

CASE REPORT

Return to Activities After Pulmonary Rehabilitation: A Case Report of COVID-19 Survivor

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ABSTRACT

Coronavirus disease 2019 (COVID-19) survivors may have difficulties returning to their previous activities due to persistent symptoms. We report a 39-year-old male, that was consulted to Medical Rehabilitation outpatient clinic with post-COVID-19. Three weeks after the first symptoms appeared, the sequelae experienced by the patient included fatigue and dyspnea during his activities. He had not been capable of returning to work and doing his hobby, namely riding a bicycle because of this complaint. We designed a 2-month pulmonary rehabilitation program, consisting of posture correction, range of motion exercise, breathing exercises, effective coughing, incentive spirometry, endurance exercises, and energy conservation techniques. After the program, he still had dyspnea when doing heavy exercises, but he was capable of riding his bicycle. He could also teach his students the Quran in the mosque, but he still felt fatigue. Although there was a persistent symptom, the rehabilitation program could give him benefits to return to his previous activities.

Keywords: COVID-19, Rehabilitation, Exercise, Fatigue, Dyspnea

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) infection can have various clinical manifestations. The Center for Disease Control and Prevention (CDC) estimates that 30% of cases are asymptomatic (1). While the rest of symptomatic patients, 40% had mild symptoms including fever, cough, fatigue, muscle aches, headache, sore throat, runny nose, nausea or vomiting, and diarrhea (without pneumonia or hypoxia), 40% had moderate symptoms (with pneumonia), 15% had severe symptoms (with severe pneumonia), and 5% had critical symptoms with complications such as respiratory failure, acute respiratory distress syndrome, sepsis to multiple organ failure (1,2).

COVID-19 survivors often still experience persistent symptoms, which is called long COVID. The most common symptoms are fatigue (up to 98% of patients) and dyspnea (up to 87.1% of patients). Long COVID symptoms last for one month after the first symptom onset, up to 24 weeks (3). Patients will experience pulmonary dysfunction, physical dysfunction, functional limitation, which will impair their quality of life (QoL) (4). Approximately 45.2% of patients have reduced their work schedule, and 22.3% of them cannot work (3).

Pulmonary rehabilitation is one of the treatments that can help improve the functional ability of COVID-19 survivors (2), so that the patient can return to their previous activities. Pulmonary rehabilitation in COVID-19 is a feasible, safe, and effective therapy. It will improve exercise performance, lung function, and QoL (2). The purpose of this case report is to demonstrate the benefits of pulmonary rehabilitation in COVID-19 survivors until the patient can resume activities.

CASE REPORT

We report Mr. S, 39 years old male, that was consulted to Medical Rehabilitation outpatient clinic Dr. Soetomo General Hospital on June 29th, 2020 with referring diagnosis of post pneumonia COVID-19. His chief complaints included cough and difficulty to expectorate the sputum during the last three weeks. It was a dry cough but sometimes accompanied with sputum. From history, he was admitted to Dr. Soetomo General Hospital for two weeks, from June 10th, 2020 until June 24th, 2020 and he was diagnosis with COVID-19. At that time, the cough worsened and he also felt severe dyspnea, fever, loss of appetite, anosmia, fatigue, and oxygen desaturation (oxygen saturation was 89%). He received oxygen therapy using a non-invasive ventilator to improve the oxygen saturation and plasma convalescence transfusion during hospitalization.

After being discharge from the hospital, he still felt dyspnea and fatigue when doing activities such as walking more than 50 meters, going upstairs and bathing. He could not do his work as a seller at the market, and could not teach his students to read the Quran at the mosque. He also could not return to do his hobby, namely cycling because of these complaints. He had no history of other chronic disease such as diabetes mellitus, hypertension, heart disease, and no previous history of dyspnea.

From physical examination were found his body mass index was 24.3 kg/m², forward head posture, and rounded shoulder. His vital signs were blood pressure 130/80 mmHg, heart rate 114x/minute, respiratory rate 22x/minute with oxygen saturation of 97% without oxygen support. We also found minimal Ronchi at the right lung. Chest expansion was 2/3/3 cm at T2/T4/T6 levels respectively, and his count test was 12. We conducted submaximal exercise testing to measure his maximal oxygen uptake (VO₂max), it was 12.418 ml/kg/min, equal to 3,5 metabolic equivalents (METs). The laboratory examination on June 17th, 2020 revealed elevated D-dimer (1510 g/L). The radiology examination using chest x-ray on June 10th, 2020 indicated bilateral pneumonia and had improved on the follow up chest x-ray on June 22nd, 2020.

