A Case Report - Physiotherapy Rehabilitation of a Patient with Post Pulmonary TB and Chronic Obstructive Pulmonary Disorder

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Abstract— Tuberculosis (TB), caused by Mycobacterium tuberculosis, has affected humans for thousands of years [1]. According to the Global Tuberculosis Report 2018, there are an estimated 10 million incident cases of tuberculosis, equivalent to 133 cases/100,000 population [2]. India accounts for 27% of all estimated incident cases worldwide [5]. Although successful treatment prevents death, many TB survivors experience long-term sequelae, including chronic obstructive pulmonary disease (COPD), bronchiectasis, and pulmonary hypertension [6,7]. COPD, defined by GOLD as persistent airflow limitation with chronic inflammation, remains a major cause of morbidity and mortality, with nearly 65 million people affected globally and 32% of global DALYs due to COPD occurring in India [4,5]. Post-tubercular lung disease significantly increases the risk of COPD, termed tuberculosis-associated obstructive pulmonary disease (TOPD) [10-14]. These patients exhibit severe airflow limitation, higher symptom burden, and reduced quality of life compared to smoking-related COPD [9]. Pulmonary rehabilitation, one of the most effective non-pharmacological strategies, includes breathing retraining, airway clearance, aerobic and resistance exercises. Evidence shows structured programs improve exercise tolerance, reduce dyspnea, and enhance functional independence [12]. A case-based physiotherapy protocol, combining education, airway clearance techniques, diaphragmatic breathing, and endurance training, improved six-minute walk distance (198 m to 440 m) and CAT score (26 to 20), underscoring its clinical value. Comprehensive physiotherapy-driven rehabilitation should be an integral component of post-TB COPD management [13,14].

***keywords*—Tuberculosis, COPD, Pulmonary rehabilitation, Functional capacity, QoL**

INTRODUCTION

Tuberculosis is caused by *Mycobacterium tuberculosis*. It has affected humans for thousands of years [1] According to the Global Tuberculosis Report 2018, there are an estimated 10 million incident cases of tuberculosis, equivalent to 133 cases/100,000 population. [2]

For many low-.and middle-income countries, the "end" of tuberculosis as a major public health problem is still a reality to achieve. India accounts for 27% of all estimated incident cases worldwide. India under its Revised National Tuberculosis Control Program (RNTCP) adopted the World Health Organization-endorsed Directly Observed Treatment,

Short-Course (DOTS) in 1997nationwide.[5]. tuberculosis in India is 204/100,000 population in 2017.[2] The estimated incidence of Tuberculosis was estimated to cause 1·4 million deaths in 2019.Individuals who develop tuberculosis experience a range of symptoms, including fever, wasting, and cough. Although successful treatment prevents death, many tuberculosis survivors experience ongoing health problems following the disease episode, and there is increasing evidence of long-term disability and elevated mortality risks in this population. The term **post-tuberculosis** describes the range of pathological conditions experienced by tuberculosis survivors. [3] Pulmonary tuberculosis, the commonest disease presentation, causes progressive destruction of lung tissue, and this damage might not fully resolve after treatment. Although prompt treatment can minimize lung damage, many tuberculosis survivors experience residual lung pathology, with cross-sectional studies consistently demonstrating substantial pulmonary impairment—including chronic obstructive pulmonary disease (COPD), spirometric restriction, bronchiectasis, and pulmonary hypertension, as well as secondary non-tuberculosis lung infections—among tuberculosis survivors. [6,7]Individuals with chronic respiratory disease experience lower quality of life, higher health-care use,and reduced economic productivity compared with healthy individuals.[10] Individuals with chronic respiratory disease additionally face higher all-cause mortality, even with only mild lung impairment.[9] In addition to pulmonary damage, extrapulmonary tuberculosis disease and drug toxicity can cause permanent damage to other organ systems, as well as social and psychological sequelae.[2]According to the WHO's estimates, nearly 65 million people have moderate to severe COPD that accounts for 5% of deaths (41.9 deaths per 100 000 individuals) globally and COPD remained the most prevalent disease-specific chronic respiratory disease (CRD) in 2017 [4,5]. COPD also imposes a significant burden owing to high health care costs and impaired health-related quality of life [6]. It is the leading cause of disability among chronic respiratory diseases and was the second leading contributor of Disability Adjusted Life Years (DALY) in 2016 [5]. In 2016, nearly 32% of global DALYs due to COPD occurred in India and COPD is responsible for 75.6% of total DALYs among chronic respiratory disease in India [5]. COPD-related mortality has been reported to be 39% from 2007-2017 [7]. Most of the existing data on COPD is from high-income countries, but 90% of deaths occur in low and middle-income countries [4]. Both India and China contributed to 33% of the world population and accounted for 66% of COPD mortality [5]. The global initiative for chronic obstructive lung disease (GOLD)1 defined chronic obstructive pulmonary disease (COPD) as "a common preventable and treatable disease, characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and the lung to noxious particles or gases." About 58% of world's tuberculosis cases occurs in South-East Asia and India contributes to 23% of the global tuberculosis burden. Developing countries are facing the dual epidemics of communicable diseases like tuberculosis, and human immunodeficiency virus infection (HIV) infection, and noncommunicable diseases like smoking and COPD. [7] The convergence of these epidemics may increase the susceptibility to diseases. Optimal management of these conditions requires thorough assessment of all the interacting epidemics. Smoking is the conventional risk factor for COPD but definitely not the only risk factor. Nonsmoking related risk factors such as biomass fuel smoke exposure, childhood lower respiratory tract infections, chronic asthma, outdoor air pollution, crop and animal farming,

