



A study to assess the clinico-radiological and spirometric profile of post tuberculosis patients in a tertiary care centre

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Article History:

Received on: 18 Aug 2020

Revised on: 25 Sep 2020

Accepted on: 01 Oct 2020

Keywords:

Dyspnoea,
Forced Expiratory
Volume in one second,
Mid Expiratory Flow
rate,
Obstructive spirometry,
Tuberculosis

ABSTRACT

Tuberculosis is an infectious disease which has affected millions of people around the world. Ten million new TB cases were identified globally in 2018, with an estimated 1.2 million deaths. Lung function impairment often occurs due to the destruction of the lung parenchyma. This causes ventilatory abnormalities, often of obstructive type. Radiological lesions are also a common consequence of pulmonary tuberculosis. This study aims to analyse the various clinical features and assess the spirometric and radiological findings in post TB patients. This is a prospective observational study. All patients visiting the Chest Medicine OPD of Saveetha Medical College and Hospital who had a history of treated pulmonary tuberculosis and were above 18 years of age were included in this study. Patients who had no signs of active Tuberculosis underwent spirometry, and a chest x-ray was taken. Clinical presentation, spirometric parameters and radiological lesion were analysed. Among the 76 patients included in this study, 73.7% were male with most patients aged between 51 to 60 years. 64.5% of the study population were smokers. Dyspnoea (94.73%) was found to be the most common presenting complaint. Obstructive pattern (49%) was found to be the most common type of spirometric pattern with 68.42% having small airway disease. Based on the Wilcox classification, Degree II (47.37%) was the most common extent of the radiological lesion. It was found that there is a statistically significant difference between smokers and non-smokers in post-bronchodilator FEV1 ($p=0.037$) and FEF25-75 values ($p=0.010$). This study reveals the presence of post tuberculosis lung impairment in the population with varying presentations and severity. Hence, further studies and interventions are required to improve the quality of life of post tuberculosis patients.

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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v11iSPL4.4304>

Production and Hosted by

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INTRODUCTION

Tuberculosis is an infectious, granulomatous disease caused by the acid-fast bacilli, *Mycobacterium tuberculosis*. According to the WHO Global tuberculosis report 2019, 10 million new TB cases were identified globally in 2018, with an estimated 1.2 million deaths (WHO, 2019). In India, 24 lakh cases of Tuberculosis were notified in 2019, out of which 90% of the cases were incident TB (new or recurrent/relapse) cases (India TB report, 2020). An important consequence of pulmonary tubercu-

losis is the destruction of lung parenchyma caused by the up-regulation of proteases and dysregulation of protease control which occurs in Mycobacterium infections (Dheda *et al.*, 2005). Completion of tuberculosis treatment significantly decreases the extent of the parenchyma attack (Bombarda *et al.*, 2003). However, it still causes a vast array of histopathological abnormalities. Despite being completely cured, some patients exhibit significant lung function impairment of all three types (obstructive, restrictive or mixed) but mainly of obstructive type due to lung destruction and inflammation (Sailaja and Rao, 2015).

Despite adequate treatment and clinical response, the majority of the patients are left with residual radiological sequelae (Nima *et al.*, 2015). Chest X-rays often show signs of fibrosis, bronchiectasis and cavitations (Meghji *et al.*, 2016). A greater extent of the radiological lesion is generally associated with a higher degree of airflow limitation (Hwang *et al.*, 2014). Smoking is also presumed to have an association with the limitation of airflow to the lungs. However, only limited data is available regarding the potential role of smoking in post TB lung disease. This study aims to analyse the various clinical features and assess the spirometric and radiological findings in post TB patients.

MATERIALS AND METHODS

This is a prospective observational study carried out in the Department of Chest Medicine of Saveetha Medical College and Hospital, Chennai from January 2020 to March 2020.

Inclusion criteria

1. All patients visiting the Chest Medicine OPD who had a history of treated pulmonary Tuberculosis and were above 18 years of age were included in this study.

