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Case Report

Physiotherapy Section

Pulmonary Rehabilitation of a Patient after Lobectomy Secondary to Pulmonary Aspergilloma: A Case Report

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ABSTRACT

Pulmonary aspergilloma is a mass in the lungs caused by a fungal infection named aspergillosis, which is caused by the fungus *Aspergillus*. There is a high prevalence of aspergilloma in patients who have previously been affected by pulmonary tuberculosis. The present case report was aimed to describe the radiological features and functional activity limitations of a patient diagnosed with aspergilloma who underwent lobectomy of the superior lobe, middle lobe and superior segment of the lower lobe. A 51-year-old male was admitted with the chief complaint of blood in his sputum, which had increased in volume over the past 10 days, leading to a diagnosis of pulmonary aspergilloma. A Computed Tomography (CT) scan and X-ray confirmed this diagnosis. The patient was referred to the Physiotherapy Department on Postoperative Day one (POD-1). The personalised pulmonary rehabilitation was directed at improving functional mobility and reducing secondary complications of the surgery. The present case report emphasises the importance of tailored pulmonary rehabilitation and its effects on functional independence.

Keywords: *Aspergillosis*, Chest expansion, Postoperative day

CASE REPORT

The Physiotherapy Department received a referral from the Cardiothoracic and Vascular Surgery Unit for a lobectomy performed on a 51-year-old man on his POD-1. The chief complaints included pain over the suture site, which began, as soon as, the anaesthesia wore off, approximately four hours after the surgery. He was unable to produce a strong cough to clear secretions, resulting in movement restrictions. According to the assessment of obesity in India, the patient was poorly built, with a Body Mass Index (BMI) of 18.1 kg/m^2 [1].

His pain was gradually progressing and had a sudden onset, which aggravated with movement, coughing and sneezing. The numerical pain rating scale was used to assess the pain and the patient rated it as 7 out of 10 [2].

A drain was present, exiting the surgical site. The history revealed that the patient was in his usual state of health about a year ago when he started noticing blood in his sputum (haemoptysis), which occurred intermittently. Initially, the haemoptysis was once or twice a week, but it gradually progressed to 10-20 mL of blood in his sputum per day, with at least one episode of haemoptysis occurring daily. In the past 10 days before admission, the blood in the sputum increased to about 80-100 mL per day and he experienced 2-3 episodes of haemoptysis daily, along with a severe cough that significantly affected his mobility.

The patient's past medical history revealed that he was a known case of pulmonary tuberculosis, diagnosed 11 years ago, for which he was treated for six months. He also suffered a head injury eight years ago due to a Road Traffic Accident (RTA), records of which were not available. The patient was admitted to another hospital a week prior, where all radiological investigations were performed, revealing a pulmonary aspergilloma. The films of these investigations were not available as they were stored in the electronic database of the previous hospital and surgery was suggested for the condition. He was then admitted to the present study hospital for management and underwent a super lobe, middle lobe and superior segment of the lower lobe lobectomy.

The surgical history revealed an Open Reduction Internal Fixation (ORIF) of the elbow at the time of the RTA. He was not a known case of any other systemic diseases.

On general physical examination, the patient's vitals were within normal limits, although he exhibited shallow breathing. His hands displayed digital clubbing of grade 3 [3].

The cough description is as follows: according to the simplified cough score, his cough was graded as 3, indicating frequent coughing that severely affected his daily life and sleep [4]. The cough was productive and included the presence of blood. The patient described his dyspnoea as modified Medical Research Council (mMRC) grade 2 (walking slower than peers on level ground); he also reported a history of nocturnal dyspnoea [5].

The patient had a forward head posture with rounded shoulders and no jugular vein distention was noted. His chest was barrel-shaped, with ribs parallel to each other, as seen in the X-ray. Chest expansion was greater on the left side compared to the right side. The incision made was a posterolateral thoracotomy, measuring 24 cm in length and 0.5 cm in width.

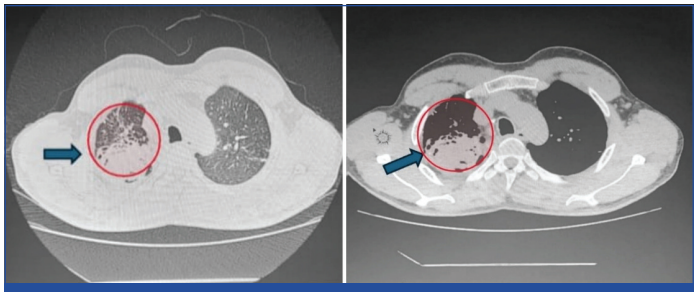
The chest expansion was measured at three levels: the axillary level, nipple level and xiphoid process level [Table/Fig-1].

