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Original Research Article

Benefits of Pulmonary Rehabilitation in Post COVID Patients: A Retrospective Study

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ABSTRACT

Background: COVID-19 disease has spread worldwide irrespective of age, gender and comorbidities. lung is the main affecting organ in corona virus disease due to which patients infected with covid19 has impacting on exercise tolerance, quality of life and dyspnoea.

Purpose: to observe the effects of pulmonary rehabilitation in post covid patients.

Objectives: to observe the effects of pulmonary rehabilitation of dyspnoea by MMRC scale and exercise tolerance by 6min walk test in post covid patients.

Methodology: A total of 61 patients meeting the inclusion and exclusion criteria. dyspnoea and exercise tolerance score has recorded before and after the pulmonary rehabilitation.

Result: post pulmonary rehabilitation score in terms of dyspnoea and exercise tolerance has showed extremely significant improvement ($p<0.001$) as compared to pre pulmonary rehabilitation score.

Conclusion: pulmonary rehabilitation is effective in improving dyspnoea and exercise tolerance in post covid patients.

KEYWORDS: Pulmonary Rehabilitation, COVID-19, Exercise Tolerance, Dyspnoea.

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INTRODUCTION

The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is a novel beta coronavirus [1]. In December 2019, an eruption of pneumonia having unknown origin was reported in Wuhan, Hubei Province, China. Pneumonia cases were epidemiologically linked to the Huanan Seafood Wholesale Market [2]. Inoculation of respiratory samples were takes place into human airway epithelial cells, Vero E6 and Huh7 cell lines, which leads to the isolation of a novel respiratory virus whose genome analysis has showed it to be a novel coronavirus which is related to SARS-CoV, and therefore named as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The global spread of SARS-CoV-2 was takes place and the thousands of deaths caused by coronavirus disease (COVID-19) due to which the World Health Organization has to declare a pandemic on 12 March 2020 [2]corona virus disease19 pandemic (COVID19), as defined by the world health organization [WHO] in February 2020 the discovery of the novel coronavirus, SARS-CoV2, scientist had debated its origin [3].

The transmission of SARS-CoV-2 virus occurs with high efficacy and infectivity mainly through the respiratory route as other respiratory viruses. The droplet and aerosols are the main important route of transmission. [4,5] oral-faecal route may be the another route of transmission of the virus as SARS-CoV-2 has been detected in the stool of the patient having covid19 pneumonia.[6]Due to the presence of ACE2 receptors in epithelial cells lining the salivary glands SARS-CoV-2 has been detected in the saliva of infected patient. [7,8]. Optimal affinity for angiotensin converting enzyme2 (ACE2) receptor and a polybasic cleavage site at the S1 S2 spike junction that determine infectivity and host range[8,10] the RNA of SARS-CoV-2 detected on inanimate surfaces like door handles, surface of cell phones in residential site with confirmed COVID19 patients due to which individuals who are coming in contact with infected surfaces they might get infected if they touch their eyes, mouth or nose [5]. according to Lauer et al. the median incubation period of SARS-CoV-2 was 5 days. 1 day (95% CI, 4.5-5.8days), and that 97.5% of infected individuals would develop symptoms within 11.5days (CI, 8.2-15.6 days) of infection [11,12]. The most common features of covid-19 are like those in influenza fever,dry cough, sore throat, malaise , myalgia , arthralgia, nasal congestion , sneezing & running nose [1].

Viral testing: Suspected cases of SARS-CoV-2 infection are confirmed by detection of unique viral sequences using a reverse real-time PCR (rt-PCR) assay. European laboratories developed an RT-PCR protocol immediately after declaration of Chinese health authorities on 7 January 2020that the outbreak of pneumonia, protocol based on alignment and comparison of available bat-related corona virus and SARS-CoV genome sequences plus five sequences from the novel coronavirus SARS-CoV-2 that were released by the Chinese authorities [13].

