INTEGRATIVE LITERATURE REVIEW ARTICLE

CARE FOR PATIENTS USING EXTRACORPOREAL MEMBRANE OXYGENATION* CUIDADOS A PACIENTES EM USO DE OXIGENAÇÃO POR MEMBRANA EXTRACORPÓREA CUIDADO DE PACIENTES CON OXIGENACIÓN POR MEMBRANA EXTRACORPÓREA

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ABSTRACT

Objective: to analyze the evidence about nursing care for patients using extracorporeal membrane oxygenation. **Method:** this is an integrative review bibliographic study, searching for articles published in scientific journals from 2008 to 2018 and indexed in the LILACS, MEDLINE and Scopus databases, and the Latin American and Caribbean Center for Science Information. Health (BIREME), analyzed by the Content Analysis technique and presented in figure forms. **Results:** nine articles were selected with the analysis that grouped the results into the following categories: Ambulation/Mobilization; Circuit management; General nursing care; Hemodynamic monitoring, prone position; Sedation status monitoring; Anticoagulation control and bleeding monitoring. **Conclusion:** it is understood that nursing care directly affects the improvement of the clinical condition of patients using this type of hemodynamic support, being essential for their complete recovery. Specific training should be provided so that nurses have sufficient skills and competencies to assist the patient safely and effectively. **Descriptors:** Critical Care; Nursing; Cardiology; Extracorporeal Membrane Oxygenation; Hemodynamic Monitoring; Nursing Care.

RESUMO

Objetivo: analisar as evidências acerca da assistência de Enfermagem a pacientes em uso de oxigenação por membrana extracorpórea. **Método:** trata-se de um estudo bibliográfico, tipo revisão integrativa, com busca de artigos publicados em periódicos científicos de 2008 a 2018 e indexados nas bases de dados LILACS, MEDLINE e Scopus e no Centro Latino-Americano e do Caribe de Informação em Ciências da Saúde (BIREME), analisados pela técnica de Análise de Conteúdo e apresentados em formas de figuras. **Resultados:** selecionaram-se nove artigos com a análise que agrupou os resultados nas seguintes categorias: Deambulação/Mobilização; Gerenciamento dos circuitos; Cuidados gerais de Enfermagem; Monitorização hemodinâmica, posição prona; Monitorização do estado de sedação; Controle da anticoagulação e monitoração do sangramento. **Conclusão:** entende-se que a assistência de Enfermagem repercute diretamente na melhora do quadro clínico de pacientes que utilizam este tipo de suporte hemodinâmico, sendo primordial para a sua completa recuperação. Devem-se proporcionar capacitações específicas para que os enfermeiros possuam habilidades e competências suficientes para assistir o paciente de maneira segura e eficaz. **Descritores:** Cuidados Críticos; Enfermagem; Cardiolgia; Oxigenação por Membrana Extracorpórea; Monitorização Hemodinâmica; Cuidados de Enfermagem.

RESUMEN

Objetivo: analizar las evidencias sobre el cuidado de Enfermería para pacientes que usan oxigenación con membrana extracorpórea. **Método:** este es un estudio bibliográfico de revisión integradora, que busca artículos publicados en revistas científicas de 2008 a 2018 e indexados en las bases de datos LILACS, MEDLINE y Scopus, y en el Centro Latinoamericano y del Caribe de Información en Ciencia de la Salud (BIREME), analizadas por la técnica de Análisis de Contenido y presentadas en forma de figuras. **Resultados:** se seleccionaron nueve artículos con el análisis que agruparon los resultados en las siguientes categorías: Ambulación/Movilización; Gestión de circuitos; Cuidados generales de Enfermería; Monitoreo hemodinámico, posición prono; Monitorización del estado de la sedación; Control de anticoagulación y monitoreo de hemorragias. **Conclusión:** se entiende que la atención de Enfermería impacta directamente en la mejora de la condición clínica de los pacientes que utilizan este tipo de soporte hemodinámico, siendo esencial para su recuperación completa. Se debe proporcionar capacitaciones específicas para que los enfermeros tengan suficientes habilidades y competencias para ayudar al paciente de manera segura y efectiva. **Descriptores:** Cuidados Críticos; Enfermería; Cardiolgia; Oxigenación por Membrana Extracorpórea; Monitorización Hemodinámica; Atención de Enfermería.