Exclusion criteria

1. Patients with active pulmonary Tuberculosis (based on two sputum smears for acid-fast bacilli testing and chest x-rays).
2. Inadequately treated pulmonary Tuberculosis (i.e. wrong anti-tubercular drug regimen, inadequate dosage, incomplete course of treatment).
3. Patients with a prior history of chronic lung disease or lung carcinoma before the onset of Tuberculosis

4. HIV positive patients.

Patients who fit the above criteria were asked to provide informed consent, and a thorough history was elicited. Information regarding past tuberculosis history and its treatment was also recorded. The extent of smoking was determined by calculating the "Smoking Index". If SI<100, the person was considered as a mild smoker, if SI=100-300 the person was considered a moderate smoker and if SI>300 the person was considered as a heavy smoker.

General survey, vital signs and detailed respiratory system examination findings were also recorded. Chest X-ray (posteroanterior view) was done to evaluate signs of inactive TB. The chest X-Ray was assessed based on Wilcox classification (Willcox and Ferguson, 1989). Each lung was divided into three zones, and the extent of lesions (fibrosis, cavitation, parenchymal calcification and bronchiectasis) was described as follows:

Degree I - Minimum involvement of only one zone, without cavitation.

Degree II - Involvement of two or three zones with/without cavitation or involvement of one zone with cavitation.

Degree III - Severe involvement of more than three zones with or without cavitation.

"Others" - Normal chest X-ray, hyperinflation of the lung, thickening of pleura, calcification or any other abnormality.

Subsequently, spirometric evaluation was done before and fifteen minutes after administration of a bronchodilator. FEV1 (Forced Expiratory Volume in one second), FVC (forced vital capacity), PEFR (Peak Expiratory Flow Rate) and FEF 25-75 (Mid-expiratory flow rate) were recorded for all patients.

Based on the spirometric findings and clinical symptoms, the patients were diagnosed with obstructive, restrictive, mixed lung disease or said to have normal spirometry. The presence of small airway disease was also determined. Furthermore, the obstructive cases were further classified based on GOLD criteria (i.e., FEV1 \geq 80% - mild, FEV1=50 to 79% - moderate, FEV1= 30 to 49% - severe and FEV1<30% - very severe).

All the procedures followed in our study are under the ethical standards of the Institutional Committee, and informed consent was obtained from the study population.

RESULTS

This prospective study was done with a sample size of 76 patients who had a prior history of treated PTB and came to the chest medicine OPD with respiratory complaints in the study period. Amongst the study population, there were 20 females and 56 males.

The mean age of the study population was found to be 52.8±14.3 years with most of the patients aged between 51 to 60 years [Figure 1]. The mean BMI of the study population was found to be 22.07±3.05. Most of the study population (59.21%) had a BMI of 20-25. [Figure 2]

