Residência RP Pediátrica
Publicação Oficial da Sociedade Brasileira de Pediatria
ISSN-Online: 2236-6814

Submitted on: 06/08/2025
Approved on: 09/08/2025

REVIEW ARTICLE

Physiotherapeutic Performance in Pediatric Patients Under Extracorporeal Membrane Oxygenation

Joyce Liberali Pekelman Rusu[1], Mariana Pardini Morais[1], Mariana Mazzuca Reimberg[1], Anahid Feres Chahine[1], Juliana Honorio Lopes[1], Beatriz Brohem Moscatello[1]

Keywords:
Extracorporeal Membrane Oxygenation, Rehabilitation, Pediatrics, Physical Therapy Modalities, Neonatology, Intensive Care Units, Pediatric.

Abstract

Extracorporeal membrane oxygenation (ECMO) is an invasive therapy that ensures adequate oxygen supply in specific conditions. This study aimed to identify physiotherapeutic interventions in neonatal and pediatric patients undergoing ECMO in intensive care units. A systematic review was conducted using the SciELO, LILACS, PEDro, and PubMed databases with the descriptors "ECMO," "Neonatal," "Pediatric," "Neonatology," "Extracorporeal membrane oxygenation," "Physical Therapy," and "Rehabilitation," both individually and combined using the Boolean operator "AND." The inclusion criteria comprised randomized clinical trials, cohort, case-control, and cross-sectional studies, clinical guidelines, and case reports published in the last 14 years in Portuguese, English, or Spanish, involving pediatric patients. Articles that did not meet the objective, systematic or literature reviews, and duplicates were excluded. A total of 610 articles were initially found, with 12 meeting the selection criteria. Three studies addressed early mobilization (10 to 60 minutes), considering cannulation, age-specific goals, and patient progression. Aspiration was the only respiratory technique described. Nine studies discussed ventilatory support, with pressure-controlled ventilation being the most used mode. Reported parameters included PIP from 15 to 21 cmH^2O, PEEP from 5 to 14 cmH^2O, FiO^2 from 21% to 90%, respiratory rate between 10 and 20 breaths/min, and tidal volume =6 mL/kg. Physiotherapy during ECMO involved assisting in ventilatory support and preventing respiratory and motor complications through early mobilization strategies, ventilator setting adjustments, and aspiration. The authors declare no conflicts of interest. No funding was received to support this research.

[1] Centro Universitário São Camilo, Departamento de Fisioterapia - São Paulo - São Paulo - Brazil.

Correspondence to:
Joyce Liberali Pekelman Rusu
Centro Universitário São Camilo. Av. Nazaré, 1501 - Ipiranga, São Paulo - SP, 04263-200. E-mail: joyceliberali@hotmail.com

Resid Pediatr. 2026;16(2).
DOI: https://doi.org/10.25060/residpediatr-2026-1495

Creative Commons. Attribution-NonCommercial-ShareAlike 4.0 International.

INTRODUCTION

Extracorporeal Membrane Oxygenation (ECMO), also referred to as Extracorporeal Life Support (ECLS), is an invasive form of partial extracorporeal circulation used to maintain adequate oxygen delivery in cases of reversible cardiopulmonary failure that are unresponsive to conventional therapies[1]. The first successful use of ECMO in children undergoing cardiac surgery was reported in 1970. Five years later, its application in neonates with severe respiratory failure was described[2].

The primary purpose of ECMO is to allow pulmonary and/or cardiac rest while the underlying condition recovers. During extracorporeal support, blood is drained by an external pump, either rotary or centrifugal, and passes through a silicone or polymethylpentene membrane for oxygenation and carbon dioxide removal. A heat exchanger maintains appropriate blood temperature before reinfusion into the patient's circulation[3].

Cannulation requires the placement of large-bore cannulas in major vessels and can be performed in two configurations. In the venoarterial (VA) mode, blood is drained from the right atrium through a cannula inserted into the right jugular vein, femoral vein, or directly into the right atrium, and returned to the aorta through a cannula placed in the right carotid artery, femoral artery, or aorta. In the venovenous (VV) mode, blood is drained through the posterior and inferior ports of a dual-lumen cannula inserted into the right jugular vein and reinfused into the right atrium via the anterior port directed toward the tricuspid valve. The VV configuration is associated with a lower rate of complications[2,3].