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INTRODUCTION

Extracorporeal membrane oxygenation (ECMO) is known to be an invasive mechanical circulatory assistance (MCA) mechanical support designed to provide partial or total cardiopulmonary support for patients with cardiac and pulmonary failure. It is set up in a fast-install technology that is applicable to most patients and quickly reverses circulatory failure and/or anoxia.¹⁻²

It should be noted that this system consists of a cardiopulmonary bypass circuit consisting of a set of tubes, an artificial oxygenation membrane and a propelling pump where the purpose is to maintain perfusion of tissues with oxygenated blood while waiting for the previously affected organ to recover like the heart and lung or both. In this process, it is noteworthy that the low oxygenated blood rich in carbon dioxide is drained from the venous system and driven by a centrifugal pump through an artificial oxygenation membrane.³

It is understood that ECMO is a procedure of high cost and complexity, requiring adequate laboratory and technological infrastructure, as well as specific material resources. It is observed that this technology has been widely used in recent years and presents increasingly favorable results, especially related to heart transplantation. It was evidenced that the use of this therapy can cause risks and complications such as bleeding and the risk of infection by exposure and insertion of the cannulas.⁴

It is recommended that high complexity patients should receive specific care planned by nurses with specialized skills. It is noteworthy that the Nursing team provides assistance of great importance due to the need for constant patient evaluation due to the particularity of uninterrupted ECMO care. The application of nursing care systematization is considered as a method that enables the organization of care efficiently to the demand for patient care implementation.⁵

It is understood that, to provide specific care, it is necessary to have a highly specialized and qualified nursing team for its implementation. It should be emphasized that education and preparation beyond their basic nursing degree is mandatory in order to provide this patient with an optimal level of care.⁶

In this context, the importance of the use of mechanical circulatory assistance in the care of critically ill patients and its increasing technological diffusion in high complexity hospitals in Brazil, which require from nursing professionals, conduct based on scientific evidence on ECMO, is emphasized.

OBJECTIVE

- To analyze the evidence about nursing care for patients using extracorporeal membrane oxygenation.

METHOD

This is an integrative review study that was conducted from January to April 2018. It is noted that the integrative review is a research method, as it allows the incorporation of evidence to guide clinical practice, providing support for decision-making through the synthesis of knowledge from published studies.⁷

The PICO strategy was used to formulate the guiding question, with P corresponding to patients using extracorporeal membrane oxygenation; I - nursing care and O - care. The following research question was guided by the Evidence-Based Practice: "What is the evidence in the literature about nursing care provided to patients using extracorporeal membrane oxygenation?". Included in the study population were articles related to nursing care for patients using extracorporeal membrane oxygenation.

Data was collected from publications available in the databases: Latin American and Caribbean Health Sciences Literature (LILACS), MEDLINE, Scopus, Elsevier Publisher, and Latin American and Caribbean Center on Health Sciences Information (BIREME). For the search of the articles, the following Health Descriptors (DeCS) were selected: Critical care; Nursing; Extracorporeal Membrane Oxygenation and Mechanical Circulatory Support. Descriptors were used for the search, using the Boolean operators AND and OR. Studies were included between November 2017 and February 2018.

For the selection of articles, the following inclusion criteria were established: studies in Portuguese, English and Spanish, published from 2008 to 2018, containing the full abstract available online. The titles and abstracts were independently assessed in the databases previously cited by three reviewers, so that studies addressing nursing care and/or nursing care directly to patients were included. in use of extracorporeal membrane oxygenation. Studies addressing the exclusive assistance of other professionals to patients using extracorporeal membrane oxygenation, literature reviews, secondary studies, letters and editorials were excluded.

