ASSOCIATION OF VASOPRESSOR USE DURING RENAL REPLACEMENT THERAPY AND MORTALITY IN ACUTE KIDNEY INJURY

Baxter

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Javier A. Neyra, MD, MS[1]; Jorge Echeverri, MD, MS[2]; Daniel Bronson-Lowe, PhD[2]; Caio Plopper, MD[2]; Kai Harenski, MD[3]; Raghavan Murugan MD, MS, FRCP[4].

[1]University of Alabama at Birmingham, Birmingham, AL, USA; [2]Baxter Healthcare Corporation, Global Medical Affairs, Deerfield, IL, USA; [3]Baxter Deutschland GmbH, Unterschleissheim, Germany; [4]Program for Critical Care Nephrology, Department of Critical Care Medicine, University of Pittsburgh, Pittsburgh, PA.

Introduction

- Renal replacement therapy (RRT) may lead to hemodynamic instability and vasopressor use.
- The effect of vasopressor use on clinical outcomes after starting RRT is not well described.
- Aim of the study: To examine the association of vasopressor use in the early period following RRT initiation with in-hospital mortality.
- Target population: Critically ill adult patients with AKI.

Methods & Materials

- Design and participants: A cohort study of adult critically ill patients with AKI requiring RRT in U.S. hospitals who survived the first 3 days post-RRT initiation. (Figure 1)
- Data source: Premier PINC AI Healthcare Database.
- Study period: January 1, 2018, to June 30, 2021.
- Statistical analysis: Cox regression to assess the impact of vasopressor exposure [3 days before and after RRT initiation (continuous RRT [CRRT] or intermittent hemodialysis [IHD]) on hospital mortality by day 90. Adjustments made for demographics, comorbidities, acuity of illness, IV fluid use, and ICU care processes. The final analysis was stratified by the initial RRT modality due to a significant interaction between RRT modality and vasopressor use on mortality.

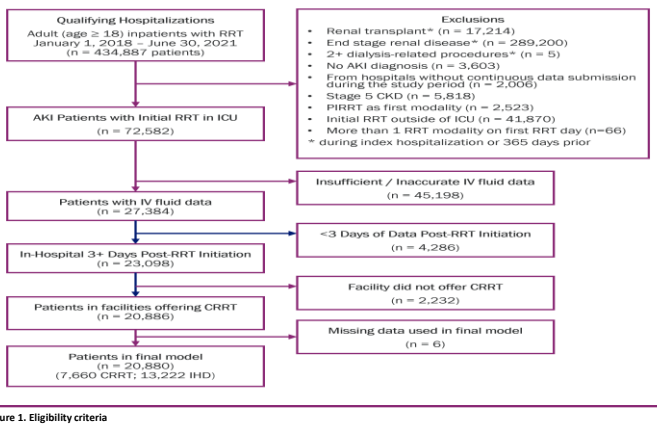

Figure 1. Eligibility criteria

Results

- A total of 20,882 patients with AKI treated with RRT were analyzed (Figure 1).
- The average age was 63 years, with 38% women and 37% receiving initial treatment with CRRT. Among all patients, 72% received vasopressors (16% before RRT initiation, 21% after RRT initiation, and 35% both before and after RRT initiation). The change in the number of vasopressors received pre- vs. post-RRT initiation is depicted in Figure 2.
- Patients who used vasopressors after RRT initiation had more sepsis, septic shock, and COVID-19, greater use of mechanical ventilation and ECMO, and greater fluid requirements before RRT initiation
- A lower 90-day survival rate was observed in patients who received vasopressors after starting RRT (21%, 95% CI: 19%-24%) compared with those who did not receive vasopressors post-RRT initiation (39%, 95% CI: 34%-45%; p<0.001; Figure 3).
- In the adjusted analysis, the number of vasopressors used after RRT initiation was found to be independently associated with hospital mortality for both RRT modalities (Table 2)
- Average daily IV fluid use was also independently associated with hospital mortality for both RRT modalities (Table 2).

