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Case Report

Rehabilitation Journey of a COVID-19 Survivor from Hospitalization to Follow-up: A Case Report of Progressive Lung Fibrosis

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Abstract

Progressive lung fibrosis, an enduring complication of COVID-19, affects lung function adversely, fatigue levels, exercise tolerance, and health-related quality of life, affecting more than 50% of the confirmed cases. Furthermore, the number of post-COVID survivors is steadily increasing, stipulating a need for early, safe, and effective post-COVID pulmonary rehabilitation (PR). A 62-year-old male diagnosed with viral pneumonitis with severe lung fibrosis post-COVID infection exhibited severe exercise intolerance during hospitalization. An 8-week supervised, structured PR program led to early weaning from oxygen support and improved patient's functional outcomes. Amelioration in the patient's clinical status was demonstrated by a 50% reduction in his fatigue levels and a three-fold change in his functional capacity. This case study highlights the importance of early initiation of PR in optimizing patient's health status and reducing any further functional limitations.

Keywords: Exercise intolerance, exercise training, post-COVID pulmonary rehabilitation, pulmonary fibrosis

Introduction

The entire world has witnessed the catastrophe of the COVID-19 pandemic, with a surge in confirmed cases accounting for 67 million and over 1.5 million deaths. India witnessed the second-highest number of cases globally, showing a rising trend.[1] The recent data as of October 25, 2021, projects a 98.18% recovery rate, with the mortality rate declining to 1.33%.[2] The aftermath of the COVID-19 outbreak catalyzed the number of COVID-19 survivors with persistent symptoms of breathlessness, fatigue, and reduced exercise tolerance affecting their functional well-being even after being tested negative for the disease.[3] Progressive lung fibrosis was reported to be one of the long-term complications affecting 61% of the patients who had a disease duration of more than 3 weeks.[4] With an increase in the number of COVID-19 survivors, there arose a need for early pulmonary rehabilitation (PR) to improve lung function, exercise tolerance, and health-related quality of life (HR-QOL). The frontiers in PR and various respiratory societies have worked immensely to derive consensus regarding the COVID-19 rehabilitation guidelines demonstrating its effectual role in acute stages.[5,6] Although the preliminary guidelines support the role of physiotherapy in post COVID-19 patients , there is dearth of literature observing the effect of structured in-patient PR program in these survivors presenting with severe lung fibrosis.[7] Moreover there is limited information available on the role of these rehabilitation exercises on patient recovery in terms of improved multi-system function and successful oxygen weaning. Our case report elucidates the effect of structured exercise-based PR in a post COVID-19 fibrosis patient dependent on supplemental oxygen.

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A 62-year-old male, a known case of COVID-19 4 weeks ago, dependent on supplemental oxygen for activities of

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daily living (ADL), presented to the hospital second time with complaints of breathlessness maintaining oxygen saturation (SpO2) between 75% and 80% on 4 L/min of oxygen through the nasal cannula. He was then admitted to the intensive care unit for a day on 15 L/min of oxygen through a nonrebreathing mask diagnosed with viral pneumonitis and severe lung fibrosis. Table 1 presents date-wise investigation findings.

On the 2nd day, the patient was shifted to a step-down in-patient unit with 8 L/min oxygen support, and PR was commenced as per the American Thoracic Society/European Respiratory Society guidelines.[5,8] It is paramount to note that patient had not received any form of therapy during his previous hospital stay. The goals of PR were to aid him in independently performing his self-care activities, ambulation, and return to home with family. The protocol comprised lung expansion therapy consisting of diaphragmatic breathing exercises, segmental breathing exercises, thoracic expansion exercises, incentive spirometer, and early mobilization. In addition, mobility training included an active free range of motion exercises of all the joints, and strength training of the lower and upper extremities was initiated. At the start of the treatment regimen, he would maintain SpO2 of 89% on 8 L/min oxygen, which would rise to 93% toward the end of the session. Details of the therapy delivered with supplemental oxygen requirement are summarized in Table 2. The patient was symptomatically better, and oxygen support gradually weaned from 15 L/min to 8 L/min and then from 6/min to off oxygen support by the end of the 8th week of rehabilitation [Figure 1].

