

ELMOCPAP AT COVID-19 – A THERAPEUTIC MANAGEMENT AND MONITORING PROTOCOL: EXPERIENCE REPORT

ELMOCPAP NA COVID-19 – UM PROTOCOLO DE MANEJO E MONITORIZAÇÃO TERAPÊUTICA: RELATO DE EXPERIÊNCIA

ELMOCPAP EN COVID-19 – UN PROTOCOLO DE MANEJO Y SEGUIMIENTO TERAPÉUTICO: RELATO DE EXPERIENCIA

ABSTRACT

To report a management and therapeutic monitoring protocol for ELMOcpap in COVID-19. This is a study of the experience report type of the professional daily life of a nucleus of resident physiotherapists in infectious diseases carried out at the São José Hospital for Infectious Diseases (HSJ) regarding the experience regarding the institutional protocol for the management and monitoring of ELMOcpap therapy developed in the institution. After analyzing the shared experiences, the results were described about the management of ELMOcpap at COVID-19; and therapeutic monitoring, in which protocols and guidelines found for the implementation of the ELMOcpap at the HSJ were addressed and compiled, including experiences lived by the core of resident physical therapists at the hospital. The management protocol and therapeutic monitoring of ELMOcpap follow recommendations established in accordance with the standards of the ELMO interface developers. Furthermore, the institutional protocol facilitates the identification of therapy failure or success, allowing a safe and effective management of non-invasive ventilatory support applied to patients with COVID-19.

Descriptors: COVID-19; Noninvasive Ventilation; Physical Therapy Department Hospital.

RESUMO

Relatar um protocolo de manejo e monitorização terapêutica do ELMOcpap na COVID-19. Trata-se de um estudo do tipo relato de experiência do cotidiano profissional de um núcleo de fisioterapeutas residentes em infectologia, realizado no Hospital São José de Doenças Infecciosas (HSJ) sobre a experiência diante do protocolo institucional para o manejo e monitorização da terapia ELMOcpap, desenvolvido na instituição. Após análise das experiências compartilhadas, os resultados foram descritos quanto ao *manejo do ELMOcpap na COVID-19 e monitorização terapêutica*, nos quais foram abordados e compilados protocolos e diretrizes encontrados para execução do ELMOcpap no HSJ, incluindo experiências vivenciadas pelo núcleo de fisioterapeutas residentes do hospital. O protocolo de manejo e monitorização terapêutica do ELMOcpap segue recomendações estabelecidas em conformidade com as normas dos desenvolvedores da interface ELMO. Ademais, o protocolo institucional facilita a identificação da falha ou sucesso da terapia, permitindo um manejo seguro e eficaz do suporte ventilatório não invasivo aplicado em pacientes com COVID-19.

Descritores: COVID-19; Ventilação Não Invasiva; Serviço Hospitalar de Fisioterapia.

RESUMEN

Reportar un protocolo de manejo y seguimiento terapéutico para ELMOcpap en COVID-19. Se trata de un estudio del tipo relato vivencial de la vida diaria profesional de un núcleo de fisioterapeutas residentes en enfermedades infecciosas realizado en el Hospital São José de Enfermedades Infecciosas (HSJ) respecto a la experiencia en el protocolo institucional para el manejo y seguimiento de la terapia ELMOcpap desarrollada en la institución. Luego de analizar las experiencias compartidas, los resultados se describieron acerca de manejo de ELMOcpap en COVID-19; y seguimiento terapéutico, en el que se abordaron y recopilamos los protocolos y guías encontradas para la implementación del ELMOcpap en el HSJ, incluyendo experiencias vividas por el núcleo de fisioterapeutas residentes en el hospital. El protocolo de manejo y seguimiento terapéutico de ELMOcpap sigue las recomendaciones establecidas de acuerdo con los estándares de los desarrolladores de interfaces ELMO. Además, el protocolo institucional facilita la identificación del éxito o fracaso de la terapia, permitiendo un manejo seguro y eficaz del soporte ventilatorio no invasivo aplicado a pacientes con COVID-19.

