

Ventilatory Support in Children With Pediatric Acute Respiratory Distress Syndrome

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Objective:

To describe the recommendations of the Pediatric Acute Lung Injury Consensus Conference for mechanical ventilation management of pediatric patients with acute respiratory distress syndrome.

Design:

Consensus Conference of experts in pediatric acute lung injury.

Methods:

The Pediatric Acute Lung Injury Consensus Conference experts developed and voted on a total of 27 recommendations focused on the optimal mechanical ventilation approach of the patient with pediatric acute respiratory distress syndrome. Topics included ventilator mode, tidal volume delivery, inspiratory plateau pressure, high-frequency ventilation, cuffed endotracheal tubes, and gas exchange goals. When experimental data were lacking, a modified Delphi approach emphasizing the strong professional agreement was used.

Results:

There were 17 recommendations with strong agreement and 10 recommendations with weak agreement. There were no recommendations with equipoise or disagreement. There was weak agreement on recommendations concerning approach to tidal volume and inspiratory pressure limitation (88% to 72% agreement, respectively), whereas strong agreement could be achieved for accepting permissive hypercapnia. Using positive end-expiratory pressure levels greater than 15 cm H₂O in severe pediatric acute respiratory distress syndrome, under the condition that the markers of oxygen delivery, respiratory system compliance, and hemodynamics are closely monitored as

positive end-expiratory pressure is increased, is strongly recommended. The concept of exploring the effects of careful recruitment maneuvers during conventional ventilation met an agreement level of 88%, whereas the use of recruitment maneuvers during rescue high-frequency oscillatory ventilation is highly recommended (strong agreement).

Conclusions:

The Consensus Conference developed pediatric-specific recommendations regarding mechanical ventilation of the patient with pediatric acute respiratory distress syndrome as well as future research priorities. These recommendations are intended to initiate discussion regarding optimal mechanical ventilation management for children with pediatric acute respiratory distress syndrome and identify areas of controversy requiring further investigation.

Mechanical ventilation can be indispensable for assuring adequate gas exchange for patients with acute respiratory failure. However, it may exacerbate, or even initiate, lung injury and inflammation and has, therefore, been identified as a risk factor for poor patient outcome. The development of ventilator-induced lung injury (VILI) has led to the concept of lung-protective ventilation strategies. Such an approach is based on two primary principles. The first is to avoid overdistension (i.e., volutrauma) and the other is to avoid or minimize the cyclic opening and closing of alveoli (i.e., atelectrauma) (1).

Ventilatory strategies that limit tidal stretch of the alveoli (e.g., low tidal volume ventilation and high-frequency ventilation), permissive gas exchange strategies (e.g., permissive hypercapnia

and permissive hypoxemia), positive end-expiratory pressure (PEEP) titration with or without recruitment maneuvers, and ventilatory modes that partially or proportionally assist spontaneous breathing have been advocated. Unfortunately, specific pediatric outcome data on lung-protective ventilation are sparse, especially with regard to the ventilator strategy and/or mode(s) used to manage patients with pediatric

acute respiratory distress syndrome (PARDS). There is generally a low level of evidence for most of the recommendations described in this article, and thus, specific recommendations are largely based on the experience in the adult population for patients with acute respiratory distress syndrome (ARDS), with consensus-based modifications for pediatrics.