</sup>

In the bibliography reviewed, we found no studies reporting that the incidence TB sequelae is higher in women than in men, as was observed in the present study (60% for women). This could be due to the specific characteristics of the facilities, to the great amount of exclusion or to

the small study sample. We observed TB sequelae in adults in their productive prime, which results in higher governmental expenditures, mainly for those patients who also present more severe clinical, functional and radiological profiles. This situation is probably related to delayed diagnosis and treatment of TB.

In one study, an inverse relationship between the amount of sputum production and forced expiratory volume in one second was described.<sup>(4)</sup> Because ours was a descriptive study and the information was extracted from medical charts, it was not possible to quantify the symptoms. Therefore, when we evaluated the symptomatic and asymptomatic patients (without quantifying them through PF tests), we observed no significant difference ( $p = 0.18$ ).

Controversy exists regarding which is the disorder most frequently in TB sequelae. Some authors<sup>(9-10)</sup> found mild restrictive ventilatory disorder to be the most prevalent in the patients with cavitory disease, whereas the patients without cavitation presented functional normality. Others<sup>(4,11)</sup> found a higher prevalence of obstructive disorders (68%). A study<sup>(3)</sup> that analyzed a Brazilian population with severe obstructive pulmonary disease found that 15.7% presented pulmonary TB sequelae. Another study<sup>(12)</sup> concluded that TB causes chronic airflow limitation that becomes more severe when it is recurrent. In our study, we found that the mixed disorder was the most prevalent (34%), which is in accordance with the findings of another study<sup>(13)</sup> that evaluated patients with multidrug-resistant TB sequelae.

In the present study, we demonstrated that the radiological evidence classified as degree III reflected greater functional severity, as well as that chest X-rays presenting little alteration indicated that PF is likely to be normal or only slightly altered. These data are in agreement with those of other authors.<sup>(4,10)</sup> Some authors have described intervals ranging from six months to sixteen years between the chest X-ray and the spirometry.<sup>(4,10-11)</sup> In our study, the mean interval was seven months.

The proportion of nonsmokers (54%) was comparable to that of smokers (46%), a difference that was not significant. The patients who smoked presented a mean of 14.8 pack-years. When we analyzed the functional alterations in these patients, we observed that there was a significant

confounding factor related to the fact that the epidemiological data on environmental exposure (to pollution and to smoke from wood combustion) were not evaluated. Therefore, spirometric alterations should be evaluated using specific protocols. We found quite a large percentage of smokers in this population. Smoking is one of the harmful habits that most significantly influences the development of TB.<sup>(1)</sup>

When there are PF alterations due to pleural TB sequelae, mild restrictive ventilatory disorder is predominant, and pleural thickening of at least 10 mm increases the probability reduced lung volumes.<sup>(5,14)</sup> We had only two cases of pleural TB sequelae and access to the chest X-ray in only one of those two cases. The same situation was encountered in the three cases of pleuropulmonary TB sequelae, and it was not possible to evaluate the data found.

The early discovery and treatment of TB cases, as recommended by the Brazilian Ministry of Health, will contribute to controlling the disease and its sequelae,<sup>(1)</sup> thereby preventing many patients from becoming unable to work.<sup>(11,15-16)</sup>

Further studies involving longitudinal, sequential analysis and larger samples of patients should be conducted in referral centers for TB in Brazil. In addition, treatment protocols involving the use of bronchodilators and pulmonary rehabilitation should be established for patients with functional TB sequelae in order to improve their quality of life.

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