

# The Association of Patient and Technical Characteristics and Survival

## A retrospective analysis of the Worldwide Exploration of Kidney Replacement Outcomes Collaborative in Kidney Disease (WE-ROCK)

Michelle C. Starr<sup>1</sup>, Huaiyu Zang<sup>2</sup>, Nicholas Ollberding<sup>2</sup>, Shanthi Balani<sup>3</sup>, Andrea Cappol<sup>4</sup>, Eileen Ciccio<sup>5</sup>, Catherine Joseph<sup>6</sup>, Aadil Kakajiwala<sup>7</sup>, Aaron Kessel<sup>8</sup>, Melissa Muff-Luett<sup>9</sup>, María J Santiago Lozano<sup>10</sup>, Matthew Pinto<sup>11</sup>, Stephanie Reynaud<sup>12</sup>, Sonia Solomon<sup>11</sup>, Cara Slagle<sup>2</sup>, Rachana Srivastava<sup>13</sup>, Weiwen V. Shih<sup>14</sup>, Tenille Webb<sup>15</sup>, Kat Gist<sup>2</sup>, Shina Menon<sup>16</sup> on behalf of the WE ROCK Investigators

<sup>1</sup>Indiana University School of Medicine; <sup>2</sup>Cincinnati Children's Hospital Medical Center; <sup>3</sup>University of Minnesota; <sup>4</sup>Children Hospital Bambino Gesù; <sup>5</sup>Washington University School of Medicine; <sup>6</sup>Texas Children's Hospital; <sup>7</sup>Children's National Hospital; <sup>8</sup>Cohen Children's Medical Center; <sup>9</sup>University of Nebraska Medical Center; <sup>10</sup>Gregorio Marañón University Hospital; <sup>11</sup>School of Medicine; <sup>12</sup>Maria Fareri Children's Hospital at Westchester Medical Center; <sup>13</sup>Hopital Bicetre, APHP Université Saclay, Kremlin-Bicetre; <sup>14</sup>Mattel Children's Hospital at UCLA; <sup>15</sup>Children's Hospital Colorado, University of Colorado School of Medicine; <sup>16</sup>Children's of Alabama/University of Alabama at Birmingham; <sup>17</sup>Seattle Children's Hospital, University of Washington



### Background

There are limited large multicenter studies on the epidemiology and outcomes of pediatric patients receiving continuous renal replacement therapy (CRRT), a well-established modality for care of children and young adults with acute kidney injury (AKI) and fluid overload (FO). We aimed to describe associations between patient characteristics, initial CRRT prescription, and ICU survival.

### Methods

The Worldwide Exploration of Renal Replacement Outcomes Collaborative in Kidney Disease (WE-ROCK) study is a retrospective, international multicenter study (32 centers, 7 nations) of patients 0-25 years treated with CRRT for AKI or FO from 2018-21.

- Exclusion:**
- Previous dialysis dependence
  - Known severe congenital kidney disease that is likely to progress to end stage kidney disease
  - Simultaneous ECMO utilization
  - CRRT for non-AKI/FO reason (inborn errors of metabolism)

**Primary outcome:**

- Survival to ICU discharge

Table 1. Multivariable regression models for survival to ICU discharge.

Variable	Reference	Contrast	OR (95% CI)
Weight, kg	11.6	55.0	0.79 (0.63, 0.98)
Fluid overload % (ICU admission to CRRT initiation)	2.4	18.1	0.97 (0.89, 1.05)
Sepsis at ICU admission	No	Yes	1.11 (0.82, 1.50)
No comorbidities	No	Yes	0.58 (0.37, 0.90)
Cardiac comorbidities	No	Yes	1.43 (0.97, 2.10)
Immunologic comorbidities	No	Yes	2.12 (1.45, 3.11)
Oncologic comorbidities	No	Yes	1.52 (1.06, 2.17)
PELOD-2 Score at CRRT Initiation	4.0	9.0	2.44 (1.98, 3.02)
Time from ICU Admission to CRRT Initiation (days)	1.0	6.0	1.07 (1.02, 1.13)
Hospital size	Small	Medium	1.20 (0.83, 1.75)
Hospital size	Small	Large	1.38 (0.95, 2.01)

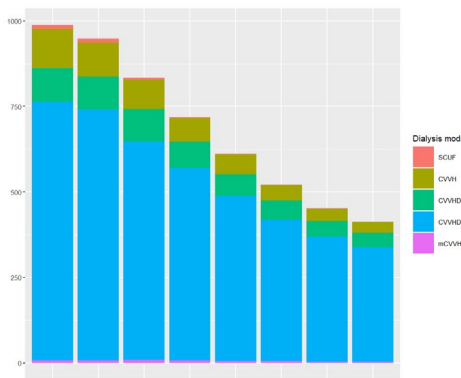


Figure 1. Stacked bar chart of dialysis modality on each day of therapy.

