Extracorporeal Membrane Oxygenation (ECMO) for Severe Asthma Exacerbations Requiring Mechanical Ventilation

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Asthma patients placed on a ventilator have a mortality of 7-15%. The tragedy is that the underlying pathophysiology of asthma exacerbations is reversible if given enough time. Standard therapies for asthma include systemic corticosteroids and short-acting bronchodilators. Standard therapies work but they take time, which some patients don’t have. Severely ill patients can develop respiratory failure with high blood CO₂ and decreased blood pH requiring mechanical ventilation. These patients often have high lung pressures, which increases the risk for ventilator-induced lung injury. For these severe patients salvage therapies like permissive hypercapnia and inhaled anesthetics can be used but sometimes they don’t work quickly enough. Extracorporeal membrane oxygenation (ECMO) is now being used to bridge the most severely ill asthma patients until standard therapies start take effect. The knowledge of ECMO in asthma is limited to case reports, case series, and registry studies that lack critical controls. To date, no randomized controlled trials or observational cohort studies have been performed.

Data Analysis:
- Covariate adjusted analysis of 128 ECMO vs 14,943 NO ECMO subjects (total cohort)
- Propensity score adjusted analysis of the total cohort
- Propensity score matched analysis of 1 ECMO to 2 No ECMO patients (93 vs 186)

Flow Diagram:
- Inclusion Criteria
  - Severe Asthma Exacerbation
  - ECMO-capable hospital admission
  - Bronchodilator/bronchodilator
  - Systemic corticosteroids
  - Invasive Ventilation
- Exclusion Criteria
  - Age > 65 (N=374)
  - Age < 18 (N=8)
- Analyzed Subjects
  - ECMO: N=128
  - NO ECMO: N=14,943
- Results:
  - Total Hospital Cost:
    - ECMO (N=128) vs NO ECMO (N=14,943)
  - Adverse Effects:
    - Hemorrhage
    - Infection
    - Neurologic or cardiac complications
    - Pneumothorax

Hypothesis:
ECMO is associated with reduced mortality in severe asthma exacerbations treated with standard therapies and mechanical ventilation.

Study Design:
- Retrospective Epidemiologic Cohort Study
- Premier Database from 2010-2020

Results:
- Characteristics
  - ECMO N (%) vs NO ECMO N (%)
  - p-value
  - Standardized Mean Diff
- Characteristics
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  - Standardized Mean Diff

Limitations:
- The Premier database does not contain blood gas results, ventilator settings or ventilator pressures
- Small number of ECMO patients
- Confounding by indication is always possible
- Selection bias is always possible

Conclusions:
ECMO was associated with lower mortality, higher costs, increased hemorrhage and decreased brain death, suggesting that select asthma exacerbation patients may benefit from ECMO.

Funding: K. Louise Coulter Pulmonary Research and Health Sciences Fellowship Award