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## REVIEW ARTICLE

### Chest Physiotherapy in Patients Admitted to the Intensive Care Unit With COVID-19: A Review

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#### Abstract:

COVID-19, also commonly known as coronavirus, is presently declared a pandemic disease by the World Health Organisation (WHO). This disease is transmitted by close contact with infected patients who are either asymptomatic or symptomatic. About 5% of COVID-19 patients are admitted to the Intensive Care Unit (ICU) and present with either pneumonia or acute respiratory distress syndrome. Chest physiotherapy may be provided to some patients admitted in ICU who may be broadly classified into the following two groups: 1. Patients suspected or infected with COVID-19 with no underlying lung disease (Other than COVID-19) & 2. Patients suspected or infected with COVID-19 with underlying lung disease (Other than COVID-19). Generally, asymptomatic patients do not require chest physiotherapy, but symptomatic patients do. This literature review discusses the various chest physiotherapy techniques related to body positioning, breathing, airway clearance, and mobilization that can be provided to COVID-19 patients admitted to the ICU. More importantly, precautions to be taken by the physiotherapist involved in the care of COVID-19 patients in the ICU have also been reviewed.

**Keywords:** COVID-19, Chest physiotherapy, Intensive care unit, Symptomatic patients, Lung disease, Pandemic.

#### Article History

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## 1. INTRODUCTION

Coronavirus is a single-stranded RNA virus that belongs to the Coronaviridae family of viruses [1]. Subjects affected with this coronavirus develop Coronavirus disease, also known as COVID-19 [2]. Presently, this is a pandemic disease as declared by the World Health Organisation (WHO) worldwide. Patients acquire this infection if they come in close contact with infected persons who are either asymptomatic or symptomatic with cough and sneeze symptoms [3]. The respiratory symptoms observed in such patients are sore throat, dry, and mostly non-productive cough. Sometimes the clinical presentation is of mild respiratory tract infection (Influenza-like illness (ILI)), or the patient will show pneumonia or Adult Respiratory Distress Syndrome (ARDS) or may even present with respiratory failure late in the disease course. The acute respiratory illness is managed in the Intensive Care Unit (ICU),

and because of severe hypoxic respiratory failure, it may require oxygen therapy, Non-invasive Ventilator (NIV) support, or invasive ventilatory support along with other advanced care management [2]. The patient develops ventilatory limitation, dyspnea, and ventilation/perfusion ratio mismatch due to the respiratory system involvement [4].

Patients admitted to the ICU usually have dyspnea associated with decreased tidal volume, Ventilation-perfusion (V/Q) mismatch, and muscular dysfunction requiring chest physical therapy to optimize the body's oxygen transport system [5]. Evidence suggests that amongst COVID-19 patients, around 80% of patients are asymptomatic, 15% of patients present with mild symptoms requiring oxygen support, and 5% of patients are critically ill and may require intubation along with advanced airway management techniques [6]. The admission rate of COVID-19 patients is nearly 5% in ICU [7].

Chest physiotherapist provides airway clearance techniques, optimal patient positioning, and inspiratory muscle training that improve the ventilatory function in these patients.

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COVID-19 patients may present in two different manners, *i.e.*, some patients show severe hypoxemia with normal lung compliance, wherein the cause of hypoxemia is impaired pulmonary blood flow. On the other hand, there is a different subset of COVID-19 patients who present with severe hypoxemia and decreased lung compliance like ARDS [8].

COVID-19 has affected the lives of not only common people but also of health care professionals. Today, many hospital wards are converted into semi ICU and ICU to manage critically ill and intubated COVID-19 patients. The physical therapist is one of the intensive care unit team members who can play an essential role in managing even COVID-19 patients. During patient management, they are in close contact with the patient, and many of the interventions done by chest physiotherapists are aerosol-generating, and thus the therapist's safety is of great concern in such situations. A patient admitted to the ICU can be either suspected or infected COVID-19 patient with normal underlying lung or diseased lung pathology.

The review article aims to find the role of chest physiotherapy in COVID-19 infected patients admitted to the ICU. Thus, admissions in ICU can be of patients suspected or infected with COVID-19, with or without underlying lung disease (Other than COVID-19).

### **1.1. Chest Physiotherapy in COVID 19 Patients**

Generally, it has been observed that asymptomatic COVID-19 patients do not require chest physiotherapy, whereas symptomatic cases require chest physiotherapy as per their clinical presentation.

#### ***1.1.1. Patients Suspected or Infected with COVID-19 with no Underlying Lung Disease (Other than COVID-19)***

These are normal individuals with no previous history of any underlying respiratory disease. These patients may or may not require ventilatory support, depending on their clinical parameters.