Levels	Measurement
Axillary level	2 cm
Nipple level	1.5 cm
Xiphoid level	1 cm

[Table/Fig-1]: Examination of chest expansion.

Pulmonary auscultation revealed mild crepitus heard prominently on the left side, while cardiac auscultation showed normal S1 and S2 sounds with no abnormal sounds detected. A chest CT scan revealed cavitation lesions in the right lung with intracavity hypoedema, suggestive of pulmonary aspergilloma. A few subpleural nodules were found, surrounded by ground-glass opacities in the right lower lobe and left upper lobe, with focal bronchiolar wall thickening in the right lower lobe indicating an infective etiology. Fibrosis with traction bronchiectasis, calcified parenchymal nodules and mediastinal lymphadenopathy were observed on the CT, suggestive of sequelae from a previous infection, which in the present case is pulmonary tuberculosis.

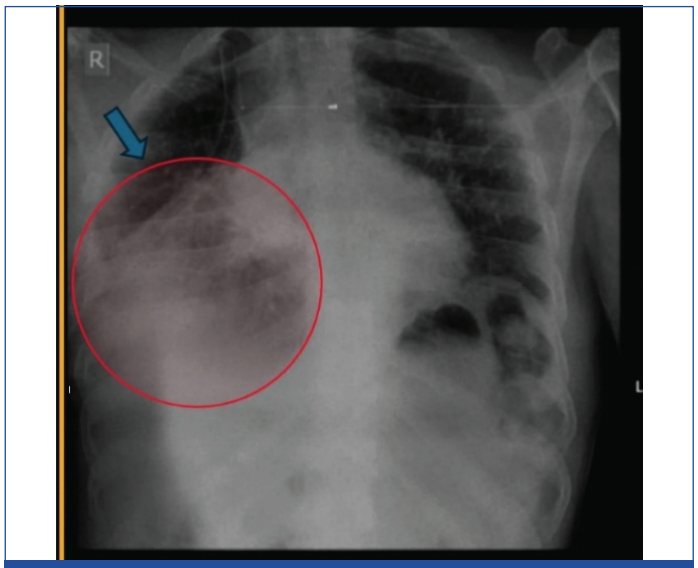
A transverse section of a CT scan displaying ground-glass opacity in the right lung, indicative of infections or chronic interstitial disease, in this case, aspergilloma [Table/Fig-2]. The opacity is seen to occupy 50% of the visible lung field in the transverse section.



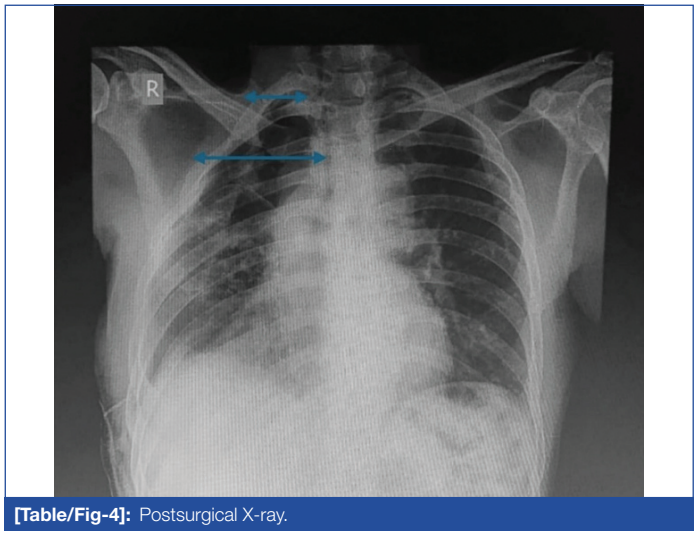
[Table/Fig-2]: Transverse section of a CT scan.

The haematological reports revealed low haemoglobin levels (9.5 g/dL) [6] and a higher total leucocyte count (14,568/mm^3) [6], along with elevated total bilirubin (2.0 mg/dL) [7] and Serum Glutamic-Oxaloacetic Transaminase (SGOT) levels (45 U/L) [7].

Chest X-ray taken prior to surgery, revealing opacities in the right lung indicative of infective infiltrates or fluid accumulation, or both [Table/Fig-3]. Chest X-ray taken immediately after surgery, demonstrating better aeration in the lower lobes of both the right and left lungs, which can indicate improved ventilation following the removal of the infected lobes [Table/Fig-4]. Asymmetry of the rib cage is noted due to the removal of the upper and middle lobes of the right lung.