Because ECMO is a highly complex and invasive therapy in neonatal and pediatric populations, it is generally indicated for patients with an estimated mortality risk between 50% and 100%[3]. According to the Extracorporeal Life Support Organization (ELSO), indications in neonatal and pediatric patients include severe cardiac failure with high mortality risk and potentially reversible etiology, severe respiratory failure with a PaO_2/FiO_2 ratio between 60 and 80, and failure to respond to optimized mechanical ventilation[4]. Contraindications include lethal chromosomal anomalies, severe neurological injury, uncontrolled bleeding, significant intraventricular hemorrhage, vessels unsuitable for cannulation, multiple organ failure, severe immunosuppression, terminal or chronic liver failure, and end-stage renal disease[4,5]. The most frequently reported complications during ECMO support include cannula-related hemorrhage, massive pulmonary hemorrhage, neurological events, infection, ischemia, and renal failure[6-8].

Prolonged exposure to the intensive care environment and complications associated with extracorporeal membrane oxygenation may affect neonatal and pediatric development. Extended immobilization and frequent handling can contribute to delayed motor development, reduced bone mass, and excessive stimulation of the visual and auditory systems, potentially increasing stress levels and morbidity[9,10].

Physiotherapeutic interventions in neonatal and pediatric intensive care units aim to prevent or minimize motor and respiratory impairments associated with altered pulmonary function, respiratory mechanics, functional capacity, and musculoskeletal health. These interventions may also influence length of hospital stay and healthcare costs[11,12].

OBJECTIVE

This systematic review aims to identify physiotherapeutic interventions performed in neonatal and pediatric patients undergoing Extracorporeal Membrane Oxygenation in intensive care units.

METHODS

This systematic review was conducted in five stages: formulation of the research question, database search, independent screening and selection of studies by two reviewers, methodological quality assessment, and synthesis of results. The research question was structured according to the PICO strategy and defined as follows: "What physiotherapeutic interventions, addressing motor and respiratory aspects, are performed in neonatal and pediatric patients undergoing Extracorporeal Membrane Oxygenation in an intensive care unit?"

The literature search was carried out between January 2020 and November 2024 in the electronic databases SciELO, LILACS, PEDro, and PubMed. The search strategy included the descriptors "Extracorporeal Membrane Oxygenation," "ECMO," "Pediatric," "Neonatal," "Neonatology," "Physical Therapy," and "Rehabilitation," in Portuguese and English, according to the Health Sciences Descriptors (DeCS), combined using the Boolean operator "AND," as presented in Table 1.

Eligible studies included randomized clinical trials, cohort studies, case-control studies, cross-sectional studies, clinical guidelines, and case reports published in indexed journals in Portuguese, English, or Spanish. Studies involving neonatal and pediatric patients were considered regardless of underlying diagnosis, length of hospitalization, or duration of ECMO support. Exclusion criteria comprised studies not aligned with the review objective, systematic or narrative reviews, duplicate publications, and articles published more than 14 years prior to the search date.

RESULTS

According to the methods, 883 studies were retrieved from the electronic databases, of which 871 did not meet the selection criteria, leaving 12 articles selected for this systematic review, as detailed in Figure 1.

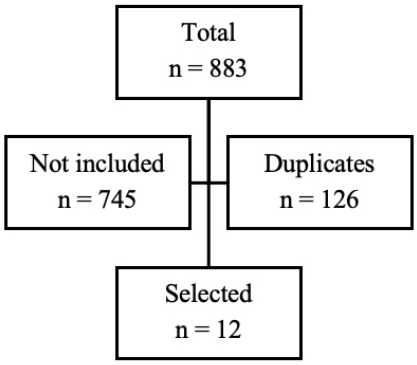

Figure 1. Flowchart of the results from the literature search

The search strategy adopted for the literature search, as described in Table 1, shows the number of articles retrieved from each electronic database according to the general descriptors used, with a total of 883 studies: 291 from LILACS, 516 from PubMed, and 76 from SciELO.

