Original Research Paper

Volume - 13 | Issue - 06 | June - 2023 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Respiratory Medicine

CROSS-SECTIONAL DESCRIPTIVE STUDY OF CORRELATION BETWEEN DELAY IN DIAGNOSIS OF PULMONARY TUBERCULOSIS AND PULMONARY FUNCTION IN PREVIOUSLY TREATED PATIENTS IN A TERTIARY CARE CENTRE

Abirami Nallathambi*	Resident, Department of Respiratory Medicine, Shri Sathya Sai Medical College and Research Institute, Tiruporur. *Corresponding Author
S Sreekaanth	Assistant Professor, Department of Respiratory Medicine, Shri Sathya Sai Medical College and Research Institute, Tiruporur.
Jereen Varghese	Assistant Professor, Department of Respiratory Medicine Shri Sathya Sai Medical College and Research Institute, Tiruporur.
Ajay I Rathoon	Consultant Nephrologist, Chennai Urology and Robotic Institute, Chennai.

ABSTRACT **Aim:** To assess the lung function and the factors associated with a change in lung function among patients who were previously treated for pulmonary tuberculosis (PTB). To find out the relationship between Delay in Diagnosis of pulmonary tuberculosis (interval between onset of PTB symptoms and diagnosis of disease) with the Severity of lung function. **Materials And Methods:** It is a cross-sectional descriptive study conducted in a tertiary care center over 1 year after attaining the ethical clearance. The study population of 85 patients presenting in Respiratory Medicine OPD with clinical and radiological features of pulmonary tuberculosis sequelae. The data collected were statistically analyzed. **Results:** A total of 85 patients were included in the study as the study population. Among the study population, the most common type of lung disease was Mixed pattern - 33 (38.8%) followed by obstructive pattern 20 (23.5%) and restrictive pattern 19 (22.4%) and the least common 13 (15.3%) was Normal pattern. Diagnostic delay (days) had a negative correlation with FVC (Forced Vital Capacity)-restrictive pattern, FEV1(Forced Expiratory Volume)-obstructive pattern, FEV1/FVC ratio, MEF 25-75%(Maximal Expiratory Flow)-small airways obstruction, and DLCO (Diffusing capacity of Lung for Carbon Monoxide). **Conclusion:** PTB has a significant effect on lung function even after the successful completion of treatment. Patients with diagnostic delay in pulmonary tuberculosis will have a high chance of ending up with chronic lung disease in the post-treatment phase of PTB. Routine use of spirometry and early identification of these patients will decrease the burden of post-Tuberculosis sequelae in India and also around the World. This will also improve the quality of life in sequelae patients.

KEYWORDS :

INTRODUCTION

Tuberculosis is a communicable disease and remains the number one cause of death by infectious disease(1). PTB destroys lung parenchyma by up-regulating several processes and also by dysregulating protease control. Lung function impairment is related to long-term respiratory symptoms, in turn affecting the quality of life. Pulmonary function tests (PFTs) play an important role in identifying lung function derangement(2). Early diagnosis with the treatment of pulmonary tuberculosis reduces the number of cases along with reduction of incidence of sequelae in turn improving the quality of life(3). Thus this study was chosen to assess lung function and the factors associated with change in lung function among patients who were previously treated for pulmonary tuberculosis (PTB) and we also find out the relationship between Delay in Diagnosis of pulmonary tuberculosis with the Severity of lung function.

MATERIALS AND METHODS

It is a cross-sectional descriptive study conducted in a tertiary care center. The study population was patients presenting in Respiratory Medicine OPD with clinical and radiological features of pulmonary tuberculosis sequelae. The study was conducted from January 2020 to December 2022.

Inclusion Criteria

1) Both male & female patients
2) Patients who have completed treatment at least 18 months before the study
3) Age >18 years
4) Patients who have stopped smoking after a diagnosis of Pulmonary TB
5) X-ray chest showing features suggestive of fibrosis, cavity, calcifications, bronchiectasis

Exclusion Criteria

1) Active pulmonary tuberculosis patients
2) Extra-pulmonary tuberculosis patients
3) Severe Respiratory distress
4) Any pre-existing airway, parenchymal, or interstitial lung diseases
5) Patients not fit for spirometry

Statistical Analysis

Data was entered in MS Excel and Statistical Analysis was done by SPSS 23 software. The results were presented in descriptive statistics and an appropriate test of significance was applied with a 5% level of significance and 95% confidence interval.

