Case Report
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Pulmonary rehabilitation and exercise therapy in a patient with COVID-19: A Case report

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Abstract

Dyspnea, shortness of breath, and inability to perform activities of daily living are the main complaints in patients with COVID-19 and physiotherapy has a vital role in managing such symptoms. We present a case treated with pulmonary and neurological physiotherapy, which improved symptoms and quality of life. In this case report, the importance and potential effect of concise physiotherapy on patients with COVID-19 is presented.

Keywords: Dyspnea, Pulmonary Rehabilitation, Exercise therapy, Coronavirus, Iran

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Introduction

In late 2019, a novel mysterious coronavirus, currently named as the 2019 novel Coronavirus, emerged from Wuhan, China, and spread globally (1). This novel virus is highly contagious (2). The clinical form of COVID-19 varies from uncomplicated illness to severe or critical conditions resulting in respiratory failure, which needs different types of mechanical ventilation and support in an intensive care unit. In some severe cases, in addition to respiratory involvement, even systemic manifestations in the form of sepsis, septic shock, and dysfunctional syndrome occur in several organs (3).

COVID-19 could involve the respiratory and nervous systems (4, 5). Pulmonary rehabilitation regulates the breathing cycle, improves ventilation, removes secretion, and improves the quality of life of the patients (6). Also, exercise therapy has a significant role in preventing loss of muscle mass and strength in hospitalized patients (7). The purpose of this study is to show the effects of pulmonary rehabilitation and exercise therapy in a patient with COVID-19.

Case report

The patient was a 49-year-old homemaker. In terms of past medical history, she had no underlying disease and no history of smoking. The patient's height and body mass index (BMI) were 1.61cm and 21.2kg/m^2, respectively. On March 1, 2020, she began presenting anosmia and dysgeusia after 2 days of fever and dyspnea when performing moderate activities and presenting nonproductive cough at rest. During the first week she was not hospitalized and just received medication for influenza h1n1, which was prescribed by a medical practitioner. The patient took oseltamivir 75mg 2 times a day and acetaminophen 325, and QID.

After developing diarrhea, hemoptysis, and intolerable fever, she was hospitalized (March 7, Loghman-e hakim hospital, Tehran, Iran). Upon admission her blood pressure was 130/80mmhg, heart rate was (HR) 88bpm, respiratory rate was (RR) 25 rpm, and peripheral oxygen saturation (spo2) at rest was 92%. Her body temperature was elevated (38.60C) and there were coarse breath sounds of both lungs

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↑What is "already known" in this topic:
COVID-19 is associated with respiratory, neurological, and immobility complications.

→What this article adds:
COVID 19 cases benefit from respiratory physiotherapy and exercise therapy in different ways.

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at auscultation. No alteration was found in cardiac auscultation.

Her laboratory studies showed an increased neutrophil count 2.8×10^9/L and decreased lymphocyte count 0.9×10^9/L. The real time fluorescence polymerase chain reaction of the patient's sputum was positive for the 2019-ncov nucleic acid. An enhanced chest CT showed bilateral multilobar ground-glass opacification.

In the first week of admission she presented hypertension, 160/110 on average, which was controlled by Metoprolol. The level of consciousness decreased and GCS average was recorded 12 from 15. During the hospitalization, she received hydroxychloroquine sulfate (400 mg 3 times daily for 10 days) + lopinavir–ritonavir (400 mg and 100 mg, respectively, 2 times daily for 10 days) + Oseltamivir (75 mg 2 times daily for 10 days). She received oxygen therapy with reservoir bag (8L/min), which was replaced by a nasal cannula on the day 10 of admission. During discharge, the patient breath ambient air.

On the third day of admission (March 10) at the hospital, physiotherapy was started for her. The main chief complaints were dyspnea, shortness of breath, and inability to perform activities of daily living such as eating. The patient underwent a neurological (GCS) and pulmonary (Modified Borg Scale (MBS) assessment. The quality of life assessment was done using the Saint George's Respiratory Questionnaire (SGRQ). After the initial assessment, she was admitted to the Pulmonary and neurological physiotherapy department of the hospital.

The program lasted 3 weeks and consisted of 2 daily training sessions (30 minutes on average). On the first day of admission to the physiotherapy as the patient was not fully alert and independent, the program focused on passive range of motion exercise (15 minutes 2 times a day), intercostal muscle stretching (5 minutes 2 times a day), chest wall oscillation and vibration (every 2-4 hours for 5 minutes) and proper positioning. Generally, the interventions for the first week were passive and active-assisted exercises and PNF (15 min BD), diaphragmatic breathing (5 cycles each session), pursed-lip breathing (5 cycles each session), segmental breathing (5 cycles each session without resistance), vibration and whole-body exercise training (20 repetitions for each joint) such as bridging, range of motion, and core stability exercise. If possible, the patient should be mobilized to a sitting position or with her head raised. This position is more favorable for ventilation. Moreover, to increase tolerance to exercise and cardiovascular improvement, the patient was encouraged to walk 50 meters every day in self-paced speed while she was oxygenated with portable oxygen. It is reasonable to restrict any heavy intervention at the acute stage, as it may increase the susceptibility to infection and threaten the patient's vital sign stability. Therefore, the patient's vital parameters and well-being was assessed and monitored throughout the entire physiotherapy process. The exercises were terminated if any of the following symptoms was reached: worsening of dyspnea, SpO_2 decrease by 85% or less, and the heart rate increase to 85% or more of the predicted maximum heart rate.

