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Case Series

Physiotherapy management of COVID-19 patients in acute set up of government tertiary care hospital: A case series

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ABSTRACT

The entire world is in the grip of COVID-19. India is under lockdown since 24th March 2020. On 19th April 2020 our Institute, a Tertiary Care Hospital, was declared as COVID-19 dedicated Hospital by the Municipal Corporation of Greater Mumbai.13th May onwards, Physiotherapy School & Centre, an integral part of the above mentioned institute, was called upon to offer their services to the COVID-19 patients. This paper aims to share our physiotherapy professional experiences and challenges faced as front liners in treating critically ill patients with COVID-19 admitted in Intensive Care Unit through case series of 4 patients.

1. Introduction

COVID-19 is a highly communicable disease caused by SARS-CoV-2 transmitted by direct contact with infected people (droplet transmission within 1 m distance) and indirect contact with surfaces or with objects used by the infected person in the same environment. Airborne transmission may be possible during aerosol-generating procedures like endotracheal intubation, bronchoscopy, open suctioning, nebulization, prone positioning, weaning the patient from the ventilator, NIV, tracheostomy, and CPR.[1]

The clinical presentation begins within 14 days of exposure, however in most cases symptoms present after about 5 days and symptom onset is within 11.5 days in 97.5% of individuals.[2,3](Table 1) Hypoxaemia without the perception of dyspnoea ('silent hypoxaemia') is a hallmark of the disease. Hypoxaemia is usually associated with an increase in alveolar to arterial oxygen gradient signifying either a ventilation perfusion mismatch or an intra-pulmonary shunting.[4] Adverse outcomes are associated with comorbidities like hypertension, diabetes, obesity, cardiovascular disease, lung disease, immunocompromised diseases and high levels of D-dimer, fibrinogen and prolonged prothrombin time.[5] There is evidence of myalgias and loss of muscle mass amongst COVID-19 survivors impacting their daily activities.[6]

Although COVID-19 primarily affects the lungs, other systems with ACE 2 receptors are also affected like the heart, blood vessels, kidney, liver and Gastrointestinal tract. Inflammation of the cardiac wall leading to myocarditis, pericarditis and pericardial effusion, are well-recognized complications of viral infections. Cerebrovascular and neurological symptoms could be explained by hypercoagulability status (increased levels of fibrinogen, anti-phospholipids antibodies and D-dimer) in patients with COVID-19, leading to thrombi formation in the vessels.[7]

RT-PCR is the most common clinical laboratory method for detection of the pathogenic virus in respiratory secretions through Nasopharyngeal Swab Test. Blood reports show decreased albumin, High CRP, High LDH, lymphopenia, High ESR. CT Scans commonly show bilateral ground-glass, crazy paving opacities and

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consolidation particularly on the peripheral and the lower lobes of the lungs.[8]

The mainstay of clinical treatment consists of symptomatic management and oxygen therapy, with mechanical ventilation for patients with respiratory failure. COVID-19 is a novel disease, the pathophysiology of which is still not very clear. Role of Physiotherapeutic intervention is well established in Intensive care and is effective in treating respiratory disorders such as ventilatory dysfunction, dyspnea by reducing work of breathing, improving ventilation and quality of life.[9] The aim of this article is to share the Physiotherapy interventions and its benefits in the management of critical patients with severe disease of Covid-19 in the Intensive Care Unit of a government tertiary care hospital. The patients in this case series have a diverse presentation and response to physiotherapeutic interventions.

Table 1: Classification of Covid-19 patients[3]

Asymptomatic	Rt-PCR swab test positive. No Clinical signs and symptoms. Chest Imaging Normal
Mild	Symptoms of acute upper respiratory tract infection (fever, fatigue, myalgia, cough, sore throat, runny nose, sneezing) or digestive symptoms (nausea, vomiting, abdominal pain, diarrhea)
Moderate	Pneumonia (frequent fever, cough) with no obvious hypoxaemia, chest CT with lesions
Severe	Pneumonia with hypoxaemia (SpO2 <92%)
Critical	Acute respiratory distress syndrome (ARDS) may have shock, encephalopathy, myocardial injury, heart failure, coagulation dysfunction and acute kidney injury.

2. Patient Information

2.1. Case study 1

A 29-year-old male, gym trainer by occupation was admitted to ICU on the 5th day of onset of symptoms. His saturation was maintained on 14 litres oxygen with bag and mask ventilation. His CRP was 79.10 mg/dl, D-Dimer was 1.2 ng/dl, ferritin was 716 ng/ml, PO2-76.5. HRCT showed COVID pneumonia grade 3 with multiple confluent ill-defined patchy attenuation in the bilateral Lung parenchyma. The first session of Physiotherapy began with patient education followed by breathing control and thoracic expansion exercises in supine as well as in sitting and ended with prone positioning which patient maintained for 2 hours. Exercises of the upper and lower limb were included as the patient's condition stabilized. The patient showed good recovery and was further progressed to exercises in standing. Spot Marching was given before progressing to walking around the bed and later to walking in ICU. As the patient was young he could tolerate the exercises well and made a quick recovery. Sessions were concluded with prone positioning (Table 2).

