Physiotherapeutic performance in the care of patients with Covid-19

Atuação fisioterapêutica no atendimento dos pacientes com Covid-19

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ABSTRACT
After the first diagnosis of COVID-19 in Wuhan, in December 2019, many studies were published in an attempt to clarify the clinical picture and the ways in which the disease is transmitted. To date, more than 186,737,584 million cases have been confirmed worldwide, and about 15% of infected patients will need oxygen therapy and another 5% will evolve into a severe form of the disease, evoking intensive care. In parallel, the virus has a high degree of transmissibility, increasing the risk of contamination for the healthcare team. In this context, during hospitalization of this population and admission to Intensive Care Units, physical therapy activities have been widely recommended. However, there is little evidence in the literature about the appropriate guidelines and protocols for the safe application of therapeutic approaches in this scenario. In this
narrative review, research and studies on physical therapy approaches in the treatment of patients with COVID-19 admitted to the ICU were summarized.

**Keywords:** Physiotherapy, COVID-19, SARS-CoV-2, Intensive Care Unit, Rehabilitation.

**RESUMO**
Após o primeiro diagnóstico da COVID-19 em Wuhan, em dezembro de 2019, muitos estudos foram publicados na tentativa de esclarecer o quadro clínico e as formas de transmissão da doença. Até hoje, mais de 186.737.584 milhões de casos foram confirmados no mundo inteiro, e cerca de 15% dos pacientes infectados precisarão de oxigenoterapia e outros 5% evoluirão para uma forma grave da doença, evocando os cuidados intensivos. Em paralelo, o vírus tem um alto grau de transmissibilidade, aumentando o risco de contaminação para a equipe de saúde. Neste contexto, durante a hospitalização desta população e a admissão nas Unidades de Tratamento Intensivo, as atividades de fisioterapia têm sido amplamente recomendadas. Entretanto, há poucas evidências na literatura sobre as diretrizes e protocolos apropriados para a aplicação segura de abordagens terapêuticas neste cenário. Nesta revisão narrativa, foram resumidas pesquisas e estudos sobre abordagens fisioterapêuticas no tratamento de pacientes com COVID-19 admitidos na UTI.

**Palavras-Chave:** Fisioterapia, COVID-19, SARS-CoV-2, Unidade de Cuidados Intensivos, Reabilitação.

**1 INTRODUCTION**

The COVID-19 is a disease caused by coronavirus 2 Severe Acute Respiratory Syndrome (SARS-CoV-2), characterized by a clinical picture that varies from asymptomatic to severe respiratory infections frames. First identified in Wuhan, People's Republic of China, in December 2019. The disease was declared a pandemic by the World Health Organization (WHO) in March 2020 (MENDES et al. 2020; XU et al. 2020).

To date, more than 186 million cases have been confirmed worldwide, with more than 4 million deaths. In Brazil alone, more than 19 million people were infected and more than 500,000 deaths were registered (XU et al. 2020; JHU, 2020). Clinically, the most common signs and symptoms in patients with COVID-19 include fever, sore throat, cough, dyspnea, sputum, headache, myalgia, and fatigue (XU et al. 2020; GUAN et al. 2020). However, most patients infected by the virus (> 80%) are asymptomatic or have mild signs (SÍRIO LIBANÊS, 2020).

At the same time, the virus is highly transmissible and about 15% of cases are severe and require oxygen therapy. In addition, another 5% are critical cases that require intensive hospital care, being admitted to Intensive Care Units (ICU) (Thomas et al,
In this context, the disease most severely affects elderly individuals, with coexisting comorbidity, which contributes to the worsening of the clinical picture, requiring hospitalization and/or ventilatory support (GUAN et al. 2020).

Thus, emerging evidence has been concerned with the early diagnosis of COVID-19, in addition to elucidating its underlying pathophysiological mechanisms, in order to strengthen preventive measures and optimize the therapeutic resources used (Zhou, 2020). From this perspective, during hospitalization of these patients, especially after admission to the ICU, physical therapy treatment plays a potential key role in their evolution and recovery (THOMAS et al., 2020).

