Review Article

The Role of Pulmonary Rehabilitation in Patients with Tuberculosis Sequelae

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Abstract

Pulmonary tuberculosis (TB) is a leading cause of mortality and morbidity worldwide. In recent years, patients with chronic respiratory diseases have been found to have a decreased quality of life. Pulmonary TB is also a significant risk factor for chronic respiratory diseases due to its effect on lung function. Although patients with pulmonary TB are considered "successfully treated" and "cured" by completing the full treatment, patients often struggle with post-TB sequelae to the lung leading to impaired functional status and decreased Quality of life. Pulmonary rehabilitation is an effective tool to improve the clinical, physical, psychosocial, and overall quality of life. This review highlights the role of pulmonary rehabilitation in patients with pulmonary TB sequelae.

Keywords: Pulmonary impairment, quality of life, tuberculosis sequelae, tuberculosis rehabilitation

Introduction

Tuberculosis (TB) is a communicable disease and is one of the top ten causes of death worldwide. Approximately 10 million people fell ill with TB in 2019.[1]

According to the World Health Organization (WHO), India has the highest TB burden globally with an estimated incidence of 26.9 lakh cases in 2019.[2] TB treatment saved 63 million lives globally between (2000 and 2019).[1] The disease primarily affects the lungs (pulmonary TB) but can also affect other sites (extra-pulmonary TB). TB is an illness of poverty, socioeconomic burden, and stigma. People with pulmonary TB often suffer from lung damage, including fibrosis, cavitation, and other radiological changes, even if they are considered completed anti-TB regimen and declared cured.[3] This can lead to loss of lung function, decreased quality of life, and physical and psychosocial impairments. They also face a substantial economic burden due to loss of wages and cost due to treatment for TB.

WHO's end TB strategy has laid out guidelines to eradicate TB by 2030.[1] National Tuberculosis Elimination Program has laid down guidelines for a post-TB follow-up to diagnose and manage post TB sequelae.[4] Pulmonary rehabilitation is the most effective and evidence-based tool for the optimal management of Post TB sequelae to prevent further morbidity and mortality and aims to improve the quality of life.[5]

Birth of Tuberculosis Rehabilitation

The most famous phrases of the Roman poet Juvenal in western society, *"Menssana in corporesano,"* is best translated as "A healthy mind lives within a healthy body." A sign of good health is a fit body, and exercise became an essential aspect of Greco-Roman civilization. In the olden days, rest was considered as a treatment for impaired health.[6] In the 19th century, patients with various disorders were advised to rest in bed and were treated by nurses and healthcare professionals. Bed rest was accepted as standard therapy. Sanatoriums were established for TB patients to provide good rest, nutritious food, and fresh air.[7]

The concept was that rest and a good nutrition program was the most effective treatment for managing TB patients to

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improve their immunity and control the infection. The high altitude at rest, clean air, and nourishment reached its height of acceptance as therapy. In the 18th century, the sanatorium was first introduced in Europe to treat and rehabilitate TB patients, followed by the United States of America and Canada.[8]

Pulmonary Rehabilitation

The council of rehabilitation defines rehabilitation as "the restoration of the individual to the fullest medical, mental, emotional, social, and vocational potential of which he or she is capable."[9] Pulmonary rehabilitation has arisen as a recommended standard of care based on scientific evidence for chronic respiratory disease patients.[10] The American Thoracic Society and the European Respiratory Society have recently adopted the following definition of pulmonary rehabilitation as a comprehensive intervention, based on a complete patient assessment followed by tailored, multidisciplinary therapy and education to improve the physical and emotional conditions of patients with chronic respiratory diseases and to promote adherence to healthy behaviors.[6] It is one of the most cost-effective treatments for chronic respiratory diseases and improves overall quality of life and daily activities.[11]

Sequelae of Pulmonary Tuberculosis

Patients often struggle with pulmonary TB sequelae after completion of anti-TB therapy or complete microbiological cure.[12] Amar *et al*. and Visca *et al*. suggested that pulmonary TB infection, bronchiectasis, pneumonia, and exacerbation of chronic obstructive disease more commonly occur.[13,14] It results in structural changes of the lung, including emphysema and bronchiectasis.[11] In addition, air pollution and tobacco smoking also damage lung parenchyma from repeated infection.[15] Post-TB sequelae can show obstructive airway disease, restrictive airway disease, or mixed defect.[16] It is essential to know the pattern of the pulmonary abnormalities of patients. These effects progress to lung dysfunction that differs from minor breathlessness to decreased Quality of life and affects daily living. It is essential to perceive these inconveniences so as not to confuse them as continuous dynamic sicknesses. Due to significant disability of decreased quality of life and affected daily living, postpulmonary TB sequelae patients are good candidates for pulmonary rehabilitation.[17]

Prevalence of Postpulmonary Tuberculosis Sequelae

In an observational study of TB sequelae in treated TB patients, Gohar Ali *et al*.[18] found that only 11 (9%) of 155 patients had effective cures from the disease. In comparison, 91% had TB sequelae (both lung parenchymal and pleural sequelae).[18] It indicates that TB sequelae are frequent and should be identified early after TB therapy to improve the Quality of life.[18]

