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Case Report

Physiotherapy Section

Efficacy of Pulmonary Rehabilitation in Pulmonary Tuberculosis Sequelae with Cystic Bronchiectasis and Pulmonary Hypertension

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ABSTRACT

Cystic bronchiectasis, also known as saccular bronchiectasis (a severe type of bronchiectasis), is a condition that occurs as a complication and sequelae after pulmonary Tuberculosis (TB). There is chronic permanent dilation of bronchi that occurs after destructive changes in elastic and muscular layers of bronchial walls which further leads to the ballooning of bronchi and difficulty in clearing secretions with recurrent infection of the respiratory tract. Pulmonary hypertension is another major complication after bronchiectasis which affects pulmonary circulation. A 44-year-old female reported to the physiotherapy department with cystic bronchiectasis and pulmonary hypertension. The positive symptoms were chronic cough with mucoid sputum, low-grade fever, chest pain, breathlessness (modified Medical Research Council (mMRC) grade III), and easy fatiguability. The goals were set and inpatient Pulmonary Rehabilitation (PR) started with the aim of reducing burdening of symptoms and promoting the Quality of Life (QoL). The therapeutic interventions were splinted coughing techniques, deep breathing exercises, thoracic expansions, postural correction exercises, dyspnoea relieving positions, strength training, and pacing techniques. After rehabilitation the ventilation along with strength improved, dyspnoea was reduced, and exercise tolerance was increased.

Keywords: Dyspnoea, Physiotherapy, Quality of life, Therapeutic interventions, Ventilation

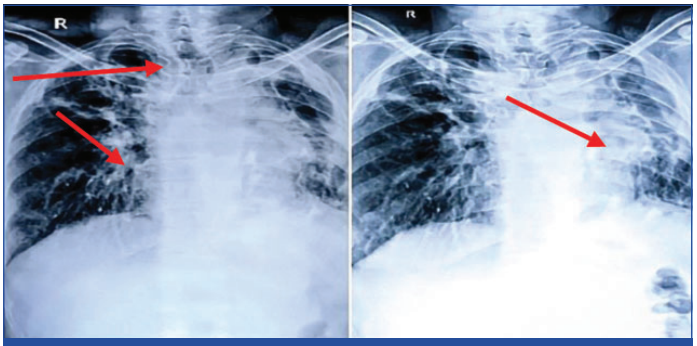
CASE REPORT

A 44-year-old female patient, a farmer by occupation, visited the medicine department with chief complaints of breathlessness (mMRC grade III), dry cough, and early fatigue for 1 year. The current symptoms are described in [Table/Fig-1]. She was diagnosed with pulmonary TB, nine years back and took medications for eight months. For three years she had a similar episode of chest pain, cough, fever, and breathlessness and was diagnosed with post-TB sequelae, for which she again took medication for six months. After all suggested investigations were done shown in [Table/Fig-2,3], the patient was diagnosed with post-TB with cystic bronchiectasis and pulmonary hypertension. After the diagnosis patient was referred to the Department of Physiotherapy for further management.

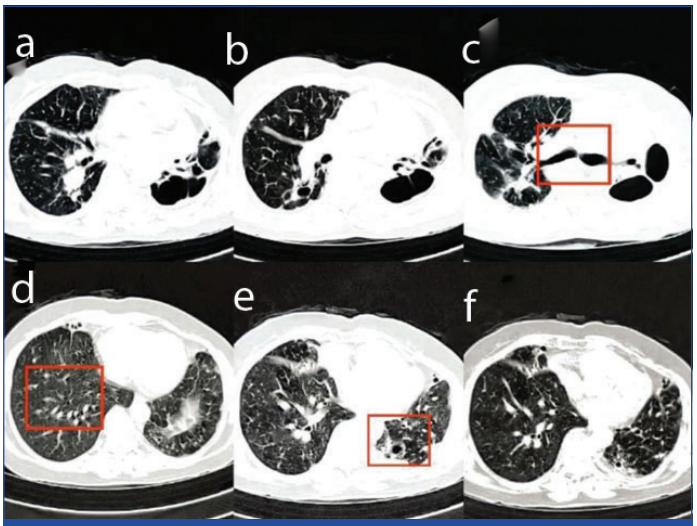
Symptoms	Onset	Duration	Type	Aggravating factors	Relieving factors
Dyspnoea (mMRC Grade III)	Sudden	-	-	Walking or doing Activities of Daily Living (ADLs)	Rest
Cough	Sudden	-	Dry	Exertion	Rest and medication
Sputum	-	-	Mucoid	-	-
Chest pain	Sudden	10-15 minutes	Sharp shooting	Exertion and doing ADLs	Rest
Fever	Gradual	3-4 days	Mild to moderate	-	Rest and medication

