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Prevalence of Anemia in Patients with Chronic Kidney Disease

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Original Article

ABSTRACT

Background: *Chronic kidney disease (CKD) is a major public health problem. In patients followed in Primary Care with diseases as frequent as arterial hypertension (AHT) or diabetes mellitus (DM), the prevalence of CKD can reach 35-40%. The magnitude of the problem is even greater considering the increase in morbidity and mortality, especially cardiovascular, related to renal deterioration* ***Objective***: *To assess the prevalence of anemia in patients with chronic kidney disease.* ***Methods:*** *A, cross-sectional study. conducted at two tertiary medical centers; Kidney transplant and diseases center in Al Najaf city and Al-Immamain Al-Khadimain Medical City , a tertiary hospital in Baghdad city, republic of Iraq during a period of in one year ; 1st of January to the end of December 2018, included 500 respondents of both genders.* ***Results***: *A total of 500 patients, (54.4%) were male (45.6%) were female with disease mean duration 8.6±5.7 years for male and 7.9 ± 6.2 years for female with no significant difference. Significant associations were found between male and female among BMI, Hb level, S. creatinine and eGFR (P≤0.05). The prevalence of anemia (39.0%) in males and (55.2%) in females had hemoglobin values ≤ 12 g/dL, The overall prevalence of anemia in CKD was (55.6%). A strong association between anemia and female sex was noted..* ***Conclusions***: *The prevalence of anemia in non-dialysis CKD patients was (54.4%) and it increase with increase the stage of the disease.*

Keywords: CKD, Anemia, Non-dialysis, erythropoietin

1.INTRODUCTION

Chronic kidney disease (CKD) is a major public health problem. CKD is considered the final destination common to a constellation of pathologies that affect the kidney in a chronic and irreversible way. (1) In patients followed in Primary Care with diseases as frequent as arterial hypertension (AHT) or diabetes mellitus (DM), the prevalence of CKD can reach 35-40%. The magnitude of the problem is even greater considering the increase in morbidity and mortality, especially cardiovascular, related to renal deterioration. (2)

The kidneys works as blood filter, it eliminating waste products and regulate the electrolytes and fluid balance. Glomeruli are a bundle of capillaries that the filtration is occurs. When the glomerular filtration rate decrease to <60 mL/min/1.73 m2 it will indicates that the patients has chronic kidney disease (CKD), as do structural or functional renal abnormalities, which may be present in people with normal GFR. (3)

CKD is associated with high mortality and morbidity rate, especially at the cost of cardiovascular pathology. (4,5) In addition, CKD is associated with a series of complications, among which is anemia, 4 which has been linked to increased morbidity and mortality and progression of CKD. (6)

The presence of anemia is already observed in early stages of CKD (stage 3), but its prevalence increases as renal failure progresses to more advanced stages. The main cause of anemia in patients with CKD is erythropoietin deficiency, although a reduction in the half-life of red blood cells, iron and vitamin deficits, and other factors have also been implicated. (7)

Since the introduction of recombinant human erythropoietin, erythropoiesis stimulating agents (ESAs) have become the cornerstone of the treatment of CKD anemia and have allowed reducing transfusion requirements, improving quality of life, and reducing left ventricular hypertrophy and morbidity and mortality in these patients. (8) However, the goal of hemoglobin has been the subject of debate in recent years as a result of recent randomized studies and meta-analyzes that have shown that the total correction of anemia with ESA is not associated with better survival, a significant improvement in quality of life, but with a possible increase in cardiovascular adverse effects. (9)

The European guidelines of 2010 recommended objective hemoglobin between 11 and 12 g / dl, without intentionally exceeding 13 g / dl, (10) and the EMA (European Medicines Agency) advised not to exceed hemoglobin levels above of 12 g / dl in patients treated with erythropoiesis stimulating agents. (11)

The erythropoietin production is one of the lesser known functions of the kidneys, a signaling

molecule that stimulates red blood cell production, in response to decreased oxygen levels in the blood. Any disruption of this process, e.g., secondary to a functional abnormality due to CKD, has the potential to produce anemia, a condition in which the number of circulating red blood cells, and therefore the level of hemoglobin, is lower than normal. (12)

Other possible causes of anemia in CKD include iron deficiency, inflammation, and the accumulation of uremic toxins. (13,14) Thus, the abnormal composition of blood or urine is an additional indicator of kidney damage.

