International Journal of Scientific Reports
Rasal SS et al. Int J Sci Rep. 2021 Nov;7(11):551-555
http://www.sci-rep.com

pISSN 2454-2156 | eISSN 2454-2164

DOI: https://dx.doi.org/10.18203/issn.2454-2156.IntJSciRep20214104

Case Report

Physiotherapy interventions facilitating recovery in COVID-19 patient on immunosuppressive therapy and with multiple comorbidities: a case report

Sayali S. Rasal, Sushama A. Bhandare*, Saraswati K. Iyer

Department of Physiotherapy, PT School and Centre, Seth GS Medical College and KEM Hospital, Mumbai, Maharashtra, India

Received: 11 September 2021
Accepted: 12 October 2021

***Correspondence:**
Sushama A. Bhandare,
E-mail: sushamab7@rediffmail.com

ABSTRACT

The global pandemic of the Coronavirus disease 2019 (COVID-19) has increasingly emerged as a multisystem infection with a wide spectrum of patient presentation, clinical severity and eventual outcomes. Physiotherapy treatment is pivotal to combat the consequences of the viral infection assisting timely functional recovery. Early intervention, routine assessments and tailormade rehabilitation programs aid in the comprehensive management of the patient and reduce further debilitating long COVID sequelae. This case report describes the course of a COVID-19 patient admitted in a COVID dedicated ICU, on immunosuppressive therapy and with multiple comorbidities, receiving daily physiotherapy treatment from admission to discharge. The change in the functional status was assessed using various outcome measures namely single breath count, breath holding time, Medical Research Council sum score, 30 sec sit to stand, timed up and go and 6 min walk test demonstrating a positive effect of physiotherapy interventions in facilitating recovery in the patient.

Keywords: COVID-19, Physiotherapy, Immunosuppressive therapy, Comorbidities

INTRODUCTION

The Coronavirus 2019 disease (COVID-19) is caused by the novel beta zoonotic virus called the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2).[1] The commonly presented symptoms include fever, cough, dyspnea, fatigue and myalgia. Other frequently encountered symptoms include chest pain, thromboembolic disorders, arthralgia, headache, dizziness, gastrointestinal disturbances and metabolic disorders.[2] The human Angiotensin converting enzyme 2 (ACE-2) receptors abundantly expressed in the pulmonary system serve as the entry port for the virus. The ACE-2 receptors are also found in other organs namely the heart, small intestine, kidneys, thyroid, testis and adipose tissues further indicating the multisystem involvement. The entry of the virus leads to a cascade of infection induced cell death and injury to the epithelial surfaces.[3] This hyperinflammatory profile leads to a marked elevation of circulating proinflammatory cytokines and chemokines (cytokine storm) and other biomarkers of inflammation.[4] The key hallmark of COVID-19 severity is the progression to systemic disease with multiorgan damage and failure as a result of unrestricted inflammation, direct viral infection, endothelial dysfunction and hypoxic mediated dysfunction.[5]

Early physiotherapy intervention is an important adjunct and critical evidence-based component in the management of COVID-19 patients. A variety of treatment techniques can be applied for patient care depending upon the disease severity, patient cooperation and associated comorbidities.[6] It has clinically proven to prevent, reduce the adverse consequences and long term impairments associated with COVID-19 infection.[7] Physiotherapy interventions in COVID-19 patients in the form of

therapeutic positioning, breathing exercises (diaphragmatic and segmental breathing exercises, thoracic expansion exercises, crocodile breathing), chest proprioceptive neuromuscular facilitation techniques (chest PNF), mobility exercises, incentive spirometry and ambulatory training have shown benefits in aiding clearance of secretions, facilitating lung ventilation and perfusion match thereby improving lung function, mitigating adverse effects of immobilization and ICU acquired weakness and thus aiding functional recovery.[8]

The following case report describes the clinical presentation of a COVID-19 patient with multiple comorbidities, admitted in a COVID dedicated ICU. The patient being a renal transplant recipient, was on immunosuppressive therapy. The patient received optimal medical management along with one supervised physiotherapy session daily. The changes in the functional status with daily physiotherapy interventions were assessed periodically using simple clinical outcome measures namely Single breath count (SBC), Breath holding time (BHT) to assess pulmonary function, Medical Research Council (MRC) sum score to assess muscle strength, 30 seconds sit to stand (30 sec STS) to gauge lower extremity strength and endurance, Timed up and go (TUG) to assess balance and 6 min walk test (6MWT) to assess cardiorespiratory endurance.

