

## Original Article



# Association of Anemia with Chronic Kidney Disease: A Tertiary Care Hospital Based Cross Sectional Study

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### Abstract

**Background:** Chronic kidney disease (CKD) is a worldwide public health problem. It is usually associated with anemia and prevalence of anemia increases progressively with worsening CKD. **Objective:** To find out the association of anemia with different stages of CKD. **Materials and Methods:** This cross-sectional study was conducted in the department of physiology in Mymensingh medical college, Bangladesh over a period of one year from January to December 2016. A total number of 174 subjects were enrolled in this study among which 87 patients and 87 healthy participants. On the basis of inclusion and exclusion criteria study subjects were divided into case and control group. Hemoglobin concentrations in the blood were measured in all study subjects by using auto-analyzer. **Result:** Hemoglobin concentration in the blood was decreased in both male and female CKD patients which were  $9.55 \pm 1.13$  gm/dl and  $9.11 \pm 0.95$  gm/dl respectively and result was statistically significant ( $p < 0.01$ ). 55% is anemic in stage 1, 61% in stage 2, 70% in stage 3, 75% in stage 4, 86% in stage 5 of CKD. **Conclusion:** This study revealed that prevalence of anemia is common in all stages of CKD patients in Mymensingh, Bangladesh. It emphasizes the need for regular checking of anemia in CKD patients and early referral to the nephrologists.

**Key words:** Chronic kidney disease (CKD), Anemia, Hemoglobin concentration.

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### Introduction

Chronic kidney disease (CKD) is a major public health burden with an increasing incidence, prevalence and poor outcomes. Consequences of kidney disease includes kidney failure, decreased kidney function and cardiovascular diseases.<sup>1</sup> Anemia is a common manifestation in CKD, where there are a lot of morbid consequences. The concentrations of hemoglobin begin to decrease in early renal impairment. It also causes harder outcomes, such as mortality and cardiovascular complications.<sup>2,3</sup>

According to WHO, anemia is defined as the Hb level  $< 13$  g/dl in men and  $< 12.0$  g/dl in women. However, normal hemoglobin distribution differs not only with sex but also with physiological status and ethnicity.<sup>4</sup> The cause of anemia in chronic kidney disease is relative deficiency of erythropoietin, declined erythropoiesis due to toxic effects of uremia on marrow precursor cell, reduced red cell survival, blood loss

due to increased capillary fragility and low platelet function, decreased dietary consumption and absorption of iron and other hematins.<sup>5</sup>

The objective of this study was to find out the association of anemia with different stages of CKD. This type of study was not done in Mymensingh region of Bangladesh. So, it necessitates finding out the actual pattern of association between anemia and CKD in this region of Bangladesh.

### Materials and Methods

This cross-sectional study was conducted in the department of physiology in Mymensingh medical college from January to December, 2016. A total number of 174 subjects participated in this study. Among them 87 were patients and 87 healthy individuals. Persons below 20 years and above 70 years, pregnant woman, persons having arthritis, chronic liver disease, endocrine disease, malignancy and history of regular

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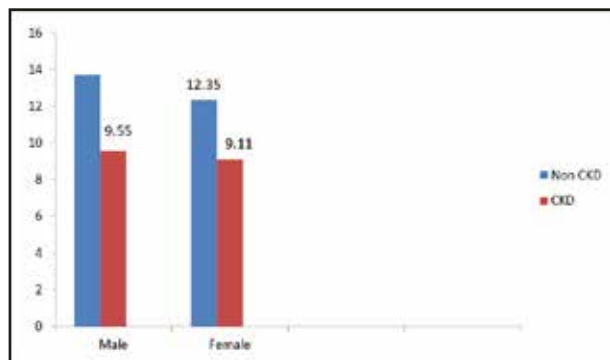
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alcohol consumption were excluded from our study. During visit the available age matched CKD patients and healthy persons were interviewed, examined and sample of blood were collected with informed written consent. The patients were selected on the basis of history, clinical examination and relevant investigations. Hemoglobin concentration in blood was determined by using auto analyzer. Anemia was defined as hemoglobin concentration <13 g/dl in case of male and <12 g/dl in case of female. Stages of CKD were determined by calculating estimated GFR. Statistical analysis was done by using SPSS , version 20 and level of significance was determined by student’s unpaired t test.

**Results**

Out of 174 study subjects, 87 were CKD patients and 87 were healthy individuals. The hemoglobin concentration of control group male & case group male were 13.76±0.12 g/dl & 9.55±0.17 g/dl respectively. In study group male, hemoglobin concentration was decreased. Result was statistically significant (p<0.01).

The hemoglobin concentration of control group female & study group female were 12.35±0.12 g/dl & 9.11±0.14 g/dl respectively. In study group female, hemoglobin concentration was decreased & result was significant (p<0.01).



**Figure 1:** Mean hemoglobin concentration of study population

According to the above result, hemoglobin concentration was decreased in CKD patients than in Non-CKD healthy group. All the results were statistically significant.

In our study we found increased serum creatinine and decreased eGFR in CKD patients which is shown in the Table I below.

