

Effect of Physiotherapy Intervention on COVID-19 Patient with Comorbidities

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Abstract

Introduction: Coronavirus disease 19 (COVID-19) is a new virus linked to the same family of viruses as Severe Acute Respiratory Syndrome (SARS). Concern has aroused regarding association between increased risk of complication and death among COVID-19 patients with underlying diseases.

Objective: To highlight the effect of physiotherapy intervention on function performance of COVID 19 inpatient with comorbidities.

Case presentation: Sixty one years old, male with past medical history of hypertension (HTN), diabetes mellitus (DM), ischemic heart disease (IHD). In addition, there was history of angioplasty 10 years ago in India. On 24 June 2020, he was admitted with tachypnea and fever and found to be COVID positive in AL Nahada Hospital. He was intubated due to desaturation to 60% despite being on 15L oxygen in non-rebreathing mask. Post intubation, he was shifted to Royal Hospital on Mechanical Ventilator (MV) and admitted in COVID ICU. On 26 June, patient was extubated on NIV since he was conscious, and stable hemodynamic.

Management and outcome: manual muscle testing (MMT) and berg functional balance scale (BBS) were used as outcome measures to evaluate the efficiency of physiotherapy intervention. These interventions were early mobilization and breathing exercises.

Result & Conclusion: The results of this case study suggest that the physiotherapy intervention used in this case aided to speed up improvement and recovery. The results of this report warrant for further studies with larger sample size and more controlled study design to test for the effect of early physiotherapy intervention in functional performance of Covid-19 patients.

Keywords: Coronavirus (COVID-19) • physiotherapy • cardiovascular disease • function performance.

Introduction

Corona virus disease 19 (COVID-19) was first detected in Wuhan, China, and then outbreak to other countries. COVID-19 was officially known as "severe acute respiratory syndrome coronavirus 2" (SARS-CoV-2) by the International Committee on Taxonomy of Viruses based on phylogenetic analysis [1]. Up to end of July, according to statistics of world health organization, there were 16 523 815 confirm cases in 216 countries [2]. In Oman, the first case was reported on 24th February 2020 [3].

COVID-19 affects all age groups. Most infected people will develop mild to moderate symptoms, such as fever, dry cough and dyspnoea [1]. Angiotensin-converting enzyme 2 (ACE2) receptor provides the entry point for the coronavirus to infect a wide range of human cells. ACE2 plays essential role in cardiovascular and immune systems. It is highly present in the heart and lung [4]. Therefore, SARS-COV2 invades alveolar epithelial cells resulting in respiratory symptoms. These symptoms are more severe in patients with comorbidities [5]. A recent study had shown that 25% and 58.3% of critically ill patient with COVID19 had underlying heart disease and hypertension, respectively [6]. Moreover, According to mortality rate released by the National Health Commission, 35% of COVID patients had a history of hypertension and 17% had a history of coronary heart disease [4].

Up to date there is still no cure treatment for COVID-19. The major focus of treatment is oxygen therapy, infection control and symptomatic relief. Physiotherapy is one component of treatment program that play significant role in physical rehabilitation and respiratory management of patients with COVID-19 [7]. One systemic review had shown that physiotherapy intervention

specifically early progressive mobilization was valuable for patients in intensive care unit (ICU) in term of improving functional ability and reduce admission period in ICU and hospital [8]. Recently, the Australian Physiotherapy Association published clinical practice recommendation for physiotherapy management for COVID-19 patients in the acute hospital setting that includes respiratory training, mobilization and therapeutic exercises [9]. Nevertheless, there are no studies that evaluate the efficiency of physiotherapy for COVID-19 patients with underlying diseases. This case study aims to clarify the effect of physiotherapy intervention on functional performance of COVID 19 patient with co-morbidities.