CASE REPORT

A 52 years old male, retired personnel, presented with complains of fever, chills, dry cough, diarrhea and tingling numbness in bilateral upper extremities persistent since 5 days. The patient had tested SARS-CoV-2 positive on RT-PCR test 3 days prior to hospital admission and was on home quarantine in view of positive contact history. However, he noticed oxygen desaturation on activity and reported to the hospital. His vitals on admission were heart rate: 100 beats per minute, SpO_2: 97% (rest) and 92% (on walking), blood pressure: 100/60 mmHg (on standing) and 114/74 (on lying). He was admitted to the COVID dedicated ICU and was put on supplemental moist oxygen via nasal cannula (NC) at 4 l/min to maintain SpO_2 at 98%. The patient is a renal allograft transplant recipient, 25 years back due to end stage renal disease with chronic glomerulonephritis and is on dual immunosuppression (prednisolone and azathioprine). He also had a past history of pulmonary Koch's 27 years back for which he completed one year long Anti-Koch's treatment (AKT). The patient was diagnosed with osteoporosis 7 years back. He also underwent staple haemorrhoidectomy for haemorrhoids 4 years ago. The patient also complained of chronic cough 2 years back with investigations revealing centriacinar emphysematous changes in the lungs. He is a known hypertensive, taking regular antihypertension medications and has central obesity. The patient had also received the first dose of Covishield vaccine 63 days prior to hospital admission.

Radiological findings of chest X-ray revealed non-homogenous opacities in bilateral lung fields and high-resolution computer tomography showed multifocal areas of ground glass opacities, reticulations, interlobular septal thickening and fibrosis predominantly in bilateral upper and lower lobes with 30-35% lung involvement. The CT severity score was 10/25 indicating moderate severity.

The patient received optimal pharmacological treatment: tablet azathioprine, tablet pantoprazole, tablet amlodipine, tablet wysolone, tablet shelcal, tablet rantac, injection remdesivir. He also received one supervised session of physiotherapy treatment daily. With improvement in his condition, the supplemental oxygen was gradually tapered from 4 l/min via nasal cannula to room air as the ability to maintain oxygen saturation improved. The patient also showed improvement in the functional status in terms of improvement in the breathing pattern and dyspnea control, efficient secretion clearance and the ability to ambulate without oxygen desaturation. The patient was discharged 18 days after admission.

Table 1: Blood investigations.

Parameter	Day of assessment	Findings	Inference
CRP	Day 2	43.8 mg/l	Elevated
IL-6	Day 2	5.8 pg/ml	Normal
	Day 4	7.1 pg/ml	Normal
D-dimer	Day 2	0.6 mg/l	Elevated
LDH	Day 4	621.5 IU/l	Elevated
Haemoglobin	Day 4	13.1 g/dl	Reduced
	Day 5	12.5 g/dl	Reduced
	Day 6	13.1 g/dl	Reduced
Creatinine	Day 1	1.4 mg%	Normal
	Day 4	1.5 mg%	Normal
	Day 6	1.4 mg%	Normal

Note: CRP- C-reactive protein, IL-6- Interleukin 6, LDH- Lactate dehydrogenase.

Table 2: Change in oxygen saturation with physiotherapy interventions.

