

# Importance of Physiotherapy in Post Pneumonectomy Renal Transplant Recipient: A Case Report

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DOI: <https://doi.org/10.52403/ijshr.20230215>

## ABSTRACT

Pulmonary mucormycosis is a rare but opportunistic fungal infection that complicates immunosuppressed solid organ transplant recipients. Although antifungal medication is the remedial dependence in management of pulmonary mucormycosis, early surgical intervention provides advantage over medical treatment alone. However, major impairments and complications such as altered pulmonary and physical function induced by surgery are known to occur. We report the case of a 25-year-old male post renal transplantation on immunosuppression who developed invasive pulmonary mucormycosis in right middle and lower lobe. Liposomal Amphotericin B therapy provided insufficient infection control and lesion invaded the adjacent chest wall, ribs and intercostal muscles. After right pneumonectomy combined with anterior chest wall resection, the initial post-operative physiotherapy assessment was carried out. The patient was found to have productive cough, dyspnoea, chest pain, reduced chest expansion and excursion, limited range of motion of shoulder on affected side and limited activities of daily living. Six weeks of inpatient physiotherapy regime was given which included breathing exercises, thoracic mobility exercises, incentive spirometry, active range of motion exercises, positioning, bed mobility and early ambulation. Follow up assessment showed reduced pain intensity and improvement in oxygen saturation, Timed up and go

test (TUG) time, handgrip strength, activities of daily living and quality of life [Short form 36 (SF-36)].

**Keywords:** Pneumonectomy, Thoracic Surgery, Renal Transplant, Physiotherapy

## INTRODUCTION

Pulmonary mucormycosis, an infrequent, opportunistic fungal infection often complicates chronic diseases and immunosuppressed solid organ transplant recipients. As per a review, the infection rates of post – transplant fungal infection were approximately 2-14 % (Yan Song, et al., 2017)<sup>[1][2]</sup>. In another retrospective study conducted in 2011, 16 renal transplant recipients out of 1330 were found to have had mucormycosis (SM Godara, HL Trivedi et al)<sup>[3]</sup>. Although liposomal Amphotericin B is the remedial dependence in management of pulmonary mucormycosis, in immunocompromised patients, early surgical intervention provides advantage over medical treatment alone.

Pneumonectomy is the surgical resection of unilateral lung with ligation of the bronchial stump. However, major impairments and complications such as pneumonia, atelectasis and altered physical and pulmonary function induced by surgery are known to occur. Physiotherapy has been

extensively used pre and/or postoperatively to avoid surgical complications and enhance recovery of the patients.

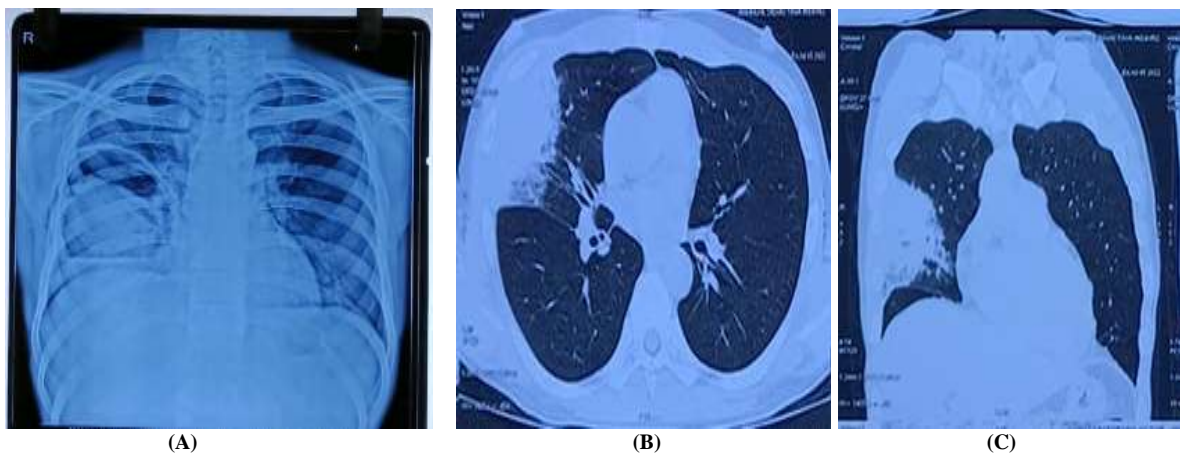
Pulmonary rehabilitation in this patient who had undergone pneumonectomy was designed individually after taking into consideration the postoperative and the discharge phases.

## CASE REPORT

### PATIENT INFORMATION

A 25-year-old patient presented to a tertiary hospital with complaints of chest pain and

breathlessness and was diagnosed to have pneumonia. Later he developed hemoptysis and his radiological and cytological findings were consistent with pulmonary mucormycosis for which he underwent right sided pneumonectomy. He also had a history of robotic renal transplantation 7 months earlier, after which he had an episode of antibody mediated rejection which was managed conservatively. His maintenance immunosuppression included Omnacortil, mycophenolate mofetil. He was also a known case of hypertension.