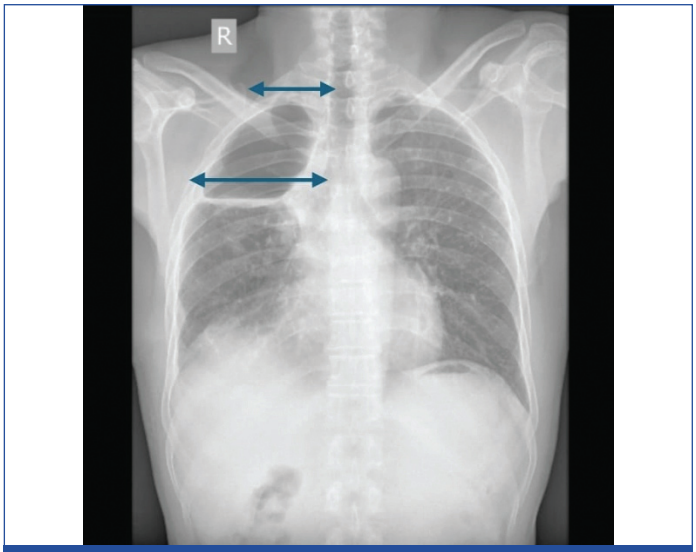


[Table/Fig-3]: Presurgical X-ray.



[Table/Fig-4]: Postsurgical X-ray.

Chest X-ray taken after physiotherapy, illustrating symmetrical halves of the rib cage and improved ventilation in both lungs [Table/Fig-5].



[Table/Fig-5]: X-ray following physiotherapy.

The surgical procedure performed included a right upper and middle lobectomy with right superior segmentectomy of the lower lobe. The incision made was a posterior lateral thoracotomy, measuring 18 cm.

Physiotherapy management began on days 1 and 2 and on POD-1 in the Intensive Care Unit (ICU), with the goal of managing pain, encouraging the patient to perform exercises, preventing postoperative pulmonary complications (such as atelectasis or pneumonia) and promoting effective airway clearance.

Interventions (Physiotherapy treatment was administered twice a day): The patient's vitals were stable, with an SpO_2 of 98% while on eight litres of oxygen. The patient was assisted into a Fowler's position from supine lying to optimise lung expansion and improve oxygenation. The patient was educated about changing positions every two hours. Diaphragmatic breathing exercises were taught to improve lung expansion. Due to the patient's complaint of pain from the surgical procedure, repetitions were limited to five repetitions in two sets. Incentive spirometry was initiated and the patient was advised to use it every two hours. Active movements of the ankle and knee were started, with three sets of 10 repetitions each.

Day 3 (ICU)

Vitals were stable with 99% SpO_2 on an O_2 supply of six litres. Along with the exercises from the previous day, the patient was made to sit on the edge of the bed for 10 minutes while his vitals were monitored and they remained stable. Since sitting at the edge of the bed was well tolerated, the patient was assisted in standing with the help of a walker for three minutes. Spirometry was performed effectively, along with other exercises, multiple times throughout the day.

Day 4 (ICU)

As the vitals remained stable while performing spirometry, active exercises of the lower limbs, edge of bed sitting, standing and walking were initiated. The patient was assisted in walking around the bed with a walker and support from the physiotherapist. This helped the patient overcome ineffective coughing and sputum removal.

Day 5

On POD 5, the patient was shifted to the wards with stable vitals and the external oxygen supply was stopped. The repetitions of the lower limb exercises were increased. Exercises such as thoracic expansion, shoulder mobility exercises and spot marching were initiated. The patient was able to ambulate for 50-100 metres with minimal assistance from the therapist. The use of the incentive spirometer was continued.

Day 6

The main concern of the patient was walking uphill, as his residence was in a hilly location. To prepare him for this, stair climbing was initiated. The patient experienced dyspnoea (Modified Borg dyspnoea scale- 13, i.e., somewhat hard [8]). After ample rest, he began the exercises again. The patient's interest and determination played a key role in his rehabilitation.

Day 7

After completing all the bedside exercises and ambulation, the patient was made to walk on the ramps while applying effective energy conservation techniques, such as leaning forward on the wall, staying in a wall squat position until breathing became easier and practicing pursed lip breathing. At this stage, the patient was able to climb one flight of ramp (8 metres). With a modified Borg dyspnoea scale score of 11 (i.e., light exertion) [8], vital signs and saturation were monitored throughout the process.

