



Pulmonary rehabilitation after COVID-19

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The COVID-19 pandemic, caused by infection with the virus known as SARS-CoV-2, has created a complex scenario for global health, with various types of complications and levels of functional impairment in millions of individuals recovering from the disease. The severe form of the disease causes lung damage and may result in respiratory failure. Subsequently, the affected patients may develop pulmonary fibrosis, a consequence of the process of lung injury repair. Patients presenting with more severe forms of the disease often need respiratory support, which ranges from oxygen therapy to prolonged invasive mechanical ventilation. Prolonged hospitalization of patients requiring intensive care may have severe systemic consequences.⁽¹⁾ Although post-COVID-19 sequelae are more common in patients who developed the severe form of the disease, individuals who had moderate disease may also have some degree of functional impairment, as may those who did not require hospitalization.

Post-COVID-19 functional impairment can limit the ability of the individual to perform activities of daily living, reduce functionality, alter professional performance, and hinder social interaction. In addition, the affected individuals can become more sedentary, increasing the risk of comorbidities. Today, although it is still imperative to take action to reduce the risk of mortality, health care facilities need to readjust their strategies to target the physical and functional recovery, as well as the social reintegration, of those individuals through pulmonary rehabilitation.

PULMONARY REHABILITATION AFTER COVID-19

In addition to the disease itself, prolonged hospitalization (with or without the use of mechanical ventilation) can have deleterious effects, such as pulmonary, cardiovascular, muscle, and cognitive changes, as well as anxiety and depression.⁽¹⁾ It is not uncommon for a prolonged ICU stay to lead to the development of ICU-acquired muscle weakness, which hinders physical and functional recovery.⁽²⁾ Patients who recover from COVID-19 after a prolonged ICU stay should undergo pulmonary rehabilitation, initially in an individualized, gradual manner during hospitalization, and continuing after hospital discharge in order to mitigate/reverse the consequences of the disease.⁽³⁾ Ideally, the pulmonary rehabilitation of such patients should be conducted by a multidisciplinary team because of the multisystemic impairment caused by COVID-19.

Although early mobilization is essential to the recovery of critically ill patients with COVID-19, many such patients show a rapid drop in oxygen saturation in the beginning of the recovery phase,⁽⁴⁾ which limits early rehabilitation to some extent. However, other objectives must be considered during hospitalization, such as improving respiratory symptoms and maintaining airway permeability. Therefore, an early bedside approach, special attention being given to any signs of clinical instability of the patient, is recommended.

In patients who have recovered from COVID-19, the physical and functional impairment can persist for weeks after hospital discharge, as can some symptoms (such as dyspnea, desaturation, cough, weakness, and fatigue). In addition to the damage caused by prolonged hospitalization and inactivity, the persistent high inflammatory burden and previous health conditions seem to have a negative influence on the recovery of such patients.^(3,5,6) A $\text{PaO}_2/\text{FiO}_2$ ratio < 324 and $\text{BMI} \geq 33 \text{ kg/m}^2$ at hospital admission are independent predictors of persistent respiratory impairment and the need for follow-up.⁽⁵⁾ To improve the evolution and, consequently, the prognosis of such patients, rehabilitation after discharge is also recommended, given that physical exercise is feasible and useful for survivors of critical illnesses.⁽⁷⁾ Because there is as yet no large body of evidence on specific physical rehabilitation for COVID-19 survivors, it is recommended that low- to moderate-intensity exercises be prescribed, safety being a priority. The needs and the functional impairment of each individual must also be considered in the rehabilitation program.⁽³⁾ Prior to hospital discharge, the need to use oxygen (at rest or during physical exertion) must also be evaluated.⁽³⁾ Chart 1 describes some of the principles of rehabilitation for COVID-19 survivors.

HOME-BASED PULMONARY REHABILITATION

Given that SARS-CoV-2 continues to have a high rate of infection, physical distancing has still been strongly recommended. Physical distancing makes it practically impossible to carry out traditional outpatient rehabilitation in groups, and rehabilitation programs (including physical exercise programs) should therefore be adapted to be performed at home. The efficacy of home-based rehabilitation has been demonstrated in various studies, including some conducted in Brazil.⁽⁸⁾ Patients who are more debilitated can also benefit from home-based rehabilitation because it allows them to avoid going to the outpatient clinic, which could hinder adherence to the program and increase the risk of reinfection. In addition,

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Chart 1. Pulmonary rehabilitation for COVID-19 survivors.^(3,11,12)

General recommendations

Physical exercises must be adapted to individual needs and limitations of patients; symptoms during physical exercise (such as dyspnea, desaturation, and fatigue) should be taken into consideration; high-intensity exercises are not recommended; patients should receive instruction regarding the physical, psycho-emotional, and nutritional aspects of each stage of rehabilitation; and preventive measures, such as use of alcohol-based hand sanitizers, physical distancing, and personal protective equipment, are essential during the assessment and on-site monitoring of patients at risk of transmitting the virus or at risk of reinfection.