Descriptorios: COVID-19; Ventilación No Invasiva; Servicio de Fisioterapia en Hospital.

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INTRODUCTION

COVID-19, the English acronym for coronavirus disease 2019, is an infectious disease whose main symptoms are fever, fatigue and dry cough, which may also result in nasal congestion, headache, sore throat, anosmia and ageusia. Approximately 15 to 20% of individuals develop severe forms of the disease, including Acute Respiratory Distress Syndrome (ARDS), requiring ventilatory support¹.

In Brazil, until the 8th of August 2021, 20,165,672 cases of COVID-19 infection were confirmed, 923,331 of which were confirmed in the state of Ceará². Despite the severe form of the disease developing in a small portion of infected people, since the beginning of the pandemic, there has been a considerable number of hospital admissions of patients who needed ventilatory support in Intensive Care Unit (ICU) beds, which contributed to generate an overload in the entire health system³.

Given this situation, the need arose to create a helmet-like interface, manufactured in Brazil, which would allow the application of positive pressure in a non-invasive way, but which was capable of ensuring respiratory isolation and complete sealing to minimize the dispersion of aerosols and the risk of contamination of the environment and infection of health professionals, allowing its application outside the ICU. Thus, the ELMO (which associated with CPAP therapy, was called ELMOcpap) emerged from a public-private partnership coordinated by the School of Public Health of Ceará Paulo Marcelo Martins Rodrigues (ESP)⁴. Among the public services and In private, more than 2,400 ELMOs were applied to patients with COVID-19. These services promoted the opening of specialized wards for non-invasive ventilatory support. Teams were trained and protocols established. Thus, this study aims to report a management and therapeutic monitoring protocol for ELMOcpap in COVID-19.

METHODS

This is an experience report-type study. The experience is the professional routine of a nucleus of physiotherapists residing in infectious diseases of the Multiprofessional Residency Program at ESP. The executing institution of this program is the São José Hospital for Infectious Diseases (HSJ), which is a public agency, linked to the Department of Health of the State of Ceará (SESA). Information regarding the experience was gathered, discussed and analyzed in

biweekly meetings, lasting 2 hours, in the presence of physical therapy residents during the period from May to July 2021. In these meetings, some documents were reviewed together with the experiences in the field of practice, such as protocols and recommendations of the hospital and the State through SESA guidelines. The results are presented and discussed through the analysis of thematic categories: management of ELMOcpap in COVID-19 and therapeutic monitoring.

RESULTS

MANAGEMENT OF ELMOCPAP AT COVID-19: INDICATIONS AND TECHNICAL EXECUTION

The protocols used at the HSJ present some criteria for determining the correct time to install the ELMO helmet. The use of therapy is indicated in adults over 18 years of age, of any gender identity, diagnosed with COVID-19, who progress to mild to moderate hypoxemic respiratory failure, presence or absence of bilateral opacities in the lung parenchyma when analyzed. radiographic images, requiring oxygen therapy with a flow equal to or greater than 4 L/min to maintain peripheral oxygen saturation (SpO₂) between 92% and 96%.

Blood gas alterations are also observed as an indication criterion for the use of ELMO. The patient must present: a pH value close to the normal value, however, he may have a propensity for mild acidosis, maintaining a pH > 7.34; arterial carbon dioxide pressure (PaCO₂) with values close to the normal range (30 to 45 mmHg); arterial oxygen pressure (PaO₂) above 60 mmHg, in addition to a PaO₂/FIO₂ ratio greater than 120 and less than 250, when possible to be evaluated.

To apply the therapy, the team follows the recommendations of the equipment request process at the HSJ Material and Sterilization Center (CME), including the measurement of the patient's neck circumference, using a tape measure that identifies the appropriate size (PP to GG) of the helmet for each individual, when checked against the data from a table recommended by the equipment manufacturer. After the physiotherapist fills out the ELMO request form, the nursing staff requests it to the CME. Part of the pre-assembled material is received: PVC dome, cervical silicone collar and rigid external base, in polypropylene, with fixing pins for the silicone strap. The rest of the pieces are installed at the bedside by physiotherapists and/or nurses. After assembly, and prior to the installation of the equipment on the patient, guidelines are given regarding the objectives of the

therapy, as to the reasons that make it necessary at that time and how it will be applied.