exposure to various dust, chemicals and pollutants, and treated case of pulmonary tuberculosisare also important risk factors in disease causation, particularly in developing countries. [8,9] Past history of pulmonary tuberculosis has recently emerged as a risk factor for later developmentof COPD. If this relationship is correct, it would pose a significant burden on healthcare considering the fact that prevalenceof both the conditions are high in developing countries. Post tuberculousdevelopment of COPD is not a new thought; it hasbeen mentioned in the literature in the past also [10–14]. However, this issue has been studied in details only recently. All woodet al. named the condition of tuberculosis-associated obstructive pulmonary disease as TOPD. Patients of pulmonary tuberculosis may develop airflow obstruction either during the active phase or post-treatment phase of the disease. The prevalence of airflow obstruction in pulmonary tuberculosis is variable depending on the nature of study, definition of airflow obstruction used, and geographical locations. Pulmonary rehabilitation is one of the most effective non-pharmacological strategies for COPD patients, including those with a post-tubercular etiology. Evidence suggests that structured rehabilitation programs significantly improve exercise tolerance, reduce dyspnea, and enhance quality of life in individuals with chronic respiratory disorders. A systematic review by Singh et al. (2019) concluded that pulmonary rehabilitation provides clinically meaningful benefits in COPD patients by improving functional capacity and reducing hospitalization rates. These findings emphasize the need for comprehensive rehabilitation in patients with a history of pulmonary tuberculosis who develop chronic airflow limitation [12]. Post-tubercular COPD presents unique clinical challenges compared to smoking-related COPD. Research indicates that individuals with post-tuberculosis lung disease exhibit more severe airflow limitation, greater lung function decline, and higher symptom burden, despite receiving standard pharmacological treatment. According to Pasipanodya and Gumbo (2011), post-TB sequelae significantly contribute to the global burden of chronic respiratory diseases, underscoring the importance of non-pharmacological strategies such as physiotherapy and pulmonary rehabilitation to optimize patient outcomes.[13] Exercise training and breathing exercises form the cornerstone of physiotherapy in pulmonary rehabilitation for COPD. Studies have shown that combining aerobic training, resistance exercises, and breathing retraining techniques can improve pulmonary mechanics, reduce dyspnea, and enhance functional independence. Holland et al. (2013) reported that physiotherapy-led pulmonary rehabilitation programs significantly improve six-minute walk distance, respiratory muscle strength, and quality of life in patients with chronic lung conditions, including post-TB COPD.[14]

