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Case Report

Tele-rehabilitation of a middle-aged female with bronchiectasis as post COVID-19 sequelae: a case report

Chhaya V. Verma, Rutuja Kamble*

Physiotherapy School and Centre T.N. Medical College and B.Y.L Charitable Hospital, Maharashtra, India

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***Correspondence:**
Dr. Rutuja Kamble,
E-mail: rutujak35@gmail.com

ABSTRACT

COVID-19 pneumonia causes dilatation of lung parenchyma which leads to destruction of segmental bronchi that can further progress into bronchiectasis. COVID-19 causes many sequels in the respiratory system and frequently presents with dyspnoea, fatigue, loss of strength, reduced functional capacity and sometimes severe multi-organ affection. Physiotherapy interventions through tele-rehabilitation have acquired a fundamental role in the recovery of the functions and quality of life. Pulmonary tele-rehabilitation which is done in this case report study includes patient education, respiratory care, exercise training, ambulatory program with supplementary oxygen, strengthening, endurance training and energy conservation. All these interventions play an important role in patent's treatment protocol from hospital discharge to resuming work by assisting in weaning of supplementary oxygen, improving functional capacity of lungs and thus facilitating recovery. Rehabilitation of COVID-19 causing bronchiectasis in healthy individual has not been reported in literature yet. So, here we present a case report of tele-rehabilitation of a middle- aged female who developed progressive bronchiectasis as a sequela of COVID-19 pneumonia evident on serial chest CT scans.

Keywords: Pulmonary rehabilitation, COVID-19, Tele-rehabilitation, Post COVID-19 sequelae

INTRODUCTION

COVID-19 pandemic in India is a part of the world-wide pandemic of coronavirus disease caused by severe acute respiratory syndrome coronavirus 2 (SARS- CoV2) as of August 2021. According to updated official figures, India has the second highest number of confirmed cases in world.[1] SARS-CoV-2 is notably genetically similar to SARS-CoV-1, with 86% similarity in their respective genomes. COVID-19 from past experience of SARS-CoV-1 and a recent study of the long-term consequences of SARS infection noted chronic lung injury as sequelae of the infection. In addition to the interstitial changes seen in the immediate recovery phase of severe acute respiratory distress syndrome, it is likely that long-term post-infective bronchiectasis may be a more perceptible complication of this pandemic.[2,3]

Bronchiectasis has several aetiologies, the most common being post-infective and accounts for almost one-third of cases.[4] Traction bronchiectasis is a subtype of it whereby the bronchi are dilated secondary to mechanical traction from fibrosis of the adjacent lung parenchyma. It is therefore plausible that if severe COVID-19 results in fibro proliferative lung disease that traction bronchiectasis becomes evident.[5] Many cases of COVID-19 causing pneumonia and ARDS have been reported but no significant evidence is available for COVID-19 causing bronchiectasis.[6] One very recent study analysed the radiological changes after severe pneumonia due to COVID-19 which observed that approximately a quarter of patients had developed bronchiectasis.[7]

The goal of physiotherapy rehabilitation is to enable the patient to further increase physical activity and improve functional capacity. Prolonged hospital admission or

isolation greatly reduces the functional capacity, resulting in muscle weakness, low exercise endurance, weakness and fatigue. Long periods of absence from social and family activities can also make patients feel isolated. Prolonged isolation may also lead to negative psychological effects like depression, anxiety. The purpose of physiotherapy treatment in discharged patients is to enable patients to return to society, restore their organic functions and prevent psychological disorder.[8]

CASE REPORT

A 55 years old female residing in Delhi, Income tax officer by profession, known case of diabetes mellitus and bronchial asthma since 10 years, presenting with complaints of breathlessness (mMRC grade 3), intermittent dry cough and fatigue, restricting her activities of daily living such as walking, grooming, bathing etc. She was diagnosed as COVID-19 pneumonia on 28th April 2021 and was admitted in hospital for 4 weeks. She was on non-rebreather mask (NRBM) with 15 l of O_2/ minute. Her detailed medical investigation and physiotherapy management have been mentioned in Table 1-3. Patient was discharged on 22nd May 2021 and physiotherapy treatment started on 11th day of discharge through teleconsultation.

