Case Report
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Pulmonary Rehabilitation on Recovery in Patients with Post-COVID Interstitial Lung Disease: A Case Report

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ABSTRACT

Post covid Pulmonary rehabilitation being a comprehensive approach to recovery, a case study was done on a patient with interstitial lung disease, dependent on oxygen port for his basic Activities of daily living. Multidisciplinary approach was explored where a tailored exercise regime was planned patient centric using the FITT principle. The outcome measures SpO2, RPE, FIM and St George's Respiratory Questionnaire were noted every week to keep a check on the prognosis and to know the impact of pulmonary rehabilitation. The result concluded a significant improvement in FIM score and decrease in RPE, O2 dependency was reduced for basic ADL that in turn enhanced patients' psychological well-being.

Keywords: *Pulmonary Rehabilitation, ADL, FIM, FITT, Interstitial Lung Disease*

Background

Globally post covid 19 has triggered Chronic respiratory diseases (CRD) disturbing the physiological process of respiratory and cardiovascular fitness leading to deterioration in Activities of daily life (Holland, 2022). CRD is an umbrella term describing various conditions affecting the lungs and airways like asthma, pneumoconiosis, interstitial lung disease (ILD), and pulmonary sarcoidosis. The sustainable development goal (SDG) defined by the United Nations (UN) is CRD as third leading cause of mortality with a substantial burden and cost globally from 2019 (Holland, 2022). Hence World Health Organization (WHO) aim in 1/3rd reduction of premature mortality by implementing Pulmonary rehabilitation strategies for the period 2030 (Rochester *et al*., 2023). The three key roles outlines as: one billion more individuals enjoying better health and well-being, universal health coverage, and enhanced protection against health emergencies (Dowman *et al*., 2021).

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The interstitial lung diseases (ILDs) are distributed as a group of over 200 chronic lung conditions characterised by inflammation, dyspnoea on exertion, troublesome cough, exercise intolerance, and poor health-related quality of life (GBD, 2019). A pathologic abnormalities occur predominantly in the lung interstitial, a connective tissue framework surrounding the alveoli, airways and blood vessels. Recently, development of pulmonary fibrosis after COVID-19 infection has been reported, most commonly in those who have undergone mechanical ventilation (Labaki and Han, 2020). ILDs vary in underlying diagnoses and clinical course where comprehensive supportive care for all ILD subtypes can aid to optimise clinical outcomes and patient wellbeing. The key elements of comprehensive supportive care focusing on interventions delivered by physiotherapists include pulmonary rehabilitation, supplemental oxygen, education, psychosocial support and symptom management.

Pulmonary rehabilitation (PR), a comprehensive intervention that is tailored exercise training based on patients' symptoms, education and behaviour change that is designed to improve the physical and psychological condition of people and to promote long-term adherence to health-enhancing behaviours. The PR core components include structured and progressive individually tailored exercise training designed by a rehabilitation team by a multidisciplinary healthcare professional. The rehab aims on self-management education, patient assessment and outcomes measurement and aid in reducing dyspnoea, increases exercise capacity, improves health-related quality of life (HRQoL) and confers social support. Despite its proven benefits, PR remains underused and under resourced (Lu *et al*., 2020). Less than 5% of people with COPD who may benefit from PR receive it. There are studies that recommend focusing solely on PR an FEV_1 <50% predicted. The evidence base for PR has evolved substantially in recent years to include other CRDs and novel models for delivery remotely using telehealth technologies too. Evidence-based guidelines should lead to greater knowledge of the proven benefits of PR, highlight the role of PR, and in turn foster referrals too. However, data for patients with interstitial lung disease (ILD) are limited. This case study aimed to examine an effect on an inpatient pulmonary rehabilitation on functional status and quality of life for a post-covid patient.

Aim

To know the Pulmonary Rehabilitation effect on patients' recovery with Post-COVID Interstitial Lung Disease.

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Case Description

A 74 years old male with a history of Post covid Interstitial Lung Disease and Liver Cirrhosis from 2 to 5 years respectively came to the physiotherapy department in a wheelchair with a portable oxygen cylinder of 6L. Patient had Pulmonary consultation and was advised for pulmonary conditioning and rehabilitation along with supportive therapy and medications. An evidence based pre assessment for vitals like Respiratory rate, Oxygen saturation, Blood pressure was carried out followed by outcome scale such as FIM, dyspnoea rate of perceived exertion, St George's Respiratory Questionnaire were administered as a part of Cardiopulmonary rehabilitation.

