

# Rehabilitation Needs of Patients with Covid-19 in Acute Phase

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Received: 📅 April 23, 2020

Published: 📅 April 29, 2020

## Abstract

**Background:** COVID-19 (Coronavirus Disease 19) is a viral infection caused by SARS-Cov-2, that primarily affects the lower respiratory tract and causes several symptoms described as flu-like. Treatment of the disease generally consists of managing clinical symptoms and in case of more severe complications, patients require to be transfer to Intensive Care Units (ICU). Since this type of infection is extremely recent, there are only few studies on the rehabilitation of patients with COVID-19.

**Materials and Methods:** Papers were identified via a search of PubMed, Scopus and Pedro databases, in order to analyze the role of the physiotherapist in the intensive care units, in the management of non-invasive ventilation (NIV), not forgetting the risk of infection for healthcare professionals.

**Conclusion:** The analysis of literature carried out shows the importance of the physiotherapists in the management of critically ill patients in the ICU. Key goal of physiotherapy in ICU is the quality of long-term recovery, rather than short-term survival, and physiotherapists play a valuable role in achieving this goal. Finally, in the case of airway infections, the use of Personal Protective Equipment (PPE) should not be overlooked, especially because physiotherapeutic procedures generating aerosols are at high risk of transmission for infections.

**Keywords:** Physiotherapy; Physiotherapist; Covid-19; Coronavirus; Pulmonary rehabilitation; Chest physiotherapy; Intensive care unit

**Abbreviation:** ACBT: Active Cycle of Breathing Techniques; BIPAP: Biphasic Positive Airway Pressure; CPAP: Continuous Positive Airway Pressure; ECMO: Extra Corporeal Membrane Oxygenation; ICU: Intensive Care Unit; ILD: Interstitial lung diseases; MERS: Middle East respiratory syndrome; NIV: Non Invasive Ventilation; PPE: Personal Protective Equipment; PEP: Positive Expiratory Pressure; RICU: Respiratory Intensive Care Units; SARS: Severe Acute Respiratory Syndrome; MHI: Manual hyperinflation; PICS: Post-Intensive Care Syndrome

## Introduction

COVID-19 (Coronavirus Disease 19) is a viral infection caused by SARS-Cov-2 [1,2], that primarily affects the lower respiratory tract and causes a number of symptoms described as flu-like, including fever, cough, shortness of breath, myalgia and fatigue [1]; in severe cases pneumonia, Acute Respiratory Distress Syndrome (ARDS), sepsis and septic shock can occur, up to the death of the patients [3]. Treatment of the disease generally consists of managing clinical symptoms and in case of more severe complications, such as ARDS,

which develops in more than 40% of hospitalized patients, 10% require transfer to ICU (Intensive Care Unit) [4].

Since this type of infection is extremely recent, there are only few studies on the rehabilitation of patients with COVID-19, and among them we mention recommendations [5] published in China, a very recent international document [6], and an Italian position paper [7]. This article is a narrative literature review and the papers were identified via a search of PubMed, Scopus and Pedro

databases, in order to analyze the role of the physiotherapists in intensive care, in the management of NIV (Non Invasive Ventilation) and in relation to infection risk during aerosol-generating procedures. Due to poor results about Sars-Cov-2, we so referred to indications relating to Severe Acute Respiratory Syndrome, SARS (2002), Middle East respiratory syndrome, MERS (2012), Influenza epidemic management.

## Literature Analysis

### Role of the physiotherapist in the management of the patient in the ICU

Faverio et al. [8], in their review, stress the importance of rehabilitation in interstitial lung diseases (ILD) management. ILD are heterogeneous group of diseases characterized by fibrotic and inflammatory anomalies of the lung, so the lung injury and repair caused by COVID-19 has many similarities with ILD [9]. Faverio et al. in agreement with a previous paper [10], compare the efficacy of Extra Corporeal Membrane Oxygenation (ECMO) to invasive ventilation in the treatment of patients with ARDS. The studies highlight the possibility offered by ECMO of early mobilization and walking compared to invasive ventilation; 35 patients of 100 recruited in the study, underwent to physiotherapy, which is not only safe, but also useful for reducing complications and promoting faster recovery [8,10].