Case Presentation

Sixty one years old male with past history of hypertension (HTN), diabetes mellitus (DM), ischemic heart disease (IHD). In addition, there is history of angioplasty before 10 years ago in India. On 24 June 2020, He was admitted with tachypnea and fever in AL Nahada Hospital because of COVID19. He was intubated since he showed desaturation to 60% despite being on 15L oxygen in non-rebreathing mask. After intubation, he was shifted to Royal Hospital on mechanical ventilator (MV) with the following settings; synchronized intermittent mandatory ventilation (SIMV) mode, fraction of inspired oxygen (FIO2 50%), positive end expiratory pressure (PEEP 10), pressure support (PS14). He was admitted in COVID ICU in the Royal Hospital. On 26 June 2020, patient was extubated on non-invasive ventilator (NIV) since he was conscious and stable hemodynamic; vital signs were as following; HR 60 beat/mint, SPO2 95%, BP 140/60 mm hg, RR 25 breath/mint.

Physiotherapy intervention started in COVID ICU on 28 of June 2020. Patient was conscious, oriented and responding to commands. He was on NIV; PEEP 8, FIO2 60%.

Physical examination findings

General observation, patient appeared thin. He was oriented, and conscious. Most of time, he was observed in Semi-Fowler's position. The patient was in different oxygen supports (nasal cannula, advance venture mask, and non-invasive ventilator) exchange according to his saturation and ABG result. The patient was attached to arterial and intravenous lines, ECG leads, pulse oximeter, and urine catheter. The patient was afebrile. Vital signs reading

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Received 06 November 2020; **Accepted** 09 March 2021; **Published** 16 March 2021

on cardiac monitor were as following; HR 60 beat/mint, SPO2 92% on nasal cannula 4L oxygen, RR 21, ABP 110/40. However, the patient de-saturated with light active movement in the bed especially in second day of extubation and first day of physiotherapy. Chest expansion was decreased overall. Patient was fully alert and Glasgow's Coma Scale (GCS) results were 15/15. In addition the patient has good cognitive functions in terms of communication, memory and perception.

Laboratory result

Table 1 illustrates the result of arterial blood gas (ABG's). These reading were taken immediately post extubation. It shows hypoxemia with metabolic alkalosis problem. However, the haemoglobin (12.5 g/dl) and International Normalized Ratio (1.09) were normal.

Chest X ray

Anteroposterior chest x-ray Figure A showed bilateral patchy area of airspace opacities; Cost phrenic angle was obliterated in left side, hila and mediastinum unremarkable. No bony abnormality. Chest x-ray in Figure B post extubation was still showing bilateral patchy area of airspace opacities, more in right middle lobe.

Musculoskeletal assessment

Complete active range of motion (AROM) was achieved in upper and lower limbs. No deformities were reported.

Physiotherapy intervention

Positioning: Self-side lying and prone position was encouraged to improve saturation (gas exchange) and optimize ventilation perfusion matching. In the current case, immediate improvement in saturation in prone position was observed compared to other positions (side lying, Semi-Fowler's position and sitting).

Breathing exercise: Deep breathing exercise and breathing control (diaphragmatic breathing exercise) were done to increase pulmonary efficiency. In this case and other COVID 19 patients, it was observed that diaphragmatic breathing exercise, work better in improving saturation and reducing tachypnea-and shortness of breath (SOB) compared to deep breathing exercises. However, it had short-term effect so; patient was instructed to follow up with regular breathing exercises.

Huff-cough technique (ACBT) was done to clear the airway. The patient had good effort of coughing with dry cough or minimal secretion observed in most days.

Active mobilization: Early mobilization was progressed according to patient ability since he was in ICU with oxygen support. Early mobilization includes; sitting at edge of bed, active range of motion (AROM) exercises for upper and lower limbs, marching exercise, walking, and strength exercises for lower limb. The intensity and repetition of exercise was increased gradually. At early days of admission in ICU, sudden desaturation was noted with mild mobilization without showing any symptoms.