After 1 week of rehabilitation (March 17), the program was progressed to a harder level as the patient could do all the above exercises independently and without stopping. At this stage the patient exercised with an ergometer (at a fixed velocity and low resistance, (2 times daily for 7 minutes) and was encouraged to exercise without oxygen while she concentrated on breathing control. The patient was alert and could benefit from constant and active pulmonary rehabilitation, so the physiotherapist showed her how to use incentive spirometry every 2 hours. The initial attempt was very low (about 500 mL) but the maximal inspiratory capacity reached to 1500 mL. At this time if she experienced any kind of difficulty in berating, she could use oxygen. After 2 weeks of hospitalization, her symptoms resolved and she was discharged.

In the last week of rehabilitation, which was done in an isolated space at home, vital signs were stable and the patient did not have any limiting issues for her daily activities, but she said her activity and performance were lower than before the disease, so the focus of rehabilitation was to achieve the level of independence before the onset of symptoms. In addition to the exercises mentioned in the previous steps, rehabilitation activities consisted of exercising in a real environment such as climbing stairs (5 minutes), washing dishes (5 minutes) and cooking (5 minutes), and use of incentive spirometry (10 breathing cycles every 2 hours) and acapella (6 breathing cycles every 4 hours). Exercises were evaluated and followed up by telerehabilitation with a smartphone.

Discussion

The patient went through a total of 42 physical training sessions in 3 weeks. A complete assessment was done pre-program and post program. The results are presented in Table 1.

Based on our knowledge, this article is the first to address the effect of physiotherapy in patients with COVID-19 in Iran. Although there are beneficial guidelines in the management of patients with COVID-19, these guidelines are not written based on actual experience with these patients and they are merely guidelines (8-12). There are very little data based on which make definite comments on the reasons for a possible concurrence between respiratory and neurological complications. It is clear that hypoxemia and the virus itself are essential problems for the nervous system (13), but the guidelines just concentrate on pulmonary aspects of the disease (14). Neuroinvasive potential of SARS-CoV2 may be at least partially responsible for the respiratory problems caused by COVID-19 (15, 16). Awareness of the potential impact of this virus has a significant role for selecting appropriate physiotherapy intervention for patients with COVID-19. Neurorehabilitation and exercise therapy in addition to cardiopulmonary rehabilitation can improve quality of life (17, 18), shortness of breath, and dyspnea (19). Exercise therapy, along with respiratory physiotherapy, leads to the opening of collapsed alveoli, which prevents decreased lung function and atelectasis, resulting in improved perfusion-to-ventilation ratios. Moreover, respiratory physiotherapy approach improves

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Table 1. Results of physical training sessions assessments of the patient in 3 weeks

Item	Preprogram	Post program
The mean severity of dyspnea	42	15
Modified Borg Scale	7	1
Level of consciousness (Glasgow coma scale)	12	15
Saint George's Respiratory Questionnaire	42	23
Quality of life (SF36): assessment of the quality of life		
• Physical health	50	79
• Role limitations due to physical health	62	71
• Physical pain	65	85
• General health	61	76
• Energy	63	75
• Social functioning	59	79
• Role limitations due to emotional problems	64	80
• Mental health	59	81
Self-rating anxiety scale (for assessing anxiety)	56	47

the function of the diaphragm as the most essential respiratory muscle. It improves the tidal volume. Respiratory muscle training during exercise reduces the accumulation of metabolites and delays the response of metabolic receptors. These mechanisms reduce the work of the respiratory muscles and the number of breaths (20).

In addition to respiratory issues, sometimes a feeling of abandonment and being neglected may be induced in patients in isolation and confinement (21). In these situations, an exercise is a way to overcome stress and anxiety and make hopes to return to normal life. These people need emotional and psychological support through respiratory and relaxation techniques. Maintaining physical fitness and independence in isolation situations is essential for mental and physical health.

Incentive spirometry and breathing exercises with acapella and cornet can be done at home and several times a day, which reduces the chances of contracting other diseases because there is no need for a presence of a physiotherapist (22).

Conclusion

This case report provides evidence for the implementation of physiotherapy in patients with COVID-19. Currently, COVID-19 has a large number of cases in Iran, Italy, United States of America, and France. We hope our clinical case report will be helpful for rehabilitation of these patients. As shown in this study, COVID-19 cases benefit from physiotherapy, which improves the symptoms of disease in different ways.

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Conflict of Interests

The authors declare that they have no competing interests.

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