Original Research Paper

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Pathology

PROFILE OF ANAEMIA IN CHRONIC KIDNEY DISEASE PATIENTS IN A TERTIARY CARE CENTRE

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ABSTRACT This research was conducted in MGM Medical college and Hospital to study the profile of anaemia in chronic kidney disease patients. Anaemia is a leading cause of morbidity in chronic kidney disease patients. The study aims towards finding the type of anaemia, its morphology and its etiology by assessing various RBC indices and iron studies. **Objective:** To study the profile of anaemia in chronic kidney disease patients in a tertiary care centre. **Methodology:** This is a retrospective study done at a tertiary care centre. Red blood cell (RBC) indices like MCV, MCH , MCHC and PCV along with serum creatinine, blood urea, iron, ferritin and total iron binding capacity (TIBC) were assessed. **Results:** Out of 50 cases studied, 26 cases (52%) were male and 24 cases (48%) were female. The minimum- maximum age range was 06-74 years with a mean +/- SD of the entire group being 43.06 +/- 16.62 years. Out of 50 cases , 33 cases (66%) were diagnosed of normocytic normochromic anaemia, 16 cases (32%) were of microcytic hypochromic anaemia and 2% cases were of megaloblastic anaemia. 44 cases (88%) were diagnosed with anaemia of chronic kidney disease with normal iron levels and rest 6 cases (12%) were of iron deficiency anaemia. **Conclusion:** Evaluation of various RBC parameters help us to assess the type and etiology of anaemia in CKD patients. This helps us to choose appropriate treatment modalities thereby reducing the mortality and morbidity rate in patients of anaemia in CKD.

KEYWORDS : Anaemia, Chronic Kidney Diseases, RBC Indices

INTRODUCTION

Anaemia is a common complication in chronic kidney disease and is associated with a decreased quality of life and increased morbidity and mortality. CKD is a common healthcare problem due to comorbid conditions like diabetes, hypertension etc.

Anaemia is generally defined as the haemoglobin level less than 13gm/dl in men and less than 12 gm/dl in women.

Anaemia of chronic kidney disease is a type of normocytic, normochromic anaemia and hypoproliferative anaemia which is common with renal disease.[1]

Chronic kidney disease is defined as the presence of diminished GFR that is persistently less than 60ml/min/1.73 m^2 for at least 3 months.[2] It is a non-communicable disease that affects significant population in the world including India. Kidney disease is ranked 3rd for causing high mortality and morbidity rates in India after cancer and heart disease.

Anaemia in chronic kidney disease patients, is associated with multifactorial pathophysiology involving impaired erythropoiesis, decreased erythropoietin production and dysregulated iron metabolism.

Anaemia is defined based on serum hemoglobin level, serum transferrin saturation (TSAT), an indicator of circulating iron and serum ferritin an indicator of stored iron.[3]

Symptoms and signs of anaemia in chronic kidney disease include fatigue or tiredness, shortness of breath, weakness, body ache, chest pain, dizziness, fainting, trouble in concentrating, unusually pale skin and fast or irregular heartbeats.[4] All these symptoms appear due to decreased erythropoietin secretion and low iron levels which lead to reduced haemoglobin formation thereby lowering the oxygen binding capacity of red blood cells.

Haemoglobin being the major carrier of oxygen, patients with chronic kidney disease with severe anaemia have increased chance of developing cardiac ailments because the heart is deprived of oxygen and have to work harder to pump enough blood to reach distant organs and tissues.

Various causes of chronic kidney disease include:-

1- Diabetic Nephropathy
2- Hypertensive Nephropathy
3- Glomerulonephritis
4- Polycystic kidney disease
5- Interstitial nephritis
6- HIV associated nephropathy
7- Reflux nephropathy and other congenital renal disease

Predominance of glomerulosclerosis or interstitial fibrosis strongly supports of patient having chronic kidney disease which can be confirmed by a renal biopsy.[5]

Excoriations (uremic pruritus), pallor(anaemia), muscle wasting and nitrogenous fetor are all signs of advanced chronic kidney disease. Hyperkalemia and metabolic acidosis may complicate the disease.

MGM Medical College and Hospital is a multispeciality tertiary care centre treating many patients enrolled for treatment of chronic kidney disease, most of these have anaemia.