Improvement in patient's health status was documented through various functional outcome assessments such as Fatigue Assessment Scale, short physical performance battery (SPPB), Post-COVID functional status, 1-min Sit-to-stand test (STST) [Figure 1]. There was more than a 50% reduction in fatigue levels and an almost three-fold improvement in functional capacity, as presented in Figure 1.

Table 1: Date-wise investigation reports of the patient

Investigations with date	Remarks
RT-PCR	April 29, 2021: Positive; June 01, 2021: Negative
HRCT chest	
May 01, 2021	CTSS: 20/25; CO-RADS 5; COVID-19 pneumonitis
May 13, 2021	CTSS: 17/25; CO-RADS 6 (type L); Severe fibrosis: 84% involvement of lungs on visual assessment
May 25, 2021	CTSS: 16/25; CO-RADS 6 (Type H); Moderate parenchymal involvement; 65% involvement of lungs on visual assessment
June 03, 2021	CTSS: 14/25; CO-RADS 6 (type H); Fibrosis and Bronchiectasis; Moderate parenchymal involvement; 52% involvement of the lungs on visual assessment
June 14, 2021	CTSS: 13/25; CO-RADS 6 (Type H)
August 01, 2021	CTSS: 14/25; CO-RADS 5 (Type L); Moderate parenchymal involvement
Pulmonary angiography May 16, 2021	Severity Score: 18/25; CO-RADS 6 (Type L); Severe parenchymal involvement; 65% involvement of lungs on visual assessment. Features of pulmonary artery hypertension. Moderate pneumomediastinum noted
CRP	May 13, 2021: 6.4; May 14, 2021: 7
D-dimer	May 13, 2021: 515.55
Ferritin	May 13, 2021: 313.66

RT-PCR: reverse transcription-polymerase chain reaction, HRCT: High-resolution computed tomography, CTSS: CT scan severity score, CO-RADS: COVID-19 Reporting and Data system, CRP: C-reactive protein

Table 2: Week-wise saturation -monitored post-COVID rehabilitation protocol and changes in the functional outcome measure

Weeks	1st	2nd	3rd	4th	5-6th	7-8th
Oxygen support (L/min)	8 to 6	4	3	2 to 1	Nil	Nil
Pre-SpO_2	89%	91%	91%	92%	92%	97%
Breathing exercises	5 reps, 2 sets	5 reps, 2 sets	5 reps, 2 sets	5 reps, 2 sets	5 reps, 2 sets	5 reps, 2 sets
Incentive spirometer (cc)		250-300 5 reps, 2 sets	250-500 5 reps, 2 sets	500–750 5 reps, 3 sets	500-1000 5 reps, 3 sets	750–1000 5 reps, 3 sets
Mobility exercise	5 reps, 1 set	5 reps, 1 set	5 reps, 1 set	5 reps, 1 set	5 reps, 1 set	5 reps, 1 set
EOB sitting	-	5 min	10 min	10 min	10 min	10 min
Strengthening	-	-	Static quadriceps, hamstrings	Static quadriceps, hamstrings	UL and LL multiple angle isometrics	UL-with ½ litre bottle, LL - 1-2 kg, wall squats, lunges
Standing	-	-	2 min	2 min	2 min	-
Spot marching	-	-	-	5 reps, 2 sets	5 reps, 2 sets	10 reps, 2 sets
Ambulation	-	-	-	Around the bed (6-7 steps)	Corridor (40 steps)	Corridor (110 steps)
Post-SpO_2	93%	92%	91%	92%	92%	97%

SpO_2: Oxygen saturation, Reps: Repetitions, EOB: Edge of the bed, UL: Upper limb, LL: Lower limb

