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ORIGINAL RESEARCH

Assessment of pulmonary functions in cured pulmonary tuberculosis patients

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ABSTRACT

A cross sectional study was conducted to asses Pulmonary Functions to find out abnormalities caused as a sequel of Pulmonary Tuberculosis in cured patients. Present study also aimed to find presence of diffusion defect against alveolar capillary interface with the help of DLCO in Patients with Spirometric abnormality. A Microbiologically confirmed cases of Pulmonary TB patients who completed optimum period of treatment and tested negative for sputum for acid fast bacilli were included in the study. In this study, a total of 100 cases were taken in which there were 56 symptomatic and 44 asymptomatic post-TB cases. In both these groups males were predominant with 60% and 56% respectively. Mean age was 46±10years in both groups. Main symptoms in symptomatic group were shortness of breath in 42 of the 56 symptomatic cases(75%), cough in 28 of 56 symptomatic cases(50%). Of the total 100 cases normal spirometric pattern was found in 30%, obstructive pattern in 50% patients with 62% of them being bronchodilator responsive, restrictive & mixed pattern in 14% & 6% of cases respectively. In spirometry assessment of 56 symptomatic post-TB cases, obstructive pattern was predominant type documented in 29 cases (52%) & bronchodilator responsiveness in 18 cases i.e. 62% of total cases with obstructive pattern, 16% restrictive & 7% mixed pattern abnormality and normal pattern in 25%. In spirometry assessment of 44 asymptomatic post-TB cases, obstructive pattern is documented in 21 cases (47.6%) out of which bronchodilator responsiveness is present in 13 cases (62%), mixed pattern in 4.5%, restrictive pattern in 11% and normal spirometry is documented in 36.3% cases. Out of 56 symptomatic patients 42 had shortness of breath and 28 complained of cough. Out of 50 patients diagnosed with obstructive pattern abnormality diffusion defect was present in 22(44%) and all 14(100%) cases diagnosed with restrictive pattern had diffusion defect. Authors concluded that The most common cause of lung function impairment in symptomatic post-TB individuals is obstructive lung disease. In spirometry analysis, a considerable proportion of asymptomatic post-TB subjects also have an obstructive pattern of lung function. In a clinical setting, such cases receive less evaluation and treatment. In all TB patients, regardless of symptoms, a prompt examination with spirometry is essential.

Keywords: spirometry analysis, microbiology, pulmonary tuberculosis

INTRODUCTION

As the most contagious illness in the world, pulmonary tuberculosis, which is caused by Mycobacterium tuberculosis, affects one-third of the population and is a leading cause of death globally. According to estimates, two out of every five Indians have been affected with pulmonary TB. The Global TB Report 2023 estimates that 342,000 Indians lost their lives to tuberculosis (TB) in 2022. Compared to 2021, when 494,000 fatalities were predicted, this represents a decrease. The decrease is ascribed to India's attempts to lower the number of TB cases and fatalities as well as the nation's submission of fresh data to the WHO.[1]

Treatment efficacy is increased and the duration of treatment is shortened by the conventional regimen of isoniazid, rifampicin, ethambutol, and pyrazinamide. [2,3]

However, as these medications only have bactericidal and bacteriostatic effects, they can be categorized as antimicrobials. However, pulmonary tuberculosis typically results in lung damage that causes airway illnesses, which are typically left untreated and can cause significant morbidity and death.[4] These lead to pulmonary sequelae, which are characterized by structural alterations in the bronchi and parenchyma, such as fibrotic bands, emphysematous changes, bronchovascular distortion, and bronchiectasis. Furthermore, following a microbiological cure, these alterations in the lungs persist indefinitely. They affect the calibre of airways, increase their resistance, and decrease airflow. The process of fibrotic scarring may also lead to a decrease in overaalll lung capacity. Patients with active tuberculosis may develop chronic

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airway obstruction syndrome as a result of inadequate treatment of bronchial obstruction; this condition shares many clinical characteristics with chronic obstructive pulmonary disease.[5]

Therefore, after completion of course of ATT , a pulmonary function assessment is required to determine whether any abnormalities in pulmonary function have been caused as a result of TB sothat the proper treatment can be administered.

AIM AND OBJECTIVES

- Assessment of Pulmonary Functions to find out abnormalities caused as a sequel of Pulmonary Tuberculosis in cured patients.
- To find presence of diffusion defect against alveolar capillary interface with the help of DLCO inPatients with Spirometric abnormality

MATERIAL AND METHODS

Type of study: Cross-sectional study.