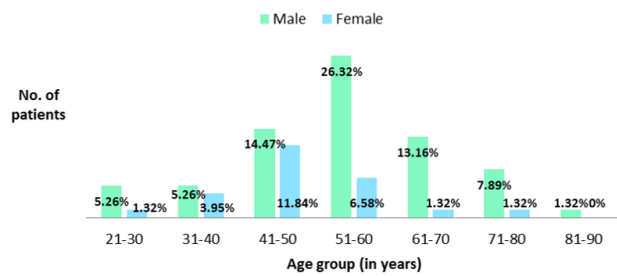


Figure 1: Age and sex distribution of the study population

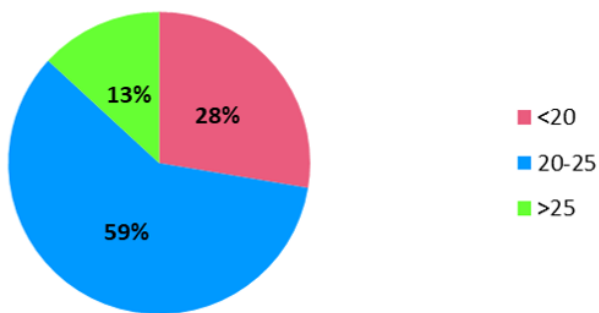


Figure 2: BMI of the study population

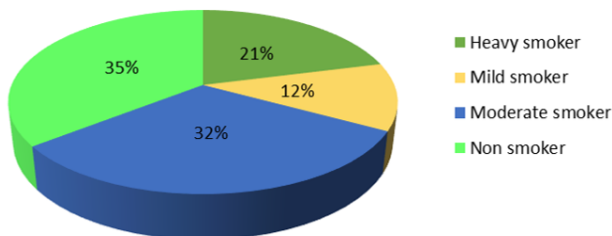


Figure 3: Smoking status of the study population

There were 49 smokers and 27 non-smokers in the study population. Among the smokers, 9 were mild smokers, 24 were moderate smokers, and 16 were heavy smokers [Figure 3]. Dyspnoea was found to be the most common presenting complaint with 94.73% of the patients complaining of dyspnoea

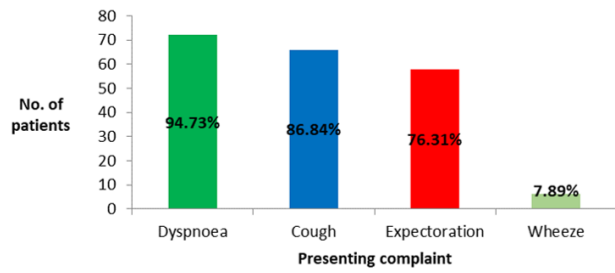


Figure 4: Clinical Presentation

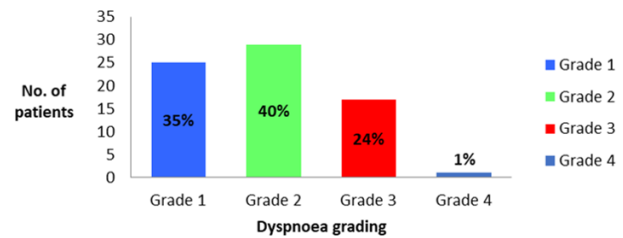


Figure 5: Dyspnoea grading of the study population

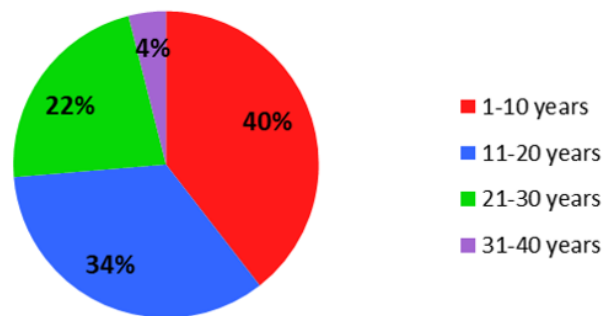


Figure 6: Past TB history of the study population (no. of years since TB treatment)

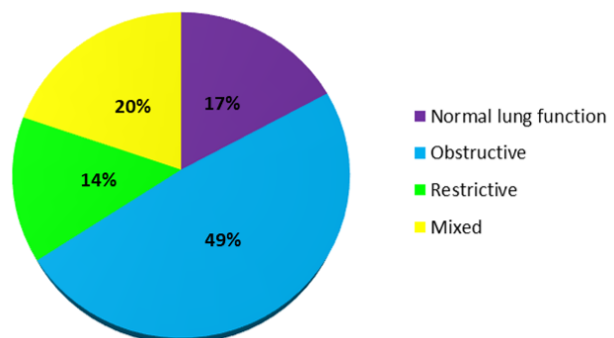


Figure 7: Distribution of Spirometry pattern in the study population

Table 1: Comparison of Past TB history of the study population with spirometry pattern

