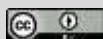## Original Article

Extent of Anemia with Progressing Stages of CKD

Liton Chandra Ghosh[1], Mahbuba Akhter[2], Swapon Kumar Saha[3], Nayan Ranjan Sarker[4]

ABSTRACT

Introduction: *Anemia was first linked to CKD over 170 years ago by Richard Bright. As kidney disease progresses, anemia increases in prevalence, affecting nearly all patients with stage 5 CKD. Anemia in CKD is associated with reduced quality of life and increased cardiovascular disease, hospitalizations, cognitive impairment, and mortality. This study aimed to analyze the extent of anemia with progressing stages of CKD.* ***Methods and Materials:*** *This cross-sectional study was conducted in the Department of Nephrology, Dhaka National Medical College Hospital, for 1 year; from January 2020 to January 2021. A total of 50 subjects were included in this study as per inclusion criteria.* ***Result:*** *Among the study subjects, most of the patients 44% suffered from severe anemia followed by 36% patients who had moderate anemia. According to extent of CKD, most of the patients 50% had stage 5 CKD (ESRD), followed by 20% patients who had stage 3 CKD, and the rest 20% patients suffered from stage 4 kidney disease. Among the patients who had stage 3 kidney disease, 16% patients had mild anemia, followed by 8% patients who had moderate anemia, and the rest 6% patients had severe anemia.* ***Conclusion****: In this study, among the patients who had the end-stage renal disease (ESRD) or stage 5 CKD, 14.0% of patients had moderate anemia and 36.0% of patients had severe anemia. So, this study concluded that the extent of anemia increases with progressing stages of CKD.*

Keywords: *Anemia, CKD, ESRD, Hemoglobin*

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INTRODUCTION

According to the World Health Organization (WHO), anemia is defined as hemoglobin (Hb) levels <12.0 g/dL in women and <13.0 g/dL in men. However, normal Hb distribution varies not only with sex but also with ethnicity and physiological status [1]. Anemia is a common feature of CKD associated with poor outcomes. Anemia in CKD is typically normocytic, normochromic, and hypo-proliferative [2]. The definition and classification of chronic kidney disease (CKD) have evolved, but current international guidelines define this condition as decreased kidney function shown by glomerular filtration rate (GFR) of less than 60 mL/min per $1 \cdot 73$ m^2, or markers of kidney damage, or both, of at least 3 months duration, regardless of the underlying cause [3]. In CKD stage 1, GFR >90 ml/min per 1.73 m^2 and albuminuria, in stage 2, GFR 60 to 89 ml/min per 1.73 m^2 and albuminuria, in stage 3, GFR 30 to 59 ml/min per 1.73 m^2, and in stage 4 GFR 15 to 29 ml/min per 1.73 m^2 [4]. Early CKD stages require less complex care and generate lower costs. In contrast, late-stage CKD is every bit as complex and costly as other major chronic diseases. Health authorities may not recognize and fund CKD care appropriately until late-stage CKD is defined clearly as separate and distinct from earlier stages of the disease [5]. All patients with stage 1 CKD should be assessed either in person or by data review by a nephrologist, and a decision reached as to whether a specialist assessment is required for appropriate evaluation such as renal biopsy, genetic testing, or additional imaging studies. All patients with stages 2–4 should be under the care of or should have access to, the advice of a nephrologist. All patients with progressive stage 3 CKD should be seen regularly by a nephrologist, to determine the need for and the timing of preparation for renal replacement treatment. All stage 4 CKD patients will be under the care of a nephrologist unless a co-morbidity such as advanced malignant disease makes this inappropriate [6]. The development of anemia is expected in CKD stages 3 to 5, but onset varies from one patient to another [7]. Many factors contribute to declining hemoglobin as CKD progresses, but impaired production of erythropoietin by failing kidneys is a central cause. The hepcidin-mediated iron restriction also contributes to anemia by downregulating both intestinal iron absorption and the release of stored iron for erythropoiesis [8]. Hemoglobin levels in individuals with chronic kidney disease fluctuate frequently above or below the recommended target levels within short periods even though the calculated mean hemoglobin remains within the target range of 11 to 12 g/dl [9]. Anemia remains an important complication experienced by patients with kidney disease, although it is treatable. The prevalence of anemia depends on its definition but generally increases in frequency and severity in the more advanced stages of chronic kidney disease [10]. This study aimed to analyze the extent of anemia with progressing stages of CKD.