Study Variables

1. Socio-demographic variables: Name, Age, Sex, Height, Weight, Occupation, Socioeconomic status
2. Spirometry variables: FEV1, FVC, FEV1/FVC ratio, MEF 25-75%, DLCO
3. Other study variables: Diagnostic Delay (DD)in days

METHODOLOGY

Patients were selected as per inclusion and exclusion criteria, written informed consent was obtained and then patients were subjected to spirometry.

Institutional Ethical committee clearance was obtained before the study. Informed consent was obtained from all the patients recruited before the start of the study.

RESULT

A total of 85 patients were included in the study as the study population. Among the study population, most of the subjects - 24 (28.24%) were in the 41 - 50 years age group followed by 22 (25.88%) in 31 - 40 years, and least 5 (5.88%) were in 21 - 30 years. More than half of the subjects belonged to the 31 to 50 years age group. The male population was predominant with around 53 (62.35%) compared to 32 (37.65%) females. Among elderly subjects, male subjects were predominant (19) in our study compared to females (2), and, among young subjects, females were more predominant (16).

Among the study population, the most commonly seen lung sequelae was Mixed pattern - 33 (38.8%) followed by obstructive pattern 20 (23.5%) and restrictive pattern 19 (22.4%), and the least common one was normal pattern-13 (15.3%). Small airway obstruction was seen in 20 subjects (23.5%). Among subjects with mixed patterns (n=33), the majority of the subjects had mild restriction - 14 (42.4 %) followed by 11 (33.3 %) with moderate restriction and 8 (24.3 %) with severe restriction. Most of the study population had mild DLCO - 35 (41.2%) followed by 23 (27.1%) with moderate DLCO and 15 (17.6%) with severe DLCO and the least of the patients 12 (14.1%) had normal DLCO.

Among the study population, a Delay in Diagnosis of 15 to 35 days was

seen in 15 (17.7%) patients, 36 to 55 days in 35 (41.2%) patients followed by 56 to 75 days in 23 (27%)patients, and a period of > 75 days in 12 (14.1%) patients as noted in Table 1. Among the study population, 50 subjects had decreased FVC, 55 subjects had decreased FEV1, 55 subjects had decreased FEV1/FVC ratio, 66 subjects had decreased MEF 25-75%, and 73 patients had decreased DLCO. Delay in Diagnosis (days) has a negative correlation with FVC, FEV1, FEV1/FVC, MEF 25-75%, and DLCO and it is statistically significant with a correlation coefficient of -0.69 as noted in Figure1-5. FVC decreases by -0.81 times for each unit increase in Delay in Diagnosis (days). The correlation between FVC and Delay in Diagnosis (days) was statistically significant.

DISCUSSION

Tuberculosis remains a public health problem worldwide with increased mortality and morbidity among all chronic infections, 24% of the global TB burden is accounted by India.

The normal fall in FEV1 per year is around 30 ml in non-smokers and around 50 ml in smokers(4). There is an accelerated decline in pulmonary function in elderly individuals affected with TB, especially over 40 years of age.

In our study, smoking was not considered a significant predictor of pulmonary function impairment. This is because males who took part in the study quit smoking after diagnosis of tuberculosis and the women did not have any smoking history before and after infection with Tuberculosis.

The pattern of lung function impairment observed in the study was mostly mixed (38.8%) followed by obstructive (23.5%) and restrictive pattern (22.4%).

Almost the whole of the Respiratory system including lung parenchyma, bronchi, bronchioles, and lymph nodes were involved in PTB. Dysregulation of protease control and upregulation of proteases like matrix metalloproteinases causes lung remodeling. Histopathological abnormalities can occur after successful treatment causing sequelae like cavity formation, fibrosis, bronchiectasis, and bronchial & bronchiolar obstruction, etc. Sequelae changes can cause restrictive, obstructive, or mixed pulmonary function impairment(5).

