Understanding uncertainty: A novel prediction model of mortality of patients with AKI initiated on CRRT

Rami Bzeih, DO; Wayne Satz, MD; Avrum Gillespie, MD
Temple University Hospital, Philadelphia, PA

TEMPLE HEALTH

Introduction

- Utilization of CRRT is still associated with a high mortality rate, ranging from 50-64%.

- Given the risks and costs associated with CRRT, it is important to ensure that it is utilized appropriately.

- Currently, no standard model exists for determining prognosis of patients on CRRT.

- Utilizing retrospective data, we developed a predictive model of mortality associated with CRRT that uniquely includes pressor requirement as a factor.

Methods and Materials

- Retrospective, single-center study

- Included 1637 patients admitted to Temple University Hospital between August 2016 to July 2023 who were placed on CRRT at any point during admission.

- Excluded patients with end-stage kidney disease (ESKD).

- Mortality was defined as patients who expired during admission or were placed in hospice.

- Pressor requirement was defined as total number of intravenous vasopressors utilized prior to CRRT initiation.

- The model was developed initially from univariate analysis of 14 factors (see table 1), with 7 of those risk factors included in logistical regression.

	Survived to discharge (N=494)	Deceased (N=1143)	p-value
Age Mean (SD)	55.9 (14.8)	60.7 (14.4)	<0.001
Sex Female	165 (33.4%)	460 (40.2%)	0.01
CHF	95 (19.2%)	186 (16.3%)	0.17
Cirrhosis	38 (7.7%)	107 (9.4%)	0.32
BMI Mean (SD)	30.0 (9.26)	31.9 (9.59)	<0.001
Lactate Mean (SD)	7.11 (5.76)	13.5 (8.28)	<0.001
Initial Creatinine Median [Min, Max]	2.61 [0.290, 35.6]	2.06 [0.240, 22.4]	<0.001
Maximum Creatinine Median [Min, Max]	6.57 [1.10, 35.6]	4.37 [1.07, 22.4]	<0.001
Bicarbonate Mean (SD)	21.4 (6.90)	21.3 (6.82)	0.67
Potassium Mean (SD)	4.59 (1.22)	4.41 (1.11)	0.005
Albumin Mean (SD)	2.75 (0.749)	2.58 (0.712)	<0.001
ICU LOS Median [Min, Max]	4.00 [0, 65.0]	3.00 [0, 224]	0.019
ECMO	35 (7.1%)	120 (10.5%)	0.038
Mechanical Ventilator	417 (84.4%)	1070 (93.6%)	<0.001

Table 1. Demographics and ICU data

Results

- Overall mortality rate was 70%

- Age, female sex, BMI, maximum lactate, creatinine, and low albumin were all significantly associated with mortality and were included in the prediction model along with pressor requirement.

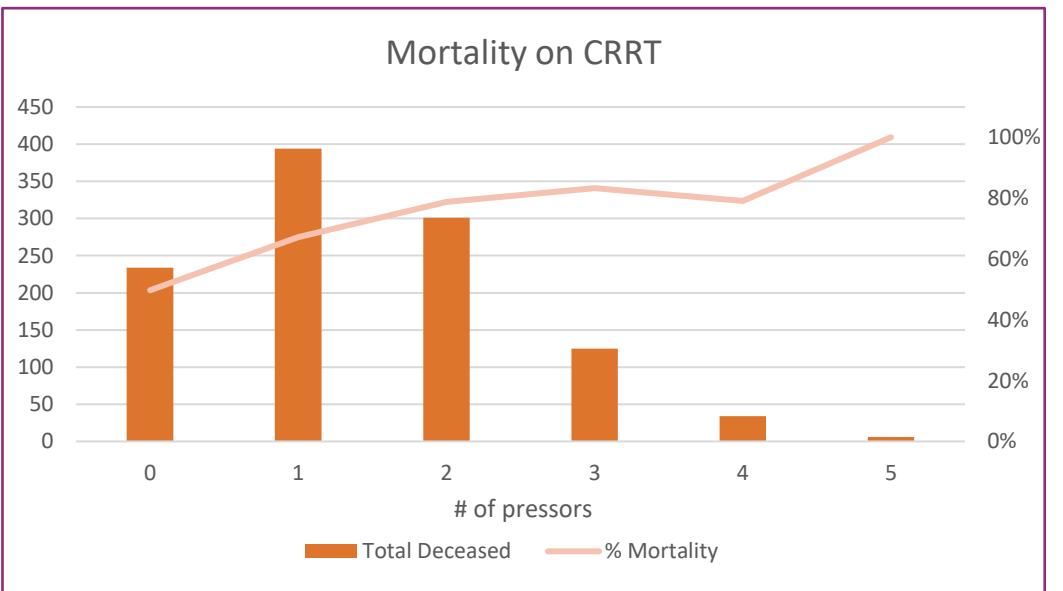- Our logistic regression model had an Area Under Curve (AUC) of 0.84.

