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Physiotherapy Interventions in COVID-19 Patient with Multiple Comorbidities: A Case Report

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ABSTRACT

The rapid outbreak of coronavirus disease, which arose from severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections, has become a public health emergency. Large number of patients diagnosed with COVID-19 need critical care for prolong period of time. There is risk of severe adverse outcomes in COVID-19 patients with multiple comorbidities. Collaboration between medical interventions and early and sustained comprehensive rehabilitation play an important role in patient recovery from acute care to discharge. Physiotherapist, who play an important role in multidisciplinary treatment contribute majorly to improve patient's lung and functional capacity.
We present a case of a 52-year-Old male diagnosed with COVID-19 and with multiple comorbidities, focusing on role of pulmonary rehabilitation in collaboration with Medical management and outlining the pathway of recovery from ICU to discharge.

Key words: COVID-19, Physiotherapy, Pulmonary rehabilitation, Comorbidities, Case report, Acute care.

INTRODUCTION

The novel coronavirus (COVID -19) which is caused by SARS-CoV-2, was first found in Wuhan city of china in December 2019. [1] The spectrum of severity ranges from a complete asymptomatic/very mild presentation requiring no hospitalization, to a severe viral-pneumonia requiring intensive care, which in many cases, leads to respiratory failure and eventual death. [2] COVID-19 patients with comorbidities like diabetes, hypertension and other cardiovascular and cerebrovascular diseases yield poorer clinical outcomes. [3] Medication related myopathy, Critical illness myopathy and neuropathy (CIMN) are underdiagnosed conditions within the intensive care setting and contribute to ventilator wean failure and delay the recovery. [4] Physiotherapists are an integral part of the multidisciplinary team (MDT) of all hospital setups. Physiotherapy in COVID-19 patients, focusing on improving pulmonary functions and early mobility in intensive care unit(ICU) and in step down unit(SDU), have shown to be beneficial in augmenting early weaning of oxygen support, improving lung function, preventing ICU acquired weakness, and contributing to early recovery of patient. [5,6] Collaboration between the fields of medical care and pulmonary rehabilitation play an important role in optimizing patient recovery. [7]

CASE PRESENTATION

A 52-year-old male presenting with complains of fever, dry cough and breathlessness on exertion, was admitted in COVID-19 dedicated ICU on 26/6/20 with

diagnosis of COVID-19, stage 3 and 70% lung involvement on HRCT. He had associated comorbidities of Diabetes Mellitus (20 years) & HTN (4 years) with a past history of Pulmonary Koch's and was a chronic alcoholic.

On admission in ICU, patient was on non-invasive ventilation (NIV) with fraction of inspired oxygen (FiO2) 90%. His investigations, medical treatment and physiotherapy care were as mentioned in table 1 and 2. He had prolonged hospital stay of 6 weeks (ICU) and 3 weeks in Step down care unit (SDU). He was discharged on 29/08/2020.

Table 1: Investigations and medical management

RT -PCR test		Result	
26 /06/2020 6/07/2020 29/07/2020		COVID positive	
24/08/2020		COVID negative	
Investigation		Value	Inference
Haemoglobin	17/07/2020	13.4 g/dl	Borderline normal
	2/08/2020	12.1 g/dl	Borderline normal
Alkaline phosphatase	7/7/2020	255.0 U/L	Above normal
BUN: Creatinine	13/07/2020	20: 1.2	Normal
INR	18/07/2020	1.56	Borderline high
HGT	27/6/2020	467 mg/dl	Impaired
	6/7/2020	289 mg/dl	Impaired
	24/8/ 2020	168mg/dl	Normal
MEDICAL MANAGEMENT: It included oxygen therapy and Medications (inj tocilizumab, low molecular weight heparin, inj piptaz, inj piperacilin, inj colistin, inj HI, tab Amlo, tab metoprolol, tab septran, inj DEXA.)			