In this scenario, the physical therapist is one of the professionals responsible for respiratory support, as well as for maintaining the individual's functionality and preventing complications (Thomas et al., 2020; Brambatti, 2020; Lazzeri, 2020). However, despite the growing number of studies, research on physical therapy performance in the face of the current pandemic remains scarce. In this article, we present a non-systematic narrative review to discuss the main physical therapy approaches adopted in the treatment of patients with COVID-19 admitted to the ICU worldwide.

2 DEVELOPMENT

This research was supported by scientific articles, guidelines, technical notes, expert opinions, guidelines, recommendations and/or protocols from the World Health Organization (WHO), Brazilian Association of Cardiorespiratory Physiotherapy and Physiotherapy in Intensive Care (ASSOBRAFIR), Association of Intensive Care Medicine Brazilian (AMIB), Brazilian Association of Emergency Medicine (ABRAMED), Portuguese Association of Physiotherapists (APF), Albert Einstein and Sírio Libanês Institutions, among others, published in 2020. The key words used in the bibliographic research were physiotherapy, COVID-19, SARS-CoV-2, intensive care and rehabilitation unit.

3 DISCUSSION

PHYSIOTHERAPEUTIC SCREENING

According to the recommendations of Thomas et al., 2020, physical therapy screening should be actively performed by the physical therapist or through referral. First, the respective professional must assess the patient's clinical condition by reading the data recorded in the medical record. At this stage, information on signs and symptoms
presented, general and respiratory, as well as imaging exams, in addition to the history of previous disease or comorbidities (THOMAS et al, 2020; BRAMBATTI, 2020) (Figure 1) should be considered.

In order, after interpreting the clinical findings, the physical therapist must assess the real need for physical therapy care, and may discuss the indication with the assistant health team. Similarly, the Portuguese Association of Physiotherapists emphasizes that the specialized service should only be indicated in cases of severe impairment of oxygenation, as only in these situations the benefit may outweigh the risk of contagion generated to the team (APF, 2020). However, for other patients, adequate physical therapy assistance must be ensured as soon as possible clinical changes are observed.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

COVID-19 is transferred to third parties through the air or through personal contact with infected secretions, expelled through coughing, sneezing or a runny nose. In this aspect, the virus can remain viable in the air for at least 3 hours, in addition to 24 hours on hard surfaces and up to 8 hours on soft surfaces, which gives the pathogen a high rate of transmission (VAN, 2020). Thus, the use of PPE, essential in the health team's routine, must be observed even more carefully during the care of these patients (THOMAS et al, 2020).

It is imperative, in the care of patients with COVID-19, to use an isolation gown, cap, N95 mask, goggles or face shield and procedure gloves, in a respiratory isolation environment with negative pressure, when possible, or environment airy with a closed door and the least number of professionals needed (Martinez, 2020). It is agreed that any aerosol-generating procedure must be carried out respecting the use of adequate PPE, as well as the correct order of placement and removal of them (Arbillaga, 2020). Furthermore, it is extremely important that spontaneously breathing patients use a surgical mask during any and all contact with the health team (THOMAS et al, 2020).

THERAPEUTIC RESOURCES AND CONDUCT

oxygen therapy

After viral infection by SARS-CoV-2, affected patients may initially not present severe oxygenation losses, however, during the course of the disease, cases may progress with rapid deterioration of this function. Therefore, it is necessary to continuously monitor peripheral oxygen saturation (SpO₂) (BRAMBATTI, 2020).
In this context, the Brazilian Association of Intensive Care Medicine indicates oxygen therapy when $\text{SpO}_2 < 94\%$ and/or signs of respiratory distress occur (AMIB, 2020) , similarly to the recommendations published by Wilcox, 2020. However, due to the potential risk of aerosolization, during supplemental therapy the practice of humidification should not be carried out. In addition, if there are complications arising from the dryness of the upper airways (UA), the prescription of moisturizers in a sodium chloride self-applied nasal gel should be suggested (SÍRIO LIBANÊS, 2020).

That said, the use of a nasal cannula is recommended for flows of up to 6 l/min and a mask with a reservoir of up to 10 l/min, associated with the use of a surgical mask that is correctly adjusted and replaced every 6-8 hours (Brambatti, 2020). On the other hand, if clinical evolution is not observed, the health team should not delay orotracheal intubation (OTI) (Figure 2).

