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The Prevalence of Anemia among Patients with Chronic Kidney Disease in Kabul, Afghanistan

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ABSTRACT

Background: Anemia is one of the major complications of chronic kidney disease (CKD). We aimed to determine the prevalence of anemia among CKD patients in Kabul, Afghanistan, addressing a national data gap.

Methods: This cross-sectional study was conducted from Mar 2023 to Mar 2024, at Ali Abad Teaching Hospital, Kabul, Afghanistan, enrolling adult CKD patients diagnosed based on estimated glomerular filtration rate (eGFR) <60 mL/min/1.73m² using the CKD-EPI formula. Anemia was defined as hemoglobin levels below 13 g/dL in men and 12 g/dL in women.

Results: Of 2,427 patients screened, 82 were diagnosed with CKD. The overall prevalence of CKD was 3.38%, with 94% of CKD patients also diagnosed with anemia. The mean hemoglobin level for men was 8.65 g/dL, and for women, it was 9.05 g/dL. No statistically significant differences were found in hemoglobin levels across CKD stages or between genders.

Conclusion: The research identified an alarmingly high prevalence of anemia, affecting 94% of patients diagnosed with CKD in Kabul, far exceeding international averages. This highlights the significant gaps in healthcare and socio-economic barriers affecting patient care.

Keywords: Chronic kidney disease, Anemia, Prevalence, Afghanistan

Introduction

The kidneys act as blood filters, eliminating waste products and maintaining the balance of fluids and electrolytes. This filtration process takes place through clusters of capillaries known as glomeruli. When the glomerular filtration rate (GFR) drops below 60 mL/min/1.73 m² for three months or longer, regardless of the underlying cause, it is defined as chronic kidney disease (1, 2). One of the kidneys' primary functions is the production of erythropoietin, a regulatory hormone that stimulates red blood cell formation in the bone marrow when oxygen levels in the blood decline (3).

Numerous hematological and biochemical issues develop in the body when the renal system is impaired and chronic kidney disease occurs

(4). Anemia in CKD is linked to a lower quality of life and higher risks of cardiovascular disease, hospitalizations, cognitive decline, and mortality (5). It is also associated with many symptoms such as insomnia, shortness of breath, and fatigue. However, these symptoms are nonspecific and, in patients with CKD, may be a result of uremia. Because symptoms develop gradually, patients often do not report them until advanced stages. However, when asked directly, they may acknowledge experiencing limitations in their daily activities (6). Anemia, a frequent complication in CKD, is typically normocytic, normochromic, and hypoproliferative and arises from a combination of contributing factors, including chronic inflammation, insufficient erythropoietin production, disturbances in iron metabolism, blood loss associated with hemodialysis, uncontrolled hyperparathyroidism, and deficiencies in key nutrients such as iron, folic acid, and vitamin B12. Additionally, the use of certain medications, such as ACE inhibitors and the presence of uremic toxins also significantly contribute to the development of anemia in these patients (7). The National Health and Nutrition Examination Survey (NHANES) III revealed that the prevalence of anemia rises as the estimated GFR declines. Data collected from 2007 to 2010 indicated that anemia was twice as common in individuals with CKD (15.4%) compared to the general population (7.6%). The prevalence of anemia also increased with the progression of CKD, ranging from 8.4% at stage 1 to 53.4% at stage V (1, 2). In another research, the prevalence of anemia rose from 1% to 33% in men and from 1% to 67% in women as CKD advanced (2). The prevalence of anemia increased in the various stages of CKD, with rates of 42%, 33%, 48%, 71%, and 82% in stages 1 through 5, respectively (8). In another multicenter cross-sectional study in three different nephrology clinics, anemia was present in 55.9% of the CKD patients (9). A six month cross-sectional study at Lady Reading Hospital Peshawar revealed that the prevalence of anemia in chronic kidney patients was 48.62% (2). In another large-scale, cross-sectional US multicenter survey anemia was present in 47.7% of 5222 pre-dialysis patients with chronic kidney disease (10). Large-scale population studies have shown that the incidence of anemia (hemoglobin <12 g/dL) is below 10% in patients with CKD stages I and II and rises to 20%-40% in stage III, reaches 50%–60% in stage IV, and surpasses 70% in those with end-stage renal disease (stage V). Other research indicates that anemia affects up to 90% of patients in the dialysis population (7). Finally in Japan, the prevalence of anemia was 40.1% in patients with CKD stage 4 and 60.3% in those with CKD stage 5 (3).