This protocol were adopted by 30 European countries, as three rt-PCR assays were developed,the first line assay targets the E gene common to the coronaviruses belonging to Sarbecovirus subgenus and encoding the envelope protein. The second assay targets the RdRp gene encoding the RNA-dependent-RNA polymerase. This assay contains two molecular probes: one reacts with the SARS-CoV and SARS-CoV-2 RdRp gene, while the second one (RdRP_SARSr-P2) reacts with SARS-CoV-2 RdRp gene. The third assay targets the N (nucleocapsid) gene [14].

If compare with **gender, age, and comorbidities** the infection rate among men and women was similar, the death rate among men were 4.7% compared with 2.8% for women from confirmed cases of China. Similarly, In Italy, the reported death rate in men (16.6%) was higher than that in women 9.1% [16]. the increased rate of mortality and morbidity is due to patients have had diabetes mellitus, obesity and/or hypertension. gender, age, and comorbidities were the risk factors for the COVID-19 patients [15].

Pulmonary Pathology of COVID-19 may be demonstrated as 4 main morphological stages, including an early stage (day 0–1) with oedema, incipient epithelial damage, and capillaritis/endothelialitis, (2) the stage of exudative diffuse alveolar damage (DAD) (days 1–7), and (3) the organizing (1 to several weeks) and (4) the fibrotic stage of DAD (weeks to months). Gross examination of the lungs usually showed an increased weight with oedema and diffuse congestion, and cut surfaces with irregularly distributed regions of consolidation, and in a subset of cases haemorrhage or infarction, frequently with visible thrombosis in feeder vessels [15].

Pulmonary rehabilitation: Pulmonary rehabilitation is a comprehensive intervention based on a thorough patient assessment followed by patient tailored therapies, which include but are not limited to, exercise training, education, and behaviour change, designed to improve the physical & psychological condition of people with chronic respiratory disease & to promote the long term adherence of health enhancing behaviours [9]. The outcome measurement in pulmonary rehabilitation include exercise capacity, symptoms (dyspnoea & fatigue) & health related quality of life [9]. Patients with restrictive lung disease experience greater work of breathing due to

progressive stiffness, increased compliance & scarring of lung tissue [9]. Training inspiratory muscles with a restrictive breathing device may be beneficial in patients who have decreased inspiratory muscle strength & breathlessness despite receiving optimal medical therapy [9].

Patients with severe lung disease may be restricted by symptoms of shortness of breathing during most daily activities even walking at a slow pace may be limited.Patients with severe lung disease require a modified approach to exercise testing lower workloads & interval training will facilitate improved tolerance to longer bouts of endurance exercise. A 6 min walk test should be utilized as part of evaluation process of determine of functional levels & exercise tolerance [9-17]. About 60% of those presenting with dyspnoea are aged e”65 yearsCOVID-19 survivors show a mild reduction of their exercise capacity, probably caused by muscle deconditioning [18].

Need of Study: Pulmonary rehabilitation may improve short term physical outcomes and quality of life in (PICS) post-intensive care syndrome & in respiratory condition, as early rehabilitation enhances exercise capacity, reduces depression & anxiety. improves health related qualities, fatigue & strength of respiratory muscles in patients with various forms of respiratory disorders.it will help to observe the effectiveness of pulmonary rehabilitation who are taking as a treatment and to increased awareness about pulmonary rehabilitation for post covid patients during this pandemic for better quality of life.

MATERIALS AND METHODS

In this retrospective study design, observational with pre and post paired t test were performed to observe the effectiveness of pulmonary rehabilitation in post covid patients. 61 patients were meet the inclusion criteria of having 80 sample size.We included the patients having age of 35-65yrs oldand completed the pulmonary rehabilitation program for at least 6 weeks after COVID19 infection.19 patients were rejected as having pre-existing respiratory condition and women who were pregnant and 2 patients were not willing to participate in the pulmonary rehabilitation program. Modified medical research council (MMRC) scale [reliability=.56] and 6MWT used as outcome measures.