RT-PCR: Reverse Transcription Polymerase Chain Reaction, BUN: Blood Urea Nitrogen, INR: International normalized Ratio, HGT: Hemo Glucose Test, HI: Human Insulin, inj: injection

Table 2: Physiotherapy management and Outcomes

Duration of hospital stay	Week 1-2	Week 3-4	Week 5	Week 6-7	Week 8	Week 9
Oxygen support	NIV with NRBM Trials	NRBM with FM trials	FM	NP	NP with off O_2 trial	Room air
Oxygen (O_2) l/min	90%→ 80%→ 75% Fio2 → 15	15→8 →5	9→5→4	10→4→2	2 →1	Off O_2
Therapeutic position	√	√	√	√	√	√
Breathing exercise	√	√	√	√	√	√
Incentive spirometer	×	×	400 cc/sec	600 cc/sec	800 cc/sec	1000 cc/sec
ICU Mobility Score	1-3	6	6	10	10	10
6 MWT	Date:8/8/20 Distance:135 metre, Oxygen titration:3 L Date:23/8/20 Distance:144 metre, Oxygen titration: 2 L					
TUG	Date:8/8/20, oxygen support:2 L/min, time:33 sec Date: 25/8/20, oxygen support: off o_2, time:8 sec					
SBC	Date:8/8/20, oxygen support:1 L/min, count:7 Date:25/8/20, oxygen support: off o_2, count:25					

NIV: Non-Invasive Ventilation, NRBM: Non-Rebreathing Mask, FM: Face Mask, NP: Nasal Prongs, Fio_2: Fraction of inspired oxygen, IMS: ICU Mobility Scale, L/min: Litre/minute,
6 MWT: six-minute walk test, TUG: Time up and go, SBC: single breath count

DISCUSSION

The ongoing novel coronavirus disease (COVID-19) is threatening the global human population. Viral Pneumonia is the main feature of COVID-19 and adequate ventilatory support is crucial for survival of patient. Elderly patients with comorbidities are more vulnerable to coronavirus disease and studies have shown that prolonged ICU stay causes ICU acquired weakness and also has psychological impact on patient. Since patients with COVID-19 suffer from various degrees of respiratory, physical, and psychological dysfunction, pulmonary rehabilitation is equally important in acute as well as subacute phase for the treatment of the disease. This case represents the prolonged course of patient in hospital and effectiveness of multiple components of inpatient pulmonary rehabilitation along

with medical care which helped the patient to recover.

Patient was admitted in intensive care unit (ICU) with symptoms of fever, dry cough, breathlessness on exertion and was on noninvasive ventilatory (NIV) support. In initial period of ICU stay, physiotherapy goal was to improve lung functions and prevent complications arising due to immobility. The patient had fear of NIV mask and difficulty to adapt to NIV and this was a major barrier observed by the physiotherapist. Therefore, overcoming this barrier by educating about the need for NIV and counseling about his health condition played an important role to build rapport with patient. In initial 2 to 3 days, it was important to focus on therapeutic positioning as any other intervention was not tolerated by patient due to respiratory instability. COVID-19 pneumonia primarily and predominantly affects the posterobasal zone of lung and therefore therapeutic prone position, which helps to improve expansion of posterobasal zone of lung contributed significantly to improve oxygen saturation. [8] Awake prone position with head turned to one side was given for 15 minutes to maximum 30 minutes with monitoring of vitals and it was emphasized to do 3 to 4 times/day. [9] It was difficult for the patient to attain prone position due to discomfort caused by NIV and therefore assistance by physiotherapist to attain prone position and explaining the importance of it, helped the patient to maintain the therapeutic position.

Posterobasal segmental breathing exercises in prone position were given to the patient. Patient was unable to fully expand the posterobasal zone of lung in segmental breathing, and therefore addition of proprioceptive neuromuscular facilitation (PNF) stretches during posterobasal segmental breathing in prone facilitated adequate lung expansion and thus improvement in oxygen saturation. 10 repetitions of PNF stretches where given with rest pause as needed based on monitoring of vitals. It was observed that, prone position and PNF stretches in posterobasal segmental breathing plays an important role in weaning from NIV and to improve oxygen status of patient. Chest mobility exercises were also given to the patient. [10,11]

To prevent complications arising due to immobility, ankle toe movements and heel sides were given to patient and eventually progressed to bed side exercises which included upper limb and lower limb mobility exercises and spot marching. Considering prolonged ICU stay of patient, it was very crucial to focus on improving peripheral conditioning of patient.

