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Case Report

Role of exercise in severe COVID-19 case

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Abstract

Severe COVID-19 infection can lead to prolonged recovery and troublesome symptoms. The symptoms reported in those patients were dyspnea, fatigue, weakness, anxiety, and activity intolerance. Patients showed limited exercise capacity and interfered with daily activities, as well as the quality of life. We report the role of exercise in improving activity tolerance in a survivor of a COVID-19 severe case. A male patient, 51 years, came to outpatient pulmonary rehabilitation after hospitalization due to a severe case of COVID-19. The patient had a low activity tolerance presented as fatigue, dyspnea, activity-induced oxygen desaturation, and inability to perform exercise testing, in addition to mild anxiety. A set of exercises consisting of breathing, flexibility, muscular, and cardiorespiratory endurance were given for 4 weeks along with psychological counseling. Barthel Index, cardiorespiratory fitness, sit-to-stand test, Fatigue Severity Scale, Medical Research Council Dyspnea Scale, and maximum breathing capacity were recorded as outcome measures. A Zung Self-rating Anxiety Scale and insomnia severity index were also measured. After 4 weeks, the symptoms of activity intolerance decreased. There were improvements in all outcomes except for the insomnia severity scale. Experts recommend that COVID-19 patients should carry out regular daily activities and low to moderate-intensity exercise in the first 6-8 weeks after discharge. Resuming daily physical activities as early as possible can affect functional recovery. It is also beneficial for general fitness, fatigue, emotional disturbance, and lack of confidence. In this patient, low-intensity exercises as recommended by experts were given to improve activity tolerance.

Keywords: *Activity tolerance, COVID-19, exercise, rehabilitation, survivor*

INTRODUCTION

About 10% of COVID-19 patients experienced prolonged recovery and remained unwell beyond three weeks. Patients with severe infection have more severe pulmonary dysfunction that leads to troublesome symptoms six months after infection. Many factors affect recovery such as prolonged inflammation and immune reaction, deconditioning, as well as psychological factors.[1,2] Moradian et al.[3] found that fatigue is the most common symptom followed by dyspnea. Other symptoms such as weakness, anxiety, and activity intolerance were also reported in their study. A significant number of patients showed limited exercise capacity which interfered with daily activities and quality of life.[4] We report a case of a COVID-19 survivor severe case with fatigue, dyspnea, activity-induced oxygen desaturation, and an inability to perform exercise testing to explore more about the role of exercise in improving activity tolerance.

MATERIALS AND METHODS

A male patient, 51 years, came for outpatient pulmonary rehabilitation (PR) after hospitalization due to a severe case of COVID-19. The patient was admitted to an intermediate ward for three weeks and got inpatient rehabilitation programs before being discharged. At the beginning of the outpatient PR programs, the patient complained about easy fatigue accompanied by shortness of breath. He felt fatigued when doing self-care and talking for about five minutes. He also felt shortness of breath when walking for about 10 meters, which caused him to take rest for a few minutes before continuing walking. He used oxygen supplementation of 2-3 liters/minute when walking and talking. Since his job is as a counselor, he felt worried that he couldn't return to work as he needs to talk for a long time during work-hour. He worked for about eight hours a day and six days a week before getting sick. He had hypertension, obesity, and a smoking habit, and seldom did any sports activities. His daily physical activity level ranged from 1.5 to 4 metabolic equivalent (METs) for doing daily activities and his job.

On physical examination, we found symptoms and signs of activity intolerance. Oxygen saturation without supplemental oxygen was 90-92% and with supplemental oxygen was 96% at rest and decreased to 93% when talking, 92-93% when sitting without support or transfer, and 90-91% when walking. His resting heart rate was 104 bpm and increased to 115 bpm when walking. The Borg scale of dyspnea at rest was 0 but increased to 5 when walking.

Thorax examinations were normal, except for very limited chest expansion (1 to 1.5 cm). Neuromusculoskeletal examinations were normal. The muscular fitness category based on static handgrip strength measurement was excellent. Results of the body composition test using bioelectrical impedance analysis were body mass index 25.9 kg/cm2 (obesity), fat mass 35.1% (obesity/very poor), muscle mass 45.1% (normal), and bone mass 3.0 (normal). His cognitive status was normal.