Outcome measure and follow up: Patient was admitted in Royal Hospital for 11 days; 9 days in COVID ICU and two days in COVID ambulatory ward. The patient was seen by physiotherapist; six sessions per week, 20-30 minutes each session. Light intensity of simple exercises such as; breathing exercises, AROM exercise for UL & LL, walk near to bed, sit to stand and marching and strength exercises for LL were done. After discharge from Royal Hospital, the patient planned to continue therapy in another private hospital, since his condition was stable and only requiring minimal oxygen supplement on exertion. In the last session of physiotherapy, he was on nasal cannula 2L oxygen, maintaining SPO2 94-95%. He was on physiotherapy from 28 June to 5 July 2020.

The manual muscle testing and berg functional balance scale were used as outcome measure to assess the improvement of function performance of patient. The measurement was taken first time in ICU and reassessed second time in ambulatory ward before discharge.

Results

Manual Muscle Test (MMT)

Overall, the patient had good muscle power; approximately grade 5 in upper limb. Therefore, MMT was utilized mainly for the anti-gravity muscles in lower limb (LL) because these muscles have primary function of maintaining upright standing and important for locomotion. Result of MMT in Table 2 revealed improvements in muscles strength especially in knee extensor muscles.

Berg functional Balance Scale (BBS)

As illustrated in Table 3, there was remarkable improvement in the balance during functional activity of patient. The large difference between score in ICU and ambulatory ward reflected good and fast progress. Berg et al (1992) interpreted the total of score as following; 0-20 high risk, 21-40 moderate risk and, 41-56 low risk of falling [10].

Table 1. ABG's result post extubation.

ABG's	Patient values	Normal values
PH	7.53	7.35-7.45
PCO2	35mmhg	35-45
PO2	50 mmhg	83-108
HCO3	29 mmol	22-28
Base excess	6.3 mmol/L	-2 to +2

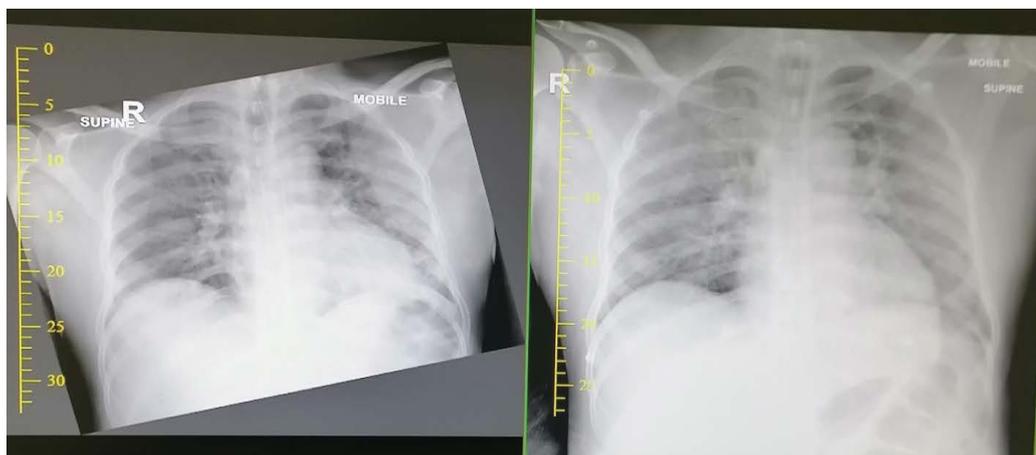


Figure 1. A) G28 June (B: extubation). B) date: 25 June (A: intubation).

Table 2. MMT results; grades indicator (0=no movement, 1=muscle contraction without movement, 2=Full ROM with gravity elimination, 3=full ROM against gravity, 4=full ROM against moderate resistance, 5=full ROM against maximum resistance).

