

The use of ELMO helmets for the treatment of patients with COVID-19: experience report

O uso de capacete ELMO para o tratamento de pacientes com a COVID-19: relato de experiência
El uso de cascos ELMO para el tratamiento de pacientes con COVID-19: relato de experiencia

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Abstract

Objective: to describe nurses' experience with the use of the ELMO helmet for the treatment of patients with COVID-19. **Methods:** experience report in an emergency care unit located in a metropolitan city of Ceará, Brazil, in the period from March 15 to June 22, 2021. Content Analysis was used for organization and analysis through references in the area. **Results:** the potentialities of care during the ELMO helmet use were observed, such as a decrease in indications for orotracheal intubation, improvement in respiratory distress, and decrease in morbidity, but also weaknesses such as diminished patient-healthcare professional communication, need for careful evaluation of the time of use and patient response, risk of psychological instability, and risk of broncho-aspiration; moreover, health teams collaborative aspects such as increased intra-team communication, effective interaction, and greater decision-making were registered. **Conclusion:** important results in treating COVID-19 can result from the use of this tool; however, there is a need for strict monitoring in order to avoid major respiratory complications as well as physical and psychological sequelae from the wearing of ELMO.

Descriptors: Nursing Care. Patient Care Team. Interdisciplinary Placement. COVID-19.

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Whats is already known on this?

The use of the ELMO helmet may reduce orotracheal intubation in patients with COVID-19, and the determination of criteria for the election of potential users and their strict follow-up is necessary.

What this study adds?

This study reports that nurses contribute to identify the failures in the ELMO helmet therapy, highlighting its potentialities and weaknesses in this equipment's use and the importance of its monitoring.



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Resumo

Objetivo: descrever a experiência de enfermeiros sobre o uso do capacete ELMO para o tratamento de pacientes com a COVID-19. **Métodos:** relato de experiência em unidade de pronto-atendimento localizada numa cidade metropolitana do Ceará, Brasil, no período de 15 de março a 22 de junho de 2021. Utilizou-se a Análise de Conteúdo para a organização e a análise por meio de referencial da área. **Resultados:** foram observadas as potencialidades do cuidado durante o uso do capacete ELMO, como a diminuição das indicações de intubação orotraqueal, melhora de desconforto respiratório e diminuição da morbidade, mas, também as fragilidades como a comunicação paciente-profissional de saúde diminuída, necessidade de criteriosa avaliação do tempo de uso e a resposta do paciente, o risco de instabilidade psicológica e de broncoaspiração; além disso, aspectos colaborativos da equipe de saúde como comunicação intraequipe aumentada, interação efetiva e maior tomada de decisão foram registrados. **Conclusão:** importantes resultados no tratamento da COVID-19 podem advir da empregabilidade dessa ferramenta, no entanto, há a necessidade de acompanhamento rígido para que se evitem as complicações respiratórias maiores, assim como as sequelas físicas e psicológicas pelo uso do ELMO.

Descritores: Cuidados de Enfermagem. Equipe de Assistência ao Paciente. Práticas Interdisciplinares. COVID-19.

Resumen

Objetivo: describir la experiencia de enfermeros con respecto al uso del casco ELMO para el tratamiento de pacientes con COVID-19. **Métodos:** informe de experiencia en una unidad de atención de emergencia ubicada en una ciudad metropolitana de Ceará, Brasil, de 15 de marzo a 22 de Junio 2021. Se utilizó el Análisis de Contenido para la organización y el análisis a través del referente del área. **Resultados:** se observaron potencialidades de cuidado durante el uso del casco ELMO, como disminución de las indicaciones de intubación orotraqueal, mejoría de las molestias respiratorias y disminución de la morbilidad, pero también debilidades como la disminución de la comunicación paciente-profesional de la salud, necesidad de evaluación cuidadosa del tiempo de uso y la respuesta del paciente, el riesgo de inestabilidad psicológica y el riesgo de broncoaspiración; además, se registraron aspectos colaborativos del equipo de salud como mayor comunicación intra-equipo, interacción efectiva y mayor toma de decisiones **Conclusión:** importantes resultados en el tratamiento de la COVID-19 pueden derivarse de la empleabilidad de esa herramienta, sin embargo, existe la necesidad de acompañamiento rígido para evitar complicaciones respiratorias mayores, así como las secuelas físicas y psicológicas por el uso del ELMO.

