



(CASE SERIES)



Physiotherapy management of geriatric COVID-19 patients in an intensive care unit of a government tertiary care hospital: A case series

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Abstract

COVID-19 caused by SARS-CoV-2 has resulted in an alarming rate of mortality and morbidity worldwide, particularly in older population. It began as an outbreak in December 2019. The contribution of physiotherapy in preventing complications of restricted mobility and early recovery has been aptly acknowledged by the medical fraternity. This paper aims to share our experience and strategies as front liner Physiotherapists in treating critically ill geriatric patients with COVID-19, admitted in the Intensive Care Unit through case series of 3 patients.

Key-words: COVID-19; Physiotherapy; Comorbidities; Intensive Care Unit.

1. Introduction

The global outbreak of Severe Acute Respiratory Syndrome coronavirus 2 (SARS-CoV-2) disease 2019 (COVID-19) is having a dramatic effect throughout the world. This case series reflects the physiotherapy approach in geriatric rehabilitation associated with COVID-19 infection. SARS-CoV-2 is a novel disease that had emerged in December 2019 in China which spread rapidly all over the world including India. The first case of COVID-19 in India was reported in January 2020. Since it is novel, and the causative agent of a potentially fatal disease that is of great global public health concern, hence, the literature related to COVID-19 and guidelines regarding its modes of transmission, safety measures, intervention, etc. are constantly being updated as more and more knowledge is being shared all over [1].

In the COVID-19 pandemic, the older adults have been categorized as high risk. The reason being presence of other comorbidities like diabetes, hypertension, ischemic heart disease, and others that may be associated with aging. Clinical observation in this population highlights respiratory impairment, vascular consequences, effect of bed rest, effects of polypharmacy, and aggravation of frail state caused by COVID-19 infection. With advancing age, there is a decline in the physiological functions of the body as a whole [2]. The mortality and morbidity are found to be higher in this age group. According to Korea disease control, the fatality rate was high in the age group of more than 60 years of age, reaching 16.9%, and 24.4% in the age group of 70 – 79 years and >80 years respectively [3, 4].

SARS-Co-2 has been established as a cause of severe alveolar damage and pneumonia in patients with COVID-19. The consolidation of lung parenchyma precipitates the alterations in blood gases resulting in hypoxemic respiratory failure. There is involvement of not only the lungs but multiple organ systems like the central nervous system. As one of the functions of the central nervous system is to regulate the breathing process, it is a daunting task to compute the extent to which the failure of the central regulation of the breathing process contributes to the mortality in these patients.

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At the level of alveolar capillary membrane, SARS-CoV-2 causes exudative and organized diffuse alveolar damage. The ongoing exudation along with fibrosis in the terminal bronchioles and alveolar walls thicken the gaseous exchange barrier further leading to profound hypoxia, threatening hypoxemic-respiratory failure. It has been observed that COVID patients may show normal saturation at rest but may de-saturate on doing any activity. It is also seen that some patients with a severe drop in PO₂ remain asymptomatic initially due to a possible compensation by an increase in the rate of breathing that comes into play by the neurogenic mechanism to combat hypoxia resulting from a poor diffusion of O₂ across the alveolar barrier. A possible explanation for such severe hypoxemia occurring in a compliant lung is the possible loss of lung perfusion and hypoxic vasoconstriction [5, 6].

Physiotherapeutic interventions play an important role as a complementary intervention in geriatric patients to treat and improve the overall functional level and to optimizing patient's recovery, as it takes into consideration the severity of respiratory symptoms and prevents further respiratory deterioration preserving of existing functional capabilities. This is because geriatric subjects have issues like fear of fall, balance impairments, osteoarthritis, which make independent mobility difficult [7, 8].

Physiotherapy is an integral part of the ICU team supporting the holistic treatment of patients with non-invasive, non-pharmacological treatment modalities mainly involving body positioning, breathing exercises, limb mobilization, relaxation, functional training of patients, and assisting in ventilator support weaning trials [9].

The choice of physiotherapy intervention and its intensity is individually tailored based on patient's health condition, comorbidity, and the respiratory potential. The safety of the patients as well as the physiotherapist is important more so because physiotherapy interventions are usually aerosol generating. Personal protective Equipment acts as a barrier while giving physiotherapy. The verbal instructions are not clearly audible through the mask and face shield especially in the elderly with hearing impairment. Contactless Physiotherapy as laid in the guideline is also not practical in the elderly due to fear of losing balance. We present here three elderly cases, successfully treated overcoming these challenges while delivering Physiotherapy.

