Original Article

Chronic Kidney Disease

Anemia in Patients Suffering from Chronic Kidney Disease

Shamsuddin Shaikh[1], Syed Qaiser Husain Naqvi[1] and Jawaid Hussain Lighari[2]

ABSTRACT

Objective: To determine the frequency of anemia in patients suffering from chronic kidney disease.
Study Design: Cross sectional study
Place and Duration of Study: This study was conducted at the Department of Medicine, Peoples University of Medical and Health Sciences, Nawabshah, Sindh from January to, December 2016.
Materials and Methods: A total of 200 chronic kidney disease patients were selected by non-probability convenience sampling according to inclusion criteria chronic kidney disease for more than six months and age more than 20 years and exclusion criteria patients of blood disorders like Leukemia, lymphoma, hemorrhagic disorders, pregnancy and patients on NSAIDs . Detailed history and clinical examination was carried out. Patients were staged according to their glomerular filtration rate who has not received any treatment of anemia. Questionnaire was filled covering current treatment, weight, laboratory investigations including blood complete picture, blood urea, serum creatinine, estimated GFR, urine analysis. Data was entered and analyzed by SPSS software 21.0 version. The continuous variables were analyzed by student's T-test. Categorical variables were analyzed by chi-square test considering 95% CI and 5% margin of error.
Results: Study results show Mean Standard Deviation (SD) of age as 45.5 ±7.5 years. Male patients comprised of 120 (60%) and female 80(40%). Mean and SD of creatinine clearance was noted as 40.6 ± 20.5 ml/1.73 m^2. Maximum Chronic Kidney Disease of stage IV was present in 84 (42%). Stage V, III, II and I were noted in 50 (25%), 30 (15%), 24 (12%) and 12 (6%) respectively. Anemia was noted in 170 (85%) study subjects. Mean ±SD of Hemoglobin Distribution according to Staging of Chronic kidney disease revealed 9.16 ±2.06 mg/dl. Most common microcytic hypo-chromic anemia 122 (61%) Patients while normocytic normochromic and macrocytic hypo-chromic anemia was found in 40 (20%) and 8 (4%) of chronic kidney disease subjects respectively.
Conclusion: The research study results conclude that majority of patients of CKD were anemic. Most common type of anemia in CKD patients is microcytic and hypochromic anemia. It is necessary to manage these patients timely and appropriately as their survival chances can be increased.
Key Words: Anemia**,** Chronic kidney disease, Blood Urea, Serum creatinine levels.

Citation of articles: Shaikh S, Naqvi SQH, Lighari JH. Anemia in Patients Suffering from Chronic Kidney Disease. Med Forum 2018;29(9):22-26.

INTRODUCTION

According to World Health Organization anemia is defined as a hemoglobin (Hb) concentration <13.0 g/dl for adult males and post-menopausal women and Hb of <12.0 g/dl for women.[1]

From the major organs of the body, kidneys play important role, which filter nearly 200 liters of blood coming to them through blood vessels in 24 hours. This permits excess ions, metabolic wastes and toxins to go in urine and essential substances are retained for body use.

[1.] Department of Medicine / Pathology[2] / Community Medicine[3], Peoples University of Medical and Health Sciences, Nawabshah.

Correspondence: Dr. Shamsuddin Shaikh, Professor of Medicine and Pro-Vice Chancellor, Peoples University of Medical and Health Sciences, Nawabshah.
Contact No: 0300-3205588
Email: shams.shaikh57@yahoo.com

Received: January, 2018; Accepted: April, 2018

Its function is as purification plant which purifies blood, so that body organs, systems and cells may get blood free of waste products which may alter cell function or damage them. Kidneys normalize blood chemistry of electrolyte, urea, creatinine, calcium and PH. Kidneys are unappreciated until they are diseased.[2-4]