Among the twelve selected scientific articles, nine addressed ventilatory support, while three focused on motor interventions in pediatric and neonatal patients, as outlined in Table 2.

Table 1. Results of the literature search separately by database.

Descritor	LILACS	PubMed	SciELO	Total no descritor
"ECMO"	259	81	62	402
"ECMO" AND "Neonatal"	5	12	3	20
"ECMO" AND "Neonatologia"	6	-	-	6
"ECMO" AND "Pediatria"	9	-	6	15
"ECMO" AND "Physical therapy"	-	158	-	158
"ECMO" AND "Physical therapy" AND "Neonatology"	-	4	-	4
"ECMO" AND "Physical therapy" AND "Rehabilitation"	-	73	1	74
"ECMO" AND "Reabilitação"	1	-	-	1
"ECMO" AND "Physical therapy" AND "Pediatric"	-	40	-	40
"Extracorporeal membrane oxygenation" AND "Physical therapy"	-	148	-	148
"Oxigenação por membrana extracorpórea" AND "Fisioterapia"	-	-	2	2
"Oxigenação por membrana extracorpórea" AND "Neonatal"	4	-	-	4
"Oxigenação por membrana extracorpórea" AND "Neonatologia"	3	-	-	3
"Oxigenação por membrana extracorpórea" AND "Pediatria"	3	-	2	5
"Oxigenação por membrana extracorpórea" AND "Reabilitação"	1	-	-	1
TOTAL	291	516	76	883

Table 2. Results: Motor and respiratory interventions reported in the selected scientific articles.

Author, Year	Article Title	Patient Profiles	Study Design	Physiotherapy Role
Wild, Rintoul, Kattan and Gray. [4]	Extracorporeal Life Support Organization (ELSO): Guidelines for Neonatal Respiratory Failure	Not applicable.	Clinical practice guideline.	Ventilatory support with ventilator parameters during ECMO: PIP 15-20 cmH2O; PEEP 5-10 cmH2O; T insp 0.5-1s; RR 12-20 bpm; FiO2 0.21-0.31.
González-Pardo, Cassalett-Bustillo and Núñez. [7]	ECMO respiratorio como opción terapéutica en falla respiratoria refractaria en la edad pediátrica	2 patients, the first 4 months old weighing 7 kg and the second 2 months old weighing 5 kg.	Case Report.	Described aspiration as the main technique for secretion removal. Ventilation parameters for lung rest: PIP < 20 cmH2O, PEEP 8-14 cmH2O, FiO2 < 0.4.
Higashida et al. [8]	Efficacy of "Awake ECMO" for critical respiratory failure after pediatric open-heart surgery	4 years old, male.	Case Report.	Ventilatory support with parameters: FiO2 0.21-0.9, PEEP 5 mmHg, PIP 19-21 cmH2O, Pressure Support 14-25 cmH2O.
Zebuhr, Sinha, Skillman and Buckvold. [10]	Active Rehabilitation in a Pediatric Extracorporeal Membrane Oxygenation Patient	8 years old, male, ARDS secondary to Influenza A	Case Report.	Mobilization program initiated on the 53rd day of hospitalization, after tracheostomy and with reduced sedation, progressing from passive mobilizations to active as the patient evolved.