A study conducted by Agarwala et al. in India observed that 52.7% of PTB-treated patients had an obstructive defect on spirometry(6). Most of the studies have shown that pulmonary TB sequelae patients have an obstructive pattern of lung impairment. But more recent studies have revealed that mixed and restrictive patterns were more common compared to the obstructive pattern(5).

Definitions of various delays are noted in Table 2. The minimum Delay in Diagnosis in this study was 20 days and the maximum was 90 days. The mean duration of DD in our study was 53 days (7 to 8 weeks).

It is estimated that a patient with untreated smear-positive pulmonary TB may infect on average more than 10 persons per year. The treatment delay affects an individual, the community, and a country's health and economy. It also increases the extent of lung damage which in turn results in the increased incidence of developing multi-drug resistant strains (MDR-TB)(7).

Ngahane et al., found that the median duration of symptoms before TB diagnosis was greater in patients who were found to have lung function impairment (LFI) than in patients without LFI. The median duration of symptoms before the diagnosis of TB was 4 weeks (3 – 8). This duration was significantly higher in patients who had LFI (median 8) than that in patients without any LFI (median 4)(8).

Another study, which had information collected from the TB registry from December 2012 to May 2013 showed that the mean delay in diagnosis of PTB was 7.05 ± 6.16 weeks. A delay in the diagnosis of smear-positive patients harms the general population as during this period a patient can infect the community. This in turn affects the prevalence of TB locally and globally(9). A study by Bello et al. showed that the mean total delay was 87.6 days and the mean health system delay was 39.3 days(10).

The cause for delay in our study may be that most of the subjects who participated had a lack of adequate health education and they were from rural villages in a poor socio-economical status which hampers them to seek medical aid as quickly as possible. This increased delay in diagnosis may be the cause for extensive pulmonary function derangement resulting in restrictive or mixed patterns.

According to WHO, TB-associated stigma was one of the major factors associated with patient delay. Patients with a high level of TB-associated stigma were more likely to delay when compared to patients with low TB-associated stigma. TB-associated stigma may have played an important role in hindering patients from seeking early health care due to fear of being diagnosed with TB(11).

Adenager et al. found that immunosuppressive diseases like HIV often produce atypical presentations of TB which weakens the clinician's and patient's ability to notice TB, which in turn results in diagnostic delay(12). But, in our study, we didn't have any HIV-infected subjects. Hence, HIV was not taken into consideration just like smoking.

In our study, FVC decreased by 0.81 %, FEV1 decreased by 0.98 %, FEV1/FVC ratio decreased by 0.31 %, MEF 25-75% decreased by 0.9 %, DLCO decreased by 0.58 % for each day delay as noted in Figure1-5.

Renata Báez-Saldaña et al showed that for each day delay in starting treatment there is a fall of 0.01 to 0.07% in spirometry parameters(13). This shows that even a single-day delay in starting treatment can have a huge impact.

Even though TB is a notifiable disease and comes under the National Tuberculosis Elimination Program, there is still a mean delay of 53 days. In addition to patient delay, healthcare delay is an important factor that has to be considered. Improper management and delayed evaluation by the General Practitioners, as improper or lack of health education to the public regarding tuberculosis may also be causes for delay in initiation of treatment. General Practitioners should have a high level of suspicion for diagnosing tuberculosis and aggressive screening should be carried out for any patient with symptoms and signs of tuberculosis.

Table 1: Distribution Of Lag Time Duration

Delay in Diagnosis (in days)	Number of subjects	Percent
15 to 35	15	17.7 %
36 to 55	35	41.2 %
56 to 75	23	27 %
> 75	12	14.1 %
Total	85	100 %

Table 2: Definitions Of Various Delay

Onset of Symptom	The day when the patient first becomes aware of the symptom or symptoms
Patient delay	The time interval from the first onset of symptom to the first visit to the health center or hospital or private clinics, and time longer than 21 days.
Healthcare system delay	The time interval from the patient's first visit to the health center, hospital, or private clinic to the commencement of treatment, and time longer than 7 days
Total treatment delay	The time interval from the first onset of symptom to the commencement of treatment or the sum of patient delay and health care system delay