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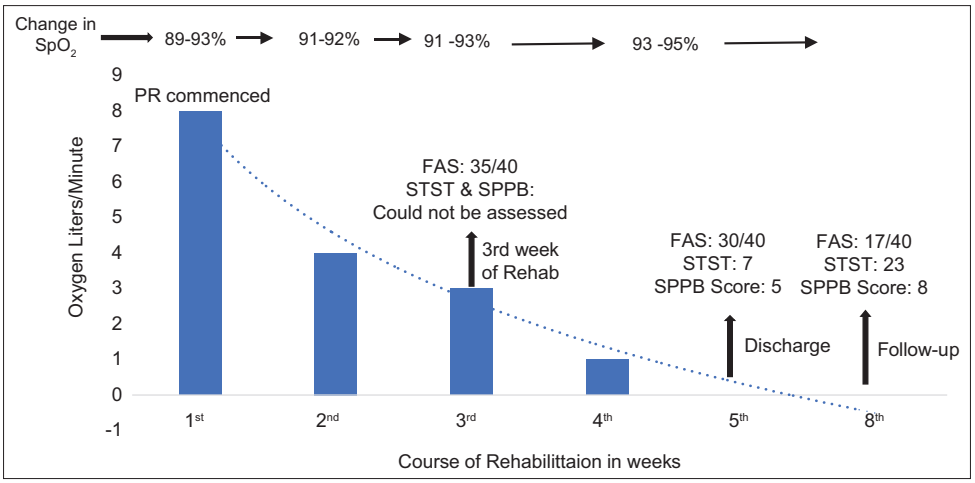

Figure 1: Decline in supplemental oxygen with improvement in oxygen saturation and changes in functional outcome measures during rehabilitation. FAS-Fatigue Assessment Scale, STST- Sit-to-stand test, SPPB-Short physical performance battery. SpO2- Peripheral capillary oxygen saturation, PR- Pulmonary rehabilitation

During discharge, an extensive home-based PR protocol was given to the patient. Due to the geographical barrier to access the hospital for rehabilitation, rehabilitation delivery was shifted from a supervised outpatient set-up to home-based PR. Technologically driven PR was delivered telephonically once a week to ensure symptom monitoring and adherence to the treatment protocol. At the end of 8 weeks of rehabilitation, a follow-up visit was arranged wherein the patient was reassessed, and progression in the treatment was advised.

Discussion

Our case report illustrates the effect of exercise-based PR in post-COVID-19 fibrosis patients' from hospitalization to follow-up.

PR is a comprehensive multidisciplinary intervention used to alleviate symptoms such as breathlessness, exercise intolerance, etc., in patients with chronic respiratory diseases. In our case, 5 weeks of in-patient structured exercise-based PR consisting of lung expansion therapies, aerobic training, and peripheral muscle strengthening aided in achieving the patient's goal to be functionally independent. Lung expansion therapies helped optimize the oxygen transport and alveolar ventilation, which reduced the need for oxygen support over the weeks of rehabilitation.[9] In addition, there was an improvement in exercise tolerance as observed by 1-min STST and SPPB scores from discharge to follow-up, which resonates with the findings of a systematic review demonstrating significant improvement in 6-min walk distance and dyspnea with PR in patients with fibrosis.[9] We assume that lung fibrosis as observed here is irreversible; however, the probable mechanism of improvement in functional capacity could be attributed to enhanced oxygen extraction and consumption by peripheral muscles as observed in patients with pulmonary fibrosis and pulmonary artery hypertension.[10,11] Moreover, the progressive increase in training would have led to adaptation in the cardiopulmonary system, causing a gradual decline in the need for supplemental oxygen from 15 L/min to room air. Similarly, the fatigue level reported before the rehabilitation protocol compared to that at follow-up tailed off gradually. This agrees with a study done by Swigris *et al*., reporting the efficacy of PR program on fatigue levels in idiopathic pulmonary fibrosis patients.[12] The probable reason could be aerobic and strength training on peripheral skeletal muscle adaptation at the cellular and molecular levels, improving its oxygenation status. In addition, home-based exercise training helped maintain the overall lung function and exercise capacity.

Although delayed in initiating, exercise-based PR proved to be effective in optimizing the patient's functional capacity, thereby improving his independence in ADL. In addition, the case report highlights the inevitable factor of early initiation of exercise-based PR during hospitalization, perhaps preventing progression of the disease severity and aiding to restore HR-QOL.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his clinical information to be reported in the journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity.

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Conflicts of interest
There are no conflicts of interest.

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