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Dose anemia is associated with ESKD progression and mortality? : Study from multinational cohort

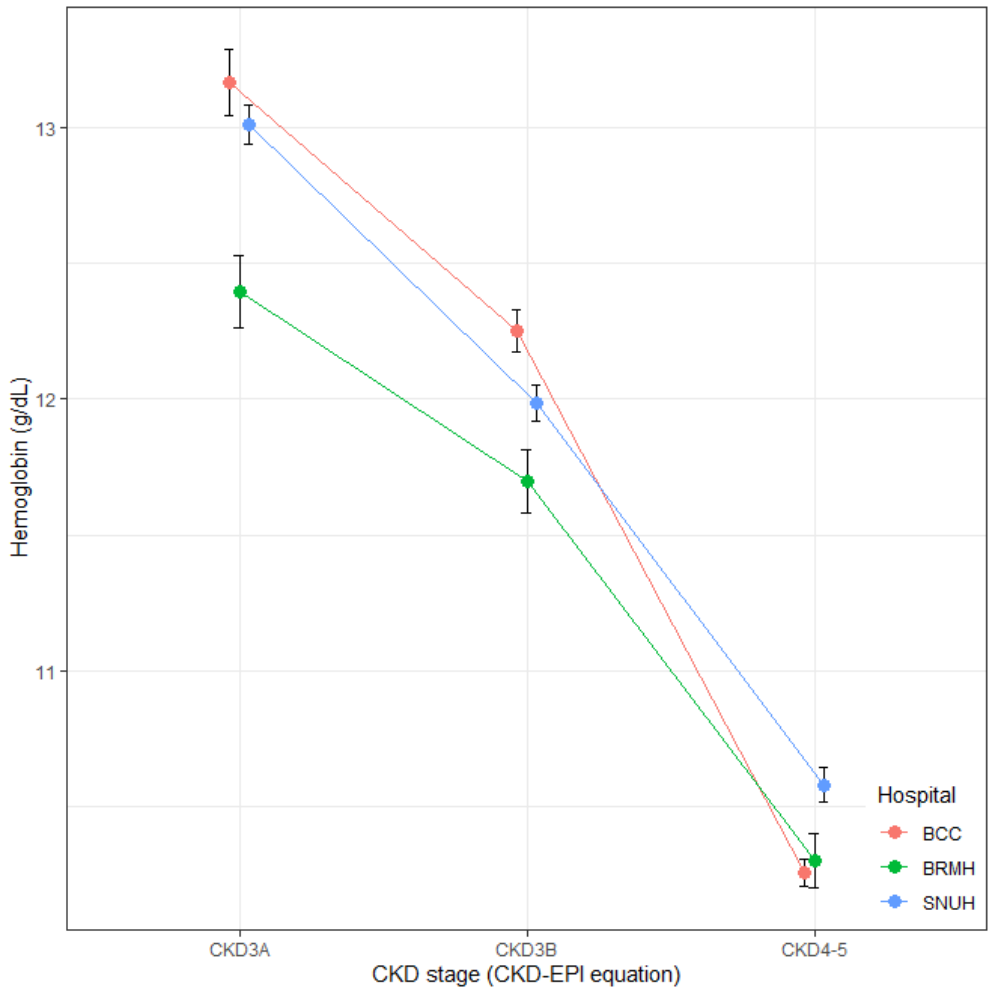
Soie Kwon[1], Ping-Hsun Wu[2], Dong Ki Kim[3], Chun Soo Lim[4], Yon Su Kim[3], Ming-Yen Lin[2], Yi-Wen Chiu[2], Shang-Jyh Hwang[2], Jung Pyo Lee[4]
[1]Department of Internal Medicine-Nephrology, Chung-Ang University Hospital, Korea, Republic of
[2]Department of Department of Renal Care, College of Medicine Kaohsiung Medical University , Taiwan
[3]Department of Internal Medicine-Nephrology, Seoul National University Hospital, Korea, Republic of
[4]Department of Internal Medicine-Nephrology, Seoul National University Boramae Medical Center, Korea, Republic of