Author, Year	Article Title	Patient Profiles	Study Design	Physiotherapy Role
Haydin et al. [13]	Late Arterial Switch Surgery Under ECMO Support in a Patient with Transposition of the Great Arteries with Intact Ventricular Septum: A Case Report	30 months, 12 kg	Case Report.	Ventilatory support using RR 10-12 rpm, FiO2 0.35-0.45, PEEP 5-10 cmH2O to provide an PIP <20 cmH2O.
Betters et al. [14]	Development and implementation of an early mobility program for mechanically ventilated pediatric patients	74 patients with an average age of 53 months (22-154), 40% male.	Retrospective study.	Described motor physiotherapy, with patients being stable prior to therapy. Sessions lasted from 10 minutes to 1 hour depending on patient tolerance. Recommended securing access points and cannulation prior to therapy. Specific mobility goals according to age should be established. Progression: exercises in supine position (cycle ergometer), position change from supine to sitting, sitting to standing, transfer to a chair, and ambulation.
Miranda et al. [15]	ECMO in Neonates with Congenital Diaphragmatic Hernia: The Experience of a Portuguese ECMO Referral Center	14 neonatal patients (age ≤ 28 days) with CDH, 10 male and 4 female.	Descriptive retrospective study.	Ventilatory support (conventional or V-AFO) was provided with the following ventilatory parameters at 24 hours of ECMO: PIP 20-21 cmH2O; PEEP 5 cmH2O; MAP 10-12 cmH2O; FiO2 40%.
Prodhan et al. [16]	Extracorporeal membrane oxygenation support among children with adenovirus infection: a review of the Extracorporeal Life Support Organization Registry	163 patients, 108 pediatric and 55 neonatal; 95 male.	Retrospective study.	Ventilatory support in neonates and pediatric patients was discussed, with PIP, MAP, and FiO2 mentioned, but without clear specification of parameters for each population.
Solé et al. [17]	Venoarterial extracorporeal membrane oxygenation support for neonatal and pediatric refractory septic shock: more than 15 years of learning	21 patients, 9 pediatric and 12 neonatal; 13 male.	Single-center retrospective observational study.	Ventilatory support in neonates and pediatric patients. PEEP, PIP, MAP, and PaO2/FiO2 ratio were mentioned, but without clear specification of the parameters for each population. Once ECMO was established, the general approach was to minimize ventilator settings.
Marhong et al. [18]	Mechanical ventilation during extracorporeal membrane oxygenation an international survey	141 centers registered in ELSO, 11 pediatric, 11 neonatal, and 53 pediatric-neonatal.	Cross-sectional and multicenter study.	PEEP ranged from 6 to 10 cmH2O, with a predicted VT ≤ 6 mL/kg. Ventilation was generally controlled, with about one-third of centers reporting the use of spontaneous ventilation. Most centers initiate ECMO weaning prior to weaning from MV.
Turner et al. [19]	Ambulatory ECMO as a bridge to lung transplant in a previously well pediatric patient with acute respiratory distress syndrome (ARDS)	16 years old, female, with right lower lobe pneumonia and respiratory failure.	Case Report.	On the 28th day of ECMO, a tracheostomy was performed, which facilitated the commencement of rehabilitation, including bed sitting and short-distance ambulation, until lung transplantation was completed.
Junior et al. [20]	Knowledge regarding extracorporeal membrane oxygenation management among Brazilian pediatric intensivists: a cross-sectional survey	Convenience survey with 654 intensivists from 45 Brazilian pediatric intensive care units.	Cross-sectional and multicenter study.	Optimization of MV parameters was performed, although specific parameters were not detailed.

Abreviations definition: ECMO = Extracorporeal Membrane Oxygenation; ELSO = Extracorporeal Life Support Organization; FiO2 = Fraction of Inspired Oxygen; PaO2 = Partial Pressure of Oxygen in Arterial Blood; RR = Respiratory Rate; CDH = Congenital Diaphragmatic Hernia; MV = Mechanical Ventilation; MAP = Mean Airway Pressure; PEEP = Positive End-Expiratory Pressure; PIP = Peak Inspiratory Pressure; PS = Pressure Support; RPM = Respirations per Minute; T ins. = Inspiratory Time; ARDS = Acute Respiratory Distress Syndrome; VT = Tidal Volume; V-AFO = Ventilator-Associated Flow Oscillations.

DISCUSSION

It was observed that the main physiotherapeutic interventions in pediatric patients are mobilizations and developmental stimulation, which should be performed as early as possible, with therapeutic goals tailored to the patient's age. Regarding respiratory care, the procedures described included aspiration and ventilatory support with

adjustments to mechanical ventilator parameters. The protective ventilatory strategy was the most frequently mentioned, emphasizing the use of low tidal volumes, which should always be individualized for each patient.

