Case Series

# A case series on post-COVID pulmonary rehabilitation: Early experiences from Kerala, South India

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## ABSTRACT

Patients who were contracted with COVID-19 are reported to have a variety of symptoms affecting neuromuscular, psychological, cardiac, and respiratory systems. A significant proportion of patients present with prolonged symptoms even weeks to months including minor illness. The lung is the most common and important organ affected in COVID-19 and sequela can result in exertional breathlessness, cough, hypoxia, or pulmonary fibrosis. Along with medical and supportive therapy, a multidisciplinary pulmonary rehabilitation program is essential to improve the quality of life and reduce symptoms in post-COVID-19 patients. We report a case series of three cases who presented with diverse manifestations after COVID-19 recovery, who were treated with a multidisciplinary pulmonary rehabilitation program. This case series, with early experiences from Kerala which had its peak of COVID-19 pandemic in late October 2020, shows a substantial improvement of symptoms in patients even with initial rehabilitation sessions itself, which shows promising hope in post-COVID-19 management.

**Key words:** COVID-19, Post-COVID, Pulmonary rehabilitation

Post-COVID pulmonary manifestations present with diverse manifestations. It includes dyspnea, cough, chest pain, fatigue, palpitation, or exertional breathlessness [1]. The cases with severe COVID and cytokine storm syndrome may later turn into pulmonary fibrosis or hypoxic requiring oxygen support. It is reported that a few of the patients may recover over time partially or completely but some patients may have persistent symptoms including those patients with mild illness during the disease period [2]. Post-COVID patients may have diverse manifestations which include neuromuscular, cardiac, and psychological sequela along with respiratory morbidity. It may be related to inflammation, prolonged hospital stay, ventilation, or steroid myopathy.

We hereby report a case series of three cases of COVID survivors who presented with diverse symptoms and improved with pulmonary rehabilitation. The aim is to highlight the fact that pulmonary rehabilitation in post-COVID scenario can have a significant positive outcome.

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## CASE SERIES

### Case 1

A 33-year-old medical student had contracted with COVID-19 infection in July 2020. He had a history of seasonal bronchitis and pulmonary tuberculosis. He had complaints of dry cough, hemoptysis, and breathlessness during the disease period. Fever started on the 2nd day and persisted for 5 days. His inflammatory markers were high with interleukin-6 of 150 picogram/ml. He was treated with antivirals, steroids, anticoagulants, tocilizumab, and other supportive medications. He was admitted to ICU for 4 days with supplemental oxygenation.

His COVID reverse transcription-polymerase chain reaction (RT-PCR) came negative after 16 days of infection. After 2 weeks of disease negativity, he started having fever spikes with occasional chills, cough with scanty expectoration, myalgia, arthralgia, fatigue along with Grade 3 Modified Medical Research Council (MMRC) scale dyspnea, and palpitation. He was admitted to a local hospital and was treated with broad-spectrum antibiotics and steroids. Repeat RT-PCR for COVID-19 was negative. He presented to our hospital after 2 months of persistent symptoms. His pulse rate

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was 110/min, blood pressure (BP) was 120/80 mm Hg in a sitting position, spO2 was 98% in room air, and the respiratory rate was 26/mt. His chest X-ray and computed tomography (CT) chest was normal. He was ruled out for COVID-19 reinfection and other opportunistic infections. Routine blood investigations showed slightly elevated inflammatory markers (C-reactive protein 26.80 mg/dl) and a deranged liver function test. He had tachypnea and tachycardia. His visual analog fatigue scale (VAFS) was 8. He was not able to perform a 6-min walk test. Hamilton Anxiety Rating Scale (HAM-A) score was 16 and Hamilton Depression Rating Scale (HAM-D) score was 4.

He was started on pulmonary rehabilitation. After 2 weeks, he was reviewed in the pulmonary rehabilitation clinic. He covered 440 m in 6 MWT with MMRC Grade 1 dyspnea. His VAFS was 2. His symptom of cough relieved. His HAM-A score decreased to 4 and continued pulmonary rehabilitation for 4 weeks.

## Case 2

A 74-year-old male with a known history of systemic hypertension, coronary artery disease, dyslipidemia, chronic obstructive pulmonary disease (COPD), and diabetes presented with complaints of low-grade fever, cough, and myalgia for 2 weeks. COVID-19 RTPCR was positive in September 2020. He had been initially admitted with COVID-19 pneumonia in the nearby public health facility. He was referred to our center for evaluation of hypoxia. His saturation on room air was 75% with arterial blood gas showing Type 1 respiratory failure (PaO2: 66.8). He was tachypnoeic and his BP was 130/70 mm Hg in the right arm in the supine position. His complete blood count showed features of lymphopenia (4.9 ku/mol). His rapid antigen test for COVID was found to have negative after 2 weeks.