Case description

A 79-year-old male patient on 29th July 2025 came to our department with complaints of, shortness of breath during walking(>1km), stair climbing (10 step); cough, difficulty in expectoration, reduce of appetite and loss of weight since 15day and easy to fatigue. Shortness of breath that got worsened from grade 3 to grade 4. He was referred by an outside hospital. Patient had history of diabetes and hypertension for the past 3 years **both well-controlled on oral therapy** (e.g. sitagliptin 50 mg once daily and amlodipine 5 mg once daily)—with blood pressure typically 130/80 mm Hg and $HbA_1c \approx 6.8$ % in the past year.

First Illness (~25 Years Ago) He initially developed a common cold with cough and dyspnea, unresponsive to over-the-counter remedies after 5–7 days. Fifteen days later, symptoms progressed to exertional breathlessness, low-grade fever (37.5 °C), **hemoptysis**, marked fatigue, reduced appetite, and 2–3 kg weight loss. A general physician diagnosed **pulmonary tuberculosis with a secondary pulmonary infarct** (noted as "cox infarction"). He received standard four drug anti-TB therapy for **6–8 months**, followed by advice to continue medications (monotherapy unclear) for a prolonged duration.

Relapse (~20 Years Later) After nearly two decades of stability, he presented with recurrent **productive cough**, low-grade fever, **arthralgia in elbows**, dry mouth, decreased appetite, and unintentional weight loss. Dr. Ajay Kothiwada ordered sputum cultures and chest-X-ray, leading to a diagnosis of **relapsed pulmonary tuberculosis** complicated by **secondary infarction and fibrosis**. He was hospitalized for ~10 days, treated medically (no oxygen/ventilator required), and discharged on a **daily metered-dose inhaler (likely ICS/LABA)** plus "as-needed" use.

Latest Episode (~1 Month Ago) During his stay in Canada, Mr. Patel experienced a recurrence of dry cough, persistent low-grade fever, dyspnea on walking 0.5 km or climbing a few stairs (NYHA II–III), anorexia, ≈2 kg weight loss, and increasingly tenacious sputum; despite productive cough he was unable to expectorate effectively. Sputum AFB smear, GeneXpert and culture were all negative, and chest imaging showed no new cavitations or consolidation—ruling out active tuberculosis. Instead, radiographic evidence of longstanding post tuberculosis lung fibrosis and simplified spirometry (if obtained) demonstrated fixed airflow limitation, leading to a diagnosis of **acute exacerbation of COPD** on a background of post-TB lung disease—an entity increasingly recognized, especially in elderly TB survivors .Given his inability to expectorate despite mucus production, early initiation of **chest physiotherapy with airway clearance techniques**—such as positive expiratory pressure (PEP) breathing, huffing and assisted cough—is appropriate; meta-analyses indicate these techniques reduce hospital stay, ventilator assistance needs, and aid sputum clearance in AECOPD.. In addition, enrolment in a **pulmonary rehabilitation program** soon after exacerbation (combining supervised exercise training, breathing exercises and self-management education) is strongly advised to improve dyspnea, functional capacity, and reduce the risk of future exacerbations and re-hospitalization.

The patient has no significant surgical history. Medically, the patient has been diagnosed with hypertension and hypothyroidism for the past two years and is currently on treatment for both conditions. There is no significant family history of cardiac, pulmonary, or hereditary illnesses.

In terms of personal history, the patient follows a vegetarian diet, with a reduced appetite noted currently. Sleep pattern is normal, and there are no addictions reported. The patient has a known dust allergy. Regarding environmental factors, the patient resides on the ground floor of his residence and utilizes Western-style sanitation facilities. The patient's medication regimen comprised Thyronorm 50 mg, Doxy 100, Amlodac 2.5, Aerodil DX, pulmonary nutritional powder, Mucinac 600, and Glycohale FB administered via inhaler.