Studies accessed from the online databases through a library collection were read in which the three reviewers independently read them in full, and those who met the inclusion criteria and answered the research question were selected. The articles were classified according to the level

of evidence (LE). In the classification used, it is considered that, according to the clinical question of the study, there is a hierarchy of evidence, and for the clinical question of Intervention/Treatment or Diagnosis/Test, the strength of the evidence is classified into seven levels (level I - stronger: evidence of systematic review or meta-analysis of all relevant randomized controlled trials). When the clinical issue is Prognosis/Prediction or Etiology, the authors propose to classify the strength of evidence into six levels (level I - evidence from cohort or case-control studies). It is noteworthy that, in the case of a clinical question about meaning, the strength of evidence is classified into six levels (level I - evidence of meta-synthesis of qualitative studies).⁹

Preliminarily, 613 records were identified, 202 in MEDLINE, 178 in LILACS, 179 in the Latin American and Caribbean Center for Health

Sciences Information (BIREME) and 54 in SCOPUS, by searching the selected databases and in the journal portal. After reading, 500 were excluded, as 150 were duplicated, 120 were out of time, 91 had other themes, 89 did not contain abstracts, and there were 50 articles focusing on children. The abstracts of 113 articles were read, of which 80 were excluded, as 50 articles were not available in full and 30 had other themes. A total of 33 articles were read and 24 were excluded, as they did not fit the theme of this review. Nine studies were selected to compose the sample of this integrative review. It is described that the selection of primary studies was performed according to the flowchart in figure1. It is noteworthy that the information was extracted through a validated instrument for systematic organization and, later, the classification into thematic categories.⁸

Figure 1. Flowchart of study selection according to Preferred Reporting Items for Systematic Reviews and Meta-Analyzes.¹⁰ Aracaju (SE), Brazil, 2019.

RESULTS

The final sample consisted of nine articles. From these, 33.3% of the studies (three) were extracted from the MEDLIFE database; 33.3% (three) of LILACS; 22.2 (two) from the Latin American and Caribbean Center on Health Sciences Information (BIREME) and 11.1% (one) from Scopus. Regarding the characterization of primary studies, most of the publications (66.6%)

were in the English language. As for the authors' home institution, all were linked to universities. It is observed that the study site was the United States of America (22.2%), Spain (22.2%) and Brazil (22.2%), being only one study conducted in the United Kingdom (11.1%). Regarding the year of publication, 55.5% of the studies were published in 2016. Figure 2 shows the studies included in this review according to the title, year/country, language and purpose of the studies.

Title of the article	Title of the journal	Authors	Year/ Country	Language	Objective
The early diagnosis and management of mixed delirium in a patient placed on ECMO and with difficult sedation: A case report	Intensive and Critical Care Nursing	Acevedo-Nuevo, González-Gil, Romera-Ortega, Laterre-Marco, Rodríguez-Huerta. ²⁶	Spain 2018	English	To evaluate the efficacy of carperitide in maintaining renal function during intraoperative and postoperative management of patients with renal dysfunction undergoing elective cardiovascular surgery.
Ten things that nurses should know about ECMO	Intensive Care Med	Van Kiersbilck, Gordon, Morris. ³⁷	France 2016	English	Describe ten important nurse care tips for ECMO patients.
The Utility of Nurse-Managed Extracorporeal Life Support in na Adult Cardiac Intensive Care Unit	Ann Thorac Surg	Hackmann, Wiggins, Grimes, Fogel, Schenke, Barr, et al ⁶	USA 2017	English	Educate bedside nurses to manage ECLS circuits by increasing availability of trained providers.
Plan de cuidados individualizado durante oxigenación con membrana extracorpórea. Caso clínico	Enfermería Intensiva	Mañosa, García, Jordan, Hereu, Tejero, Simón, et al. ³⁰	Spain 2016	Spanish	Describe the experience using a process-oriented nurse to safely ambulate VV-ECMO patients .
Safety of Nurse-Led Ambulation for Patients on Venovenous Extracorporeal Membrane Oxygenation	Progress in Transplantation	Boling, Dennis, Tribble, Rajagopalan , Hoopes. ¹⁷	USA 2016	English	To assess the feasibility and safety of daily nursing in patients undergoing venous venous extracorporeal membrane oxygenation (VV-ECMO) for severe respiratory failure.
Daily nursing care on patients undergoing venous-venous extracorporeal membrane oxygenation: a challenging procedure!	The Japanese Society for Artificial Organs	Redaelli, Zanella, Isgro, Lucchini, Pesenti, et al. ²⁷	Italy 2016	English	To assess the feasibility and safety of daily nursing in patients undergoing venous-venous extracorporeal membrane oxygenation (VV-ECMO) for severe respiratory failure.
Nursing care for a patient using ECMO	Baiana Journal of Nursing	Costa, Pereira da Hora, Araujo, Pedreira. ⁵	Brazil 2011	Portuguese	To present and discuss the experience of caring for a patient with Acute Respiratory Distress Syndrome (ARDS) submitted to extracorporeal membrane oxygenation (ECMO).
An international survey: the role of specialist nurses in adult respiratory extracorporeal membrane oxygenation	British Association of Critical Care Nurses	Daly, Camporota, Barrett. ²⁴	London 2016	English	Describe current VV-ECMO adult care staff arrangements.
Use of Extracorporeal Oxygenation Membrane in a Post-Lung Transplant Patient: Nursing Care	Enfermería Global	Oliveira, Neves, Jardim, Mendes, Naves, Bruno, et al. ⁴⁰	Brazil 2015	Portuguese	To describe the systematized nursing care provided to a patient with PGD after lung transplantation who received support with venovenous ECMO.