2. PATIENTS and METHODS

It is an epidemiological, cross-sectional study. The current study conducted in two tertiary hospitals in Al Najaf city (Kidney transplant and diseases center) and tertiary hospital in Baghdad city in (Al-Immamain Al-Khadimain Medical City) in one year duration in the period from the 1st of Jan 2018 to the end of Dec 2018, in which 500 respondents irrespective to the age women were enrolled in the current study. The data was collected using a specially designed questionnaire form, demographic data of the patients were collected (age, gender, weight, height, stage of CKD, time of diagnosis of CKD) and data corresponding to anemia (hemoglobin levels, ferritin levels, transferrin saturation index [IST]], treatment with ESA, iron, folic acid or vitamin B 12). The glomerular filtration rate (eGFR) was also estimated using the Modification of Diet in Renal Disease (MDRD-4) formula.

Selection of patients

The population studied was adult patients with CKD and eGFR less than 60 ml / min / 1.73 m 2 who were not on dialysis

Definition of Anemia

Was defined as hemoglobin levels <13.5 g / dl in men and <12 g / dl in women or treatment with ESA. Ferropenia was defined as ferritin levels <100 ng / ml and / or IST <20%.

Inclusion criteria

- Chronic kidney disease patients within the age ≥ 18 years.
- Patients with established clinical diagnosis of CKD stage 3, 4 and 5 not on dialysis attended to the outpatient's clinic.

Exclusion criteria:

- Patients whose clinical history did not have a recent hemoglobin determination (two months prior

to inclusion).

- Any situation or condition of the patient that, in the opinion of the investigator, discourages his participation in the study.

Statistical analysis

After data entering, then it analyzed by using the IBM-SPSS version 25. The categorical variables were described by absolute and relative frequencies, For the description of the continuous variables, the mean and standard deviation were used. For the quantitative variables, parametric (Student's t or ANOVA tests) or nonparametric tests were used, accordingly. For the qualitative variables, the chi-square test was performed , Fisher's exact test was used when chi-square was inapplicable . Statistical significance was set at less than 0.05 to be significant difference or association

3. RESULTS

A total of 500 chronic kidney disease patients were enrolled in the study; 272 (54.4%) were male and 228 (45.6%) were females (**Figure 1**) with a mean disease duration of 8.6 ±5.7 years for males and 7.9 ± 6.2 years for females with no significant difference between both genders in the mean duration. Significant differences were found between males and females in body mass index (BMI) , hemoglobin (Hb) level, Serum creatinine and eGFR ($P \leq 0.05$). (**Table 1**)

According to the eGFR value, 33 patients were in stage 1, 70 patients in stage 2, 134 patients in stage 3, 141 patients in stage 4, and 122 patients in stage 5. The prevalence of anemia according to gender in CKD patients is presented (**Figure 2**). Out of the 272 male patients 21 (7.7%) had had hemoglobin values ≤ 10 g/dL, and 106 (39.0%) male patients had hemoglobin values of 10.1- 12 g/dL. Among females, 25 (10.9%) had Hb ≤ 10 and 126 (55.3%) had Hb of 10.1 – 12 g/dl (**Table 2**). The overall prevalence of anemia in CKD was (55.6%). A strong association between anemia and female gender was found, ($P<0.05$). (**Table 2 & Figure 2**). The prevalence of anemia was increase with increase in CKD stages in which it start from 8.2% in stage 1 to 41.0% in stage 5 (**Table 3**).