Parameters	Day 1-day 5	Day 6-day 10	Day 11-day 15	Day 16-day 18
O_2 status	4 l/min - 2 l/min via NC	2 l/min - 1 l/min via NC	1 l/min via NC to Room air (RA)	RA
SpO_2 (at rest) (%)	99	98	98	97
SpO_2 (with PT treatment) (%)	91	91	93	90
SpO_2 (on recovery) (%)	98	99	98	98
Positioning	✓	✓	✓	✓
Breathing exercises	✓	✓	✓	✓
Mobility exercises	✓	✓	✓	✓
Standing	✓	✓	✓	✓
Incentive spirometer (cc)	×	500-600	700-800	1000
Spot marching	×	✓	✓	✓
Ambulation (m)	×	50-100	100-250	300

Table 3: Improvement in outcome measures with physiotherapy interventions.

Parameters	Day 1	Day 5	Day 12	Day 18
SBC	9	14	21	30
BHT (sec)	11	19	25	35
MRC sum score	48/60	48/60	52/60	52/60
30 sec STS (repetitions)	Not performed	4	9	13
TUG (sec)	Not performed	Not performed	15	13
6MWT (performed on RA)	Not performed	Not performed	257 m 2 rest pauses SpO_2 drop to 88%	300 m No rest pause SpO_2 drop to 92%

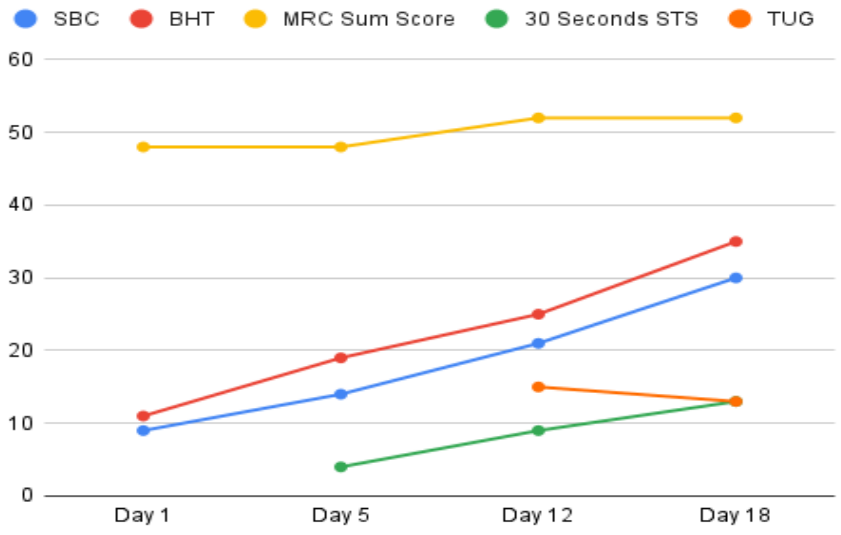

Figure 1: Graphical presentation of improvement in outcome measures with physiotherapy interventions.

The various blood investigations performed during the ICU stay are shown in Table 1. Elevated CRP, D-dimer and LDH values indicate an ongoing inflammatory process and tissue damage in the body. The patient also had reduced hemoglobin level on repeated investigations.

The improvement in the oxygenation status and the various physiotherapy interventions incorporated in the rehabilitation program are summarized in Table 2.

Various outcome measures were assessed periodically. The incremental trend in the subsequent performance of the outcome measures indicates a substantial and positive effect of physiotherapy interventions suggesting an improvement in the patient status as seen in Table 3 and Figure 1.

DISCUSSION

The physiotherapy intervention program was based upon the guidelines given by the Maharashtra State Council for Occupational Therapy and Physiotherapy for chest physiotherapy management of COVID-19.[9] The program was custom made and gradually modified to accommodate the change in the transition of supplemental oxygenation to room air and improvement in the functional status. The patient was educated about the physiotherapy program, the benefits of the intervention, importance of compliance to the regime and encouraged to ask questions and seek reassurance. The patient was supervised during the physiotherapy treatment session using a pulse oximeter and the heart rate and oxygen saturation response to interventions were recorded.

