




## The Annals of Thoracic Surgery

Volume 119, Issue 2, February 2025, Pages 413-422

Congenital & Pediatric

Research

# Outcomes in Children Who Undergo Postcardiotomy Extracorporeal Membrane Oxygenation: A Report From the STS-CHSD

Tanya Perry DO<sup>1</sup>  , David S. Cooper MD, MPH<sup>1</sup>, Todd Sweberg MD, MBA<sup>2</sup>,  
Marshall L. Jacobs MD<sup>3</sup>, Jeffrey P. Jacobs MD<sup>4</sup>, Bin Huang PhD<sup>5 6</sup>, Chen Chen PhD<sup>6</sup>,  
Ravi R. Thiagarajan MD, MPH<sup>7 8</sup>, Marissa A. Brunetti MD<sup>9</sup>, Javier J. Lasa MD<sup>10</sup>, Eva W. Cheung MD<sup>11</sup>,  
S. Ram Kumar MD, PhD<sup>12</sup>, Iki Adachi MD<sup>13</sup>, Awais Ashfaq MD<sup>14</sup>, Katsuhide Maeda MD, PhD<sup>15</sup>,  
Farhan Zafar MBBS, MS<sup>14</sup>, David L.S. Morales MD<sup>14</sup>

Show more 

 Share  Cite

<https://doi.org/10.1016/j.athoracsur.2024.07.020> ↗

[Get rights and content](#) ↗

## Abstract

### Background

Children who undergo cardiac surgery may require postcardiotomy extracorporeal membrane oxygenation (ECMO). Although morbidities are considerable, our understanding of outcome determinants is limited. We evaluated associations between patient and perioperative factors with outcomes.

### Methods

The Society of Thoracic Surgeons Congenital Heart Surgery Database was queried for patients aged <18 years old who underwent postcardiotomy ECMO from January 2016 through June 2021. The primary outcome was survival to hospital discharge. The secondary outcome was survival without neurologic injury. Logistic regression for binary outcomes and competing risk analysis for survival were used to identify the most important predictors. Variables were selected by stepwise procedure using entry level  $P = .35$ . Those with  $P \leq .1$  were kept in the final model.

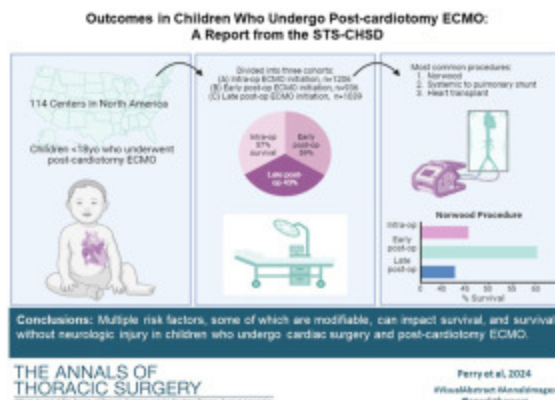
## Results

Postcardiotomy ECMO was used to support 3181 patients during the same hospitalization as cardiac surgery: (A) intraoperative initiation of ECMO,  $n = 1206$ ; (B) early postoperative ( $\leq 48$  hours),  $n = 936$ ; and (C) late postoperative ( $>48$  hours),  $n = 1039$ . The most common primary procedure of the index operation was the Norwood procedure. Of those with intraoperative ECMO, 57% survived to discharge vs 59% with early postoperative ECMO and 42% late postoperative ECMO ( $\chi^2_{(2)} = 64$ ,  $P < .0001$ ,  $V = 0.14$ ). In all groups, postoperative septicemia, cardiac arrest, and new neurologic injury had the strongest association with mortality, whereas postoperative reintubation and unplanned noncardiac reoperation were associated with higher survival.

## Conclusions

Multiple risk factors impact survival in children who undergo cardiac surgery and postcardiotomy ECMO. ECMO initiated  $>48$  hours after surgery is associated with the poorest outcomes. This is the first step in creating a predictive tool to educate clinicians and families regarding expectations in this high-risk population.

