Original Research Article

To assess the pulmonary impairment in treated pulmonary tuberculosis patients using spirometry

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International Archives of Integrated Medicine, Vol. 3, Issue 10, October, 2016.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 09-09-2016 **Accepted on:** 25-09-2016
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Dhipu Mathew, Kirthana G, Krishnapriya R, Srinivasan R. To assess the pulmonary impairment in treated pulmonary tuberculosis patients using spirometry. IAIM, 2016; 3(10): 94-99.

Abstract

Background: Tuberculosis is one of the leading causes of death due to infectious Disease worldwide, with an estimated 8.9 million new cases and 1.6 million Deaths worldwide.

Aim: To study the type and degree of pulmonary impairment in treated pulmonary Tuberculosis patients using spirometry. To co -relate present symptoms and radiological findings and to assess the degree of impairment. For identification of impairment (obstructive, restrictive or mixed) that contribute to long term disability and decreased quality of life.

Materials and methods: Retrospective observational study was done in Meenakshi Medical College Hospital. A total of 75 treated pulmonary tuberculosis patients were taken for study with clinical data, chest x-ray pattern, smoking and biomass fuel exposure history were recorded. Their pulmonary function was assessed using spirometry.

Results: All patients were symptomatic and most common symptom was breathlessness. Chest radiograph showing 1 or 2 zones involved patients were 40 (53.3%) and more than 3 zones involved were 35 (46.7%).Most of the patients 51 (68%) showed a Restrictive pattern in spirometry, 10 (13.3%) showed an obstructive pattern and 14 (18.7%) showed a mixed pattern. Smoking and Bio-mass fuel exposure did not show a significant co-relation with spirometry pattern but initial sputum positive patients and defaulter patients showed a significant co-relation with spirometry pattern.

Conclusion: The most common pulmonary impairment pattern in treated pulmonary tuberculosis patients was Restrictive pattern. Hence pulmonary tuberculosis need follow up even after treatment for early detection and treatment for their pulmonary disability.

Key words

Tuberculosis patients, spirometry, Smoking, Chest radiograph, Breathlessness.

Introduction

Tuberculosis is one of the leading causes of death due to infectious Disease worldwide, with an estimated 8.9 million new cases and 1.6 million Deaths worldwide. It is unknown how many survivors of tuberculosis are living today; however, when the incidence of tuberculosis and the success of therapy are considered, the numbers of living tuberculosis survivors are substantial and increasing [1].

The presence of extensive residual lung lesions may be a predictor of permanent disability following tissue destruction, cor-pulmonale and susceptibility to opportunistic infections, leading to reduced quality of life. Histo -pathological findings resulting from tuberculosis include the formation of caseating granuloma, tissue liquefaction, and cavity formation [2]. When these occur in the lung, many survivors experience permanent anatomic changes. These result in pulmonary sequelae that are characterized by bronchial and parenchymal structural changes, including broncho-vascular distortion, bronchial stenosis bronchiectasis, emphysematous changes, residual cavities and fibrosis.

Additional evaluation for patients after tuberculosis has been cured is currently recommended only for those patients who have suggestions of disease recurrence [3].Studies of pulmonary function in individuals with pulmonary tuberculosis demonstrated variable patterns and severity of impairment. Pulmonary function studies can show restrictive, obstructive, or mixed patterns and range from normal to severe impairment. These findings are currently incompletely characterized. These patients do not completely represent the populations affected by tuberculosis. Accurate estimates of the frequency and extent of pulmonary impairment from tuberculosis are important to patients and clinicians. Pulmonary function tests (PFTs) objectively quantify lung function and impairment, and are used to evaluate persons with chronic lung disease [4]. To determine the pattern and extent of pulmonary function abnormalities that is attributable totuberculosis.

Materials and methods

Study setting

Study was conducted in Department of Respiratory Medicine, Meenakshi Medical College Hospital and Research Institute. Institutional ethics committee approval obtained.

Study design: Retrospective study design was used.

Period of study: September 2012 to September 2014.

Sample size: Seventy five patients were evaluated in the study.

Inclusion criteria: All treated pulmonary tuberculosis patients who has completed treatment according to RNTCP guidelines, now smear negative and declared cured.

Exclusion criteria: Patients who had any respiratory disorders like Bronchiectasis, Asthma, Interstitial lung diseases and prior history of ATT treatment.