A study done by Willcox *et al*.;[19] reported that in treated pulmonary TB patients, there is a high frequency of obstructive lung disease. Out of 71 people, 48 subjects (68%) who had previously been treated for TB had their pulmonary function tested for up to 16 years, and there was evidence of early airway obstruction.[19]

Tuberculosis Rehabilitation

There is a scarcity of studies regarding pulmonary rehabilitation in pulmonary TB sequelae. The most common treatment prescribed for this chronic disease is bronchodilator therapy, inhaled corticosteroids, and oxygen therapy.[20] Since it affects the overall quality of life of the patient, pulmonary rehabilitation for post-TB sequelae will be a boon to mankind. Rehabilitation of post-TB sequelae involves a multidisciplinary approach. After the bacteriological cure of TB, early post-TB sequelae and implementation of PR increase the overall patient's quality of life. Singh *et al*. also reported a significant improvement in functional status and quality of life in their study of patients who received post-TB pulmonary rehabilitation.[11] It is tailored individually and consists of physical exercises, breathing exercises, psychological counseling, and nutritional and educational components. It improves symptoms and the functional capacity of the lung.[21]

Physical Exercise

The vital part of the pulmonary rehabilitation program is physical exercises that improve symptoms and physical activities of patients with chronic lung diseases.[22] Upper limb exercise includes flexion and extension of shoulder, elbow, and arm exercises. Lower limb exercises include squats, walking, and stair-climbing, which reactivate the physical recondition. The target of physical activity consists of both upper limbs and lower limbs where minimal exercises are preferred, followed by an increase in intensity. Weights and repetition of the upper and lower exercises result in muscle strength.[3] To achieve endurance, walking and cycling are performed. Depending on the patient's endurance, the intensity should be increased slowly. In a study, Rupert Jones *et al*. reported that the main focus of the rehabilitation program was aerobic lower limb exercises, which includes physical reconditioning for strengthening essential muscles to improve oxygen utilization for enhancing cardiopulmonary performance.[15]

Breathing Exercises and Psychological Support

The program consists of breathing exercises which are deep breathing exercises, pursed-lip breathing exercises, diaphragmatic breathing exercises in a sitting position to improve the breathing discomfort.[22] Pursed lip breathing involves active exhalation with resistance by a pursed-lip seal to produce an expiratory whistle (expiration). Expiration should be double the duration of inspiration. This type of breathing reduces airway collapse by improving lung ventilation. The diaphragmatic technique involves slow and deep inspiration by placing one hand on the chest and the other on the abdomen, projecting the abdominal wall to the outside.

The overall goal is to improve the patient's quality of life and functional ability of the lung and improve the patient's psychosocial status for successful disease management.[23] Various psychological problems such as depression, anxiety, and stress are associated with chronic lung diseases patients, especially with TB sequelae which depletes their quality of living and well-being.[10] Emotional support must be provided to patients during the pulmonary rehabilitation program. Patient and program results should be assessed at the end of the program and periodically after that. This assessment must compare the status of the patient before and after the rehabilitation program.

This review suggests that pulmonary rehabilitation for post-pulmonary TB sequelae is a great boon to mankind. Many of the research and TB guidelines fail to address the importance of post TB impact.[24] TB can be prevented, the progression from infection to active illness can be stopped, and active disease can be detected and treated quickly, but the disease's impact is not considered once the treatment ends.[25] TB survivors have a high prevalence of respiratory complaints, radiological abnormalities, and functional deficit,[25,26] leading to sedentary life. Even in the absence of positive laboratory results, the chances of the impact of TB are high. However, some smear-negative recurrent TB may be undiagnosed chronic lung illness.[24] There is still a need for research to understand the pathophysiology of pulmonary TB sequelae. However, it is apparent that such complications induce pulmonary impairment and contribute significantly to the global burden of chronic respiratory disorders.[24] Greater awareness is needed to implement pulmonary rehabilitation for postpulmonary TB impact, leading to improved overall quality of life of patients.

To conclude, although pulmonary TB sequelae are one of the causes of chronic lung disease, very little literature is available about pulmonary rehabilitation in them. Indications for pulmonary rehabilitation for post-TB sequelae are reduced exercise tolerance, quality of life, functional status of the lung, and increased symptoms. More research is needed for evidence-based practice. The management of post-TB sequelae using pulmonary rehabilitation (PR) to improve overall quality of life of the patient, functional status of the lung, exercise tolerance, and psychological support can reduce the sedentary life of patients with post-TB sequelae.

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Conflicts of interest

There are no conflicts of interest.