Table 2 -Table 5 Details of hemodynamic parameters with Physiotherapy management of cases from day of admission to day of discharge in intensive care unit

2.2. Case study 2

A 30-year-old male with recently diagnosed diabetes mellitus was admitted to ICU on 7th day of onset of symptoms. He was on BIPAP, Fio2 100%. His IL6 was 9.47, ferritin was 386, D-Dimer was 4779 ng/dl, CRP was 60 mg/dl and PO2-60. HRCT showed ground-glass opacities and ill-defined consolidation patch in the bilateral middle and lower lobe. Xray showed bilateral fluffy shadows in middle and lower lobes. Initially, positioning in prone was difficult because of the risk of detachment of BIPAP mask hence high side-lying and quarter prone positions were used. In bed mobility and breathing exercises were given. As his condition improved, he was shifted from BIPAP to bag and mask ventilation. Prone positioning was now included along with exercises in sitting, standing and walking. Sessions were concluded with prone positioning (Table 3).

2.3. Case study 3

A 34-year-old male, fruit seller by occupation, was hospitalized on the 12th day of onset of symptoms and transferred to ICU the next day. He was on 8 litres oxygen bag and mask ventilation. CRP was 65 mg/dl, ferritin was 1144 ng/ml and PO2-67.9. HRCT showed multiple large ground-glass opacities with consolidation patch involving 70% of lung parenchyma. As 70% of lung parenchyma was involved, this patient desaturated considerably with exercise. Patient's oxygen level was increased before starting the exercises as he used to desaturate (up to 85%). He benefited from prone positioning and breathing control. Exercises were gradually progressed from in bed mobility exercises to exercise in standing keeping in consideration the hemodynamic stability of the patient. Sessions were concluded with prone positioning (Table 4).

2.4. Case study 4

A 59-year-old male, with diabetes and hypertension, was admitted in the hospital on the 5th day after the onset of symptoms and was transferred to ICU on the same day. His oxygen saturation was maintained on bag and mask Ventilation with 8 litres oxygen. D-Dimer was 11.3ng/dl; CRP was 77 mg/dl and ferritin was 1315 ng/ml and SPO2 level was 63.3. Chest Xray showed bilateral fluffy shadows indicating ARDS. The first session of Physiotherapy began with patient education followed by breathing control

Table 2: Case study 1

Days		**1**	**2**	**3**	**4**	**5**	**6**	**7**
O2 supply BMV		14 L	14 L	8 L	6 L	4 L	2 L	Nil
PR bpm	Pre	88	92	81	89	92	88	88
	Post	92	96	100	96	88	96	91
RR bpm	Pre	24	22	25	23	20	26	25
	Post	22	21	22	20	21	22	23
SPO2 %	Pre	100	99	98	100	100	100	100
	Post	97	97	98	97	99	100	100
Positioning		√	√	√	√	√	√	√
Breathing exercises		√	√	√	√	√	√	√
Exercises in lying		√	√	√	√	√	√	√
Exercises in Sitting		x	√	√	√	√	√	√
Standing		x	x	√	√	√	√	√
Spot marching		x	x	x	√	√	√	√
Walking		x	x	x	x	x	√	√

Table 3: Case study 2

Days		**1**	**2**	**3**	**4**	**5**	**6**	**7**
O2 supply	Mode	BIPAP	BIPAP	APRV	BMV	BMV	BMV	BMV
	FiO2 %	100%	60%	50%	15L	8L	4 L	2 L
PR bpm	Pre	76	83	81	76	85	86	86
	Post	71	81	85	93	89	84	99
RR bpm	Pre	29	28	27	23	25	22	23
	Post	25	24	23	21	22	19	18
SPO2 %	Pre	100	99	99	98	100	100	98
	Post	98	96	95	99	99	100	100
Positioning		√	√	√	√	√	√	√
Breathing exercises		√	√	√	√	√	√	√
Exercises in lying		√	√	√	√	√	√	√
Exercises in Sitting		x	√	√	√	√	√	√
Standing		x	x	x	x	x	√	√
Spot marching		x	x	x	x	x	√	√
Walking		x	x	x	x	x	x	√

Table 4: Case study 3

Days		**1**	**2**	**3**	**4**	**5**	**6**	**7**
O2 supply BMV		10 L	8 L	8L	6 L	4 L	2L	Nil
PR bpm	Pre	74	79	82	79	86	83	85
	Post	81	89	88	84	88	89	88
RR bpm	Pre	23	25	26	24	28	23	22
	Post	20	22	23	21	24	22	20
SPO2 %	Pre	98	98	98	100	99	98	99
	Post	97	98	96	98	98	99	100
Positioning		√	√	√	√	√	√	√
Breathing exercises		√	√	√	√	√	√	√
Exercises in lying		√	√	√	√	√	√	√
Exercises in Sitting		√	√	√	√	√	√	√
Standing		x	x	√	√	√	√	√
Spot marching		x	x	x	√	√	√	√
Walking		x	x	x	x	x	x	√

exercises in sitting. Exercises were progressed at a slower rate as the patient complained of easy fatigability. Adequate rest-pause was included between all exercises. Exercises began with lower repetition and then were progressed according to patient perception of fatigue. The exercise was terminated whenever he complained of severe fatigue and pain in calf muscles. Sessions were concluded with prone positioning (Table 5).