Respiratory physiotherapy is indicated for patients undergoing ECMO across all age groups, primarily due to the need for ventilatory support and the risk of pulmonary collapse. The protective mechanical ventilation strategy was the most frequently reported, utilizing low tidal volumes (≤6 ml/kg), PEEP values ranging from 6–10 cmH2O, PIP within normal limits (≤21 cmH2O), and low FiO2 levels (<0.4)[4,7,8,13-15]. Two studies mentioned parameters as PEEP, PIP, MAP, and FiO2, but without clear specification of parameters for each population[16,17]. One study highlighted aspiration as the main procedure for secretion removal, aiming to improve the ventilation-perfusion ratio, emphasizing that its application must consider the patient's hemodynamic status[7]. The scarcity of information regarding parameters and criteria for weaning from mechanical ventilation in ECMO patients was identified as a limitation in the selected studies. Only one study mentioned initial weaning from ECMO, followed by weaning from mechanical ventilation, with the spontaneous ventilation mode (PS) being the most commonly utilized[18]. Regarding bronchial hygiene and lung re-expansion techniques applied to adult ECMO patients, there are still no publications addressing these interventions in pediatric and neonatal populations[11].

Motor physiotherapy was addressed in three studies, which concluded that physiotherapy programs should establish specific mobility goals, taking into account the patient's hemodynamic stability and age, with treatment progression occurring as the child's clinical condition improves[10,14,19]. No study reported contraindications to mobilization in ECMO patients; however, motor physiotherapy should be performed safely, adopting certain contraindication criteria and protocols for abrupt interruption of therapy in cases of hypoxia, hemodynamic instability, unstable heart rhythm, intracranial pressure fluctuations, cannulation instability, and oxygen saturation decline[12]. Furthermore, continuous monitoring during therapy is essential to prevent mechanical complications of the ECMO circuit, such as cannula failure or rupture, pump malfunction, oxygenator or heat exchanger failure, circuit disruption, air embolism, and thrombosis. Constant surveillance of ECMO system functionality is crucial to ensure circuit integrity[5].

The implementation of therapy requires a well-trained multidisciplinary team, as clinical management is restricted and limited by safety concerns, particularly due to the high risk of cannula displacement[14,21].

The use of ECMO in Brazil is relatively recent and remains a scarce resource with a high initial cost. However, although the acquisition of extracorporeal support represents a significant investment, the daily costs associated with its use are not substantially higher than those of patients treated exclusively with invasive mechanical ventilation (IMV). This is because the combination of ECMO and IMV has been associated with reduced mortality and shorter hospital stays, which helps offset the investment in this therapy[22].

Although ventilatory management is a multiprofessional approach, in Brazil, it has been predominantly within the scope of physiotherapy practice. For this reason, ventilatory management, including the description of ventilatory parameters, was included in this study[23,24].

The findings of this research reveal a significant limitation in the availability of high-quality scientific studies from a methodological standpoint regarding the role of physiotherapy in pediatric and neonatal populations. The lack of studies addressing physiotherapeutic techniques in patients undergoing ECMO hinders the implementation of specific interventions and restricts the use of therapies that could offer beneficial effects, such as promoting typical development and improving pulmonary function[25,26].

Furthermore, in Brazil, a significant proportion of pediatric and neonatal intensivists have limited knowledge regarding the use of extracorporeal membrane oxygenation (ECMO), particularly concerning its indications, management, and associated complications. This highlights the need for more comprehensive and in-depth studies to foster a better understanding and application of this technology in clinical practice.

CONCLUSION

Physiotherapeutic interventions in patients undergoing ECMO primarily aim to support ventilatory function and prevent pulmonary and motor complications. The most commonly reported strategies include adjustments to mechanical ventilation settings, airway suctioning to ensure bronchial hygiene and early mobilization.

Nonetheless, the current body of evidence remains limited. The limited studies available often presents low methodological quality, which limits the generalizability of their findings. Moreover, there is a notable scarcity of research specifically targeting pediatric and neonatal populations, groups that exhibit distinct clinical and physiological characteristics compared to adults, and thus require tailored physiotherapeutic approaches.