**nebulization**

Despite the applicability of nebulization, studies published so far confirm that given the high rate of virus transmission, all forms of administration of the conduct, including inhalation, as potential generators of aerosols, should be avoided (Sírio Libanês, 2020; Freitas, 2020b; Simonds , 2010; WHO, 2020). However, in cases of extreme need, the procedure must be performed in a respiratory isolation environment (Martinez, 2020), using a bronchodilator with millimeter metering through a spacer (AMIB, 2020; CMA, 2020).

In contrast, for patients with COVID-19 on ventilatory support, the Associazione Riabilitatori Dell'Insufficienza Respiratoria recommends the use of ultrasonic nebulizers connected in closed circuit invasive mechanical ventilation, without removing the antimicrobial filter in the expiratory branch (AR, 2020).

**Non-Invasive Ventilation (NIV)**

NIV provides ventilatory support to patients who have ventilatory drive, without the need for an endotracheal airway. Thus, lung volumes are susceptible to drastic variations, which can result in lung injury, associated with higher mortality in patients with Acute Respiratory Distress Syndrome (ARDS) (WILCOX, 2020). Similarly, in a small retrospective case series from Wuhan, 72% of patients with COVID-19 who used NIV died, although mortality rates were also high for patients who were primarily intubated (WILCOX, 2020; (ROBBA, 2020) ).
Thus, the uncertainty of the strategy’s benefits, emerging evidence suggests that NIV in the treatment of hypoxemic respiratory failure associated with COVID-19 is closely related to unsatisfactory or controversial results. In this context, in addition to the high failure rate, late intubation and greater aerosolization due to inadequate mask fitting, are consequences attributed to therapy, making it non-recommended as a first-line strategy (BRAMBATTI, 2020; ROBBA, 2020; TANZI, 2020).

On the other hand, when indispensable, non-invasive ventilatory assistance must be performed, carefully observing the recommendations for the use of PPE to mitigate the risks of contamination for health professionals (BRAMBATTI, 2020). Concomitantly, the physiotherapeutic guidelines documented so far indicate the use of a double circuit, with a heat and humidity exchanger and a barrier filter at the expiratory exit (Martinez, 2020). In addition to these precautions, the face mask or full face mask is the most recommended type of interface, followed by the Helmet helmet (NHS, 2020).

Initially, the suggested adopted parameters include positive expiratory airway pressure (EPAP) ≥ 8cmH₂O, positive inspiratory pressure (IPAP) for tidal volume (VT) ≤ 8 ml/kg of predicted weight and inspired oxygen fraction (FiO₂) enough to maintain an SpO₂ > 92%. However, in the observation of FiO₂ > 60%, VC ≥ 9 ml/kg, signs of respiratory distress or inability to maintain time longer than 2 hours without the use of NIV, OTI should be considered, avoiding complications and worse outcomes (LEBANESE SYRIOUS, 2020).

**Orotracheal Intubation (IOT)**

In the care of patients with COVID-19, there is no consensus regarding early intubation due to lack of evidence. Although the procedure reduces the risk of self-induced lung injury, it is also related to high mortality rates. Therefore, until now, the ideal approach seems to be the management based on individuality, given the heterogeneity of the staff (WILCOX, 2020).

It is not uncommon, during the technique, there is a decrease in SpO₂ < 70%, making pre-oxygenation of patients essential. Therefore, it is recommended that in individuals with COVID-19, intubation should be performed in rapid sequence, also considering the production of aerosols, with a reduced and experienced medical team, and, if necessary, pre-oxygenation performed with a mask of a reservoir with the lowest possible air flow to maintain effective oxygenation, avoiding manual hyperinflation (BRAMBATTI, 2020; AMIB, 2020).
Filters in Ventilation Support

During artificial ventilatory assistance, in suspected or confirmed cases of the new coronavirus, under invasive mechanical ventilation (IMV), or in NIV, the physiotherapist should give preference to the HMEF (Heat and moisture exchanger filter), which complies the three functions of filtering, heating and humidifying the gas. However, it is essential that the filter has a bacterial and viral filtration efficiency greater than 99.99%. However, in the event of its unavailability, another option to be adopted is the HME (Heat and Mositure Exchanger) filter, indispensably associated with HEPA (High Efficiency Particulate Air) at the end of the expiratory circuit, for gas filtration exhaled (BRAMBATTI, 2020; MARTINEZ, 2020).