Despite the global recognition of anemia as a common and significant complication in patients with CKD, there is a critical lack of epidemiologic data specific to Afghanistan. No comprehensive studies have been conducted to assess anemia prevalence among CKD patients in the country, highlighting a significant gap in understanding and managing this condition within the Afghan healthcare system. We aimed to address this deficiency by precisely quantifying anemia prevalence in CKD patients in stages 3–5 at Ali Abad Teaching Hospital in Kabul and examining its correlation with gender and disease progression, thereby providing the first comprehensive data in this context. This research will inform healthcare policy, guide clinical practice, improve anemia management among CKD patients in Afghanistan, and serve as a foundational reference for future studies.

Materials and Method

This hospital-based descriptive-analytical and cross-sectional study was conducted from Mar 2023 to Mar 2024 at Ali Abad Teaching Hospital, a major referral center in Kabul, Afghanistan to investigate the prevalence of anemia in patients diagnosed with CKD. Since one of the

accepted methods of data collection for such descriptive studies is the non-probability convenience sampling technique (11-13), we also collected our sample using this technique from among the patients who visited Ali Abad Teaching Hospital during a one-year period and met the inclusion criteria.

The inclusion criteria were adult patients (≥18 yr) with confirmed CKD, based on elevated serum urea and creatinine levels and patients who consented to participate in the study while the exclusion criteria included patients with acute kidney injury (AKI), Patients with non-renal causes of anemia, patients who did not provide informed consent and pregnant women.

Data Collection Procedures

Upon hospital admission, patients underwent serum creatinine testing, using colorimetric method, as part of their routine clinical evaluation. CKD was diagnosed based on elevated level of this biomarker, confirming impaired renal function (14). Following CKD diagnosis, hemoglobin levels were measured using automated hematology analyzers to assess the presence of anemia. Anemia was defined according to the WHO's Hemoglobin cutoffs for anemia: hemoglobin levels less than 13 g/dL in men and less than 12 g/dL in women (15, 16).

Statistical Analysis

All analyses were performed by SPSS 27 (IBM Corp., Armonk, NY, USA) and the results were presented in the form of tables. Alongside descriptive statistics we performed Mann-Whitney U test to determine the relationship between sex and hemoglobin levels, Kruskal-Wallis test to determine the correlation of hemoglobin level and stages of CKD and Chi-square test to find the relation between ESRD and gender. The statistically significant level (alpha level) for hypothesis test was 0.05, we rejected the null hypothesis when p-value was less than alpha level.

Ethical Consideration

Study protocol was reviewed and approved by Biomedical Ethic Committee of Ghalib University, Kabul, Afghanistan (AF.GKU.REC.1402.003). Informed consent was obtained from all participants prior to their inclusion in the study.

Results

From Mar 2023 to Mar 2024, totally 2,427 patients visited the Internal Medicine department of Ali Abad Teaching Hospital. After conducting creatinine tests and determining estimated glomerular filtration rate (eGFR) using the CKD-EPI formula, 82 patients (37 men and 45 women) were diagnosed with CKD, defined as eGFR <60 mL/min/1.73 m². The mean age of the patients was 56.3 yr (SD 15.2), with men having a mean age of 57.4 yr (SD 17.6) and women 55.6 yr (SD 13.3). The overall prevalence of CKD among screened patients was 3.38%. Patients were categorized into CKD stages 3, 4, and end-stage renal disease (ESRD), with distributions and gender breakdowns shown in Table 1.

Among the 82 CKD patients, 77 (94%) were diagnosed with anemia, defined as hemoglobin levels <13 g/dL in men and <12 g/dL in women. The prevalence of anemia was similar between sexes, with 35 (95%) men and 42 (93%) women affected. Anemia was present in all patients in stage 3 and ESRD, and in 92% of those in stage 4. Detailed prevalence rates overall, by CKD stage, and by sex are presented in Table 2. The hemoglobin distribution was non-normal (Shapiro-Wilk test, $P<0.01$). No significant differences in hemoglobin levels were observed between sexes (Mann-Whitney U test, $P=0.236$) or across CKD stages (Kruskal-Wallis test, $P=0.596$).

