

Clinical Outcomes in Patients with Anemia in CKD Using Linked US Claims and Electronic Health Records

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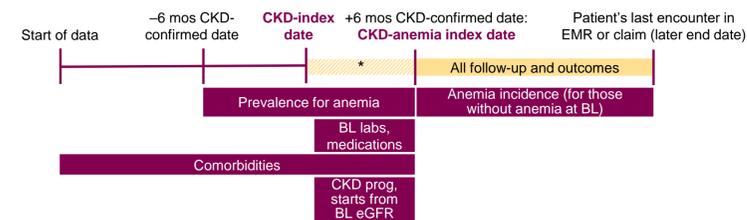
Introduction

- Anemia is a well-known complication of chronic kidney disease (CKD) that has been associated with increased mortality and hospitalization, and poor health-related quality of life (HRQoL).¹⁻³
- Current approaches for the management of anemia in CKD focus primarily on the use of erythropoiesis-stimulating agents (ESAs) and iron supplementation. However, unmet clinical needs remain,⁴⁻⁶ and contemporary outcome data to understand the long-term burden of anemia are scarce.
 - Recent initiatives by the US Department of Health and Human Services have highlighted the need for more comprehensive management of CKD.⁷
- This retrospective analysis describes selected cardiovascular (CV) and renal outcomes in non-dialysis CKD patients with and without anemia in US real-world practice.

Methods

- Linked claims (MarketScan[®]) and electronic medical records (EMR) data (Explorys[®]) (Limited Claims EMR Dataset; LCED) were collated by IBM[®] Watson Health[™].
 - Data were obtained from the 5-year LCED, a static dataset consisting of approximately 4.4 million patients covering the period from January 2012 to June 2018 and September 2018 for claims and EMR data, respectively.
- The study population comprised all adult inpatients and outpatients (aged ≥18 years) with CKD (stages 3a to 5) – based on documented estimated glomerular filtration rate (eGFR) measurements <60 mL/min/1.73 m² between January 1, 2012 and June 30, 2018 (CKD index), with a second confirmatory eGFR measurement ≥90 days later – with ≥1 hemoglobin (Hb) test >6 months after CKD index.
 - Key exclusion criteria at baseline included active bleeding, >30 days of dialysis before CKD index, end-stage renal disease undergoing dialysis, and documented iron deficiency⁸ (serum ferritin ≤30 ng/mL, or serum ferritin 31–99 ng/mL with either total iron-binding capacity >450 µg/dL or transferrin saturation <20%). Renal transplantation was not excluded.
- Anemia was defined as the presence of Hb <10.0 g/dL at any time within 6 months of CKD index to identify those with anemia eligible for active treatment.⁸ Patients could have a Hb test in both inpatient and outpatient settings.
- Baseline covariates were ascertained during the 6-month period between the CKD index date and CKD-anemia index date (Figure 1).
- Data were summarized by descriptive statistical methods, and no inferential analyses were performed.

Figure 1. Study time periods and data collection



Index date was defined for each patient as the first date that all eligibility criteria were met. All patients were followed from the index date through to September 30, 2018. *Possible to find BL laboratory value-dependent outcomes, such as eGFR doubling or serum creatinine doubling here, as the BL laboratory value will be between 0–180 days of CKD index. BL, baseline; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; EMR, electronic medical record; mos, months; prog, progression.

Results

Baseline characteristics

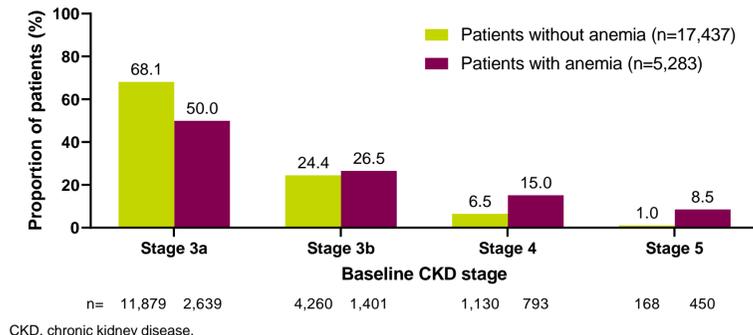
- The base cohort included 22,720 patients with a mean (median) follow-up of 3.36 (3.61) years.
- Of the base cohort, 5,283 patients (23%) had anemia. The mean age (± standard deviation [SD]) of patients with and without anemia was 71 (14) and 70 (12) years, respectively (Table 1).
- The mean (median) follow-up time for patients with and without anemia was 2.93 (2.88) and 3.48 (3.79) years, respectively.
- The majority of patients had CKD stage 3a or 3b (Figure 2).

