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Original Research Article

Pulmonary Rehabilitation in Patients with Post COVID Respiratory Sequelae

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Abstract:

Background: Shortness of breath, anxiety, weariness, muscle soreness, and cognitive impairment are typically the most recurrent symptoms that continue following COVID-19. Furthermore, problems involving the central nervous system and cardiovascular diseases may also appear in certain instances.

Objectives: In patients with post-COVID-19 respiratory sequelae, the study sought to assess how well pulmonary rehabilitation improved functional capacity, decreased dyspnea, and eased enduring symptoms.

Materials and Methods: It was a retrospective, observational study. The study was carried out at a tertiary care centre. The study data that was retrieved was for one year. Data from 202 participants were retrieved for the study. The study included adult patients (≥18 years) with a confirmed diagnosis of COVID-19 who had functional impairments 4–12 weeks after recovery or who had persistent respiratory symptoms such coughing, tiredness, or dyspnea.

Results: Nearly half of the 90 participants (44.6%) experienced severe dyspnea at baseline (mMRC ≥3). The percentage of participants with Grade 0–1 dyspnea rose from 21.8% to 51.5% after pulmonary rehabilitation, with a p-value of less than 0.001, whereas the percentage of participants with Grade ≥3 dyspnea fell from 44.6% to 17.8%, with a p-value of less than 0.001.

Conclusion: As demonstrated by longer Six-Minute Walk Test distances, it considerably enhanced functional exercise capacity in this study and lessened the intensity of dyspnea, exhaustion, coughing, anxiety, and sleep disruptions.

Recommendations: It is important to quickly assign COVID-19 patients to systematic pulmonary rehabilitation programs that incorporate breathing exercises, physical therapy, and psychological support.

Keywords: Pulmonary rehabilitation, Respiratory impairment, Post-COVID-19 patients, exercise capacity, PR.

Introduction

2019 saw the emergence of the SARS-CoV-2 virus. The SARS coronavirus (SARS-CoV) is the cause of the acute respiratory disease known as COVID-19. It quickly spread around the world, causing a crisis in the areas of society, healthcare, and the economy [1, 2].

Fever, nonproductive cough, dyspnea, weariness, and myalgia were the most often occurring moderate symptoms, which affected a considerable percentage of the population. However, additional symptoms may also appear, including headaches, pharyngalgia, rhinorrhea, vomiting, diarrhea, or changes in or loss of taste [3, 4].

When more severe symptoms like hypoxia, respiratory failure, acute respiratory distress syndrome, and even multiorgan failure appear, people's health may be seriously jeopardized. Neurological problems, such as encephalopathies, strokes, psychosis, and inflammatory syndromes of the central nervous system, may arise in certain patients during the acute period [4].

Often called a "post-COVID-19 condition," this condition appeared four to twelve weeks following a Covid-19 infection. Affected people's quality of life may be severely reduced by these symptoms, which can last for weeks or even months [5]. Shortness of breath, anxiety, weariness, muscle soreness, and cognitive impairment are typically the most recurrent symptoms that continue following COVID-19. Furthermore, problems involving the central nervous system and cardiovascular diseases may also appear in certain instances [6].

According to a statement on pulmonary rehabilitation (PR) by the American Thoracic Society (ATS) and the European Respiratory Society (ERS), PR can improve quality of life

(QoL), increase exercise capacity, and lessen dyspnea in people with chronic obstructive pulmonary disease (COPD). It may also have significant short-term benefits for patients with interstitial lung diseases (ILD) [7, 8].

According to a review, patients with post-COVID-19 should have access to a thorough rehabilitation program that includes a multidisciplinary team including cardiorespiratory, neuromuscular, and psychological therapies [9].

In patients with post-COVID-19 respiratory sequelae, the study sought to assess how well pulmonary rehabilitation improved functional capacity, decreased dyspnea, and eased enduring symptoms.

Methodology

Study Design: It was a retrospective, observational study.

Study Settings: The study was carried out at a tertiary care centre. The study data that was retrieved was for one year.