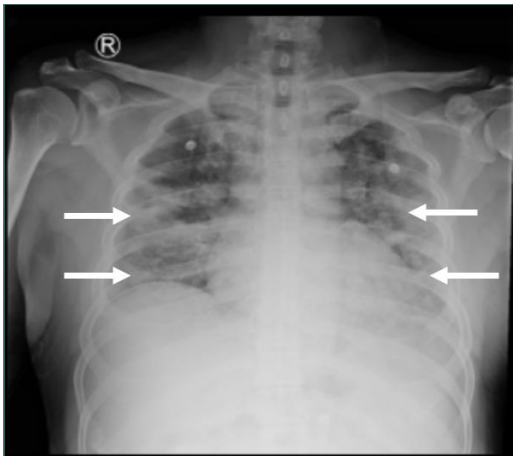

Image 1. Chest X-ray examination: persistent pneumonia and cardiomegaly

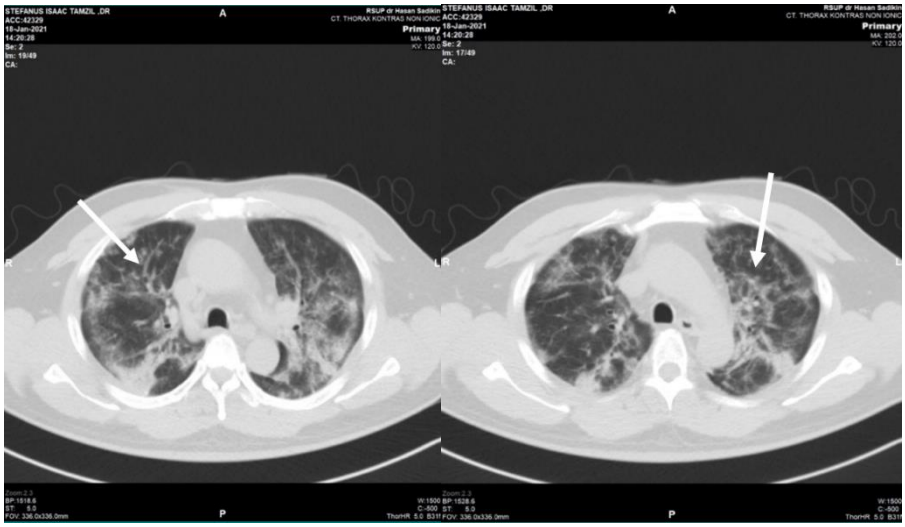

Image 2. CT-scan examination: patchy consolidation with ground-glass opacity, dilatation, thickening of bronchi, and the fibrotic lung

We established a PR program in this study with low-intensity exercises due to the limitations of the activities and exercise tolerance. Techniques for activity management, breathing control, and energy conservation techniques were the main topics of the training. Psychological counseling was provided to help patients feel less anxious, sleep better, and worry less about not being able to return to their old jobs. Two times in the hospital and once at home (under video call supervision) aerobic exercise was administered.The prescription of exercises is shown in Table 1.

RESULT

After two weeks, the complaint of fatigue was decreased. The patient started working with online client meetings, but later complained of headaches and musculoskeletal pain in his back. He was still worried considering that his office is on the second floor. After four weeks, his complaints decreased. He could go upstairs without any complaint. There was no headache or neck pain anymore. He has gone back to work and can talk for a long period. Table 2 shows the functional assessments of this patient before the program, after two weeks, and after four weeks.

Table 1. Prescription of Exercise in the First Four Weeks

Type of Exercise	Prescription
Chest expansion exercise	Twice a day, 1 set, 5 repetitions, progress gradually with increasing repetition
Controlled-breathing exercise	Deep breathing and pacing when performing activities
Breathing exercises with the incentive spirometer	Twice a day, 4 sets, 10 repetitions, 2-3 minutes rest intervals, initial volume at 50% of maximum inspiratory volume, progress gradually with adjusting volume
Flexibility exercise	Applied to the muscle of the head-neck and shoulder girdle, once daily
Isometric exercise	Applied to the upper and lower limb, 3 times a week, 2 sets of 5 repetitions

Table 2. Result of Functional Assessments after Two and Four Weeks

Functional Status	Baseline	After 2 Weeks	After 4 Weeks
ADL (Barthel Index)	12 (moderate disability, difficulty in toilet use, transfer, mobility, climbing stairs, and bathing)		20/20 (independent)
Cardiorespiratory Fitness (based on the 6-minute walking test)	The test was stopped at 50 seconds due to shortness of breath and oxygen desaturation (93% to 88%), and the dyspnea scale increased from 0 to 5	• Walking distance 324 meters, maximum oxygen uptake (VO2max) prediction (Cahalin protocol) 13.7, and metabolic equivalents 3.9 • Symptoms after the test moderate dyspnea, fatigue, and hard effort • No oxygen desaturation	• Walking distance 384 m, VO2max prediction 15.5, metabolic equivalents 4.4 • Symptoms after the test moderate dyspnea, fatigue, and hard effort • No oxygen desaturation
Fatigue Severity Scale	47/63		33/63
Sit-to-Stand Test	14 times in 30 seconds		21 times in 30 seconds
Psychological Assessment (the Zung Self-rating Anxiety Scale)	45/80 (mild anxiety)		35/80 (normal)
Insomnia Severity Index	8/24 (sub-threshold insomnia, the patient moderate satisfaction, mild difficulty falling and staying asleep, and problem in waking up too early)		8/24 (sub-Threshold insomnia)
Medical Research Council Dyspnea Scale	+4 (too dyspneic to leave the house or breathless when dressing)		1 (dyspnea when hurrying or walking up a slight hill)
Maximum inspiratory volume	750 cc	1250 cc	2000 cc
Quality of life assessment with Short-Form 36 (SF-36)	Low in physical functioning, role physical, general health, and vitality. High in bodily pain		