The patient was advised positioning in accordance to the CARP protocol comprising of two hourly changes in positioning into left lateral recumbent, right lateral recumbent, upright sitting with 60-90 degrees head end elevation and prone lying.[10] Spending more time in prone lying was encouraged as it lead to a steady rise and maintenance of SpO_2. The prone lying position shifts the weight of the mediastinum ventrally, improves the dorsal motility of the diaphragm thereby augmenting increased alveolar recruitment in the posterior basal segments of the lung leading to greater alveolar recruitment and compliance. This eventually leads to more uniform and improved ventilation and reduced ventilation-perfusion mismatching.[11]

The patient was taught controlled breathing exercises focusing on diaphragmatic activation and purse lip exhalation to aid in controlling the respiratory rate thereby reducing the work of breathing and also improving venous return. The use of accessory muscles of respiration was discouraged. The patient performed 10-15 repetitions of diaphragmatic breathing exercise, segmental breathing exercises (apical, lateral coastal and posterior basal), thoracic expansion exercises and crocodile breathing exercise. Flow based incentive spirometer was initiated from day 6 and gradually progressed. Different breathing exercises were performed to target different predominant lung zones and augment improved lung ventilation.[12]

Early mobilization was initiated to combat the adverse effects of immobility and ICU acquired weakness.[13] In-bed mobilization exercises included ankle toe movements, heel slides, straight leg raises, hip abduction and adduction, wrist pumps, elbow flexion and shoulder flexion and abduction exercises. Bed side mobility exercises included dynamic knee extension and hip raises. 10 repetitions of each exercise were performed. Standing was initiated day 3 onwards. Sit to stand, one leg standing and spot marching were incorporated to get the patient ready for ambulation. Ambulation was gradually initiated with walking bedside with supplemental oxygen day 6 onwards. The oxygen was titered to maintain SpO_2 above 90% at all times. Gradual increments in the ambulation distance were made with improvement in the patient status with the patient eventually walking upto 300 m on room air without undue fatigue or rest pauses.

In addition to the one supervised physiotherapy session, the patient also performed all the exercises unsupervised during the day at periodic intervals with emphasis on positioning, incentive spirometry and breathing exercises performed two hourly.

The effect of physiotherapy interventions on the functional status of the patient were periodically assessed using simple and convenient outcome measures. Taking into consideration the multisystem involvement of COVID-19, the outcome measures were selected to assess multiple functional systems. SBC and BHT are both simple bedside assessment tests of pulmonary function requiring breath holding maneuvers to perform the tests.[14] The MRC sum score is a quick assessment tool for evaluating muscle weakness by assessing the manual strength of six muscle groups (shoulder abductors, elbow flexors, wrist flexors, hip flexors, knee extensors and ankle dorsiflexors).[15]

The 30 sec STS test required the patient to perform as many repetitions of full standing from a chair seated position in 30 sec and is therefore a quick assessment test of lower extremity strength and endurance. The TUG test is designed to assess the balance and risk of fall. The patient was instructed to stand up from a seated position in a chair, walk a distance of 3 meters, turn around, walk back and sit down again. The time taken to complete the test was noted.[16] The 6MWT is a simple level ground walking test, performed in accordance to the American Thoracic Society, 2002 guidelines to assess cardiopulmonary endurance and is highly reflective of the capacity of perform activities of daily living.[17] Table 3 and Figure 1 show the improvement in the subsequent performance of the outcome measures indicating a positive effect of physiotherapy interventions in improving the overall functional status and facilitating patient recovery.

CONCLUSION

Physiotherapy interventions during the course of the hospital stay proved to be beneficial in the recovery of the patient. It proved to be an important adjunct in addition to optimal medical management to improve the clinical and functional status of the patient.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Chatterjee P, Nagi N, Agarwal A, Das B, Banerjee S, Sarkar S, et al. The 2019 novel coronavirus disease (COVID-19) pandemic: A review of the current evidence. Indian J Med Res. 2020;151(2):147-59.