**Table I:** Level of serum creatinine and estimated GFR of study subjects

Variable	S. Creatinine		eGFR		P- value
	Control	Case	Control	Case	
Male	1.03±0.18	3.08±1.38	85.89±2.02	28.65±1.11	0.0001
Female	0.98±0.16	2.98±1.92	70.58±1.92	30.14±0.92	0.0001

There was various number of CKD patients in different ages. Table II is showing it with percentage.

**Table II:** Age distribution of CKD patients

Age range	Number of patient	Percentage (%)
20- 30	08	09
31 - 40	13	15
41- 50	18	21
51 - 60	27	31
61 - 70	21	24
Total	87	100

**Table III:** Distribution of CKD patients by stage

CKD stage	Number of patient	Percentage
Stage 1	18	21%
Stage 2	23	26%
Stage 3	27	31%
Stage 4	12	14%
Stage 5	07	08%
Total	87	100%

Anemia was found to be increased gradually with declining GFR and advancement of CKD. The frequency and percentage of anemia in CKD is shown in the Table IV below.

**Table IV:** Distribution of anemia in chronic kidney disease patient by stage

CKD stage	Non anemic	Anemic	Percentage of anemia
Stage 1	8	10	55%
Stage 2	9	14	61%
Stage 3	8	19	70%
Stage 4	3	9	75%
Stage 5	1	6	86%
Total (87)	30	57	65%(Avg)

The hemoglobin concentration is gradually decreased with the advancement of CKD (Table V).

**Table V:** Mean hemoglobin concentration for stages of CKD

CKD stage	Hb Concentration (g/dl) (Mean±SD)
Stage 1	11.18±2.13
Stage 2	10.76±2.08
Stage 3	8.89±1.73
Stage 4	8.24±1.94
Stage 5	7.58±2.24

## Discussion

This study has demonstrated high prevalence (65%) of anemia in CKD patients in Mymensingh district, Bangladesh. This prevalence is almost similar with other studies.<sup>6-8</sup> Reduced erythropoietin, declined red cell survival, increased loss of blood due to capillary fragility and poor platelet function as well as less dietary intake and absorption of iron and other hematinics are responsible for anemia in CKD.<sup>5</sup> Anemia in patients with CKD is a multifactorial process, in which chronic inflammation, erythropoietin deficiency, iron metabolism disorders, blood loss on hemodialysis sessions, uncontrolled hyperparathyroidism, deficiency of essential nutrients like iron, folic acid, and vitamin B12, the use of some drugs, including ACE inhibitors and uremic toxins play the most important role. The understanding of underlying mechanisms of anemia in CKD is important due to the fact that in some patient's erythropoietin stimulating agents (ESA) treatment might be least ineffective or even deleterious.<sup>9,10</sup> According to McGill JB et al, (2006) anemia is more common in diabetic nephropathy and erythropoietin deficiency occurs in early diabetic nephropathy which damage kidney due to peritubular fibroblast. (Have to change the language)<sup>11</sup>

According to Thomas MC et al. 2004, in CKD there is increased level of inflammatory cytokines such as interleukin-6 which enhance production and secretion of hepcidin, a hepatic protein that inhibits intestinal iron absorption and impairs iron transport from the reticuloendothelial system to bone marrow. Erythropoietin which normally enhances iron transport from macrophages to the blood stream is impaired thereby exacerbating relative iron deficiency.<sup>12</sup> Some studies showed anemia may worsen renal medullary hypoxia leading to renal interstitial injury and fibrosis which progress kidney disease.<sup>13,14</sup> Another study which was done on 345 patients, showed that, 26.4% (n = 91) had anemia and 29.6% had moderate to severe renal failure (GFR < 60 ml/min). The association between anemia and a higher prevalence of renal failure was statistically significant (p = 0.005).<sup>15</sup> Liubao GU et al, showed that anemia is a risk factor for renal disease progression.<sup>16</sup>

We have found in our study, hemoglobin concentration in male is greater than female. The etiology is male has a special sex hormone known as testosterone which is responsible for erythropoietin stimulation and ultimately causes more red

blood cell production and greater hemoglobin concentration.<sup>17</sup> It is shown in our study that, there is a gradual increase in the prevalence of anemia according to stage, which is 55% anemia in stage 1, 61% in stage 2, 70% in stage 3, 75% in stage 4, 86% in stage 5 of CKD. Similar result was found in another study where they found 21% anemic in stage 1 with gradual increasing in anemia reaching 98% anemic in stage 5.<sup>18</sup>

This study was a single centered study and sample size was small. Only hemoglobin concentrations were tested for anemia determination. But CBC, red cell indices, iron profile, PBF, Vitamin B12 and folic acid concentration was not done. Though anemia can be identified by simply investigating hemoglobin concentration but the etiology and pattern of anemia couldn't be evaluated without doing those investigations.

## Conclusion

This study has documented a relatively high prevalence of anemia in all stages of CKD. The prevalence of anemia has increased from CKD stage one to stage five. A strong association has found between anemia and CKD. As we know that anemia with CKD has a lot of adverse consequences, so, immediate measure should be taken for the management of anemia and early referral to nephrologists should be confirmed.

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