In a complete review, all possible interventions of the physiotherapist in Respiratory Intensive Care Units (RICU) are analyzed [11]. Patient management in ICU, includes bed rest still today, especially for patients with mechanical ventilation [12], however, it is already known that rehabilitation is an integral part of patient's management in this setting. Physiotherapy has the following objectives in this context: to improve the patient's functional capacity, to restore respiratory autonomy, and exercise capacity, reducing, therefore, the risks of complications associated with bed rest [13].

The main objective is certainly early weaning from invasive ventilation and many studies have analyzed the effectiveness of physiotherapy intervention in achieving that goal. We will, then, analyze below rehabilitation interventions that can be carried out in RICU, in relation to the effectiveness of each intervention.

### Positioning

It is considered a real treatment. It is used with the aim of improving the ventilation/perfusion ratio ( $V_0/Q_0$ ), lung volumes and mucociliary function, to reduce respiratory and cardiac work [13]. Specific examples of positioning to be used in intensive care are: positioning in a semi-upright position, to improve lung volumes and reduce respiratory work in patients who are weaned from mechanical ventilation; prone position to improve the ventilation/perfusion ratio, redistribute edema and increase residual

functional capacity (short-term oxygenation improvements for 57-92% of patients with severe acute respiratory failure)[13-15]. Regarding prone positioning, a strong appreciation is addressed to physiotherapist's positioning management due to the low incidence of accidental extubations, hypotensive crises and arrhythmia [14].

### Active/passive mobilization

Have significant effects on functional status, muscle strength, duration of mechanical ventilation, ability to walk and quality of life. Early mobilization is associated with greater exercise capacity at discharge, with an increase in the functional capacity of muscle strength [17,18]. There are some evidence also in favor of the use of the cycle ergometer and electrical neuromuscular stimulation [19]. Revisions about the use of neuromuscular stimulation, however, report very low- or low-quality tests on the beneficial effects of electrical muscle stimulation provided in ICU to improve muscle strength, trophism and polyneuropathy/myopathy [20,21].

### Chest rehabilitation

Includes early mobilization, inspiratory muscle training, manual hyperinflation, percussion/vibration of the chest wall, removal of secretions, guided cough. Study's results indicate that chest physiotherapy in ICU reduces extubation failure in patients with mechanical ventilation and significantly improves respiratory parameters, reduce the pulmonary infection rate, length of stay on mechanical ventilation, hospitalization and mortality [22-24].

### Manual hyperinflation (MHI)

Maneuver frequently used in seriously ill patients intubated and mechanically ventilated. Patients are disconnected from the mechanical ventilator and after their lungs are temporarily ventilated with a balloon for manual ventilation usually with the addition of 100% oxygen [25]. This maneuver is useful to simulate a physiological and effective cough. By moving the secretions of the smaller airways to the larger ones, it is then possible to easily remove the secretions by aspiration. In Paulus et al.'s review [26] there are no indications for the use of this technique in unstable, intubated and mechanically ventilated patients. Manual hyperinflation does not appear to be associated with a reduction in the duration of mechanical ventilation, permanence in the ICU and prevention of ventilator-associated pneumonia [26], and further studies are necessary to investigate the use of MHI by physical therapists for better understanding benefits and intrinsic risks [27]. Very interesting is a review investigating the role of physiotherapy in reducing the symptoms of post-intensive care syndrome (PICS) [28]. This syndrome is characterized by psychophysical problems that occur in critically ill survivors of ICU [29]; these impairments can be long lasting and adversely affect self-perceived quality-of-life. The potential benefits for patients participating in early rehabilitation in ICU are improvement of muscle strength, quality of life, reduction of hospital and intensive

care stay, reduction of mechanical ventilation and costs [30-32]. The studies analyzed show the importance of the multidisciplinary team in management of the critically ill patient and the need for evidence-based approaches for which research should certainly be implemented [28].

### **Role of the physiotherapist in the management of Non-Invasive Ventilation (NIV)**

Non-invasive ventilation (NIV) is a ventilation technique that provide ventilatory support for a patient with respiratory problems without a need for endotracheal intubation or tracheostomy. Understanding how the technique works and how to apply it appropriately is necessary to manage patients with respiratory failure effectively and appropriately [33]. Physiotherapists with advanced or specialized respiratory skills are well integrated in the assistance and management of patients who use NIV, also integrating airway clearance techniques such as respiratory exercises, use of Positive Expiratory Pressure (PEP), active cycle of breathing techniques (ACBT), assisted cough to manage acute and chronic respiratory failure [33]. A recent review aimed at producing guidelines on the training of healthcare professionals working with NIV. No clinical studies that examine the impact of education and training in the use of NIV as a primary objective were found. Therefore, some studies with indirect evidence have been identified, including a study based on simulation and narrative reviews. The review concludes that education and training have the potential to increase the knowledge and skills of staff using NIV. It is therefore desirable that all health professionals, and among them physiotherapists, participate in dedicated and homogeneous training programs at international level [34].

