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Case Report

Physical Medicine and Rehabilitation Section

Advancing Pulmonary Rehabilitation Approach in Improving Well-being in a Long COVID-19 Syndrome Case

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ABSTRACT

Being a highly contagious disease, Coronavirus Disease-2019 (COVID-19) has shown its impact throughout the world. Clinical manifestations are seen primarily involving the respiratory system. Fever, cough, fatigue, and breathlessness are the commonly seen symptoms. Several cases of COVID-19 manifest as viral pneumonia-induced Acute Respiratory Distress Syndrome (ARDS). COVID-19 symptoms appear not only during the course of the illness but also as its after effects. Long COVID-19 is said to be multisystem syndrome, categorised as postacute or chronic depending upon the time frame. It is characterised by the presence of symptoms beyond four weeks of the actual disease. Change in structural components in the lung leads to having a functional consequence on the body, affecting the cognitive, psychosocial, mental and physical well-being of the patients. Studies have shown alveolar damage same as ARDS. The most common pulmonary sequences seen are dyspnoea, cough (dry/with expectoration) and decreased diffusion capacity leading to reduced endurance. The present case report was of a 45-year-old nurse, who presented with the symptoms of postacute long COVID-19. Her previous scan of thorax showed a severity score of 11/25 after being tested COVID-19 positive. In view of the presenting complaints, a tailor-made pulmonary rehabilitation program was administered which showed great improvement in overall health condition. This case had been reported to document the effects of post COVID rehabilitation program on aspects such as functional capacity, quality of life, anxiety and depression using novel measures such as Incremental Shuttle Walk Test (ISWT), World Health Organisation Quality of Life-Brief Version (WHOQOL-BREF), and Depression, Anxiety and Stress Scale-21 Items (DASS-21). Rehabilitation has been proven to be effective and safe in improving the exercise performance, quality of life affected due to COVID-19 and psychological function of the patients.

Keywords: Aerobic training, Coronavirus disease-2019, Exercise, Functional independence, Respiratory function

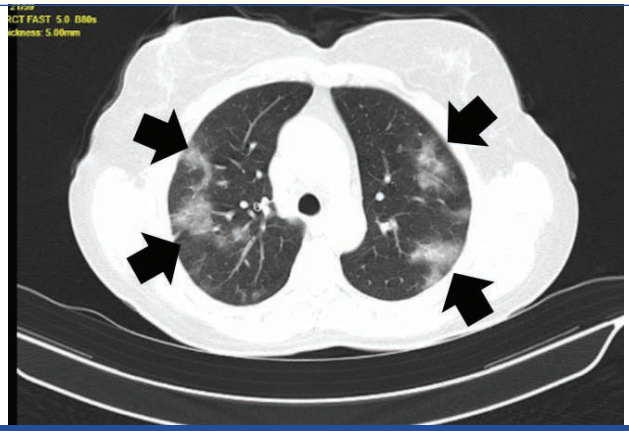
CASE REPORT

A 45-year-old female patient, a nurse by occupation came to the COVID rehabilitation centre with complaints of intermittent joint pain, fatigue, tiredness in doing activities of daily living and trouble sleeping for seven days. She was a known case of hypertension for five years and used to take tablet amlodipine. Additionally, reported a history of being COVID-19 positive one month ago with symptoms like breathlessness, sudden morning chest pain with palpitations and low saturation level and hypoxia on room air.

Previous laboratory data available with the patient from the time of hospitalisation is shown in [Table/Fig-1] [1,2]. After the discharge of the patient from the hospital the above mentioned values came to a normal range and the patient got stable haemodynamically. High Resolution Computed Tomography (HRCT) thorax was done at first when the patient arrived to the hospital. Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test was done and it came out to be positive and was suggestive of multiple ill-defined patchy ground-glass opacities with septal thickening and consolidation in bilateral lung fields imaging grading is COVID-19 Reporting and Data System (CORAD-6) [3] with a severity score of 11/25 as shown in [Table/Fig-2].