Descritores: Atención de Enfermería. Grupo de Atención al Paciente. Prácticas Interdisciplinarias. COVID-19

INTRODUCTION

The COVID-19 pandemic has still caused significant transformations in human society in numerous aspects. More than a year after the first reported case, 649,038,437 cases, and 6,645,812 deaths around the globe, the world is still experiencing the repercussions of the pandemic.⁽¹⁾ Although positive changes have occurred in numerous countries such as Holland, New Zealand, and China, other countries such as Brazil are still suffering from the repercussions of the disease.⁽²⁾

Brazil faces challenges concerning COVID-19, with vaccination at a slowing pace, ongoing denialism towards the disease, and increasing cases (35,751,411 reported cases) and deaths (691,449 deaths) nationwide.^(1,2)

COVID-19 has emerged as a viral infection that culminates in severe respiratory failure with severe systemic complications such as hypoxemic respiratory failure that require adequate ventilatory and therapeutic support. Since the beginning of the pandemic, treatments have been performed in patients with COVID-19 to ensure adequate therapy, such as the use of masks with oxygenation reservoirs as well as nasal oxygen catheters, and noninvasive and invasive ventilation for critically ill patients.^(3,4) In light of this, new technologies have been developed for treatment aimed at maintaining physiologically feasible oxygen saturation (SatO₂) and preserving lung function, such as the ELMO.⁽⁴⁾

The ELMO helmet was developed in the State of Ceará, Brazil, and consists of a pulmonary support tool that reduces respiratory discomfort and contributes to minimizing the need for orotracheal intubation and mechanical ventilatory support. Furthermore, it has been used as an alternative in Intensive Care Units, hospital emergency rooms, and similar units due to the limited supply of mechanical ventilators and the risk of infection by aerosolization provided by COVID-19.^(4, 5)

Worldwide studies have compared the results from ELMO helmet wearing and orotracheal intubation on the survival of patients with COVID-19. A retrospective cohort conducted in Italy identified clinical worsening of patients who were in the helmet and had delayed orotracheal intubation, being recommended to carefully evaluate the patient's condition in employing the ELMO.⁽⁶⁾ Contrarily, a case series study identified the feasibility of the ELMO helmet wearing and its contribution to reducing mortality in patients with COVID-19 who undergo intubation.⁽⁴⁾

In this scenario, the nurse has been one of the main individuals facing the disease, being an essential component of the health team in the care of mild, moderate, and severe patients with COVID-19.⁽³⁾ Therefore, the wearing and installation of the ELMO helmet are one of the nurses' responsibilities, especially in healthcare settings where the presence of other healthcare professionals, such as physiotherapists, is restricted or nonexistent.

Therefore, the indication of the ELMO helmet must be considered for each case of an ill patient, and a careful evaluation is required during the entire process to identify therapy failure and early intubation as previously recommended.⁽⁶⁾ Furthermore, the restrictions and complications of using the equipment may generate physical sequelae such as hearing and dermatological lesions, in addition to psychological disorders as well as affect communication between health care professionals and the patient. These problems require the development of urgent studies.

Given this, the development of health technologies in the pandemic of COVID-19 was and still is urgent. Associated with this is the need to reaffirm the practices of collaboration and interaction among professionals who are on the front lines in fighting the disease, aiming to overcome fragmentation in healthcare actions and achieve care quality, with emphasis on nurses as the greatest workforce in fighting the disease.

Thus, the study aimed to describe nurses' experience of using the ELMO helmet to treat patients with COVID-19.

METHODS

This is a descriptive, qualitative study of the experience report type⁽⁷⁾ on the use of the ELMO helmet for the treatment of patients with COVID-19 in an Emergency Care Unit (ECU) located in a metropolitan city of Ceará, Brazil. The state ECUs are located in more socially vulnerable and peripheral areas of the city, being gateways to the Brazilian health system for urgencies and emergencies, especially for patients infected with COVID-19.⁽³⁾

The site has 24 active nurses distributed in day and night shifts in three different schedules with four nurses per shift. During the pandemic, due to the increased number of infected patients and the complexity of care actions, six nurses were added to the three existing shifts. Two of the nurses on the front line of the disease participated in the study. The other nurses did not contribute, citing a lack of time and institutional reasons.