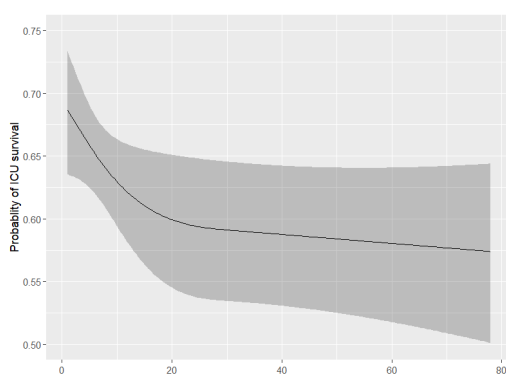


Figure 2. ICU survival by duration of CRRT days.

Table 2. Patient characteristics at CRRT Initiation and Association with ICU Survival.

Variable	Overall N = 980	Survivor to ICU discharge N = 629 <sup>1</sup>	Non Survivor to ICU discharge N = 351 <sup>1</sup>	p-value <sup>2</sup>
<b>Patient Characteristics at CRRT Initiation</b>				
Vasopressor-Inotrope Score	5 (0, 20)	2 (0, 13)	10 (0, 28)	<0.001
PELOD-2 Score	7 (4, 9)	6 (4, 8)	8 (6, 11)	<0.001
% Fluid overload	7.4 (2.4, 18.1)	6.8 (1.9, 16.6)	8.8 (3.5, 21.6)	0.002
<10%	571 (59%)	380 (61%)	191 (55%)	0.13
10-20%	180 (18%)	114 (18%)	66 (19%)	
>20%	224 (23%)	132 (21%)	92 (26%)	
Time from ICU Admission to CRRT	2 (1, 6)	2 (1, 5)	3 (1, 10)	<0.001
Loop diuretic challenge performed?				0.12
Yes - furosemide	309 (32%)	212 (34%)	97 (28%)	
Yes - bumetanide	13 (1.3%)	7 (1.1%)	6 (1.7%)	
Continuous diuretic infusion	238 (36%)	139 (34%)	99 (40%)	0.12
Urine output (24 h prior) (ml/kg/h)	0.46 (0.13, 1.22)	0.42 (0.13, 1.21)	0.53 (0.14, 1.23)	0.7
Serum Creatinine (mg/dL)	1.71 (0.89, 3.24)	2.10 (0.98, 3.69)	1.39 (0.80, 2.48)	<0.001
eGFR (ml/min/1.73 m <sup>2</sup> )	26.5 (15.8, 46.7)	23.8 (13.7, 44.8)	30.9 (19.1, 48.1)	<0.001
CRRT duration (days)	6 (3, 14)	6 (3, 12)	8 (3, 19)	0.042

<sup>1</sup> Statistics presented: n (%); median (IQR)  
<sup>2</sup> Statistical tests performed: chi-square test of independence; Wilcoxon rank-sum test

### Results

#### Demographics

- In the 980 children, ages ranged from newborn to 25 years with a median weight of 26.8 kg
- Most common reason for admission was shock, infection, or trauma (37%), followed by respiratory failure (20%). 46% had sepsis at ICU admission.
- Comorbidities were seen in 81%, with oncologic (23%), cardiac (20%), and gastrointestinal (19%) being the most common (Table 1).
- Of the cohort, 629 (64.1%) survived to ICU discharge

#### CRRT Initiation

- CRRT was initiated a median of 2 days (IQR 1,6) after ICU admission and lasted a median of 6 days (IQR 3,14).
- Longer time from ICU admission to CRRT initiation (aOR 1.07, 95% CI 1.02-1.13) and higher PELOD-2 score at CRRT initiation remained independently associated with an increased risk of death during ICU stay after multivariable adjustment (Table 2).