Parameters	Values	Normal range
Arterial Blood Gases (ABG)	Respiratory acidosis without compensation followed by metabolic alkalosis with partially compensated respiratory acidosis.	
White Blood Cell Count (WBC) (cells/cumm)	10600	4000-11000
Haemoglobin count (g/dL)	9.8	11.6-15

[Table/Fig-1]: Previous laboratory report [1,2].



[Table/Fig-2]: An HRCT scan of a COVID-19 positive patient with a score of 11/25, suggestive of multiple ill-defined patchy ground-glass opacities with septal thickening and consolidation in bilateral lung fields.

The patient was hospitalised immediately and started on antibiotics, prednisolone, antiplatelet, nebulisation and other multivitamin supplements. The patient was put on a face mask with 10 litres of Oxygen (O_2) as she was inefficient in maintaining oxygen saturation at room air. After a stay of 20 days in the hospital, the patient was discharged as she got symptomatically better. A home exercise regime was given at the time of discharge to be done for six weeks. The home exercise regime consisted of patient education, where the patient was educated about lifestyle, to be active, to take a nutritional diet and to be involved in social activities. Exercises like huffing and coughing techniques, breathing exercises, and thoracic expansion exercises were also included.

The patient came for physiotherapy rehabilitation with complaints of dyspnoea, early fatigue, joint pain and decreased lung capacity. The patient was educated about her present condition, the effects

of long COVID-19 and its impact on functional capacity and quality of life. On examination, the patient was haemodynamically stable. Observation showed that the patient was minimally restless and using accessory muscles while breathing. The detailed evaluation included basic vital signs- Heart rate (HR) was 88 bpm (beats per minute), Blood pressure (BP) was 120/90 mmHg, Oxygen saturation (SpO_2) was 97% on room air, and the temperature was febrile with 39.5°C. The degree of dyspnoea was 2 on the Modified Medical Research Council (MMRC) dyspnoea scale [4]. Auscultatory findings revealed reduced air entry at bilateral lower zones. The systemic evaluation was followed by a functional assessment. DASS-21 [5] and WHOQOL-BREF [6] scales were filled by the patient, in order to assess the level of anxiety and depression and affected quality of life post COVID. An Incremental Shuttle Walk Test (ISWT) was performed by the patient under supervision to assess the exercise capacity on a 9-meter track [7].

After thorough assessment, a tailor-made exercise protocol was prescribed. The exercise regime focused on relieving dyspnoea, inducing relaxation and improving the functional capacity of the patient so as to reduce fatigue. The intervention program consisted of 12 treatment sessions which were supervised. The exercises were planned according to the Frequency, Intensity, Time, Type (FIIT) principle [8]. Wherein the frequency was three times a week, with 30-60 minutes of exercises including warm-up, aerobic exercise, and cool-down (as tolerated by the patient).

The interventions were started with breathing exercises along with a range of motion exercises. Pursed lip breathing, diaphragmatic breathing and segmental breathing along with relaxation techniques like Jacobson's relaxation was taught to the patient and instructed to be done every four hours. The patient was educated about the effects of bad posture and explained why it has to be avoided. The patient was encouraged to incorporate postural correction techniques along with energy conservation to improve the efficiency of patient care at the workplace. However the patient had complete control over the frequency of exercises in order to prevent a decrement in the training effect. The patient required oxygen support during the first three exercise sessions which were recorded as three litres in the first two sessions and two litres in the 3rd session, followed by no oxygen support in the later weeks as pacing techniques were indulged in the exercise program. An incentive spirometer device was given so as to indulge sustained maximal inspiration with a set of 4 of 10 repetitions. Aerobic exercise was aimed at walking as tolerated by the patient, followed by a phase of cool-down, including stretching exercises for major muscle groups of the upper and lower limbs. The rehabilitative intervention also included psychological support. Motivation when required and promoting self-care was addressed during the intervention. The effectiveness of the program was recorded on the basis of outcome measures.

Outcome measures used included Numerical Pain Rating Scale (NPRS), DASS-21, WHOQOL-BREF and ISWT scale [5-7]. WHOQOL-BREF scale interpretation involved transforming the raw score of the scale into a transformed score, converting it to a range of 0-100 [6]. The normal value for the ISWT for the age of 42 years is 624 meters approximately [7]. Improvement was seen in patient's health in the course of rehabilitation as shown in [Table/Fig-3]. The course of hospitalisation was briefly recorded as shown in [Table/Fig-4].