In contrast, the Brazilian Association of Cardiorespiratory Physiotherapy and Physiotherapy in Intensive Care does not recommend the simultaneous use of HMEF and HEPA filters, since the binomial increases the cost of the strategy and results in increased airflow resistance, as well as does not guide the use of HEPA or HMEF filter at the outlet of the inspiratory branch of the circuit. Furthermore, it is highlighted that the use of HME and HMEF close to the expiratory valve increases the risk of condensation in the expiratory cassette (MARTINEZ, 2020).

In this sphere, it is also important to highlight that when changing the filters, when necessary, the mechanical ventilation must be turned off or put on stand by, and clamped the orotracheal tube to avoid alveolar derecruitment and especially aerosolization in the current situation. (Sírio-Libanês, 2020; Brambatti, 2020; Jeria, 2020). In view of the pandemic, it is also highlighted that active humidification through heated aqueous humidifiers increases the chance of droplet dispersion into the environment, and, therefore, should be avoided in patients with COVID-19 (LAGO, 2020).

Invasive Mechanical Ventilation (VMI)

The use of the protective strategy during invasive ventilatory support is recommended with the objective of reducing the risks of lung injury induced by mechanical ventilation (IVLP), and is strongly associated with better results in patients with ARDS (WILCOX, 2020). Initially, 100% FiO$_2$ and 10 cmH$_2$O PEEP should be offered, with an ideal VT of 4 q 6 ml/kg (Brambatti, 2020). In parallel, the ventilation mode adopted will depend on the patient's clinical presentation, however recent guidelines suggest starting volume-controlled ventilatory assistance in order to obtain reliable parameters of respiratory mechanics, to be calculated after the initial adjustments.
According to the stabilization of the clinical picture, the physiotherapist, together with the medical team, must adjust the parameters of mechanical ventilation (Table 1).

**Adjustment of Positive End Expiratory Pressure (PEEP)**

According to Mazzoni et al., 2020, in the management of suspected and confirmed severe cases for infection by the new coronavirus, the alternative table of ARDSNet can be used to adjust FiO2 by 60% with PEEP of 10 cmH2O and subsequently, it should be chosen by the lowest PEEP for the best SpO2. On the other hand, in the event of high PEEP values, it is suggested to perform the titration maneuver (MAZZONI, 2020) (Figure 3).

In this scenario, for PEEP titration, sedation and neuromuscular blockade, volume-controlled ventilation, TV of 5 ml/kg of the predicted weight and square inspiratory flow, with a pause of 0.2 seconds, are indicated. Thus, PEEP is raised to 20 cmH2O and FiO2 is adjusted to maintain SpO2 target between 90-95%. In sequence, the PEEP must be reduced by 2 cmH2O, every 1 minute, and the ideal will be the one that results in greater static compliance with less driving pressure (MAZZONI, 2020).

**Prone posture**

The recommendation of the prone posture for patients with severe ARDS is consolidated in the literature (BARBAS, 2014). However, this conduct requires human resources and prior training to be performed safely (Sírio Libanês, 2020; Robba, 2020). In this aspect, therefore, the physiotherapist can either lead the responsible team, or train it with practical simulations (THOMAS et al, 2020).

In ICU care for patients on ventilatory support with COVID-19, posture is recommended for at least 16 hours for those who do not respond to 4-6 hours of protective ventilation, with a PaO2/FiO2 ratio < 150 mmHg, after the ideal PEEP is adjusted (Brambatti, 2020; WHO, 2020; Mazzoni, 2020). In sequence, the conduct must follow the protocols previously established in ARDS frameworks (BRAMBATTI, 2020).

In response to therapy, there should be a 10 mmHg increase in PaO2, or 20 mmHg in the PaO2/FiO2 ratio (Brambatti, 2020). Consequently, the criteria for interruption of the prone posture are considered: PaO2/FiO2 ratio > 150 mmHg, PEEP ≤ 10 cmH2O and FiO2 ≤ 60% for more than 4 hours in the supine posture (Brambatti, 2020; Martinez,
Before considering the practice, the team must pay attention to the absolute contraindications of the technique (ARBILLAGA, 2020).