His chest X-ray and CT scan images are depicted in Figure 1. ECHO was showing dilated LA and mild AR. His respiratory rate was 28/mt. He was initially started with continuous bilevel positive airway pressure (BiPAP) with 12:6 later tapered. He was on 6 L oxygen with the face mask. He was started on Pirfenidone 1200 mg along with Rivaroxaban and N Acetyl Cysteine. He was enrolled for pulmonary rehabilitation. His VAFS was 9. High-intensity resistance training was not initiated as the patient was hypoxic and was on supplemental oxygen. The patient was reviewed by telemedicine consultation in the 2nd and 4th weeks. His HAM-A and HAM-D scale was 5. His VAFS came down to 4.

The patient was compliant with all suggested exercise training. The patient was followed up with the telemedicine consultation every alternate day. His respiratory rate was 22/mt, SpO2 was 95% with 0.5 L O2 with nasal prongs. The patient was instructed to continue the pulmonary rehabilitation training.

## Case 3

A 48-year-old female, staff nurse by profession was diagnosed to have COVID-19 infection. She was asymptomatic during her disease period. There was a history of hypothyroidism and systemic hypertension. Her vitals were normal with a saturation of 98% in room air. Routine blood investigations were within normal limits. She was treated conservatively. After 1 month of her illness, she developed central catchy chest pain which was intermittent. She had exertional breathlessness with MMRC Grade 3. Her SpO2 was 100 % on room air and respiratory rate was 20/min with a pulse rate of 71/min and BP of 100/70 mm Hg in the right arm in sitting position. Her chest X-ray is shown in Figure 2. She was referred for further evaluation and pulmonary rehabilitation.

As a part of the evaluation, a 6-min walk test was done. She could perform only 2 min 7 s with 240 m distance after which she developed intolerable dyspnea with dyspnea Borg scale of 4 and her respiratory rate was 32/min. There was no desaturation and tachycardia. Her VAFS was 7. Her D Dimer was 0.29 mcg /L and electrocardiogram was normal. She was enrolled for the pulmonary rehabilitation program. She was prescribed an inhaled corticosteroid and long-acting muscarinic antagonist inhaler and also incentive spirometry 5 times/day (10 repetitions each). She was reviewed after 2 weeks and 4 weeks in the clinic. She was symptomatically better with MMRC Scale reducing to Grade 1. She covered 420 m in a 6-min walk test with no desaturation and dyspnea Borg Scale 2 (slight breathlessness) in the 2nd week and 520 m with Borg Scale 1 in the 4th week. Her VAFS was 2. She completed pulmonary rehabilitation for 4 weeks.

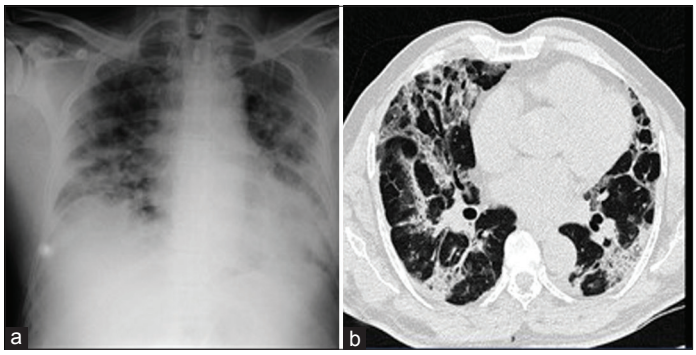


**Figure 1: (a) Chest X-ray posteroanterior view at discharge shows bilateral patchy opacity; (b) CT chest shows diffuse patchy ground-glass opacity, peribroncho vascular, and interlobular septal thickening, traction bronchiectasis with evidence of fibrosis (Case 2)**