Clinical findings

Informed consent was obtained before the patient was examined. The assessment parameters have been described in table 1. Upon examination, the patient was observed to be cooperative and aware of time, place, and people. Breathlessness with the use of accessory muscles, grade III, was present according to the Modified Medical Research Council (MMRC) scale.

The patient has an ectomorphic body type. Postural assessment reveals kyphosis with right shoulder elevation. The observed breathing pattern is abdominothoracic in nature. The trachea is deviated to the left, likely due to underlying fibrotic changes. Trail's sign is

positive, and there is visible use of accessory muscles during respiration. Cyanosis is present, notably in the nail beds and tongue, indicating possible hypoxemia. Pallor is also present, while clubbing is absent.

Chest asymmetry is observed, along with a positive tracheal tug sign. Additionally, jugular vein distention (JVD) is present, suggestive of possible right-sided heart involvement or increased central venous pressure. The trachea is palpated deviated to the left, consistent with previous observation, likely due to fibrotic changes in the lung.

Upon palpation, the trachea is shifted to the left due to fibrotic changes, with no tenderness of the accessory muscles. Chest excursion is asymmetrical in all zones (upper, middle, and lower) of left lung, indicating less expansion on the left side. Muscle tightness is present in the sternocleidomastoid and pectoralis minor. Tactile fremitus is decreased on the right side across all lobes and increased on the left side across all lobes. This suggests increased lung tissue density on the left and a possible presence of air or fluid in the pleural space on the right. Percussion reveals a hyper-resonant note on the right side in all lobes and in the left upper lobe, with dullness noted in the left middle and lower lobes.

Auscultation of the lungs revealed abnormal vesicular-bronchial sounds across all lobes. On July 29, 2025, a wheeze was noted in the lower lobe, with crackles present in the left upper lobe and the right lower lobe. A follow-up on August 6, 2025, showed persistent crackles in the posterior lower lobe. A posteroanterior (PA) view chest X-ray from July 26, 2025, showed the trachea deviated to the left side as in fig. 1. The left lung displayed fibro-citatory and calcified changes, while the right lung was hyperinflated with a small amount of fibro-calcification. Z-N culture revealed Gram-positive Pneumococci which indicates a pneumococcal infection, particularly pneumonia.

Table 1 Assessment parameters

Sr. no.	Parameters		Pre- intervention	Post- pulmonary rehab intervention
1.	Vitals	BP	116/70 mmHg	116/80mmHg
		HR	88 bpm	80
		Spo2	98%	99%
		RR	30	25
2.	Chest expansion	At axilla	0.5 cm	2 cm
		At nipple level	2 cm	3 cm
		At Xiphisternum	2.5 cm	4 cm
3.	MMT	Diaphragm	3	4
4.	Breath Hold time		3 sec	5 sec
5.	Incentive spirometer		900 cc 1 sec hold	1200 cc 5 sec Hold
6.	PEFR		150 L/ min	200 L/min
7.	Stair climbing test	BP	128/88 mmHg	142/91 mmHg
		HR	91	117
		Spo2	97	95

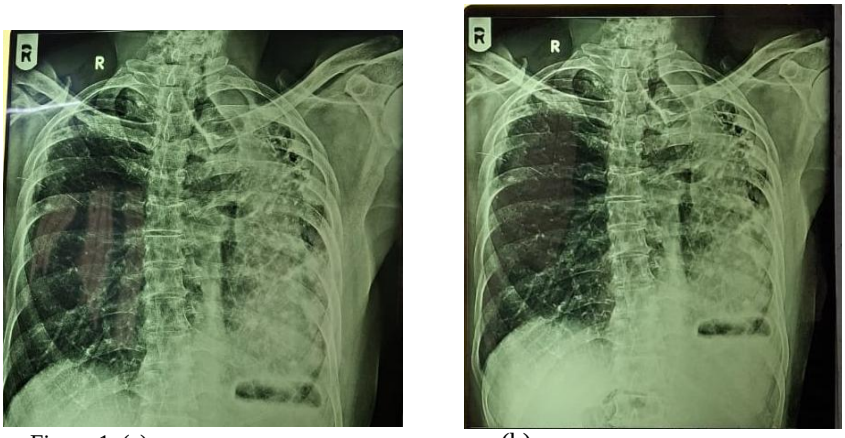

Figure 1. (a) (b)