2. Case Study - 01

A 70-year-old female was admitted to ICU on the 3rd day of onset of symptoms (fever with, dry cough, severe breathlessness, myalgia, vomiting, loss of smell and dizziness) and had type II b hypoxia. She had associated comorbidities of ischemic heart disease and hypertension (15 years). Her saturation was maintained on 15 liters of oxygen with non-rebreathing mask ventilation. HRCT was suggestive of atypical pneumonia (CORADS 6). 50 to 60% area of lung involvement was reported with bilateral ground glass opacities forming consolidation, interlobular septal thickening in both the lung fields predominantly in sub pleural location. Increased cardiothoracic ratio suggested cardiomegaly. The first session of physiotherapy began with patient education followed by breathing control and thoracic mobility exercises in the supine position, sitting. The session ended with prone positioning which she maintained for 30 to 45 minutes as tolerated. Exercises of the upper and lower limbs were included as the condition stabilized. While performing in bed and bedside mobility exercises, she was hemodynamically stable; as assessed by pulse rate ECG and oxygen saturation as noted from the monitors. She was further progressed to performing exercises in standing like Spot Marching, walking around the bed with oxygen support and later walking in ICU with oxygen tube extension. Even though the patient falls under the geriatric age group, she could tolerate the exercises well and made a quick recovery. Sessions were concluded with relaxation in a prone position. (Table 1)

3. Case Study - 02

A 70-year old male was hospitalized for a COVID-19 infection on the 2nd day of onset of symptoms (fever with chills, dry cough, severe breathlessness, myalgia, and headache) and transferred to ICU on the same day with type II b hypoxia. He had associated comorbidities of hypertension (5 years), ischemic heart disease. He was on NIV, Fio₂ 70% and PEEP 8 cm of H₂O. He would de-saturate up to 88% Spo₂ with exercise and hence his oxygen support was increased by 2 liters before starting the exercises. He benefited from crocodile breathing exercise i.e. posterior basal lung expansion exercise in prone position as evidenced by an improvement in SPO₂. Exercises were gradually progressed from in bed mobility exercises to out of bed mobility exercises as well as an exercise in standing keeping in consideration the hemodynamic stability of the patient. Sessions were concluded by relaxation in the prone position. (Table 2)

4. Case study- 03

A 60 year old male, was hospitalized in a private hospital for 18 days, due to financial constraint he came to the public sector ICU. Initially, he was on NIV and maintained oxygen saturation for 2 days. He was symptomatic (fever with, dry cough, severe breathlessness, loss of smell, vomiting, and fatigue) with per rectal bleeding. He had associated comorbidities of diabetes (11 years), hypertension (5 years) and ischemic heart disease. CT Pulmonary angiogram done on the 4th day of admission suggested asymmetric bilateral diffuse ground glass opacities intermixed with few septal thickening, more marked in the lower lobes. Mild abnormal dilation of the central as well as peripheral bronchioles was seen. Few tiny parenchymal cysts were seen in the anterior as well as the posterior segment of the right upper lobe. Similar findings were noted by HRCT at the time of discharge from the private hospital. Physiotherapy session began with patient education followed by breathing control and thoracic mobility exercises in the supine position, sitting further progressed to standing, spot marching, and walking with adequate rest pauses with respect to hemodynamic stability. Sessions were concluded by relaxation in prone body position. (Table 3)

Table 1 Physiotherapeutic intervention with hemodynamic details- Case 01

Days of PT treatment		1	2	3	4	5	6	7	8
Mode		NRBM	NRBM	NRBM	NRBM	FM	FM	FM	NP
Oxygen support (L/min)		15/L	10/L	12/L	8/L	5/L	8/L	5/L	2/L
Pulse(bpm)	Pre	76	76	69	68	88	48	56	66
	Post	x	89	63	74	93	51	63	74
Spo2 (%)	Pre	94	94	84	98	93	93	96	94
	post	x	96	95	97	96	93	96	97
Positioning		x	√	√	√	√	√	√	√
Breathing exercises		x	√	√	√	√	√	√	√
In bed mobility		x	x	x	√	√	√	√	√
Sitting exercises		x	x	x	x	√	x	√	√
Standing		x	x	x	x	x	x	√	√
Spot marching		x	x	x	x	x	x	x	√
walking		x	x	x	x	x	x	x	√