Figure 2. Characteristics of primary studies. Aracaju, Sergipe, Brazil, 2018.

It was found that the prevalent type of study was the case study (33.3%) and, regarding the level of evidence of the studies, 77.7% were classified as IV. Figure 3 describes the characteristics of the primary studies included in the review according to each delimited category.

Title of the article	Type of study	Level of evidence	Conclusion
<i>The early diagnosis and management of mixed delirium in a patient placed on ECMO and with difficult sedation: A case report</i>	Case study	IV	Finally, it can be concluded that the multimodal and multidisciplinary approach of the patient, through the combination of nursing interventions, rigorous DBP control and pharmacological measures, can achieve good patient outcomes, reaching significant milestones in a relatively short period of time.
<i>Ten things that nurses should know about ECMO</i>	Bibliographic review	IV	ECMO should take into consideration the presence of large referral centers with well-trained medical professionals and nurses. ECM-competent, advanced-care nurses have a positive impact on the care of ECMO patients.
<i>The Utility of Nurse-Managed Extracorporeal Life Support in na Adult Cardiac Intensive Care Unit</i>	Cohort	II	With ongoing education and assessment, including crisis training, physiology and cannulation strategies, CTICU nurses can safely operate ECLS circuits and can increase the availability of adequately trained providers to accommodate the exponential increase in patients using ECMO.
<i>Plan de cuidados individualizado durante oxigenación con membrana extracorpórea. Caso clínico</i>	Case study	IV	This case may support nurses to care for patients undergoing venovenous ECMO, although more cases are needed to standardize care according to the NANDA taxonomy.
<i>Safety of Nurse-Led Ambulation for Patients on Venovenous Extracorporeal Membrane Oxygenation</i>	Series of cases	IV	Adopting a nursing program to ambulate VV-ECMO patients is safe and may reduce other complications associated with immobility.
<i>Daily nursing care on patients undergoing venous-venous extracorporeal membrane oxygenation: a challenging procedure!</i>	Prospective and observational	IV	Nursing care can have a significant impact on physiological factors and parameters of patients undergoing VV-ECMO support.
<i>Cuidado de Enfermagem a uma acidente em us de ECMO</i>	Qualitative and exploratory	IV	Nursing care proved to be of quality, as it was systematized and based on the national and international literature on ECMO.
<i>An international survey: the role of specialist nurses in adult respiratory extracorporeal membrane oxygenation</i>	Cross-sectional	IV	An infusion nurse with the appropriate staffing size implemented by most centers probably reflects the most efficient use of available professional skills.
<i>Use of Extracorporeal Oxygenation Membrane in a Post-Lung Transplant Patient: Nursing Care</i>	Experience report	IV	The systematization of established care has shown to add scientific knowledge, guidance to clinical practice and comprehensive care.