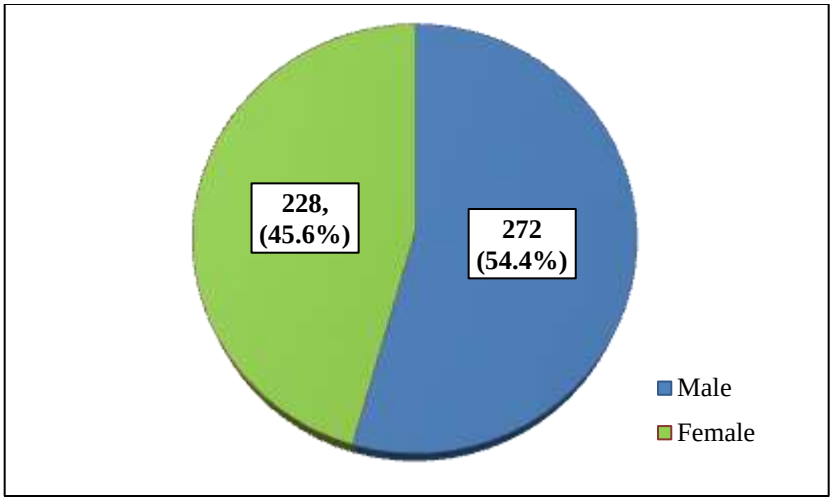

Figure 1. Gender distribution of the studied group

Table 1. Baseline characteristics of the studied group

Stage	Male Mean ±SD	Female Mean ±SD	P. value
Age (year)	45.7±12.5	47.4±17.3	0.200
Disease duration (years)	8.6±5.7	7.9 ± 6.2	0.100
BMI (kg/m^2)	23.5±3.9	22.3±1.7	<0.001
Hemoglobin (g/dl)	11.23±3.02	10.38±3.82	0.005
S. creatinine (mg/dl)	2.5±1.0	2.0±0.8	<0.001
eGFR (ml/min/1.73m^2)	49.2±28.7	54.8±35.19	0.050

SD: standard deviation

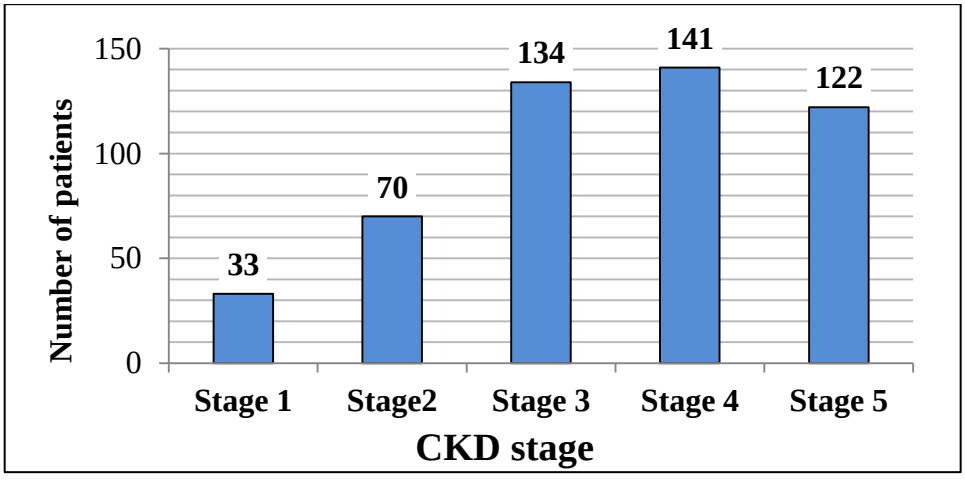

Figure 2. Distribution of the studied group according to the CKD stage

Table 2. Levels of Hemoglobin and Prevalence of anemia according to gender in CKD patients

Gender	Number of patients (%)	Hemoglobin Level (g/dl)		
		Mean ± SD	≤ 10 n (%)	≤ 12 n (%)
Female	228 (45.6)	10.38±3.82	25 (10.9%)	126 (55.3%)
Male	272 (54.4)	11.23±3.02	21 (7.7%)	106 (39.0%)
Total	500 (100.0)	10.84 ± 3.17	-	-