Looking at the gravity of this problem, this research is done to study profile of anaemia in chronic kidney disease patients, to understand definitive cause of anaemia and the appropriate treatment required in these patients.

Aim

To study the profile of anaemia in Chronic Kidney Disease (CKD) patients.

Objective

1. To study and analyse changes in various red blood cell (RBC) parameters (hemoglobin concentration, MCV, MCH, MCHC and PCV) in patients with chronic kidney disease.
2. To classify type of anemia in chronic kidney disease patients.
3. To find etiology of anaemia in chronic kidney disease patients.

MATERIALS AND METHOD

MGM Medical College and Hospital, Chhatrapati Sambhaji Nagar is a tertiary care centre with an active Nephrology department. Data of patients with confirmed diagnosis of chronic kidney disease was analysed for a retrospective study from June 2024- August 2024 with a sample size of 50 patients.

The study was approved by the Institutional Ethics Committee of MGM Medical College, Chhatrapati Sambhaji Nagar.

Known patients of chronic kidney disease admitted in the nephrology department were tested for CBC, TLC, serum creatinine, blood urea levels, Iron, ferritin and total iron binding capacity (TIBC).

Statistical Analysis

The data was analysed using a statistical software SPSS version 30. The data with quantitative variables are presented as mean (+/- standard deviation)

Inclusion Criteria

1- Patients with chronic kidney disease having estimated glomerular

filtration rate (eGFR) <60ml/min/1.73 m^2 for >3 months.

Exclusion Criteria

1- Pregnancy

OBSERVATION AND RESULTS

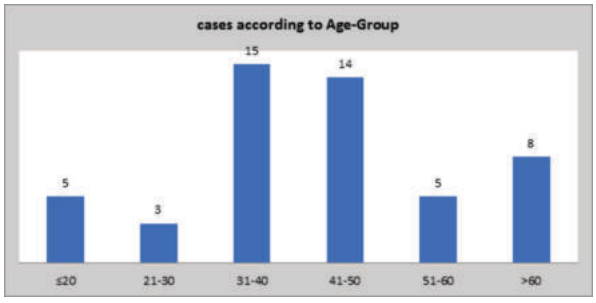
All the patients that fulfilled the inclusion criteria were included in the study. To find the morphological type of anaemia the values of haemoglobin, total leukocyte count, RBC parameters like MCV, MCH, MCHC and PCV were obtained.

Other values obtained were Iron, TIBC, Ferritin, serum creatinine and blood urea. To find the etiological type of anaemia iron studies and ferritin levels were studied.

The study was done at Central Clinical Laboratory, Department of Pathology, MGM Medical College and Hospital, Chhatrapati Sambhaji Nagar. Data of 50 chronic kidney disease patients was enrolled and the following results were obtained.

Table 1: Distribution of Cases According to Age-Group

Age-Group	No. of cases	Percentage
≤20	05	10.0
21-30	03	6.0
31-40	15	30.0
41-50	14	28.0
51-60	05	10.0
>60	08	16.0
Total	50	100%
Mean±SD	43.06±16.62 years	
Min-Max	06-74 years	



Out of 50 patients, 26 (52%) were male and 24 (48%) were female patients diagnosed with chronic kidney disease.(Table 2, graph 2)

Table 2: Distribution of Cases According to Gender

Gender	No. of cases	Percentage
Male	26	52.0
Female	24	48.0
Total	50	100%

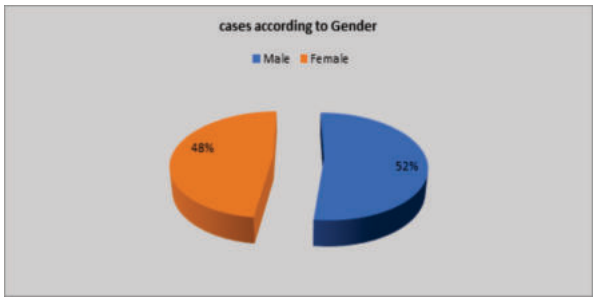


Table 3: Mean and Standard Deviation of CBC level

	N	Minimum	Maximum	Mean	Std. Deviation
Hb	50	5.00	14.00	8.18	1.99
MCHC	50	22.00	38.0	32.52	2.50
TLC/DLC	50	1810.0	21250.0	8796.00	3924.99
MCV	50	70.20	104.10	83.92	7.64
MCH	50	21.9	32.5	27.044	2.83
RBC COUNT	50	1.89	6.32	3.142	0.847
PCV	50	15.40	53.20	26.46	7.48