- (A) Pre-operative chest Xray showing cavitation in the right lung field  
(B) (C) HRCT scan images showing large wall cavity lesion involving right middle lobe which was seen communicating with right middle lobe segment bronchi, also infiltrating adjacent chest wall and 3<sup>rd</sup> to 6<sup>th</sup> ribs with involvement of intercostal muscles

### CLINICAL PRESENTATION

The patient was referred for physical therapy post pneumonectomy. Upon initial encounter with physiotherapist as an inpatient, he had complaints of pain around the incision site (VAS : 5/10) and dyspnea (mMRC Grade IV). Physical examination revealed pulse rate of 91/min, blood pressure of 149/100mmHg, respiratory rate 22/min, and saturation 99% on 4L O<sub>2</sub> via nasal cannula. The patient was found to have reduced chest excursion and expansion, altered posture, limited range of motion in right shoulder joint, reduced muscle strength in bilateral upper and lower limbs ( $\geq 3/5$ ) and limitations in activities of daily living (FIM Score : 66/126)

### INTERVENTIONS

The physiotherapeutic rehabilitation of this patient included breathing exercises, mobility exercises along with postural correction and early ambulation. Given the patient's hyperalgesia, the first PT session consisted of deep breathing exercises, ankle pumping exercises and wound care. As the pain subsided with the help of analgesics, progression to further exercises such as range of motion exercises for extremities and incentive spirometry were initiated. Lateral positioning in bed was initiated as soon as the patient was comfortable and progression to upright positioning was made by the end of the 3<sup>rd</sup> week.

**Table 1. Summary of interventions**

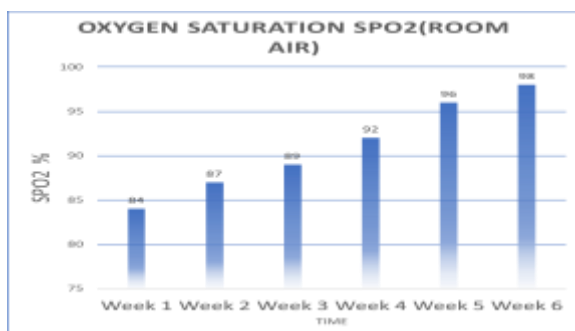
TIME	GOAL	INTERVENTION	REMARKS
Week 1	To prevent post-surgical complications	Deep breathing exercises Ankle pumping exercises	Sessions were given thrice a day
	To improve dyspnoea	Pursed lip breathing	Repetitions were decided as per patient's pain
	To maintain airway clearance	Pain free huffing with splinting	
	To improve V/Q matching	Positioning on operated side Upright positioning	
Week 2-3	To increase shoulder ROM and correct posture	Active assisted exercises of right shoulder joint	Sessions were given twice a day
	Wound care	Chest binder and wound splinting	10 repetitions
	To improve active ventilation	Incentive spirometry Thoracic expansion exercises	Ambulation carried out with monitoring of patient's vital signs
	To improve ambulation	Out of bed mobilization Spot marching Activity pacing	
Week 4-6	To improve activities of daily living and ambulatory status	Bedside walking Gradual increase in walking distance Chair stands	Sessions were given twice a day
	To improve ventilatory status	Costal expansion exercises Incentive spirometry with hold for 3s	
	To progress for more challenged task	Initiation of stair climbing	
	To improve muscle strength	Strengthening exercises of upper limb with free weights Closed kinetic chain exercises of lower limbs	2 sets of 5 repetitions 60% of 1RM

**RESULT**

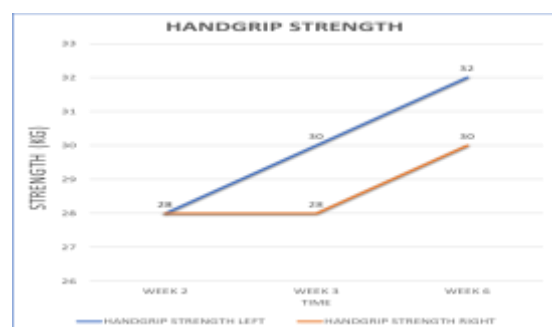
The patient was discharged from the hospital at a modified independence level (FIM score: 117) 42 days after his admission. He demonstrated improvement with pain at 0/10 and dyspnoea grade improved from grade IV to grade II (mMRC). The patient showed an improving trend in oxygen saturation over a period of six weeks (Fig 1). His TUG test improved to

4 seconds and handgrip strength, which was measured using a handheld dynamometer, improved markedly in the left hand (Fig 2). Inspiratory capacity which was measured via an incentive spirometer improved to 900cc/s.

