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Assessment of Health-Related Quality of Life in Post Pulmonary Tuberculosis Patients

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Abstract
Globally, tuberculosis remains an important public health problem and a major leading cause of mortality and morbidity. The term *posttuberculosis lung disorder* (PTLD) encompasses various manifestations after successful treatment of tuberculosis, such as respiratory symptoms, decline in respiratory function, residual radiological lesions, exercise intolerance, and reduced health-related quality of life (HRQOL). We aimed to assess the HRQOL in PTLD patients by 36-Item Short Form Health Survey. Our study was conducted on PTLD patients who completed their antituberculosis treatment and presented to the outpatient department with diagnosed PTLD or post pulmonary tuberculosis. A total of 92 patients aged 18-81 years participated in the study after giving written informed consent. Biomass exposure was statistically significant for mental health components ($P<.05$). Post pulmonary tuberculosis patients with obstructive airway disease showed decreased HRQOL in both physical and mental health components. Our findings revealed a high prevalence of comorbidities, and no significant association was found between physical and mental health components of HRQOL. Thus, we emphasize the need for psychological counselling, pulmonary rehabilitation, and follow-up as holistic management even after microbiological cure for post pulmonary tuberculosis and suggest early screening of HRQOL to improve people's standard of living.

Keywords: pulmonary tuberculosis, posttuberculosis sequelae, SF-36, quality of life, late tuberculosis, health assessment
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Оценка качества жизни пациентов после туберкулеза легких

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Резюме
Во всем мире туберкулез остается важной проблемой общественного здравоохранения и ведущей причиной смертности. Термин «посттуберкулезные изменения» включает различные проявления после успешного лечения туберкулеза, такие как респираторные симптомы, снижение функции дыхания, остаточные повреждения легких на рентгенограмме, непереносимость физической нагрузки и снижение качества жизни, связанного со здоровьем.
Целью нашей работы являлась оценка качества жизни у пациентов с посттуберкулезными изменениями посредством опросника SF-36. Наше исследование включало пациентов с посттуберкулезными изменениями, которые завершили противотуберкулезное лечение и обратились в амбулаторное отделение с диагнозом «посттуберкулезные изменения» или «последствия туберкулеза легких». Всего в исследовании приняли участие 92 пациента в возрасте 18–81 год, предоставившие письменное информированное согласие. Воздействие биотоплива на дыхательные пути было статистически значимым для компонентов психического здоровья ($p<0,05$). У пациентов с обструктивным заболеванием дыхательных путей, перенесших туберкулез легких, наблюдалось снижение качества жизни, связанного как с физическим, так и психическим здоровьем. Наши результаты демонстрируют высокую распространенность сопутствующих заболеваний. Значимой связи между компонентами физического и психического здоровья обнаружено не было. Таким образом, мы подчеркиваем необходимость психологического консультирования, легочной реабилитации и последующего наблюдения в рамках целостного подхода к лечению даже после

микробиологического излечения от последствий туберкулеза легких и рекомендуем ранний скрининг качества жизни, связанного со здоровьем, для улучшения уровня жизни пациентов.
***Ключевые слова**:* туберкулез легких, последствия туберкулеза, SF-36, качество жизни, поздняя стадия туберкулеза, оценка состояния здоровья
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Background

Global Tuberculosis Burden. *Mycobacterium tuberculosis* is an infectious bacillus that causes tuberculosis (TB). Globally, TB remains an important public health problem and a major leading cause of mortality and morbidity.[1] Despite advances in TB diagnosis and treatment, nearly 10.0 million TB cases (ranging from 8.9 to 11.0 million) were reported in 2019.[2] Worldwide, TB treatment saved 63 million lives between 2000 and 2019,[3] and 1.3 million TB deaths were reported in the 2020.[4] Approximately a quarter of the world population is estimated to have a latent TB infection leading to risk of developing the disease during their lifetime.[5] Drug-resistant TB is also one of the major public health concerns globally. As per 2020 World Health Organization global TB report, half a million people developed rifampicin-resistant TB (RR-TB), of which around 78% had multi-drug resistant TB (MDR-TB). The morbidity of MDR-TB or RR-TB was 465 000 people in 2019.[2]