Table 4: Mean and Standard Deviation of Iron studies

	N	Minimum	Maximum	Mean	Std. Deviation
Iron	50	11.00	168.0	57.68	34.84
TIBC	50	95.00	413.0	216.84	69.26
Ferritin	50	25.00	1090.0	499.18	319.47

Out of 50 patients diagnosed of having Chronic Kidney Disease and after assessing the parameters, 16 cases (32%) were with microcytic hypochromic anaemia, 33 cases (66%) showed normocytic normochromic type of anaemia and 1 case (2%) was found to have macrocytic normochromic type of anaemia.

The most common type of anaemia found was normocytic normochromic type of anaemia. MCV values ranged from 70.20 – 104.10 fl. and the mean being 83.92 fl. (Table 3)

In our study the CKD patients were categorised into anaemia of chronic disease and iron deficiency anaemia by looking for ferritin levels. A total of 50 patients were enrolled out of which 45 cases (90%) were diagnosed to have anaemia of chronic kidney disease (Ferritin 100 ng/ml) followed by 5 cases (10%) were diagnosed to have Iron deficiency anaemia (Ferritin<100 ng/ml).

Table 4: Mean and Standard Deviation of S.Creatinine and Blood Urea level

	N	Minimum	Maximum	Mean	Std. Deviation
S.Creatinine	50	3.00	19.0	7.26	3.16
Blood Urea	50	18.00	231.0	90.64	54.56

Table 5 : Relation between S. Creatinine, Blood Urea and CBC

	S.Creatinine		Blood Urea	
	r-value	p-value	r-value	p-value
Hb	-0.307	P=0.030 S	-0.215	P=0.134 NS
MCHC	0.144	P=0.317 NS	-0.023	P=0.872 NS
TLC/DLC	0.122	P=0.398 NS	-0.016	P=0.912 NS
Iron	-0.058	P=0.692 NS	-0.163	P=0.257 NS
TIBC	0.142	P=0.326 NS	-0.083	P=0.567 NS
Ferritin	0.014	P=0.269 NS	0.175	P=0.223 NS
MCV	-0.167	P=0.248 NS	-0.325	P=0.021 S
MCH	-0.098	P=0.499 NS	-0.223	P=0.120 NS
RBC COUNT	-0.418	P=0.003 S	-0.372	P=0.008 S
PCV	-0.406	P=0.003 S	-0.439	P=0.001 S
Blood Urea	0.602	P<0.0001 S	--	--

S: Significant, NS: Not Significant

The S.Creatinine was negatively correlated with Hb, RBC COUNT & PCV. This negative relationship was statistically significant. The S.Creatinine was negatively correlated with Iron, MCV and MCH. But this negative relationship was not statistically significant.

The S.Creatinine was positively correlated with MCHC, TIBC, Ferritin and MCH. But this positive relationship was not statistically significant.

The blood urea was negatively correlated with MCV. RBC COUNT & PCV. This negative relationship was statistically significant. The blood urea was negatively correlated with Hb, MCHC, TLC/DLC, Iron, TIBC, and MCH. But this negative relationship was not statistically significant.

The blood urea was positively correlated with Ferritin. But this positive relationship was not statistically significant.

The S.Creatinine was positively correlated with Blood urea. This positive relationship was statistically significant.

DISCUSSION

This study conducted, depicted that most of the patients have normocytic normochromic type of anaemia, i.e., 66% (33 cases) . 32% (16 cases). Have microcytic hypochromic type of anaemia and 2% have macrocytic normochromic type of anaemia. The most common age group being affected is 31-40 years.

The mean age of our population is 43.06 +/- 16.62 years. Another study done by Indira et al[6] had mean age of 52+/-14 years, study by Neha et al[7] showed mean age 52.4+/-11.8 years and Sanjay et al[8] 55.5+/-14 years.

In the above study conducted, the mean haemoglobin was 8.18 gm%. This finding was in concordance with studies conducted by Neha et al[7], Arjun et al[9] and Rumi et al[10].

