

Research Article

Pulmonary Rehabilitation in the Post-COVID-19 Era: A Comprehensive Review

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Abstract

Healthcare systems around the globe have suffered immensely due to COVID-19, with Long COVID developing into a condition defined by individuals who experience ongoing symptoms long after they recover from the initial viral infection. The most common respiratory complications related to Long COVID include impaired lung function, chronic shortness of breath, and decreased exercise capacity. Pulmonary rehabilitation (PR) is an essential program for wellbeing and lung function among patients with chronic respiratory disease. This long-term respiratory sequela can be alleviated by the implementation of pulmonary rehabilitation (PR) which has shown to be one of the most efficacious strategies in these patients demonstrating restoration of pulmonary function, decrease of dyspnea and improvement of physical capacity. The paper further discusses the role of PR in patients recovering from COVID-19 as an adjunct therapy to address long-term sequelae of viral pneumonia. Moreover, the increasing use of telemedicine has been a game changer in expanding access to PR, particularly for patients who are unable to participate in face-to-face rehabilitation visits. Not only has telemedicine improved patient participation in PR programs, but it has also allowed for improved long-term health, as the service can reach more people. Therefore, it is decisive to highlight that PR continues to be a fundamental pillar in the rehabilitation of post-Covid patients, improving their health indicators and their daily life. Ultimately, the growth of telemedicine should further expand and improve the reach and utility of PR over the longer term.

Keywords

Pulmonary Rehabilitation, Chronic Dyspnea, Impaired Pulmonary Function, SARS-CoV-2 Infection

1. Introduction

The Coronavirus disease 2019 (COVID-19) pandemic, caused by the new viral pathogen SARS-CoV-2, has significantly impacted global health care systems, strained hospitals and disrupting healthcare delivery across the world. Though the early emphasis was on treating the acute phase of the disease, now the emerging issue is Long COVID, the disease that develops weeks later, also known as post-acute sequelae of SARS-CoV-2 infection. Long COVID is a catchall for an

array of lingering symptoms that continue to trouble people weeks or months after the acute infection has cleared. These ongoing symptoms can be varied, but most commonly include fatigue, impaired cognition, and, substantially, respiratory complaints [1].

Some of the most chronic and frequently cited effects of long COVID are respiratory in nature: chronic dyspnea (or shortness of breath), fatigue and reduced exercise tolerance.

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These symptoms dramatically lower quality of life among many COVID-19 survivors, affecting their ability to complete activities of daily living and to get back to pre-illness levels of physical functioning. Importantly, these post-infection symptoms are a particular worry for patients who suffered severe illness but may also plague people with mild to moderate cases of COVID-19. As a result, respiratory complications are one of the chief ongoing concerns in the post-COVID recovery phase [2].

Pulmonary rehabilitation (PR) is a multidisciplinary, comprehensive program that has been pivotal in the management of chronic lung diseases including chronic obstructive pulmonary disease (COPD). PR programs focus on the panoply of physical and emotional dimensions impaired by respiratory dysfunction: exercise capacity, breathlessness and psychological well-being. PR usually consists of supervised exercise training, education on disease management, respiratory techniques and support for mental health challenges — such as anxiety and depression commonly associated with chronic lung diseases. Multiple studies have highlighted the positive impact of PR on enhancing physical capacity and quality of life among patients with chronic lung diseases such as COPD, which has rendered PR as a suitable modulator for similar post-COVID-19 pulmonary conditions [3].

Considering the new evidence related to post-COVID pulmonary sequelae implementation of pulmonary rehabilitation in post-COVID patients is the aim of this review. Particularly, it will explore how PR can be adapted to the needs of COVID-19 survivors, the clinical benefits of addressing long-term respiratory symptoms with PR and PR's potential role in improving recovery for those struggling with Long COVID. This review emphasizes the role of PR as an important therapeutic technique in the recovery process of post-COVID patients by exploring the current state of research in this area, thus shedding light on the capacity of PR to enhance patient outcome and quality of life following the pandemic phase [2].

2. Pulmonary Rehabilitation

Pulmonary rehabilitation is an evidence-based approach designed to enhance the functional capacity and quality of life for those suffering from chronic lung diseases [5]. It usually consists of exercise training, education, nutritional advice and psychological support. Pulmonary rehabilitation has been demonstrated to improve outcomes in COPD [5], interstitial lung diseases [6], and asthma patients. The respiratory sequelae of COVID-19 have led researchers and clinicians to adopt the principles of pulmonary rehabilitation [4, 19].

3. Post-COVID Respiratory Complications

After acute COVID-19 recovery, many patients suffer from

long-term respiratory complications such as persistent cough, dyspnea, and reduced lung function [9, 20]. The degree of pulmonary function impairment associated with COVID-19 after acute infection may be significant, with pulmonary fibrosis observed in some individuals [17, 21]. These long-term sequelae, which can persist for months, require specialized rehabilitative interventions for their mitigation.