[Table/Fig-1]: Description of symptoms.

The patient was conscious, well-oriented, cooperative, afebrile, haemodynamically stable, and relates most of her medical history. She was ectomorphic, with a Body Mass Index (BMI) of 17 kg/m^2. She was on three liters of oxygen via nasal prongs, and the use of accessory muscles while breathing was observed. Respiratory examination revealed supraclavicular hollowness, barrel chest shape, and positive trail's sign as the trachea deviates to the left-side. Chest expansion was reduced at the nipple and xiphisternum levels, respectively. On percussion, a dull note was present over the left lung in the supramammary, mammary and inframammary regions. On auscultation, the air entry was reduced in the left upper, middle, and lower zones and right lower zones.



[Table/Fig-2]: Chest X-ray showing tracheal deviation to left-side and hyperinflation of the right lung, bronchovesicular margins, and cardiomegaly.



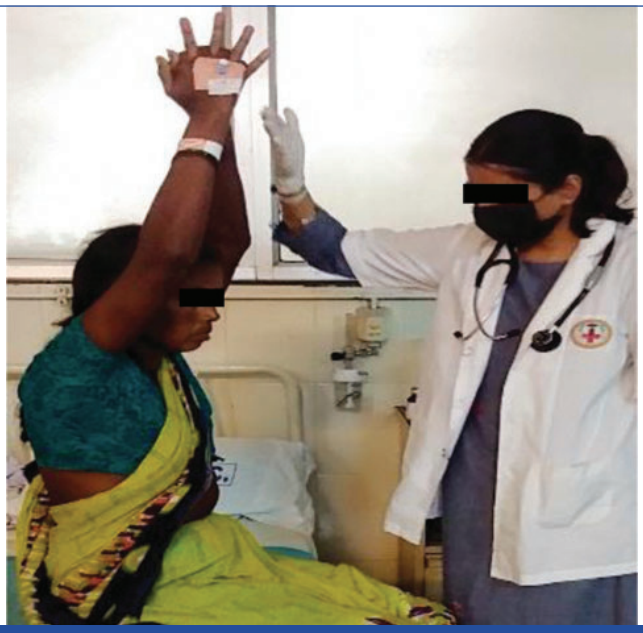
[Table/Fig-3]: Shows HRCT-Thorax shows of Cystic Bronchiectasis where d, e, and f show air-filled cystic lesions noted. c shows the middle lobe showing communication.

Physiotherapy management: The physiotherapy prescription started with the education of the patient and family about the present condition. Explaining to them the problems regarding their condition, goals to overcome it, and the importance of exercise therapy. The two weeks of inpatient rehabilitation are detailed in [Table/Fig-4].

Six-Minute Walk Test (6MWT) further improvement was measured in the modified Borg scale [1] followed by chest pain reduction while activity and on rest for that was used Numeric Pain Rating Scale (NPRS) [2] along with the improvement in quality of life was assessed using World Health Organisation Quality of Life (WHOQoL) [3].