Assembling the accessories is divided into a few steps. At first, two oxygen (O₂) and compressed air (AC) flowmeters are connected; then, the distilled water reservoir is positioned on the humidification base, which must be kept turned off at all times. The two flow latexes are then coupled to the triple connector installed in one of the water reservoir inlets – this connector is also described under the name Batman on the HSJ request and return forms. Afterwards, the circuit with the Heat and Moisture Exchanger (HME) filter is connected to the other inlet of the water tank. The silicone adapter must be positioned at the outlet of the inspiratory branch, where the other side of the circuit is attached. In the expiratory branch, the High Efficiency Particulate Arrestance (HEPA) filter is fixed with the Positive End Expiratory Pressure (PEEP) valve – this filter has a structure for fitting the cuffometer, necessary to measure the internal pressure of the ELMO.

The next step corresponds to the leak test, with adjustments for O₂ and AC flows. The helmet is then placed on a flat surface; and with the help of a second professional, the outer base of the helmet is supported. At this point, the helmet inflates and is inspected for flow leaks. After performing the test, the person's hearing protectors are adjusted and, again with the help of a second professional, a maneuver is performed to open the cervical collar, allowing the passage of the patient's head. For this, it is requested to perform a slight inclination of the patient's head towards the front; soon after, the adaptation of the silicone straps to the fixation pins is carried out, in addition to the adjustment of the PEEP to 10 cm₂HO, confirming this value with the use of a cuffometer. At the end, professionals check the appropriate O₂ and AC flow adjustments to provide an Inspired Oxygen Fraction (FIO₂) needed to maintain target SpO₂. It is worth complementing that, when feeding the patient, the team must reset the O₂ and AC flowmeters to prevent the generation of aerosols.

THERAPEUTIC MONITORING IN HANDLING THE ELMO INTERFACE AT COVID-19

Parameters such as respiratory rate (f), SpO₂ in pulse oximetry and use of accessory muscles are essential measures to determine the AC, O₂ and FIO₂ flows offered. In the hospital units, everyone must have knowledge about the conduct, but the adjustments of the flows mentioned are carried out by the physiotherapist of each unit. Patients who tend to have tachypnea or dyspnea benefit from higher flows (50 to

60L/min). FIO₂ and total O₂ and AC flows are adjusted according to each patient, for which there is a form for follow-up and evaluation of the success or failure of the therapy.

When the indication for the use of the ELMO is observed, the form is opened with data such as date, time, FIO₂ offered, total flow (FT), AC flow, O₂ flow, SpO₂, f, heart rate (HR) and PEEP. One of the parameters also adopted for this follow-up is the adaptation of the ROX index 5, which is used in the management of the high-flow nasal cannula (CNAF) to monitor the evolution of patients. This form can be found in the medical record, from the beginning until discharge from therapy or the indication of other measures, such as non-invasive ventilation (NIV) or orotracheal intubation (OTI). The ROX index proves to be quite effective as a monitoring measure for these patients. Its formula is performed using SpO₂ divided by the FIO₂ offered, the resulting value is divided by f. After two hours of using this resultant, the ROX index value should increase by 2.85 or more; after six hours, it must be greater than 3.47; after 12 hours, greater than 3.85; after 24 hours, greater than 4.88. Weaning from the supply of AC, O₂ and FIO₂ flows is performed according to the breathing pattern, SpO₂ and ROX index, the lower the FIO₂ and f, the higher the index value.

Sometimes, the use of ELMO is interspersed with CNAF, in order to provide comfort to those patients who could not tolerate the helmet for long periods and in patients in the process of improving their condition without presenting a drop in saturation. In addition, it is interspersed with a reservoir mask and nasal cannula.