Days of PT treatment		9	10	11	12	13	14	15	16
Mode		NP	NP	NP	NP	NP	NP	RA	RA
Oxygen support (L/min)		4/L	2/L	4/L	2/L	2/L	1/L	Off O2	Off O2
Pulse(bpm)	Pre	70	75	77	72	72	82	76	88
	Post	83	89	79	92	84	94	88	100
Spo2 (%)	Pre	98	93	92	95	99	96	97	98
	post	96	95	94	95	98	98	95	100
Positioning		√	√	√	√	√	√	√	√
Breathing exercises		√	√	√	√	√	√	√	√
In bed mobility		√	√	√	√	√	√	√	√
Sitting exercises		√	√	√	√	√	√	√	√
Standing		x	√	√	√	√	√	√	√
Spot marching		x	√	√	√	√	√	√	√
walking		x	√	√	√	√	√	√	√
BHT		Date: 28/8/20, Oxygen support: 2 L/min, Count 4 Date: 5/9/20, Oxygen support: off O2, Count 30							

Table 2 Physiotherapeutic intervention with hemodynamic details- Case 02

Days of PT treatment		1	2	3	4	5	6	7	8	9	10
Mode		NIV	NRBM	NRBM	NRBM	NRBM	NEBM	NRBM	FM	NP	NP
Oxygen support (L/min)		Fio2 70% PEEP 8	13/L	15/L	10/L	8/L	8/L	6/L	10/L	6/L	2/L
Pulse(bpm)	Pre	70	62	72	57	84	82	69	76	76	83
	Post	72	70	77	69	101	90	87	100	88	79
Spo2 (%)	Pre	95	92	94	86	88	96	91	97	96	97
	post	06	97	99	97	99	100	99	100	98	98
Positioning		√	√	√	√	√	√	√	√	√	√
Breathing exercises		√	√	√	√	√	√	√	√	√	√
In bed mobility		x	x	√	√	√	√	√	√	√	√
Sitting exercises		x	x	√	√	√	√	√	√	√	√
Standing		x	x	x	x	x	√	x	√	√	√
Spot marching		x	x	x	x	x	x	x	√	√	√
walking		x	x	x	x	x	x	x	√	√	√
BHT		Date: 28/8/20, Oxygen support: 13 L/min, Count 7 Date: 5/9/20, Oxygen support: 2 L/min, Count 30									

Table 3 Physiotherapeutic intervention with hemodynamic details- Case 03

Days of PT treatment		1	2	3	4	5	6	7	8
Mode		NIV	NRBM	NRBM	NRBM	NRBM	FM	NP	NP
Oxygen support (L/min)		x	8/L	15/L	8/L	9/L	6/L	4/L	1/L
Pulse(bpm)	Pre	x	103	99	91	94	96	105	111
	Post	x	88	89	79	85	83	84	109
Spo2 (%)	Pre	x	94	96	100	96	91	91	99
	post	x	95	97	100	95	94	96	98
Positioning		x	√	√	√	√	√	√	√
Breathing exercises		x	√	√	√	√	√	√	√
In bed mobility		x	√	√	√	√	√	√	√
Sitting exercises		x	x	x	√	√	√	√	√
Standing		x	x	x	x	√	√	√	√
Spot marching		x	x	x	x	x	x	√	√
walking		x	x	x	x	x	x	x	√
BHT		Date: 28/8/20, Oxygen support: 8 L/ min, Count 6 Date: 5/9/20, Oxygen support: 1 L/min, Count							

NIV: Non Invasive Ventilation; NRBM: Non rebreathing mask; NP: Nasal prongs; O.: Oxygen; Po. FiO2: Fraction of Inspired Oxygen; L/min: Liters/min; FM: face mask; BHT: Breath holding time; PEEP: positive end-expiratory pressure; RA: room air.



Figure 1 Exercises in propped up position



Figure 2 Crocodile breathing exercise in prone

5. Discussion

Elderly patients with comorbidities are more sensitive to coronavirus disease. They have prolonged ICU stay which may result in ICU acquired weakness and also show psychological impact. Wei-Jie Guan et al have reported that poorer clinical outcomes in patients with increased comorbidity than those without a greater number of comorbidities correlated with poorer clinical outcomes [10, 11]. Hence, acute care Physiotherapy is indicated immediately after the patient is hemodynamically stable. Patients in ICU were on various ventilatory supports. Initially in the ICU, the physiotherapy goal was to improve lung function and reduce complications arising due to immobility. Patients had difficulty to accept various ventilatory modes like NIV, Non ReBreathing Mask, nasal prongs, Face mask, and this posed difficulty in assuming the prone position [12].