Place of study: Department of Pulmonary Medicine, Prasad. Institute of Medical Sciences Lucknow. Institutional Ethics Committee clearance was taken before commencing the study. Written informed consent was taken from all the patients included in the study.

Duration of study: 12 months

Study sample: Study population comprised of following patients.

1. Those who completed treatment and declared cured under NTEP guidelines in Prasad Medical College, Lucknow.
2. Patients coming to the OPD of Pulmonary Medicine department, Prasad Medical College, and taken complete treatment under NTEP. 100 patients were enrolled in the study.

Inclusion Criteria

Microbiologically confirmed cases of Pulmonary TB patients who completed optimum period of treatment andtested negative for sputum for acid fast bacilli

Exclusion Criteria

1. Extra Pulmonary TB cases
2. Incomplete TB treatment
3. Patients who tested positive after completion of ATT
4. Pre-existing airway disease before diagnosis of TB
5. Smokers
6. Patients with age <18 years and >60years.
7. Pregnant patients
8. Patients with Chest Pain/Hemoptysis
9. Patients who fit in criteria of relative contraindications as per ATS/ERS standardization of Spirometry 2019update
10. Patients who cannot perform PFT

PFT

- Minibox+ by PulmOne was used to perform Spirometry & calculate Lung Volumes and DLco Spirometry and Lung Volumes report was analyzed to find out any abnormality in spiromtric assessment and result was noted.
- Then the PFT report was further analyzed to classify abnormality of pulmonary functions based on pattern whether it is obstructive, restrictive, mixed, normal.
- Patients with Obstructive pattern abnormality were tested for Bronchodilator responsiveness. DLCO was performed in patients with obstructive, restrictive & mixed pattern abnormality.

Procedure of Spirometry and interpretive algorithms

Spirometric evaluation was done before and 15 min after administration of 400 microgram salbutamolusing pressurized metered-dose inhaler with small-volume spacer device. All patients were instructed not to use any bronchodilator on the preceding night and on the day of procedure. Spirometric procedure was carried out as per ATS/ERS task force recommendation for standardization of lung function testing. An improvement in FEV1 of at least 12% and 200 ml over the pre-bronchodilator value was considered bronchodilator responsive. FVC, FEV1, and FEV1/FVC ratio values for case patients were compared with gender-specific and race-specific adult predicted normative population values and the control group.

Interpretive algorithms were used in determining restrictive or obstructive patterns and spirometryresults were analysed and categorised as follows:

- Normal - FEV1/FVC ratio of >70% and an FVC of >80% predicted
- Obstructive - airway obstruction was defined as an FEV1/FVC ratio of <70% and an FVC of >80%predicted
- Mixed-combined defects were FVC of <80% predicted and an FEV1/FVC ratio of <70% & TLC
- <80% predicted
- Restrictive-restrictive defects as an FEV1/FVC ratio of >70% with an FVC of <80% predicted & TLC
- <80% predicted
- Diffusion defect- DLCO < 75% predicted

RESULTS

Table 1: Spirometry assessment of symptomatic post-tuberculosis cases (n=56)

Spirometric Pattern	Number of cases
Normal	14 (25%)
Obstructive- Bronchodilator responsive	18 (32%)

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Obstructive- Bronchodilator non responsive	11 (20%)
Restrictive	9 (16%)
Mixed	4 (7%)

Table 2: Spirometry assessment of asymptomatic post-tuberculosis cases (n=44)

Spirometric Pattern	Number of cases
Normal	16 (36.3%)
Obstructive- Bronchodilator responsive	13 (29.5%)
Obstructive- Bronchodilator non responsive	08 (18.1%)
Restrictive	05 (11.3%)
Mixed	02 (4.5%)

Table 3: Comparative spirometry analysis of symptomatic (n=56) and asymptomatic (n=44) cases incured pulmonary tuberculosis patients

Spirometric Pattern	Symptomatic cases	Asymptomatic cases
Normal	14 (25%)	16 (36.3%)
Obstructive- Bronchodilator responsive	18 (32%)	13 (29.5%)
Obstructive- Bronchodilator non responsive	11 (20%)	08 (18.1%)
Restrictive	9 (16%)	05 (11.3%)
Mixed	4 (7%)	02 (4.5%)

Table 4: Symptoms of participants.