## Visual Abstract



Download: [Download high-res image \(228KB\)](#)

[Download: Download full-size image](#)

---

## Section snippets

### Data Source

This retrospective cohort study used data from the STS-CHSD, which collects preoperative, intraoperative, and early postoperative data for congenital heart surgery performed at 114 centers in North America, capturing >90% of pediatric congenital heart operations in the United States.<sup>11,12</sup> Data collection and accuracy has been described previously and represents a very high level of completeness and accuracy.<sup>13</sup>

The STS Research and Analytic Center serves as the data coordinating center for all ...

### Results

During our study period, 4396 patients aged <18 years old underwent ECMO support during the same hospitalization as congenital heart surgery: (A) preoperative ECMO initiation, n= 1215; (B) intraoperative, n= 1206; (C) early postoperative (<48 hours), n= 936; and (D) late postoperative (≥48 hours after surgery), n= 1039 (Figure 1). The most common index procedure overall was the Norwood, which remained the most frequent procedure in each individual cohort (Figure 2). The 10 most frequent ...

### Comment

This study, using data from the STS-CHSD, is a large analysis of risk factors and outcomes of children who undergo ECMO after heart surgery. Those undergoing the Norwood have the greatest likelihood of postcardiotomy ECMO, and single-ventricle anatomy accounts for the most common fundamental diagnoses in all cohorts. The poorest outcomes were associated with late initiation of ECMO (>48 hours) after surgery.

We found greater SHD in those who undergo ECMO cannulation at the time of their index ...

### Funding Sources

The authors have no funding sources to disclose. ...

## Disclosures

Farhan Zafar reports a relationship with TransMedics Inc that includes: employment. David S. Cooper reports a relationship with Mallinckrodt LLC that includes: consulting or advisory and with Prolacta Bioscience Inc that includes: speaking and lecture fees. Ravi Thiagarajan reports a relationship with Extracorporeal Life Support Organization that includes: speaking and lecture fees and with the Society of Critical Care Medicine that includes: speaking and lecture fees. Jeffrey P. Jacobs reports ...

[Special issue articles](#)   [Recommended articles](#)

---

## References (24)

J.P. Jacobs *et al.*

[The Society of Thoracic Surgeons Congenital Heart Surgery Database: 2019 update on outcomes and quality](#)

Ann Thorac Surg (2019)

J.E. Mayer *et al.*

[The Society of Thoracic Surgeons Congenital Heart Surgery Database: 2020 update on outcomes and research](#)

Ann Thorac Surg (2020)

S.R. Kumar *et al.*

[The Society of Thoracic Surgeons Congenital Heart Surgery Database: 2022 update on outcomes and research](#)

Ann Thorac Surg (2023)

A. Sengupta *et al.*

[Influence of intraoperative residual lesions and timing of extracorporeal membrane oxygenation on outcomes following first-stage palliation of single-ventricle heart disease](#)

J Thorac Cardiovasc Surg (2023)

P.J. Chai *et al.*

[Effects of ischemia on pulmonary dysfunction after cardiopulmonary bypass](#)

Ann Thorac Surg (1999)

F. Savorgnan *et al.*

## Relationship between gestational age and outcomes after congenital heart surgery

Ann Thorac Surg (2021)

T. Bové *et al.*

## Outcome analysis of major cardiac operations in low weight neonates

Ann Thorac Surg (2004)

R.R. Thiagarajan

## Extracorporeal membrane oxygenation for cardiac indications in children

Pediatr Crit Care Med (2016)

C.E. Mascio *et al.*

## Perioperative mechanical circulatory support in children: an analysis of the Society of Thoracic Surgeons Congenital Heart Surgery Database

J Thorac Cardiovasc Surg (2014)

M.A. Brunetti *et al.*

## Characteristics, risk factors, and outcomes of extracorporeal membrane oxygenation use in pediatric cardiac ICUs: a report from the Pediatric Cardiac Critical Care Consortium Registry

Pediatr Crit Care Med (2018)



[View more references](#)

---

## Cited by (0)

---

Presented at the Sixtieth Annual Meeting of The Society of Thoracic Surgeons, San Antonio, TX, Jan 27-29, 2024.

[View full text](#)

© 2025 by The Society of Thoracic Surgeons. Published by Elsevier Inc.



All content on this site: Copyright © 2025 or its licensors and contributors. All rights are reserved, including those for text and data mining, AI training, and similar technologies. For all open access content, the relevant licensing terms apply.