TB Burden in India. As per the India TB report 2022, the approximate TB incidence of all TB forms in India for 2020 was 188 per 100 000 population, which were 129-257 per 100 000 population.[6] In 2021, the cumulative number of newly registered and recurrent TB patients was 1 933 381, representing a 19% increase from the 2020 count of 1 628 161 cases.[6] As per National Tuberculosis Elimination Programme (NTEP), 1 751 437 TB patients were notified, and 83% of them (1 453 692) were successfully treated.[6] The national health programmes use 5 types of drug-resistant TB: isoniazid-resistant TB, RR-TB, MDR-TB, pre-extensively drug-resistant TB (pre-XDRTB), and extensively drug-resistant TB (XDR-TB). According to the global TB report for 2021, the number of treated MDR and XDR-TB cases was approximately 4 per 100 000 and 1 per 100 000 population, respectively.[6]

Following treatment, the significant number of patients is left with persistent respiratory symptoms, lung function impairment, decreased quality of life, radiological abnormalities, and reduced exercise tolerance.[7] Hence, the recent national guidelines have included a follow-up of patients at the end of 6, 12, 18, and 24 months after the treatment completion. Sequelae might be more frequent in MDR-TB cases. Functional limitations increase significantly in MDR-TB patients who underwent multiple treatments compared with patients cured in the first treatment.[8] Histopathological findings in TB patients include caseating granulomas, liquefaction of the tissues, and cavity formation. About 85% of the patients continue to have permanent residual anatomic changes, such as structural impairments of the airways, pleural and parenchymal impairment (including deformity of bronchovascular structures), stenosis of the bronchial wall, residual cavities, and fibrosis, all of which can cause the most severe lung function abnormalities.[9] The parenchymal destruction occurs due to protease upregulation and dysregulation of protease control;[10] hence, post-tuberculosis abnormality has emerged as a separate clinical condition.

Post Pulmonary Tuberculosis. The term *post pulmonary tuberculosis* (PTB) or *posttuberculosis lung disorder* (PTLD) encompasses various manifestations after successful TB treatment, such as respiratory symptoms, decline in respiratory function, residual radiological lesions (fibrotic strands, calcification, fibrosis, cavities, and bronchiectasis), exercise intolerance, and reduced health-related quality of life (HRQOL). Approximately 18%-87% of pulmonary TB patients experience lung impairment and may have up to 3 times higher mortality rate than that of the general population.[11] The burden of post TB may be underreported in developing countries where clinical services, research, and advocacy are far from adequate. In addition, it is hard to fully measure the impact of sequelae as they affect not only an individual but also their families and entire communities. Even after successful treatment, many patients suffer from post TB sequelae that may be structural complications (bronchiectasis, broncholithiasis, residual cavitation, chronic obstructive pulmonary disease [COPD]), infectious complications (COPD exacerbations, *Aspergillus fumigatus* infections, nontuberculous mycobacteria infections, pneumonia), or psychosocial morbidities (anxiety, depression, financial burden).[8] Respiratory symptoms and decreased lung function in post PTB patients have impaired HRQOL. Limited exercise tolerance resulting in disuse muscle atrophy, as seen in COPD, might occur in these patients. There is no definitive treatment of TB sequelae as the pathophysiology resulting in the sequelae and lung function impairment is not clearly known. Pathophysiology could be heterogeneous due to the wide spectrum of clinical and radiological presentation.[12] Treatment in these post PTB cases focuses on the nutrition, symptom management, lung function, and quality of life. Hence, our study was undertaken to assess HRQOL in post PTB patients.

Materials and Methods

Our cross-sectional observational study included post PTB patients who visited Chettinad Hospital and Research Institute and Primary Health Centre (Kelambakkam, Chennai, India) between May and September 2022. A total of 92 patients were recruited after obtaining institutional ethical committee approval (IHEC-I/1025/22) and proper patient informed consent. The inclusion and exclusion criteria are presented in Table 1. HRQOL was assessed using the 36-Item Short Form Health Survey (SF-36). It was administered with patients sitting comfortably in a chair in a quiet area, away from the distractions. The purpose and importance of this questionnaire (how it helps the physician to understand the patient's problem in their day-to-day life) were first explained to patients. Due to the varied literacy status of the study population and to avoid bias the questionnaire was read to the participants by the staff who were familiar with the questionnaire and fluent in both English and a patient's native language.