S. No.	Problem list	Goals	Interventions
1.	Chest pain while breathing and coughing	To reduce chest pain	Splinted coughing.
2.	Decreased lung compliance, ventilation, and oxygenation	To improve lung compliance, ventilation, and oxygenation	Deep breathing exercises where breath holds of 5-7 seconds were added for better results.
3.	Decreased chest expansion at nipple and xiphisternum	To improve chest expansion	Active inhalation was started which is larger than normal breaths by keeping the shoulder, neck, and elbow straight while moving up with inhalation and bringing it down relaxing while exhalation. As given in [Table/Fig-5], This can increase peripheral airflow and collateral ventilation. Promotes lung expansion.
4.	Forward neck posture with reduced strength of the body	To improve posture and increase the strength of the body	1. Chin tucks and active neck movements. 2. For reduced strength, active range of motion free exercises of the upper and lower extremities. Shoulder and elbow flexion with ½ liter bottle Static sets of the gluteus, hams, and quads. With 5-second holds followed by dynamic quads, heel slides, and ankle pumps. (5 Reps×2 sets) the repetitions and sets were increased gradually. While the patient was performing therapist has to supervise and check vitals.
5.	Dyspnoea	To reduce dyspnoea	Dyspnoea relieving positions. 1. Side lying with head elevation 30-45° 2. Sitting upright in the chair 3. Forward lean sitting with help of a pillow 4. Leaning forward while standing. (Out of which no-1 and 3 were used in rehabilitation other positions were therapeutically educated).
6.	Reduced efficiency in walking	To improve walking efficiency	Hallway ambulation in supervision.
7.	Getting easy fatigue and inability to carry out activities of daily living	To make the patient functionally independent	Pacing techniques where one can use energy reserve technique to identify the baseline of work and carry out activities.

[Table/Fig-4]: Shows the list of problems, goals, and interventions.



[Table/Fig-5]: Thoracic expansion for improving chest expansion and upper extremities mobility.

The outcome measures were taken on the first day of referral, then after two weeks of physiotherapy rehabilitation, and after one week while follow-up. So, the pre, post, and follow-up are given in [Table/Fig-6]. On the follow-up the dyspnoea was relieved from mMRC grade III to mMRC grade I, and the patient was able to cover more distance without getting fatigued in test-retest on a

Outcome measures	On 1st day of physiotherapy reference	After 14 days at the time of discharge	After 7 days of discharge in follow-up
Dyspnoea (mMRC)	Grade III	Grade II	Grade I
Numeric Pain Rating Scale (NPRS)			
On activity	8/10	7/10	4/10
On rest	4/10	2/10	0/10
Six-Minute Walk Test (6MWT) (distance)	220 m	380 m	420 m
Modified Borg Scale after Exercises (15 minutes)	4	3	2
Impulse oscillometry	Pre-test 1. R5Hz-2.60 kPa/(L/s) 2. R20Hz-1.30 kPa/(L/s)	Post-test 1. R20Hz-2.00 kPa/(L/s) 2. R20Hz=1.10 kPa/(L/s)	
WHO-QOL			
Physical health	58/100	64/100	70/100
Emotional health	74/100	78/100	80/100
Social health	78/100	78/100	80/100
Environmental health	80/100	80/100	80/100

[Table/Fig-6]: Outcome measures.

DISCUSSION

Pulmonary TB is a major global health challenge and the second leading cause of infectious disease-related deaths, affecting individuals of all ages. Even after recovery, patients may still experience sequelae, with 295.9 cases per 100,000 people experiencing structural lung damage leading to physiological impairments and disability [4]. Cystic bronchiectasis is a persistently progressive condition characterised by the destruction of the muscular and elastic components of the lungs, resulting in wider and damaged large airways. This condition can occur after an infection or fibrotic changes in lung tissues and is more prevalent in females, with significant morbidity [5]. Pulmonary hypertension is a rare but critical condition that affects pulmonary circulation, with a prevalence of 10-52 cases per million. Individuals with pulmonary hypertension typically experience primary symptoms of breathlessness, decreased functional abilities, and reduced QoL [6].