#### ***1.1.2. Patients do not Require Ventilatory Support***

Patients may be on room air or high flow oxygen therapy through High Flow Nasal Cannula (HFNC). If a patient with normal underlying lung presents with pneumonitis, lower respiratory tract infection, and dry cough, chest physiotherapy will not be useful regarding airway clearance. Nevertheless, if the patient presents with exudative consolidation as evidenced radiologically (ultrasonography, chest radiograph, or computed tomography scan of the chest), chest physiotherapy for airway clearance is recommended.<sup>6</sup> If the patient presents with alveolitis or fibrosis (late in the disease course), chest physiotherapy aims to improve ventilation and oxygenation, decrease breathing, increase the respiratory muscle strength, and maintain muscles' strength [9].

#### ***1.1.3. Patients on Ventilatory Support***

These COVID-19 patients require ventilatory support in the form of invasive mechanical ventilation or NIV. Mostly these patients present as pneumonia associated with or without

hypoxemia, or they show ARDS-like presentation [1]. In such patients, the treatment line aims to improve oxygenation, increase respiratory muscle strength, airway clearance, and prevent deconditioning [9, 10].

#### ***1.1.4. Patients Suspected or Infected with COVID-19 with Underlying Lung Disease (Other than COVID-19)***

These are individuals with a previous history of respiratory diseases like Chronic Obstructive Pulmonary Disease (COPD), Interstitial Lung Disease (ILD), asthma, post tuberculosis sequelae, and bronchiectasis [9].

There may also be systemic co-morbidities like hypertension, diabetes mellitus, obesity, cardiac problems, oncological issues, and neuromuscular problems. Evidence suggests that patients with pre-existing co-morbidities have more fatality than those without co-morbidities [1].

#### ***1.1.5. Patients not on a Ventilator***

Patients may be on room air or high flow oxygen therapy through HFNC. If the patients have an underlying respiratory disease, they may have secretions in their airways, which may be associated with dyspnea. Repeated exacerbations of their underlying lung disease in the past would be a risk factor for current existing underlying pathology in the diseased lungs, which may well require intensive lung physiotherapy depending upon their ability to clear their airways actively or requiring assistance due to increased tenacity of the secretions [6, 10]. The treatment line here aims to improve ventilation, bronchial hygiene, dyspnea relieving techniques, improve functional limitations, and improve exercise capacity [9, 10].

#### ***1.1.6. Patients on a Ventilator***

These patients may be on invasive mechanical ventilation or NIV. As previously discussed, these patients mostly present as pneumonia associated with hypoxemia or exacerbations of their underlying respiratory disease. They may even have severe complications due to associated co-morbidities and may present with ARDS.<sup>1</sup> The line of physiotherapy treatment in such patients depends on their clinical presentation, but majorly, the treatment aims to improve ventilation, bronchial hygiene, improving functional limitation, early weaning, and prevention of deconditioning [6, 9, 10].

## **1.2. Physiotherapy Techniques used in ICU**

### ***1.2.1. Body Positioning***

Prone lying position is recommended in hypoxemic COVID-19 patients. It improves oxygenation and ventilation.<sup>6,11</sup> If the patient is not ventilated, an active prone lying position can be given, or an assisted position can also be given [10, 11]. Commands can be provided with audio-visual aids and charts to help prevent contact with COVID-19 patients and decrease transmission risk.

If the patient is on a ventilator, then rotational bed therapy can help prevent complications with adjustments. It helps to improve ventilation along with clearing of basal lung lobes. It also prevents deconditioning [12].

The minimum duration for prone positioning in COVID 19 patients is 12 hours per day. The position should be changed every 2 hours, and the side should also be switched.<sup>11</sup> Coordinated team effort is of paramount importance in turning intubated position and strict implementation of airborne infection control measures during the positioning maneuver.

### 1.2.2. Caution

The following precautions need to be taken during prone positioning of the COVID-19 patient:

(1) If the patient is on a ventilator, then during positioning, precautions should be taken to prevent the tubing from being accidentally disconnected, which may inadvertently lead to a sudden release of secretions [11].

(2) Physiotherapists and other assisting healthcare workers should wear complete personal protective equipment (PPE) and preferably be on the patient's backside to prevent direct contact with aerosol [6].

(3) Patients on a ventilator should be monitored closely during a change of position to prevent hemodynamic and cardiac problems in such patients [10].

(4) The therapist should be at least 2m apart from the patient during the session [6].

(5) The patient should wear a surgical mask during the treatment if not on a ventilator during physiotherapy treatment [6].

(6) If the patient is conscious, he must cough into the tissue that should be disposed of, and hand hygiene must be maintained [6, 10]

## 2. BREATHING TECHNIQUES

Various breathing techniques that may be utilized are diaphragmatic breathing technique, pursed-lip breathing, segmental breathing exercise, and inspiratory muscle training technique [13]. These exercises may be utilized in non-ventilated patients who are not in respiratory distress.