Data Collection and Procedure: Ethical approval was taken from the ethical committee. Consent was taken from the physiotherapist given pulmonary rehabilitation to post covid patients. 61 Patients were selected as per the inclusion criteria. Assessment proforma filled of every patient who are coming under inclusion criteria. Patient’s symptom of dyspnoea on MMRC scale recorded and exercise tolerance on 6 MWT readings were noted. Difference and progression of readings of pre pulmonary rehabilitation and post pulmonary rehabilitation were recorded.

RESULTS

A total of 61 samples were taken in this study, in which 35 to 65 yr of both male & female who had completed there pulmonary rehabilitation for at least 6 weeks were included. 30 male & 31female were included in this study. Pre MMRC dyspnoea grade and RPE mean value from 6 min walk test for exercise tolerance is compared & analysed with post RPE mean value at the end of the 6week pulmonary rehabilitation program. It is seen that Post pulmonary rehabilitation RPE and MMRC mean value is more than pre RPE and MMRC mean value.

Table 1: mean and p value of pre & post RPE (Rate of perceived exertion) from 1-10 Borg Rating Scale for 6 min walk test with the use of paired T test to measure the exercise tolerance.

N	Outcome measure	Mean+-Sd	P value
61	**Pre RPE**	1.644+- 1.300	<0.001
61	**Post RPE**	0.28+-0.38	<0.001

Graph 1: comparison between RPE of pre and post pulmonary rehabilitation.

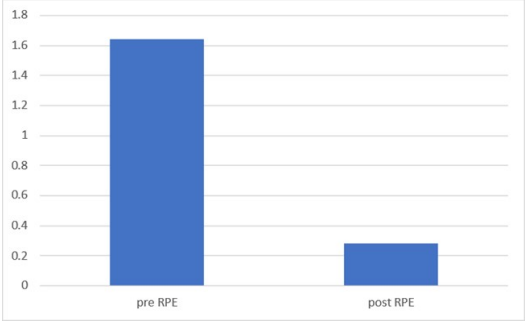
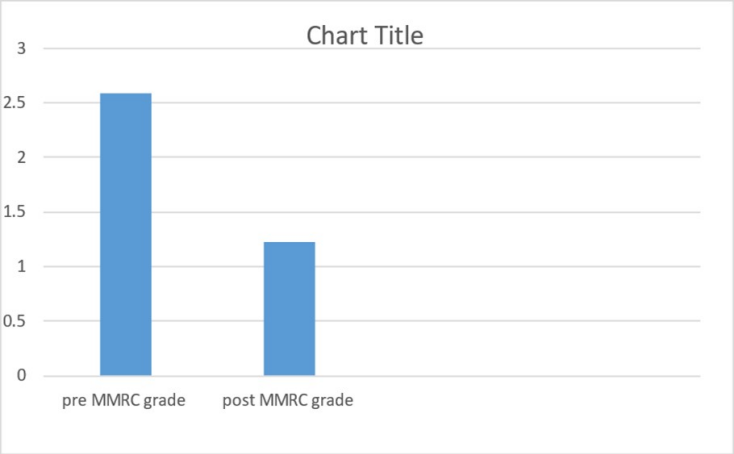


Table 2: Mean and p value of pre & post MMRC (modified medical research council) grade, on using paired t test.

N	Outcome measures	Mean+-Sd	P value
61	**Pre MMRC grade**	2.590+-0.844	<.001
61	**Post MMRC grade**	1.230+-0.496	<.001



Graph 2: Comparison between MMRC grade of pre and post pulmonary rehabilitation.

DISCUSSION

Pulmonary rehabilitation is a comprehensive intervention based on a thorough patient assessment followed by patient tailored therapies ,which include but are not limited to, exercise training, education ,and behaviour change ,designed to improve the physical & psychological condition of people with chronic respiratory disease & to promote the long term adherence of health enhancing behaviours which shows the effect in exercise capacity, symptoms (dyspnoea & fatigue) & health related quality of life [20-23].