Details of the study

This was a retrospective observational study with a sample consisting of 75 patients from Chest and TB Department, Meenakshi Medical College, Kanchipuram, Tamilnadu. The period of data collection was from November2012 to November 2013. The study included adult patients diagnosed with pulmonary tuberculosis treated over a period of 6months or more and declared cured according to RNTCP guidelines. Patients with tuberculosis in other organs, any respiratory disorders prior to ATT treatment were excluded from the study. Patients were selected by analyzing their previous records, presenting symptoms initial sputum status, Treatment duration, post treatment chest radiographs were recorded. The radiological

changes were ranked according to the number of zones involved. Information was collected through a standardized form with demographic data age, gender, ethnicity clinical data, medications and smoking habits. Next, we performed a spirometry with assessment of lung function using the variables: forced expiratory volume in 1s (FEV1), forced vital capacity (FVC), FEV1/FVC ratio. FVC, FEV1, FEV1/FVC ratio was compared with gender, ethnicity, height and weight. Airway obstruction was defined as anFEV1/FVC ratio of <70% and an FVC of >80% predicted, restrictive defects as an FEV1/FVC ratio of >70% and an FVC of <80% predicted, and mixed defects were FVC of <80% predicted and an FEV1/FVC ratio of <70%. Interpretive algorithms were used in determining restrictive or obstructive patterns [5].The device used was the Spirometer Koko Legent ML3500 (Microlab, USA). In the test the patient was seated with elbows bent and his mouth firmly attached to the mouthpiece. The nose clip was also used to prevent air leakage. The patient was asked to perform a forced expiration starting from total lung capacity (TLC). FVC maneuvers were performed three times; the best results were considered. Tests were performed according to Guidelines for Pulmonary Function Tests. The results were expressed as mean and standard deviation for data with normal distribution.

Statistical analysis

The analysis of categorical variables the chi-square test was used and for the analysis of continuous variables the t-test. All tests were performed using the statistical program Statistical Package for Social Sciences (SPSS) version 13.0 for Windows. We considered the significance level of 5% ($p<0.05$).

Results

Seventy five patients were taken for study. Their age, gender, present symptoms like cough, sputum, and breathlessness were noted. Smoking habit and bio-mass fuel exposure history was noted. Initial sputum status before treatment and duration of treatment, present chest radiograph and Spiro metric values were recorded. It was observed that most of the patients were among 40 to 70 years of age group who presented with respiratory symptoms and showed decrease in lung function. Among 75 patients, 19 (25.4%) were from 50 -59 years of age group and 19 (25.4%) were from 60-69 years of age group. 17 (22.7%) patients were within 40-49 years age group, 8 (10.6%) were within 30-39 years age group. The rest 4 (5.3%) were less than 30 years of age and 8 (10.6%) more than 70 years of age as per **Table - 1**.

Table - 1: Age distribution and spirometry pattern of patients studied.

Age group (years)	Pattern							
	Restrictive		Obstructive		Mixed		Total	
	No	%	No	%	No	%	No	%
<30	3	75.0	1	25.0	0	0.0	4	100.0
30-39	7	87.5	0	0.0	1	12.5	8	100.0
40-49	11	64.7	1	5.9	5	29.4	17	100.0
50-59	14	73.7	3	15.8	2	0.5	19	100.0
60-69	12	63.2	2	10.5	5	26.3	19	100.0
>70	4	50.0	3	37.5	1	12.5	8	100.0
Total	51	68.0	10	13.3	14	18.7	75	100.0

There was a male predominance in our study. It was observed that 51 (68%) of patients were males and 24 (32%) were females. The male: female ratio was 2.1:1 observed in this study. Most of the females who respiratory symptoms and showed pulmonary impairment were within

40 -60 years of age group and males were within 60-70 years of age group. Most of the patients were symptomatic, the most common presenting was breathlessness in63 patients (84%) followed by cough and sputum in 61 patients (81.3%). Out of 75 patients taken for study, 57 (76%) were sputum positive initially before tuberculosis treatment. Out of the 57 patients, 44 (77.2%) showed a Restrictive pattern, 3 (5.3%) patients showed a obstructive pattern and 10 (17.5%) patients showed a mixed pattern as per **Figure - 1**.

22 out of 75 patients were defaulters who had taken treatment for more than six months and have completed treatment under category 2 according to RNTCP guidelines. Out of 22 patients, 21 (95.5%) showed a Restrictive pattern. 1 (4.5%) patient showed a obstructive pattern as per **Table - 2**.

Figure – 1: Showing co-relation between Initial sputum status and spirometry pattern.