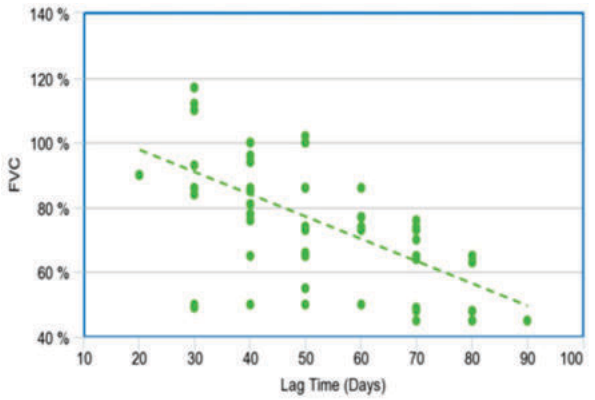

Figure 1: Correlation Between Lag Time And Fvc (restrictive Pattern) In The Study Population

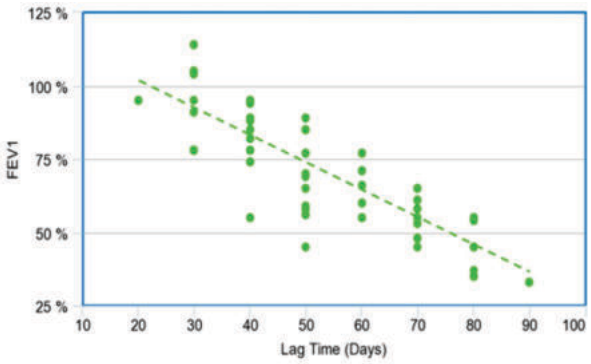

Figure 2: Correlation Between Lag Time And Fev1 (obstructive Pattern) In The Study Population

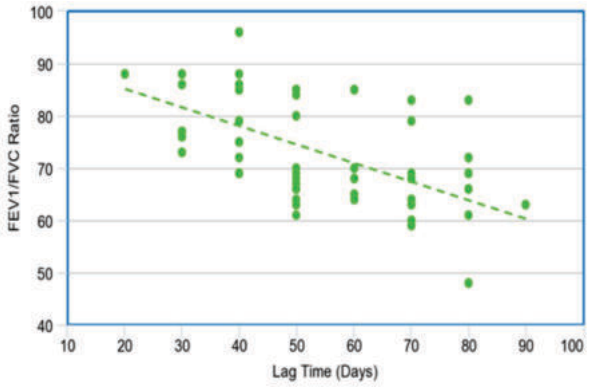

Figure 3: Correlation Between Lag Time And Fev1 / Fvc In The Study Population

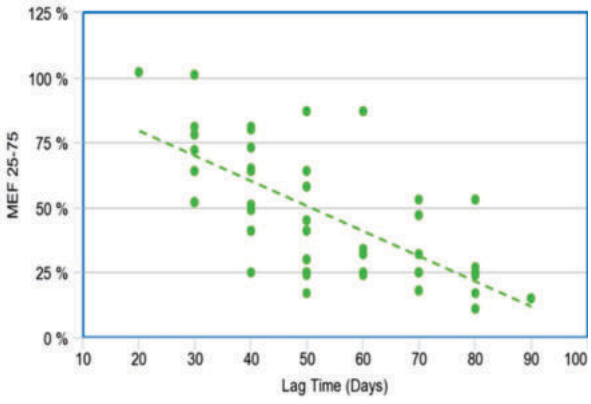

Figure 4: Correlation Between Lag Time And Mef 25 - 75% (small Airways Obstruction) In The Study Population