Patient required extended oxygen support on non-rebreathing mask (NRBM), hence aggressive respiratory therapy consisting of interventions to improve patient's lung functions and to assist in weaning was continued. Diaphragmatic breathing in prone position (crocodile breathing) was given along with PNF stretches in posterobasal segmental breathing exercise, chest mobility exercises and therapeutic prone position. Diaphragmatic breathing in prone position led to increased mobility of lower part of ribcage and significant improvement in lung expansion. [12,13] Single physiotherapy session everyday consisted of 10 repetitions of each exercise with monitoring of vitals and oxygen saturation was maintained above 90%. [9]

Walking program was initiated, once the patient tolerated bed side walking with supplementary oxygen. Oxygen titration was required as patient desaturated during walking and providing supplementary oxygen also helped the patient to cover more distance and contributed to functional capacity of patient. Distance was increased by 10 metres daily with oxygen titration as required to prevent Spo2 drop below 90%. During walking program, heart rate was maintained within the limits of 20 beats/min above resting heart rate. [9] In this patient, walking program started with 20 metres on 6 L Of oxygen, progressing to 40 metres on 3 L of oxygen and later 50 metres on 3 L of oxygen and eventually patient covered a

distance of 200 metres on 1 L oxygen. Rest pause was given to the patient during episodes of dyspnoea and if Spo2 drop was > 3% from baseline, breathing control and dyspnoea relieving position helped to recover to baseline saturation, to relieve dyspnoea and to continue walking. [10,14]

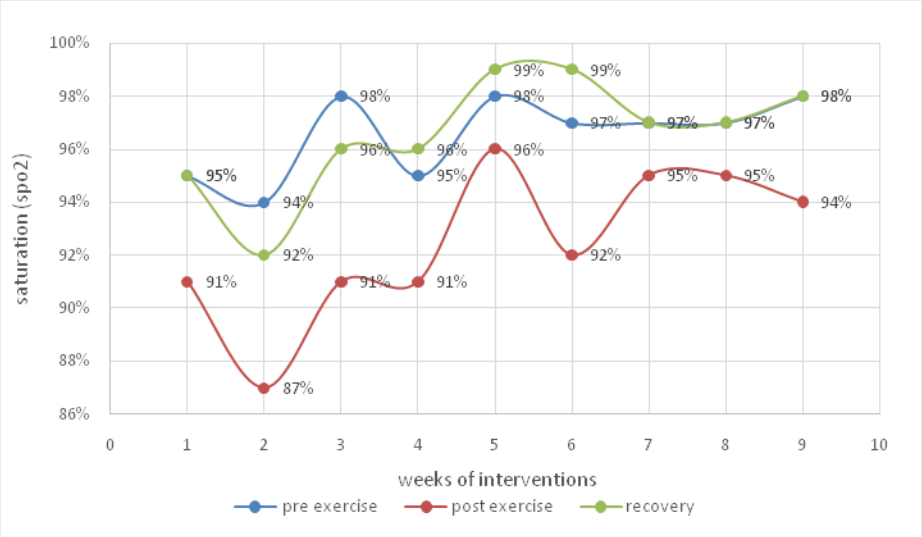
After a month of intensive physiotherapeutic and medical care, patient was weaned from higher to lower oxygen support as described in table 2 and transferred to step down unit (SDU). Incentive spirometry was initiated as patient was shifted to nasal prongs. Breathing exercise, mobility exercises and walking program were continued.10 repetitions of Incentive spirometer every one to two hours, provided visual feedback to the patient to take deep breaths, thus increasing his lung capacity from 400cc to 1000 cc and also led to self-motivation of the patient to perform better. [15,16]

Functional capacity was assessed by 6 min walk test (6MWT). Patient covered 6-minute walk distance(6MWD) of 135 metres with 2 pauses due to rate of perceived exertion-5 and oxygen was titrated upto 3 L to complete test with 95% Spo2 on recovery. After 2 weeks of pulmonary rehabilitation, a pre discharge 6MWT showed an increase in 6-minute walk distance (6MWD) of 144 metres with no pause, oxygen was titrated upto 2 L to complete the test and Spo2 on recovery was 98%. Improvement in functional independence was also indicated by decrease in Time up and go test (TUG) time from 33 seconds to 8 seconds at end of 2 weeks.