Study Population: Data of 202 participants were retrieved for the study. The study included adult patients (≥18 years) with a confirmed diagnosis of COVID-19 who had functional impairments 4–12 weeks after recovery or who had persistent respiratory symptoms such coughing, tiredness, or dyspnea. Informed consent was given by participants, who had to be able to engage in a pulmonary rehabilitation program and be in a stable medical condition. The trial excluded patients who were pregnant or nursing, had uncontrolled comorbidities, had significant cardiovascular, neurological, or musculoskeletal diseases that limited exercise, had behavioral or cognitive disorders that interfered with program adherence, or had an active COVID-19 infection.

Data Collection: Comorbidities, time since COVID-19 recovery, demographic information, and baseline clinical indicators such as mMRC dyspnea grade and Six-Minute Walk Test (6MWT) distance were obtained. Details about the pulmonary rehabilitation program were documented, such as its length, the number of sessions attended, program completion, and the causes of dropouts. Assessments of symptoms, such as coughing, anxiety/depression, sleep problems, exhaustion, and dyspnea, were recorded at baseline and following the conclusion of the rehabilitation program.

Study Procedure: Strength training, breathing techniques, cardiovascular activities, and psychological support were all incorporated into the program, which was created in accordance with the criteria of the European Respiratory Society (ERS) and the American Thoracic Society (ATS). Over the course of roughly seven to eight weeks, each participant attended three to five supervised sessions each week, with the length of each session being determined by the subject's tolerance and baseline functional capacity. Prior to the start of PR, baseline tests were conducted, such as the Six-Minute Walk Test (6MWT), mMRC dyspnea grading, and symptom evaluation (fatigue, cough, anxiety/depression, and sleep problems). To gauge progress in exercise capacity, dyspnea severity, and symptom burden, these tests were conducted again at the conclusion of the program.

Statistical Analysis: SPSS version 26.0 was used for statistical analysis. Data were initially entered in Microsoft Excel. The data have been presented as either the number of participants (n) with percentages (%), or mean±SD.

The independent t-test was used for statistical analysis. Statistical significance was defined as a p-value of less than 0.05.

Results

The participants' average age was 55.1 ± 12.5 years. 118 (58.4%) of the 202 participants were men, and 84 (41.6%) were women. The average time from COVID-19 recovery to initiation of pulmonary rehabilitation was 7.3 ± 2.0 weeks. The baseline demographics of study participants are detailed in Table 1.

Table 1: Baseline Demographics of Study Participants

Parameters	Value
Age (in years)	55.1 ± 12.5
Male Participants	118 (58.4%)
Female Participants	84 (41.6%)
Time from COVID recovery to PR	7.3 ± 2.0

The cohort was primarily composed of middle-aged to older persons, as evidenced by the fact that 110 (54.4%) of the participants were in the 41–60 age range. Of the study population, the least number of participants were 18 (8.9%) who were under 30 years old, and 38 (18.8%) who were over 60. The age distribution of research participants is displayed in Figure 1.

