ORIGINAL ARTICLE

POST TB PULMONARY DISABILITY: AN ONGOING CHALLENGE FOR INDIA

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ABSTRACT

Introduction: Pulmonary tuberculosis can involve the airways, resulting in mucosal oedema, hypertrophy/hyperplasia of the mucosal glands, increased mucous secretion and smooth muscle hypertrophy. They affect the calibre of the airways, increase their resistance and decrease airflow. This study was planned to assess pulmonary disability by simple methods in symptomatic patients who were pulmonary tuberculosis survivors after successful treatment completion.

Methodology: The present study was a cross sectional study, conducted at the Department of Respiratory Medicine, Pramukhswami Medical College, Karamasd, Anand. Total 53 patients fulfilling the criteria were included in the study. All patients underwent thorough clinical assessment, six minute walk test (6MWT), and spirometry for assessment of pulmonary disability. Spirometry was done after holding bronchodilators for 24 hours. In spirometry, pre-bronchodilator FVC, FEV1, FEV1/FVC and post bronchodilator FVC, FEV1, FEV1/FVC were the chief variables analyzed.

Result: Out of total 53 patients, mean age of patients was 53.6 years. Maximum number of patients (14) (26.4%) were in the age group of 61-70 years. 42 (79.2%) were males and 11 (20.8%) were females. As per the WHO classification for BMI, 25 (47.2%) patients were underweight, 24 (45.3%) were in normal range and 4 (7.5%) were overweight. Spirometry pattern was normal in 3 patients, obstructive in 5 patients, restrictive in 20 (37.7%) patients and combined (mixed) in 25 (47.2%) patients. There was significant statistical difference between groups (spiometry pattern distribution) in context of mean weight. (P=< 0.001). According to the newly developed index, 2 (3.8%) patients belonged to class I, 1 (1.9%) patient to class II, 8 (15.1%) patients to class III, 10 (18.9%) patients to class IV and 32 (60.4%) patients belonged to class V pulmonary disability.

Keywords: Spirometry, Six minute walk test, BMI

INTRODUCTION

Most of the technologically advanced world has seen more than a century of declining incidence of tuberculosis (TB). The less developed world has also been so fortunate, and in these populous regions also the incidence of TB is decreasing. This is mainly due to continued efforts for early diagnosis, wide- spread availability of anti-TB drugs, advocacy and political commitment. India ranked first among the high-burden countries and contributed to 24% of the estimated global incident TB cases and about 20% of global TB-related deaths in 2013. Prevalence and incidence rates of all forms of tuberculosis were 211 and 171 respectively per 100,000 of population in 2013, showing a steady decline compared to previous years. Since its inception in 1997, the RNTCP has initiated almost 20 million patients on treatment.[1]

One of the underestimated areas for holistic TB management is post TB disability among cured patients. Pulmonary tuberculosis can involve the airways, resulting in mucosal oedema, hypertrophy/hyperplasia of the mucosal glands, increased mucous secretion and smooth muscle hypertrophy. They affect the calibre of the airways, increase their resistance and decrease airflow. The mechanism of fibrotic scarring can also result in reduced total lung capacity.[2] Therefore, delay in diagnosing TB has been shown to relate directly to the severity of pulmonary damage and the frequency of residual morbidities, negatively affecting the quality of life and leading to pulmonary disability.[3]

Some authors have stated that obstructive ventilatory disorder is the most often found disorder in patients with pulmonary TB sequelae, and the intensity usually varies in accordance with the extension of the lesion.[3] Nonetheless, the restrictive ventilatory disorder is predominant in patients with pleural TB sequelae.[4] Post tuberculosis disability can be assessed by spirometry, six minute walk test (6MWT), arterial blood gas analysis (ABG), lung diffusion capacity for

carbon monoxide (DLCO) and maximal oxygen consumption (VO2 max). The spectrum of post TB disability can be said to be a type of handicap as suggested by various studies.[5-7]

This study was planned to assess pulmonary disability by simple methods in symptomatic patients who were pulmonary tuberculosis survivors after successful treatment completion.

METHODOLOGY

Study Design: The present study was a cross sectional study, conducted at the Department of Respiratory Medicine, Pramukhswami Medical College, Karamasd, Anand. All patients from our outpatient department fulfilling following criteria were included in the study:

Inclusion criteria: Patients fulfilling all of the following criteria were included in the study

- Those who had completed treatment of pulmonary tuberculosis as per the RNTCP guidelines
- Those who were symptomatic in the form of i) cough ii) Dyspnoea iii) chest pain iv) fever v) haemoptysis and/or other constitutional symptoms
- Sputum smear for AFB negative at the time of study
- Willing to give informed written consent.