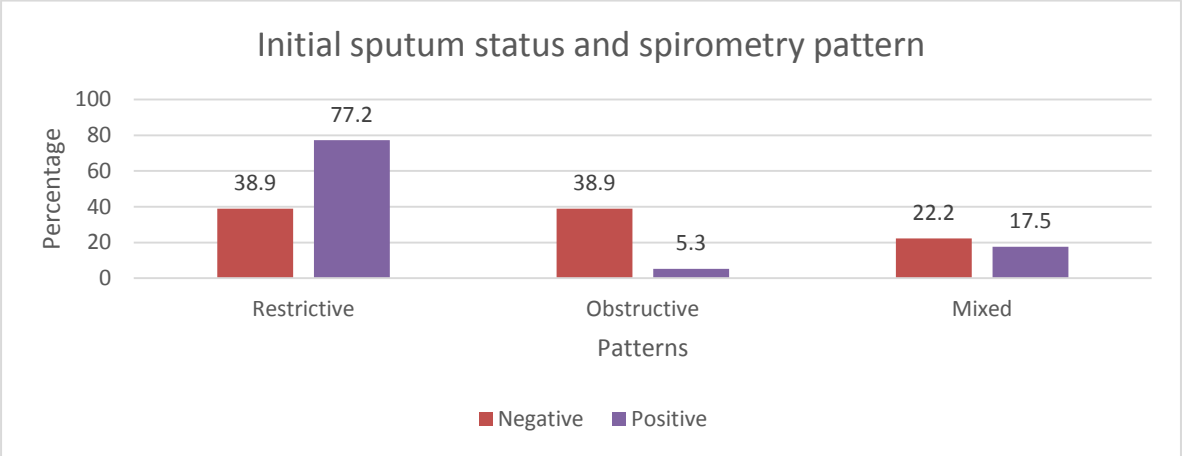

Table – 2: Comparing mean values between pattern.

Variables	Pattern	N	Mean	Std. Dev	F-Value	P-Value
FVC	Restrictive	51	53.71	14.045	23.849	<0.001
	Obstructive	10	84.1	9.171		
	Mixed	14	51.5	12.177		
	Total	75	57.35	16.789		
FEV1	Restrictive	51	51.9	14.731	5.528	0.006
	Obstructive	10	61	6.633		
	Mixed	14	42.36	13.276		
	Total	75	51.33	14.527		
FEV1/FVC	Restrictive	51	101.41	15.925	59.15	<0.001
	Obstructive	10	66	5.416		
	Mixed	14	63.93	5.484		
	Total	75	89.69	21.824		

Discussion

In our study, It showed a male predominance than females with a ratio of 2.1:1 and most patients were between fifty to seventy years age group and all the patients were symptomatic including cough, sputum and breathlessness due to pulmonary tuberculosis sequelae and showed decrease in pulmonary function We found no

differences between the groups in relation to the prevalence of smoking. Smoking and biomass fuel exposure are important factors in the decline in lung function, but apparently was not determinant in the differences found. However we found a strong co-relation between initial sputum status and pulmonary function impairment, also treatment defaulters who had taken treatment for more than six months also showed more decrease in lung function. In a previous study done by Jotam G. Pasipanody, et al. [6] done in health science Centre, University of north Texas states that most of the patients with treated pulmonary tuberculosis showed a restrictive pattern on spirometry, Pulmonary impairment was more common in cigarette smokers; however, after adjusting for demographic and other risk factors, the difference did not reach statistical significance. They concluded that pulmonary tuberculosis is associated with frequent pulmonary damage despite microbiological cure. In another study conducted by S.K. Verma, S. Kumar, Kiran, et al. [7] done at Chhatrapati Sahuji Maharaj Medical University, Lucknow, Uttar Pradesh, India. The authors found that out of 73 patients studied only 15 patients had obstructive airway disease by spirometry criteria, 21 patients had mixed obstructive with restrictive disorder. Restrictive pathology was seen in 37 patients. However, they concluded that the exact abnormality that results from tuberculosis infection has to be considered in detail with future studies and a better understanding of the pathophysiology of airflow limitation may point the way to therapeutic strategies for control of symptoms in these patients. Respiratory impairment arises from several anatomical features for example; damage to bronchi resulting from extensive fibrosis or endo bronchial stricture can cause airflow obstruction [8]. Greater lung volume loss appears to stem from parenchymal injury and subsequent fibrotic process [9]. Our study demonstrated the existence of significant functional limitations in patients with sequelae of pulmonary tuberculos is. These limitations are more obvious and serious when failure occurs initial treatment and second-line drugs are needed. Smoking and biomass fuel exposure history was not a significant predictor of pulmonary function deterioration but smear-positive disease extensive pulmonary involvement with poor radiological improvement and prolonged duration of treatment showed a significant co-relation with pulmonary function deterioration. These findings highlight the need for the strategies to prevent treatment non-compliance and subsequent rescue regimens.

Conclusion

In conclusion, the most common pulmonary impairment pattern in treated pulmonary tuberculosis patients was Restrictive pattern followed by mixed pattern and obstruction. After completion of pulmonary Tuberculosis treatment, the risk factors of pulmonary function deterioration include smear positive disease, extensive disease before treatment, prolonged treatment duration and less radiographic improvement after treatment. Hence pulmonary tuberculosis need follow up even after treatment for early detection and treatment for their pulmonary disability.

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