The data collection period ranged from March 15 to June 22, 2021, through an interview linked to the recorded memory of events and observation of the assistance dynamics with annotations in a field diary and a copy transferred to Microsoft Word®. The interview was triggered by the following questions: What possibilities did you observe in the wearing of the ELMO helmet? Did you observe any flaws or weaknesses? Is there good interaction between the health team professionals for helmet installation and follow-up? The reports were obtained during and after the nurses' workday.

In order to have criticality and reliability in the report, the six-step thematic analysis criteria were followed, according to Nowell *et al.*⁽⁸⁾ The first stage involved familiarization with the information, through reading, triangulation of the different methods of collecting reports, reflections on all thoughts about the information, and identification of potential codes and themes. The second stage consisted of generating the initial codes, with pair discussions and the use of a coding framework. The third step was the search for themes through detailed annotation of the development and concept and theme hierarchies. The fourth step comprised the theme review, with themes and subthemes examined by all researchers. The fifth step consisted of defining the themes, through discussion in pairs and with all researchers, consensus on the themes, and documentation of the findings. Finally, the sixth step resulted in the generation of the themes report, through peer review of the researchers, description of the coding and analysis process, descriptions of the context and theoretical background, and methodological and analytical choices throughout the study.

The following thematic categories were determined: Potentials and weaknesses of care during ELMO helmet wearing and Collaborative perspectives with ELMO helmet use on COVID-19 patients.

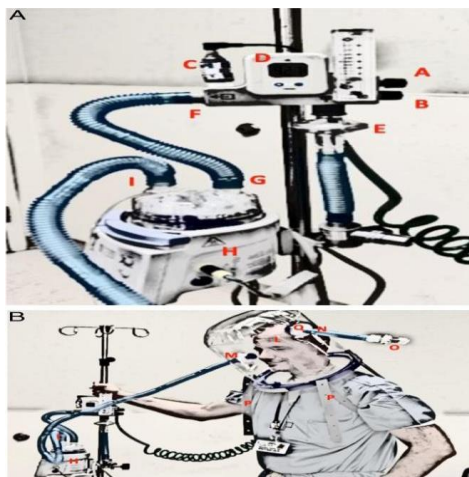
Since this is an experience report provided by the authors, the study does not require approval from the Research Ethics Committee. However, it is emphasized that the research ethics guidelines were followed, highlighting that the reports do not directly involve research participants. Finally, the adapted Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was followed for methodological rigor in qualitative research.⁽⁹⁾

RESULTS

Potentialities and weaknesses of care during the use of the ELMO helmet

Amidst so many doubts regarding the treatment of patients with COVID-19, the ELMO helmet has emerged as another possibility to avoid clinical worsening of patients who have been hospitalized presenting mild to moderate respiratory failure. Figure 1 demonstrates the equipment in healthcare:

Figure 1. ELMO helmet configuration. Fortaleza (CE), Brazil, 2021.



Source: ¹¹

However, the easy handling and simplicity in its use, as well as the need for quick assistance, brings with it a mistaken idea that every patient can be submitted to this therapy. We can also add to this the little training, lack of knowledge, and low adherence to the indications and contraindications of its use, making it not very effective, and may even bring harm to patients who do not fit within this profile.

During the training period for the application of ELMO, almost 100% of the nursing professionals adhered to the training. Due to the short time available and the urgent need to apply the new therapy, the training took place in their own work environment, where subjects related to its handling, assembly, and application in different patients with COVID-19 were discussed.

It is worth mentioning that only three nurses participated in the first training course in a public health training unit in the state, in which, besides theoretical classes, they had the opportunity to put on the ELMO helmet through simulations. This moment brought up possible situations that could occur during patient care, which resulted in a great differential in learning. These three nurses later disseminated what they learned to the others in the health unit.

Other essential aspects that were noticed during the training were the indications and contraindications for its use. In order to describe some particularities of the ELMO use, table 1 shows its potentialities and weaknesses:

Table 1. Potentialities and weaknesses of the ELMO use. Fortaleza (CE), Brazil, 2021.

