Venovenous extracorporeal membrane oxygenation in COVID-19-related acute respiratory distress syndrome: What’s the catch?

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COVID-19 is still around, and in the most severe cases can rapidly progress to acute respiratory distress syndrome. When mechanical ventilation fails to improve oxygenation, we desperately shift our management to venovenous extracorporeal membrane oxygenation (vv-ECMO). In this opinion article, we discuss which patients are the most suitable to select for this technique, reiterate previous observations in acute respiratory distress syndrome, and the options for the patients judged not fitting for ECMO.

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Coronavirus-19 (COVID-19) still carries high morbidity and mortality burden, despite the adoption of universal vaccination measures and evidence-based therapeutics. A considerable number of patients require admission into the intensive care unit (ICU) for the management of acute respiratory failure and the resultant acute respiratory distress syndrome (ARDS) that may arise.1

Whether this entity is exactly the same as the ARDS that emanates from other infections is still unclear, but, through the past 3 years, it has notoriously carried a grave prognosis despite optimal, extrapolated management. Management includes lung-protective ventilation, high positive end-expiratory pressure (PEEP), prone positioning and neuromuscular blockade, but when these fail in re-establishing normoxia, or at least in improving hypoxia, venovenous extracorporeal membrane oxygenation (vv-ECMO) emerges as the last resort.

Kunavarapu and colleagues were pioneers in demonstrating that ECMO treatment improved respiratory parameters and RASS score and facilitated physical rehabilitation, favouring survival in 75% of COVID-19-related ARDS cases.2 While this seems quite encouraging, attention is required as to who should be selected for this life-saving but resource-intensive technique.

Before the era of COVID-19, several studies investigated the candidacy for ECMO in ARDS and we were able to standardise suitability for the latter by using scoring systems, PRESERVE and RESP scores by Schmidt et al being the most reputable and reliable.3 Investigators agreed that advanced age, immunosuppression, number of days on mechanical ventilation (MV) before cannulation and certain ventilator parameters carried less favourable outcomes.4 But are these criteria generalisable to COVID-19 related ARDS? The RESP score is a potentially validated tool that can help clinicians in this matter’s decision-making.5 The elderly and immunocompromised were again demonstrated as poor candidates for ECMO,6 rationalising denial of this technique in these subsets of patients, with the sole aim to benefit those who we predict will have better outcomes. Close attention to MV might play a role in the selection process, as a driving pressure of 15 cmH2O or more is informative of possible deleterious ventilation injuries, expediting initiation of ECMO, and the Extracorporeal Life Support Organization (ELSO)’s selection criteria for ECMO can be, in this context, applicable to COVID-19 related ARDS: PaO2/FiO2 < 60 mmHg for > 6 hours, PaO2/FiO2 < 50 mmHg for < 3 hours or pH < 7.20 and PaCO2 > 80 mmHg for <6 hours.7 Centre-related factors are also crucial as ECMO was associated with better survival rates when performed in high-volume centres (>30 patients treated with vv-ECMO in the previous year), as well as in regions with particular ECMO network fundamentals to meet high demand.8

Several of the aforementioned factors are non-modifiable, but one is worth detailing, as physicians have some control over it, which is the number of days on mechanical ventilation before ECMO initiation for COVID-19. Giraud et al deduced in their study that vv-ECMO must be considered early in the management of these patients and that this therapy is futile beyond the seventh day of MV.9 This finding was further supported in other studies,10,11 as early initiation of ECMO might prevent ventilator-induced lung injury, favouring prompt parenchymal recovery. Hayanga and colleagues argue that if the P/F ratio does not improve over the first 4 days of ventilation, cannulation for ECMO is deemed essential,12 while others insist that beyond 7–10 days on MV, COVID-19 related ARDS patients should not receive ECMO therapy unless it is a bridge for transplantation.9

But how does this algorithm translate in the real-time world? ECMO is resource-intensive, as successful outcomes need consumables, structural and human resources,9 making provision of this technique even harder. And when the pandemic hit, it became even scarcer, exacerbating healthcare disparities among different populations. One may suggest prioritising spending on allocation and training personnel, but that is very expensive.
and time-consuming, and until that happens, selection should be applied, carefully. Clinicians might restrict criteria to include and exclude patients based on the factors mentioned earlier, and rely on advanced directives or surrogate decision-makers to plan how to proceed with care. Does this conflict with the four pillars of medical ethics? Definitely not, as ECMO by itself is not without harm, runs its inherent thrombotic/hemorrhagic risks on one hand, and, on the other, meets distributive justice when the finite resources are reserved for those who are most likely to benefit from them, even when this implies transitioning the others to comfort care.

ECMO has been affirmed to be successful in managing COVID-19 related ARDS; however, it contrasts with the dearth of necessary resources, devoting this technique to the patients who have the most realistic chances for meaningful outcomes.

References


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