Accordingly, further high-quality studies are warranted to deepen the understanding of physiotherapy's role in pediatric and neonatal patients receiving ECMO. Such investigations are essential to inform safe, effective, and evidence-based clinical practices for this highly complex and vulnerable population.

REFERENCES

1. Domínguez ED, Salas G, Valdés M, Rubio C, Bellani P, Rodas S, et al. Oxigenación por membrana extracorpórea (ECMO): experiencia en una unidad de cuidado intensivo neonatal. Arch Argent Pediatr. 2012;110(5):404-411. doi: http://www.doi.org/10.5546/aap.2012.404

2. Carpenter JL, Yu YR, Cass DL, Olutoye OO, Thomas JA, Burgman C, et al. Use of venovenous ECMO for neonatal and pediatric ECMO: a decade of experience at a tertiary children's hospital. Pediatr Surg Int. 2018;34(3):263-268. doi: http://www.doi.org/10.1007/s00383-018-4225-5

3. Kattan J, González Á, Castillo A, Caneo LF. Neonatal and pediatric extracorporeal membrane oxygenation in developing Latin American countries. J Pediatr (Rio J). 2017;93(2):120-129. doi: http://www.doi.org/10.1016/j.jpedp.2017.01.002

4. Wild KT, Rintoul N, Kattan J, Gray B, Engle RW, Keene S, et al. Extracorporeal Life Support Organization (ELSO) guidelines for neonatal respiratory failure. ASAIO J. 2020;66(5):463-470. doi: http://www.doi.org/10.1097/MAT.0000000000001153

5. Monreal VE, Zuleta YM, Reyes ES, Palominos EL. ECMO pediátrico: una puesta al día. Neumol Pediatr. 2019;14(1):34-40. doi: http://www.doi.org/10.51451/np.v14i1.82

6. Santana-Santos E, Silva JR, Ribeiro AC, Oliveira M, Nascimento R, et al. Clinical outcomes of pediatric patients treated with extracorporeal membrane oxygenation. Acta Paul Enferm. 2016;29(4):405-417. doi: http://www.doi.org/10.1590/1982-0194201600056

7. González-Pardo OM, Cassalett-Bustillo G, Núñez F. ECMO respiratorio como opción terapéutica en falla respiratoria refractaria en la edad pediátrica. Rev Colomb Cardiol. 2016;23(6):560-566. doi: http://www.doi.org/10.1016/j.rccar.2016.01.021

8. Higashida A, Hoashi T, Kagisaki K, Shimada M, Takahashi Y, Hayashi T, et al. Efficacy of "awake ECMO" for critical respiratory failure after pediatric open-heart surgery. J Artif Organs. 2016;19(2):196-199. doi: http://www.doi.org/10.1007/s10047-015-0876-3

9. Giachetta L, Marques NC, Paula A, Marques CB, Zuana AD. Influence of length of hospitalization on neuromotor development in premature newborn infants. Fisioter Pesqui. 2010;17(1):24-29. doi: http://www.doi.org/10.1590/S1809-29502010000100005

10. Zebuhr C, Sinha A, Skillman H, Buckvold S. Active rehabilitation in a pediatric extracorporeal membrane oxygenation patient. PM R. 2014;6(5):456-460. doi: http://www.doi.org/10.1016/j.pmrj.2013.11.005

11. Maia FES. A fisioterapia nas unidades de terapia intensiva neonatal. Rev Fac Cienc Med Sorocaba. 2016;18(1):64-65. doi: http://www.doi.org/10.5327/Z1984-4840201622134

12. Van Dyk M. Physiotherapy for ECMO patients. Egypt J Crit Care Med. 2018;6(3):147-149. doi: http://www.doi.org/10.1016/j.ejccm.2018.12.013

13. Haydin S, Ozturk E, Yildiz O, Tuzun B, Guzeltas A. Late arterial switch surgery under ECMO support in a patient with transposition of the great arteries with intact ventricular septum: a case report. Braz J Cardiovasc Surg. 2020;35(1):113-116. doi: http://www.doi.org/10.21470/1678-9741-2019-0106

