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Utilization of ECMO to Reduce VILI in Adults With ARDS: An Integrative Research Review

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Abstract

Utilization of extracorporeal membrane oxygenation to prevent ventilator induced lung injury in the treatment of adults with acute respiratory distress syndrome

An Integrative Research Review

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Extracorporeal Membrane Oxygenation (ECMO) is a treatment that has been utilized successfully for respiratory or cardiorespiratory failure in the neonatal and pediatric populations for years (Turner, 2013). Despite poor outcomes initially, utilization of this treatment is gaining popularity in the adult population in recent years (ELSO, 2018). Acute respiratory distress syndrome (ARDS) is a disease process that carries with it very high mortality rates despite advancements in critical care medicine as well as ventilator management (Paolone, 2017). Ventilator induced lung injury (VILI) is a complication from ventilator management in the treatment of ARDS that contributes to mortality and morbidity (Tremblay, 2006). The implementation of lung protective ventilation (LPV) was introduced to address the issue of VILI. It is unknown if implementation of ECMO will reduce or prevent VILI nor do we understand fully the outcome effects ECMO truly has on adult patients with ARDS. This review was done utilizing the methodology discussed by Whittemore & Knaff for Integrated Research Reviews (2005) and Brown (2018) to answer the question: “Is ECMO being utilized to prevent/reduce ventilator induced lung injury (VILI) in the treatment of adults with acute respiratory distress syndrome (ARDS)?” A literary search using key words of ECMO and ventilator induced lung injury in the Cochran Library, PubMed, CINAHL Plus, Medline Complete, Google Scholar, and Bibliographic Mining identified 62 articles. Twenty-one articles were duplicates. Articles were excluded for patient populations other than adults, narrow/specific ECMO focus, or focus outside the scope of this topic. A final sample of 12 articles met criteria: two level 1 systematic reviews, 1 level 1 multicenter random control trial, 1 level 5 clinical review, 1 level 5 comprehensive review, 2 case reports/literature reviews which were level 5 and 7 respectively, 4 level 5 reviews, and 1 level 6 review (Long & Gannaway, 2015). All appraisals done using either the PRISMA Statement (Long & Gannaway, 2015), 3 Minute checklist by Godin (2011), or appraisal tools from Brown (2017). Due to the very specialized subject matter and treatment, the number of quality research articles with a high level of evidence was
limited. Literature would suggest that to prevent or reduce VILI, clinicians are now implementing the use of ECMO in the treatment of adults with ARDS to allow the utilization of LPV. Further supporting the implementation of this treatment is the renowned CESAR Trial or The Conventional Ventilation or ECMO for Severe Adult Respiratory Failure that was published in 2009 which just happened to be the year of the pandemic Swine Flu. This trial showed survival rates without disability after 6 months of patients treated with ECMO of 63% in contrast to the patients treated with conventional mechanical ventilation having a survival rate of only 47% (Turner, 2013). The literature would suggest that ECMO is utilized in conjunction with other modalities to help prevent VILI, namely high frequency oscillating ventilation (HFOV), neuromuscular blockade medications (NMBM’s), and prone positioning (He, 2017 & Culbreth et al., 2016). It has been acknowledged in the ECMO community that more and higher levels of research needs to be done to assess the effects of ECMO in the reduction of VILI as well as the overall success rate of the adult patient being treated for ARDS with ECMO. After reviewing the poster information the learner will have a better understanding of how the implementation of ECMO for patients with ARDS in conjunction with other therapies may increase overall survival rates as well as decrease morbidity and mortality. The learner will also become aware of the increasing usage of ECMO in the adult population and the dire need for more and higher quality studies to better understand its effects on outcomes.

**Applicable category:**
Clinical, Academic, Students, Leaders, Researchers

**Keywords:**
Acute Respiratory Distress Syndrome, Extracorporeal Membrane Oxygenation and Ventilator Induced Lung Injury

**References:**

References
Abstract Summary:

The purpose of this integrated review is to answer the question: “Is Extracorporeal Membrane Oxygenation (ECMO) being utilized to prevent/reduce ventilator induced
lung injury (VILI) in the treatment of adults with acute respiratory distress syndrome (ARDS)?

**Content Outline:**

Utilization of Extracorporeal Membrane Oxygenation (ECMO) to prevent ventilator induced lung injury (VILI) in the treatment of adults with acute respiratory distress syndrome (ARDS)

**Introduction**

Traditionally considered a treatment only used for neonates and pediatrics, ECMO utilization is growing substantially in the adult population. ECMO along with HFOV, neuromuscular blockade medications, inhaled Nitric Oxide, and prone positioning allows for lung protective ventilation and may reduce the incidence of ventilator induced lung injury in ARDS patients.

I. ARDS is a disease process that carries high mortality/morbidity rates
   A. Complications occur in ARDS patients due to the high ventilator setting used in their treatment
   B. VILI is a complication from high ventilator settings in the treatment of ARDS
   C. VILI has been shown to be detrimental to patient outcomes

II. The goal in ARDS management is lung protective ventilation (LPV)
   A. LPV was introduced to reduce/prevent VILI
   B. LPV includes lower tidal volumes and lower peak pressures
   C. LPV is not always enough to maintain adequate gas exchange in the ARDS patient

III. Adjunct therapies used in conjunction with ECMO to improve gas exchange
   A. High Frequency Oscillating Ventilation (HFOV) is a more advanced form of ventilation thought to be gentler on the lungs.
   B. Inhaled Nitric Oxide, prone positioning, and neuromuscular blockade medications are used to promote oxygenation and gas exchange

IV. ECMO allows for LPV and therefore allows the lungs to rest and heal
   A. ECMO does the work of the lungs by giving the blood oxygen and removing carbon dioxide
   B. Ventilator settings may be lowered dramatically once ECMO is initiated
Conclusion

A. Utilization of ECMO along with other adjunct therapies in the treatment of adults with ARDS allows for lung protective ventilation and therefore may reduce the incidence of ventilator induced lung injury

B. Implementation of ECMO may reduce the morbidity/mortality rates in adult patients with ARDS

C. Utilization of ECMO in the adult population has increased exponentially in recent years according to the Extracorporeal Life Support Organization (ELSO)