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Original Research Article

Study on Prevalence of Anemia in Chronic Kidney Disease Patients: A Hospital-Based Cross-Sectional Analysis

Khushboo Rani[1], Jamshed Anwer[2], Rishi Kishore[3], Vijay Shankar[4]

[1]Assistant Professor, Department of Nephrology, Nalanda Medical College & Hospital, Patna, Bihar, India.

[2]Assistant Professor, Department of Nephrology, Nalanda Medical College & Hospital, Patna, Bihar, India.

[3]Assistant Professor, Department of Nephrology, Nalanda Medical College & Hospital, Patna, Bihar, India.

[4]Professor and HOD, Department of Nephrology, Nalanda Medical College & Hospital, Patna, Bihar, India.

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Corresponding author: Khushboo Rani

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Abstract

Background: Because of iron deficiency, chronic inflammation, and decreased erythropoietin synthesis, anemia often exacerbates chronic kidney disease (CKD). It lowers patient's quality of life while increasing morbidity and cardiovascular risks. Access to healthcare and the severity of the condition affect its prevalence. In order to diagnose CKD patients early and treat them effectively, it is essential to assess their burden. Assessing the prevalence of anemia in patients with chronic kidney disease was the goal of this study.

Methods: The Department of Nephrology at Nalanda Medical College and Hospital in Patna, Bihar, conducted this cross-sectional study from October 2024 to September 2025. Purposive sampling was used to enroll 217 CKD patients in total. To identify anemia, hematological tests were carried out, including a measurement of hemoglobin levels. A pre-made questionnaire was used to record the participant's clinical and demographic details. MS Office products were used to evaluate the data.

Results: The prevalence of anemia was 41%, with comparable rates for both sexes. It was higher among those with high incomes (47.1%) and more prevalent among urban dwellers (57.4%) than rural ones (26.7%). Current smokers had the lowest anemia rates (26.5%), whereas former smokers (43.7%) had slightly higher rates than never-smokers (43.2%). The severity of CKD (7.4% in stage 1 to 86.7% in stage 5) and comorbidity (71.4% in very high-index patients) both increased anemia.

Conclusion: Anemia is a common side effect of chronic kidney disease that gets worse as the condition worsens and the severity of comorbidities increases. To lessen its burden, improve patient outcomes, and raise the quality of life for those who are impacted, early screening and focused treatment are crucial.

Keywords: Anemia, chronic kidney disease, CKD hemoglobin.

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Introduction

A common and serious side effect of chronic kidney disease (CKD) is anemia, which raises morbidity, mortality, and lowers quality of life [1]. Iron deficiency, chronic inflammation, and diminished erythropoietin (EPO) production are some of the causes. For better patient outcomes and efficient care, it is crucial to comprehend the prevalence and causes of anemia in CKD [2]. Waste buildup and fluid imbalances are the results of chronic kidney disease (CKD), a degenerative illness characterized by a slow deterioration in renal function [3]. The production of EPO, a hormone that promotes the development of red blood cells in the bone marrow, is one of the kidneys' primary roles. EPO production decreases with declining renal function, which results in decreased red blood cell formation and anemia [4]. The shorter life of red blood cells and the effects of uremic toxins, which inhibit erythropoiesis, exacerbate this situation [5]. Anemia in CKD is also significantly influenced by iron deficiencies. Red blood cell generation is hampered by iron shortage because iron is necessary for hemoglobin synthesis. Due to inadequate food intake, poor absorption, and increased iron losses during dialysis, CKD patients frequently suffer from iron insufficiency [6]. Functional iron shortage is also exacerbated by chronic inflammation in chronic

kidney disease (CKD), which raises hepcidin levels and reduces iron availability from body reserves and inhibits iron absorption [7]. Depending on the demographic and diagnostic standards, anemia is more common in CKD patients.