The impact score is the most essential part of the questionnaire that covers a wide range of disturbances experienced by patients in their daily lives, including psychological disturbances and social functions. The total score summarizes the impact of the disease on the patient's overall health status. A total score of 100 denotes a good possible health status, whereas score 0 denotes the worst possible health status. Hence, as the SF-36 score decreases, the HRQOL of the patient worsens.[13] All the collected data were entered in a Microsoft Excel spreadsheet (Microsoft Corp., USA) and then transferred to IBM SPSS Statistics, version 28.0 (IBM Corp., USA). Values were expressed as percentages. The Pearson's chi-square test was used, and $P < .05$ was considered statistically significant.

Results

The obtained data were then compared between physical and mental health components in the SF-36 to age, gender, body mass index (BMI), comorbidities, and personal history. The age of the patients varied from 18 to 81 years. Majority (64.1%) were in the age group of 39-59 years followed by the age group of 18-38 years (26.1%). There were 8.7% of the patients between 60 and 80 years, and 1.1% were in the age group of >80 years. Among 92 patients, 54 (58.7%) patients were male, and 38 (41.3%) were female. 55 (59.8%) patients were in the normal BMI group followed by 35 (38%) patients in the underweight group, 2 (2.2%) in the overweight group, and none of the patients were in the obese 1 and obese 2 groups (Table 2).

Our study showed that among 92 participants, 35 (38%) patients had diabetes mellitus, 37 (40.2%) had hypertension, 3 (3.3%) had coronary artery disease, and 74 (80.4%) had obstructive airway disease (OAD).

Table 1
Inclusion and exclusion criteria
Таблица 1
Критерии включения и исключения

INCLUSION CRITERIA
• Age >18 years
• All genders
• Patients cured/completed a course of anti-TB treatment for PTLD and presented with symptoms
EXCLUSION CRITERIA
• Age <18 years
• Smear positive PTB
• TB treatment defaulters*
• Treated/current extra PTB
• Patients with psychiatric disorders
• Patients unwilling to participate in the study

Note: * Interruption of TB treatment for 2 or more consecutive months

Прим.: * Прерывание противотуберкулезного лечения на 2 и более мес. подряд

Table 2
Patient distribution by age, gender, and BMI
Таблица 2
Распределение пациентов по возрасту, полу и ИМТ

Age group	Number of participants	Percentage
18-38 years	24	26.1
39-59 years	59	64.1
60-80 years	8	8.7
>80 years	1	1.1
Gender	**Number of participants**	**Percentage**
Male	54	58.7
Female	38	41.3
BMI	**Number of participants**	**Percentage**
Underweight	35	38.0
Normal	55	59.8
Overweight	2	2.2
Obese 1	0	0
Obese 2	0	0

Personal history revealed that 12 (13%) patients were smokers and had alcohol use disorder, and 8 (8.7%) were exposed to biomass (Table 3).

There was no statistical difference between comorbidities when compared with physical and mental health components; however, OAD showed significant statistics when compared with physical and mental health components ($P < .000$). Likewise, biomass exposure appeared to be statistically significant when compared with mental health components ($P < .042$), whereas

Table 3

Patient distribution by comorbidities and personal history

Таблица 3

Распределение пациентов по сопутствующим заболеваниям и жизненным факторам

Comorbidities		Number of participants	Percentage
Diabetes mellitus	NO YES	57 35	62.0 38.0
Hypertension	NO YES	55 37	59.8 40.2
Coronary artery disease	NO YES	89 3	96.7 3.3
Obstructive airway disease	NO YES	18 74	19.6 80.4
Personal history		**Number of participants**	**Percentage**
Smoking	NO YES	80 12	87.0 13.0
Alcohol use disorder	NO YES	80 12	87.0 13.0
Biomass exposure	NO YES	84 8	91.3 8.7

Table 4

Correlation of physical and mental health components with comorbidities, personal histories, age, gender, and BMI

Таблица 4

Корреляция компонентов физического и психического здоровья с сопутствующими заболеваниями, жизненными факторами, возрастом, полом и ИМТ

	Diabetes mellitus	Hypertension	Coronary artery disease
Physical component	*P*>.889	*P*>.086	*P*>.299
Mental component	*P*>.877	*P*>.067	*P*>.636
	Smoking	**Alcohol use disorder**	**Biomass exposure**
Physical component	*P*>.719	*P*>.318	*P*>.136
Mental component	*P*>.138	*P*>.706	*P*<.005
	Age	**Gender**	**BMI**
Physical component	*P*>.709	*P*>.269	*P*>.514
Mental component	*P*>.279	*P*>.455	*P*>.985

none of the personal histories were significant compared with physical and mental health components. Similarly, there was no difference between age, gender, and BMI compared with physical and mental health components of the HRQOL (Table 4).