SD: standard deviation

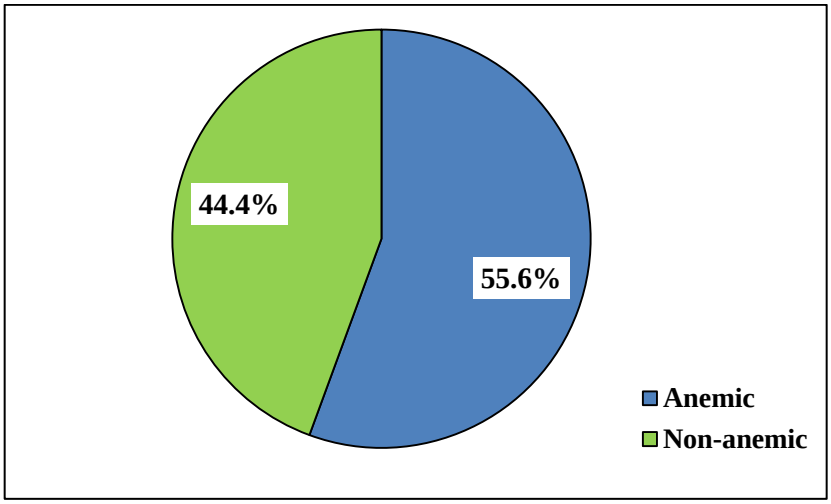

Figure 3. Overall prevalence of anemia

Table 3. Prevalence of anemia according to the CKD stages

Stage	No.	%
1	41	8.2
2	53	10.6
3	78	15.6
4	123	24.6
5	205	41.0
Total	**500**	**100.0**

DISCUSSION

Anemia is a common complication of chronic kidney disease (CKD) and is associated with a decrease in the quality of life of patients, as well as an increase in morbidity and mortality and progression of CKD. In patients with CKD, anemia is defined as the situation in which the concentration of hemoglobin (Hb) in the blood is found 2 standard deviations below the average Hb concentration of the general population, corrected for age and sex. (15)

The current study revealed that there is significant associations were found between male and female among Hb level, S. creatinine and eGFR, this is in agreement with that found by Poudel B et al (2013). (16). The most common finding in the current study is that the overall prevalence of anemia in CKD was (55.6%), which is in agreement with Obrador GT et al (2001) study mentioned that the prevalence of anemia was (51%) in non-dialysis CKD patients. (17) But more than that found in American study by Stauffer ME when the prevalence of anemia was 15.4% in people with CKD which is represents an estimated 4.8 million people. Moreover it is more than that found in was present in McClellan W et al (2004) when less than half of the respondents evaluated in a clinical practice. (18) In our analysis the prevalence of anemia was increase with increase in CKD stages in which it start from 8.2% in stage 1 to 41.0% in stage 5. This is similar to that Stauffer M, study that mentioned the prevalence of anemia increased with stage of CKD, from 8.4% at stage 1 to 53.4% at stage 5. (16) A similar trend has been reported by several other authors, consistent with the known pathogenesis of CKD (i.e., that erythropoietin production decreases as kidney function worsens). (19-21) Fishbane et al. found high rates of iron deficiency in adult men (57.8 to 58.8%) and women (69.9 to 72.8%) with CKD stages 3–5 in the NHANES III and 1999–2004 surveys, indicating that anemia in higher stage CKD may have multiple causes. (22)

CONCLUSIONS

The prevalence of anemia in non-dialysis CKD patients was (54.4%) and it increase with increase the stage of the disease.

Ethical Clearance: The study protocol was approved by the scientific committee of the Iraqi Ministry of health, Najaf Health directorate and Al-Karkh health directorate. Verbal consent was taken from each respondent before the beginning of the study and patients were informed that all data in the current study were used confidentially and merely for the purpose of the study.