The factors associated with good response to the use of ELMO follow the recommendation of the Technical Note made available by SESA in partnership with the Escola de Saúde Pública (ESP). Thus, from 30 minutes to two hours, a decrease in dyspnea, a feeling of greater comfort when breathing, faces with a calmer expression, decrease in the use of accessory muscles for breathing, reduction in respiratory and heart rates, improvement in SpO₂ for it are expected Previous FIO₂, arterial blood gases showing PaO₂/FIO₂ with a 30% increase in the measured value. Regarding this last item, blood gases are taken before starting the ELMO, on the day the patient starts therapy, and after one to two hours. As the patient presents good adaptation and improvement of the clinical condition, the need to collect this exam is dispensed with, sometimes only collected once a day, taking into account also that it is a painful exam and that the

adjustments and weaning of the FIO₂ is performed by pulse oximetry.

The success of the therapy is defined as the maintenance of an SpO₂ greater than 92% (except for patients with chronic CO₂ retention, such as those with chronic obstructive pulmonary disease and neuromuscular diseases), weaning from oxygen therapy to nasal cannula < 4 l/min or removal total oxygen support. Failure is defined as the worsening of cardiorespiratory parameters during therapy, without improvement in the breathing pattern or patient rejection to use and IOT. The schematization of an institutional protocol allows the identification of the success or failure of the therapy, favoring a safer and more skillful decision-making regarding the continuity or not of the ELMOcpap by the team.

DISCUSSION

Based on the ELMOcpap management protocols created by the Ceará School of Public Health and the Ceará Health Secretariat (SESA)⁶, the HSJ developed its own protocol for using this therapy. The subdivision between the management protocol, with its indication/contraindication criteria, and therapeutic monitoring are essential for the identification of failure and success in a timely manner, which provides safety and efficacy to the therapy. Based on the above and on what has already been portrayed in the literature, it is important to highlight that the creators of the helmet-type interface describe that this device, with complete sealing and respiratory isolation, provides the applicability of positive pressure in the airway in a safe and comfortable way for patient 3. This report has already been described by several authors who used the Helmet interface, demonstrating the possibility of applying a higher PEEP value for a long time and avoiding orotracheal intubation by up to 55.4% when compared to the type interface oronasal⁷.

The description of the equipment installation process corroborates the manufacturer's rules of use. However, the occlusion of the cervical silicone collar – performed in the gas flow leakage test at the HSJ – differs from the instructions in the manual, which demonstrates an illustration of the execution by means of a twisting maneuver on the cervical collar. However, the practice of this became easier and safer when performed by placing the helmet on a flat surface, as previously reported, in addition to not interfering negatively in the assembly and installation processes of the ELMO⁸ helmet.

Adequate monitoring will bring benefits to patients, since, if the total flow and FIO₂ are not adjusted according to the needs of each patient,

respiratory distress and/or hypoxemia may intensify, as well as the adjustment of PEEP, which should not exceed values of 12cmH₂O, avoiding complications such as barotrauma or hemodynamic repercussions⁹. Although similar devices are already described in the literature, ELMO is a new technology in Brazil and has its particularities, such as being relatively simple to configure and apply, becoming a useful alternative to treat patients with hypoxemic acute respiratory failure secondary to COVID-19 in situations such as the pandemic that has overwhelmed healthcare systems; not need a mechanical fan for its use; does not require electricity; provide a good cervical seal, preventing dissemination of viral particles, in addition to allowing up to 5 times the reprocessing and reuse by other patients, reducing hospital costs. The elaboration of protocols and their description in the literature allows us to reproduce them in other places and assess their outcomes when taking decisions in different health conditions. In this sense, the scarcity of studies on the subject can be seen as both a limitation and a potential, with regard to encouraging the development of new research.

FINAL CONSIDERATIONS

It is concluded that the protocol follows the recommendations established by the ELMO interface developers. The institutional protocol allows for safe and effective management, but each institution must analyze it and adapt it to the reality of resources, as well as the clinical and functional profile of patients. It should be noted that the recommended actions must be carried out by trained teams, enabling the early identification of patients who will benefit from the therapy.

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