Finally, we analyzed a Italian study in which 201 patients were recruited in order to define a standardized protocol of adaptation to NIV, for patients with chronic respiratory diseases and, in the second instance, evaluate the role of the physiotherapist, also in terms of time used for each patient to educate him on the use of NIV [35]. As emerged from previous studies, the role of the physiotherapists in the United States is different Italy due to education system, and in usually focused on the choice of the ventilator and the mask, on the setting of the ventilator and on patient's training, while the role of the doctor is mainly related to the management of NIV [36-38]. Nursing staff are usually identified as being responsible for night monitoring and side effects such as damage to facial skin [36-38]. In Italy there are some differences in educations terms compared to the United States, and therefore also the activities carried out by physiotherapists with advanced skills and specific education in the respiratory field are different. In this study it emerges that they can play a key role in the management of patients with chronic respiratory diseases, sleep disorders, and with neuromuscular diseases [35]. The inclusion of physiotherapists in the management

of NIV and the standardization of procedures seems to reduce the time spent by other healthcare professionals in patient education by optimizing the management of the activities carried out. The cost-effectiveness of this management must be verified in wider clinical trial contexts.

### **Procedures at risk of infection for the physiotherapist**

In rehabilitation treatment of patients with Covid-19 in acute phase, the risk of infection for physiotherapists must be taken into great consideration since the rehabilitation techniques used normally are responsible for the generation of aerosols. The Canadian Guidelines developed in 2011 [39] on the occasion of the SARS Coronavirus epidemic, report the treatments most closely linked to the risk of infection for healthcare professionals: Biphasic Positive Airway Pressure (BIPAP), Continuous Positive Airway Pressure (CPAP), endotracheal intubation, airway aspiration, high frequency oscillatory ventilation, tracheostomy, chest physiotherapy, nebulizer treatments, airway clearance methods and bronchoscopy [40]. From the afore mentioned Guidelines [38] and from the studies conducted on the occasion of the SARS-Coronavirus epidemic, it appears evident the risk for physiotherapists who deal with acute respiratory rehabilitation for infected patients [40-42]. A risk reduction can be obtained with the use of Personal Protective Equipment (PPE), in particular a N95/FFP3 mask or equivalent, a completely waterproof gown, a visor, goggles and gloves, moreover these procedures should be carried out in a single room with a minimum number of highly qualified healthcare professionals present and especially in case of need [7,40,43].

### **Conclusion**

The analysis of literature carried out shows the importance of the physiotherapists in the management of critically ill patients in ICU. The ICU is a dynamic environment in which physiotherapists are an integral part of the multidisciplinary team of critical area providing various types of interventions, from chest physiotherapy in the acute phase, to prevention and recovery of motor deficits. Key goal of physiotherapy in ICU is the quality of long-term recovery, rather than short-term survival, and physiotherapists play a valuable role in achieving this goal [44]. It also Appears also to be important to define educational strategies both for healthcare professionals, so that they are properly educates, and for patients, who must be educated in the use of the devices, trying if possible, to produce shared guidelines [17,18]. Finally, in the case of airway infections, the use of PPE should not be overlooked [45], as the physiotherapeutic procedures generating aerosols are considered to be at high risk of transmission for infections as already seen for SARS-Coronavirus 2 [39,40] and therefore potentially dangerous for the physiotherapists who use them.

## Acknowledgements

All authors contributed to the literature search, identification of relevant studies, and writing of the paper.

## Conflict of Interest

The authors declare no conflict of interest.

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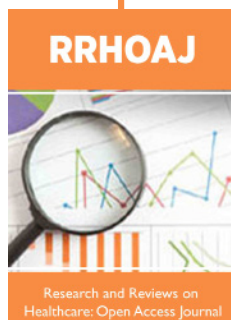
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DOI: [10.32474/RRHOAJ.2020.05.000204](https://doi.org/10.32474/RRHOAJ.2020.05.000204)



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