Interestingly, in the COVID-19 field of studies, there is observational evidence that provides reasonable support for a prone stance test also for conscious spontaneous breathing patients (Wilcox, 2020). These are suggested positioning cycles every 30 min to 2 hours, including dorsal and lateral decubitus position, sitting position beyond the head with high (30-60 °) and in prone posture, with evaluation of SpO₂ at each cycle (Figure 4). In these circumstances, it is important to emphasize that observation of the response to therapy should be continuous, as well as signs of IRpA, and, in general, if the patient does not respond to the prone posture, the team should consider the alveolar recruitment maneuver (ARM) (BAMFORD, 2020).

Alveolar Recruitment Maneuver (MRA)

ARMs are indicated in situations of refractory hypoxemia, unresponsive to other interventions (PaO₂ < 60 mmHg and/or FiO₂ > 60%), but their practice is considered risky (Sírio Libanês, 2020) and is not routinely indicated (Robba, 2020). Therefore, in the management of patients affected by COVID-19, the Associazione Riabilitatori Dell'Insufficienza Respiratoria advises that the decision must be shared with the team (AR, 2020). Furthermore, it is recommended that, in addition to the isolated recruitment strategy, it is possible to associate it with the prone posture if the patient responds to the recruitment maneuver in the supine position (Sírio Libanês, 2020).

At the same time, it is highlighted that ARMs can especially benefit infected patients classified as phenotype 2, who have diffuse atelectasis and peribronchial opacities on chest computed tomography (CT) or those with phenotype 3, with an irregular pattern in the examination, accompanied by pulmonary mechanics with characteristics similar to those observed in ARDS. However, it is not associated with the population with multiple ground-glass opacities on CT, located mainly in the subpleural region, with normal compliance, and severe hypoxemia, characterized as phenotype 1 (ROBBA, 2020).

Severe Refractory Hypoxemia

The management of patients infected with coronavirus is highly complex and careful monitoring is essential for favorable outcomes. In cases of reduced PaO₂/FiO₂ < 100 mmHg, inability to maintain protective ventilation, presence of asynchrony or severe
hypercapnia (pH < 7.25), the following strategies should be considered: a) sedation and continuous neuromuscular blockade, to reduce respiratory drive and maintain protective parameters; b) prone position; c) PEEP adjustment for better compliance and alveolar recruitment maneuvers; d) recruitment in the prone position, if the patient responds to the supine maneuver; e) removal of unnecessary dead space from the mechanical ventilator, checking reductions in tubes and connections; f) control of CO₂ production; (Sírio Libanês, 2020) g) temperature at 36°C (Sírio Libanês, 2020) h) use of nitric oxide if a history of “cor pulmonale” or as a rescue maneuver for hypoxemia; i) extracorporeal membrane oxygenation (SÍRIO LIBANÊS, 2020; ROBBA, 2020).

**Cardiopulmonary Resuscitation (CPR)**

The population affected by SARS-CoV-2 has a higher probability of acute deterioration, as well as a higher risk of cardiopulmonary arrest (CPA), therefore, it is extremely important that the rapid response team is signaled, alert and prepared for this type of event. (Guimaraes, 2020). In this context, if it is possible to anticipate the risk of CPA in these patients, it is recommended to transfer them to a quarter of negative pressure, aiming to reduce the risks of exposure to health professionals (EDELSON, 2020).

In summary, mouth-to-mouth ventilation, as well as pocket masks, are not recommended (Guimaraes, 2020; RcuK, 2020). In addition, bag-valve-mask (BVM) or endotracheal bag-tube ventilation should also not be performed, as they do not have superior evidence when compared to IMV (Guimaraes, 2020). Therefore, the patient must be intubated as soon as possible.

On the other hand, as there is no other alternative, when ventilating through BVM, a TV VC 600 ml is recommended and the sealing technique is properly performed by two professionals, using an oropharyngeal cannula (Guedel) covered by a surgical mask (Guimaraes, 2020; Edelson, 2020; Morakami, 2020). In addition, a HEPA filter must be added between the mask and the bag (Guimaraes, 2020; Morakami, 2020).