Chronic kidney disease (CKD) is a pathological deterioration of renal functioning culminates into hypertension, anemia, osteoporosis, neuropathy and vascular disease. Glomerular filtration rate is the best estimates of renal functions, which is indirectly measured by creatinine clearance and urine analysis. Patient is easily tired has puffiness around eyes, poor appetite, disturbed sleep, oedema on ankle and feet, dry skin, less urine output. Aging, uncontrolled D.M and hypertension, connective tissue disorders, family history of CKD are conditions which predispose to CKD.[5] Anemia inpatients of CKD is multifactorial like anorexia, dietary restrictions, decreased erythropoietin, blood loss and even mylosclerosis kidney dialysis outcome quality initiative guideline defines CDK stages as below:

Stage I: GFR ≥ 90 ml/min/1.73m^2. Kidney damage. Normal or increased GFR.
Stage II: GFR 60-89 ml/min/1.73m^2. Kidney damage with reduced GFR.
Stage III: GFR 30-59 ml/min/1.73m^2. Kidney damage with moderately reduced GFR.
Stage IV: GFR 15-29 ml/min/1.73m^2. Kidney damage with severely reduced GFR.
Stage V: GFR <15 ml/min/1.73m^2. on dialysis. Complete Kidney damage.[6]

Anemia in CKD patient has multifactorial effect as erythropoietin deficiency, inflammatory mediators like cytokines, iron and vitamin deficiency, bone marrow dysfunction and retention of nitrogenous compounds[7].

In 1836 the Richard Bright first described anemia in CKD patients during search of Bright's disease, he noticed pallor[7, 8].

National Kidney foundation and Kidney dialysis outcome quality initiative guideline in 2006, defined Anemia in CKD as:

Adult male- hemoglobin level < 13.5 g/l
Adult female- hemoglobin level < 12.0 g/l [6, 7]

It is reported that majority of CKD patients with reduced renal function usually present with normocytic and normochromic anemia. If left untreated, the anemia of CKD results into tissue hypoxia,[9] cardiomegaly, congestive cardiac failure, angina, ventricular hypertrophy and increased or decreased cardiac output. About 26 million USA populations are suffering from CKD and millions more are at risk[10, 11].

Anemic patient of CKD complaint of sluggish mental activity, reduced cognitive function, reduced penile tumescence at night and impaired immunity and immune response[12]. Anemia causes growth retardation and decreased brain growth and intellectual functions in childhood. Such disabilities reduce quality of life (QoL), impair rehabilitation of the CKD patients and survival is decreased[13].

Based on the WHO criteria of anemia, approximately, 90% patients of chronic kidney disease (CKD) with glomerular filtration rate (GFR) 25 -30 ml/min are suffering from anemia and usually present with Hb <10 g/dl[14].

Reported prevalence of anemia defined as Hb<12 g/dl in CKD is 42%, 33%, 48% and 82% in stage 2 to stage 5 patients respectively. While anemia defined at Hb<11 g/dl, the prevalence was calculated as 21%,17%, 31%,49% and 72% respectively for stages 1 to 5[15].

Regarding morphological classification of anemia, various reports have been observed in CKD patients. Reported results are 80%, 15% and 5% of normochromic-normocytic, hypochromic-microcytic and macrocytic anemia respectively. Study conducted by Levin had reported a prevalence of only 25% of anemia in CKD patients[16].

A cross sectional study conducted in USA reported a prevalence of 47.7% of anemia among more than five thousand CKD patients[17]. A study conducted in Indonesia at Department of Internal Medicine Sanglah Hospital Denpasar, Bali, by Ketul Suega reported a prevalence of 84.5% of an anemia in CKD patients[18]. In Nigeria a study by Akinsola found anemia in 87% of CKD patients[19] and by Chinwuba noted a prevalence of anemia in 77.5% patients ranging from 26.7% to 77.5% in different CKD stages[20].

MATERIALS AND METHODS

This present cross sectional study was conducted after the approval of ethical review committee at Department of Medicine PUMHS Nawabshah (SBA). Data was collected at Medical Ward PMCH Nawabshah Sindh from January to, December 2016. 200 patients suffering from chronic kidney disease were assessed for anemia. Sample was selected by non-probability convince sampling considering inclusion criteria chronic kidney disease for more than six months and age more than 20 years and exclusion criteria patients of Leukemia, lymphoma and pregnancy. Detailed history was taken and clinical examination was carried out. Patients were staged according to their current Glomerular filtration, rate who has not received treatment of Anemia. Questionnaire was filled covering current treatment, weight, laboratory investigation including Blood Complete picture, blood urea, serum creatinine, estimated GFR and urine analysis. Data was collected on pre-tested structured questionnaire based on variables described above. It took about a one year to complete the collection of data. All data was entered in SPSS 21 version. The continuous variables were analyzed by student's T-test. Categorical variables were analyzed by chi-square test considering 95% CI and 5% margin of error. Data was analyzed for Standard deviations, frequencies and percentages.