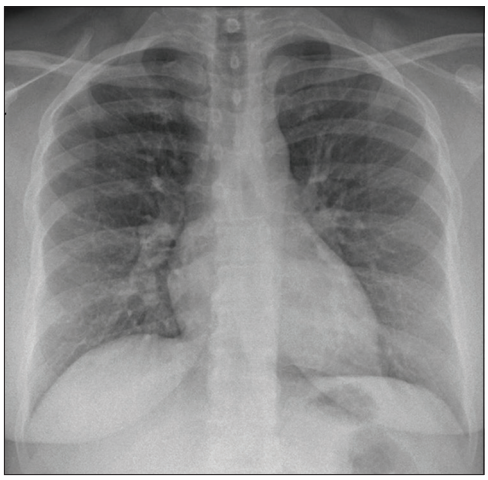

**Figure 2: Chest X-ray showing bilateral mid and lower zone haziness (Case 3)**

## DISCUSSION

SARS Cov2 virus infection officially declared as COVID-19 which is believed to be originated from China, so far there have been 67,780,361 confirmed cases including 1,551,214 deaths, reported to the World Health Organization dated December 9, 2020 [3]. Post-COVID disease usually affects multiple systems though the primary organ of involvement is the lung. There is respiratory, cardiovascular, neuromuscular, and psychological sequela reported in post-COVID disease. There is no clear cut definition for post-COVID disease. However, it can be termed as persisting symptoms 3 weeks after the first onset of symptoms and if more than 12 weeks, it is termed as chronic COVID disease [4].

Approximately 10% of people are affected with prolonged illness after COVID-19 [4] though it varies in different geographical areas. Most of the patients may improve with symptomatic treatment and optimal mobilization. The survivors from COVID-19 may be affected by fatigue, breathlessness, persistent cough, exertional breathlessness, chest pain, or hypoxia. A good number of COVID survivors may have residual ground-glass opacity, vascular thickening, bronchiectasis, and crazy paving pattern [5]. The radiological changes and functional capacity may change over time or persist as there are evidences suggested by the studies done among SARS Cov1 survivors [6-8]. It is now known that patients with COVID-19 may be affected by respiratory failure and may need prolonged ICU care and ventilatory management. The symptoms may be related to overexpression of pro-inflammatory cytokines and prothrombotic factors.

Pulmonary rehabilitation is an effective strategy in alleviating symptoms, improving quality of life, and decreasing psychological distress in a good number of chronic respiratory diseases like COPD. Institutional-based pulmonary rehabilitation is a challenge in the scenario and may need precaution for health care workers also. Kerala is a Southern state of India which has appreciably fought to the pandemic and peaked its cases recently, started to witness post-COVID manifestations. Pulmonary rehabilitation is a comprehensive program with a multidisciplinary team that includes a pulmonologist, nurse, physiotherapist, respiratory therapist, dietician, and clinical psychologist. As part of the newly developed protocol, all the patients were attempted to have baseline evaluation with a 6-min walk test, SpO2, MMRC scale, Hamilton A and Hamilton D scale, VAFS, and numerical rating scale for pain. The goal of pulmonary rehabilitation includes improving both physical and psychological quality of life and enabling the patients to have an optimal return to their family and personal life. Pulmonary rehabilitation has been recognized and incorporated by the global initiative for obstructive lung diseases as a standard of care in COPD management [9]. Pulmonary rehabilitation has been shown to improve exercise capacity, reduce hospital stay, anxiety, respiratory muscle function, dyspnea, and improve skeletal muscle function. Follow-up studies of SARS Cov1 show that these patients suffered from restrictive pulmonary dysfunction, exertional dyspnea, and reduction in quality of life [7]. A very limited number of guidelines are currently available for the conductance of pulmonary rehabilitation in post-COVID cases [10-12]. Several centers attempted for respiratory rehabilitation across the globe in patients with post-COVID manifestations [13].

**Table 1: Pulmonary rehabilitation exercises performed for the cases**

| Cases | Rehabilitation exercise technique |
|---|---|
| Case 1 | Purse lip breathing, Diaphragmatic breathing, Range of motion exercise, thoracic expansion exercise, upper limb, and lower limb strengthening exercises – (shoulder rotation, active straight leg raise, wall pushups, sit ups, squatting, quadriceps sets, and calf muscle stretch) |
| Case 2 | Purse lip breathing, breathing retraining-started with 15 repetitions every 4 h, Diaphragmatic breathing, thoracic expansion exercises, incentive spirometry, positional therapy( leaning forward), upper limb and lower limb endurance training (active straight leg raise, repeated flexion extension of knee, and shoulder rotation), calf muscle stretching |
| Case 3 | Flexibility training, breathing retraining exercises, purse lip breathing, diaphragmatic breathing exercise, Incentive spirometry, thoracic expansion exercise, upper limb and lower limb strengthening and endurance training (shoulder rotation, active straight leg raise, tread mill walking, wall push-ups, sit ups, squatting, quadriceps sets, and calf muscle stretching) |