No. of years since TB treatment	Mixed	Normal	obstructive	Restrictive	Total
1-10 years	4	10	9	7	30
11-20 years	3	2	19	2	26
21-30 years	7	1	7	2	17
31-40 years	1	0	2	0	3
Total	15	13	37	11	76

Table 2: Comparison of spirometry pattern with extent of radiological lesion

Radiological lesion extent	Normal	Obstructive	Restrictive	Mixed	Total
Degree 1	6	7	2	4	19
Degree 2	4	18	6	8	36
Degree 3	0	8	2	3	13
Others	3	4	1	0	8
Total	13	37	11	15	76

Table 3: Comparison of extent of radiological lesion with severity of airflow obstruction

Radiological extent	Mild	Moderate	Severe	Very severe	Total
Degree 1	0	4	2	1	7
Degree 2	0	5	10	3	18
Degree 3	0	1	3	4	8
others	0	2	2	0	4
Total	0	12	17	8	37

Table 4: Comparison of post bronchodilator values between Smokers and Non smokers

Spirometric Parameters	Smokers	Non Smokers	p-value
FVC% predicted	62.59±17.66	60.63±22.55	0.676
FEV1% predicted	48.59±18.01	58.41±21.47	0.037
PEF% predicted	55.86±21.34	63.78±25.39	0.152
FEF25-75% predicted	44.18±27.77	61.22±24.85	0.010

[Figure 4]. mMRC Grade 2 was found to be the most common dyspnoea grade [Figure 5]. Other complaints included Cough (86.84%), expectoration (76.31%) and wheeze (7.89%). Most patients (40%) were treated for TB in the past 10 years [Figure 6]. Obstructive pattern (49%) was found to be the most common type of spirometric pattern followed by mixed (20%) and normal (17%) pattern [Figure 7]. Among the study population, small airway disease was present in 52 patients (68.42%).

Based on the Wilcox classification, Degree II (47.37%) was the most common extent of the radiological lesion followed by Degree I (25%) and Degree III (17.11%) [Table 2]. Among the obstructive cases, 7 cases were degree I, 18 cases

were degree II, 8 cases were degree III, and four belonged to the 'others' category. Most of the cases with normal spirometric pattern had been treated for Tuberculosis within the past ten years [Table 1]. Most of the obstructive cases (45.95%) had severe airflow obstruction [Table 3].

Post bronchodilator percentage predicted FVC, FEV1, PEF and FEF25-75 values were compared between smokers and non-smokers. While no significant difference between the two could be found for FVC and PEF, it was found that there is a statistically significant difference between smokers and non-smokers in post-bronchodilator FEV1 (p=0.037) and FEF25-75 values (p=0.010). [Table 4]

DISCUSSION

While Tuberculosis is curable, the patients often experience a permanent alteration in lung function, which eventually leads to chronic lung disease. This study done to assess the clinical, radiological and spirometric profile of post pulmonary tuberculosis patients yielded interesting results which are discussed below.

The mean age of the study population was found to be 52.8 ± 14.3 years, with most of the patients were aged between 51-60 years. This is similar to a study by Santra et al. in which the mean age was 53.39 ± 13.86 years with most of the patients (30.43%) aged between 60- 69 years (Santra et al., 2017).

As per our study, out of the 76 participants, 49 (64.47%) were smokers, and 27 (35.53%) were non-smokers with most of the smokers being moderate smokers. A similar study by Chushkin et al. reported that 64.5% of the study population were smokers, while 35.5% were non-smokers. (Chushkin and Ots, 2017). A study by Panda et al. shows that of the 101 participants, 77 patients (76.2%) were non-smokers while 24 patients (23.7%) were either smokers or ex-smokers (Panda et al., 2016). A study by Santra et al. revealed that 43.48% of the study population were smokers, while 56.52% were non-smokers. Among the smokers, most of them were heavy smokers (Santra et al., 2017). This might be due to the reason that their study population included only obstructive and mixed pattern