OBJECTIVES

General Objective

- To analyze the extent of anemia with progressing stages of CKD.

Specific Objective

- To see the eGFR levels in different stages of CKD.

METHODS & MATERIALS

This cross-sectional study was conducted in the Department of Nephrology, Dhaka National Medical College Hospital, for 1 year; from January 2020 to January 2021. A total of 50 subjects fulfilling the inclusion criteria were enrolled as study subjects. Written consent was obtained from each subject. A structured questionnaire (research instrument) was developed containing all the variables of interest. All patients underwent necessary laboratory investigations. Data were processed and analyzed using the software SPSS (Statistical Package for Social Sciences) version 11.5. For all analytical tests, the level of significance was set at 0.05, and $p < 0.05$ was considered significant. Prior permission was taken for this study from the Ethical Committee of Dhaka National Medical College, Hospital, Dhaka, Bangladesh.

Inclusion Criteria

- Patients of ≥45 years.
- Patients who had given consent to participate in the study.

Exclusion Criteria

- Patients who had other chronic diseases except for CKD.
- Patients who did not give consent to participate in the study.

RESULTS

Among the study subjects, most patients 60.0% belonged to the age group of > 60 years, followed by 30.0% patients from 55-60 years of age, and the rest 5 (10.0%) patients were from 50-55 years of age [Figure 1]. About 60% of the patients were male and 40% were female in this study [Figure 2]. Concerning the degree of anemia, most of the patients 44.0% suffered from severe anemia followed by 18 (36.0%) patients who had moderate anemia [Figure 3]. According to extent of CKD, most of the patients 50.0% had stage 5 CKD (ESRD), followed by 10 (20.0%) patients had stage 3 CKD, and the rest 10 (20.0%) patients suffered from stage 4 kidney disease [Table I]. Among the patients who had stage 3 kidney disease, 8 (16.0%) patients had mild anemia, followed by 4 (8.0%) patients who had moderate anemia, and the rest 3 (6.0%) patients had severe anemia. Among the patients with stage 4 CKD, 6 (12.0%) patients had moderate anemia and 4 (8.0%) patients had severe anemia. Among the patients who had the end-stage renal disease (ESRD) or stage 5 CKD, 7 (14.0%) patients had moderate anemia and 18 (36.0%) patients had severe anemia [Table II].
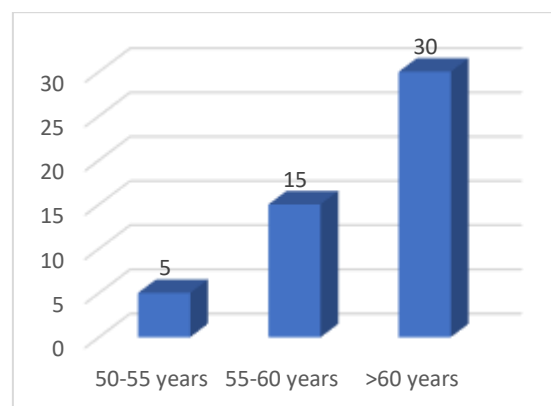
Figure 1: Distribution of subjects according to age (N=50)
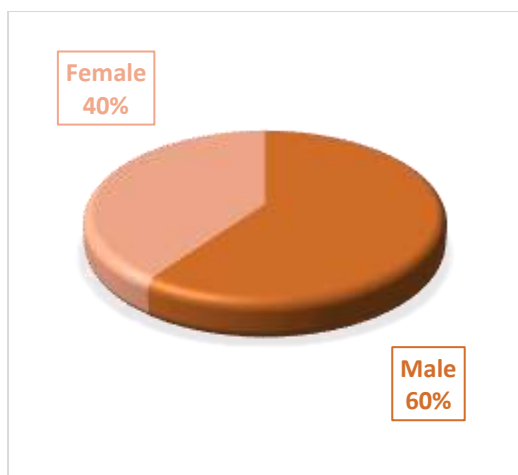
Figure 2: Distribution of subjects according to sex. (N=50)
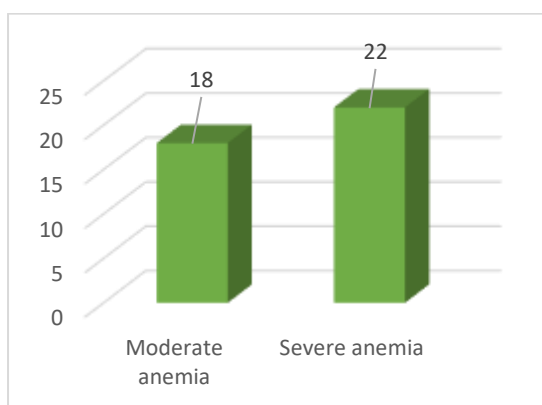
Figure 3: Distribution of patients according to degree of anemia (N=50)

