

## Outcomes Associated with Asthma Exacerbations with Respiratory Failure Treated with Extracorporeal Membrane Oxygenation (ECMO)

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**Rationale:** Asthma affects 20 million adults in the United States resulting in up to 500,000 hospitalizations each year. Patients admitted to the intensive care unit (ICU) for asthma exacerbations requiring invasive ventilation have a mortality of ~7%. Extracorporeal membrane oxygenation (ECMO) is a salvage technique used in patients with respiratory failure to increase delivery of oxygen, remove CO<sub>2</sub> and allow time for recovery. Case series and uncontrolled registry studies have examined benefits of ECMO for asthma exacerbations with respiratory failure, but no studies have examined outcomes associated with use of ECMO for asthma exacerbations compared to standard care. **Objective:** To assess outcomes associated with use of ECMO during asthma exacerbations requiring invasive ventilation compared to standard care. **Methods:** Patients were extracted from the Premier Database from 2010-2020 if they had a primary diagnosis of asthma, or a primary diagnosis of respiratory failure with a secondary diagnosis of asthma, and were treated with invasive ventilation. Patients were excluded for age < 18y, no ICU admission, chronic lung disease other than asthma, COVID-19, or if they were not treated with corticosteroids. Hospital mortality was the primary study outcome. Key secondary outcomes included ICU length of stay (LOS), hospital LOS, length of invasive ventilation and hospital costs. Differences in outcomes were assessed using propensity score matching at a 1:2 ratio of ECMO *versus* no ECMO, and by covariate adjustment of the entire study group. **Results:** A total of 20,494 patients with asthma exacerbations requiring invasive ventilation were included in the study, of which 130 were treated with ECMO and 20,364 were not. After propensity matching, ECMO (N=103) versus no ECMO (N=206) was associated with reduced mortality (11.4% vs. 23.3%, p = 0.017) and increased hospital costs, but no difference in ICU LOS, hospital LOS or length of mechanical ventilation (Table). The covariate-adjusted model replicated these findings (Table). When individual patients were assigned a probability of being treated with ECMO equal to the hospital rate where they were admitted, each 10% increase in the hospital rate of ECMO was associated with no change in the odds of mortality (OR, 1.12: 95% CI, 0.82-1.52), p=0.48). ECMO was also associated with increased renal replacement therapy (P = 0.02), shock (P=0.02) and 30-day all-cause readmission (P = 0.01). **Conclusion:** ECMO was associated with reduced mortality at the cost of increased morbidity in asthmatics requiring invasive ventilation, indicating that ECMO has the potential to save thousands of lives.

**Table. Outcomes Associated with ECMO for Asthma Exacerbations Compared to No ECMO**

	Propensity-Matched Model N=309			Covariate Adjusted Model N=20,494		
	<b>OR</b>	<b>95% CI</b>	<b>P Value</b>	<b>OR</b>	<b>95% CI</b>	<b>P Value</b>
<b>Mortality</b>	0.43	0.22-0.85	0.016	0.38	0.21-0.68	0.001
	<b>Ratio</b>	<b>95% CI</b>	<b>P Value</b>	<b>Ratio</b>	<b>95% CI</b>	<b>P Value</b>
<b>Hospital Cost</b>	1.76	1.47-2.12	<0.0001	1.65	1.44-1.89	<0.0001
<b>ICU LOS</b>	1.20	0.96-1.49	0.12	1.14	0.98-1.34	0.09
<b>Hospital LOS</b>	1.15	0.91-1.44	0.24	1.08	0.92-1.26	0.34
<b>Length of Invasive Ventilation</b>	1.13	0.91-1.41	0.26	1.08	0.93-1.26	0.30

Abbreviations: ECMO = Extracorporeal Membrane Oxygenation, LOS = length of stay, OR = odds ratio, CI = confidence interval.