Day 8

A 6-Minute Walk Test (6MWT) was done to determine his exercise tolerance. The Troosters' equation for the 6MWT is 6MWD pred= 218+{5.14×height (cm)-5.32×age (y)}-{1.8×height (cm)}+(51.31× sex). Where male=1 and female=0 [9].

The predicted walking distance according to this formula was 559.1 metres. The patient walked for seven and a half laps, which is 435 metres. Therefore, the total distance walked by the patient is 77.8% of the total predicted distance. This indicates that the patient could achieve three Metabolic Equivalents (METs) by the end of the pulmonary rehabilitation. METs is a straightforward way to express the energy cost of physical activities, represented as a multiple of the resting metabolic rate [10].

The patient was discharged eight days after the surgery. At the time of discharge, the patient was symptomatically better and stable. The outcomes both pre and post-treatment are explained in [Table/Fig-6] [2,4,8,11,12]. The patient was advised to visit the hospital for re-evaluation after two weeks. A pamphlet containing home exercises was provided to the patient, which included coping strategies, nutritional advice and the benefits of exercise, along with a prescription for each exercise and ambulation guidance.

Parameters	Pretreatment	Post-treatment	Decrease %	Increase %
Modified Borg dyspnoea scale [8]	6	2	33.3	-
NPRS [2]	On rest-5/10	On rest-1/10	20	-
	On activity-8/10	On activity-5/10	62.5	
Hospital Anxiety and Depression Scale (HADS) [11]	Depression-14	Depression-6	42.8	-
	Anxiety-12	Anxiety-5	41.6	
Barthel index [12]	80/100	30/100		37
Simplified cough score [4]	Grade 3	Grade 2	66.6	-

[Table/Fig-6]: Outcome measures [2,4,8,11,12].
NPRS: Numeric pain rating scale

DISCUSSION

Aspergillus spores primarily enter the respiratory tract and the external auditory canal. These filamentous organisms rapidly multiply and become consequential in patients with diseased lungs or systemic immunodeficiency. Aspergillomas do not tend to invade the surrounding lung tissue [13].

Haemoptysis is the most common clinical manifestation in symptomatic patients. The bleeding source is usually a bronchial vessel and is secondary to:

- Direct invasion of capillaries in the wall lining;
- Endotoxin release from the organism;
- Mechanical irritation of exposed vessels within the cavity;
- A rapidly growing cavity that can erode into the pleural surface and intercostal arteries, causing massive, often fatal haemoptysis that is highly challenging to control [13].

Patients with simple aspergilloma are often asymptomatic, while those with complex aspergilloma, like in the present case, commonly present with more severe symptoms such as haemoptysis, bronchorrhoea, chest pain, poor nutritional status and impaired respiratory function. Surgery is currently the mainstay of treatment for aspergilloma but is associated with considerable mortality and morbidity [14,15].

Mycobacterium tuberculosis causes infections that can be pulmonary or extrapulmonary and can weaken the immune system. The pulmonary manifestation of this infection can cause cavities in the lung. This scarring and cavitation in the lungs create an ideal environment for fungi such as *Aspergillus* to colonise and grow, which leads to the formation of aspergilloma. This was evident in the present case, as the patient had tuberculosis, which might be a predisposing factor for aspergilloma formation.

A case study similar to the present case was published by Kokok AS et al., [16]. This study focuses on improving lung function, managing symptoms and preventing complications. It also emphasises the need for a tailored rehabilitation programme to enhance recovery, improve the quality of life for patients and their families and minimise the risk of postoperative complications [16].

Another similar study was published by Yadav S, which discusses a rare and challenging case in which a diabetic Indian male has both tuberculosis and aspergilloma simultaneously. The coexistence of these two diseases makes this a rare and interesting case. It is also complicated, as the patient in this case was immunocompromised due to diabetes. The patient presented with similar complaints to the present case, specifically haemoptysis. In this case, management addressed both infections simultaneously with antitubercular drugs and antifungal therapy. The highlight of this study is the consideration of fungal infections in patients with a history of tuberculosis, especially those with other underlying conditions like diabetes [17].

CONCLUSION(S)

A tailored pulmonary rehabilitation protocol for a patient post-lobectomy due to aspergilloma improved the aerobic capacity, as evidenced by the values from the 6MWT. It also reduced dyspnoea, as indicated by the scores on the modified Borg dyspnoea scale and improved chest symmetry and expansion, which was observed in the post-physiotherapy chest X-ray.

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