14. Betters KA, Hebbar KB, Farthing D, Griego B, Easley T, Turman H, et al. Development and implementation of an early mobility program for mechanically ventilated pediatric patients. J Crit Care. 2017;41:303-308. doi: http://www.doi.org/10.1016/j.jcrc.2017.08.004

15. Miranda M, Abecasis F, Almeida S, Torres E, Boto L, Camilo C, et al. ECMO in neonates with congenital diaphragmatic hernia: the experience of a Portuguese ECMO referral center. Acta Med Port. 2020;33(12):819-827. doi: http://www.doi.org/10.20344/amp.13075

16. Prodhan P, Bhutta AT, Gossett JM, Stroud MH, Rycus PT, Bratton SL, et al. Extracorporeal membrane oxygenation support among children with adenovirus infection: a review of the Extracorporeal Life Support Organization registry. ASAIO J. 2014;60(1):49-56. doi: http://www.doi.org/10.1097/MAT.0000000000000013

17. Solé A, Jordan I, Bobillo S, Moreno J, Balaguer M, Hernández-Platero L, et al. Venoarterial extracorporeal membrane oxygenation support for neonatal and pediatric refractory septic shock: more than 15 years of learning. Eur J Pediatr. 2018;177(8):1191-1200. doi: http://www.doi.org/10.1007/s00431-018-3174-2

18. Marhong JD, Telesnicki T, Munshi L, Del Sorbo L, Detsky M, Fan E. Mechanical ventilation during extracorporeal membrane oxygenation: an international survey. Ann Am Thorac Soc. 2014;11(6):939-944. doi: http://www.doi.org/10.1513/AnnalsATS.201403-100BC

19. Turner DA, Rehder KJ, Bonadonna D, Gray A, Lin S, Zaas D, et al. Ambulatory ECMO as a bridge to lung transplant in a previously well pediatric patient with ARDS. Pediatrics. 2014;134(2):e603-e607. doi: http://www.doi.org/10.1542/peds.2013-3435

20. Júnior JC, Barbosa AP, Araujo OR, Tonial CT, Oliveira FRC, Souza DC, et al. Knowledge regarding extracorporeal membrane oxygenation management among Brazilian pediatric intensivists: a cross-sectional survey. Crit Care Sci. 2023;35(1):57-65. doi: http://www.doi.org/10.5935/2965-2774.20230350-en

21. Hayes D, McConnell PI, Preston TJ, Yates AR, Kirkby S, Galantowicz M. Active rehabilitation with venovenous extracorporeal membrane oxygenation as a bridge to lung transplantation in a pediatric patient. World J Pediatr. 2013;9(4):373-374. doi: http://www.doi.org/10.1007/s12519-013-0437-x

22. Brasil. Ministério da Saúde. Relatório de recomendação nº 138: uso da oxigenação extracorpórea no suporte de pacientes com insuficiência respiratória. Brasília: Ministério da Saúde; 2015[citado em 2 out 2024]. Disponível em: https://www.gov.br/conitec/pt-br/midias/relatorios/2015/relatorio_oxigenacaoextracorporea_final.pdf

23. Lourenção ML, Carvalho WB. Pediatric ventilation weaning. Rev Bras Ter Intensiva. 2020;32(3):333-336. doi: http://www.doi.org/10.5935/0103-507X.20200061

24. Bacci SL, Pereira JM, Chagas AC, Carvalho LR, Azevedo VM. Role of physical therapists in the weaning and extubation procedures of pediatric and neonatal intensive care units: a survey. Braz J Phys Ther. 2019;23(4):317-323. doi: http://www.doi.org/10.1016/j.bjpt.2018.08.012

25. Vasconcelos GAR, Almeida RCA, Bezerra AL. Repercussões da fisioterapia na unidade de terapia intensiva neonatal. Fisioter Mov. 2011;24(1):65-73. doi: http://www.doi.org/10.1590/S0103-51502011000100008

26. Oliveira BS, Mendonça KMPP, Freitas DA. Fisioterapia motora no recém-nascido prematuro em unidade intensiva neonatal: uma revisão sistemática. Conscientiae Saude. 2015;14(4):647-654. doi: http://www.doi.org/10.5585/conssaude.v14n4.5254