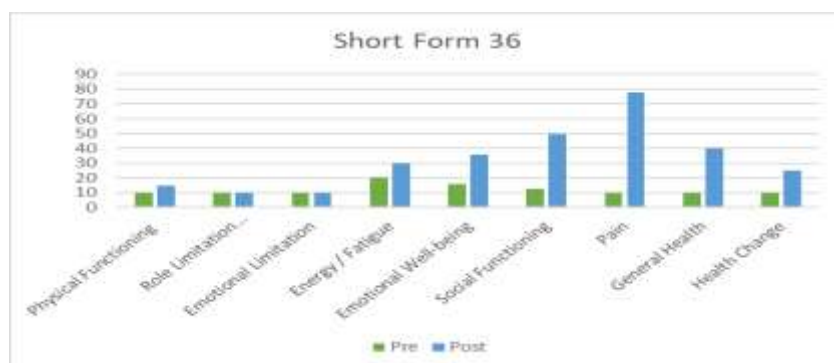
The quality of life was assessed using Short Form 36 (SF-36) questionnaire and improvements in the both physical as well as mental component scores (Fig 3).



**Fig.1 Graph showing improving trend in oxygen saturation**



**Fig.2 Graph showing increment in handgrip strength**



**Fig.3 Graph showing improvement in quality of life measured by SF 36**

## **DISCUSSION**

Thoracic surgeries are associated with high occurrences of postoperative pulmonary complications which also impact patient morbidity and mortality and the causes for these complications can be multifactorial. The surgery can cause changes in mechanics and function of the respiratory muscles which can further lead to its dysfunction.

Respiratory muscles weakness could also be present preoperatively and together with poor preoperative physical functioning, it can make patient more vulnerable to postoperative pulmonary complications. The pulmonary function and exercise capacity of the patient decrease as a result of resection of the lung parenchyma after thoracotomy<sup>[4]</sup>. The maximal reduction in exercise capacity occurs immediately after surgery, as reported in a previous study (Nagamatsu et al, 2011)<sup>[5]</sup>. Another reason for the reduction in exercise capacity and functional reserve can be explained as pain and chest wall limitation due to surgical injury, besides lung parenchyma loss. Studies have shown that early incorporation of exercises can ameliorate patient's physical strength, functional status and quality of life. In a study conducted in 2017 by Manivel et al, it was concluded that protocol based post-operative physical therapy regime is effective in improving pneumonectomy patients of rare causes<sup>[6]</sup>.

As this patient had complaints of breathlessness and incisional pain, an individualized exercise program which included breathing exercises, pain management, along with airway clearance and prevention of circulatory complications were prescribed to the patient in the initial week. Progression to further exercises was made depending on the patient's condition.

Any maneuver that emphasizes inflation increases lung volume and maintains patency of the smaller airways and incentive spirometry is the most widely prescribed technique for preoperative and postoperative lung expansion<sup>[7]</sup>. It actively recruits the diaphragm and other inspiratory muscles. A study by Gonazo Varela et al. implied that

implementation of an intensive chest physiotherapy program for lobectomy patients decreased the rate of postoperative atelectasis without increasing the cost of the procedure<sup>[8]</sup>.

Thoracotomy leads to shoulder functional limitations, with loss of shoulder mobility, strength, and pain. Reeve et al. 2010, carried out a study in which they tested a shoulder treatment protocol after pulmonary resection. At hospital discharge, one month and three months after discharge, the intervention group had substantially less pain, both at the shoulder and the chest<sup>[9]</sup>.

A systematic review concluded that exercise training increased exercise capacity and quadriceps muscle force of people following lung resection for NSCLC and also showed improvements on the physical component score of general HRQoL and decreased dyspnea.<sup>[10]</sup>

## **LIMITATIONS**

The preoperative data could not be analyzed as the patient was not referred for physiotherapy pre-operatively and hence was not assessed for the respiratory and functional capacity. Changes in respiratory muscles strength (maximum inspiratory and expiratory pressure) could not be assessed as the pre-operative data for the same was not available.

## **CONCLUSION**

The impairment of respiratory muscle strength after thoracic surgery may complicate the expectoration of sputum. As the oxygen demand of ventilatory muscles may exceed oxygen delivery capacity to respiratory muscles it can lead to muscle fatigue and reduced exercise capacity after surgery.

In the preoperative phase, the main aim is to prevent postoperative pulmonary complications and reduce the length of hospital stay, respiratory muscle training and bronchial hygiene. In postoperative phase, goals are prevention of complications, breathing exercises for pulmonary expansion, bronchial hygiene

and early ambulation along with postural correction and range of motion exercises for shoulder joint.

**Declaration by Authors**

**Acknowledgement:** None

**Source of Funding:** None

**Conflict of Interest:** The authors declare no conflict of interest.

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How to cite this article: Pramudita Tripathi, Bharat Tiwari. Importance of physiotherapy in post pneumonectomy renal transplant recipient: a case report. *International Journal of Science & Healthcare Research.* 2023; 8(2): 119-123. DOI: <https://doi.org/10.52403/ijshr.20230215>

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