In our study, majority of patients (66%) have evidence of normocytic

normochromic anaemia which have normal MCV, MCH and MCHC values. The following study conducted agrees with Indira et al[8] in which majority of patients were diagnosed of having normocytic normochromic anaemia with normal RBC indices.

In our study conducted the most common morphological pattern of anaemia found is based on MCV values which is normocytic normochromic type of anaemia (66%) which is in concordance with studies done by Indira et al[8], Neha et al[9] and Sanjay et al[10] where the maximum number of cases were normocytic normochromic anaemia (94%, 76% and 65.4% respectively).

The second common pattern of anaemia in our study is microcytic hypochromic type of anaemia(32%) which was also seen in the studies done by Indira et al[6], Neha et al[7] and Sanjay et al[8] (3.4%, 22% and 14.2% respectively).

However, in comparison with our study, the study done by Talwar et al[11] showed a higher incidence of microcytic hypochromic anaemia (67%).

In our study megaloblastic anaemia was seen in 2% cases which was in concordance with studies done by Indira et al[6], Neha et al[7], Sanjay et al[8] and Talwar et al[11] (2.6% , 2%, 20.4% and 1% respectively).

In our study etiology of anaemia is classified on the basis of ferritin levels. Ferritin levels 100ng/l indicates anaemia of chronic kidney disease and ferritin levels <100ng/l indicates iron deficiency anaemia. In the following study among 50 patients 44 cases (88%) had anaemia of chronic kidney disease and 6 cases (12%) signifies iron deficiency anaemia. These findings were seen in concordance with the study done by Radhika et al[12] and Manu et al[13]. As per study done by Radhika et al[12], out of 50 cases, 86% cases showed anaemia due to chronic kidney disease. In the study conducted by Manu et al[13] , out of 68 patients, 60.29% had incidence of anaemia due to chronic kidney disease and 39.71% cases had iron deficiency anaemia.

CKD patients, particularly on hemodialysis have impaired dietary iron absorption. Many CKD patients receive erythropoietin stimulating agents (ESAs) which deplete the circulating iron pool by increasing erythropoiesis. Thus, CKD patients are more prone to true iron deficiency anaemia.[14]

Iron and Erythropoietin (EPO) are crucial for red blood cells (RBCs) production in the bone marrow. Iron availability is controlled by liver hormone hepcidin, which regulates dietary iron absorption and macrophage iron recycling from senescent RBCs. There are several feedback loops that control hepcidin levels including iron and EPO.

In CKD patients, hepcidin levels have to found to be highly elevated due to reduced renal clearance and induction by inflammation leading to iron restricted erythropoiesis, shortened red blood cell lifespan and increased blood loss.

Interstitial fibrosis is seen in all CKD patients regardless of the initial disease causing kidney injury. This leads to irreversible loss of normal kidney tissue and function. The fibroblasts or pericytes which secrete erythropoietin are differentiated into myofibroblasts in CKD patients. There is a high possibility that there is impaired erythropoietin production in myofibroblasts in patients of chronic kidney disease.[15]

Patients of chronic kidney disease may also show macrocytic normochromic or megaloblastic anaemia due to vitamin B12/ folate deficiency, dialysis induced changes in red cell volume and bone marrow suppression.[6]

Normocytic normochromic anaemia in renal failure patients is mainly hypoproliferative anaemia due to EPO deficiency leading to bone marrow suppression and peripheral destruction.

In our study the age for diagnosis of CKD is observed one decade early. Studies have shown that younger age may predict a faster time to reaching kidney failure.[16]

CONCLUSION

Anaemia in chronic kidney disease is a leading cause of morbidity in patients with CKD. The most common age group being affected is 31-40 years of age followed by 41-50 years of age. The morphological classification of anaemia can be achieved by assessing various RBC parameters like MCV, MCH and MCHC. The most common type being normocytic normochromic anaemia due to EPO deficiency, microcytic hypochromic anaemia due to iron deficiency and megaloblastic anaemia due Vit -B12/ folate deficiency.

The etiological classification is done by assessing the ferritin levels. When ferritin levels are equal to or >100ng/ml, it is classified as anaemia of chronic kidney disease but when the ferritin levels drop below 100 ng/ml it is classified as iron deficiency anaemia.

Evaluation of various RBC parameters helps in the classification of anaemia and further helps in choosing appropriate treatment modalities thereby decreasing the morbidity and mortality rate in patients of Chronic Kidney Disease.

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