In this retrospective study, purpose was to observe the benefits of pulmonary rehabilitation in post covid patients, in which 35-65 years of male and female who have taken pulmonary rehabilitation for at least 6 weeks were selected. Before and after pulmonary rehabilitation comparison was done between the mean values of dyspnoea on MMRC scale, RPE on Borg rating scale (1-10 scoring) after performing 6 min walk test. The difference was observed and statistically analysed. The exercises included in the pulmonary rehabilitation protocol were pursed lip breathing exercise, dyspnoea relieving positions, physical conditioning exercise, high/low intensity training, flexibility/mobility exercise. 1.644 is the pre RPE mean value 0.28 is the post RPE mean value, that is RPE(rate of perceived exertion) had improved at the end of the rehabilitation program & mean value of MMRC grade before pulmonary rehabilitation program is 2.590 & mean value at the end of the pulmonary rehabilitation program is 1.230 it means dyspnoea had improved [24-27].

Most of the rehabilitation centres had used Pursed lip breathing as a primary mode of treatment. It has benefitted more as it naturally slows down the respirations & decreased minute ventilation, exhalation through pursed lip during walking, lifting, pushing or pulling activities prevents breath holding & straining. physiologically pursed lip decreases premature airway closure/trapping thereby reducing residual volume. Physical conditioning exercise is aimed to improve cardiopulmonary endurance, maximizing work capacity, improves flexibility, strength & respiratory muscle function. High or low intensity training gains maximum physiological improvement in aerobic fitness such as VO2 max, delayed aerobic threshold, decreased heart rate for a given work rate. Flexibility & mobility exercise can be used as a warmup&cool down activity for aerobic conditioning or at any time to relieve muscle tension & anxiety. Pursed lip breathing can improve spo2 by increasing alveolar ventilation, increases tidal volume, reduces respiratory rate, slows expiratory flow, and improve CO2 removal.

A study done by Rainer Gloeckl et al, on Benefits of pulmonary rehabilitationin COVID-19: a prospective observational cohort study showed that, Patients in the post-acute phase of a mild to critical course of COVID-19

admitted to a comprehensive 3-week inpatient pulmonary rehabilitation programme. On admission, patients had a reduced 6MWD, an impaired FVC and a low SF-36 mental health score. Patients attended a median (IQR) 100% (94–100%) of all provided pulmonary rehabilitation sessions and they were given breathing retraining, bicycle endurance training, strength training, Jacobson relaxation technique, activities of daily living training. At the time of discharge, it was seen that patients in both subgroups improved in 6MWD, FVC and SF-36 mental component. No adverse event was observed. concluded that pulmonary rehabilitation is a feasible, safe and effective therapeutic option in COVID-19 patients independent of disease severity [28].

Another study done by, Matthias Hermann et al, on Feasibility and Efficacy of Cardiopulmonary Rehabilitation After COVID-19 they retrospectively analysed a cohort of COVID-19 patients. The cohort was divided in ventilated and non-ventilated patients for the analysis and then risk factors, assessments, and questionnaires on admission were compared in both groups , set up a standardized inpatient Pulmonary rehabilitation program of 3 weeks, including a total of 25–30 therapy sessions on 5–6 weekdays that multimodal program were mainly consisted of an individualized endurance exercise and strength training and that was carried out according to a protocol adapted to the severity of the disease and functional physical limitations. at the end of pulmonary rehabilitation program, they were concluded that pulmonary rehabilitation is beneficial, feasible after COVID19 [22].

Thus, there is improvement in both dyspnoea & exercise tolerance in post covid patients at the end of the pulmonary rehabilitation program.

CONCLUSION

This study concludes that there are benefits of pulmonary rehabilitation in post covid patients.

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Conflicts of interest: **None**

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