

## **MAIN VENTILATORY MODALITIES USED IN WEANING IN A NEONATAL AND PEDIATRIC INTENSIVE CARE UNIT**

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**Abstract: Introduction:** The weaning process is a challenge when it comes to Neonatal and Pediatric Intensive Care Units (NICUs), the spontaneous breathing test (SBT) is used in different ventilatory modalities. Objective: To report recent research on which modality is most used in pediatrics and neonatology during ERT. **Methodology:** This is a study of an integrative literature review. The following databases were consulted: Pubmed/MEDLINE, Scientific Electronic Library Online (SCIELO) and Latin American and Caribbean Literature in Health Sciences (Lilacs). Experimental articles were included, which dealt with the proposed theme, published in full, in the last 12 years, without linguistic restriction. Excluded, works presented only in summary/abstract form, articles published in full, but that were case reports or experience reports, articles that deviated from the theme. **Results:** We analyzed 51 articles published in full, of which 6 were analyzed and included in the competition. **Discussion:** It was possible to observe that pressure-support ventilation (PSV) is the most prevalent ventilatory modality in pediatrics, while in the neonatal population continuous positive airway pressure (CPAP) is the most used, despite this there is a shortage of protocols for weaning in the ICU. Conclusion: studies are needed aimed at creating protocols, bringing more safety for clinical application in both the pediatric and neonatal populations.

**Keywords:** Weaning from the respirator; Neonatology; Pediatrics; Artificial respiration.

## INTRODUCTION

Several situations require infants and children to institute mechanical ventilation (MV) and advanced ventilatory support (Johnston et al., 2012). Once installed, the MV weaning process must be performed as soon as possible. The spontaneous breathing test (SBT), Toby's index and assessment of

muscle strength are methods used for weaning in adults (Johnston et al., 2012, Newth et al., 2009). However, in neonatology and pediatrics, there is no real definition of which strategy to use. (Newth et al., 2009)

The weaning process is a challenge when addressing the Neonatal and Pediatric Intensive Care Units (NICU), there is no strong evidence of any effective method, tests or validated criteria that are considered reliable means to determine standardized for weaning from MV. (Mhanna et al., 2014). Most NPUIs use parameter reduction as a weaning strategy or perform ERT.

The application of ERT can be applied in the pressure-support ventilation mode (PSV+PEEP), ventilation with pressure support, where positive end-expiratory pressure (PEEP) and pressure support (PS) are adjusted, commonly used by the population pediatric. In addition, another modality applied is the continuous positive airway pressure (CPAP), which consists of continuous positive airway pressure. (Medeiros et al., 2011)

The duration of ERT can vary from 30 min to 120 min, considering success if the patient remains extubated for 48 hours without signs of respiratory distress. Failure would result in returning to MV with the attempt of a new test after 24 hours. Weaning performed correctly reduces the rate of weaning failure and consequently reintubation, thus reducing the morbidity and mortality of children and neonates. (Eskandar et al., 2007)

There is a scarcity of studies on which modality is best used for weaning from MV. Therefore, the objective of this study is to report recent research on which modality is most used in pediatrics and neonatology during ERT.

## **METHODOLOGY**

This is a study of an integrative literature

review, which seeks to capture, recognize and synthesize the production of knowledge about a subject or theme, carried out in the period of January and February of 2023.

The following databases were consulted: Pubmed/MEDLINE, Scientific Electronic Library Online (SCIELO) and Latin American and Caribbean Literature in Health Sciences (Lilacs).

The descriptors and their similar ones in English were used, according to DECs and MeSH, respectively: “Respirator weaning” “Neonatology” “Pediatrics” “Artificial respiration” and their respective crossings.

As inclusion criteria, experimental articles were considered (clinical trials, crossed trials, quasi-experimental, cohort, case series), which dealt with the proposed theme, published in full, in the last 12 years, without linguistic restrictions.