Assessment

- Need for oxygen at rest and on physical exertion; physical, cognitive, and emotional status; dyspnea; anxiety; depression; peripheral muscle strength; and respiratory function (spirometry or plethysmography) in individuals with persistent respiratory symptoms or considerable pulmonary involvement

During hospitalization

- Breathing exercises and bronchial hygiene, if necessary; expectoration into a closed recipient to avoid aerosolization
- Early mobilization in bed; body positioning management (sitting and standing); ambulation and light aerobic exercise (walking or cycling)
- Exercise characteristics
 - Intensity: Borg scale score ≤ 3 with a progressive increase to 4-6; frequency: 1-2 times a day; and duration: 10-45 min

After hospital discharge (6-8 weeks)

- Aerobic exercise: light intensity with gradual increase; 3-5 sessions per week; duration of 20-30 min; and intermittent training for patients with severe fatigue
- Strength training for the lower and upper limbs: progressive resistance training in 2-3 sessions per week, 8-12 repetitions
- Balance exercises, breathing exercises, and bronchial hygiene, if necessary
- Home-based rehabilitation is preferred; if possible, consider instructing family members to help with supervision; if performed at an outpatient clinic, individual sessions are preferable

Considerations for telerehabilitation

- Patient evaluation (via telemonitoring) with application of questionnaires over the telephone or even physical evaluation by videoconference
- Prescription of specific exercises for each patient, allowing them to be supervised (or not) by real-time videoconference
- Diary with information about limitations and occasional discomfort during exercises, to ensure safety
- Verification of the space and the safety of the place where the exercises will be performed
- Aerobic exercises for the lower limbs (e.g., walking)
- Strength training of the upper limbs (e.g., light weights, elastic bands, or other)
- Strength training of the lower limbs (e.g., squats)
- Frequency: at least twice a week to replace supervised training sessions at the outpatient clinic, in addition to an unsupervised home-based exercise program on at least two other days of the week (telemonitoring)
- Reassessment via telemonitoring

patients with severe post-COVID-19 sequelae often need help from family members, who can be trained by health professionals in their own home environment. Individualized rehabilitation of such patients and training of family members in the home environment allows the use of the resources available in each home, with the necessary adjustments, in an environment that is familiar to the patient. Finally, current technological tools (such as software and applications for tablets and cell phones) allow prescription, and remote monitoring of rehabilitation activities, providing greater safety for patients and family members.

TELEREHABILITATION

In an attempt to mitigate difficulties in the process of rehabilitating COVID-19 survivors and to reduce risks, greater attention has been given to telerehabilitation. Telerehabilitation uses telecommunication resources

to offer rehabilitation remotely, in real time or not, the benefits of which are similar to those of face-to-face supervised rehabilitation,⁽⁹⁾ thus minimizing barriers of distance, time, costs, and risks. The Brazilian Federal Council of Physiotherapy and Occupational Therapy, by means of Resolution no. 516 of March 20, 2020,⁽¹⁰⁾ has authorized the teleconsultation, teleinterconsultation, and telemonitoring services that have already been endorsed by the World Health Organization. Chart 1 describes some principles of telerehabilitation in COVID-19 survivors.

FINAL CONSIDERATIONS

Pulmonary rehabilitation is recommended mainly to improve the physical and functional recovery of COVID-19 survivors before and after hospital discharge. Therefore, it is necessary to consider the needs of each patient carefully by performing a comprehensive

assessment. Given the systemic manifestations of COVID-19, survivors should be monitored by a multidisciplinary team. There is as yet no robust body of evidence on the characteristics and effects of specific interventions for COVID-19 survivors. Therefore, current rehabilitation guidelines for that population are mainly based on preliminary results, expert opinions, and previous evidence on the rehabilitation of patients surviving critical illnesses.

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