Diaphragmatic breathing exercises increase diaphragm excursion. These exercises can be taught to the patients and practiced by them if they are not on a ventilator, irrespective of the presence of underlying respiratory disease. Also, in patients showing alveolitis and fibrosis, these breathing exercises can decrease the lung's atelectasis areas.<sup>9</sup>Pursed lip breathing exercises can be taught to conscious patients, and it may be beneficial, especially in patients with underlying obstructive lung disease like COPD [10, 13]. This technique helps in creating positive pressure and thus decreases dyspnea and work of breathing. Dyspnea relieving positions can be given in such patients, and pursed-lip breathing can be practiced [13]. Similarly, segmental breathing exercise also increases the lateral and coastal expansion of the lung. It also decreases the atelectasis areas so that it can be recommended in patients with evidence of alveolitis and fibrosis at the time of presentation [9, 13]. Inspiratory muscle training (IMT) is provided by IMT devices that are readily available and can be cost-effective for some patients, but a single device for a single patient and routine cleaning and disinfection of the devices is crucial [13].

Hemodynamic monitoring is also essential. The technique can be taught to a conscious patient with the help of the audio-visual aid method [10]. IMT improves respiratory muscle strength [13].

## 3. AIRWAY CLEARANCE TECHNIQUE

Various physiotherapy techniques generally used for airway clearance routinely are positioning, cough and huff techniques, various bronchial hygiene techniques (e.g., modified postural drainage technique, positive expiratory pressure device, cough assist devices, high-frequency chest wall oscillator, and active cycle of breathing technique), suctioning procedures (open suction via endotracheal and tracheostomy pathway, saline installation, and manual hyperinflation via AMBU bag), any other maneuver that requires disconnection from the ventilator and results in secretion removal and any mobilization technique that assists in the removal of secretions [10, 13].

All of these procedures are potentially aerosol-generating procedures [6]. Therefore, physiotherapists should decide whether to provide a particular technique by assessing risk: benefit ratio and, if beneficial, they should follow the following recommendations and guidelines to minimize the exposure.

Before the airway clearance technique, nebulization is generally recommended in normal patients. However, it is contraindicated in COVID 19 patients [6]. Risk: benefit ratio should be assessed before conducting airway clearance techniques, and also experienced clinicians in the team should be contacted and consent must be taken before conducting these techniques in an environment wherein airborne infection guidelines are strictly implemented.

Inhalation and humidification therapy is not recommended in COVID-19 patients. Inhalers (metered-dose inhalers) should be used [14]. The spacer should be used with inhalers, and it should be single-patient used. In ventilated patients, the ultrasonic nebulizer may be used in a closed circuit without removing the anti-microbial filter [2, 6]. Generally, the aerosol-generating technique is relatively contraindicated in COVID-19 patients.

*Active Cycle of Breathing Technique (ACBT)* and autogenic drainage technique can be taught to non-ventilated patients with underlying lung pathology, but with airborne precaution.

Positive Expiratory Pressure (PEP) using an oscillatory PEP device can be used. If required, a single patient device can be used.

Postural drainage positions can be given, but after consulting senior clinicians and with all the precautions [6]. Postural drainage techniques such as percussion, vibrations, and shaking are absolutely contraindicated in all the COVID-19 patients due to aerosol generation risk.

Suctioning should be done with precautions in suspect or confirmed COVID-19 patients. Open suctioning should be avoided, and close suctioning should be the mode of treatment [2, 6].

The following essential precautions should be strictly followed during physiotherapy management of suspect/confirmed COVID-19 patients:

- (1) Proper hand hygiene.
- (2) Use of PPE. Face shield, hair cover, N95 mask, and full-sleeved gowns should be worn [6].
- (3) Proper disposal of patient secretions [6, 13]
  - (1) Proper disinfecting and cleaning instruments and equipment used by the patient for his/her benefit [2, 6].
  - (2) Maintaining a safe distance from the patient, *i.e.*, at least >2 m and therapist position, should be preferably at the patient's backside [6].
  - (3) Physiotherapy technique must be carried out either in a negative pressure room or single room with a single patient and minimum staff, and it is pertinent to avoid visitor's entry during an intervention [6].
  - (4) The patient should wear a surgical mask and preferably, should be appropriately placed and use disposable equipment to reduce the patient's movement to minimize the spread of infection [6].

#### 4. MOBILIZATION

Active mobilization is essential to prevent deconditioning and maintain the range of motion and muscle strength [9, 10, 13]. Strength training using therabands of a different colour can be given. Every patient should have their own theraband to prevent cross-infection [13]. Charts and audio-visual aids can help mobilize conscious patients, and in an unconscious patient, passive mobilization is given to prevent deep vein thrombosis (DVT) and other complications due to prolonged bed rest [11, 13]. Sitting on the bed edge or near the bedside is essential for early recovery. Similarly, if the patient has sufficient strength, walking should also be encouraged as early as possible for a speedy recovery.