Figure 3. Characteristics of primary studies regarding level of evidence and conclusion. Aracaju, Sergipe, Brazil, 2018.

From the fluctuating reading and the immersion of the studies included in the review, we identified the main approaches to nursing care provided to patients using ECMO in which categories of analysis were observed, as well as the percentage of studies that addressed this theme. They are: ambulation/mobilization; circuit management; general nursing care; hemodynamic monitoring; prone position; monitoring of sedation status; anticoagulation control and bleeding monitoring.

DISCUSSION

- **Walking/Mobility**

It was evidenced that the lack of mobility resulting from the impact of the disease or weakness related to some invasive procedure or hemodynamic instability may be aggravated by the use of ECMO. Studies have shown that lack of mobilization is directly linked to increased length of stay.¹¹⁻¹⁴ Implementation of this intervention has been found to physiologically improve ventilation, central and peripheral perfusion, muscle metabolism, wakefulness, and prevention of deep and venous thrombosis.¹⁵

It is noted that the patient's mobility will be restricted in the venoarterial ECMO modality, since the cannulas that are inserted into the right atrium and aorta provide hemodynamic instability to any movement. It is assumed that the use of alternative cannulation sites, such as the jugular and subclavian vein, became possible with the implementation of new technologies such as the double lumen cannula. However, it is pointed out that these devices hinder patient mobility and especially ambulation.¹⁶

Through several studies, advances in nursing interventions that facilitate mobilization have been found, but there are still several barriers that hinder the implementation of this care. It is pointed out that increased workload, lack of time management, infrastructure, training and patient safety concerns are some of the difficulties found in the studies.^{17-18,12,19-20}

These barriers must be identified, as this can help in the creation of an educational intervention that addresses their concerns and doubts. It is understood that the creation of an early mobility institutional protocol can be an effective solution in guiding and supporting nursing interventions. It is emphasized that training and guidance can have a positive impact on nurses' attitudes.²¹

• Circuit management

It was found that nurses are able to manage the circuits of patients who are using ECMO in the ICU bed. Inspection of circuit integrity for clot formation, air accumulation, and leakage has been noted to be essential to preserving patient safety. It is recognized that this monitoring is usually performed by a perfusionist who has extensive experience in this intervention.²²

The efficiency of nurses in monitoring circuits was evidenced in studies showing an increase in the hospital discharge rate, and most survivors were successfully weaned from support. It is noteworthy that, when trained, these professionals can assess the volume, arterial gases, understand advanced bases of the physiology of ECMO, and identify early emergency situations. It is noteworthy that the survival rate of patients using ECMO increased by 17% compared to perfusion circuit management.^{22,6}

It is understood that the performance of nurses enables greater availability of care to patients who need this treatment, being an efficient and low cost alternative. It was found that there is usually no additional cost for nursing due to the acuity and level of care dependence of the patient and it is the same without the responsibility of managing the circuit.^{6,23}

It is recognized that nurses are increasingly entering the field with experience in critical care in managing ECMO circuits. Several programs are being created with the purpose of training and

qualifying nurses in the management of these circuits. It is noteworthy that the response rate of the studies is very positive, supporting this practice.²⁴

• Daily General Nursing Care

General nursing care is an intervention that aims to improve hygiene and patient comfort, avoiding iatrogenic infections. It was evidenced, in studies, that there is an instability, mainly of the respiratory parameter, during the execution of the nursing care in patients using ECMO.²⁵⁻²⁶ There is a need for cooperation between doctors and nurses in the evaluation of patients who use this device to analyze the tolerance level of nursing care.²⁶

It was evidenced that the daily nursing care protocol is composed of care such as bed bath and lifting with a scoop stretcher (stretcher that allows patient elevation in order to minimize the mobilization of restricted patients in the bed), allowing performing intimate cleaning and removing dirt, changing endotracheal tube positioning and dressing changes as needed. It is emphasized that it is important to evaluate bleeding and monitor the integrity of the vascular access.