Table 1: Demographic Characteristics and Distribution of CKD Stages by Sex Among Patients at Ali Abad Teaching Hospital, Kabul, Afghanistan (March 2023–March 2024)

Characteristic	*Overall (N=82)*	*Male (n=37)*	*Female (n=45)*
Age, yr			
Mean ± SD	56.3 ± 15.2	57.4 ± 17.6	55.6 ± 13.3
CKD Stage, n (%)			
Stage 3	23 (28.0)	12 (52.2)	11 (47.8)
Stage 4	28 (34.1)	14 (50.0)	14 (50.0)
ESRD	31 (37.8)	11 (35.5)	20 (64.5)

Note: CKD, chronic kidney disease; ESRD, end-stage renal disease; SD, standard deviation. Percentages for CKD stages are row percentages for overall and column percentages for sex-specific distributions

Table 2: Prevalence of Anemia Overall and by CKD Stage Among Patients with CKD (N=82)

CKD Stage/Anemia Status	*n (%) with Anemia*	*n (%) without Anemia*	*Total n (%)*
Overall	77 (94)	5 (6)	82 (100)
Stage 3	23 (100)	0 (0)	23 (100)
Stage 4	26 (93)	2 (7)	28 (100)
ESRD	31 (100)	0 (0)	31 (100)
By Sex (Overall)			
Male	35 (95)	2 (5)	37 (100)
Female	42 (93)	3 (7)	45 (100)

Note: Anemia defined as hemoglobin <13 g/dL in men and <12 g/dL in women (World Health Organization criteria). CKD, chronic kidney disease; ESRD, end-stage renal disease. Percentages rounded to nearest whole number for clarity. No significant association between anemia and CKD stage (Kruskal-Wallis test, P=0.596) or sex (Mann-Whitney U test, P=0.236)

The mean hemoglobin level among all CKD patients was 8.87 g/dL (SD 2.00). Among anemic patients (n=77), the mean hemoglobin was 8.87 g/dL overall, 8.65 g/dL (SD 2.18; 95% CI: 7.93–9.38) for men, and 9.05 g/dL (SD 1.86; 95% CI: 8.49–9.60) for women. Given the non-normal distribution, median values were also calculated: overall median 8.90 g/dL (IQR 7.50–10.20), 8.70 g/dL (IQR 7.40–10.00) for men, and 9.10 g/dL (IQR 7.60–10.40) for women. These hemoglobin statistics are summarized in Table 3.

Table 3: Hemoglobin Levels Overall and by Sex among CKD Patients with Anemia (n=77)

Statistic	*Overall*	*Male (n=35)*	*Female (n=42)*
Mean, g/dL	8.87	8.65	9.05
SD	2.00	2.18	1.86
95% CI	8.42–9.32	7.93–9.38	8.49–9.60
Median (IQR)	8.90 (7.50–10.20)	8.70 (7.40–10.00)	9.10 (7.60–10.40)

Note: CI, confidence interval; IQR, interquartile range; SD, standard deviation. Hemoglobin levels were non-normally distributed (Shapiro-Wilk test, P<0.01). No statistically significant difference between sexes (Mann-Whitney U test, P=0.236). Data focused on anemic patients for clinical relevance; overall CKD patient means are similar

Discussion

In this cross-sectional study, we assessed the prevalence of anemia across different stages of CKD, including stage 3, stage 4, and End-Stage Renal Disease (ESRD), among patients in our study population**.** Our analysis showed that the prevalence of CKD among patients who visited Ali Abad Hospital in Kabul during the one-year period from 2023 to 2024 was 3.38%. Among the patients, 28% were in stage 3, 34.1% were in stage 4 and 37.9% were in ESRD, demonstrating a progressive increase in percentage of patients with upgrading of stages. Although in our study the number of women with ESRD was higher than that of men, which initially led us to assume that cultural factors and gender-based discrimination might have limited women's equal access to healthcare services and resulted in delayed diagnosis.