RESULTS

Study results show Mean Standard Deviation (SD) of age noted as 45.5 ±7.5 years. Males comprised of 120 (60%) and female 80(40%). Mean and SD of creatinine clearance was noted as 40.6 ± 20.5 ml/1.73 m^2. Most Chronic Kidney Disease patients of stage IV was present in 84 (42%). Stage V, III, II and I were noted in 50 (25%), 30 (15%), 24 (12%) and 12 (6%) respectively. Anemia was noted in 170 (85%) study subjects. Mean ±SD of Hemoglobin Distribution according to Staging of Chronic kidney disease revealed 9.16±2.06 mg/dl. Most common Microcytic hypo-chromic anemia was found in 122 (61%) Patients while normocytic normochromic and macrocytic hypo-chromic anemia 40 (20%) and 8 (4%) was noted in chronic kidney subjects respectively.

Table No. 1: Age Distribution of Study Population (n=200)

Age in years	Number of Pt. with Percentage	Mean and SD	P-Value
20- 29.9	22 (11%)	45.5 ±7,5	0.0001
30-39.9	28 (14%)		
40-49.9	70 (35%)		
50-59.9	120 (30%)		
≥60	20 (10%)		
Total	200 (100%)		

Table No. 2: Hemoglobin Distribution according to Staging of CKD (n=200)

Creatinine clearance showing staging (GFR) of CKD	Mean and SD (mg/dl)
Stage II: GFR 60-90 m/min/1.73m^2.	10.15±2.85
Stage III: GFR 30-59 m/min/1.73m^2.	9.55±2.63
Stage IV: GFR 15-29 m/min/1.73m^2.	8.12±2.32
Stage V: GFR <15 m/min/1.73m^2.	7.50±2.10
Total	9.16±2.06

Table No. 3: Body Mass Index (BMI) of study population (n=200)

BMI	Number of Pt. and Percentage	P-Value	Mean and SD
≤25 kg/m^2	116 (58%)	0.0001	26.9± 3.17
25-29.9 kg/m^2	74 (37%)		
≥30 kg/m^2	10 (5%)		
	200 (100%)		

Table No. 4: Creatinine Clearance showing Staging (GFR) of CKD (n=200)

Creatinine clearance showing staging (GFR) of CKD	Mean and SD
Stage II: GFR 60-89 m/min/1.73m^2.	75.65 ± 6.10
Stage III: GFR 30-59 m/min/1.73m^2.	45.10 ± 7.5
Stage IV: GFR 15-29 m/min/1.73m^2.	20.25 ± 4.0
Stage V: GFR <15 m/min/1.73m^2.	11.50 ± 1.50
Total	40.00± 20.5

Table No. 5: Serum Creatinine according to Staging of CKD (n=200)

Creatinine clearance showing staging (GFR) of CKD	Mean and SD
Stage II: GFR 60-89 m/min/1.73m^2.	6.15 ± 3.49
Stage III: GFR 30-59 m/min/1.73m^2.	7.02 ± 3.96
Stage IV: GFR 15-29 m/min/1.73m^2.	5.39 ± 3.86
Stage V: GFR <15 m/min/1.73m^2.	5.39 ± 2.74
Total	6.98 ± 3.87

Table No. 6: Chronic Kidney Disease Distribution according to Staging (n=200)

Stage	No of Pt. and Percentage
Stage I: GFR ≥ 90 m/min/1.73m^2.	12 (6%)
Stage II: GFR 60-89 m/min/1.73m^2.	24 (12%)
Stage III: GFR 30-59 m/min/1.73m^2.	30 (15%)
Stage IV: GFR 15-259 m/min/1.73m^2.	84 (42%)
Stage V: GFR <15 m/min/1.73m^2.	50 (25%)
Total	200 (100%)

