Case study

Combating a Case of COVID Pneumonia with ARDS – a Physiotherapist's Standpoint

Abstract

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus, affecting multiple organ systems. The disease usually presents as mild to moderate respiratory illness but in many cases has progressed to development of pneumonia and ARDS ultimately requiring ventilatory support and prolonged ICU stay. Prolonged immobilization itself is a harbinger of various complications drastically altering a patient's functional status. Physiotherapy plays a vital role in the management of COVID-19 symptoms as well as in the prevention of complications. This case report describes the progress of a 44-year old female patient diagnosed with COVID-19 presenting with subsequent pneumonia and ARDS. The patient was started with medical management and supplemental oxygen therapy. In combination to the above-mentioned protocols, physiotherapy treatment was also initiated. After 2 weeks of rehabilitation and drug therapy, the patient displayed improved respiratory function at room air and was able to independently ambulate with minimal breathing difficulty.

Keywords

COVID-19, physiotherapy, pneumonia, ARDS, rehabilitation.

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus, that affects various organs containing the Angiotensin-converting enzyme 2 (ACE-2) receptors, similar to the ones present in the pulmonary system. This leads to a multiorgan inflammation, creating a cascade of events worsening the patient's condition [1]. In moderate to severe cases, COVID-19 can cause pneumonia that progresses to acute respiratory distress syndrome (ARDS), which may require hospital stay, ventilatory support and Intensive Care Unit (ICU) admission [2]. The patient discussed in this case report met the ARDS criteria established in the Berlin consensus, including acute onset, abnormal radiological findings in the lung and abnormal oxygenation values [3]. A cardio-respiratory physiotherapist plays an invaluable role in the rehabilitation of critically ill patients by delivering evidence-based therapy to improve the patient's pulmonary, cardiac and overall function as well as preventing further complications and co-morbidities [4]. This case report discusses about the progress of a patient diagnosed with COVID-19 pneumonia associated with ARDS who underwent physiotherapy rehabilitation with details on assessment findings, rehabilitation plan and execution.

Case presentation

A 44-year-old female patient with a known history of Type 2 Diabetes Mellitus presented with remittent hyperpyrexia and progressive breathlessness associated with intermittent expectorating cough and scanty purulent sputum. In addition, the patient also had a possibility of COVID-19 exposure. The vitals on the day of admission were as follows: SPO2: 90% on 6 liters of Oxygen, Heart Rate: 82 beats/minute, Respiratory Rate: 20 breaths/minute, Blood Pressure: 164/86 mmHg, Temperature: 101.4º F associated with night sweats. A Reverse Transcription Polymerase Chain Reaction test (RT-PCR test) displayed a positive result that established the suspected diagnosis to initiate the COVID-19 Medical Protocol. Within 24 hours of admission into COVID ICU, the patient's existing symptoms aggravated further with the addition of two episodes of Hemoptysis.

Chest X-ray showed heterogenous infiltrates over bilateral lung fields (left > right) and reduced lung expansion, indicating features of COVID pneumonia with ARDS (Figure 1). Her ABG values revealed uncompensated respiratory alkalosis and hypoxemia with Partial pressure of Oxygen (PaO2) value of 66 mmHg.

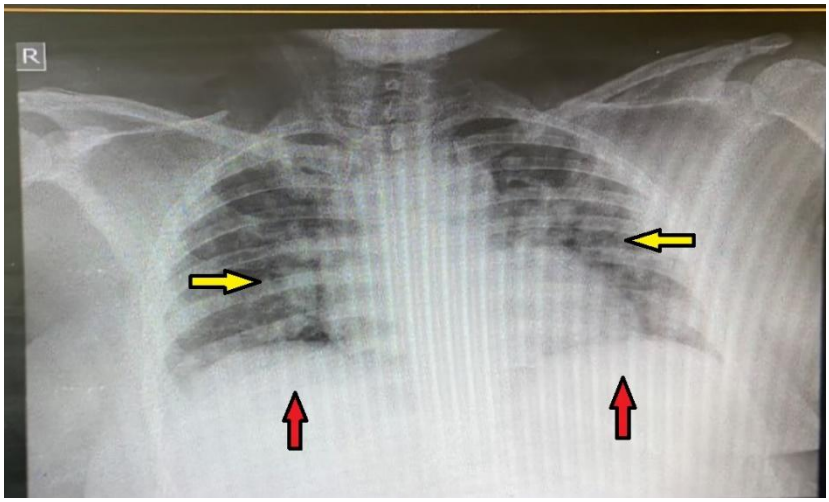

Figure 1: Chest X-ray of the patient on the day of admission shows heterogenous infiltrates over bilateral lung fields (yellow arrows) and reduced lung expansion (red arrows).