Figure 1. Mortality compared by # of pressors at initiation of CRRT.
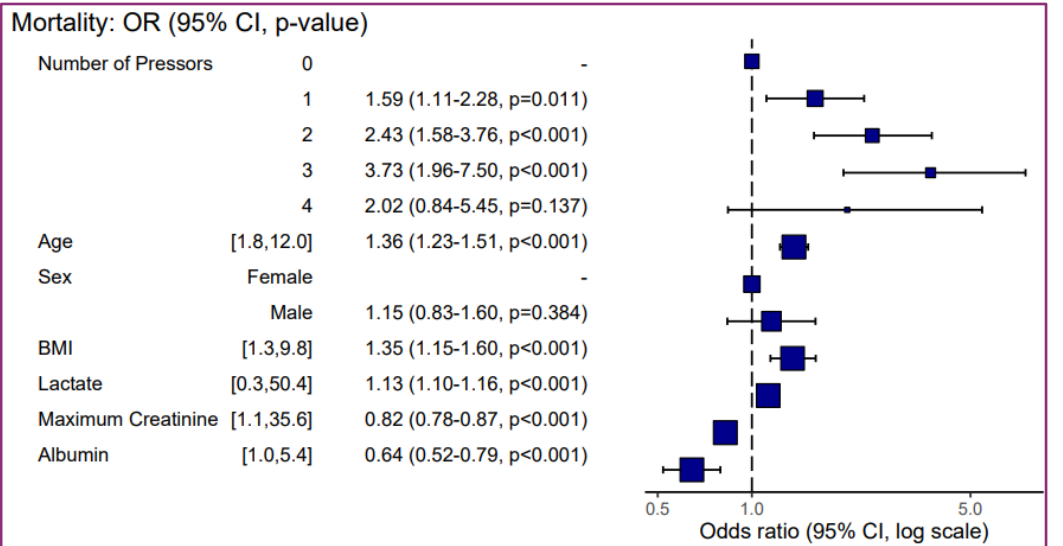

Mortality: OR (95% CI, p-value)

Number of Pressors	0	-
	1	1.59 (1.11-2.28, p=0.011)
	2	2.43 (1.58-3.76, p<0.001)
	3	3.73 (1.96-7.50, p<0.001)
	4	2.02 (0.84-5.45, p=0.137)
Age	[1.8,12.0]	1.36 (1.23-1.51, p<0.001)
Sex	Female	-
	Male	1.15 (0.83-1.60, p=0.384)
BMI	[1.3,9.8]	1.35 (1.15-1.60, p<0.001)
Lactate	[0.3,50.4]	1.13 (1.10-1.16, p<0.001)
Maximum Creatinine	[1.1,35.6]	0.82 (0.78-0.87, p<0.001)
Albumin	[1.0,5.4]	0.64 (0.52-0.79, p<0.001)

Figure 2. Odds ratios of factors included in model.

Discussion

- While mortality risk is high for all patients started on CRRT, the risk increases substantially for those requiring vasopressors.

- While other prognostic models have been published, this model is unique in its inclusion of vasopressor requirement, which shows significant predictability of mortality.

- Currently, there is no objective evidence to guide nephrologists and intensivists in deciding when to withhold CRRT.

- With further validation, this model can be utilized to stratify the prognosis of patients prior to starting CRRT, help guide goals of care discussions, and reduce the initiation of CRRT in patients whose outcomes will not be meaningfully altered.