Exclusion criteria: Patients fulfilling any of the following criteria were excluded

- Smoker (current or former)
- Any other respiratory disease not a sequel of tuberculosis (e.g. bronchial asthma, COPD)
- Sputum smear positive for AFB at the time of study
- Cardiac co-morbidities of any type
- Not willing to participate/give informed written consent

Total 53 patients fulfilling the criteria were included in the study.

All patients underwent thorough clinical assessment, six minute walk test (6MWT), and spirometry for assessment of pulmonary disability. Spirometry was done after holding bronchodilators for 24 hours. In spirometry, pre-bronchodilator FVC, FEV1, FEV1/FVC and post bronchodilator FVC, FEV1, FEV1/FVC were the chief variables analyzed. Six minute walk test (6MWT) was performed as per the American Thoracic Society (ATS) Guidelines for the Six Minute Walk Test and analysed by an equation derived by a recent Indian study. During 6 minute walk test, parameters assessed were 6 minute walk distance (6MWD), oxygen saturation, pulse rate and respiratory rate.

Table 1: Reference Equation for 6-Minute Walk Test in Healthy Indian Subjects (25-80 Years).[8]

Gender (25-80)	Reference equation	Coefficient of determination (R2)	Residual SD n
Indian males	561.022-(2.507*age[years]+(1.505*weight[kg]-(0.055*height[cm])	0.288	62.36
Indian females	-30.425-(0.809*age[years]-(2.074*weight[kg]+(4.235*height[cm])	0.272	76.91

Tool used to assess pulmonary disability

A newer tool was developed and used in which pulmonary disability was classified by spirometry and six minute walk test as these tests do not require an advanced set up like those required to measure DLCO and VO2 max.

Table 2: Classification of Pulmonary Disability According to New Tool

Factor	Class					
	0	I	II	III	IV	V
FEV1,% of predicted	>=80% and	70-79 % and/or	60-69 % and/or	50-59 % and/or	40-49 % and/or	<40 % and/or
FVC, % of predicted	>= 80% And	70-79 % and/or	60-69 % and/or	50-59 % and/or	40-49 % and/or	<40 % and/or
6MWD, % of predicted	>= 80%	70-79%	60-69 %	50-59 %	40-49 %	<40 %

Permission of the Institutional Human Research Ethics Committee was taken to conduct the study. Informed consent was taken from all patients included in the study and patient information sheets in local language were provided to all patients. Patients not willing to give informed written consent were excluded from the study without affecting the course of management.

RESULTS

Total 53 patients were enrolled in the study. All patients underwent thorough clinical assessment, six minute walk test (6MWT), and spirometry for assessment of pulmonary disability.

Table 3: Profile of study participants (N=53)

Variable	No. (%)
Age	
<= 40	8 (15.1)
41-50	12 (22.6)
51-60	13 (24.5)
61-70	14 (26.4)
>= 71	6 (11.3)
Gender	
Male	42 (79.2)
Female	11 (20.8)
Body Mass Index (BMI)Kg/m2	
Under Weight, <18.5	25 (47.2)
Normal, 18.5-24.9	24 (45.3)
Overweight, 25.0-29.9	4 (7.5)
Spirometry Pattern Distribution	
Combined	25 (47.2)
Restrictive	20 (37.7)
Obstructive	5 (9.4)
Normal	3 (5.7)

Table 4: BMI and spirometry pattern distribution

Defect	BMI			Total
	Underweight	Normal	Overweight	
Normal	0	1	2	3
Obstructive	0	4	1	5
Combined (Mixed)	16	9	0	25
Restrictive	9	10	1	20

Table 5: Relation between spirometry pattern distribution and weight

Spirometry Pattern	No.	Mean (weight)	SD	p-Value
Combined	25	47.32	9.25	<0.001
Normal	3	70	11.79	
Obstructive	5	59.80	7.12	
Restrictive	20	47.4	11.53	

Table 6: Severity Wise Distribution

Pulmonary Disability	No. (%)
Class 0	0
Class I	2 (3.8)
Class II	1 (1.9)
Class III	8 (15.1)
Class IV	10 (18.9)
Class V	32 (60.4)

Out of total 53 patients, mean age of patients was 53.6 years. Maximum number of patients (14) (26.4%) were in the age group of 61-70 years. 42 (79.2%) were males and 11 (20.8%) were females. As per the WHO classification for BMI, 25 (47.2%) patients were underweight, 24 (45.3%) were in normal range and 4 (7.5%) were overweight. Spirometry pattern was normal in 3 patients, obstructive in 5 patients, restrictive in 20 (37.7%) patients and combined (mixed) in 25 (47.2%) patients.