Potentialities	Weaknesses
Decreased indications for orotracheal intubation Improved respiratory distress Maintenance of oxygen saturation >94% Maintenance of PaO ₂ and PCO ₂ at an acceptable level, Decreased morbidity Preservation of patient consciousness Decreased infectious risks from aerosolization Decrease in costs with more technologically dense therapies such as mechanical ventilation	Decreased patient-provider communication Restriction of diet Restriction in oral medications Need for careful evaluation of the time of use and patient response; Risk of psychological instability generated by claustrophobia and anxiety about the underlying disease Dryness of the ocular and labial mucosa Risk of broncho-aspiration Aural repercussions if ear protectors are not used

Source: Elaborated by the authors (2021).

Fear, insecurity, and the weaknesses pointed out in the previous table contributed to a decrease in the patients' adherence to the device. Thus, daily conversations, psychological support with an explanation

of the necessity, the results observed, and the urgency of the helmet use by health team professionals were necessary and contributed to greater adherence. Likewise, the use of medication to reduce anxiety was also indicated to help at this moment.

Faced with this problem, the nurses had to carefully evaluate the treatment with the ELMO helmet. This moment consisted mainly of monitoring saturation, heart rate, and respiratory rate through hemodynamic monitoring and the patients' tolerance to the equipment, all parameters recorded in electronic medical records. The adherence and withdrawal criteria were related to tolerance and the results of tests such as blood gas analysis.

The nurses had to deal with situations such as feelings of claustrophobia and broncho-aspiration, which also focused on increased caution in the indication of the ELMO helmet, attention to patients in use, and training.

Another relevant aspect encountered by the nurses was the assembly of the equipment. Since it is a complex piece of equipment that requires technical training and careful handling, the assembly systematization (which involves the PVC dome, the silicone cervical collar, the rigid polypropylene base, the compressed air and oxygen flowmeters, latex, trachea, HME filter, humidifier jar, HEPA filter, peep valve, and earplugs) made it difficult to assist with the equipment in face of the second wave of COVID-19's chaotic dynamics and the perspective of being a new technology.

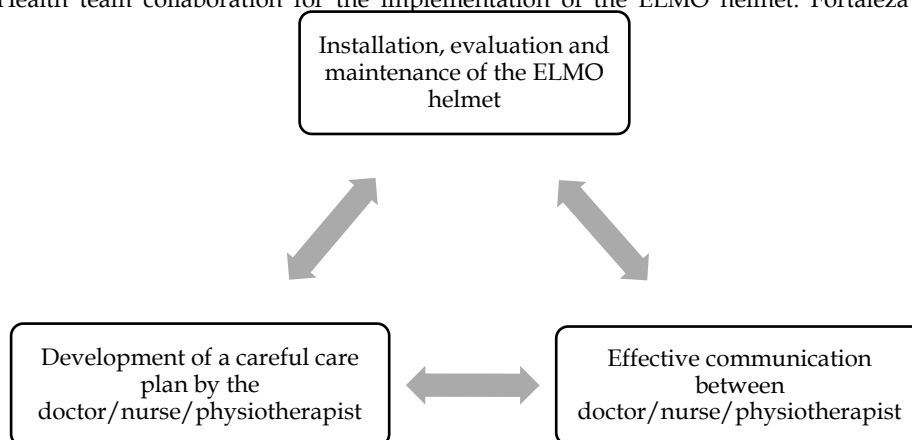
Collaborative perspectives on the use of the ELMO helmet in patients with COVID-19

The decision to start therapy with ELMO primarily involves the medical professional's decision after gasometry and clinical aspects, which assesses its installation. Multiprofessional support and assessment are requested; however, it is important to emphasize that this process is not immune to difficulties. Possible obstacles include the small number of blood gas tests available at the time, as well as the fact that it is a painful test that causes emotional and physical stress to the patients.

Given the large demand of patients and because it is an ECU, nurses have many duties and the ELMO helmet would be one of many additional obligations to be performed. The need for a second professional to apply the helmet, the low knowledge about its indications and contraindications, and the need for bedside follow-up were barriers faced by these professionals. It is noteworthy that once the helmet therapy has been started, it is necessary to closely follow up on the patient's evolution, i.e., if he/she had a positive or negative response.