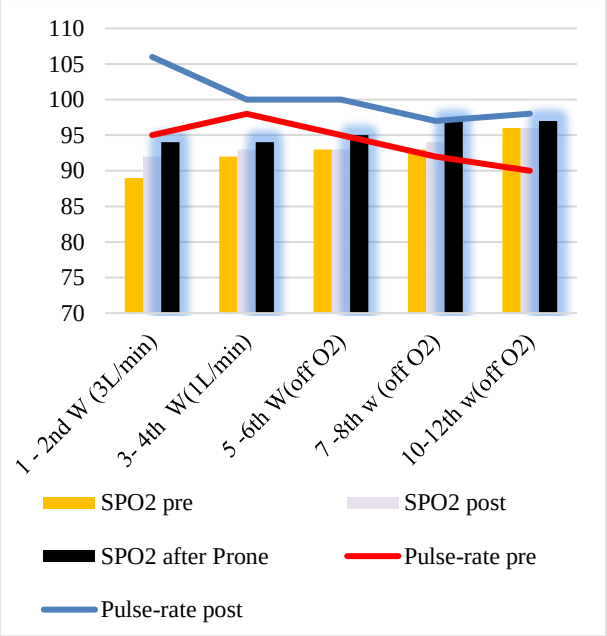

Figure 1: Changes in parameters during physiotherapy rehabilitation.

W-Week, SPO_2-Saturation of peripheral oxygen, L/min-Litre/minute, off 0_2 -No supplemental oxygen.

Table 1: Investigation and medical management.

Variables		Results
RT-PCR test		
28/04/2021		COVID-Positive
21/05/2021		COVID-Negative
Investigation		
HRCT	4/5/2021	CTSS-17/ 25 (Moderate) CORADS-5 Findings: Multifocal and peripheral ground glass densities suggestive COVID pneumonia
	20/5/2021	CTSS-19/25 (Severe) CORAD-6. Findings: Multifocal and peripheral ground glass densities with fibro-elastic changes with minimal traction bronchiectasis in bilateral lungs. Mild pulmonary hypertension
	20/8/2021	CTSS- 13/ 25 (Moderate) CORADS- 5 Findings: Sequelae of atypical pneumonitis and mild restrictive defect with impaired diffusion.
Medical management: It included oxygen therapy (NRBM/ NC) and medications like remdesivir, LMWH, ecosprin, augmentin-500, multivitamin, and metformin-500 were prescribed		

Rt-pcr test-reverse transcription polymerase chain reaction, CTSS-Chest CT severity score, LMWH-Low molecular weight heparin.

Table 2: Physiotherapy management.

Physiotherapy treatment duration	Week 1-2	Week 3-4	Week 5-6	Week 7-8	Week 8-12
O_2 therapy-nasal prongs (L/Min)	3L →1L	1L→ off 0_2	0ff 0_2	0ff 0_2	Off 0_2
Oxygen saturation	89%→ 90%→ 92%	92% →93%	93%	93% →94%	96%
Therapeutic positioning (prone position)	94%	94%	95%	97%	97%
Relaxation	√	√	√	√	√
Breathing exercise	√	√	√	√	√
Incentive spirometry	×	400 cc	900 cc	1200 cc	1200 cc
Strengthening exercise	×	×	√	√	√

DISCUSSION

Bronchiectasis occurs due to repeated stress to the lung in form of inflammation with failure to clear the mucoid secretions. The main cause of bronchiectasis is transmural lung infections such as pulmonary TB and Pneumonia. COVID-19 pneumonia causes dilatations of lung parenchyma which leads to destruction of segmental bronchi that can further progress into bronchiectasis.[5] This case represents the effectiveness of pulmonary tele-rehabilitation in a patient who was admitted in hospital for a prolonged period and discharged with supplemental oxygen. The main goals of pulmonary tele-rehabilitation were to wean off O_2 support as early as possible, to maintain oxygen saturation while performing activities, to speed up the recovery, to achieve independence in her daily activities and to get back to her pre COVID-19 lifestyle.

Physiotherapy assessment and examination were taken on first session through telecommunication. Breathing exercises such as breathing control, pursed-lip breathing, diaphragmatic breathing, breath stacking, incentive spirometry were started. Bed exercises like ankle toe movements, heel slides; active ROM exercises of wrist, elbow and shoulder were started. As she was diagnosed with traction bronchiectasis along with COVID-19 at the time of discharge her oxygen saturation used to drop down by 3-4% in initial 2 weeks of tele-rehabilitation just by performing bed mobility exercises. Hence we added pacing techniques and pursed-lip breathing while performing every activity. The SpO_2 in 1st week on 3L O_2 by nasal prongs was 89% and after the physiotherapy treatment, she could achieve around 94% of saturation (Table 2 and Figure 1). The main goal of acute post COVID-19 rehabilitation phase was to maintain saturation, prevent chest complications and to achieve functional recovery by performing low intensity graded functional exercises (RPE-2 or 3) on Modified Borg's scale. Strenuous activities were contraindicated in acute phase as they can cause immune suppression.[8]