Scales	Week 1	Week 4
NPRS	5/10	1/10
ISWT	175 m	280 m
DASS-21	Moderate depression, anxiety, and stress	Mild depression, anxiety, and stress
WHOQOL-BREF	50.5	60.3

[Table/Fig-3]: The patient's improvement in outcome measures taken.
NPRS: Numerical pain rating; scale; ISWT: Incremental shuttle walk test; DASS: Depression anxiety stress scale; WHOQOL-BREF: World Health Organisation quality of life-brief version

Course	Weeks
Hospital stay for COVID treatment	3 weeks
Home stay after being discharged	1 week
Rehabilitation span	4 weeks

[Table/Fig-4]: Patient's course of hospitalisation.

DISCUSSION

The novel coronavirus has threatened the human population [9]. Not only are those with co-morbidities more prone to getting the infection but even those with no co-morbidities can also suffer from COVID-19 [10].

George PM et al., has documented the algorithm addressing the need of follow-up of COVID-19 patients. Those suffered from COVID-19 must go through a holistic assessment within four weeks of discharge [11]. Vanhorebeek I et al., have shown that a long Intensive Care Unit (ICU) stay causes acquired weakness and has a psychological impact on patients [12]. This case showed the prolonged stay of the patient at the hospital first due to COVID-19 and then due to its complications. Yang LL and Yang T, stated in a study about the consequences of COVID-19 that it has acute effects such as muscle dysfunction and weakness, long bed rest and reduced pulmonary function. The study was in favour with the present case study showing positive effects of pulmonary rehabilitation program where the session lasted for about 1-1.5 hours, 4-5 times per week.

Aerobic training was given for 30-40 minutes along with resistance training [13]. In this case, the effectiveness of inpatient pulmonary rehabilitation along with medical care was seen which resulted in rapid recovery of post COVID patients. Weerahandi H et al., stated that a rehabilitation program does not reverse the structural changes that are occurred due to COVID-19 but improves the efficiency of the body to cope-up with complications that have occurred [14]. An integrated pathway in COVID-19 rehabilitation has been established for the survivors according to their symptoms and needs [15]. In the present case report, the patient was admitted to ICU with COVID-19 positive and came to the rehabilitation centre with symptoms of long COVID-19. In the initial days, the intervention was focused on education, psychological support and breathing exercises. These exercises collectively showed improvement in the maintenance of oxygen saturation followed by aiming at improving the functional capacity. Improvements were seen in all the components with which the patient came for rehabilitation.

Pulmonary rehabilitation program is proven to be an effective option for patients who suffered with COVID-19, where the outcomes were measured on 6 minute walk distance, pulmonary function and quality of life before and after the intervention given [16]. Also, with the rise of this pandemic and the physical mode of transmission of the disease, fear has been significantly increased among people to go for institution-based pulmonary rehabilitation program. Patients are advised to be at home and avoid contact with others. Some typical hospital or clinic centred pulmonary rehabilitation programmes have converted some or all of their learning materials to home-based telerehabilitation during the pandemic to meet this significant care gap. However, some barriers are also there in implementing this approach [17].

CONCLUSION(S)

The outcome of the present study showed that a holistic, individually tailored pulmonary rehabilitation program is safe and has demonstrable health advantages and well-being in post COVID-19 patients with symptomatic long COVID-19. A properly planned rehabilitation program containing education of the patient, goal oriented breathing exercises and aerobic training is necessary in patients with long COVID-19 to reach realistic functional goals. Relaxation techniques, breathing exercises, postural correction techniques to reduce the load of breathing and aerobic exercise in

the form of walking showed significant improvement in the functional capacity and overall quality of life of post COVID-19 patients.

Author's contribution: PRB made substantial contributions to the conception and design of the manuscript, been involved in drafting the manuscript and VV has revised it critically. PRB and VV have given final approval to the manuscript.

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