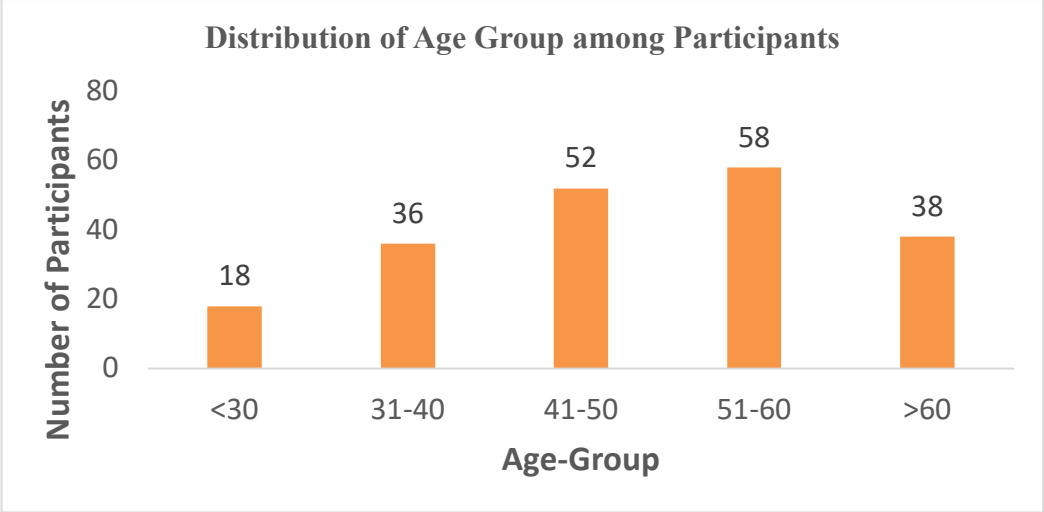

Figure 1: Distribution of Age-Group among Study Participants

Associated comorbidities among research participants are displayed in Figure 2. 75 patients had hypertension, 60 had diabetes mellitus, 30 had cardiovascular disease, 24 had chronic respiratory illness, and 10 had chronic kidney disease. The distribution of comorbidities across research participants is displayed in Figure 2.

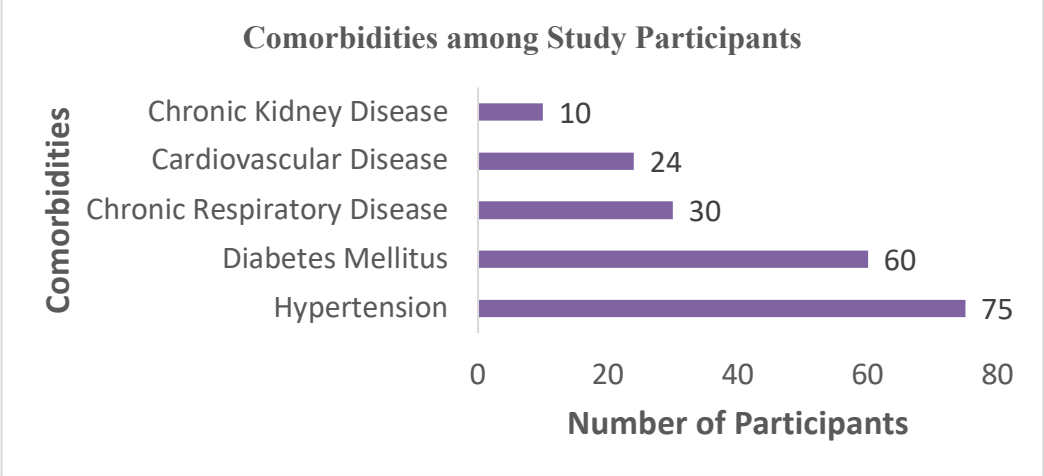

Figure 2: Distribution of Comorbidities among Study Participants

Figure 2 shows the associated comorbidities among research participants. Ten patients had chronic kidney disease, thirty had cardiovascular disease, twenty-four had chronic respiratory illness, sixty had diabetes mellitus, and seventy-five had hypertension. Figure 2 shows the distribution of comorbidities among research participants.

Table 2: Pulmonary Rehabilitation Details

Parameters	Value
Duration of PR program (in weeks)	7.5 ± 1.3
Number of sessions attended	19.2 ± 3.6
Completion rate	178 (88.1%)
Dropouts	24 (11.9%)
Reasons for Dropouts	
Transportation Issues	11
Lack of Motivation	07
Other Medical Conditions	06
Baseline Six-Minute Walk Test	301.4 ± 75.1
Post-PR Six-Minute Walk Test	381.8 ± 69.2

Nearly half of the 90 participants (44.6%) experienced severe dyspnea at baseline (mMRC ≥3). The percentage of participants with Grade 0–1 dyspnea rose from 21.8% to 51.5% after pulmonary rehabilitation, with a p-value of less than 0.001, whereas the percentage of participants with Grade ≥3 dyspnea fell from 44.6% to 17.8%, with a p-value of less than 0.001. The distribution of patients based on the mMRC dyspnea scale is shown in Table 3. The distribution of patients based on the mMRC dyspnea scale is displayed in Table 3.