3.1. Role of Pulmonary Rehabilitation in Post-COVID Recovery

Pulmonary rehabilitation has been recognized as an important component of outpatient care for COVID-19 patients, especially for those manifesting respiratory symptoms. It was reported that pulmonary rehabilitation can improve exercise capacity, decrease dyspnea and improve quality of life in patients with respiratory complications of post-COVID disease [7, 10]. Additionally, pulmonary rehabilitation is useful in preventing the progression of pulmonary fibrosis by maintaining lung function through regimented exercise and therapy [8].

Nguyen et al.'s systematic review and meta-analysis specifically, in 2016, having shown a significant decrease of dyspnea as well as improved exercise tolerance with pulmonary rehabilitation in chronic respiratory diseases. The strength of this evidence is important for the extension of these interventions to post-COVID-19 patients as much of the pathophysiology appears comparable to those who sustain chronic lung diseases [15].

3.2. Telemedicine and Pulmonary Rehabilitation

The COVID-19 pandemic, which has prompted implementation of social distancing strategies and lockdown, has facilitated the expansion of telemedicine practice, which has permitted continuity of pulmonary rehabilitation programs. Telehealth platforms have allowed healthcare providers to offer remote pulmonary rehabilitation and help eliminate some of the barriers to access experienced by patients, especially those in rural or low resource areas [10, 11, 38]. This approach has been effective for chronic respiratory diseases and appears to hold promise for treatment of post-COVID. [12, 18]. Telemedicine enables remote monitoring which guarantees patient participation in rehabilitation programs and allows for immediate adaptations in patient management.

A study by Orenstein, S., et al. found that telemedicine-based pulmonary rehabilitation resulted in significant improvements in quality of life and functional capacity in patients as compared to traditional in-person rehabilitation [13]. Given the reliance on mobility for consultations, the convenience of telehealth services can be equally important as the patients transition into the post-COVID recovery phase [16, 31, 34].

3.3. Effectiveness of Pulmonary Rehabilitation in Post-COVID Syndrome

Several studies have assessed the effect of pulmonary rehabilitation on the symptoms of Long COVID. Martin et al. Pulmonary rehabilitation can reduce fatigue and dyspnea in COVID-19 survivors according to [21]. Figueiredo, P. V., et al. [30] supervised rehabilitation was associated with improvements in exercise tolerance, respiratory muscle strength, and function in overall physical function. In addition, psychological benefits like lower levels of anxiety and depression which are prevalent in post-COVID patients were also reported [22, 24, 25].

Jones, J., et al. [26, 27] showed that patients entering structured pulmonary rehabilitation programs experienced significantly greater improvements on both lung functionality and mental well-being than patients receiving usual care. This highlights the need to include pulmonary rehabilitation as a standard of care protocol for post-COVID patients [14, 28, 29].

4. Challenges and Future Directions

The results are promising; however, there are significant barriers to the broad adoption of pulmonary rehabilitation for post-COVID patients. Indeed, access to rehabilitative facilities, the need of specialized devices, and economic impact on healthcare systems, are some of the major hurdles [23, 35-37]. Telemedicine could be a valid option, even if not all patients have the technology for dealing with remote rehabilitation [33].

Further research needs to be conducted, to optimize the rehabilitation protocols for these patients, to clarify the long-term effects of pulmonary rehabilitation on post-COVID lung function, and to evaluate the feasibility of implementing digital health tools to better manage this emerging patient population [16, 32, 39, 40].

5. Conclusion

More than three years into the COVID-19 pandemic, it brought about global, systematic, and long-term health threats, with survivors struggling on with Long COVID, marked by lingering respiratory symptoms and complications like pulmonary dysfunction and exercise intolerance. Pulmonary rehabilitation (PR) was therefore identified as an essential tool in managing these long-term respiratory sequelae, critical for enhancing lung function, dyspnea, and exercise tolerance. We have highlighted the importance of PR in the recovery of post-COVID patients and emphasized its role as an effective procedure to improve pulmonary health status and overall well-being.

Moreover, with the growing popularity of telemedicine, PR has never been more accessible to patients because those who are unable to attend in-person sessions due to geographical

constraints or physical limitations can now access vital rehabilitation services. By incorporating remote care into the equation, PR is more accessible than ever, and therefore the benefits of PR are reaching more and more people, which will successfully improve long-term health outcomes. To sum up, pulmonary rehabilitation is an important and vital component in the rehabilitation of post-COVID patients, providing an effective method to improve recovery and quality of life for individuals suffering from the long-term respiratory consequences of the virus.

Abbreviations

COVID-19	Coronavirus Disease 2019
Long COVID	Long-term Effects of COVID-19
PR	Pulmonary Rehabilitation
TM	Telemedicine

Author Contributions

Siavash Hosseinpour Chermahini is the sole author. The author read and approved the final manuscript.

Declaration

Ethical Approval and Consent to Participate

Not applicable.

Consent to Publish

Not applicable.

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Availability of Data and Materials

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

The author declares no conflicts of interest.

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