Symptoms	Present	Absent
Dyspnea	42	58
Cough	28	72

Table 5: Diffusion Defect:

Diffusion defect	Total cases	Present	Absent
Obstructive	50	22	28
Restrictive	14	14	0
Mixed	6	1	5

In this study, a total of 100 cases were taken in which there were 56 symptomatic and 44 asymptomatic post-TB cases. In both these groups males were predominant with 60% and 56% respectively. Mean age was 46±10years in both groups. Main symptoms in symptomatic group were shortness of breath in 42 of the 56 symptomatic cases(75%), cough in 28 of 56 symptomatic cases(50%). Of the total 100 cases normal spirometric pattern was found in 30%, obstructive patternin 50% patients with 62% of them being bronchodilator responsive, restrictive & mixed pattern in 14% & 6% of cases respectively. [Table 3 & Fig 1]

In spirometry assessment of 56 symptomatic post-TB cases, obstructive pattern was predominant type documented in 29 cases (52%) & bronchodilator responsiveness in 18 cases i.e. 62% of total cases with obstructive pattern, 16% restrictive & 7% mixed pattern abnormality and normal pattern in25%. [Table 1]

In spirometry assessment of 44 asymptomatic post-TB cases, obstructive pattern is documented in 21 cases (47.6%) out of which bronchodilator responsiveness is present in 13 cases (62%), mixed pattern in 4.5%, restrictive pattern in 11% and normal spirometry is documented in 36.3% cases [Table 2].

Out of 56 symptomatic patients 42 had shortness of breath and 28 complained of cough [Table 4]

Out of 50 patients diagnosed with obstructive pattern abnormality diffusion defect was present in 22(44%) and all 14(100%) cases diagnosed with restrictive pattern had diffusion defect.

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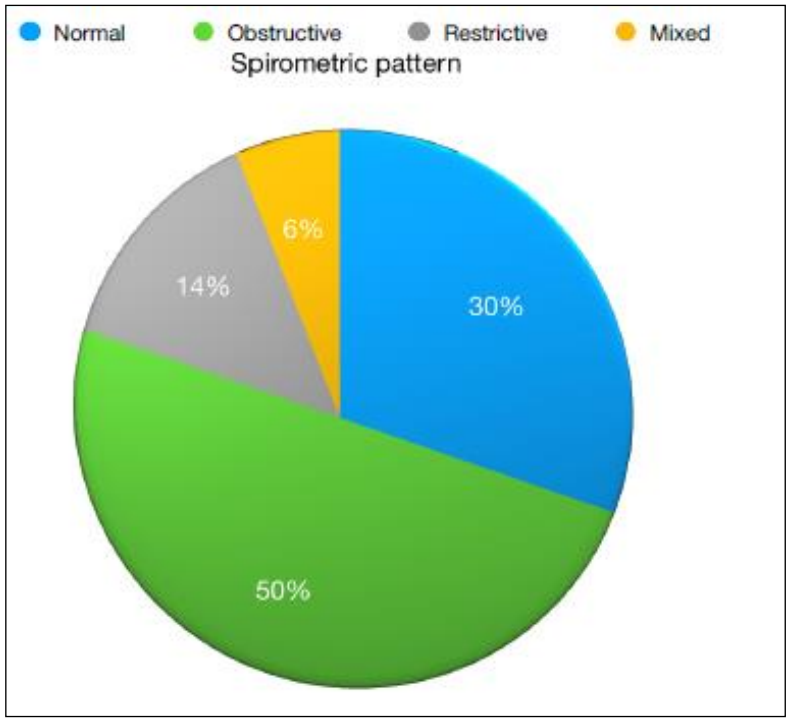

Figure 1:

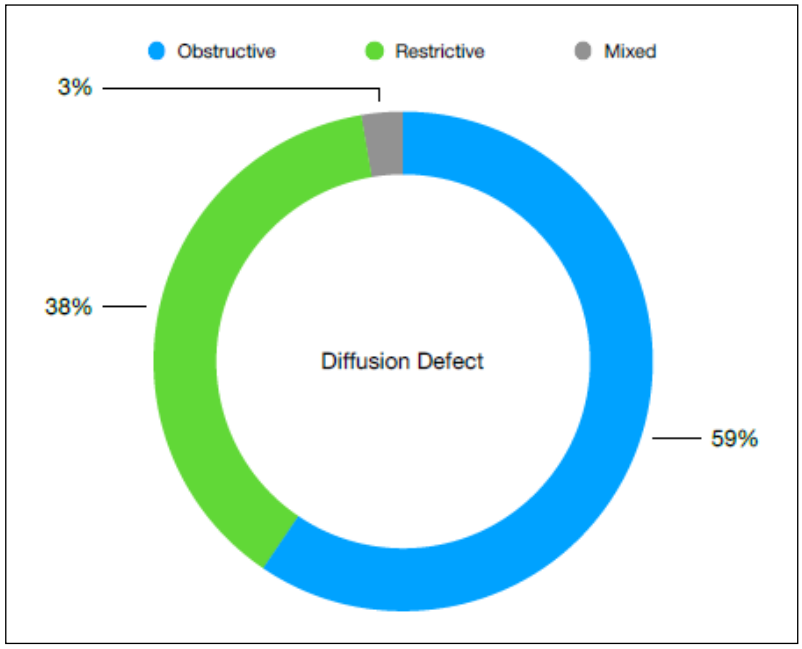

Figure 2:

DISCUSSION

Lung function pattern in post-tuberculosis cases

In this study, abnormal lung function is documented in 75% and 64% in symptomatic and asymptomatic post-TB cases respectively. According to a research by Pasipanodya[10] et al. in the US, 59% of patients who received TB treatment later developed impaired pulmonary function. More than half of the PTB patients in that study developed markedly compromised lung function. Thesefindings imply that one of the main causes of chronic lung disease is compromised pulmonary function following PTB. 52.7% of PTB patients who received treatment exhibited an obstructive ventilatory abnormality, according to a study done in India by Agarwala et al.[12] In a study carried out in Tanzania, Manji et al. found that 74% of cases had impaired lung functions.

Lung function pattern in symptomatic post-tuberculosis cases

In the present study, spirometry assessment of symptomatic post-TB cases, obstructive, restrictive, and mixed pattern was observed in 52%, 16%, and 7%, respectively of total symptomatic cases.

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According to Manji et al.'s research[11], the prevalence of distinct patterns of impairment for obstructive, restrictive, and mixed patterns of lung disease was 42%, 13%, and 19%, respectively. Individual subtypes of impairment were found to be 15%, 31%, and 13% prevalent in obstructive, restrictive, and mixed impairment, respectively, according to a study by Pasipanodya et al.[10] Similar lung function problems and findings were found in studies by Long et al., Willcox and Ferguson, Plit etal., and Lee and Chang. Among individuals with impairments, Snider et al. discovered that the following forms of dysfunction were evenly distributed: restrictive dysfunction (24%), obstructive dysfunction (23%), and mixed dysfunction (19%). Similar results were reported by Verma et al. in their research of 92 post-PTB people, and they discovered restricted pathology in 37 of them and mixedpattern in 21 patients as per spirometric criteria.

Lung function pattern in asymptomatic post-tuberculosis cases

In this study, abnormal lung function is documented in 64% of asymptomatic post-TB cases. In their investigation, Guilani et al.[9] found that spirometry abnormalities were present in 62% of asymptomatic post-TB cases. They came to the conclusion in their investigation that pulmonary function impairment is likely to develop in all cases of cured PTB. Defective lung function may be present in even asymptomatic instances.In one of the earliest studies, Anno and Tomashefski noted that PTB patients had pulmonary function impairment. In a subset of TB patients, the maximal breathing capacity decreased, the residual volume (RV) increased, and the RV/total lung capacity ratioincreased.

Obstructive is the most common abnormality documented in posttuberculosis cases?

Obstructive patterns are recorded in 29 and 21 cases of total 100 cases in spirometry assessments of 56 symptomatic and 44 asymptomatic patients respectively. The overall prevalence of the obstructive spirometry pattern was 51% and 47% in symptomatic and asymptomatic groups respectively. In five Latin American nations, the multicenter population-based PLATINO[6] study also assessed the association between the development of airway obstruction and prior TB history. Among people with a history of tuberculosis, airflow restriction was present in 30.7% of cases.

In their investigation, Gaensler and Lindgren[7] found that 61% of TB patients had indications of airway restriction.

Airflow blockage was shown to be 46% common in Indian investigations by Brashier et al.[8], and the frequency rose over time following treatment completion. Of 257 individuals with cured PTB, 86.8% exhibited spirometry readings compatible with obstructive airway disease, according to a larger study by Akkara et al.

CONCLUSION

Even when anti-TB drugs are administered successfully, people with tuberculosis nevertheless have significant impairments in lung function. The majority of patients with post-tubercular lung function impairment either suffer in quiet or continue to undergo insufficient therapy because there are no adequate guidelines addressing follow-up. Thus, appropriate protocols for post-tuberculosis patient follow-up must be established in order to evaluate lung function and administer appropriate care, thereby enhancing the patient's quality of life.

The most common cause of lung function impairment in symptomatic post-TB individuals is obstructive lung disease. In spirometry analysis, a considerable proportion of asymptomatic post-TB subjects also have an obstructive pattern of lung function. In a clinical setting, such cases receive less evaluation and treatment. In all TB patients, regardless of symptoms, a prompt examination with spirometry is essential.

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