Material and Methods

From October 2024 to September 2025, the Department of Nephrology at Nalanda Medical College and Hospital in Patna, Bihar, conducted this cross-sectional study. Purposive sampling was used to enroll 217 CKD patients who were at least 18 years old and had a confirmed diagnosis of the disease. Patient interviews were used to gather demographic information, and medical records were examined to gather pertinent test results and medical history. To find independent factors linked to anemia in CKD patients, bivariate and multivariate logistic regression analyses were performed. The modified Charlson comorbidity index was used to examine the comorbidities [8]. Patients with CKD stages 3 to 5 who were prepared to give written informed consent and were at least 18 years old met the study's inclusion criteria. These individuals were gathered from medical wards, dialysis units, renal clinics, general outpatient departments (OPDs), and emergency medical outpatient departments. Patients on dialysis, those with a known cause of anemia other than chronic kidney disease (CKD), patients with known cancers, pregnant women, and those who refused to participate were all excluded. Key contributing factors to anemia in CKD patients were identified through statistical analysis of the data using Microsoft Office tools.

Results

Anemia affected 41% of the 217 participants. The age group of 45–59 years old had the highest prevalence (44.3%), followed by the group of 60–80 years old (42.2%). The prevalence was 37.5% in the 30-44 age group and 28.6% in the 18-29 age group. The age group over 80 had the prevalence of (40.0%).

Table 1: Prevalence of anemia based on ages

Age (in Years)	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
18-29	14	6.4%	4	28.6%
30-44	40	18.4%	15	37.5%
45-59	70	32.3%	31	44.3%
60-80	83	38.3%	35	42.2%
>80	10	4.6%	4	40.0%

Anemia prevalence rates were about the same for both sexes, with a comparable proportion of men and women afflicted.

Urban individuals had a higher prevalence of anemia (57.4%) than rural residents (26.7%). The high-income group (>25,000 BDT) has the highest prevalence of anemia (47.1%). Anemia affected 43.2% of individuals who had never smoked and 43.7% of those who had smoked in the past.

Only one person had anemia with an unclear smoking status, while current smokers had the lowest prevalence (26.5%).

Table 2: Prevalence of anemia based on gender

Gender	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
Female	92	42.4%	38	41.30%
Male	125	57.6%	51	40.80%

Table 3: Prevalence of anemia based on residence

Residence	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
Urban	101	46.5%	58	57.4%
Rural	116	53.5%	31	26.7%

Table 4: Prevalence of anemia based on monthly income

Income (Rs.)	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
Low <10,000	79	36.4%	33	41.8%
Mid 10–25 thousand	104	47.9%	40	38.5%
High >25,000	34	15.7%	16	47.1%

Table 5: Prevalence of anemia based on smoking status

Smoking status	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
Never	111	51.2%	48	43.2%
Former	71	32.7%	31	43.7%
Current	34	15.7%	9	26.5%
Unknown	1	0.5%	1	100.0%

Anemia prevalence increased with CKD stage: 7.4% in stage 1, 10.0% in stage 2, 25.6% in stage 3a, 40.4% in stage 3b, 83.7% in stage 4, and 86.7% in stage 5. Anemia was present in 37.3% of patients with diabetic nephropathy (DN), 60.0% of patients with hypertensive nephropathy (HN), 27.3% of patients with glomerulonephritis (GN), and 40.0% of patients with polycystic kidney disease (PKD).

Table 6: Prevalence of anemia based on CKD stages

CKD stage	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
1	27	12.4%	2	7.4%
2	40	18.4%	4	10.0%
3a	39	18.0%	10	25.6%
3b	47	21.7%	19	40.4%
4	49	22.6%	41	83.7%
5	15	6.9%	13	86.7%

Table 7: Prevalence of anemia based on causes of CKD

Causes of CKD	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
DN	51	23.5%	19	37.3%
HN	40	18.4%	24	60.0%
GN	77	35.5%	21	27.3%
PKD	35	16.1%	14	40.0%
Others	14	6.5%	11	78.6%

DN: Diabetic nephropathy, HN: Hypertensive nephropathy, GN: Glomerulonephritis, PKD: Polycystic kidney disease

The prevalence of anemia raised in proportion to the severity of comorbidities: 26.5% in patients with a low comorbidity index (≤3), 51.6% in those with a moderate index (4-5), 62.9% in those with a high index (6-7), and 71.4% in those with a very high index (≥8).

