

Stroke in Pediatric Cardiac Surgical Patients on Extracorporeal Membrane Oxygenation: An Analysis of the Extracorporeal Life Support Organization Database

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Background:

Stroke is a common complication of extracorporeal membrane oxygenation (ECMO), and pediatric cardiac surgical patients on ECMO, particularly neonates or those with complex repairs, may be at higher risk. However, the epidemiology and predictors of stroke in these patients are not well-characterized.

Methods:

We performed an analysis of the Extracorporeal Life Support Organization (ELSO) Registry from 2002-2013 under ELSO data sponsorship, including initial ECMO runs for all patients ≤ 18 years-old. Cardiac patients were identified using diagnostic and procedure codes and surgical patients were identified using ELSO procedure codes. Procedures were mapped to STAT (Society of Thoracic Surgeons) morbidity categories to define complexity. The primary outcome was any stroke (neurologic hemorrhage or infarction). Risk factors for stroke in surgical patients were analyzed using multivariate logistic regression.

Results:

The cohort included 4,797 cardiac patients, 74% (3,563) with cardiac surgery. Of the surgical cohort, 54% were neonates, 81% had cyanotic disease and 57% were in high STAT categories (4-5). Overall, 12% had a stroke on ECMO with similar rates in surgical and non-surgical patients ($p=0.5$). Patients with stroke had higher in-hospital mortality compared to those without (53% vs. 25%, $p<0.0001$). Multivariable analysis of the surgical cohort found independent associations with stroke for neonates (adjusted odds ratio [AOR] 1.7, 95% confidence interval [CI] 1.3-2.3), lower weight-for-age z-score (AOR 1.2 for each one-point decrease, CI 1.1-1.3), and longer ECMO duration (upper quartile [≥ 168 hours] AOR 1.4, CI 1.1-1.8). Cyanotic disease, STAT category and bypass time were not associated with stroke in this model.

Conclusion:

In this multicenter analysis, we found that pediatric cardiac surgical patients on ECMO have a high rate of stroke comparable to non-surgical patients, and that stroke doubles the likelihood of in-hospital mortality. We did not identify modifiable risk factors in this cohort. Future study is necessary to determine if anticoagulation or other practices can be modified to reduce stroke incidence.