Discussion

Our study was conducted on 92 post PTB patients, and HRQOL scores were measured by the SF-36 questionnaire. Patients diagnosed with PTB suffer from a chronic disability that negatively affects both their social and physical well-being. There are no standard guidelines for the pulmonary impairment management in PTB patients even after microbiological cure to improve the HRQOL.[14] Therefore, the current study is designed to investigate the HRQOL in post PTB patients. The findings showed a statistically significant difference between the physical and mental health aspects of the SF-36 in relation to OAD ($P<.000$), and when we compared physical and mental health aspects with biomass exposure, we found a remarkable statistically significant difference in the mental health component of the SF-36 ($P<.42$).

A study by Tolba et al (2021) demonstrated an improvement of the HRQOL in post PTB patients after 12 weeks of pulmonary rehabilitation from the baseline value of 27.23 ± 11.87 to 15.66 ± 8.18 ($P<.001$).[15] A study conducted by Duyan et al (2005) in Turkey on 120 hospitalized TB patients found that the diagnosis of TB had a negative impact on the patients' quality of life due to changes in family life and social environment.[16] Another study by Unalan et al (2008) in Turkey compared 196 active and 108 inactive TB patients with 196 healthy controls and found a higher rate of depression among TB patients, which negatively correlated with their quality of life.[17]

In our study, 12 (13%) patients were smokers and 80 (87%) were nonsmokers; 12 (13%) patients had alcohol use disorder, and 80 (87%) had no alcohol use disorder; only 8 (8.7%) patients were exposed to biomass exposure, while 84 (91.3%) were not exposed to biomass. The SF-36 questionnaire has a total of 8 parts that contain physical and mental health components. The physical health components include physical function, role limitation due to physical health problems, bodily pain, and general health. The mental health components include mental health, role limitation due to personal or emotional problems, social function, and vitality. According to the HRQOL questionnaire, of 92 patients, 54 participants (58.7%) demonstrated high HRQOL, while 38 (41.3%) exhibited low HRQOL in terms of physical function. In the context of role limitation due to physical health problems, 57 individuals (62%) showed high HRQOL, whereas 38 (38%) showed low HRQOL. Similarly, in relation to bodily pain: 34 participants (37%) had high HRQOL, while 58 (63%) experienced low HRQOL. In terms of general health, 37 participants (40.2%) reported high HRQOL, whereas 55 (59.8%) reported low HRQOL.

As for the role limitation due to personal or emotional problems, the majority of the patients—43 (46.7%)—exhibited high HRQOL, whereas 49 (53.3%) demonstrated low HRQOL. In relation to social function, 30 participants (32.6%) showed high HRQOL, and 62 (67.4%) demonstrated low HRQOL. Finally, in terms of vitality, 15 participants (16.3%) experienced high HROL, while 77 (87.3%) had low HRQOL.

Our study showed that there is no statistical difference between comorbidities (except OAD) when compared with physical and mental health components. There is no statistical difference between personal histories when compared with physical health components. By correlating the physical and mental health components with age, gender, and BMI, there is no statistical difference between the physical and mental health components.

Conclusions

We analysed the HRQOL (physical and mental health components) among post PTB patients. It included various factors, such as age, gender, BMI, comorbidities, and personal history. Our study revealed that comorbidities were prevalent among the study participants, with diabetes mellitus, hypertension, and OAD being the most common. While no significant association was found between personal history and the physical and mental health components of HRQOL, biomass exposure showed a significant impact on the mental health component of HRQOL. This emphasizes the importance of holistic management that includes psychological counselling, pulmonary rehabilitation, and follow-up of post PTB patients even after the microbiological cure of TB. Our study contributes valuable insights into demographic characteristics, comorbidities, and personal history of post PTB patients and suggests early screening of HRQOL to improve the standard of living.

Author contributions

Concept and design: Narasimhan, Kumar, Perumal
Manuscript drafting: Kumar
Statistical analysis and administrative support: Narasimhan, Perumal
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Конфликт интересов

Авторы заявляют об отсутствии конфликта интересов.