It was found that, among the main complications of bed bath, the patient may have tachycardia, decreased oxygen saturation, high blood pressure and reduced central venous saturation.²⁷

Due to clinical severity, the patient may have hemodynamic instability, and the bed bath is largely responsible for causing tachycardia in patients, hypertension and reduced ECMO blood flow. It is noteworthy that the initial protocol was altered in the use of the scoop stretcher because it mobilized a slight lateralization of the patient.

It was evidenced that the state of sedation should be rigorously evaluated before and after general nursing care. It has been found that an inadequate sedation plan can increase oxygen consumption by reducing arterial oxygen saturation. It is noteworthy that, in spontaneously ventilated patients, bed bath mobilization can destabilize the patient's ventilatory state. We highlight the importance of sedation management, which should be performed through instruments such as the Ramsay Sedation Scale (RSS).

• Hemodynamic monitoring

It was evident that hemodynamic treatment is a very important intervention for critically ill patients, being used for diagnosis, therapy and even to make prognosis with the obtained data. It is believed that the purpose is to recognize and evaluate possible complications of the patient's hemodynamic state and to intervene, in a timely manner, with appropriate therapy, preventing further complications. It is noted that this

monitoring consists of invasive and noninvasive parameters.²⁸

Effective measures for monitoring these patients include pulmonary artery catheter (PAC) and pulse-induced contour output (PiCCO). The PAC measures cardiopulmonary parameters using the thermodilution principle; PiCCO uses transpulmonary thermodilution and pulse contour analysis to measure cardiopulmonary parameters and extravascular pulmonary water to predict pulmonary edema and to differentiate cardiogenic and non-cardiogenic respiratory failure. Also noteworthy is the noninvasive hemodynamic monitoring, which uses the principle of thoracic electrical bioimpedance to measure electrical conductivity and then calculate stroke volume and cardiopulmonary parameters using red blood cell arrangement.^{5,29}

It is pointed out that the critical care nurse should evaluate the ECMO parameters and correlate them with parameters such as signs of perfusion, urinary output and cardiac output. It is noteworthy that such close monitoring is necessary since, in the venous mode of ECMO, for systemic oxygenation to occur, cardiac output, native residual lung function, and specific blood flow must occur. It is observed that, in the elimination of arterial CO₂ in this modality, ECMO gas flow, cardiac output and CO₂ production of residual function of the native lungs are required.^{30,16}

The study showed that patients using ECMO may develop Harlequin Syndrome, which has as its inductive mechanism the receipt of deoxygenated blood from the pulmonary veins in the upper half of the body, and in the lower half of the body receives blood from the oxygenated ECMO circuit. It is noted that this situation occurs when the lungs have a poor residual function.³¹

The mechanical support offered by ECMO is temporary and may last from one to 30 days for patients with potential for functional recovery or as a bridge for transplantation. It is noted that its use is limited and is associated with numerous complications, such as: hemolysis; thrombosis; bleeding; strokes; infection; validity of membrane use and left ventricular decompression inability. Remember that after a week, if there are no signs of patient recovery, the implant should be scheduled to implant longer lasting devices or modify the support strategy.³²

Another very important parameter is the monitoring of oximetry based on the central pulse. It is noteworthy that the use of the oximeter in a central location, such as the ear, nose and face, can reproduce more efficient results than when placed in the peripheral position. It is observed that the evaluation of the general condition of the patient, combined with a well accurate physical examination, is the best alternative to determine

the oxygen decrease in patients with this device. It is found that the investigation of laboratory parameters may be necessary for a better case approach and resoluteness in the implementation of conducts such as arterial blood gases, tests to evaluate renal and hepatic function, among others.³³

● Prone position

It is understood that the prone position is a maneuver to combat hypoxemia, a very common symptom in patients with decreased pulmonary compliance and altered ventilation/perfusion. It is evident that there is a significant improvement in oxygenation of the patient, favoring weaning, and can be performed without compromising patient safety. This intervention, when applied to patients using ECMO, has shown benefits in survival.³⁴