Exclusion criteria were: works presented only in summary/abstract form, articles published in full, but that were case reports or experience reports, articles that did not address the topic (non-pediatric or neonatal population), as well as as literature reviews on the subject.

## **RESULTS**

After selecting the articles, the results were analyzed and discussed on the subject.

The description of the applied crossings is shown in Table 1. In which it can be observed that some keywords were very comprehensive in relation to the result of corresponding articles.

The sequence of exclusion and selection of articles is shown in the flowchart below (figure 1). The sum includes all articles searched in the 3 databases.

## **DISCUSSION**

A cross-sectional, analytical, survey-

Crossings/Database	Lilacs	SciELO	Pubmed
Weaning	188	118	116
Spontaneous breathing test	99	88	89
Extubation in pediatrics and neonatology	95	28	22
Ventilatory modalities	44	42	35

Table 1. Crossings of terms in databases and their respective search results.

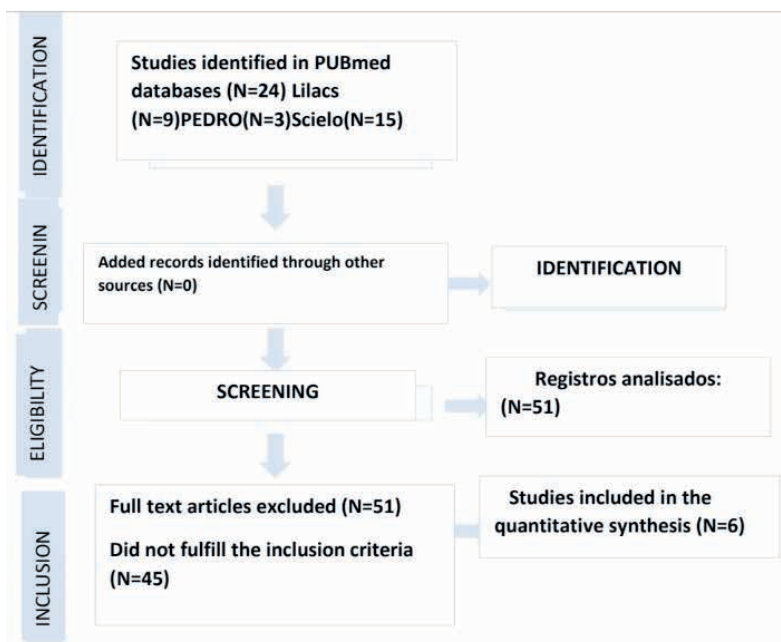


Figure 1. Flowchart of retrieval of articles for the preparation of the review.

type study, called Weaning Survey-Brazil, involving a national sample of 693 neonatal and pediatric ICUs (NICUs) whose objective was to describe the characteristics related to the application of protocols, methods and criteria used in the weaning process MV and extubation in these ICUs in Brazil. 57.6% of the ICUs used a weaning protocol, while 41.8% carried out weaning based on clinical judgment. When evaluating which mode was used, 54.1% performed gradual weaning according to the patient's tolerance and 13% used CPAP as a transitional weaning mode with values ranging from PEEP: 5-7 cmH<sub>2</sub>O and 79.6% used PSV as a transition mode with PS values: 8 to 12 cmH<sub>2</sub>O and PEEP: 5 cmH<sub>2</sub>O (Bacci et al., 2020).