Spirometry pattern was normal in 3 patients, among these, 1 patient had normal BMI according to WHO classification and 2 were overweight. Five patients had obstructive defect, among which 3 had normal BMI and 1 was overweight. 20 patients had restrictive defect among these 16 were underweight and 9 had normal BMI. 25 patients had combined defect and among these 10 patients had normal BMI, 9 patients were underweight and 1 patient was overweight.

There was significant statistical difference between groups (spiometry pattern distribution) in context of mean weight. (P=< 0.001)

According to the newly developed index, 2 (3.8%) patients belonged to class I, 1 (1.9%) patient to class II, 8 (15.1%) patients to class III, 10 (18.9%) patients to class IV and 32 (60.4%) patients belonged to class V pulmonary disability.

DISCUSSION

Pulmonary tuberculosis can involve the airways, resulting in mucosal oedema, hypertrophy/hyperplasia of mucosal glands, increased mucus secretion and smooth muscle hypertrophy. This affects the calibre of airways, increases their resistance and decreases their airflow. The mechanism of fibrotic scaring can also result in reduced in total lung capacity. Therefore, delay in diagnosing TB has been shown to relate directly to the severity of pulmonary damage and the frequency of residual respiratory morbidities, negatively affecting the quality of life and leading to pulmonary disability.

In our study, out of total 53 patients, 42 were male and 11 were female. Maximum patients were from the age group of 61 to 70 years. Spirometry pattern was normal in 3 (5%), obstructive ventilatory defect in 5 (9%), restrictive ventilatory defect in 20 patients (37%) and combined (mixed) ventilatory defect in 25 patients (47%).

Various studies have been reported to document respiratory impairment due to complications of pulmonary tuberculosis. Lucia Maria et al showed that out of 50 patients, 36 (72%) presented with symptoms such as cough, wheezing, expectoration and mixed ventilatory disorder was the most prevalent tuberculosis sequel, being present in 17 cases (34%), followed by obstructive ventilatory disorder in 12 cases (24%), and restrictive ventilatory disorder in 9 cases (18%).[9]

Another similar study by K. Sailaja et al[10] showed that out of total 56 patients, 35 patients (62.5%) had obstructive ventilatory defect, 12 patients (21.42%) had

mixed ventilatory defect and 9 patients (16.07%) had restrictive ventilatory defect. Among 35 cases of obstructive ventilatory defect, 12 patients (34.28%) had mild, 18 patients (51.42%) had moderate and 5 patients (14.28%) had severe obstruction.

In our study, all 53 patients performed 6 minute walk test (6MWT) and results were analyzed according to an equation derived from a recent Indian study done by Ramanathan RP, Chandrasekaran B.[8] In that study, 125 healthy subjects over 25 years of age were included. All subjects selected for study presented with clinical stability, defined as the absence of any acute disease during the 6 weeks preceding the study and those having chronic disease were excluded from the study and reference equation for healthy individuals was derived. Using this equation for our study, we found that 3 patients (5%) could walk > 100 %, 8 patients (15%) could walk 81 % - 100 %, 29 (54%) patients could walk 51 %-80 % and 13 (24%) patients could walk less than 50 % of predicted six minute walk distance (6MWD). Average predicted distance was 444.37m and average test distance was 329.2m.

As per the new tool used in our study it was observed that 2 (3.8%) patients belonged to class I, 1 (1.9%) patient to class II, 8 (15.1%) patients to class III, 10 (18.9%) patients to class IV and 32 (60.4%) patients belonged to class V pulmonary disability. It shows that majority of the patients had significant respiratory impairment and more than 70 percent of the patients belonged to class IV and V, collectively.

CONCLUSION & RECOMMENDATION

There is high prevalence of post tuberculosis pulmonary disability in our country and it can be assessed by simple methods including spirometry and six minute walk test (6MWT). The Revised National Tuberculosis Control Program (RNTCP) should provide clear guidelines for assessment of post TB disability and establish pulmonary rehabilitation programs to cope up with this challenge.

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