Patient Symptoms:

I. Unable to maintain oxygen saturation at room temperature
II. Respiratory Distress in basic ADL
III. Oxygen dependency of 6L
IV. Fatigue level grade 4
V. Decreased exercise tolerance
VI. Decreased ADL
VII. Decreased MET value

Patient Centric Goal was:

I. To maintain the oxygen saturation at room temperature
II. To improve respiratory muscle strength
III. To reduce oxygen dependency
IV. To reduce fatigue level
V. To improve breathing pattern
VI. To improve exercise tolerance
VII. To improve ADL
VIII. To increase MET value

Intervention

The treatment plan was directed based on a patient centric goal and a tailored exercise programme was designed for the patients. FITT (Frequency, Intensity, Time, Type) principle, being one of the key principles in prescribing exercise programmes, was designed weekly based on the parameters that

improved and showed variations. The overall treatment duration planned was 45 minutes, with 20-second bouts after each exercise. Oxygen saturation was monitored throughout the exercise to observe the physiological changes in oxygen consumption during individual exercise. FIM instrument and FSS was administered at time of admission and reassessed weekly.

The instruments used as a part of exercise programme was an Incentive spirometer, Weight cuff (500g), Thera bands, Pillows, Dumbbells, Balloon, Pulse Oximeter, walker, respiratory muscle trainer, lung expander, acapela, treadmill. Intervention included anaerobic and aerobic circuit training which had three phases: warm up, tailored isometric, isotonic exercise of Respiratory muscles followed by cool-down phase.

The exercise regime was as follows for circuit training

a) Pursed lip breathing: Pursed lip breathing helps in controlled breathing, relieves shortness of breath, improves gas exchange, and decreases the effort required to breathe. It creates a back pressure producing a small amount of positive end-expiratory pressure (PEEP) which opposes the forces exerted on the airways from the exhalation flow. It helps to support breathing by opening the airways during exhalation and increasing the excretion of volatile acids in the form of carbon dioxide preventing or relieving hypercapnia. Hence pursed lip breathing makes the body relaxed, so before starting the exercise and in interval of each exercise, the patient was instructed to perform 4-5 pursed lip breathing exercises like balloon blow and candle blow.

b) Diaphragmatic breathing exercise: Diaphragmatic breathing exercise was taught to patients with 500gm resistance in semi-Fowler position.

c) Thoracic expansion exercise: Thoracic expansion exercise was practised with the help of dumbbells with full lung expansion with a 2sec hold in the 1st week and then gradually the hold count and set were increased 2sec every week to improve the lung volume and capacity. This technique aids in improving lung expansion.

d) Activities in the bed: Bed activities include cycling (forward & backward), Bridging(unilateral/bilateral), Superman exercise, and Pelvic rotation (hip, knee flexion) were taught and practiced for 10 counts, with a rest period of 2 mins of about 3 sets.

e) Swiss ball exercise: Swiss ball exercises were practised as part of core muscle activation for about 20 repetitions.

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f) Stretching: Intercostal stretching exercises improve the muscle tensile stretch and aid in elasticity and recoil mechanism during lung expansion. Patient was made to do 4 repetitions of manual and assisted stretching during inspiration.

g) Respiratory muscle training: Breathing in or out forcefully through a handheld device like incentive spirometer and acapella was made to do for about 5 repetition 3 cycles.

h) Endurance or interval training: Aerobic training like cycling, walking in parallel, pushing wheelchair was made to as part of ADL.

i) Resistance or weight training: Set of light weights, resistance bands and weight machines were used for training the patient with periodic rest and O2 support.

j) Wall push off: Anaerobic static exercise like wall pushes up by standing facing a wall, hands flat on the wall at chest level followed by slowly lowering face and chest towards the wall.

k) Shoulder press: Modified arm press was taught to patient in sitting position with arms by the side, holding a walking stick in hands, and bringing the stick up to chest.

l) Sit to stand: As a part of ADL sit to stand on a firm chair was made to do for about 5 repetitions with pacing technique to avoid fatigue.

m) Functional Training: A fitness methodology that helps you improve patient strength and stability across a range of movements where the patient was asked to perform everyday tasks and recreational activities with intermittent O2 support.