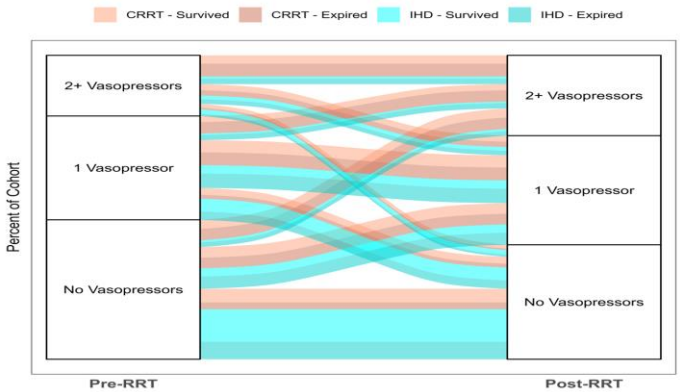

Figure 2. Vasopressor use before and after RRT initiation. Alluvial diagram assessing the transition between vasopressor use categories before and after RRT initiation according to RRT modality and 90-day outcome. Pre-RRT: within 3 days before RRT initiation, Post-RRT: withing 3 days after RRT initiation.

Table 1. Characteristics and outcomes

Characteristics	No. (%) CRRT Cohort Vasopressor Use Post CRRT initiation			No. (%) IHD Cohort Vasopressor Use Post IHD initiation		
	Yes	No	p-value	Yes	No	p-value
Total # of Patients	5.870	1.790		5.827	7.395	
% of Patients	77%	23%		44%	56%	
Demographics						
Age, years (mean, std dev)	62 (14)	61 (15)	<0.001	64 (14)	62 (15)	<0.001
Male	3,660 (62)	1,114 (62)	0.93	3,611(62)	4,539(61)	0.49
White, Non-Hispanic	3,627 (62)	1,120 (63)	0.002	3,472 (60)	4,626(63)	<0.001
Clinical Characteristics						
Medical MS-DRG	2,559 (44)	688 (38)	<0.001	3,071 (53)	3,733 (50)	0.011
Sepsis, Any	4,544 (77)	1,076 (60)	<0.001	4,539 (78)	4,465 (60)	<0.001
Septic Shock	3,970 (68)	806 (45)	<0.001	3,886 (67)	2,855 (39)	<0.001
COVID-19	1,168 (20)	260 (15)	<0.001	1,246 (21)	706 (9.5)	<0.001
APR-DRG Severity of Illness			<0.001			<0.001
Major	93 (1.6)	73 (4.1)		125 (2.1)	507 (6.9)	
Extreme	5,775 (98)	1,714 (96)		5,700 (98)	6,872 (93)	
Chronic Kidney Disease	2,692 (46)	902 (50)	<0.001	2,970 (51)	4,229 (57)	<0.001
Charlson Comorbidities Index			0.02			<0.001
0	412 (7.0)	115 (6.4)		380 (6.5)	507 (6.9)	
1-2	1,474 (25)	398 (22)		1,364 (23)	1,489 (20)	
3-4	1,627 (28)	493 (28)		1,570 (27)	1,858 (25)	
5+	2,357 (40)	784 (44)		2,513 (43)	3,541 (48)	
ECMO	344 (5.9)	87 (4.9)	0.11	70 (1.2)	32 (0.4)	<0.001
Mechanical Ventilation	5,388 (92)	1,462 (82)	<0.001	5,060 (87)	4,999 (68)	<0.001
Average Daily IV Fluid Use						
Pre-RRT Initiation, median ml (IQR)	1,750 (833; 3,333)	1,667 (750; 3,163)	0.044	1,517 (676; 3,000)	1,525 (667; 3,000)	0.39
Post-RRT Initiation, median ml (IQR)	1,883 (964; 3,433)	1,185 (500; 2,315)	<0.001	1,250 (583; 2,327)	833 (333; 1,583)	<0.001
Outcomes						
In-hospital mortality	3,307 (56)	599 (33)	<0.001	2,841 (49)	1,711 (23)	<0.001
Hospital Length of Stay, days (mean, std dev)	25 (17)	28 (18)	<0.001	24 (16)	24 (16)	0.13
ICU Length of Stay, days (mean, std dev)	19 (13)	20 (15)	0.86	17 (12)	15 (12)	<0.001