Precaution: Hemodynamic monitoring in ICU is essential during mobilization [10].

The therapist should be aware of the happy hypoxia observed in COVID 19 patients to prevent any complications due to physiotherapy in non-ventilated patients. So, it is essential for the physiotherapist to monitor and assess vital parameters, including oxygen saturation at room air, before, during, and after the intervention [15].

#### CONCLUSION

The physiotherapist's role in treating COVID-19 patients in ICU is essential for early recovery and decreasing the morbidity associated with the disease, thus improving the quality of life. However, at the same time, strict adherence to precaution is a must to prevent infection transmission.

#### CONSENT FOR PUBLICATION

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#### CONFLICT OF INTEREST

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#### REFERENCES

- [1] Hassan SA, Sheikh FN, Jamal S, Ezeh JK, Akhtar A. Coronavirus (COVID-19): A Review of Clinical Features, Diagnosis, and Treatment. *Cureus* 2020; 12(3):e7355 [http://dx.doi.org/10.7759/cureus.7355] [PMID: 32328367]
- [2] Lazzeri M, Lanza A, Bellini R, *et al.* Respiratory physiotherapy in patients with COVID-19 infection in acute setting: A position paper of the italian association of respiratory physiotherapists (ARIR). *Monaldi Arch Chest Dis* 2020; 90(1): 163-8. [http://dx.doi.org/10.4081/monaldi.2020.1285] [PMID: 32236089]
- [3] Kumar D, Malviya R, Sharma PK. Corona virus: A review of COVID-19. *Eurasian J Med Oncol* 2020; 4(2): 8-25.
- [4] Wujtewicz MA, Dyleczyk-Sommer A, Aszkielowicz A, Zdanowski S, Piwowarczyk S, Owczuk R. COVID-19 - what should anaesthesiologists and intensivists know about it? [Internet]. *Anaesth Inten Ther* 2020; 52(1): 34-41. https://pubmed.ncbi.nlm.nih.gov/32191830/
- [5] Webber BA, Barbara A, Ammani Prasad S, Main E, Denehy L. *Cardiorespiratory physiotherapy: adults and paediatrics*. Fifth edit.. Edinburgh: Elsevier Ltd 2008.
- [6] Thomas P, Baldwin C, Bissett B, *et al.* Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations. *J Physiother* 2020; 66(2): 73-82. [http://dx.doi.org/10.1016/j.jphys.2020.03.011] [PMID: 32312646]
- [7] Guan W, Ni Z, Hu Y, Liang W, Ou C, He J, *et al.* Clinical characteristics of coronavirus disease 2019 in china. *N Engl J Med* 2020; 382(18): 1708-20.
- [8] Pinto TF, Carvalho CRF. SARS CoV-2 (COVID-19): Lessons to be learned by brazilian physical therapists. *Braz J Phys Ther* 2020; 24(3): 185-6. [http://dx.doi.org/10.1016/j.bjpt.2020.04.004] [PMID: 32387006]
- [9] Porter SB. *Tidy's Physiotherapy*. 15th ed. Edinburgh: Churchill Livingstone 2013; pp. 1-668. Available from: https://www.elsevier.com/books/T/A/9780702043444
- [10] Pryor JA, Ammani Prasad S. *Physiotherapy for respiratory and cardiac problems: Adults and paediatrics*. 4th ed. Edinburgh: Churchill Livingstone 2008. Internet Available from: http://www.loc.gov/catdir/toc/ecip0720/2007\_024438.html
- [11] Ghelichkhani P, Esmacili M. Prone position in management of COVID-19 patients; a commentary. *Arch Acad Emerg Med* 2020; 8(1): e48. http://www.ncbi.nlm.nih.gov/pubmed/32309812
- [12] Goldhill DR, Imhoff M, McLean B, Waldmann C. Rotational bed therapy to prevent and treat respiratory complications: A review and meta-analysis. *Am J Crit Care. Am Associ Critical-Care Nur* 2007; Vol. 16: pp. 50-61.
- [13] Kisner C, Colby LA. *John Borstad Therapeutic exercise: foundations and techniques*. 7th ed. FA Davis 2018.
- [14] Head AP, Kale DS, Bhagwat S, Patle V, Ganvir SSA. Guidelines for Chest Physiotherapy management of COVID 19 in Indian Setup [Internet]. Mumbai 2020. www.msotpcouncil.org
- [15] Tobin MJ, Laghi F, Jubran A. Caution about early intubation and mechanical ventilation in COVID-19 [Internet]. *Annals of Intensive Care* 2020; 10: 78. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7281696/