The ventilatory mode used during ERT varies depending on the protocol of each service, most studies show that the predominance of the use of PSV+PEEP in pediatric ICUs with PS  $\leq$  10 cmH<sub>2</sub>O. A prospective, randomized, controlled study observed the use of PSV + PEEP during the ERT for 2 hours of testing, the reduction of parameters occurred gradually according to the clinical condition of the patient, the combination of PSV + PEEP modality according to clinical judgment, there was no increase in the rate of extubation failure or the need for non-invasive ventilation. (Foonda et al., 2011)

In line with foonda et al., 2011, an article by Faustino et al., 2017 with 736 patients, submitted children with acute respiratory failure due to lower respiratory tract disease, the ERT was performed in the PSV + PEEP modality, the value of PS adjusted according to the patient's tube diameter of the 788 patients who passed ERT, 736 were successfully extubated for a positive predictive value of 93%. (Faustino et al., 2017)

In the neonatal population, there is a change, where the ventilatory modality used

in ERT is CPAP. A study carried out by Al-Mandari et al., 2015 described the way in which ERT is performed in an Australian hospital, the most used modality was CPAP with PEEP: 5-8 cmH<sub>2</sub>O, duration ranging from 3 min (25%) to more than 10 min (35%) used CPAP as the breathing mode used (84%), followed by nasal intermittent positive pressure ventilation (55%) and high-flow nasal cannula (33%).

Therefore, a study by Chawla S, et al., 2013, whose objective was to assess the validity of objective measures of lung function and ERT attempt in predicting successful extubation among preterm infants with attempted extubation within the first 3 weeks of life, the modality used during ERT was CPAP, with a sample of 49 infants, of whom 80% were successfully extubated. Of the 41 babies who passed the test, only 5 babies failed extubation (Chawla S, et al., 2013)

Most studies on ERT in neonatology used the CPAP ventilation mode, with rates of 3-5 cmH<sub>2</sub>O and duration of 3-120 min, and had positive responses. In neonates and pediatric patients, unlike the adult population, SBT is only performed when the patient is actually considered fit to perform it.

Contrary to these findings, a randomized clinical trial, carried out by Teixeira et al., 2022, evaluated the effects of a 5-minute ERT and a 10-minute ERT on the success rates in extubation of very low birth weight newborns (VLBW). The ERT was performed with the CPAP ventilation mode with PEEP: 5 cmH<sub>2</sub>O, the study concluded that passing the ERT for 5-10 minutes did not improve extubation success rates and did not reduce the length of stay, when compared to clinical judgment. (Teixeira et al., 2022)

An important point to be analyzed is the criteria used to interrupt ERT both in the use of CPAP and in the use of PSV + PEEP. Signs such as apnea requiring pacing, presence

and duration of bradycardia, presence and duration of desaturation, and increased need for supplemental oxygen; test interruption criteria used in all cited studies. After the interruption, the parameters are adjusted as programmed before the patient is submitted to the test. (Chawla et al., 2013, Faustino et al., 2017, Bacci et al. 2022, Texeira et al., 2022).

Corroborating these findings, the study by Texeira et al., 2020, in addition to the clinical presentations already mentioned by the other authors, considered it important to add the assessment of respiratory effort by nose flaring (BSA), and despite the criteria for interruption and /or approval being key points, no combination of clinical events was found to define pass/fail in ERT that could distinguish between success and failure in extubation with good accuracy. (Texeira et al., 2022)

With this, it was possible to observe that PSV + PEEP is the most predominant ventilatory modality in pediatrics, while in the neonatal population CPAP is the most used, despite this there is a shortage of weaning protocols in the ICU, requiring studies aimed at creating of protocols, bringing more safety for clinical application in both the pediatric and neonatal populations.

## **CONCLUSION**

Among the various modalities in which ERT is applied, PSV+ PEEP stands out in the pediatric population, while CPAP in the neonatal population, with all of the above, it was possible to observe that, despite the existence of several studies to be carried out on the best modalities for performing ERT in the pediatric and neonatal population, there is a shortage of weaning protocols in the NPCU's, well-established protocols manage to guide clinical practice and reduce the morbidity and mortality of the assisted population.

Within this, further studies are needed to

assess the clinical impact of the methods and strategies adopted for weaning from MV and extubation of pediatric and neonatal patients and with clinical protocols for the application of ERT to guide professionals in the area. These studies must be based on safety, quality and productivity indicators applicable in ICUs.

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