Conflict of interest: The authors declare that there is no conflict

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REFERENCES

1. *DuBose TD. American Society of Nephrology Presidential Address 2006: chronic kidney disease as a public health threat - new strategy for a growing problem. Journal of the American Society of Nephrology: JASN 2007, 18 (4): 1038-1045*
2. *Sarnak MJ: Cardiovascular complications in chronic kidney disease. Am J Kidney Dis 2003, 41 (5 Suppl): 11-17*
3. *Levey AS, Coresh J, Bolton K, Culleton B, Harvey KS, Ikizler TA, et al. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. American Journal of Kidney Diseases. 2002;39(2 SUPPL. 1).*
4. *Collin AJ, Foley RN, Herzog C. US Renal Data System, USRDS 2009 annual data report. Am J Kidney Disease. 2010;55:s1.*
5. *Rucker D, Tonelli M. Cardiovascular risk and management in chronic kidney disease. Nat Rev Nephrol 2009; 5: 287-96.*
6. *Kazmi WH, Kausz AT, Khan S, Abichandani R, Ruthazer R, Obrador GT, et al. Anemia: an early complication of chronic renal insufficiency. Am J Kidney Dis 2001; 38: 803-12.*
7. *Astor BC, Muntner P, Levin A, Eustace JA, Coresh J. Association of kidney function with anemia. The Third National Health and Nutrition Examination Survey (1988-1994). Arch Intern Med 2002; 162: 1401-8.*
8. *De Nicola L, Chiodini P, Zoccali C, Borrelli S, Cianciaruso B, Di Iorio B, et al .; SIN-TABLE CKD Study Group. Prognosis of CKD patients receiving outpatient nephrology care in Italy. Clin J Am Soc Nephrol 2011; 6: 2421-8.*
9. *Palmer SC, Navaneethan SD, Craig JC, Johnson DW, Tonelli M, Garg AX,et al. Meta-analysis: erythropoiesis-stimulating agents in patients with chronic kidney disease. Annals of internal medicine. 2010 Jul 6;153(1):23-33.*
10. *Locatelli F, Aljama P, Canaud B, Covic A, De Francisco, Macdougall IC, et al .; Anemia Working group of European Best Practice (ERBP). Target haemoglobin to aim for with erythropoiesis-stimulating agents: a position statement by ERBP following publication of the Trial to Reduce Cardiovascular Events with Aranesp Therapy (TREAT) study. Nephrol Dial Transplant 2010; 25: 2846-50.*
11. *del estudio MICENAS I, Cases-Amenós A, Martínez-Castelao A, Fort-Ros J, Bonal-Bastons J, Ruiz MP, et al. Prevalence of anaemia and its clinical management in patients with stages 3-5 chronic kidney disease not on dialysis in Catalonia: MICENAS I study. Nefrología (English Edition). 2014 Mar 1;34(2):189-98.*
12. *Smith JR. The clinical and economic burden of anemia. The American journal of managed care. 2010 Mar;16:S59-66.*

13. *National KF. KDOQI clinical practice guidelines and clinical practice recommendations for anemia in chronic kidney disease. American journal of kidney diseases: the official journal of the National Kidney Foundation. 2006 May;47(5 Suppl 3):S11.*
14. *Cases A, Egocheaga MI, Tranche S, Pallarés V, Ojeda R, Górriz JL, Portolés JM. Anemia in chronic kidney disease: study protocol, management and referral to Nephrology. Primary Care. 2018 Jan 1;50(1):60-4.*
15. *Poudel B, Yadav BK, Jha B, Raut KB, Pandeya DR. Prevalence and association of anemia with CKD: A hospistal based crosssectional study from Nepal. Biomedical Research 2013; 24 (1): 99-103.*
16. *Stauffer ME, Fan T. Prevalence of anemia in chronic kidney disease in the United States. PloS one. 2014 Jan 2;9(1):e84943.*
17. *Obrador GT, Roberts, T, St. Peter WL, et al. Trends in anemia at initiation of dialysis in the United States. Kidney Int 2001;60:1875-84*
18. *McClellan W, Aronoff SL, Bolton WK, Hood S, Lorber DL, Tang KL, et al. The prevalence of anemia in patients with chronic kidney disease. Current medical research and opinion. 2004 Sep 1;20(9):1501-10.*
19. *Clase CM, Kiberd BA, Garg AX. Relationship between glomerular filtration rate and the prevalence of metabolic abnormalities: results from the Third National Health and Nutrition Examination Survey (NHANES III). Nephron Clinical Practice. 2007;105(4):c178-84.*
20. *Moossavi S, Freedman BI. Treating anemia with erythropoiesis-stimulating agents: effects on quality of life. Archives of internal medicine. 2009 Jun 22;169(12):1100-1.*
21. *Robinson B, Artz AS, Culleton B, Critchlow C, Sciarra A, Audhya P. Prevalence of anemia in the nursing home: contribution of chronic kidney disease. Journal of the American Geriatrics Society. 2007 Oct;55(10):1566-70.*
22. *Fishbane S, Pollack S, Feldman HI, Joffe MM. Iron indices in chronic kidney disease in the National Health and Nutritional Examination Survey 1988–2004. Clinical Journal of the American Society of Nephrology. 2009 Jan 1;4(1):57-61.*