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EDITORIAL COMMENTARY

HFOV in Pediatric ARDS: Viable or Vestigial?

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Pediatric acute respiratory distress syndrome (PARDS) is associated with significant mortality [1], more so in the low middle-income countries (LMIC) [2–5]. Furthermore, mortality is proportional to the severity of ARDS; 1–15% for mild and moderate ARDS and 33% for severe ARDS [6]. Over the years, several therapeutic strategies have evolved with the hope to reduce ARDS related mortality. These include low tidal volume lung protective ventilation, high frequency oscillatory ventilation (HFOV), airway pressure release ventilation (APRV), prone ventilation, nitric oxide, surfactant therapy, steroids and extracorporeal membrane oxygenation (ECMO). Among these, HFOV has been used as a 'rescue' or 'salvage therapy' for hypoxemia refractory on conventional mechanical ventilation (CMV). Pediatric acute lung injury consensus conference (PALICC) guidelines recommend use of HFOV in patients with moderate to severe ARDS with a $P_{Plat} > 28$ cm H_2O [7].

Theoretically, HFOV has an edge over CMV as it delivers smaller tidal volumes and causes less cyclical atelectotrauma due to a continuous distending pressure [8]. These advantages have however not translated into mortality benefits [9, 10]. A systematic review of 10 RCT's in adults showed that HFOV neither reduced hospital stay nor 30 d mortality [11]. Another meta-analysis of 6 RCT's in children with a total of 246 PARDS patients, failed to demonstrate significant reduction in duration of ventilation or mortality despite improved oxygenation parameters [12]. Some of the reasons postulated for this lack of benefit with HFOV were timing of transition (early vs. late) and disease and patient related factors. Contrary to the postulated theoretical benefits, one meta-analysis in adults in fact showed abnormal hemodynamic profile and barotrauma related to HFOV [13].

Given the above background, the findings reported by Chattopadhyay et al. are relevant; more so because data related to HFOV from India is limited. The authors have described 34 children with ARDS and refractory hypoxemia in whom they have assessed timing of HFOV and determinants of survival [14]. They found that improvement in oxygenation index (OI) at 48 h of initiation of HFOV along with percent increase in PaO_2/FiO_2 ratio at 24 h determined survival. These findings are similar to a previous study which had demonstrated 24 h OI to be a better predictor of survival [15].

Timing of transition to HFOV has been a contentious issue and studies are divided on this. Some have shown better survival with early as compared to late HFOV, while others have negated this [16]. In the index study too, the authors did not find any difference in mortality between early and late HFOV. However, the duration of CMV before transitioning to HFOV was higher in non-survivors [62 h (12, 144) vs. 30–25 h (12, 96)] as compared to survivors, suggesting a delayed transition. The duration of CMV prior to transition is known to impact the effectivity of HFOV [17]; lesser duration of CMV, means lesser degree of ventilator induced lung injury (VILI). Early HFOV could possibly help in better recruitment and lower VILI.

In developing countries, ARDS mortality is usually contributed by the non-pulmonary organ involvement, independent of the type of ventilation [2, 3]. Of these acute kidney injury and fluid overload are a lethal combination [18, 19]. In the current study, although a lower sequential organ failure assessment (SOFA) score was associated with survival benefit, more details about the different non-pulmonary organ dysfunctions and proportion of children with nosocomial infection could have helped us understand the reasons for death better.

In LMIC, ECMO is out of reach for many due to its limited availability and exorbitant running costs. Short of ECMO, many centers still rely on HFOV for PARDS, which fails conventional ventilation. Ideally HFOV, with its low tidal volumes, should prevent ARDS mortality. However current available evidence is unable to corroborate this. Future prospective studies focusing more stringently on timing of transition, patient and disease related factors may yield answers. Till that time, it may be premature to write off HFOV in PARDS.

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Compliance with Ethical Standards

Conflict of Interest None.

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