Objectives : Anemia is prevalent in patients with chronic kidney disease (CKD), leading not only to disabling symptoms but also potentially accelerating CKD progression or increasing mortality in non-dialysis patients. We reaffirmed this through cohorts in two countries and analyzed whether the same hypothesis holds when considering changes in hemoglobin levels during the follow-up period.
Methods : We performed a retrospective cohort study from two hospitals in South Korea and one hospital in Taiwan. The anemic patients were defined as patients with an initial hemoglobin level of <10 mg/dL. To consider changes of serum hemoglobin level after enrollment, time-varying Cox analysis was used.
Results : Among 21,225 patients, 5,384 patients were grouped as anemic patients at the enrollment. The median estimated Glomerular Filtration Rate (eGFR) was lower in anemic patients as 18.7 [IQR 10.4; 30.6] mL/min/1.73m^2 than non-anemic patients as 36.8 [25.3; 46.7]. Also, anemic patients has more comorbidities than non-anemic patients (Table 1). As CKD stages progressed, the average hemoglobin level increased, with a notable decrease in hemoglobin levels among Taiwanese patients, especially in CKD stages 4-5. In time-fixed analysis with full adjustment, higher hemoglobin level is associated with lower risk of end-stage kidney disease (ESKD) progression (aHR 0.93, 95% CI 0.919–0.951, p-value <0.001) and all-cause mortality (aHR 0.90, 95% CI 0.889–0.914, p-value <0.001). The trend was persistent even after time-varying consideration of serum hemoglobin level (ESKD: aHR 0.65, 95% CI 0.630–0.663, p-value <0.001; all-cause mortality: aHR 0.81, 95% CI 0.802–0.823, p-value <0.001)
Conclusions : We reaffirmed the risk associated with the occurrence of anemia. Also, as differences in ESA usage practices between Korea and Taiwan, future analyses will consider these variations to determine if ESA usage is associated with reductions in anemia and improvements in renal outcomes and other hard outcomes such as mortality.

Table 1.png

	Anemia	Not-Anemic	Total	p-value
N	5,384	15,841	21,225	
AGE	66.2 [56.9;75.0]	66.6 [57.0;74.0]	66.4 [57.0;74.3]	0.306
GENDER, male (%)	2476 (46.0%)	10330 (65.2%)	12806 (60.3%)	<0.001
Nationality				<0.001
- Taiwan	2675 (49.7%)	5583 (35.2%)	8258 (38.9%)	
- South Korea	2409 (50.2%)	10258 (64.8%)	12967 (61.1%)	
BMI	23.2 [20.8;26.0]	24.3 [21.9;26.9]	24.0 [21.5;26.6]	<0.001
Diabetes mellitus	2645 (49.1%)	6628 (41.8%)	9273 (43.7%)	<0.001
Hypertension	3043 (56.5%)	9184 (58.0%)	12227 (57.6%)	0.064
Dyslipidemia	1260 (23.4%)	4057 (25.6%)	5317 (25.1%)	0.001
CAD	515 (9.6%)	1367 (8.6%)	1882 (8.9%)	0.039
CVD	773 (14.4%)	2605 (16.4%)	3378 (15.9%)	<0.001
Heart failure	666 (12.4%)	1200 (7.6%)	1866 (8.8%)	<0.001
Malignancy	218 (4.0%)	454 (2.9%)	672 (3.2%)	<0.001
eGFR, CKD-EPI 2021	18.7 [10.4;30.6]	36.8 [25.3;46.7]	32.7 [19.7;44.3]	<0.001
Cr	2.9 [1.9; 4.7]	1.7 [1.4; 2.4]	1.9 [1.5; 2.9]	<0.001
Uric acid	7.4 [6.1; 8.8]	7.1 [5.9; 8.5]	7.2 [6.0; 8.6]	<0.001
Calcium	8.7 [8.3; 9.1]	9.1 [8.8; 9.5]	9.0 [8.6; 9.4]	<0.001
Phosphate	4.2 [3.6; 4.9]	3.6 [3.2; 4.1]	3.7 [3.3; 4.3]	<0.001
Cholesterol	165.0 [137.0;198.0]	178.0 [150.0;208.0]	175.0 [147.0;206.0]	<0.001
TCO2	21.9 [18.8;24.7]	25.0 [22.0;28.0]	24.0 [21.0;27.0]	<0.001
WBC	6.4 [5.1; 8.0]	6.9 [5.7; 8.4]	6.8 [5.6; 8.3]	<0.001
ALB	3.8 [3.3; 4.1]	4.1 [3.8; 4.4]	4.0 [3.7; 4.3]	<0.001

Table 1.png


13
12
11
Hemoglobin (g/dL)
CKD3A
CKD3B
CKD4-5
CKD stage (CKD-EPI equation)
Hospital
BCC
BRMH
SNUH