

Pulmonary rehabilitation after COVID-19 infection in a patient with kyphosis

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Novel coronavirus 2019 disease (COVID-19) is a highly contagious disease which may result in respiratory, physical, psychological, and widespread systemic dysfunctions. Even in young patients, pulmonary functions functional capacity, and psychosocial impairments may occur. Individualized pulmonary rehabilitation (PR) interventions in a timely manner may be required in patients with persistent respiratory, physical and psychological dysfunction.^[1] In the literature, there are studies which report the benefits of PR program consisting of aerobic and resistance exercises applied in survivors of severe acute respiratory syndrome-coronavirus (SARS-CoV) which became epidemic in 2003.^[2] This case report is valuable in terms of two reasons. First, it was the treatment experience of a patient with prolonged symptoms at the very early time of the pandemic. Second, it reports the survey of a COVID-19 patient with kyphosis and minimal scoliosis.

A 21-year-old male patient who had no known disease was admitted to our service for rehabilitation in the third month of COVID-19 infection due to persistent fatigue, dyspnea, stinging chest pain while breathing, difficulty in walking, and reduced functional capacity. His initial complaints were dyspnea, sore throat, and hemoptysis and reverse transcriptase-polymerase chain reaction (RT-PCR) test was positive after seven days. He received favipiravir 600 mg/day,

hydroxychloroquine 200 mg/day, ceftriaxone 1 g/day, and clarithromycin 1 g/day. He did not require intensive care unit (ICU) stay, but non-invasive mechanical ventilation with a nasal cannula was applied (oxygen supplementation 1 to 2 L/min) during hospitalization for 14 days. X-ray was normal (Figure 1a). The patient was admitted to our clinic in a wheel chair and was dependent during his transfers. He had a smoking history for the last one year.

Although his general condition was good, he was cachectic (body mass index: 18.6 kg/m²) and depressed. General systemic physical examination and neurological examination findings were unremarkable. Postural analysis revealed an increased thoracic kyphosis, trunk was anteflexed, right shoulder was dropped, and Adam's forward bend test was positive. Thoracal kyphosis angle was 71° and scoliosis degree was 12° in dorsal X-rays (Figure 1b, c). Routine blood tests were normal, and vitamin D3 level was 14 ng/mL.

Functional capacity assessment was performed using the 6-Minute Walking Test (6MWT). After 6MWT, blood pressure was 140/120 mmHg, oxygen saturation (SpO₂) was 84%, and the rate of perceived exertion (RPE) was 16. The total distance walked was 320 m. He described atypical chest pain and dyspnea after the test. Cardiac enzymes, D-dimer, and echocardiography were all normal, and chest pain was considered to be due to the kyphoscoliosis.

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An eight-week individual PR program was designed consisting of non-resistance, interval training (3-min exercise/1-min rest) aerobic exercise program with a recumbent bicycle ergometer initiated for 15 min, three days a week, with 2 L/min oxygen support under monitoring of rhythm electrocardiography, SpO₂, and blood pressure. In addition, range of motion, stretching, relaxation, strengthening, balance-coordination, walking, posture, scoliosis exercises at fatigue limit under oxygen support were initiated. Breathing exercises consisted of pursed lip breathing, air shifting technique, diaphragmatic breathing, and voluntary isocapnic hyperpnea.

Despite the oxygen support in the first sessions, a decrease of up to 85% was observed in the SpO₂, and the session was stopped. Due to the complaints of chest pain and stinging, the patient was unable to perform deep inspiration. Thus, we focused on

deep slow breathing exercises during the following sessions. After the first week, desaturation attacks despite to oxygen support during exercises regressed. Budesonide nebulizer 2×1 and salbutamol aerosol 1×2 puff before exercise was applied. Arterial blood gas analysis results were normal. Pulmonary computed tomography (CT) angiography excluded pulmonary thromboembolism. In both lungs, centrilobular nodules (respiratory bronchiolitis) with poorly circumscribed ground-glass density, particularly in the upper lobes and large number of scattered nodules in both lungs were detected (Figure 1d). While parenchymal areas were normal in previous CT scans before COVID-19, the radiological pattern that started with mild acinar fullness in the upper lobes on the CT during infection progressed at two months and diffuse centriacinar nodules in all lobes were evaluated on CT at three months. This was