In patients with COVID-19, on IMV the most common option is manual ventilation of the ventilator itself, with FiO₂ set at 100%, RR 10-12 rpm, I:E ratio 1:2; VC around 4-6 ml / kg patient weight and predicted PEEP 5cmH₂O, or use of ZEEP (PEEP = 0 cm H₂O) to promote chest compressions. In addition to these parameters, it is also proposed to adjust the inspiratory sensitivity as low as possible, in order to avoid additional triggers, as well as setting the Ppeak alarm at approximately 60 cmH₂O. In
this situation, if necessary to use the BVM, it is recommended to clamp the tube in the transition to the mask (MORAKAMI, 2020).

Despite the scarcity of evidence on the topic (Edelson, 2020; Bhatnagar, 2018), CPR in patients with COVID-19 in the prone posture can be performed in cases where there is no possibility of immediate change to the supine posture (Sanz, 2020). Thus, the responsible professional is recommended to perform chest compressions keeping the hands between the scapulas (Morakami, 2020), with the defibrillator paddles in the anteroposterior position (Edelson, 2020). In case of failure, the team must return the patient to the supine position and continue the procedure (Morakami, 2020).

**Early Mobilization**

Prolonged ICU stay is strongly associated with diffuse and symmetrical muscle weakness, which encompasses both peripheral and respiratory muscles, with significant repercussions on lung volumes and capacities (Brambatti, 2020). In this field, according to the recommendations of the Sociedad Española de Neumología y Cirugía Thoracica (SEPAR) mobilization should be started as early as possible, however, the following criteria should be considered: heart rate (HR) < 100 bpm, RR < 24 rpm; axillary temperature (TAX) < 37.2°C; systolic blood pressure (SBP) > 90 mmHg; SatO$_2$ > 90% (in the absence of previous respiratory failure) and adequate level of consciousness (ARBILLAGA, 2020; REY, 2020; ZHONGHUA, 2020) (Table 2).

In this scenario, the frequency and duration of therapeutic exercises can be adjusted to twice a day, from 15 to 45 minutes, with intensity regulated according to the reported sensation of dyspnea and fatigue ≤ 3 on the modified Borg scale (0-10). However, in patients with greater frailty, or with signs of fatigue, physical therapy can be performed with interval exercises (BRAMBATTI, 2020).

On the other hand, those infected with SARS-CoV-2 often have fever, and therefore higher energy expenditure, and early mobilization or exercise is not indicated (Martinez, 2020). In addition, the recommendations call for caution when prescribing exercises to patients with a time of diagnosis less than or equal to 7 days, as well as to the population with a reduced time interval between the onset of symptoms and the onset of mild dyspnea, in light of the risks of rapid evolution of the clinical picture (APF, 2020).
**Bronchial Hygiene (HB)**

Recent evidence has shown that viral infection by the new coronavirus is accompanied by dry cough. However, if there is an urgent need, the application of techniques or resources to remove bronchial secretions that may cause coughing should be carefully planned by the physiotherapist, considering the potential risk of generating droplets/aerosols and the individualities of the cases (FURLANETTO, 2020). That said, during active breathing exercises, coughing can be requested if accompanied by educational guidelines, such as the use of tissues or paper to cover the mouth region, with ideal distance from the professional to the patient of 2 meters (THOMAS et al., 2020).

There are no specific studies regarding the use of bronchial hygiene maneuvers performed on the mechanical ventilator in patients with COVID-19, therefore, if used, they should follow the indications and contraindications already established in the literature. Complementarily, when necessary, endotracheal aspiration in patients on ventilatory support is better recommended over nasotracheal support, and should only be performed in a closed system (Sírio Libanés, 2020; Brambatti, 2020; Martínez, 2020; WHO, 2020; CMA, 2020). However, if there is a need for open aspiration, it is suggested to use the “stand by” function of the ventilator to minimize the spread of aerosols (SÍRIO LIBANÊS, 2020).