In conjunction with the medical management, the patient was also referred for Physiotherapy. After collecting extensive details of history of presenting illness and progress of the disease, a thorough bedside assessment was done which displayed the following findings: significant use of accessory muscles with supra-clavicular indrawing, labored breathing pattern with abnormal inspiratory-expiratory ratio, dull percussive note over bilateral lung fields (left > right and lower lobe > middle lobe > upper lobe), and audible polyphonic wheeze. The New York Heart Association classification of breathlessness, Fatigue Severity Score and Cough Symptom score were administered for an objective analysis of the patient's condition which reported Grade 4, Score 5.2 and Grade 2 respectively.

The clinical signs and symptoms presented by the patient were meticulously formatted into the International Classification of Functioning, Disability and Health (ICF) for organized analysis of the patient's condition (Table 1). This step helps in the structured planning of the patient's Rehabilitation Goals, focusing on symptoms-wise therapy and overall improvement in function. The following aspects in the ICF checklist were relevant for this patient:

Part 1A: Impairments of body function	**Part 1B: Impairments of body structures**	**Part 2: Activity Limitation and Participation Restriction**
<u>B4: Function of the cardiovascular and respiratory system.</u> b440.3 Respiration (Breathing)	<u>S4. Structures of the respiratory system</u> S430.3 Respiratory system	<u>d2. General tasks and demands</u> d220.2 Undertaking multiple tasks <u>d4. Mobility</u> d430.3 Lifting and carrying objects d450.3 Walking d470.3 Using Transportation <u>d5. Self-Care</u> d530.3 Toileting

Table 1: International Classification of Functioning, Disability and Health (ICF) of the patient's clinical presentation and findings

Having charted out the clinical presentation of the patient, a detailed rehabilitation protocol was planned (Table 2). The following were the Goals planned for this patient:

Short-term goals	**Long-term goals**

1. Improve tidal volume and alveolar ventilation. 2. Facilitate airway and alveolar clearance 3. Enable uniform distribution in all the lobes 4. Enhance lung compliance and respiratory biomechanics. 5. Decrease the work of breathing 6. Prevent multisystem complications that will lead to limited movement, recumbency, and potential deconditioning	1. Enhance the overall efficiency of the cardiopulmonary system. 2. Improve exercise tolerance and cardio-vascular endurance. 3. Educate the patient on maintenance of attained health. 4. Prevention of disease recurrence

Table 2: Long-term and short-term goals planned for the patient

The treatment was divided as immediate intervention and long-term intervention for achieving and maintaining sustained improvement in the patient's condition (Table 3).

Immediate intervention (administered twice daily once in the morning and other in the afternoon, with each session lasting 30-45 minutes including rest period)	Active-assisted body positioning: Initiated with Fowler's position progressed to edge of the bed sitting and standing.
	Pursed lip breathing
	Techniques to repattern breathing: Sniff Maneuver, Upper Chest Inhibition, Normal Timing.
	Inter-costal stretching and mobilization of thorax. Active cycle breathing technique
	Coordinated breathing with upper limb and lower limb movements.
	Self-assisted coughing and huffing technique.
	Incentive Spirometry.
	Jacobson's Relaxation technique
	Energy Conservation Techniques
Long-Term Intervention (administered once daily, with each session lasting 20-30 minutes including rest period)	-Progression to walking with supplemental oxygen. Weaning from supplemental oxygen initiated when SpO2 value was consistent within 98%-100% range.
	Two-minute walk test (2MWT) was administered to accurately calculate the exercise intensity for the patient which was derived as 30-40% of Maximum Heart Rate (MHR)
	Based on the calculation, the patient was started with monitored walking and stair climbing.
	The patient was further advised to gradually increase the intensity by 5% MHR every week.

