Survival Advantage of Early RRT Initiation during Pediatric ECMO

AKI & CRRT Conference

Pilar Anton-Martin, MD PhD[1]; Vinai Modem, MBBS[2]; Alvaro Coronado Munoz, MD[3]; Brian Bridges, MD[4], Hitesh Sandhu, MBBS[5]

[1] Department of Pediatrics, Division of Anesthesiology and Critical Care Medicine, Children's Hospital of Philadelphia, Philadelphia, PA. [2] Department of Pediatrics, Division of Critical Care, Cook Children's Hospital, Fort Worth, TX. [3] Department of Pediatrics, Division of Critical Care, The Children's Hospital at Montefiore, Bronx, NY. [4] Department of Pediatrics, Division of Critical Care, Monroe Carell Jr. Children's Hospital at Vanderbilt, Nashville, TN. [5] Department of Pediatrics, Division of Critical Care, Le Bonheur Children's Hospital, Memphis, TN.

Abstract

Background and aims:

Acute kidney injury (AKI) and fluid overload are common comorbidities associated with increased morbidity and mortality in children supported with extracorporeal membrane oxygenation (ECMO). Understanding the optimal time to initiate renal replacement therapies (RRT) in neonatal and pediatric ECMO patients may influence their survival. The study aims to characterize RRT practices, timing of KRT initiation, and outcomes during ECMO support in children.

Methods:

Observational retrospective cohort study of children from birth to 18 years of age from the ELSO Registry Database who received ECMO support from January 1, 2016, to December 31, 2020. Primary outcome was mortality in a time-to-event analysis assessed at ECMO decannulation and hospital discharge. Multivariable Cox proportional-hazards model adjusting for a propensity score based on pre-ECMO factors was used to determine if the timing of RRT initiation was associated with improved survival.

Results:

Data for 14318 patients undergoing their first ECMO run were included in the study. Median age and weight were 71 days old (IQR, 3-983) and 4.3 kilograms (IQR, 3.2-13.6), respectively. Survival to ECMO decannulation and hospital discharge accounted for 82.5% and 60.4% of patients, respectively. Before ECMO initiation, AKI and chronic kidney disease (CKD) occurred in 10.8% and 0.7% of the cohort, with RRT being initiated in 3.2% of patients. During ECMO support, 26.1% of patients received RRT, with a median time from ECMO cannulation to RRT initiation of 19 hours (IQR, 4-55). Multivariable logistic regression demonstrated that the need for RRT before ECMO cannulation and during ECMO support were independent predictors for mortality to ECMO decannulation and hospital discharge. In patients supported with RRT during ECMO, survivors to ECMO decannulation and hospital discharge were started on RRT significantly earlier (p 0.001 and p <0.001, respectively) compared to non-survivors. Patients initiated on KRT between 24-72 hours after cannulation were more likely to survive to decannulation and showed a trend towards survival to hospital discharge.

Conclusions:

The need for RRT before cannulation and during ECMO were independent factors for mortality to decannulation and hospital discharge. Initiation of RRT 24-72 hours after ECMO cannulation seems to provide a survival advantage compared to initiation <24 hours and >72 hours. Prospective studies on RRT initiation may improve outcomes in the pediatric ECMO population.

Introduction

- AKI and fluid overload are common comorbidities associated with increased morbidity and mortality in children supported with ECMO
- RRT is an important tool to manage these comorbidities
- RRT initiated earlier during pediatric intensive care admission was associated with increased survival in single center studies, however, the ideal timing of RRT initiation providing a survival advantage to pediatric ECMO patients remains unknown

- *Aim to* characterize RRT practices, timing of RRT initiation and outcomes during ECMO support in children from the Extracorporeal Life Support Organization (ELSO)

Methods and Materials

- Observational retrospective cohort study from the ELSO Registry database
- Neonatal and pediatric ECMO patients January 2016 – December 2020
- Multivariable Cox proportional-hazards model adjusting for a propensity score based on pre-ECMO factors to examine whether time of RRT initiation was associated with mortality