References

1. WHO Global Tuberculosis Report; 2020. Available from: https://www.who.int/publications/i/item/9789240013131. [Last accessed on 2021 Nov 27].
2. NTEP India TB Report; 2020. Available from: https://tbcindia.gov.in/showfile.php?lid=3538. [Last accessed on 2021 Nov 27-11-2021].
3. Mahler B, Croitoru A. Pulmonary rehabilitation and tuberculosis: A new approach for an old disease. Pneumologia 2019;68:107-13.
4. RNTCP National Strategic Plan for Tuberculosis Elimination 2017-2015; 2017. Available from: https://tbcindia.gov.in/WriteReadData/NSP%20Draft%2020.02.2017%201.pdf. [Last accessed on 2021 Nov 26].
5. Croitoru A, Bogdan MA. Evidences related to pulmonary rehabilitation in the respiratory pathology. Pneumologia 2014;63:88-90, 92-5.
6. Clini E, Holland A, Pitta F, Troosters T: Textbook of Pulmonary Rehabilitation. 1st ed. Cham: Springer International Publishing; 2018.
7. DAVOS PLATZ: II. Sanatoriums and Hotels. Br Med J 1906;2:1407-10.
8. Baston A. Curing tuberculosis in Muskoka. In: Canada's First Sanatoria. Toronto: Old Stone Books Limited; 2013.
9. Council on Rehabilitation. Definition of Rehabilitation. Chicago: Council on Rehabilitation; 1942.
10. Ries AL, Bauldoff GS, Carlin BW, Casaburi R, Emery CF, Mahler DA, *et al.* Pulmonary rehabilitation: Joint ACCP/AACVPR evidence-based clinical practice guidelines. Chest 2007;131:4S-42S.
11. Singh SK, Naaraayan A, Acharya P, Menon B, Bansal V, Jesmajian S. Pulmonary rehabilitation in patients with chronic lung impairment from pulmonary tuberculosis. Cureus 2018;10:e3664.
12. Khan R, Malik NI, Razaque A. Imaging of pulmonary post-tuberculosis sequelae. Pak J Med Sci 2020;36:S75-82.
13. Amaral AF, Coton S, Kato B, Tan WC, Studnicka M, Janson C, *et al.* Tuberculosis associates with both airflow obstruction and low lung function: BOLD results. Eur Respir J 2015;46:1104-12.
14. Visca D, Tiberi S, Centis R, D'Ambrosio L, Pontali E, Mariani AW, *et al.* Post-Tuberculosis (TB) treatment: The role of surgery and rehabilitation. Appl Sci 2020;10:2734.
15. Jones R, Kirenga BJ, Katagira W, Singh SJ, Pooler J, Okwera A, *et al.* A pre-post intervention study of pulmonary rehabilitation for adults with post-tuberculosis lung disease in Uganda. Int J Chron Obstruct Pulmon Dis 2017;12:3533-9.
16. Kolb M, Chalmers JD, Humbert M. The evolution of the European Respiratory Journal: weathering the publishing pandemic. Eur Respir J 2021;57:2100084.
17. Ando M, Mori A, Esaki H, Shiraki T, Uemura H, Okazawa M, *et al.* The effect of pulmonary rehabilitation in patients with post-tuberculosis lung disorder. Chest 2003;123:1988-95.
18. Gohar Ali M, Syed Muhammad Z, Shahzad T, Yaseen A, Irfan M. Post tuberculosis sequelae in patients treated for Tuberculosis: An observational study at a tertiary care center of a high TB burden country. 2745. Available from: https://www.ers-education.org/lr/show-details/?idP=210871. [Last accessed 2021 Nov 26].
19. Willcox PA, Ferguson AD. Chronic obstructive airways disease following treated pulmonary tuberculosis. Respir Med 1989;83:195-8.
20. Ayari A, Smadhi H, Mejri M, Kamoun H, Greb D, Akrout I, *et al.* Management of pulmonary tuberculosis sequelae. Eur Respir J 2015;46:PA2762
21. Spruit MA, Singh SJ, Garvey C, ZuWallack R, Nici L, Rochester C, *et al*. ATS/ERS Task Force on Pulmonary Rehabilitation. An official American Thoracic Society/European Respiratory Society statement: Key concepts and advances in pulmonary rehabilitation. Am J Respir Crit Care Med 2013;188:e13-64.
22. Yoshida N, Yoshiyama T, Asai E, Komatsu Y, Sugiyama Y, Mineta Y. Exercise training for the improvement of exercise performance of patients with pulmonary tuberculosis sequelae. Intern Med 2006;45:399-403.
23. Marques A, Jácome C, Cruz J, Gabriel R, Brooks D, Figueiredo D. Family-based psychosocial support and education as part of pulmonary rehabilitation in COPD: A randomized controlled trial. Chest 2015;147:662-72.
24. van Kampen SC, Wanner A, Edwards M, Harries AD, Kirenga BJ, Chakaya J, *et al.* International research and guidelines on post-tuberculosis chronic lung disorders: A systematic scoping review. BMJ Glob Health 2018;3:e000745.
25. Dye C, Watt CJ, Bleed DM, Hosseini SM, Raviglione MC. Evolution of tuberculosis control and prospects for reducing tuberculosis incidence, prevalence, and deaths globally. JAMA 2005;293:2767-75.
26. Chin AT, Rylance J, Makumbirofa S, Meffert S, Vu T, Clayton J, *et al.* Chronic lung disease in adult recurrent tuberculosis survivors in Zimbabwe: A cohort study. Int J Tuberc Lung Dis 2019;23:203-11.