Therefore, the physiotherapist was included as an active professional in the reality of facing the COVID-19 pandemic, for the ELMO installation and insertion as well as for the assessment, follow-up, and monitoring of intubated patients with motor and respiratory outcomes of COVID-19. Figure 2 exemplifies the interactions within the healthcare team between physician, nurse, and physical therapist in the line of care with the ELMO helmet:

Figure 2 - Health team collaboration for the implementation of the ELMO helmet. Fortaleza (CE), Brazil, 2021.



Source: Elaborated by the authors (2021).

Within the ECU, the development of individualized and collective care plans was implemented to promote effective communication and interaction between the team and the specific cases eligible for the ELMO helmet use.

Thus, the nurses were supposed to develop basic care such as promoting well-being and nutrition. And, along with the physiotherapist, they would install the helmet; the physiotherapist would regulate and monitor the oxygen supply and its relation to compressed air, and the physician would evaluate the use of the helmet and perform laboratory tests to check for improvements in the patient's oxygenation and lung capacity.

However, due to the reduced number of physical therapists at the institution during the night, the development of actions such as installation and monitoring of patients wearing the ELMO helmet was carried out only by nurses and physicians during the unit's night shift. This has a direct impact on the quality of patient outcomes.

Within the described reality, strong results of the interactions in the health team were perceived, which contributed to the maintenance of quality in the care of patients using the ELMO helmet. However, there is still a need for further monitoring actions, development of care skills, and evaluation of results to achieve goals.

The involvement of a larger number of professionals in the health team contributes to the decision-making in the assistance, treatment, and care being guaranteed with safety, attention, and respecting each patient's particularities.

DISCUSSION

The assistance to patients with Acute Respiratory Distress Syndrome (ARDS) caused by COVID-19 proved to be challenging, since the increase in the number of patients requiring hospitalization associated with the collapse of ICU beds, as well as the shortage of mechanical respirators, has led to the need for using other equipment for pulmonary support such as non-invasive ventilation; however, the dispersion of aerosols during its use put the health of professionals at risk.⁽⁵⁾

Some studies from around the world on therapies using continuous positive airway pressure also highlighted similarities with the results found at the trial site but also emphasized continuous monitoring associated with usability time and criteria for use.^(5,10)

Although the ELMO helmet emerges as a method to help reduce the need for intubation, clinical signs of hemodynamic instability, excessive respiratory effort, with signs of muscle fatigue, as well as arterial gasometry analysis, observing not only SatO₂ but the partial pressure of oxygen/ fraction of inspired oxygen (PaO₂/FiO₂) ratio and PH values must be considered.⁽¹¹⁾ In addition to these signs, there is a contraindication for patients with claustrophobia syndrome, ear pinna lesions, somnolence, and the use of feeding tubes, among others.⁽¹²⁾

Thus, severe changes in these values, such as acidemia, also contraindicate therapy with ELMO, i.e., failure to observe these signs can delay the need for urgent intubation, and can be harmful to patients. It is important to emphasize that during the evaluation after the application of ELMO, in addition to the signs of improvement in respiratory discomfort, it is important and careful to request an arterial blood gas analysis beforehand to evaluate and probably indicate the wearing of an ELMO helmet. After that, another arterial blood gas in 30 minutes to two hours after its application, to assess improvement in the breathing pattern. In addition, a blood gas analysis is indicated every 24 hours of use for the following days of therapy to maintain clinical surveillance and therapeutic response.⁽¹¹⁾

Among the clinical criteria, one must evaluate if there was an increase in the PaO₂/FIO₂ ratio, alteration in the PH and partial pressure of carbon dioxide (PaCO₂) values, and the maintenance or reduction of lactate, which, due to the reasons already mentioned, combined with the lack of monitoring resources, the increase in the number of critically ill patients, and problems in sizing professionals, have brought barriers to following the recommendations rigidly, formulated by scholars in the area.⁽¹¹⁾

Although innovative and with promising results documented in studies worldwide^(4,5), other studies such as Ball *et al.*⁽⁶⁾ and Privitera *et al.*⁽¹³⁾ stated the need for careful professional monitoring by nurses to reduce complications. The authors described that delay in orotracheal intubation increases the risk of death in critically ill patients who could obtain better results with early intubation.^(6,13)

In addition, the impact of the pandemic of COVID-19 was reflected in the high demand for hospital supplies, considerably reducing the supplies needed for the follow-up of patients wearing the ELMO helmet, such as the available arterial blood gas elements. A survey on the supply of medicines and health products in Brazil during the COVID-19 pandemic period showed shortages and difficulties in all health services in the country.⁽¹⁴⁾

Other difficulties highlighted reflect indication criteria that contribute to greater criticality in the choice of therapy for patients. These aspects can influence the time of use, as well as the care provided, for example, regarding the management of the diet offered and oral medications. The development of a patient care plan is a tool that can help in this regard.