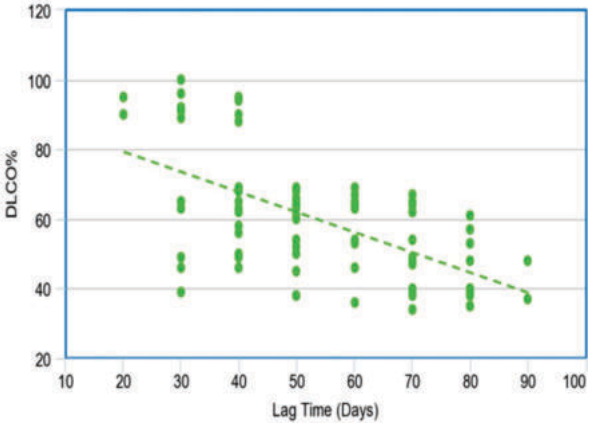

Figure 5: Correlation Between Lag Time And Dlco In The Study Population

CONCLUSION

PTB has a significant effect on lung function even after the successful completion of treatment. Patients with diagnostic delay in pulmonary tuberculosis will have a high chance of ending up with chronic lung disease in the post-treatment phase of PTB. Routine use of spirometry and early identification of these patients will decrease the burden of post-Tuberculosis sequelae in India and also around the World. This will also improve the quality of life in sequelae patients.

REFERENCES

1. Chung KP, Chen JY, Lee CH, Wu HD, Wang JY, Lee LN, et al. Trends and predictors of changes in pulmonary function after treatment for pulmonary tuberculosis. Clinics. 2011 Jan;66(4):549–56.
2. Ranu H, Wilde M, Madden B. Pulmonary function tests. Ulster Med J. 2011 May;80(2):84–90.
3. Ramos LMM, Sulmonett N, Ferreira CS, Henriques JF, Miranda SS de. Perfil funcional de pacientes portadores de seqüela de tuberculose de um hospital universitário. J Bras Pneumol. 2006 Feb;32(1):43–7.
4. Al-Hajjaj MS. Predictive Factors of Poor Lung Function in Cured Tuberculosis Patients. Ann Saudi Med. 2000 Sep;20(5–6):493–4.
5. Patil S, Patil R, Jadhav A. Pulmonary functions' assessment in post-tuberculosis cases by spirometry: Obstructive pattern is predominant and needs cautious evaluation in all treated cases irrespective of symptoms. Int J Mycobacteriology. 2018;7(2):128.
6. Agarwala A, Maikap M, Panchadhyayee P, Mandal P, Roy P. Chronic airway obstruction in post tubercular fibrosis cases: a serious lung function changes. Int J Res Med Sci. 2016;5294–6.
7. World Health Organization. Global tuberculosis control: WHO report 2011. 2011 [cited 2023 Feb 5]; Available from: https://apps.who.int/iris/handle/10665/44728
8. Mbatchou Ngahane BH, Nouyep J, Nganda Motto M, Mapoure Njankouo Y, Wandji A, Endale M, et al. Post-tuberculous lung function impairment in a tuberculosis reference clinic in Cameroon. Respir Med. 2016 May;114:67–71.
9. Madegedara D, Nandadeva D, Dhanasekera S, Kumara H. Lag period for diagnosing and starting treatment for pulmonary tuberculosis patients. Eur Respir J. 2014 Sep 1;44(Suppl 58):P2674.
10. Sreeramareddy CT, Qin ZZ, Satyanarayana S, Subbaraman R, Pai M. Delays in diagnosis and treatment of pulmonary tuberculosis in India: a systematic review. Int J Tuberc Lung Dis. 2014 Mar 1;18(3):255–66.
11. Mediterranean WHORO for the E. Diagnostic and treatment delay in tuberculosis. 2006. p. 48 p.; 30 cm.
12. Adenager GS, Alemseged F, Asefa H, Gebremedhin AT. Factors Associated with Treatment Delay among Pulmonary Tuberculosis Patients in Public and Private Health Facilities in Addis Ababa, Ethiopia. Tuberc Res Treat. 2017;2017:1–9.
13. Báez-Saldaña R, López-Arteaga Y, Bizarrón-Muro A, Ferreira-Guerrero E, Ferreyra-Reyes L, Delgado-Sánchez G, et al. A Novel Scoring System to Measure Radiographic Abnormalities and Related Spirometric Values in Cured Pulmonary Tuberculosis. Pai M, editor. PLoS ONE. 2013 Nov 1;8(11):e78926.