#### Technical Characteristics

- The most common modality prescribed at initiation was CVVHDF (76%) followed by CVVH (11%) and CVVHD (10%; Figure 1). Polysulfone filters were the most commonly used (80%).
- Anticoagulation was with citrate in 62% and heparin in 24%.
- The most common location of catheter placement was internal jugular (66%).
- There were no differences between ICU survivors and non-survivors with regards to CRRT dose, filter type, or anticoagulation (Table 3).
- There were significant practice variations by institutional size.

Table 3. CRRT Technical Characteristics and Association with ICU Survival.

	Overall N = 980	Survivor to ICU discharge N = 629 <sup>1</sup>	Non Survivor to ICU discharge N = 351 <sup>1</sup>	p-value <sup>2</sup>
<b>Initial Modality</b>				0.3
SCUF	12 (1.2%)	7 (1.1%)	5 (1.4%)	
CVVH	112 (11%)	82 (13%)	30 (8.6%)	
CVVHD	98 (10%)	62 (9.9%)	36 (10%)	
CVVHDF	747 (76%)	472 (75%)	275 (79%)	
mCVVH	8 (0.8%)	4 (0.6%)	4 (1.1%)	
<b>Filter</b>				0.8
PAES	777 (80%)	501 (80%)	276 (79%)	
Non-Polysulfone	200 (20%)	126 (20%)	74 (21%)	
<b>Anticoagulation</b>				0.078
No anticoagulation	70 (7.2%)	35 (5.6%)	35 (10%)	
Citrate	610 (62%)	395 (63%)	215 (61%)	
Heparin	238 (24%)	158 (25%)	80 (23%)	
Other	59 (6.0%)	39 (6.2%)	20 (5.7%)	
Calculated CRRT Dose per 1.73m <sup>2</sup>	2060 (1745, 2659)	2043 (1721, 2564)	2086 (1788, 2764)	0.3
Calculated CRRT Dose per kg	41.9 (30.9, 59.9)	41.2 (30.0, 59.6)	45.5 (32.2, 60.5)	0.068
Calculated CRRT Dose per kg				0.2
<25ml/kg/hr	131 (13%)	91 (15%)	40 (11%)	
25-40 ml/kg/hr	306 (32%)	200 (32%)	106 (30%)	
>40ml/kg/hr	534 (55%)	331 (53%)	203 (58%)	
Blood flow rate scaled to body weight (ml/min per kg)	3.9 (2.7, 5.5)	3.9 (2.6, 5.2)	4.1 (2.7, 6.6)	0.029
<b>Initial catheter position</b>				0.035
Internal Jugular	638 (66%)	420 (67%)	218 (63%)	
Subclavian	19 (2.0%)	13 (2.1%)	6 (1.7%)	
Femoral	297 (30%)	186 (30%)	111 (32%)	
Other	20 (2.1%)	7 (1.1%)	13 (3.7%)	
<b>Line size, French</b>				0.3
6	64 (6.7%)	36 (5.8%)	28 (8.2%)	
7	94 (9.8%)	54 (8.7%)	40 (12%)	
8	205 (21%)	130 (21%)	75 (22%)	
9	97 (10%)	65 (10%)	32 (9.4%)	
10	70 (7.3%)	44 (7.1%)	26 (7.6%)	
>10	432 (45%)	292 (47%)	140 (41%)	
CRRT duration (days)	6 (3, 14)	6 (3, 12)	8 (3, 19)	0.042

<sup>1</sup> Statistics presented: n (%); median (IQR)

<sup>2</sup> Statistical tests performed: chi-square test of independence; Wilcoxon rank-sum test

### Conclusions

- This is the largest epidemiological study of patients receiving CRRT in the pediatric ICU.
- Sicker patients with comorbidities may have lower survival.
- While differences in dialysis mode, dose, catheter size and location and anticoagulation existed in this cohort, there were no survival differences seen.
- Center differences might present opportunities to define best practices with future study.



# AKI & CRRT 2023

MARCH 29 - APRIL 1 SAN DIEGO, CALIFORNIA

THE 28TH INTERNATIONAL CONFERENCE ON

ADVANCES IN CRITICAL CARE NEPHROLOGY