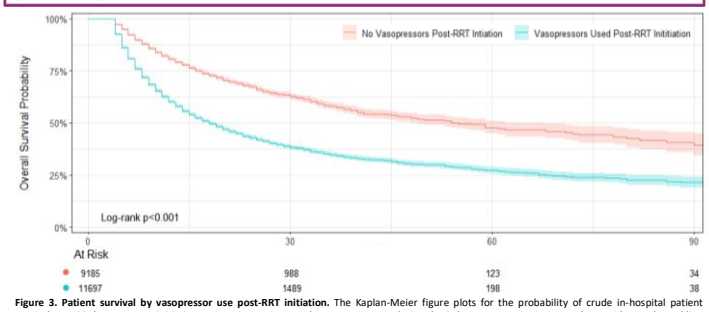

Figure 3. Patient survival by vasopressor use post-RRT initiation. The Kaplan-Meier figure plots for the probability of crude in-hospital patient survival over 90 days post-RRT initiation, comparing patients with vasopressor use during the 3 days post-RRT initiation to those without. The red line represents no vasopressor use post-RRT, the blue line represents vasopressor use post-RRT, and the shading denotes a 95% CI. The probability of survival was lower among patients who required vasopressors within three days after RRT initiation compared to those without (log-rank P < 0.001). Abbreviations: RRT: Renal Replacement Therapy

Table 2. Cox Regression Model

		CRRT (n = 7,660)			IHD (n = 13,222)	
		Hazard Ratio	95% CI	p-value	Hazard Ratio	95% CI
Age (Y)		1.02	1.01, 1.02	<0.001	1.02	1.02, 1.02
Sex	Female					
	Male	1.07	1.00, 1.14	0.046	1.17	1.10, 1.25
White, Non-Hispanic		1.00	0.94, 1.07	>0.9	0.98	0.93, 1.04
MS-DRG Category	Surgical					
	Medical	2.33	2.16, 2.50	<0.001	2.34	2.19, 2.50
APR-DRG Severity	Non Extreme					
	Extreme	1.01	0.77, 1.32	>0.9	1.77	1.38, 2.28
COVID		1.27	1.17, 1.37	<0.001	1.57	1.46, 1.68
Septic Shock		1.09	1.02, 1.18	0.017	1.14	1.07, 1.22
ECMO		1.49	1.31, 1.70	<0.001	1.32	0.98, 1.79
Mechanical Ventilation		1.25	1.11, 1.42	<0.001	1.62	1.48, 1.79
Days in ICU before RRT Initiation	0-1 days					
	2-3 days	1.03	0.92, 1.15	0.600	0.98	0.87, 1.11
	4-7 days	1.28	1.14, 1.45	<0.001	1.21	1.07, 1.37
	8+ days	1.47	1.30, 1.66	<0.001	1.38	1.22, 1.56
Number of Vasopressor, post-RRT	0					
	1	1.50	1.36, 1.65	<0.001	1.57	1.47, 1.68
	2	1.94	1.76, 2.14	<0.001	2.20	2.02, 2.40
	3+	2.06	1.72, 2.46	<0.001	2.32	1.82, 2.96
Avg Total IV Fluid Use, post-RRT	Bottom tertile					
	Middle tertile	1.10	1.01, 1.21	0.038	1.15	1.07, 1.23
	Top tertile	1.17	1.07, 1.27	<0.001	1.13	1.04, 1.21

Discussion

Key strengths of this study are its large sample of AKI patients requiring RRT who survived the first 3 days post-RRT initiation (n=20,882) and the availability of associated IV fluid and vasopressor data. Study limitations include the potential for confounding by unmeasured variables.

Conclusion

In summary, vasopressor use during the 3 days post-RRT initiation was independently and incrementally associated with higher in-hospital mortality in patients receiving either CRRT or IHD as the first modality.

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