Table 3: Immediate intervention and long-term intervention planned and provided for the patient during her hospital stay along with advice for progression after discharge

After 2 weeks of regular physiotherapy intervention, the patient was able maintain saturation of oxygen on room air. She was independently able to sit, stand and walk with minimal difficulty in breathing. She required significantly shorter rest intervals during exercises and could perform them for more repetitions and duration. Stair climbing was still a difficult task (ascending stairs > descending stairs) although the same was achieved in milder intensities and lesser frequencies on room air with no exacerbations. The patient's cough had improved, airway was clear and breath sounds were clear and equal bilaterally. The patient also reported lower levels of fatigue as compared to the time of admission. On the day of discharge, her vitals were as follows: SPO2: 99% on room air, Heart Rate: 84 beats/minute, Respiratory Rate: 17 breaths/minute, Blood Pressure: 135/80 mmHg, Temperature: 98.4º F. Chest X-ray showed significant improvement in aeration and lung expansion with reduced infiltrates and opacities bilaterally (Figure 2).

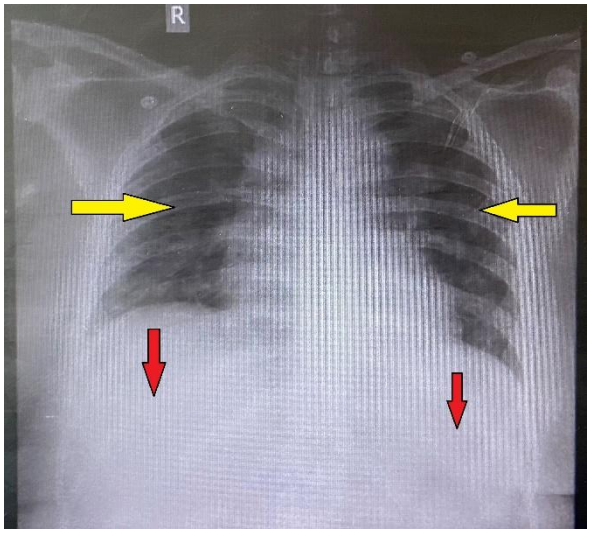

Figure 2: Chest X-ray on the day of discharge shows significant improvement in aeration and lung expansion with reduced infiltrates and opacities bilaterally.

Discussion

This case report aims to highlight the importance of early intervention of physiotherapy in COVID-19 patients. In COVID-19, the viral replication affects both the pulmonary vasculature as well as the endothelium. The release of inflammatory markers adds further damage to the microvasculature. The disease process also renders a state of hypercoagulability that shifts the physiological dynamics of the pulmonary system. This cascade keeps recurring in a loop causing repeated injury to the alveoli and the airway, which is responsible for the clinical presentation of the patient [3]. The scope of physiotherapy treatment in patients with COVID-19 pneumonia is vast. Multiple focal points are addressed such as reduced ventilation-perfusion matching, impaired airway clearance, pathomechanical movement of the thorax, reduced lung expansion, and reduced mobility [4-5].

The treatment protocol adapted for this patient are in tune with the various research articles analysed to ensure evidence-based care [4,6-7]. Several studies have shown the positive impact of exercises by directly enhancing the immune system, regulating the release of supportive defence mechanism i.e. immunoglobulins, macrophages etc. against the virulent material; by synchronising the release of C-reactive proteins that significantly aids the pulmonary defence mechanism [8-9]. In a study conducted by Scheiber B et.al., a vast majority of physiotherapists favoured an individually tailored rehabilitation program for the maximum benefit of the patient. This enables the physiotherapist to accurately assess the patient, analyse the findings and prioritise the treatment based on severity and urgency[10]. An awareness of the available literature for physiotherapy rehabilitation amongst the healthcare professionals is of utmost importance for the timely referral and initiation of treatment for the benefit of the patient.

Conclusion

As per the findings and results of this case report, it is evident that the patient benefited from the timely advent of physiotherapy intervention. The key factor was the correct identification of the problematic areas and accurate prioritization based on the clinical presentation and investigation findings. The long-term goal will guide the patient to achieve her functional status prior to COVID-19 exposure. Further studies are needed to accurately identify the effects of early intervention in critically ill patients during the acute phase and the importance of clinical reasoning in the healthcare community.

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