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Original Article

Internal Medicine Section

Clinical, Radiological and Spirometric Analysis of Treated Tuberculosis Patients- A Cross-sectional Study

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ABSTRACT

Introduction: Post-Tuberculosis (TB) complications may involve the lungs, mediastinum, pleura, chest wall, or any combination of these structures. It can also affect the caliber of the airways which might lead to the increase in their resistance and decrease in the airflow, severely impairing the quality of life. Due to a lack of controlled trials in this population, no evidence-based recommendations for the investigation and management of post-TB complications are currently available.

Aim: To study the clinical symptoms, radiological involvement and the spirometry pattern of previously treated TB patients.

Materials and Methods: This cross-sectional study was conducted in the Department of Respiratory Medicine, Shri MP Shah Government Medical College and Guru Govind Singh Government Hospital, Jamnagar, from July 2018 to December 2019. Total 102 patients with history of TB and currently sputum negative were enrolled in the study. All patients underwent clinical examination, microbiological examination, chest radiograph, and spirometry. Data was collected from case record form and entered into MS Excel spreadsheet 2016. Data analysis was done in Statistical Package of Social Science (SPSS) software version 26.0.

Results: Out of the 102 patients, there were 66 (64.71%) males and 36 (35.29%) females. Of the study population, 13 (12.74%) was asymptomatic, 7 (6.86%) had dyspnoea, 17 (16.66%) had cough and 65 (63.72%) had both cough and dyspnoea. Spirometry analysis revealed that 26 (25.49%) were normal, 6 (5.88%) had restrictive pattern, 69 (67.64%) had obstructive pattern and 1 (0.98%) had mixed pattern. Chest radiograph revealed unilateral chest involvement in 78 patients (76.47%) and 24 patients (23.52%) had bilateral chest involvement.

Conclusion: There is high prevalence of post-TB pulmonary disability causing clinical symptoms, radiological involvement and spirometry changes and thus should be assessed early to prevent further complications.

Keywords: Chest radiograph, Dyspnoea, Obstructive pattern, Pulmonary disability, Restrictive pattern, Spirometry

INTRODUCTION

Tuberculosis remains a significant cause of global morbidity and mortality [1,2]. About 10 million people developed TB and 1.4 million people died from TB in 2019, with most of the cases in developing countries [1]. Pulmonary Tuberculosis (PTB) can cause variable changes in pulmonary parenchyma. These changes range from pulmonary infiltrate to parenchymal lung devastating [3]. One of the most devasting sequelae of TB is Tuberculosis-destroyed Lung (TDL). Decreased lung and airway volume in patients with TDL are associated with progressive lung function decline, respiratory failure and pulmonary disabilities [4]. Greater lung injury has been associated with smoking, malnutrition, delayed diagnosis of TB, number of previous treatments, and a high bacillary load at the beginning of anti TB treatment [5].

On chest radiograph, even minimal scar change may lead to airflow limitation [6,7]. The changes resulting from PTB that are seen after treatment, present as Restrictive Lung Disease (RLD), Obstructive Lung Disease (OLD), or Mixed Obstructive-Restrictive Lung Disease (MORLD) [8]. Ventilation impairment in lung function is usually restrictive during active PTB treatment phase. This may persist, resolve, or change to an obstructive pattern later [9,10]. TB patients have higher odds of permeant functional changes (restrictive or obstructive pattern) in comparison to patients without TB [11,12].

Thus, this study was conducted to know the most common symptoms leading to discomfort in patients along with the radiological and spirometry analysis in these patients.

MATERIALS AND METHODS

A cross-sectional study was conducted at the Department of Respiratory Medicine, MP Shah Government Medical College, and Guru Govind Singh Government Hospital, Jamnagar, from July 2018 to December 2019. The Institutional Ethics Committee approved the study vide letter number IEC/Certi/95/2018. A 102 consecutive patients who visited the Outpatient Department (OPD) during the study period, fulfilling the following criterion, were included in the study.

Inclusion criteria:

- Patients having history of (sputum positive/sputum negative) PTB who have completed the treatment (drug sensitive, multidrug resistant or extensive drug resistant).
- Patients confirmed as currently sputum negative by microbiological examination.
- Patient aged more than 18 years.
- Smoker or non smoker.
- Patients who were treatment defaulters and who had relapse of TB but were currently sputum negative.

Exclusion criteria:

- HIV positive patient.
- Pregnant female.
- Recent upper abdominal surgery.
- Ischaemic heart diseases patient.
- Kyphoscoliosis.
- Any other respiratory diseases not a sequel of TB. (e.g., bronchial asthma, chronic obstructive pulmonary diseases).
- Patient not willing to give informed consent.