DISCUSSION

COVID-19 infection is associated with a high burden of inflammation, which can persist after hospital discharge. At six months after the onset of symptoms, patients with COVID-19 have symptoms of fatigue or muscle weakness, difficulty sleeping, and anxiety or depression. Patients with more severe illnesses during their treatment in the hospital had a more severe disorder of pulmonary diffusion capacity. Dyspnea is a common persistent symptom across varying degrees of initial COVID-19 severity. Patients with persistent dyspnea had several abnormalities including greater restriction on spirometry, lower diffusing capacity of carbon monoxide, reduced functional capacity, and increased desaturation as well as exertional symptoms during the 6-minute walk test.[2,5,6]

In this patient, activity intolerance presented as fatigue and dyspnea, activity-induced oxygen desaturation, and inability to perform exercise testing. A set of exercises and psychological counseling was given for four weeks.

Exercise as the core component of cardiopulmonary rehabilitation should be encouraged from the beginning. It is beneficial for general fitness and improves many functional disorders such as fatigue, emotional disturbance, lack of confidence, and walking performance. The exercise provided to achieve these goals are exercises to improve muscle performance and cardiorespiratory responses.[7] Exercise is also recommended to improve immune function because it can reduce systemic inflammation and respiratory tract infection. [8]

After being discharged from the hospital, post-COVID-19 patients had low physical fitness which was associated with low muscle strength.[9] Severe or critical COVID-19 patients may have poor physical fitness, post-exertion shortness of breath, muscle atrophy (including the respiratory, trunk, and limb muscles), and post-traumatic stress disorder; as possible can affect functional recovery. Being physically active increases immune surveillance against infectious pathogens including viruses. Resistance and aerobic exercises will be beneficial for general fitness, fatigue, emotional disturbance, and lack of confidence. These exercises also improve performance in effortful activities such as walking. Regular aerobic exercise with the intensity of 40–60% heart rate reserve or 65–75% of maximal heart rate or Borg dyspnea score ≤3, is recommended to improve immune function. Regular physical activity and exercise promote cardiorespiratory fitness and longevity. People with COVID-19 are also advised to undergo an assessment of physical and emotional function 6-8 weeks after being discharged.[5,7,8,11] Regular physical exercise can reduce the level of anxiety and depression; therefore, staying physically active can improve mental health.[12]

In this patient, activity tolerance was very low at the beginning, so we set a PR program with low-intensity exercises which was increased gradually as tolerated.

Short bouts of aerobic exercise could be tolerated by the patient and improved his activity tolerance. After four weeks, the symptoms and signs of activity intolerance decreased, and he could go back to work without any complaints.

There is ample evidence that exercise can increase mitochondrial biogenesis and function, restore and improve blood vessels, and release myokines from skeletal muscle that maintain or enhance cardiovascular function. Therefore, exercise can improve cardiorespiratory fitness, functional status, and re-hospitalization rates. Regular physical exercise can also improve psychological function, mood, and quality of life, thereby controlling illnesses such as depression and anxiety and also modulating pain perception.[13]

Exercise can also benefit in controlling cardiovascular risk factors so that it can

decrease mortality. The physiological changes as a result of exercise include decreased risk of ischemic heart disease, high blood pressure, and brain-vascular accidents. In addition, exercise can increase insulin sensitivity and decrease the risk of diabetes or metabolic syndrome.[14]

A combination of aerobic and resistance exercises can increase muscle mass, improve immune response and fatigue-free effort, improve the ability to transport oxygen, tone muscles, improve blood circulation, increase red blood cells, as well as increase muscle strength and bone density.[13,14]

Pulmonary rehabilitation programs after being discharged from the hospital improve respiratory function, quality of life, mobilization, and psychosocial status in adult COVID-19 patients.[13] Breathing exercise with incentive spirometry is part of the protocol for managing mild to moderate COVID-19 patients, while inspiratory muscle training can prevent the risk of severe respiratory complications.[15,16] In this patient, we plan to give inspiratory muscle training after there is a significant improvement in pulmonary function. Diaphragmatic breathing exercises as one of the interventions in pulmonary rehabilitation can improve respiratory function, stimulate the vagus nerve, and result in a relaxing effect.[17]

CONCLUSION

Low-intensity exercises for patients as recommended by experts improve activity tolerance.

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