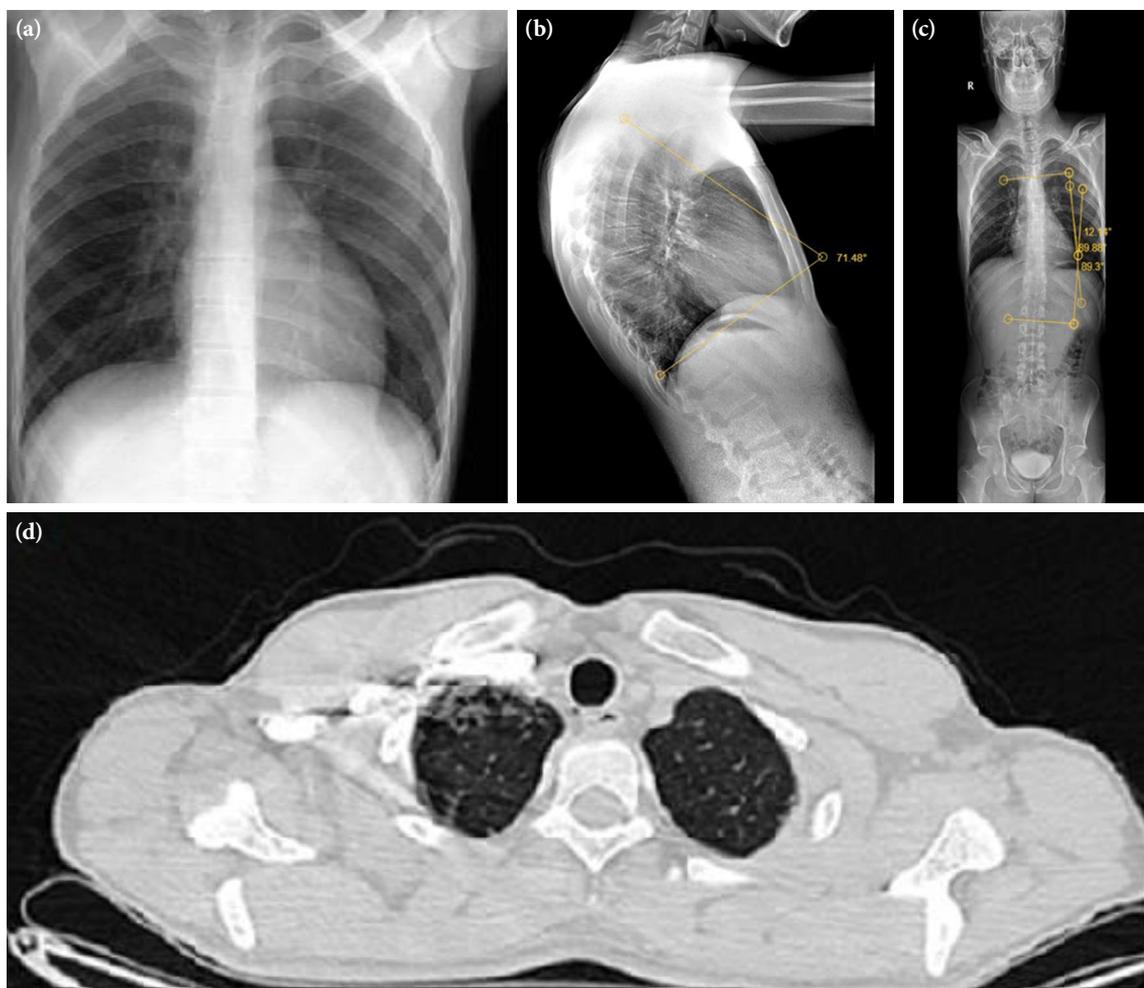


Figure 1. (a) Chest X-ray showing normal; (b, c) Lateral and anteroposterior scoliosis images; (d) Pulmonary computed tomography showing poorly circumscribed ground-glass density, in the upper lobes.

considered due to COVID-19. Methylprednisolone 32 mg/day was initiated, and after 14 days, the steroid dose was reduced by 8 mg every five days and the maintenance dose was switched to 4 mg/day. Escitalopram 10 mg/day in addition to psychotherapy for anxiety and depressive mood, and protein-based diet (90 g protein-2,500 kcal/day) was initiated. Vitamin D deficiency was replaced (2,000 IU/day).

At three weeks, desaturation during exercise and dyspnea decreased. The lower extremity interval ergometric exercises were performed continuously. Upper extremity ergometric exercises (10 Watt/20 min) were added to the program to strengthen the upper extremity and shoulder girdle muscles. In the exercise training of PR, the workload was increased by 5 Watts every week, and the exercise duration was gradually increased. After the 20th session, the patient reached a level of 25 Watt/30 min exercise with an upper extremity ergometer and 25 Watt/30 min with a lower extremity ergometer, without any oxygen support and for the last two weeks without desaturation. The total walking distance in the 6MWT increased to 420 m. The patient, who was admitted in a wheelchair and depended in transfers, was discharged independently walking without any aid and he became independent in daily living activities with increased endurance.

Even though we were not able to perform a pulmonary function test due to pandemic conditions, mild scoliosis and kyphosis deformity may be a facilitator factor resulting in restrictive pattern and prolonged dispne of our patient. Also, Sahu et al.^[3] reported a patient with kyphoscoliosis who died from COVID-19 pneumonia and underlined the importance of restrictive lung disease as a comorbid factor. Prolonged immobility due to isolation and low motivation due to depressive mood may have also played a role as comorbid factors. In survivors of COVID-19 disease, pulmonary functions, functional capacity, and psychosocial status may be impaired even in those without ICU requirement and, as in our patient, this situation may prolong for months. Pulmonary rehabilitation is an important treatment

option for patients who are hospitalized or whose complaints continue after discharge.^[4] The main goals of PR in COVID-19 patients are to improve dyspnea symptoms, relieve anxiety, reduce complications, minimize disability, and improve quality of life.^[5]

In conclusion, individually designed multi-component PR programs consisting of aerobic exercise, breathing exercises, psychosocial support, and diet and nutritional recommendations may offer a chance to these patients to return to their activities of daily living earlier.

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