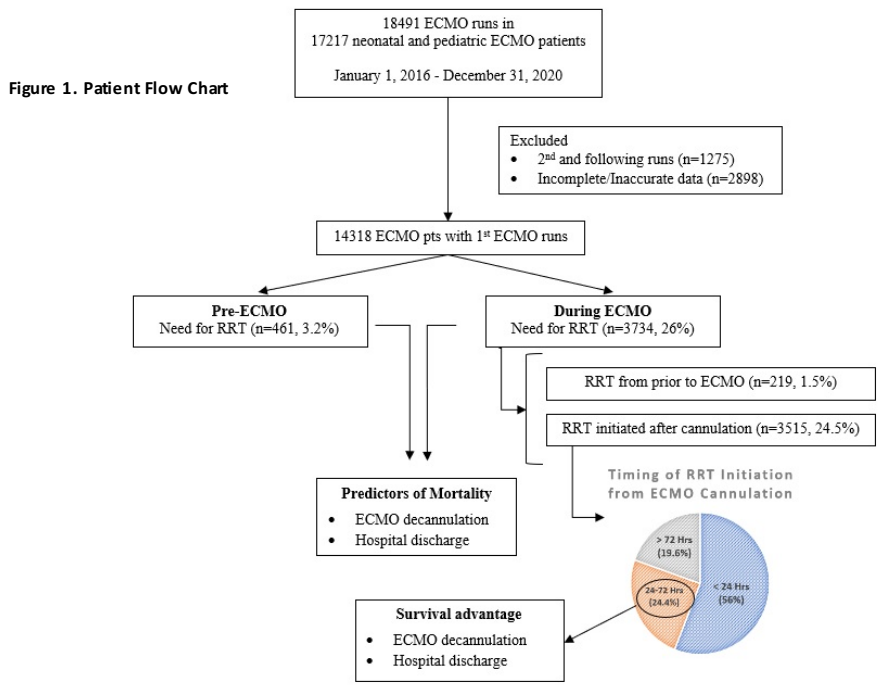

Figure 1. Patient Flow Chart

Results

- Data for 14318 patients undergoing their first ECMO run were included
- Median age and weight were 71 days old (IQR, 3-983) and 4.3 kg (IQR, 3.2-13.6)
- Survival to ECMO decannulation and hospital discharge were 82.5% and 60.4%

- Prior to ECMO initiation
  - AKI and CKD occurred in 10.8% and 0.7% of patients
  - RRT was utilized in 3.2% of patients

- During ECMO support
  - 3734 patients (26.1%) received RRT
  - Median time from ECMO cannulation to RRT initiation was 19 hrs (IQR, 4-55)

- Multivariable logistic regression demonstrated
  - **The need for RRT prior to ECMO** cannulation
  - **The need for RRT during ECMO** support

  were independent predictors for mortality at ECMO decannulation and to hospital discharge

- **Survivors** to ECMO decannulation and to hospital discharge were started on RRT significantly earlier (p 0.001 and p <0.001, respectively)

- In patients **initiated on KRT between 24-72 hours of ECMO cannulation**, the proportion of survivors to ECMO decannulation was significantly higher (p 0.03) and their hazard of death was significantly lower (HR 0.83, p 0.04)

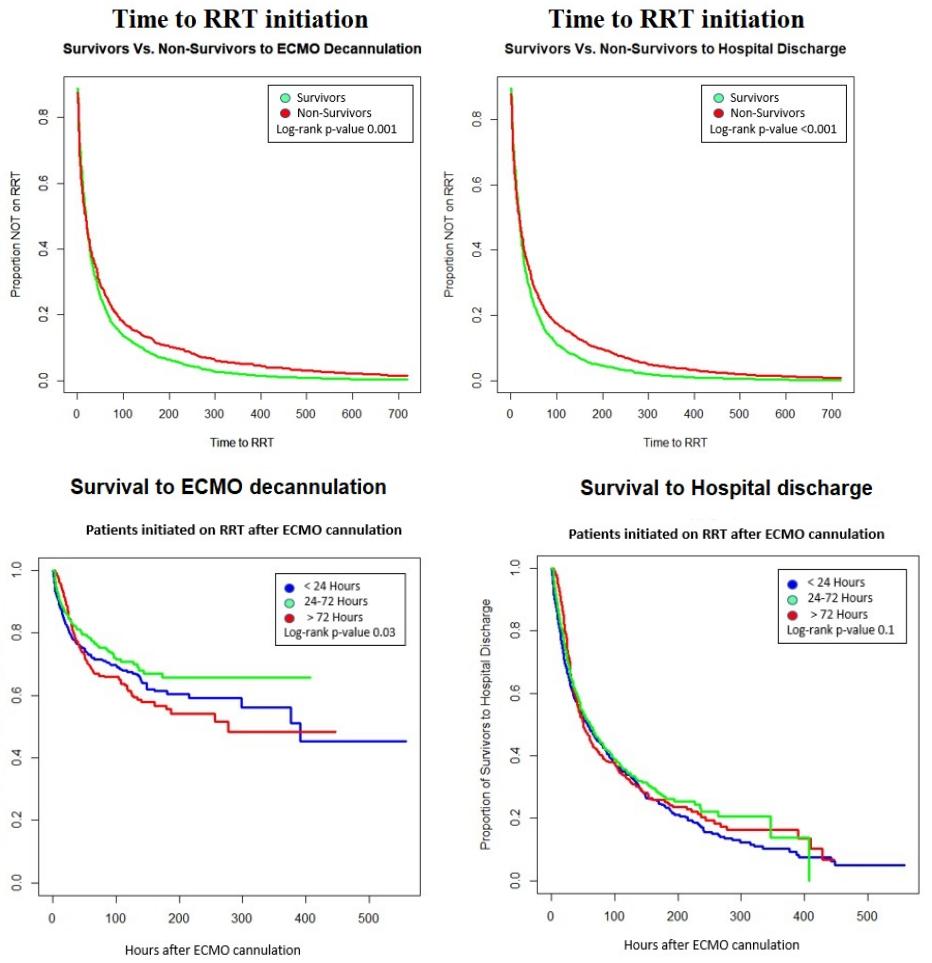

Figure 2. Time to RRT Initiation and Survival

Discussion and Conclusions

- AKI and RRT are common in neonatal and pediatric ECMO patients
- The need of RRT prior to ECMO cannulation and during ECMO support were independent factors for mortality at ECMO decannulation and to hospital discharge
- Early use of RRT may be associated with a survival advantage in pediatric ECMO
- Prospective studies on RRT initiation timing may improve outcomes in the pediatric ECMO population