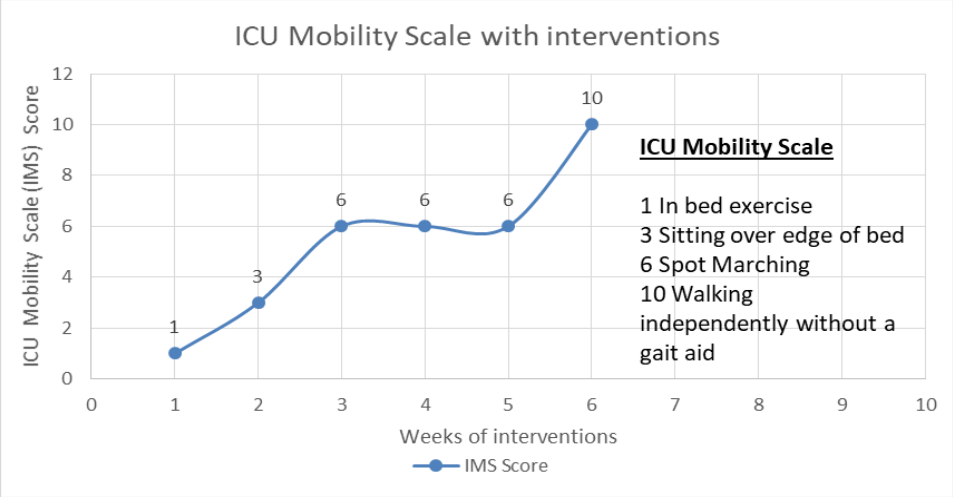
Pulmonary function of patient was assessed by Single breath count, a bedside pulmonary function test. A significant increase in single breath count (SBC) from 7 to 25 at the end of 2 weeks was observed which indicated effectiveness of breathing exercises and therapeutic positioning. On the day of admission, patient's x-ray revealed bilateral patchy consolidation as seen in figure 1 and x-ray done after a month showed significant reduction in bilateral patchy infiltrates as seen in figure 2 which also indicated improvement in lung function. As treatment continued patient was able to do exercises and daily activities without the need of supplementary oxygen. As treatment progressed over 9 weeks of duration of hospital stay, there was gradual increase seen in oxygen saturation and ICU mobility score as observed in graph 1 and 2.

On considering patients comorbidities, charts were screened daily for blood glucose and blood pressure during the exercise session. Rehabilitation along with ongoing medications in this patient had positive impact on glycemic and blood pressure control which accelerated patient's recovery. Due to extended hospital stay and severity of condition, patient had less hopes of recovery which was overcomed by motivation and psychological support provided by physiotherapist.

Figure 1: AP view chest x-ray (26/6/20) Bilateral patchy consolidation Rt > Lt
Figure 2:PA view chest x-ray (29/7/20) Bilateral minimal patchy infiltrates indicative of resolving ARDS



Graph 1: oxygen saturation and weeks of intervention



Graph 2: ICU mobility and weeks of intervention

After 9 weeks of physiotherapy and medical care, discharge was planned based on patient's clinical recovery, negative RT-PCR test, resolution of symptoms and ability to maintain oxygen saturation for 3 consecutive days at room air. Prior to discharge, home program was given to patient and he was advised to follow up at physiotherapy outpatient department for pulmonary rehabilitation. On discharge patient maintained 99% oxygen saturation at rest and in during all activities of daily living (ADL).

In-hospital Pulmonary rehabilitation in acute and subacute phase which involved patient education, respiratory care, exercise training, walking program with supplementary oxygen, energy conservation and psychological support played an important role in this patient in his course from ICU to discharge by assisting in weaning of supplementary oxygen, improving lung and functional capacity and thus facilitating recovery.

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CONSENT

Written Informed Consent was obtained from the patient for his anonymized information to be published in this article.

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