Table 1. Patient baseline characteristics

	Patients without anemia* (n=17,437)		Patients with anemia* (n=5,283)	
Female sex, n (%)	9,845 (56.5)		3,188 (60.3)	
Mean age, years (SD)	70.5 (12.3)		70.1 (13.6)	
Mean BMI, kg/m ² (SD)	30.8 (7.1)		29.3 (7.4)	
Laboratory values, median (IQR)	n		n	
eGFR, mL/min/1.73 m ²	17,437	50.0 (42.0–56.0)	5,283	44.7 (31.0–53.0)
Serum creatinine, mg/dL	1,074	1.3 (1.1–1.5)	505	1.4 (1.2–2.1)
Serum iron, µg/dL	114	71.5 (57.0–90.8)	86	63.0 (42.3–85.8)
Serum ferritin, ng/mL	1,293	110.3 (64.8–212.5)	1,226	164.4 (79.5–305.8)
TIBC, µg/dL	99	313.0 (275.5–347.5)	77	268.0 (234.0–328.0)
Serum potassium, mmol/L	1,073	4.2 (3.9–4.6)	660	4.1 (3.7–4.5)
Median Hb,† g/dL (IQR)	13.0 (12.0–14.0)		10.8 (9.8–12.0)	
Hb range,† n (%)				
<8	0		181 (3.4)	
8–9.9	0		1,252 (23.7)	
10–12	3,172 (18.2)		2,255 (42.7)	
>12	9,099 (52.2)		1,146 (21.7)	
Missing	5,166 (29.6)		449 (8.5)	

*Anemia was defined as the presence of Hb <10.0 g/dL at any time within 6 months of CKD index. †As ascertained during the 6-month period between the CKD index date and the CKD-anemia index date. BMI, body mass index; eGFR, estimated glomerular filtration rate; Hb, hemoglobin; IQR, interquartile range; SD, standard deviation; TIBC, total iron-binding capacity.

Figure 2. CKD stage by presence of anemia

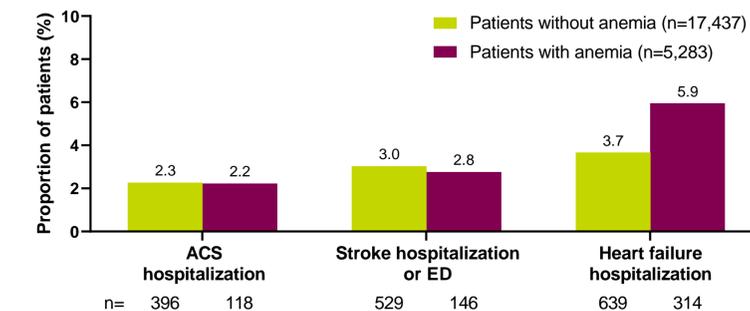


- The most common comorbidities in patients with and without anemia, respectively, were dyslipidemia (52.6% and 59.1%), type 2 diabetes (42.0% and 37.9%), heart failure (31.4% and 16.1%), and stroke (22.9% and 16.7%).
- Statins (31.9% and 37.2%) and renin-angiotensin-aldosterone system inhibitors (28.5% and 32.7%) were the most common medications received in patients with and without anemia, respectively.
 - During the 6-month post-index period, among patients with anemia, ESAs were used by 1.9% and IV iron was used by 0.04%.

Incidence of CV events

- A numerically higher proportion of patients with anemia were hospitalized for heart failure compared to those without anemia (5.9% vs 3.7%, respectively; Figure 3) during the follow-up period.
- The incidence of heart failure hospitalization (per 100 patient-years) was numerically higher in patients with anemia (Table 2).