Table No. 7: Type of Anemia in study population (n=170)

Anemia	Yes (%)	No (%)	P-Value
No Anemia (Normal Hb)	-	28(14%)	0.0001
Normocytic Normochromic Anemia	43(21.5)	1(0.5%)	
Microcytic Hypochromic Anemia	122(61%)	0(0%)	
Macrocytic Hyperchromic Anemia	7(3.5)	1(0.5%)	
Total	170(85%)	30(15%)	200

DISCUSSION

Anemia is well-defined in terms of low levels of hemoglobin (Hb). It is a major consequence of chronic kidney disease (CKD), correlated with significant morbidity. Anemia of renal failure begins comparatively early in the development of kidney disease. As the destruction of the kidney progresses, the degree of anemia increase. The present study results revealed Anemia in 170 (85.0%) in CKD subjects Mean ±SD of Hemoglobin level according to staging of Chronic kidney disease revealed 9.16 ± 2.06 mg/dl. Talwar et al reported same result from India, a study conducted with a sample of 27 chronic renal failure subjects. Anemia was found in 84% of CKD patients, of which 60% had microcytic anemia[21].

Anemia in CKD is obvious when a patient's creatinine clearance (CC) is less than 30 ml/min/1.73m2, GFR is below 50-40 ml/min, or serum creatinine is more than 3 mg/dl. If the GFR is less than 20 ml/min or the serum creatinine is more than 5, anemia is constantly present and mostly the Hb level is below 10 g/dl[22].

There are different causes of microcytic hypochromic anemia, but the major one is iron deficiency mostly due to a decrease iron intake or an increase in iron loss or aluminum intoxication in CKD patients. Folate and B12 deficiency leads to Macrocytic anemia. Both kinds of anemia can occur in CKD patients.[23]

The findings of present study found microcytic hypo-chromic anemia most common 61.0% anemia in CKD patients while Normocytic Normochromic and

macrocytic hyper chromic anemia were less common in chronic kidney subjects respectively, these results are very comparable to study conducted by Reza Afshar et al[24], he measured anemia in 87% of post-dialysis patients and 75% of pre-dialysis patients and microcytic hypochromic anemia in (61.06%) of CKD subjects even similar with other studies[18]. Current study showed 3.5% of CKD patients had had macrocytic hypo- chromic anemia which is usually due to folate and or cyanocobalamin deficiency. The findings are comparable to studies conducted Iran, Saudi Arabia and Nepal.[18, 24,-26]

CONCLUSION

The research study results conclude that majority of patients of CKD were anemic. Most common type of anemia in CKD patients is microcytic and hypochromic anemia. It is necessary to manage these patients timely and appropriately as their survival chances and longevity of life can be increased.

Author's Contribution:

Concept & Design of Study:	Shamsuddin Shaikh
Drafting:	Syed Qaiser Husain Naqvi
Data Analysis:	Jawaid Hussain Lighari
Revisiting Critically:	Shamsuddin Shaikh, Syed Qaiser Husain Naqvi
Final Approval of version:	Shamsuddin Shaikh