Our goals for this patient were to improve his posture, optimal airway clearance, improve cardiorespiratory function, and return him to work. We provided a 2-month rehabilitation program consisting of training and educational sessions. The training sessions consisted of posture correction, range of motion exercise to maintain flexibility of the body, breathing exercise, effective coughing, incentive spirometry exercise, which was done twice daily, 8-10 repetition of each exercise. The breathing exercise program that we gave consisted of diaphragmatic breathing, deep breathing, and chest expansion exercise. Endurance exercise was administered 3-5 times/week with walking or cycling.

The intensity started at 40-60% heart rate reserve (HRR) and increased until 60-80% HRR. The duration started from 2x10 minutes and increased every two days until it reached 30 minutes per day. The educational session consisted of how to do energy conservation techniques, breathing control, and relaxation technique when he felt dyspnea. Health protocol including using a face mask, keeping hand hygiene, and physical distancing was encouraged when he did activities outside the house.

After completing the rehabilitation program for two months, the patient remained to have some symptoms. He still had dyspnea when doing high-intensity exercise, i.e. intensity of 80% HRR, while he was still able to do his hobby which is riding his bicycle. He could also teach his students the Quran in the mosque, but he still felt fatigue after teaching in a sitting position on the floor, for about an hour. His count test was improve to 20, and his VO₂max increased to 22.716 ml/kg/min or equal to 6.49 METs (Table I).

Table I: Functional parameter after pulmonary rehabilitation

	Before program	After 8 weeks program
Barthel Index	90	100
Single breath count test	12	20
VO ₂ max (ml/kg/min)	12.418	22.716
METs	3.5	6.4

VO₂max: maximal oxygen consumption
METs: Metabolic equivalent

DISCUSSION

From this case report, it is evident that there was an improvement in the functional capacity of a COVID-19 survivor after the pulmonary rehabilitation program so that the patient could return to his activities and hobbies. The improvement of functional capacity can be seen from the parameters such as the Barthel Index, single breath count test, VO₂max, and METs. In this case report, our patient experienced complaints for up to 12 weeks after the first symptoms appeared. Therefore, it is likely that the patient suffers from long COVID.

The pathophysiology of long COVID-19 includes long-term tissue damage including pulmonary, cardiac and nervous systems. Pulmonary scarring is the common sequelae of COVID-19, which causes persistent symptoms of dyspnea and cough. This lung damage causes lung disorders that occur in the form of restrictive lung disorders, severe gas exchange disorders, and increased respiratory rate during strenuous activities (2,3).

Pathological inflammation also plays a role in symptoms that persist after one is declared cured of COVID-19. COVID-19 infection can cause hyperinflammatory

conditions characterized by increased levels of C-reactive protein (CRP), interleukin-6 (IL-6), ferritin, and D-dimer. This unresolved inflammation will cause chronic inflammation resulting in symptoms of myalgia, fatigue, and joint pain (3). In this case, we presented that the patient had high levels of D-dimer, so it was more likely for him to experience chronic inflammation which caused prolonged fatigue symptoms. COVID-19 patients with severe symptoms will take longer recovery. This condition is more likely due to persistent impairments in the respiratory system (2). Our patient experienced severe symptoms during the acute phase experienced where he experienced shortness of breath, desaturation and pneumonia, so it is highly presumable that the patient will experience long COVID.

Pulmonary rehabilitation could improve lung functions, likely due to breathing exercises namely diaphragmatic breathing, deep breathing, and chest expansion exercise. Training with incentive spirometry is also recommended for COVID-19 rehabilitation (2) together with posture correction, which will contribute to better lung expansion. With the symptom of fatigue, energy conservation techniques can provide benefits for the patient in carrying out his activities without requiring a lot of energy. The patient's Barthel index also improved in terms of mobility and stairs, where after undergoing the program, he could walk longer distances and go up and downstairs.

Endurance training by walking or cycling can increase the patient's VO_2 max because this activity uses large muscle groups that will enhance oxygen consumption. Another mechanism that can explain the improvement in VO_2 max is through deep breathing exercises. With deep breathing exercises, the diaphragm will contract along with the intercostal muscles, so that the rib movement will increase and the air flow in and out of the lungs will be better. Increased work of respiratory muscles will increase oxygen demand thereby increasing VO_2 max (5). An increase in VO_2 max indicates lung function improvement to deliver oxygen to tissues, especially muscles, to increase the patient's capability carrying out their activities. His functional abilities improved to 6.4 METs, which was sufficient to conduct his daily activities including teaching the Quran in the mosque. After completing the rehabilitation program, the patient could return to his activities again, although he still got easily tired, which was most likely due to long COVID

syndrome. Long term rehabilitation program is needed to overcome this persistent symptom. Our limitation was that the program we administered to the patient did not base on the standard protocol of pulmonary rehabilitation of COVID-19, due to a lack of reference at the beginning of the COVID-19 pandemic. Future studies remain required to confirm this finding.

CONCLUSIONS

COVID-19 survivors may have difficulties returning to their previous activities due to persistent symptoms, but rehabilitation programs can offer benefits in increasing their functional capacities

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