The Chi-square test revealed no statistically significant association between gender and the occurrence of ESRD at the 5% significance level (P=0.17). However, the findings of this study underscore a notably high and concerning prevalence of anemia among patients with CKD in Kabul, Afghanistan, with an alarming 94% of patients affected (45.5% men and 54.5% women). While in the analysis of NHANES data in 2007-2010 anemia had the prevalence rate of 15.4% of CKD's patients and in analysis of National Health and Nutrition Survey data from 1999-2018 the prevalence was 25.3% (1, 17). Moreover, the analysis of a cross-sectional study at Lady reading Hospital Peshawar the prevalence of anemia among CKD patient was 48.62% (2) and another multicenter study in Chinese patient and Korean cohort study the prevalence was 51.5% and 44.9% respectively (18, 19). Therefore, our study found a very high prevalence of anemia in CKD compared to the international studies, indicating a disastrous situation in Afghanistan.

We believe that the exceptionally high prevalence of anemia, alongside other apparent and underlying factors primarily affecting patients, is largely attributable to significant deficiencies in healthcare service delivery, public health infrastructure, and economic poverty. For example, in many remote areas of Afghanistan—where a large portion of the population resides—basic diagnostic and curative facilities are unavailable. Due to the lack of paved roads, patients often travel for more than a day just to reach their provincial center, where timely and appropriate diagnosis and treatment are often still not provided. By the time they arrive in Kabul, their disease has usually reached its advanced stages. These issues prevent patients from being diagnosed in the early stages of their illness, before progressing to the advanced stages. Even if they are diagnosed, due to poor economic situation, they are often unable to afford the cost of treatment. This situation underscores the need for future research to investigate the interrelationships between these contributing factors and the high prevalence of anemia in CKD. Our study also showed that nearly all patients in stages (3, 4, ESRD) had anemia. While in Boston, USA, the prevalence of anemia within CKD stages 3-5 was 58%, 92%, 92% respectively (8), which we also attribute this finding to the above-mentioned factors.

Anemia significantly elevates the likelihood of dialysis initiation among patients with CKD and is closely linked to increased rates of mortality and hospitalization in those already receiving dialysis. In individuals with non-dialysis-dependent CKD (ND-CKD), nephrologists regard anemia as a major modifiable determinant contributing to both cardiovascular and renal deterioration. Consequently, obtaining precise data on its prevalence is crucial for shaping effective public health strategies focused on early detection, prevention, and awareness of ND-CKD (18). Considering the

significant impact of anemia on CKD patients, our study stands as a unique contribution in Afghanistan, addressing a previously unfilled gap in data regarding anemia in CKD. Furthermore, it offers practical implications by enhancing awareness among CKD patients about the importance of early consultation and timely anemia treatment. The results of this study may also provide an important evidence base for the Ministry of Public Health to develop and implement informed, data-driven public health policies.

Conclusion

Our cross-sectional study highlights a high prevalence of anemia among CKD patients at Ali Abad Teaching Hospital in Kabul, Afghanistan, with 94% of the patients affected. This figure contrasts starkly with international prevalence rates, underscoring the severity of the situation in Afghanistan. While gender differences in ESRD prevalence were observed, no significant association was found between gender and disease stage. The extremely high anemia prevalence is likely influenced by various factors, including deficiencies in healthcare services, public health infrastructure, and economic challenges that limit patients' access to necessary medical care. These findings call for urgent attention to improve healthcare delivery and address underlying socio-economic barriers in Afghanistan. Additionally, the study emphasizes the importance of early diagnosis and treatment for anemia in CKD patients, associated with increased risks of cardiovascular and renal damage. Given the alarming prevalence of anemia, our research offers valuable insights for public health policies in Afghanistan, stressing the need for interventions to reduce the burden of anemia in CKD patients. Despite robust findings, methodological limitations (convenience sampling, small sample) warrant cautious generalization of results. Future studies should explore the complex relationships between anemia, CKD progression, and the socio-economic and healthcare challenges in Afghanistan to develop targeted strategies for prevention and treatment. This study thus serves as a crucial step in bridging the data gap and improving patient care for CKD in Afghanistan.

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Conflict of interest

The authors declare that there is no conflict of interests.

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