Figure.1 (a) & (b) An anteroposterior view of the thorax X-ray shows fibro-citatory and calcified changes in the left lung, while the right lung was hyperinflated with a

Therapeutic intervention

The physiotherapy intervention aimed at improving activity tolerance, encouraging diaphragmatic breathing, reducing pain, enhancing sputum clearance, improving function, and overall quality of life. Intervention commenced with patient education to enable patients and caregivers to participate actively and be empowered with knowledge and skills to cope well with the condition.

Table 2 shows the entire physiotherapy rehabilitation protocol with a two-week duration, which is a list of problems, goals, and management.

Sr.no.	Problem list	Goals	Intervention
1.	Lack of awareness about the disease	To give education about the disease and the role of physiotherapy to the patients and their families. Adherence to exercise is important.	• Avoiding Triggers: Educating patients to avoid lung irritants, such as passive smoke, strong fragrances, dust, and air pollution. • Energy Conservation: how to save energy during daily activities by pacing themselves. • Encourage regular, gentle exercise as tolerated. Explain that it can strengthen respiratory muscles and improve overall fitness.
2.	Dyspnea	To reduce work of breathing.	• Pursed–lip breathing (5 reps* 3 times a day) • Breath control techniques (5 reps focusing on 1:3, I:E ratio with minimal or no use of accessory muscles) • Expiration holds 1 min with Relaxation techniques: (Jacobson's relaxation for reducing tightness of scalene, SCM etc. for 10 mins with maximum contraction followed by maximum relaxation of muscles)
3.	Reduced chest expansion	To improve chest expansion	• Segmental breathing • Diaphragmatic breathing • Thoracic mobility exercise • Incentive spirometry DOSE: 5-10 time; 2set
4.	Unable to expectorate	To improve bronchial hygienic	• Postural drainage with percussion (5-10 min) lower lobe • Mechanical aid: Flutter, acapella (10-15 time) • ACBT (10 min)
5.	Decrease exercise tolerance	To improve lung capacity and cardiopulmonary endurance	• Aerobic exercise: - walking (12 min) - cycling (5 min) • Resistance exercise
6.		To improve diaphragm strength	• Incentive spirometry 5 rep * 3 set • IMT with load resistance of 20 mmHg*10 reps* 2 set and increasing load 2 mmHg per week • Manual resistance by directly applying pressure with heel of the hand 10 reps* 2 set with hold of 5 secs • Huffing 5 times * 3 set followed by coughing • Acapella 5-10 times
7.	Decreased strength	To increase the strength of the body and improve posture	• 50-60% of 1RM for Upper limb • 60-70% of 1 RM for lower limb • 8-12 reps* 1-2 set of the major muscles group
8.	Fatigue	To minimize early fatigue	• Energy conservation techniques/pacing techniques. Pacing during work and taking breaks throughout the day when they feel fatigued

The study's outcome measures include a modified Medical Research Council (mMRC) for dyspnea, COPD Assessment Test (CAT), PFT and a six-minute walk test for functional capacity, listed in Table 3.

Diagnosis of COPD was made using the COPD Assessment Test (CAT) with the patient scoring 26 on the COPD scale. This scale measures the impact of COPD and rates patient cough, mucus on the chest, chest tightness, stair climbing, home activity limitation, leaving home, sleep, and energy level on a scale of 0 to 5 with a total score of 40. The higher the score, the higher the impact of the condition. The 6-min walk test (6MWT) was used to assess the patient walking and show that the patient was able to complete one lap with some short of fatigue. Borg Rating of Perceived Exertion (RPE) was used to measure the patient's perceived exertion while walking. The pre-6MWT RPE was 6/10, and the post-6MWT RPE was 11/10, on the first day. Pulmonary function test was performed both before the intervention and after the intervention.