**Extubation**

The weaning process must respect classically established criteria. Thus, patients with stable hemodynamic and ventilatory parameters, conscious and with satisfactory cough reflexes will be eligible (Popat, 2012). At this stage, patients who succeed in the spontaneous breathing test in PSV mode will be candidates for tube removal, avoiding the use of the T tube, given its strong association with aerosol production (SÍRIO LIBANÊS, 2020; CMA, 2020; ROBBA, 2020).

All the precautionary criteria for the risk of contamination, used for the IOT, are also applied for the extubation. In addition, preventive measures must be taken, such as prophylactic antiemetics to reduce the risk of emesis and consequent viral spread. From this perspective, the use of high-flow nasal oxygen therapy, nebulization and use of positive pressure (NIV) after extubation should also be avoided (WAHR, 2020).

During the process, the use of a “transparent plastic curtain” is proposed as a low-cost alternative to reduce viral spread by the technique (Matava, 2020). In addition to this, another strategy that can be adopted as an additional precaution is the "aerosol box" used...
to cover the patient's head, both for intubation and for extubation, in order to reduce the risk of propagation of droplets from contaminated patients (Moraga, 2020). Interestingly, the device, with access on the sides to perform the technique, is resistant to high temperatures, easy to produce and sanitize, allowing it to be reusable.

However, according to Kearsley 2020, the measure cannot guarantee the safety of the team, since the viral load that contaminates the professional, as well as their PPE, has not been evaluated so far. Furthermore, the size of the box is not adjustable to all patients and the time to perform the techniques with the artifact makes the procedures more complex (KEARSLEY, 2020).

4 CONCLUSION

In summary, the physiotherapist within the health team, in the Intensive Care Units, can act from the screening of the patient with COVID-19, until the moment of extubation and subsequent hospital discharge. However, in the management of this population, therapeutic approaches associated with the production of aerosols, such as non-invasive ventilation and bronchial hygiene techniques, should be avoided, considering the high risk of viral dissemination.

Patients on invasive ventilatory support are recommended to use a protective strategy to mitigate the risk of lung injury, and in view of clinical stability, the physiotherapist, together with the multidisciplinary team, must adjust and monitor the parameters of ventilatory assistance. In this sphere, the prone posture is recommended for those who do not respond to the first hours of protective ventilation, and if in these circumstances a favorable response is not observed, the alveolar recruitment maneuver is indicated.

In the midst of the pandemic, early mobilization, in order to prevent the complications of prolonged hospitalization and immobilization in bed, is recommended with caution, observing the indications and contraindications of the target therapeutic resources and techniques. However, studies call for special care for patients with fever, early diagnosis and/or rapid clinical evolution of symptoms, with respiratory involvement. It is imperative, however, the proper use of personal protective equipment during all visits to infected patients.
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WILCOX, Pathology and management are similar to acute respiratory distress syndrome, 2020.


Table 1: Adjustments of ventilatory parameters

<table>
<thead>
<tr>
<th>PARAMETERS</th>
<th>SETTINGS</th>
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<tbody>
<tr>
<td>Ventilation mode</td>
<td>VCV or PCV</td>
</tr>
<tr>
<td>ideal VC</td>
<td>4 - 6 ml/kg of predicted weight</td>
</tr>
<tr>
<td>FR</td>
<td>20-35 rpm; pH&gt;7.2 and &lt;7.45 (permissive hypercapnia)</td>
</tr>
<tr>
<td>Vmin</td>
<td>Total volume between 7 - 10 l/min</td>
</tr>
<tr>
<td>inspiratory flow</td>
<td>60 l/min with descending waveform</td>
</tr>
<tr>
<td>I:E ratio</td>
<td>1:1 to 1:2</td>
</tr>
<tr>
<td>FiO₂</td>
<td>Reduce by 10% every 30 min (SpO₂ between 88 - 95%)</td>
</tr>
<tr>
<td>PEEP</td>
<td>Best compliance or FiO₂ for SpO₂ between 88 - 95%</td>
</tr>
<tr>
<td>peak</td>
<td>≤ 35 cmH₂O (if necessary, reduce inspiratory flow)</td>
</tr>
<tr>
<td>plateau</td>
<td>&lt; 30 cmH₂O (or up to 40 cmH₂O in severe ARDS)</td>
</tr>
<tr>
<td>drive pressure</td>
<td>&lt; 15 cmH₂O</td>
</tr>
</tbody>
</table>