In our cases, we have initiated breathing retraining, lower limb, upper limb endurance, and strengthening exercises which were initiated on supervision and telemonitored and escalated the frequency and intensity (Table 1). All patients completed 4 weeks of pulmonary rehabilitation training. A specific exercise prescription describing intensity, type, and frequency was given to all patients along with the health education regarding disease pathology. The experiences from the institution show that pulmonary rehabilitation is an ideal and mandatory intervention that should be done in a selected population of COVID survivors. Liu *et al*. opined that 6 weeks pulmonary rehabilitation program improves the quality of life, respiratory function, and anxiety in COVID-19 patients [14]. The study by Ghodge *et al*. shows that pulmonary rehabilitation in COVID survivors shows significant improvement in functional capacity [13]. The exact timing to start pulmonary rehabilitation in post-COVID survivors is debatable and future research areas.

## CONCLUSION

Pulmonary rehabilitation in post-COVID cases can increase effort tolerance, quality of life and decreases anxiety and dyspnea. Hence, in post-COVID cases, we need to identify the individuals who need pulmonary rehabilitation and to give early referrals.

## REFERENCES

1. Carfì A, Bernabei R, Landi F, Gemelli Against COVID-19 Post-Acute Care Study Group. Persistent symptoms in patients after acute COVID-19. JAMA 2020;324:603-5.
2. Goërtz YM, Van Herck M, Delbressine JM, Vaes AW, Meys R, Machado FV, *et al*. Persistent symptoms 3 months after a SARS-CoV-2 infection: The post-COVID-19 syndrome? ERJ Open Res 2020;6:00542-2020.

3. World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard. Geneva: World Health Organization; 2020.
4. Trisha G, Matthew K, Christine AC, Maria B, Laiba H. Management of post-acute covid-19 in primary care. BMJ 2020;370:m3026.
5. Jing W, Pan J, Teng D, Xu X, Feng J, Chen YC. Interpretation of CT signs of 2019 novel corona virus (Covid-19) pneumonia. Eur Radiol 2020;30:5455-62.
6. Gentile F, Aimo A, Forfori F, Catapano G, Clemente A, Cademartiri F, *et al*. COVID-19 and risk of pulmonary fibrosis: The importance of planning ahead. Eur J Prev Cardiol 2020;27:1442-6.
7. Hui DS, Wong KT, Ko FW, Tam LS, Chan DP, Woo J, *et al*. The 1-year impact of severe acute respiratory syndrome on pulmonary function, exercise capacity, and quality of life in a cohort of survivors. Chest 2005;128:2247-61.
8. Ng CK, Chan JW, Kwan TL, To TS, Chan YH, Ng FY, et al. Six month radiological and physiological outcomes in severe acute respiratory syndrome (SARS) survivors. Thorax 2004;59:889-91.
9. Pauwels RA, Buist AS, Calverley PM, Jenkins CR, Hurd SS, GOLD Scientific Committee. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD) Workshop summary. Am J Respir Crit Care Med 2001;163:1256-76.
10. Joint Statement on the Role of Respiratory Rehabilitation in the COVID-19 Crisis: The Italian Position Paper. Available from: https://www.ers.app.box.com/s/825awayvkl7hh670yxbmzfvcw5medm1d. [Last accessed on 2020 Nov 15]
11. Barker-Davies RM, O'Sullivan O, Senaratne KP, Baker P, Cranley M, Dharm-Datta SD, *et al*. The Stanford Hall consensus statement for post-COVID-19 rehabilitation. Br J Sports Med 2020;54:949-59.
12. Spruit MA, Holland AE, Singh SJ, Tonia T, Wilson KC, Troosters T. COVID-19: Interim guidance on rehabilitation in the hospital and post-hospital phase from a European Respiratory Society- and American Thoracic Society-Coordinated International Task Force. Eur Respir J 2020;56:2002197.
13. Ghodge S, Tilaye P, Deshpande S, Nerkar S, Kothary K, Manwadkar S. Effect of pulmonary telerehabilitation on functional capacity in COVID survivors; an initial evidence. Int J Health Sci Res 2020;10:123-9.
14. Liu K, Zhang W, Yang Y, Zhang J, Li Y, Chen Y. Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study. Complement Ther Clin Pract 2020;39:101166.

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