Abstract Type : Poster exhibition
Abstract Submission No.: A-0501
Abstract Topic : Acute Kidney Injury

Association between hemoglobin levels and kidney recovery in patients with acute kidney injury requiring continuous kidney replacement therapy: a multicenter retrospective cohort study

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Objectives : Anemia in patients with acute kidney injury (AKI) requiring continuous kidney replacement therapy (CKRT) significantly contributes to increased mortality and morbidity. In this study we aimed to explore the association between anemia and dialysis dependence in individuals with severe AKI requiring CKRT, as well as to determine the hemoglobin (Hb) levels that may affect kidney recovery.
Methods : Study Design: Retrospective cohort study. Setting and Participants: This study included 2755 patients with AKI who underwent CKRT across four medical centers between 2006 and 2021. Exposures: The average Hb of patients during CKRT was designated as the primary exposure. Outcomes: Patients were categorized into two groups: anemic (Hb <8.44 g/dL) and control (Hb >8.44 g/dL). Dialysis dependence was defined at the time of hospital discharge. Analytical Approach: The odds ratio for dialysis dependence in the anemic group was calculated by adjusting for demographics and laboratory information. Additionally, the impact of the duration of anemia was also assessed.
Results : In our cohort, 61.4% of the patients were male, with a mean age, 65.5 years. The average duration of CKRT was 7.9 days, and 64.7% of the patients were dialysis-dependent at hospital discharge. A U-shaped relationship between the average Hb levels and dialysis dependence was evident, and Hb of 8.44g/dL was identified as the critical threshold. Patients in the anemic group had a 57% increased risk of dialysis dependence compared to the control group. The association was stronger in female patients, individuals under 65 years, those with nonseptic causes of AKI, and those with lower Charlson Comorbidity Index scores. Additionally, each additional day of anemia increased

risk of dialysis dependence by 4%.

Conclusions : Hb levels <8.44g/dL during CKRT were associated with an increased likelihood of dialysis dependence. These findings highlight the significance of Hb thresholds in affecting kidney recovery.

table 1.png

Table 1. Baseline characteristics of the 2755 patients with AKI who received CKRT.

Variable	Total (n=2755)	Average hemoglobin during CKRT		p-value
		Anemic group (<8.44 g/dL) (n=741)	Control group (≥ 8.44g/dL) (n=2124)	
Sex (male), n (%)	1691 (61.4)	518 (60.7)	1173 (61.7)	0.67
Age, mean (SD)	65.5 (15.0)	63.5 (14.4)	66.4 (15.2)	<0.01
Body Mass Index, mean (SD)	23.1 (4.5)	23.2 (4.2)	23.1 (4.7)	0.72
Hypertension, n (%)	950 (34.5)	230 (27.0)	720 (37.9)	<0.01
Sepsis, n (%)	1503 (54.6)	530 (62.1)	973 (51.2)	<0.01
Biochemical data, mean (SD)				
White Blood Cell (10^3/μL)	15.2 (20.4)	15.9 (30.2)	14.9 (13.8)	0.31
Albumin (g/dL)	2.7 (0.7)	2.6 (0.6)	2.8 (0.7)	<0.01
Creatinine (mg/dL)	2.9 (2.0)	3.0 (2.2)	2.8 (1.9)	0.06
Systolic blood pressure (mmHg)	113.3 (26.9)	115.4 (28.4)	112.4 (26.2)	0.01
Diastolic blood pressure (mmHg)	60.5 (15.6)	59.2 (15.8)	61.1 (15.5)	<0.01
Hemoglobin (g/dL)	9.6 (2.2)	7.9 (1.5)	10.4 (2.1)	<0.01
CCI, mean (SD)	3.6 (2.7)	3.7 (2.7)	3.5 (2.7)	0.16
APACHE II score, mean (SD)	26.7 (7.8)	27.2 (8.1)	26.5 (7.7)	0.04
SOFA without renal score, mean (SD)	10.2 (3.6)	10.4 (3.8)	10.0 (3.5)	0.02
Duration (days), mean (SD)				
CKRT	7.9 (13.3)	7.0 (13.2)	8.2 (13.3)	0.02
Dialysis	11.7 (26.8)	9.4 (21.0)	12.7 (29.0)	<0.01
Hospitalization	43.1 (61.8)	40.9 (63.8)	44.1 (60.9)	0.20
Red cells transfusion volumes, mean (SD)	3.7 (7.3)	3.4 (5.0)	3.8 (8.1)	0.15
Ventilator, n (%)	2122 (77.0)	660 (77.4)	1462 (76.9)	0.81
CKRT setting, mean (SD)				
Blood flow rate (mL/min)	108.1 (23.3)	110.7 (23.1)	107.0 (23.3)	<0.01
Dialysate flow rate (mL/h)	1222.2 (471.9)	1278.6 (480.9)	1196.9 (465.8)	<0.01
Replacement flow rate (mL/h)	989.0 (608.6)	997.1 (653.5)	985.4 (587.5)	0.65

table 1.png


THE KOREAN SOCIETY OF NEPHROLOGY
KSN SEOUL, KOREA 2025
June 19 (Thu) – 22 (Sun), 2025 Coex, Seoul, Korea
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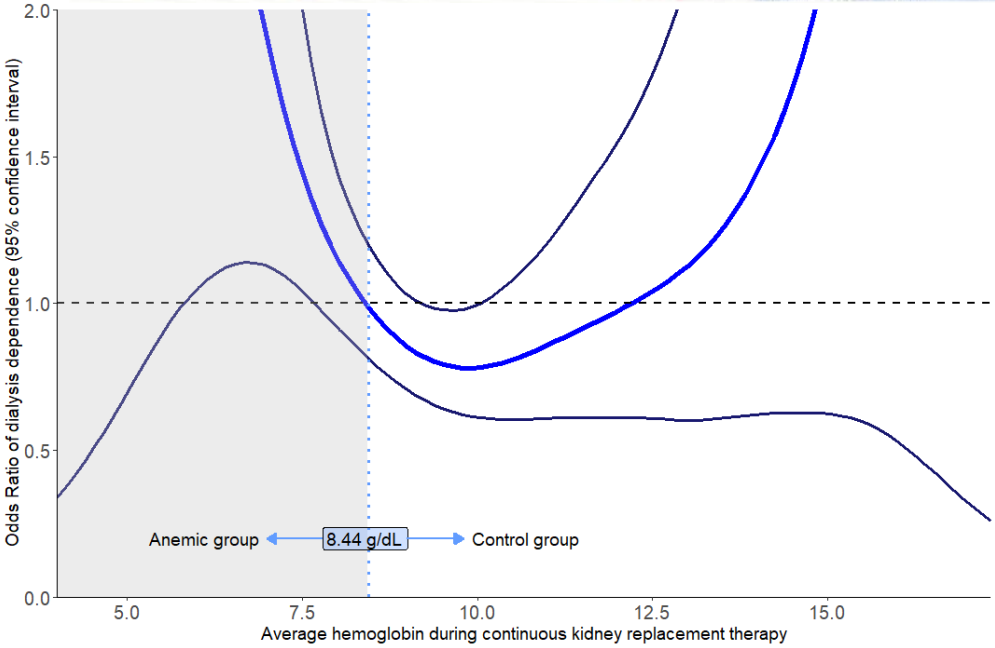
Odds Ratio of dialysis dependence (95% confidence interval)
2.0
1.5
1.0
0.5
0.0
Anemic group
8.44 g/dL
Control group
5.0
7.5
10.0
12.5
15.0
Average hemoglobin during continuous kidney replacement therapy