Pre-Assessment vitals: SpO2: 72% with 6 L of O2, FIM scale:67/126, MET score: 2- sitting , Fatigue severity Scale (FSS) level: 54 (36-normal value)- Grade 4

Sessions: Weekly 3/45 mins duration with intermittent rest period

Protocol

Month	Duration	Exercise	SPO2	MET	FIM
August	Week 1-4	-Preassessment of vitals and outcome scales. -Pursed lip breathing exercise x 5 times -Wheel chair sit to stand with walker 5 rep -Thoracic expansion exercises x3 times x no hold -Diaphragmatic exercise x3 times x3 cycles	72% - 6 L	2	65
September	Week 1- 4	-Pursed lip breathing exercise x 5 times -Thoracic expansion exercise x 4 times x 2sec hold progressed to 4 sec -Diaphragmatic breathing exercise x 5mins progressed with weight 500g -Aerobic exercises x10min progressed to 12 min with reduced O2 support by 5L -Swiss ball exercises x 5min	70%-6 L	2	67
			78%-6L	2	70
			78%-6L	3	74
October	Week 1-4	-Static exercise (same week exercise) -Swiss ball exercises x 5min -Thera band exercises -Posture correction exercises -Pacing activities -Acapella and Incentive spirometer for 3 counts -Intercostal stretching 5 rep *3 cycles	80%-5L	3	78
			84%-5L	3	78
			84%-4L	3	82
November	Week 2-4	-Static exercise -Pacing activities -Energy conservation exercises -Treadmill walking with modified Bruce protocol x6min -Incentive Spirometry -Static exercise (same week exercise) -Respiratory muscle training with resistance -Cycling x 5min -Box breathing (4,7,8)	86%-4L	3	82
			86%-3L	3	85
			92%-3L	3	96

Fig 1: Wheel chair mobilization training

Fig 2: Strengthening training

Fig 3: ADL

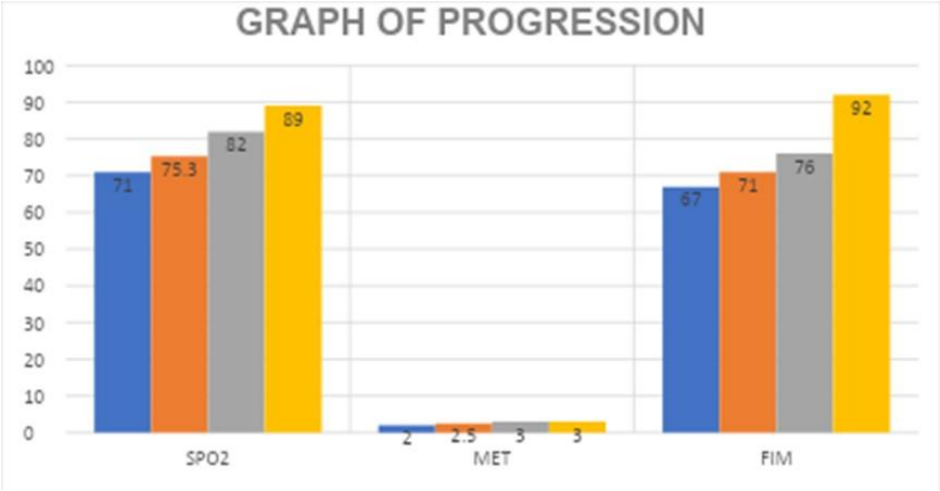
Fig 4: Independent walking indoor

Fig 5: Independent walking Outdoor

Fig 6: Treadmill training

Result

The graph showed a prognosis of the outcome score as a result of exercise programme tailored for this patient. There was a significant improvement in FIM score and ADL activities, but minimal variation in MET value and saturation level.



Graph 1: Showing the progression for 4 months in SPO2, MET and FIM level.

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Conclusions

The study showed changes in parameters during these four months and indicated substantial progress on the patient's lifestyle. Tailored Pulmonary rehabilitation showed improvement in saturation level, decrease in O2 dependency, improvement in FIM score and RPE was decreased. Hence "The Intervention with implementation of the protocol described during these four months indicated substantial progress on individual parameters to provide the way for pulmonary rehabilitation programs to be introduced in the majority of hospitals and community centres".

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