This was overcome by educating the patient regarding ventilatory support and guiding about his/her health condition. This essentially developed a rapport with the patient. COVID-19 pneumonia primarily affects the lower lobes and hence physiotherapy intervention like crocodile and diaphragmatic breathing along with prone positioning facilitates lung expansion and improves oxygen saturation.

Physiotherapy intervention began with patient education about the problem and the need for pulmonary rehabilitation. Patients were instructed and given body position changes every 30 minutes to 2 hours (prone, lying on the right side, sitting upright 60-90 degrees and lying on the left side) as per the CARP protocol to improve hypoxemia [13]. Patients

were given diaphragmatic breathing exercises prior to general mobility exercises. The therapy session concluded with crocodile breathing exercises. Adequate rest pauses were given during and after each set of exercises. A total of 30 repetitions of both the breathing exercises were done daily under supervision. This whole routine was done once per day. Graded mobility exercises were given to prevent peripheral deconditioning and bed rest, ankle toe movement, heel slides were given as in bed mobility exercises. Exercises were further progressed to sitting at the edge of the bed, standing, spot marching and walking in the ICU with adequate rest-pause followed by positioning [14, 15]. Walking program in the ICU with an extended tube despite of Non-invasive ventilatory support helped to increase the intensity of mobilization exercises to improve oxygen perfusion. Safe multi-model physiotherapy as per the individual need of the elderly giving due consideration to hemodynamic response helped patients to wean from oxygen support [16].

Patients were given diaphragmatic breathing exercises and crocodile breathing exercises which played an important role in improving oxygen saturation of patients and weaning from NIV mode. It also helped to reduce the respiratory rate and hence the work of breathing. For performing Crocodile breathing exercises, patients were instructed to lie on the stomach with their hands in a diamond shape supporting their forehead. In presence of the mask of NIV, the patients were allowed to rotate their head to one side to accommodate the mask as seen in the figure 2. They were cued to try and push their ribs out laterally and try to breathe all the way down to the sacrum [17]. This results in the ventilation of posterior basal areas of the lung which are likely to undergo atelectasis if the patients remain in the supine position all day. The ground glass opacities are also commonly found in the basal areas of the lungs. Hence crocodile breathing has an added advantage of prone position, which has been evidenced to improve oxygenation. Similar to diaphragmatic breathing exercise, crocodile breathing also recruits diaphragm muscle. The breath holding time also improved in all the three patients as seen in the tables.

The above patients were attended on one to one basis by the same Physiotherapist daily. The respiratory care, graded mobilization, walking program with supportive care along with psychological support played an essential role in all these patients towards weaning from supplemental oxygen support. All three patients were discharged, without the need for home oxygen support. Positive outcomes were obtained with physiotherapy interventions in all the three patients despite their diverse characteristics.

6. Conclusion

An individually tailored Physiotherapy regimen helps elderly COVID 19 patients towards a successful recovery. The case series highlights the patient's difficulty to adapt to the various ventilatory modes and the physiotherapist's difficulty in communicating with the patient in PPE and in planning and implementing a safe yet effective exercise program due to the presence of comorbidities like diabetes, hypertension and ischemic heart disease. The decision making is on daily basis considering the hemodynamically unstable state of the patients in ICU. Reading the previous day's notes help in this decision making and planning of the daily schedule. Hence we conclude that physiotherapy intervention was well tolerated by the patients and they were able to return to the community.

Abbreviations

COVID-19: Coronavirus disease; SARS-CoV-2: severe acute respiratory syndrome coronavirus 2; ICU: Intensive Care Unit; NIV: Non Invasive Ventilation; NRB: Non rebreathing mask; NP: Nasal prongs; ARDS: Acute respiratory distress syndrome; CARP: COVID Awake Repositioning Protocol; O₂: Oxygen; P_{O₂}: Partial pressure of oxygen; FiO₂: Fraction of Inspired Oxygen; L/min: Liters/minute; FM: face mask; BHT: Breath holding time.

Compliance with ethical standards

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Disclosure of conflict of interest

None.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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