Figure 3. Proportion of patients with CV events for CKD stages 3–5



ACS, acute coronary syndrome; CV, cardiovascular; ED, emergency department.

Table 2. Incidence rates of CV events for CKD stages 3–5

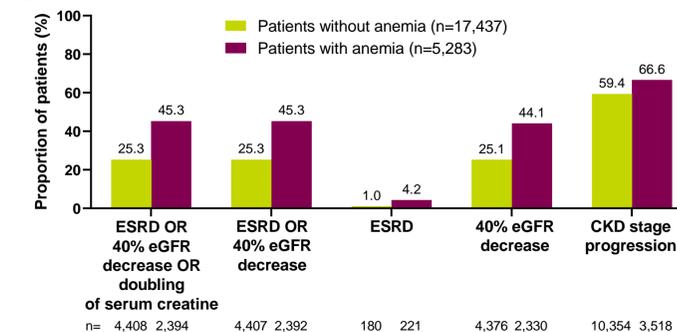
CV event, IR (lower–upper estimate)	Patients without anemia (n=17,437)	Patients with anemia (n=5,283)
ACS hospitalization	0.7 (0.6–0.7)	0.8 (0.6–0.9)
Stroke hospitalization or ED	0.7 (0.6–0.7)	0.7 (0.6–0.8)
Heart failure hospitalization	0.8 (0.8–0.9)	1.6 (1.4–1.7)

Incidence rates (per 100 patient-years) with CV event. ACS, acute coronary syndromes; CV, cardiovascular; ED, emergency department.

Incidence of renal events

- Compared with patients without anemia, a numerically higher proportion of patients with anemia experienced a sustained 40% eGFR decrease (25.1% vs 44.1%, respectively) and CKD stage progression (59.4% vs 66.6%; Figure 4) during the follow-up period.
- The incidence of renal events (per 100 patient-years) was numerically higher in patients with anemia (Table 3).
- The median annual change in eGFR slope over the study period (years from baseline) was –0.6 and –0.3 mL/min/1.73 m², in patients with and without anemia, respectively.

Figure 4. Proportion of patients with selected renal outcomes for CKD stages 3–5



CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; ESRD, end-stage renal disease.

Table 3. Incidence rates of selected renal outcomes for CKD stages 3–5

Renal event, IR (lower–upper estimate)	Patients without anemia (n=17,437)	Patients with anemia (n=5,283)
ESRD OR 40% eGFR decrease OR doubling of serum creatinine	9.7 (8.6–10.8)	25.0 (22.0–28.3)
ESRD OR 40% eGFR decrease	8.3 (8.0–8.5)	21.4 (20.5–22.3)
ESRD	0.3 (0.3–0.3)	1.5 (1.3–1.6)
40% eGFR decrease	7.3 (7.1–7.5)	18.1 (17.4–18.8)
Doubling of serum creatinine	2.9 (2.4–3.5)	5.7 (4.7–7.1)
CKD stage progression	27.4 (26.9–28.0)	43.5 (42.0–44.9)

Incidence rates (per 100 patient-years) with renal event. CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; ESRD, end-stage renal disease; IR, incidence rate.

Conclusions

- Anemia is a frequently observed complication of CKD, and the presence of anemia is associated with more advanced CKD stage.
- Comorbidities are prevalent in patients with anemia; adequate management of these patients is an important clinical consideration.
- This large US cohort study highlights the worsened outcomes associated with anemia in CKD, particularly heart failure hospitalization, CKD disease progression, and more accelerated decline in renal function. Future studies warrant the evaluation of clinical outcomes in patients with CKD and anemia treated with novel, transformative therapies.
- Improved screening and management of anemia across the spectrum of non-dialysis CKD patients provides an opportunity to mitigate adverse outcomes of this complication.

Related presentations

ePoster: #PO0274. Cost and Healthcare Resource Use in Patients With Anemia in CKD Using Linked US Claims and Electronic Health Records

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Disclosures

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