The pandemic resulted in thousands of deaths worldwide, and due to the excess of information that was televised, as well as the large number of fake news through social networks, and the internet, among others, corroborated the increase of fear and loss of confidence in health professionals.^(1,2) Therefore, the ELMO, due to the reasons already mentioned and because it is a closed system and an innovative therapy, promoted a certain resistance to the treatment of patients.

As listed in the results, the criteria that indicate the clinical worsening need to be rigorously evaluated to reduce the delay in intubation and increase mortality. Studies conducted in Brazil and worldwide concluded that early therapy in patients with mild to moderate COVID-19 may have better results.^(4-6,10,11) The difficulties listed point out situations that Nursing professionals can minimize, such as through ear protection, psychological support, careful evaluation, and monitoring of the response to the use of the helmet ELMO.

Another important aspect in the development of care with the ELMO helmet was collaboration. Cooperation among health professionals in an interdisciplinary and interprofessional manner produces greater health outcomes, with collaborative production and achievement of goals for each patient. Among the skills developed and maximized are leadership and joint decision-making for quality care, improved interactions, and health outcomes.⁽¹⁵⁾

It is emphasized that communication in health is a central element within the health team that promotes care for patients with COVID-19, through collaborative actions, promotion of collective care, reduction of conflicts, and deficiencies in the quality of the care provided.⁽¹⁶⁾

Worldwide studies conducted in Singapore, Canada, and Brazil point to collaborative practices and communication as elements for decreasing risks to the patient, increasing the quality of care, as well as satisfaction with the assistance provided.⁽¹⁶⁻¹⁸⁾

Given this, it is important to point out that in the report's context, this collaboration partially occurred, reaffirming that the ELMO helmet can only be effectively applied safely by a trained, competent, and dynamic interprofessional healthcare team.

Thus, it is believed that the therapy facilitations contributed to the clinical stabilization of patients using the equipment, with a clinical improvement in respiratory distress, preservation of patient consciousness, and a decrease in intubation indications. These data are in agreement with the aforementioned studies. ^(4-6,10,11)

This study contributed to the discussion on the use of this new tool for coping with COVID-19, the ELMO helmet, and how collaborative actions by health professionals can contribute to the development and improvement of care quality. In addition, it reduces the need for intubations and the increase of comorbidities brought about by the process of mechanical ventilation support in COVID-19 patients.

Since this is an experience report, subjective aspects about the dynamics of assistance referred to by the participants may not reflect that of other health professionals, which is a limitation. However, it is important to highlight that it also presents similarities with services in other regions of the country and the world that inserted the helmet ELMO in the dynamics of coping with the pandemic.

CONCLUSION

The use of the ELMO helmet by nurses contributes to the reduction of intubations and mechanical ventilation, in order to allow for greater survival, quality of life, and extended care for patients with COVID-19; however, there are limitations to its use.

The development of collaborations between health teams is an essential aspect that enhances the care and assistance directed and integral to the patient who wears ELMO, contributing to the effectiveness of collaborative and marked changes in the growing numbers of the pandemic.

In view of the still increasing demand for morbidity and mortality indicators for COVID-19, the development of health technologies is essential to overcome these numbers. The effectiveness of the ELMO helmet demonstrates that despite weaknesses in its employability that can be overcome, the potential results are undeniable and can assist the healthcare team in the treatment of COVID-19 and other similar diseases.

CONTRIBUTIONS

Conception or design of the study: Belarmino AC, Pinho CM, Rodrigues MENG, Data collection: Belarmino AC, Pinho CM, Rodrigues MENG, Data analysis and interpretation: Belarmino AC, Pinho CM, Rodrigues MENG, Writing the article or critical review: Belarmino AC, Pinho CM, Rodrigues MENG, Cunha LA, Ferreira Júnior AR, Final approval of the version to be published: Cunha LA, Ferreira Júnior AR.

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