In our study, 94.7% of patients complained of dyspnoea, while 86.8% complained of cough and 76.3% complained of cough with expectoration. The most common mMRC dyspnoea grading was grade II (40.28%) followed by grade I (34.72%). This was similar to a study conducted by Soni et al. in which 93.75% of the study population complained of dyspnoea while only 52.5% complained of cough with expectoration (Soni et al., 2016). These results are comparable to the ones obtained by Ghosh et al. in which 72% of the patients had dyspnoea and all of the study participants complaining of cough with 80% having expectoration (Ghosh and Bandyopadhyay, 2006).

In our study, it was observed that the obstructive pattern was the most commonly observed spirometric abnormality (49%). This was comparable to the results obtained in a study by Patil et al., which demonstrated an obstructive pattern in around 42% of the study population (Patil et al., 2018). A study by Chushkin et al. observed that 34.6% of the study

population had an obstructive pattern (Chushkin and Ots, 2017).

A study by Soni et al. reported that 31 out of 80 patients (38.75%) had mixed ventilatory impairment and 25 patients (31.25%) had the obstructive pattern (Soni et al., 2016). However, only 20% of our study population had a mixed pattern which may be due to most of our study population being smokers with less than ten years since tuberculosis treatment. A study by Ngahane et al. shows that most patients had no lung function impairment (54.6%) while restrictive type (36.1%) was the most common ventilatory disorder followed by mixed (5.2%) and obstructive (4.1%) type (Ngahane et al., 2016). In our study, only 17% of the patients had a typical spirometric pattern. This might be due to the reason that they only included patients who were treated for Tuberculosis within three years before the study. A study by SA Satti et al. revealed that most patients (43.3%) had a restrictive pattern followed by obstructive (25%) pattern (Satti et al., 2020). In our study, only 14% of the study population had a restrictive abnormality. This might be due to the reason that all cases with a history of smoking were excluded from their study.

A study by Akkara et al. on post tuberculosis reported that 38% had degree II lung involvement (Akkara et al., 2013). Our study had similar results with degree II being the most common (47.37%) extent of radiological involvement. A study by Santra et al. on post tuberculous obstructive airway disease involving only obstructive and mixed pattern, degree II (52.17%) was found to be most common (Santra et al., 2017). Similar results were observed in our study, with 48.65% of the obstructive cases having degree II radiological involvement.

Among the obstructive cases in our study, most (45.95%) of the cases had a severe degree of obstruction. A similar result was obtained in a study by Akkara et al. which showed that most (35.8%) of the study population had a severe degree of obstruction (Akkara et al., 2013). Our study compared post-bronchodilator percentage predicted values of FVC, FEV1, PEF and FEF25-75 between smokers and non-smokers. It was found that there is a statistically significant difference in post-bronchodilator FEV1 and FEF25-75 values among smokers and non-smokers. However, the association between smoking and post Tuberculosis lung impairment is inconsistent and rarely studied. Several similar studies by Santra et al., Chung et al., and Lee et al. have found no significant association between the same (Santra et al., 2017; Chung et al., 2011; Lee et al., 2011).

CONCLUSION

Very few studies have been conducted on the permanence of post-tuberculosis lung impairments. However, considering the negative impact on the quality of life of individuals affected by this condition, it is essential to understand and prevent such occurrences. From this study, we can conclude that post pulmonary tuberculosis patients commonly present with dyspnoea and cough with or without expectoration and predominantly show an obstructive spirometric pattern with degree II lung involvement. Physicians should be aware of the problems arising after treatment of pulmonary tuberculosis and counsel the patients on the same to detect such abnormalities at the earliest.

Funding Support

The authors declare that they have no funding support for this study.

Conflict of interest

The authors declare that they have no conflict of interest for this study.

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