Fig. 1: Patient positioned in prone position

Fig. 2: Exercises in lying position

Fig. 3: Spot marching

Fig. 4: Walking

3. Discussion

COVID-19 is a highly communicable viral infection associated with overactive host immune response resulting in pneumonia and ARDS. The duration of symptoms is approximately 4 to 19 days with complications setting in between 7 to 19 days 9 to 14% of patients have severe disease while 5% of patients are critical.[10] As can be seen from the above cases, even young patients (29 years, 30 years and 34 years) with comorbidities had severe to critical COVID -19 disease.

On account of the increased risk of exposure to infection, Personal Protective Equipment (PPE kit) was used while treating these patients. Assessment by Physiotherapist was limited to observing breathing pattern and respiratory rate, use of finger pulse oximeter which displays oxygen saturation and pulse rate, and cardioscope which displays heart rate and BP. Furthermore, patient assessment and Physiotherapy management should not exceed 10-15 minutes to reduce risk of exposure. Being a 1000 bedded dedicated COVID-19 hospital, the number of patients referred daily meant treating patients in PPE for 4–5 hours which was a big challenge.[11–14]

Patients with COVID-19 pneumonia and ARDS are admitted to ICU with Type 1 respiratory failure. They are unable to maintain the oxygen saturation in the blood and hence are put on oxygen therapy. During the natural course of the disease, the primary goal of a Physiotherapist in ICU is to prevent the accumulation of or to clear bronchopulmonary secretions and to prevent ICU acquired muscle weakness. As all the above patients had dry cough with no secretions, interventions were directed to reduce hypoxemia with positioning, to relieve dyspnea with a diaphragmatic breathing exercise and general exercises to prevent muscle weakness.

Physiotherapy management was started with patient education which helped in reducing anxiety and fear about the COVID 19. Patients were given position changes every

Table 5: Case study 4

Days		**1**	**2**	**3**	**4**	5	**6**
O2 supply BMV		8 L	6 L	6 L	6 L	4 L	Nil
PR bpm	Pre	83	94	89	88	92	86
	Post	92	96	98	97	98	91
RR bpm	Pre	28	27	26	24	28	27
	Post	23	25	24	21	24	23
SPO2 %	Pre	98	97	100	96	100	98
	Post	96	91	98	96	96	96
Positioning		√	√	√	√	√	√
Breathing exercises		√	√	√	√	√	√
Exercises in lying		√	√	√	√	√	√
Exercises in Sitting		√	√	√	√	√	√
Standing		x	√	√	√	√	√
Spot marching		x	x	x	√	√	√
Walking		x	x	x	x	√	√

30 minutes to 2 hours (prone, lying on the left side, sitting upright 60-90 degrees and lying on the right side) as per the CARP protocol to improve hypoxaemia.[15] Patients were given breathing exercises which helped to reduce the respiratory rate.

Graded exercises were given to prevent complications of bed rest and deconditioning. Patients were given exercises of the upper and lower extremity in supine and progressed to sitting at the edge of the bed, standing, spot marching and walking in ICU with adequate rest-pause. Exercises helped to optimize oxygen transport by improving alveolar ventilation and V/Q matching and also in maintaining normal fluid distribution in the body and also helped in reducing the fear of activity.[16] Post-exercise, the elderly patient required longer recovery time and reported a higher level of fatigue as compared to the younger patients owing to the progressive decline in innate immune response observed with increasing age, and comorbidities.[17]

The above COVID-19 patients were attended on one to one basis by a Physiotherapist for 15 minutes daily. The breathing exercises and general mobility exercises performed in the presence of Physiotherapist probably reduced their anxiety and improved their confidence to perform basic activities with less breathlessness. Positive outcomes were obtained with physiotherapy interventions in all the four patients' despite their diverse characteristics.

4. Conclusion

Thus we conclude that Physiotherapy intervention was well tolerated by the patients and hence can be administered safely in COVID 19. It helped in reducing their anxiety and fear which had a positive effect on the level of oxygen saturation and level of breathlessness. All the above patients showed early recovery which helped them to go back to the community with good functional capacity.

5. Abbreviations

ICU: Intensive Care Unit; NIV: Non Invasive Ventilation; APRV: Airway Pressure Release Ventilation; BIPAP: Bi level positive airway pressure; CPR: Cardiopulmonary resuscitation; ARDS: Acute respiratory distress syndrome; CRP: C Reactive Protein; ESR: Erythrocyte Sedimentation Rate; RT-PCR: Real-time reverse transcription polymerase chain; CARP: COVID Awake Repositioning/Proning Protocol.

6. Source of Funding

None.

7. Conflict of Interest

None.

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