Caption: VCV: volume controlled ventilation; PCV: controlled pressure ventilation; VC: ideal tidal volume; RR: respiratory rate; pH: hydrogenic potential; Vmin: minute volume; FiO₂: inspired oxygen fraction; SpO₂: peripheral oxygen saturation; PEEP: positive end-expiratory pressure; Ppeak: peak pressure; Plateau: plateau pressure; ARDS: acute respiratory distress syndrome and Drive pressure: distension pressure.

Table 2: Assessment criteria for early mobilization

<table>
<thead>
<tr>
<th>System</th>
<th>fit</th>
<th>Interrupt</th>
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<tbody>
<tr>
<td>Neurological</td>
<td>• RASS of -2 or +2</td>
<td>• Low level of awareness</td>
</tr>
<tr>
<td></td>
<td>• PIC &lt; 20 cmH₂O</td>
<td>• Agitation.</td>
</tr>
</tbody>
</table>
Respiratory

- Absence of respiratory distress and asynchrony
- PEEP ≤ 10 cmH₂O (except exceptions according to the patient's clinic)
- FiO₂ ≤ 0.6
- SpO₂ ≥ 90%
- FR ≤ 30 rpm

Cardiovascular

- SBP ≥ 90 and ≤ 180 mmHg
- MAP ≥ 65 and ≤ 110 mmHg
- HR ≥ 40 and ≤ 120 bpm
- No myocardial ischemia
- No signs of shock accompanied by lactic acid in the blood ≥ 4 mmol/L
- Absence of unstable DVT or pulmonary embolism
- Absence of aortic stenosis

- SpO₂ < 90% and FR > 30 rpm
- PAS < 90 or > 180 mmHg
- MAP < 65 or > 110 mmHg or change of more than 20% from baseline
- New onset of arrhythmia and myocardial ischemia
Others

- Absence of unstable fractures of the extremities and spine
- Absence of severe liver and kidney disease
- Absence of active bleeding
- TC ≤ 38.5°C.
- Disconnection of orotracheal tube or tracheostomy
- Absence of monitoring connected to the patient
- Patient's conscious palpitations
- Dyspnea, fatigue and exercise intolerance

Caption: RASS: richmond agitation sedation scale; ICP: intracranial pressure; PEEP: positive end-expiratory pressure; FiO₂: inspired oxygen fraction; SpO₂: Peripheral oxygen saturation; RR: respiratory rate; SBP: systolic blood pressure; MAP: mean arterial pressure; HR: heart rate; DVT: deep vein thrombosis; CT: body temperature.

Figure 1. Flowchart prepared by the authors, adapted from THOMAS et al., 2020 (6) and BRAMBATTI et al., 2020. (8) Caption: O₂: oxygen, SpO₂: peripheral oxygen saturation.
Figure 2. Oxygen therapy flowchart prepared by the authors, according to Freitas et al., 2020 (15). Caption: SpO$_2$: peripheral oxygen saturation; IRpA: acute pulmonary respiratory failure; OTI: orotracheal intubation; AA: ambient air; PaO$_2$: arterial oxygen pressure; CN: nasal cannula; MR: reservoir mask and OBS: observation. The observation shows the ideal PaO$_2$ formula associated with age.

NOTE: PaO$_2$ corrected for age: 109 - (age * 0.45)

Figure 3. Alternative table to ARDSnet, suggested by the HCFMUSP ICU team. (30) Caption: O$_2$: oxygen; FiO$_2$: inspired oxygen fraction and PEEP: positive end-expiratory pressure.
Figure 4. Flowchart adapted from Guidance for Prone Positioning of the Conscious COVID Patient 2020.

Caption: FiO₂: inspired oxygen fraction; SpO₂: Peripheral oxygen saturation; IRpA: Acute Respiratory Failure; FR: Respiratory rate; PaCO₂: Alveolar carbon dioxide pressure; SBP: Systolic blood pressure; O₂: Oxygen; DD: supine position; DLD: right lateral decubitus; LLD: left lateral decubitus.