Children's Hospital of Orange County (CHOC)
Best Evidence and Recommendations (BEaR)

Best Practices for Ventilator Management in Pediatric Acute Respiratory Distress

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Abstract

Since the adoption of Low Tidal Volume (LTV) and other lung-protective strategies for acute respiratory distress syndrome (ARDS) in the 1990s, the mortality rate has remained high at approximately 30% for both adults and pediatric patients. The aim of this evidence-based project was to identify optimal ventilator management practices for pediatric acute respiratory distress syndrome (PARDS), accomplished by comparing the utilization of APRV-TCAV with the existing protocols at CHOC. The review of literature brought to light the fact that APRV-TCAV has not undergone evaluation through randomized controlled trials in either adult or pediatric populations; rather, it has been predominantly studied using porcine models. Furthermore, it became evident that CHOC lacks a well-defined PARDS protocol. Consequently, a key recommendation emerged, advocating for establishing a systematic approach for identifying risk factors, formally recognizing the disease process, and subsequently implementing the most effective available strategies for PARDS treatment. The initial step to implementing a PARDS protocol involves the identification of individuals at high risk for PARDS and closer monitoring of these patients for the emergence of symptoms.

Keywords

Pediatrics, ARDS, PARDS, APRV-TCAV

PICO(T)

In PICU patients how does using APRV vs. current practice impact ARDS prevention and management, including time to extubation, length of stay, mortality, and cost of care?

Background and Significance

Acute respiratory distress syndrome (ARDS) is a non-cardiogenic pulmonary edema that manifests as rapidly progressive dyspnea, tachypnea, and hypoxemia (Saguil, & Fargo, 2020). While numerous studies have focused on ARDS in adults, the research on pediatric acute respiratory distress syndrome (PARDS) has been notably limited. What is potentially more noteworthy than the scarcity of randomized control studies involving children with ARDS is the

absence of criteria for defining ARDS in pediatric populations within the definitions proposed in the 1990s. The PARDIE study conducted in 2020 revealed that pediatric ARDS occurs in approximately 3% of children in intensive care units globally, with associated mortality rates varying from 17% to 33%, depending on the severity of the condition. Dembinski (2018) reported even higher mortality rates, ranging from 40% to 60%. It's worth noting that these mortality rates have remained relatively stable, with no significant changes, even after the introduction of lung-protective strategies in the early 1990s. Ventilator management predominantly involves the utilization of Low Tidal Volume (LTV). Seeking the best approach to identify and treat PARDS is essential to our organizational mission to nurture, advance, and protect the health and wellbeing of our patients.

Framework

This EBP project utilizes the "Translating Evidence into Practice: CHOC's Approach to EBP" model, adapted from the EBPI Model © 2007 Brown & Ecoff (Ecoff, Stichler & Davidson, 2020).

Search for the Evidence

Search strategies included the use of Cochrane, Pub Med, and Google Scholar. Key search words: Pediatrics, ARDS, PARDS, APRV-TCAV. This search yielded 38 articles, 22 of which were included in the project. Of these 22 studies 10 were related to high frequency oscillation ventilation and 12 were related to APRV. Only one APRV study addressed pediatric subjects. The literature reviewed consisted of 5 meta-analyses, 14 RCTs, 2 systematic reviews, and 1 conference (PALLIC-2) on the topic PARDS.

Critical Appraisal and Synthesis of the Evidence

- Unlike adult ARDS, where specific diagnostic criteria (such as the Berlin Definition) exist, there isn't a universally accepted set of criteria for PARDS (Saguil & Fargo (2020).
- The absence of standardized criteria for PARDS can lead to variations in diagnosis and management across different healthcare institutions (Yehya et al., 2020).
- The Lung Injury Prediction Score (LIPS) is a risk assessment tool used to predict the likelihood of an adult patient developing ARDS (Pehlivanlar et al., 2019).
- LIPS considers several clinical factors, including the presence of sepsis, shock, trauma, cardiac surgery, immunosuppression, obesity, and underlying disease (Pehlivanlar et al., 2019).
- By identifying patients at higher risk, healthcare providers can potentially take preventive measures and implement lung-protective ventilation strategies to reduce the risk of ARDS (Pehlivanlar et al., 2019).

- Research comparing APRV to HFOV in children is limited, with mixed findings regarding clinical outcomes (Ganesan 2018).
- Some studies suggest that APRV may provide better oxygenation and lung protection, while others find no significant difference between the two modes.
- The choice between APRV and HFOV in pediatric patients may depend on individual patient characteristics, clinician experience, and institutional protocols.
- Further research is needed to establish clear guidelines and determine the superiority of one mode over the other in pediatric populations.

Practice Recommendations

- Adopt a formal definition of PARDS at CHOC.
- Provide education on PARDS identifiers such as oxygen index (OI).
- Implement a risk assessment tool for PARDS such as LIPS.
- Develop strategies for identifying and treating PARDS earlier.
- Develop a PARDS protocol.
- Select appropriate outcome measures for new implementation strategies.

Outcome Measures

The proposed outcomes to be measured would be: time to identify ARDS, accuracy of diagnosis, and length of time to place on lung protective strategies.

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