Post-Tuberculosis Lung Damage (PTLD) presents with both obstructive and resistive airway abnormalities, resulting in increased respiratory symptoms and decreased QoL. The presence of chest pain and breathlessness has been closely associated with low QoL, influencing physical, psychological, and social areas of health in patients with pulmonary TB sequelae. This condition has been linked to depression, severe hypoxaemia, age, socio-economic class, and physiological well-being [7]. Although the specific condition is not curable, medication and physiotherapy can reduce the burden of the condition and promote life expectancy [8].

PR (Pulmonary Rehabilitation) is a multidisciplinary program for patients with respiratory impairment that compromises their clinical and functional status, affecting their QoL. In a study conducted on eight patients with TB sequelae, PR was found to have a positive impact on health-related QoL and aerobic capacity, assessing disability, exercise capacity, and participation. The study confirms that PR improves health status associated with unexpected haematosis or chest pain and other patient-related outcomes [9].

A study was conducted in 2019 to see the efficacy of PR on TB sequelae, an old disease with a new approach. This rehabilitation focused on aerobic exercises for eight weeks held three times a week, with training intensity ranging from 60-90% of maximum oxygen intake. The results were encouraging, with a 1.7 mL/kg/min increase in peak oxygen consumption (VO_2) and a 63.6 m increase in the 6MWT distance. Hence, positive feedback was achieved by improving the physical and functional status of patients with TB, as well as providing psychological support, shortening the convalescent period, and allowing patients to return to work sooner [10]. A study was conducted in 2022 to assess the efficacy of exercise therapies in patients with bronchiectasis regarding pulmonary functions, exercise capacity, and QoL. During eight weeks of rehabilitation, the key outcomes were Incremental Shuttle Walk Distance (ISWD) and 6-MWD. The secondary outcomes were Forced Expiratory Volume in one second (FEV1), St. George's Respiratory Questionnaire (SGRQ), and Leicester Cough Questionnaire (LCQ). The results concluded that PR increases exercise capacity and lung function (particularly FEV1) in individuals with bronchiectasis when compared to normal treatments [11]. Patients suffering from respiratory symptoms typically have respiratory muscle weakness. Inspiratory Muscle Training (IMT) has been found to improve inspiratory muscle strength, endurance, functional exercise capacity, dyspnoea, and QoL when used alone. At equivalent work rates, IMT paired with exercise training may result in higher decreases in dyspnoea intensity than exercise training alone [12].

In cases of pulmonary hypertension, breathlessness can be a problem in rehabilitation. Patients with major risk should be monitored properly, and this could be achieved in supervised PR programs. PR provides patients with both physiotherapy and nursing support. The personalised, individualised approach allows the optimum rehabilitation solution to be delivered to patients based on their needs [13]. There are two ways to measure outcomes: subjectively and objectively. In this case, both outcomes were taken into consideration. The main focus was on the 6MWT and retest, which shows reliability and significance in patients with respiratory problems [14]. Almost every respiratory condition affects QoL. Therefore, present study followed the World Health Organisation (WHO) definition of QOL and used the WHOQoL scale. This was because they are universally accepted and accepted and hence reliable to use as a multidimensional questionnaire [3].

CONCLUSION(S)

The PR in post-TB sequelae with cystic bronchiectasis and pulmonary hypertension was effective and clinically significant in improving oxygenation and ventilation by removing oxygen support, increasing strength, relieving dyspnoea, improving exercise capacity, and ultimately improving patients' QoL. This case report provides an integrated management plan for Cystic Bronchiectasis as a post-TB sequela. The patient achieved full recovery while rehabilitation and symptoms were managed, reducing the burden of the disease and promoting QoL. The intervention and its outcomes heavily rely on physiotherapy skills and knowledge, and more research is needed to determine the effectiveness of physiotherapy interventions in pulmonary hypertension.

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