Table 3: Distribution of patients according to mMRC dyspnea scale

mMRC Grade	Baseline, n (%)	Post-PR, n (%)	p-value
Grade 0–1	44 (21.8%)	104 (51.5%)	<0.001
Grade 2	68 (33.7%)	62 (30.7%)	0.602
Grade ≥3	90 (44.6%)	36 (17.8%)	<0.001

At baseline, individuals frequently experienced fatigue (71.3%), dyspnea (100%), cough (48.5%), anxiety/depression (40.6%), and sleep problems (36.6%). All symptoms significantly decreased following pulmonary rehabilitation: anxiety/depression decreased to 15.8%, cough decreased to 17.3%, sleep disruptions decreased to 15.8%, fatigue decreased to 34.7%, and dyspnea decreased to 78.2%. Symptom changes before and after pulmonary rehabilitation are shown in Table 4.

Table 4: Changes in symptoms before and after pulmonary rehabilitation

Symptoms	Baseline, n (%)	Post-PR, n (%)	p-value
Fatigue	144 (71.3%)	70 (34.7%)	<0.001
Dyspnea (any grade)	202 (100%)	158 (78.2%)	<0.001
Cough	98 (48.5%)	35 (17.3%)	<0.001
Anxiety/depression	82 (40.6%)	32 (15.8%)	<0.001
Sleep disturbance	74 (36.6%)	32 (15.8%)	<0.001

Discussion

The current study shows that in patients recuperating with COVID-19, pulmonary rehabilitation considerably increases functional capacity, lowers dyspnea, and eases enduring symptoms. Following rehabilitation, the mean Six-Minute Walk Test (6MWT) distance increased significantly from 301.4 ± 75.1 m at baseline to 381.8 ± 69.2 m, suggesting improved exercise tolerance. The percentage of participants who experienced severe dyspnea (mMRC ≥3) also dropped from 44.6% to 17.8%, underscoring PR's function in reducing respiratory symptoms. Following the treatment, there was also a notable improvement in other frequent post-COVID-19 concerns, such as coughing, anxiety, sadness, sleep difficulties, and exhaustion.

These results align with earlier research highlighting the advantages of pulmonary rehabilitation for long-term respiratory disorders. In order to improve quality of life, exercise capacity, and dyspnea in patients with ILD and COPD, the ATS and ERS advise PR [7,8]. These advantages are now available to patients with respiratory sequelae following COVID-19, according to recent research. In post-COVID patients, a 6-week rehabilitation program effectively reduced dyspnea and increased exercise tolerance, according to Liu et al. (2020) [10]. Similar to this, a review by Demeco et al. (2020) emphasized that systematic multidisciplinary rehabilitation can successfully address ongoing post-COVID symptoms [9]. This rehabilitation includes breathing retraining, cardiovascular and resistance exercises, and psychological support.

The practicality and acceptability of PR programs among middle-aged and older persons are demonstrated by the high completion rate (88.1%) found in this study. According to Daynes et al. (2021) [11], dropouts were mostly caused by practical issues like transportation, highlighting the potential value of home-based or community-based programs to improve accessibility.

The most often reported post-COVID-19 symptoms, fatigue and dyspnea, were considerably reduced during rehabilitation. This is consistent with research by Carfi et al. (2020), which found that more than 50% of post-COVID patients had persistent fatigue and dyspnea after two months' follow-up [12]. By improving skeletal muscular function, psychological well-being, and cardiovascular efficiency, PR may alleviate these symptoms. Furthermore, the study's findings regarding improvements in anxiety, sadness, and sleep difficulties point to the importance of integrated psychological care in PR programs for comprehensive recovery.

Conclusion

Patients with respiratory sequelae from COVID-19 can benefit from pulmonary rehabilitation. As demonstrated by longer Six-Minute Walk Test distances, it considerably enhanced functional exercise capacity in this study and lessened the

intensity of dyspnea, exhaustion, coughing, anxiety, and sleep disruptions. PR appears to be both practical and well-tolerated for middle-aged and older persons recuperating from COVID-19, as seen by high program completion rates.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations

It is important to quickly assign COVID-19 patients to systematic pulmonary rehabilitation programs that incorporate breathing exercises, physical therapy, and psychological support. It is crucial to regularly check symptoms and functional ability, and home-based or community-based programs may increase accessibility.

List of Abbreviations

COPD- Chronic Obstructive Pulmonary Disease

SARS-CoV- SARS coronavirus

PR- Pulmonary Rehabilitation

ILD- Interstitial Lung Disease

ATS- American Thoracic Society

QoL-Quality of Life

ERS- European Respiratory Society

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