Main antigravity muscles of lower limb	ICU		Ambulatory ward	
	Lt grade	Rt grade	Lt grade	Rt grade
Hip flexor	4/5	4/5	4/5	4/5
Knee extensor	3/5	3/5	4/5	5/5
Planter flexor	5/5	5/5	5/5	5/5
dorsiflexion	4/5	4/5	5/5	5/5

Table 3. BBS score in ICU and ambulatory ward. Five-points scale ranging from 0-4 Score (0=lowest function/balance maintain – 4=highest function/maintain balance safely).

Function	Score	
	ICU	Ambulatory ward
Sitting to standing	1	3
Standing unsupported	2	3
Sitting unsupported feet on floor	3	4
Standing to sitting	2	4
transfer	1	3
Standing with eyes closed	0	3
Standing with feet together	0	3
Reaching forward with outstretched arm	0	4
Pick up object from the floor	0	3
Turning to look behind/over left and right shoulders	0	4
Turn 360 degrees	0	2
Placing alternative foot on stool	0	3
Standing one foot in front	1	4
Standing on one leg	0	3
Total	10	46

Discussion

This case report demonstrates typical clinical presentation of COVID-19 patient with other co-morbidities which has shown rapid recovery course with medicine care and physiotherapy management. Furthermore, it had shown potential benefits of physiotherapy intervention in improving muscles strength and quality of performing functional activities.

Impaired physical function and muscles weakness are common finding in ICU patients because of mechanical ventilator, long period of immobilization and sedation [11]. In addition; one study reported that loss rate of muscles mass and weakens was between 4-5% every week of immobilization [12]. Therefore, the manual muscle test and berg functional balance scale used as outcome measures to measure efficiency of physiotherapy for this case. Looking to the finding of these outcome measures; this patient has achieved improvement in strength of antigravity muscles of lower limb and balance during performing functional activity.

The significant positive result of this case was achieved after certain physiotherapy interventions which are mainly breathing exercise, light strength exercises for lower limb, and early mobilization such as; marching, walking, site to stand, and AROM exercises for UL & LL. Most of clinical practice guidelines of physiotherapy recommended for active mobilization and bed mobility activates as possible based on patient's need and tolerance [13,14]. Moreover, One case series study highlight recommendation for prolonged duration of rehabilitation course for COVID19 patients especially who have severe COVID-19 infection [15]. However, early discharge of patient was one of main limitation of this case which affects duration of intervention and long-term impact of physical and respiratory function of patient.

Through the practice of physiotherapy intervention; sudden desaturation with minimal change of position was common feature with COVID19 pneumonia patients which could be due to silent hypoxia. Likewise in this case, the patient showed asymptomatic desaturation even with light intensity activity such as;

sitting at edge of bed especially in the first days of mobilization in ICU. As a result, physiotherapists should be careful during intervention and saturation should be continuously monitored during treatment even if the patient is vitally stable at rest. Several strategies were implemented during session to control the sudden desaturation and proved to be effective to reduce risk of sever desaturation. The patient was given rest break in between exercises with breathing control exercise, and slow progress of intensity of exercises with continuous observation of saturation by pulse-Oximeter.

Conclusion

According to the results of this case study, the physiotherapy intervention that used in this case has helped to speed up improvement and recovery of patient. This result shows significant effect of respiratory and physical rehabilitation on improving functional performance in patients with COVID-19. In addition, it is important to give attention to sudden desaturation especially during physiotherapy that observed in this case. These results warrant for further research with large sample size to explore efficiency of specific physiotherapy intervention as there is lack of evidence on which physical intervention or therapeutic exercises superior to other for those patients. In addition, further researches should be conduct to understand the relation between physiotherapy intervention and sudden desaturation or hypoxia in COVID 19 patients.

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How to cite this article: Al Waheibi S, Al Sulami N, Thambi A, and Al Tou. "Effect of Physiotherapy Intervention on COVID-19 Patient with Comorbidities". *Physiother Rehabil* 6 (2021):206.