Informed consent was obtained from all patients included in the study and patient information sheets in local language were provided to all patients. All patients underwent detailed history and physical examination. Patients with history and clinical features suggestive of

reactivation of PTB underwent sputum microbiological assessment and if it was negative, they were enrolled in the study. Radiological assessment was carried out through Chest X-ray Postero-anterior (PA) view. Pre and postbronchodilator spirometry assessment was conducted after holding bronchodilator (if on any) for 24 hours and then analysed.

STATISTICAL ANALYSIS

Data was collected from case record form and entered into MS excel 2016. Data analysis was done in SPSS software version 26.0.

RESULTS

In the present study, the most common involved age group was among 26-49 years and males were predominantly involved. Majority of the patients were labourers and residing in rural areas. Significant number of patients were non smokers [Table/Fig-1].

Parameters	Frequency
Age (years)	
18-25	28
26-49	40
>50	34
Gender	
Males	66
Females	36
Occupation	
Labourers	47
Homemaker	22
Student	21
Office worker	12
Residence locale	
Rural	62
Urban	40
Smoking status	
Smokers	34
Non smokers	68

[Table/Fig-1]: Demographic data.

Most of the patients were having cough along with dyspnoea followed by cough alone and dyspnoea. Few patients were asymptomatic [Table/Fig-2]. Majority of the patients were having unilateral lung involvement in comparison to bilateral lung involvement. In the current study, fibrosis was the most common abnormality followed by bronchiectasis [Table/Fig-3].

Parameters	Frequency
Cough	17
Cough and dyspnoea	65
Dyspnoea	7
No complaints	13

[Table/Fig-2]: Clinical complaints.

Involvement	Findings
Unilateral lung involvement (78)	
Bronchiectasis	16 (20.50%)
Fibrosis	37 (47.45%)
Both	25 (32.05%)
Bilateral lung involvement (24)	
Bronchiectasis	8 (33.33%)
Fibrosis	7 (29.16%)
Both	9 (37.50%)

[Table/Fig-3]: Radiographic findings based on the lung involvement.

Obstruction is the most common spirometry abnormality found followed by restrictive and mixed type. Significant number of patients was having normal spirometry [Table/Fig-4].

Pattern	Number	Obstruction
Normal	26	
Obstructive	36	Mild
	18	Moderate
	15	Severe
Restrictive	6	
Mixed	1	

[Table/Fig-4]: Spirometry analysis.

In smokers, 32 patients were having abnormal spirometry pattern out of 34 which is 94.11% in comparison to non smokers which is 64.71% (44 out of 68) [Table/Fig-5]. In males, 54 patients were having abnormal spirometry pattern out of 66 which is 81.81% in comparison to females which is 61.11% (22 out of 36) [Table/Fig-6]. In the patients having recurrent TB in the past, 22 patients were having abnormal spirometry pattern out of 37 patients, which is 59.45% in comparison to non recurrent TB cases which is 83.07% (54 out of 65) [Table/Fig-7].

Smoking status	Number	Pattern
Smoker (n=34)	28	Obstructive
	4	Restrictive
Non smoker (n=68)	41	Obstructive
	2	Restrictive pattern
	1	Mixed

[Table/Fig-5]: Spirometry analysis among smokers and non smokers.

Gender	Number	Pattern
Male (n=66)	48	Obstructive
	6	Restrictive
Female (n=36)	21	Obstructive
	1	Mixed

[Table/Fig-6]: Spirometry analysis with gender.

History of recurrent TB	Frequency
Recurrent TB in the past (n=37)	
Mild obstruction	10
Moderate obstruction	6
Severe obstruction	6
Total patients with obstruction	22 (21.5%)
Not a case of recurrent TB (n=65)	
Mild obstruction	24
Moderate obstruction	12
Severe obstruction	11
Restrictive pattern	6
Mixed pattern	1
Total patients with obstruction	54 (52.9%)

[Table/Fig-7]: Comparison of Spirometry analysis based on history of Recurrent Tuberculosis (TB).

DISCUSSION

Despite the fact that Post-Tubercular Obstructive Airways Diseases (post-TB OAD) has been well-documented for many years, TB patients are not routinely counselled or followed-up on for post-Tuberculous sequelae. Such patients are frequently misdiagnosed with TB on multiple occasions based on chronic cough, expectoration, or haemoptysis. Even though the exact pathophysiology of post-TB OAD is uncertain, an immunological

theory has been suggested. It has also been postulated that TB annihilates lung parenchyma by up-regulating numerous proteases and dysregulating the protease control mechanism. Matrix metalloproteinase-induced pulmonary damage results in cicatricial transformation of lung tissue, and such fibrotic changes are almost certainly responsible for the associated restrictive disorder [13].