Outcome Measures	Pre intervention	Post intervention
Dyspnea (mMRC)	Grade III	Grade I
CAT Score	26	20
6 min walk test (distance covered)	198 m	440 m
PFT (FEV1)	66% pred	
PEFR	150L/min	200L/min
VO2 max	30.175ml/kg/min	36.54ml/kg/min

RESULTS

The patient was 79 years old, with a height of 156 cm, weight of 46 kg, and a BMI of 18.9 kg/m². Baseline vital signs were as follows: systolic/diastolic blood pressure (SBP/DBP) of 116/70 mmHg, pulse rate (PR) of 88 bpm, respiratory rate (RR) of 30 breaths per minute, and oxygen saturation (SpO_2) at 98%. Post intervention, within 15days of pulmonary rehabilitation patient showed improvement in respiratory rate of 25 breaths per minute, oxygen saturation at 99% and pulse rate of 80bpm although the BP remained same. Over the course of one month, the patient underwent approximately 25 rehabilitation sessions. Initial progress was gradual, but by the third week, there was a noticeable improvement in activity tolerance. Inspiratory capacity, measured using an incentive spirometer, increased from 900 cc to 1200 cc. The patient wasn't able to climb up and down more than two flights of stairs, reporting a Rating of Perceived Exertion (RPE) of 8 out of 10.Post pulmonary rehabilitation, the patient was able to climb more than two flights of stairs without and exertion RPE 6 out of 10. Performance on the 6-Minute Walk Test (6MWT) improved to 6 laps from 2 laps. Additionally, the COPD Assessment Test (CAT) score improved significantly, decreasing from a baseline of 26 to 20. The patient reported increased energy levels and greater confidence in performing activities of daily living (ADLs), such as dressing, feeding, and going outside. Pulmonary function test (PFT) parameters showed no significant changes.

DISCUSSION

This case highlights the positive impact of structured physiotherapy rehabilitation in managing a patient with coexisting post-pulmonary tuberculosis (TB) sequelae and chronic obstructive pulmonary disease (COPD). Both conditions independently compromise pulmonary function, exercise tolerance, and quality of life. When coexisting, they can lead to significant physical deconditioning and functional limitations. Therefore, a multidisciplinary and individualized rehabilitation approach is essential. The patient presented with a low baseline functional capacity, as indicated by a high CAT score (26), reduced inspiratory capacity (900 cc), and limited performance on the 6-minute walk test (6MWT). These findings align with existing literature, which demonstrates that patients with a history of pulmonary TB are at increased risk of developing obstructive airway disease due to residual fibrotic and structural lung damage. Moreover, COPD further exacerbates this condition with persistent airflow limitation and increased respiratory workload. Over the course of 25 physiotherapy sessions in one month, the patient demonstrated marked improvements in functional status. The increase in inspiratory capacity from 900 cc to 1200 cc, improvement in 6MWT performance (6 laps), and the reduction in CAT score to 20 suggest improved pulmonary efficiency and symptom control[15]. The reported decrease in perceived exertion (RPE 6/10) during stair climbing also reflects enhanced exercise tolerance and reduced dyspnoea. These findings are consistent with studies showing that pulmonary rehabilitation can reduce symptom burden, increase exercise capacity, and enhance health-related quality of life in individuals with chronic respiratory diseases. Interestingly, while subjective and functional improvements were observed, pulmonary function test (PFT) parameters did not show significant change. This is not unexpected, as structural lung changes in post-TB and COPD patients are often irreversible. However, the disconnect between PFT stability and clinical improvement underscores the importance of comprehensive assessment tools—such as CAT, 6MWT, and BI scores—in evaluating the overall efficacy of rehabilitation programs.

In summary, this case reinforces the role of physiotherapy rehabilitation as a cornerstone in managing complex pulmonary conditions. Despite irreversible structural changes, targeted rehabilitation can lead to meaningful functional gains, symptom reduction, and improved quality of life. It also emphasizes the importance of early intervention, patient education, and adherence to therapy in optimizing outcomes in patients with dual pulmonary pathology.

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