It should be noted that the nurse should know the criteria for applying this position, as well as its benefits. It is noteworthy that, when indicated, it provides changes in regional pulmonary insufflation, ventilation redistribution and perfusion redistribution. The contraindications are: refractory hemodynamic instability with vasoactive drugs; chest and abdomen trauma; intracranial monitoring; hemodialysis; spinal cord injury; recent face surgery and cardiopulmonary bypass.³⁵

It is believed that using ultra-protective ventilation with low plateau pressures during VV-ECMO therapy would allow the formation of poorly ventilated areas in dependent lung regions and, consequently, could influence the change in the ventilation/perfusion ratio. It is noteworthy that the position makes it possible to recruit the dorsal regions of the lungs and thus may exert beneficial effects during VV-ECMO therapy.³⁶

Care is required to position the patient in prone, as in patients using ECMO, this intervention may increase the risk of accidental decannulation. It was evidenced in one study that, when applied by the Nursing team, there is a need for six caregivers to change the patient. It is pointed out that a nurse should be specifically responsible for tubing and ECMO during the change. Therefore, it is noted that the training of the entire team is necessary to adapt the technique and maintain patient safety.³⁷

● Sedation status monitoring

It is believed that patients placed on ECMO because of entrapment of pharmacological agents in the system membrane may have difficulty in sedation.³⁸⁻³⁹ It is suggested from the results of one study that in order to achieve a deep sedation level and contribute to a better respiratory evolution, neurological depressant drugs such as midazolam and propofol should be continuously infused and constantly monitored their level of consciousness, pupillary reaction, motor functions

and observation of vital signs. It is noteworthy that the difficult sedation of the patient, besides the intense use of pharmacological strategies, can contribute to the development of nausea, vomiting, hypotension and delirium.²⁶

• Anticoagulation control and bleeding prevention

Extracorporeal life support has been shown to cause bleeding frequently. This high risk was found to be due to the use of anticoagulant therapies to prevent thromboembolic complications and oxygen thrombosis. It is noteworthy that hemorrhages were estimated in about 30 to 60% of patients using this support and that the non-standardization of a standard protocol for anticoagulation, among large centers, is an aggravating factor for bleeding events.⁴⁰

There was a need for variable transfusions depending on the diagnosis of the patient with comorbidities, type of surgical intervention, ease and type of cannulation, and the presence of active bleeding. It has been found that transfusions can damage the immune system, cause volume overload, lung injury, and are a predictor of decreased survival in patients undergoing cardiac surgery. It is noted that the evaluation of platelets and coagulation time allow the nurse to follow the patient safely.^{5,37}

It was evidenced that the nurse should monitor the presence of bleeding in the patient, in the ECMO cannulas, membrane and circuits. It should also check the insertion site, dressing and cannula fixation, monitor hemoglobin levels, hematocrit and observe changes in hemodynamic stability.⁴¹

CONCLUSION

It can be evidenced the importance of the nurse's performance to the patient using ECMO. It is noteworthy that this professional works since the installation of ECMO, going through uninterrupted care during its use and care aimed at the recovery of the patient after removal, in addition to monitoring the actions of the Nursing team, training of new professionals and development of research on this theme; It is he who intervenes effectively based on scientific knowledge, treatment and care for this type of patient.

It is emphasized that nursing care for patients undergoing ECMO is effective, enabling the improvement of their clinical condition. It was noted that there is a need for larger centers to invest increasingly in the qualification of critical care nurses for ECMO as, when trained, these professionals have sufficient skills and competencies to assist the patient safely and effectively, reducing mortality rate and provided better patient recovery and discharge.

It was observed that, with the diffusion of ECMO in hospitals, nurses have been required to have a greater responsibility for patient care, so these professionals should receive a fair remuneration proportional to their competence and specialty. Limitations of the study were the fact that most of the articles included were cross-sectional, making it impossible to follow up interventions over time.

It is hoped that this review can help subsidize nurses to provide care to patients using mechanical circulatory support with ECMO, and it is essential to seek knowledge through the evidence presented in the scientific literature, as well as to perform new investigations, so that, based on the identification of potential problems in clinical practice, nurses are able to institute appropriate nursing interventions in order to provide quality care.

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