Long-term pulmonary complications and sequelae from PTB include lung fibrosis, endobronchial stenosis, bronchiectasis, aspergilloma, and chronic airway narrowing. It has also been demonstrated to be a risk factor for developing lung cancer [14]. Such a sequel frequently results in complications like pulmonary hypertension, cor pulmonale, recurrent respiratory infections, and haemoptysis. These patients' typical daily behaviours are also affected, which leads to low Quality of Life (QoL), an increased financial burden, and a negative psychological impact [15]. In PTB, patients who still have pulmonary impairment after anti TB therapy, the infection is reduced, and the lung function is improved. For a small group of patients, straightforward spirometry has been used to investigate the type of pulmonary impairment. The clinical and spirometry profiles of such post-TB OAD patients were evaluated in the current study. [Table/Fig-8] shows the spirometry pattern in different studies [16-18].

Study	Sample size	Gender	Mean age (in years)	Specific pattern
Patil S et al., 2018 [16]	1000 (Symptomatic-500 Asymptomatic-500)	M-64%, F-36% (Symptomatic group) M-56%, F-44% (Asymptomatic group)	42±11 y (Symptomatic group) 48±9 y (Asymptomatic group)	42% obstructive, 18% mixed (Symptomatic group) 32% obstructive, 14%-mixed (Asymptomatic group)
Mancuzo EV, et al., 2020 [17]	418 (Spirometry acceptable-378)	LDS+(174) M-66%, F-34% LDS-(204) M-84%, F-16%	LDS+(>49 y) LDS-(30-49 y)	LSD+ (33.3% obstructive, 10.9% restrictive, 28.2% mixed) LSD- (20.6% obstructive, 24.7% restrictive, 8.9% mixed)
Santra A 2017 [18]	138	M-84% F-16%	53.39±13.86 y	27.5% obstructive changes 72.46% mixed changes
Current study	102 (Normal spirometry-25.49%)	M-64.8% F-35.2%	Most of the subjects were reported in the age group-26-49 y	67.6% obstructive changes 5.8% restrictive changes 0.98% mixed changes

[Table/Fig-8]: Comparison of sample size, mean age, gender, specific pattern in spirometry in different studies [16-18].
M: Male, F: Female, Y: Year

In the current study, majority of the patients were having obstructive Spirometry changes 67.6% and 5.8% had restrictive changes in comparison to a study conducted by Patil S et al., 42% obstructive, 18% mixed (Symptomatic group) and 32% obstructive, 14% mixed (Asymptomatic group) [16]. Such a high prevalence of the mixed pattern can be explained by extensive fibrosis co-existing with obstructive abnormality. In a study conducted by Mancuzo EV et al., showed that LSD+Lung disease present (33.3% obstructive, 10.9% restrictive, 28.2% mixed) and LSD (Lung disease absent) 20.6% obstructive, 24.5% restrictive, 8.9% mixed) [17]. In the study conducted by Santra A et al., observed that 27.5% showed obstructive changes and 72.46% mixed changes [18]. As in the current study, males were primarily involved in all the above-mentioned studies.

In the current study, significant number of patients was from rural area, which may be the cause of their late presentation to the healthcare facility leading to delay in their diagnosis and treatment thereby leading to high percentage of post-tubercular symptoms and sequalae. It was seen that male gender had more chance of developing post-TB pulmonary disability which may be due to more universal prevalence of smoking among the males. In this study, it was seen that smokers had more prevalence of post-TB pulmonary disease which may be due to the additive destructive effect of the smoking along with TB diseases. Since a long time, it has been documented that PTB is more common in smokers. This is most likely because nicotine inhibits Tumour Necrosis Factor-alpha (TNF-α) production by lung macrophages, making the patient more vulnerable to the development of progressive disease from latent Mycobacterium TB infection [19].

A strong association between a medical history of TB and airflow obstruction has been proved beyond doubt by a large population based, multicentre study in Latin America (PLATINO study). Such similar findings have also been seen in this study [20].

Limitation(s)

The long-term consequences were not known as the patients were not followed-up later. Hence, the effect of disease on quality of life, the progression of disease and survival rate of the patient was not known. Future studies should be done looking into these long-term effects.

CONCLUSION(S)

This study found that patients with recurrent TB had more pulmonary disability. Early detection, treatment of PTB, and smoking cessation can significantly reduce patient morbidity and improve pulmonary function. Post-TB pulmonary disability is common, causing clinical symptoms, radiological involvement, and spirometry changes.

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