Table 8: Prevalence of anemia based on modified Charlson co-morbidity index

Index	Total		Anemia	
	No. of patients n=217	Percentage	No. of patients n=89	Percentage
Low(≤3)	113	52.1%	30	26.5%
Moderate (4-5)	62	28.6%	32	51.6%
High (6-7)	35	16.1%	22	62.9%
Very high(≥8)	7	3.2%	5	71.4%

Discussion

The age group of 45–59 years old had the highest prevalence in this study (44.3%), followed by the group of 60–80 years old (42.2%). According to a different study, the prevalence of anemia in CKD rises with age, especially in people over 40. [9] The 18–29 age group, on the other hand, had a comparatively low prevalence of anemia (28.6%), which is consistent with findings from a 2022 study that indicated a decreased frequency of anemia in younger CKD patients. [10] The prevalence of anemia was 40.8% in men and 41.3% in women, which was about equal for both sexes. This is in line with the results from 2020, which showed that the prevalence of anemia among CKD patients did not differ significantly by gender.[11]

However, some studies have found somewhat greater incidence of anemia in females, probably as a result of things like women's menstruation and pregnancy.[12] The frequency of anemia was much higher in urban areas (57.4%) than in rural areas (26.7%). Given that urban populations typically have better healthcare facilities and more options for early detection and treatment of anemia, this

differential may be caused by disparities in access to diet and healthcare. Similar results was reported in 2021, when it was discovered that anemia rates were greater among urban populations, maybe as a result of improved reporting and access to healthcare.[13] Additionally, the study discovered that the high-income group (>25,000 Rs.) had the highest rate of anemia (47.1%). This result contrasts with a number of studies that show higher anemia rates in low-income populations, which are probably caused by socioeconomic inequality, malnutrition, and restricted access to healthcare.[14] Higher income, however, would suggest a higher frequency of other risk factors, like diabetes and hypertension, which are linked to anemia and chronic kidney disease. In this study, current smokers had a lower prevalence of anemia (26.5%) than never-smokers (43.2%) and ex-smokers (43.7%).

This is an unexpected discovery because smoking is typically seen as a risk factor for anemia in people with chronic kidney disease (CKD) because it impairs erythropoiesis and causes chronic inflammation.[15] The limited sample size of current smokers (34 participants) may have distorted the results, which could account for the reduced prevalence of anemia in current smokers. The prevalence of anemia raised with the severity of CKD stages, as was to be predicted. In stage 1, the frequency was 7.4%, and in stage 5, it was 86.7%. [16]

Iron deficiency and decreased erythropoietin production, which are exacerbated by the effects of uremic toxins, are the main causes of the deteriorating anemia in the later stages of chronic kidney disease. Additionally, the study discovered that individuals with hypertensive nephropathy had a higher prevalence of anemia (60.0%), followed by those with diabetic nephropathy (37.3%), glomerulonephritis (27.3%), and polycystic kidney disease (40.0%). These results are in line with other research that demonstrates that because diabetic nephropathy and hypertensive nephropathy are progressive illnesses that affect kidney function, they are linked to greater incidences of anemia.[17]

Lastly, the modified Charlson comorbidity index showed that the prevalence of anemia raised with the severity of comorbidities. 26.5% of patients with a low comorbidity score had anemia, compared to 71.4% of patients with a very high comorbidity level.

This is consistent with earlier research showing that the presence of several comorbidities worsens anemia in individuals with chronic kidney disease (CKD) by increasing the burden of inflammation and iron shortage and further decreasing kidney function.[18] The results of this study highlight the substantial burden of anemia in patients with chronic kidney disease (CKD), with characteristics including age, CKD stage, comorbidities, and socioeconomic status influencing its occurrence. In order to improve patient outcomes and lower the risk of complications, early detection and treatment of anemia in CKD patients is essential.

Conclusion

According to this study, anemia is a frequent consequence of chronic kidney disease and becomes more common as the condition worsens. People with hypertensive nephropathy and those living in cities were more likely to experience it. A higher incidence of anemia was also linked to the severity of comorbidities. In order to lessen the burden of anemia in patients with chronic renal disease and enhance their general health and quality of life, these results highlight the significance of early screening, prompt intervention, and suitable management techniques.

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