Table I: Distribution of respondents according to the degree of CKD. (N=50)

Stage of CKD	N	%
Stage 3	10	20.0
Stage 4	10	20.0
Stage 5 (ESRD)	25	50.0

Table II: Distribution of patients according to eGFR and degree of anemia. (N=50)

eGFR	Degree of anemia		
	Mild (%)	Moderate (%)	Severe (%)
Stage 3 (30-59 ml/min)	8 (16.0)	04 (8.0)	03 (6.0)
Stage 4 (15-29 ml/min)	0 (0.0)	06 (12.0)	04 (8.0)
Stage 5 (<15 ml/min)	0 (0.0)	07 (14.0)	18 (36.0)

DISCUSSION

Among the study subjects, most patients 60.0% belonged to the age group of > 60 years, followed by 30.0% patients from 55-60 years of age and the rest 5 (10.0%) patients were from 50-55 years of age. About 60% of the patients were male and 40% were female in this study which was found similar to other studies [11][12]. Concerning the degree of anemia, most of the patients 44.0% suffered from severe anemia followed by 18 (36.0%) patients who had moderate anemia. Another study showed various extents of anemia in patients with chronic disease [13]. According to extent of CKD, most of the patients 50.0% had stage 5 CKD (ESRD), followed by 30.0% patients had stage 3 CKD, and the rest 20.0% patients suffered from stage 4 kidney disease. Among the patients who had stage 3 kidney disease, 16.0% patients had mild anemia, followed by 8.0% patients who had moderate anemia, and the rest 6.0% patients had severe anemia. Among the patients with

stage 4 CKD, 12.0% patients had moderate anemia and 8.0% patients had severe anemia. Among the patients who had the end-stage renal disease (ESRD) or stage 5 CKD, 14.0% patients had moderate anemia and 36.0% patients had severe anemia in the present study. According to another study, anemia was twice as prevalent in people with CKD (15.4%) as in the general population (7.6%). The prevalence of anemia increased with stage of CKD, from 8.4% at stage 1 to 53.4% at stage 5. A total of 22.8% of CKD patients presented with anemia [14]. According to another study, the prevalence of anemia was strongly associated with a declining glomerular filtration rate. The percentage of patients with hemoglobin $\leq$ 12 g/dL increased from 26.7% to 75.5% when the glomerular filtration rate decreased from $\geq$ 60 mL/min/1.73 m^2 to < 15 mL/min/1.73 m^2. The prevalence of hemoglobin $\leq$ 10 g/dL increased substantially from 5.2% to 27.2% when the glomerular filtration rate diminished from $\geq$ 60 mL/min/1.73 m^2 to < 15 mL/min/1.73 m^2 [15]. A study stated that treatment of anemia in pre-dialysis patients with stage 2–4 CKD may slow renal disease progression and improve energy, work capacity, health-related quality of life, and cardiac function. Optimizing the hemoglobin or hematocrit value before initiating dialysis may reduce mortality [16]. Another study showed untreated anemia places patients at risk for cardiovascular events, a more rapid progression of chronic kidney disease [17].

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study concluded that the extent of anemia increases with progressing stages of CKD. The association between anemia and mortality may be related to the severity of anemia. Thus, all CKD patients should be screened for anemia during the initial evaluation for CKD.

RECOMMENDATION

Patients with CKD should undergo appropriate screening for diagnosis of anemia since many CKD patients present at late stages. Correcting anemia has the potential to improve clinical and economic outcomes in patients with CKD. Moreover, further studies should be conducted involving a large sample size and multiple centers in this regard to get robust data.

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