Prone positioning was advised to the patient as per her tolerance after every 2 hours and the duration was gradually increased from 10 minutes to 20- 30 minutes. Patient's saturation always improved by 3 to 4% in prone position (Table 2 and Figure 1). The prone position enables redistribution of alveolar ventilation and perfusions as higher density of pulmonary vessels are present in dorsal lung region. In prone position relative increase in ventilation in dorsal nondependent areas result in improved V/Q matching.[4,9,10]

For further progression, patient was taken into sitting position for active upper limb and lower limb ROM exercises. In sitting, dynamic quadriceps and active ROM exercises were given after which progression was made to standing position with spot marching, sit to stand, balance exercises and walking around the bed. While doing these activities she used to feel fatigued so it was necessary to give rest in between with pacing as it is considered to prevent post exertional malaise.[8] As per the guidelines, drop of SpO_2 >3 % and increase in pulse rate above 120 beats per minute meant terminating the exercise and giving rest to the patient to restore stable vitals and continue thereafter.[11,12] The patient's pulse rate and oxygen saturation were continuously monitored during each exercise using pulse oximeter and exercises were progressed depending on patient's rate of perceived exertion (RPE).

When patient was able to tolerate standing position, progression was made to aerobic, endurance and strength training exercises of upper and lower limb muscles by around 5th week post-discharge. The strengthening of upper limb muscles started with a half-liter water bottle then progressed to a 1-liter water bottle. After this, light Resistance band activities were added in exercise protocol as a progression. To check the aerobic capacity of patient sit to stand, 2 minute step test and symptom limited walk test were repeated after every 2 weeks and according to the test result progression of exercises was prescribed to the patient (Table 3).

Table 3: Patient related outcome measure before and after physiotherapy rehabilitation.

Outcome measures	Pre assessment	Post 12 weeks of physiotherapy
Sit to stand test/ 1 minute	14	36
Step test/ 2 minute	15	40
Fatigue severity scale	56/63	6/63
COVID-19-QoL	17	12
PCFS scale	3	1
IPAC score	1405 MET min/ week	477 MET min/ week

The patient was evaluated before and after rehabilitation by using physical test and scales which included sit to stand test, step test, FAS, COVI19-QoL, PCFS scale and IPAC which showed good improvement in physical performance and quality of life. The 6-minute walk test is important to assess aerobic capacity and endurance in pulmonary rehabilitation but due to distance limitation in patient's house and through telecommunications proper command and safety of patient can't be ensured hence submaximal 6-minute walk test was not taken instead of that submaximal step test taken.

One minute sit to stand test used to assess leg muscle strength and endurance showed better improvement after rehabilitation. Step test also showed improvement from 15 steps/2 mins to 40 steps/2 mins. Fatigue severity scale (FSS) measured how fatigue interferes with certain activities and rates its severity according to self-reported numbers showed less fatigue after treatment.

The COVID-19-QoL scale showed a reduction of a score by 5 numbers indicated improvement in quality of life. As physiotherapy treatment continued patient was able to do exercises and daily activities without supplementary oxygen. The PCFS discusses the patient's current functional status showed better improvement at the end of treatment. According to the IPAC score, the patient was performing vigorous level intensity activity (e.g., Badminton for 1 hour 5 times/ week i.e., 1405 MET min / week) and after tele-rehabilitation, post 3 months she could accomplish mild level physical activity i.e., 477 MET min/ week.

In this case study, exercise prescription was focused on the treatment goals based on patient's current needs, her activity level, occupational status and physical functions. So accordingly, exercise protocol was divided into upper limb and lower limb exercises and suggested for 5 days/week (ACSM).[13,14] Breathing exercises and positioning were advised every day according to patient's convenience. After the physiotherapy treatment patient was managing all ADLs without breathlessness, fatigue and could walk for 15 to 20 minutes. A gradual increase was observed in oxygen saturation and functional capacity score as mentioned in Tables 1 and 2. Stair climbing used to be very difficult for her but now she can climb two flights of stairs easily. Currently, she has resumed her work after one and a half months of physical rehabilitation.

CONCLUSION

Physical tele-rehabilitation plays an important role in patient education and counselling, improving aerobic capacity and endurance, energy conservation, peripheral muscle strength and relaxation using guided and skilled techniques. Tele-rehabilitation has acquired important aspect in pandemic to meet rehabilitation needs of those in isolation where face to face treatment is not possible in scenario of infection control. Post COVID-19 sequel impairs the individual's ability to resume pre COVID-19 functional status. Hence to avoid post complications, this case report study focuses on the exercise prescription based on patient's current needs, safety, physical functions and activity level by using tele-rehabilitation.

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