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Örün E, Yalcin SS, Aykut O, Orhan G, Morgil GK, Yurdakok K, et al. Breast milk lead and cadmium levels from suburban areas of Ankara. Sci Total Environ 2011;409(13):2467-72.
2. Guyton AC, Hall JE Textbook of Medical Physiology. 11th ed. Elsevier Saunders. Philadelphia: Pennsylvania; 2012.p.996-9.
3. Barret KE, Barman SM, Boitano S, Brooks H. Ganong's Review of Medical Physiology, 24th ed. M'c Graw Hill Medical Publishing: New York; 2012.p.428-37.
4. Kumar JJ. Role of Computed Tomography in the Evaluation of Renal Masses. Dissertation. Rajiv Gandhi University of Health Sciences Bangalore Karnataka, India; 2012.
5. National kidney Foundation. URL;www.goole. com/nkf/ accessed. 30 December 2016.
6. George M. Estimated GFR in diagnosis and staging of chronic kidney disease in patients with type 2 diabetes mellitus. Dissertation. Rajiv Gandhi University of Health Sciences, karnaaka, Bangalore 2011.
7. Juma A. Prevalence of anemia and its associated factors in patients with chronic kidney disease at Muhimbili. Dissertation. Muhimbili University of Health and Allied Sciences. October, 2012.
8. Remuzzi G. Hematologic consequences of renal failure. Brenner BM, editors. The kidney. 5th ed. Philadelphia: WB Saunders Co;2016.p.2170-85.
9. Iqaki N, Takashima M, Ohyama M, Oh S, Kida A, Yanase K, et al. the beneficial effect of effective control of anemia on hyperinsulinemia and hypoxemia in a hemodialysis patient with corrected transposition of the great arteries. Clin Exp Nephrol 2004;8(2):163-7.
10. Gosmanova EO, Le NA. Cardiovascular Complications in CKD Patients: Role of Oxidative Stress. Cardiol Res Pract 2011; 2011: 156326.
11. Taddei S, Nami R, Bruno RM, Quatrini I, Nuti R. Hypertension, left ventricular hypertrophy and chronic kidney disease. Heart Fail Rev 2011;16(6): 615-20.
12. Kralova S, Leva L, Toman M Changes in lymphocyte function and subsets in dogs with naturally occurring chronic renal failure. Can J Vet Res 2010;74(2):124-9.
13. Iseki K. Role of chronic kidney disease in cardiovascular disease: are we different from others? Clin Exp Nephrol 2011;15(4): 450-5.
14. 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(4):803-12.
15. Shaheen F, Souqiyyeh MZ, Al-Attar BA, Karkar A, AI Jazairi AM, Badawi LS, et al. Prevalence of anemia in predialysis chronic disease patients. Saudi J Kidney Dis Transpl 2011;22:456-63.
16. Afshar R, Sanavi S, Salimi J, Ahmadzadeh M. Hematological profile of chronic kidney disease (CKD) patients in Iran, in pre-dialysis stages and after initiation of hemodialysis. Saudi J Kidney Dis Transpl 2010;21:368-71.
17. Chiyuan HSU, McCulloch CE, Curhan GC. Iron Status and Hemoglobin level in Chonic renal Insufficiency. J Am Soc Nephrol 2016;13:2783-2786.
18. Suega K, Bakta M, Dharmayudha TG, Profile of Anemia in Chronic Renal Failure Patients: Comparison between Predialyzed and Dialyzed Patients at the Division of Nephrology, Department of internal Medicine, Sanglah Hospital, Denpasar, Bali, Indomesia. Indonesia J Int Med 2015;37.
19. Akinsola A, Durosinmi MO, Akinla NO, The hematological profile of Nigerians with chronic renal failure. Afri J Med Med Sci 2015;29:13-6.
20. Chinwuba I, Uchenna I, Ngozi I. High prevalence of anemia in predialysis patients in Enugu, Nigeria. Nephrol Reviews 2010;2:14.

21. Talwar VK, Gupta HL. Shashinaryan. Clinico-heamotological profile in chronic renal failure. J Assoc Physicians Ind 2016; 50: 228-33.
22. Besarab A, Mc Crea JB. Anemia in ESRD. In: Nissension MR, Fine RN, editors. Dialysis therapy 2nd ed. Philadelphphia: Hanely Inc;2012.p.223-5.
23. Monograpgh. Signs and symptoms of uremia. In: Block RM Alfred HJ, Fan PY Stoff JS, editors. Rose and Block's clinical problems in nephrology. 1st ed. Little, Brown and Company: Boston; 2011.p.497-523.
24. Bhatta S, Aryal G, Kafle RK, Anemia in chronic kidney disease patient in predialysis and post dialysisstage. J Pathol Nepal 2016;1: 26-9.
25. Afshar R, Sanavi S, Salimi J. Hematological profile of chronic kidney disease patients in Iran, in pre-dialysis stages and after initiation of hemodialysis. Saudi J Kid Dis Transpl 2010; 21: 368-71.
26. Akinsola A, Durosinmi MD, Akinola NO. The hematological profile of Nigerians with chronic renal failure. Afr J Med Sci 2016;29:13-16.