2. Rothan HA, Byrareddy SN. The epidemiology and pathogenesis of coronavirus disease (COVID-19) outbreak. J Autoimmun. 2020;109:102433.
3. Ou X, Liu Y, Lei X, Li P, Mi D, Ren L, et al. Characterization of spike glycoprotein of SARS-CoV-2 on virus entry and its immune cross-reactivity with SARS-CoV. Nat Commun. 2020;11(1):1620.
4. Soy M, Keser G, Atagündüz P, Tabak F, Atagündüz I, Kayhan S. Cytokine storm in COVID-19: pathogenesis and overview of anti-inflammatory agents used in treatment. Clin Rheumatol. 2020;39(7):2085-94.
5. Bohn MK, Hall A, Sepiashvili L, Jung B, Steele S, Adeli K. Pathophysiology of COVID-19: Mechanisms Underlying Disease Severity and Progression. Physiology (Bethesda). 2020;35(5):288-301.
6. Kalirathinam D, Guruchandran R, Subramani P. Comprehensive physiotherapy management in covid-19–a narrative review. Scientia Medica. 2020;30(1):38030.
7. Thomas P, Baldwin C, Bissett B, Boden I, Gosselink R, Granger CL, et al. Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations. J Physiother. 2020;66(2):73-82.
8. Shakerian N, Mofateh R, Saghazadeh A, Rezaei N, Rezaei N. Potential Prophylactic and Therapeutic Effects of Respiratory Physiotherapy for COVID-19. Acta Biomed. 2020;92(1):2021020.
9. Maharashtra State Coucnil For Occupational Therapy And Physiotherapy. 9. Guidelines for Chest Physiotherapy Management of COVID 19 in Indian Setup, 2020. Available at: https://mahaotandptcouncil.in/Images/icon/2043%20GUIDLINES%20CHEST%20PT%20COVID%20MS%20OT%20PT. Accessed on 01 September 2021.
10. Janus General Medicine Resuscitation & Acute Critical Care. COVID Awake Repositioning/Proning Protocol (CARP), 2020. Available at: https://emcrit.org/wp-content/uploads/2020/04/ COVID-CARP-Protocol-postable.pdf. Accessed on 01 September 2021.
11. Guérin C, Albert RK, Beitler J, Gattinoni L, Jaber S, Marini JJ, Munshi L, Papazian L, Pesenti A, Baron A, Mancebo J. Prone position in ARDS patients: why, when, how and for whom. Intensive Care Med. 2020;46(12):2385-96.
12. Tucker B, Jenkins S. The effect of breathing exercises with body positioning on regional lung ventilation. Aust J Physiother. 1996;42(3):219-27.
13. Kress JP, Hall JB. ICU-acquired weakness and recovery from critical illness. N Engl J Med. 2014;370(17):1626-35.
14. Bhandare SA, Rasal SS, Iyer SK. Correlation of peak expiratory flow rate and single breath count in normal adults. Int J Res Med Sci. 2021;9(7):1960.
15. Turan Z, Topaloglu M, Ozyemisci Taskiran O. Medical Research Council-sumscore: a tool for evaluating muscle weakness in patients with post-intensive care syndrome. Crit Care. 2020;24(1):562.
16. Ozcan KB, Ozsoy I, Akdeniz B, Ozpelit E, Sevinc C, Acar S, et al. Test-retest reliability and validity of the timed up and go test and 30-second sit to stand test in patients with pulmonary hypertension. Int J Cardiol. 2020;304:159-63.
17. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories. ATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med. 2002;166(1):111-7.

Cite this article as: Rasal SS, Bhandare SA, Iyer SK. Physiotherapy interventions facilitating recovery in COVID-19 patient on immunosuppressive therapy and with multiple comorbidities: a case report Int J Sci Rep 2021;7(11):551-5.