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Clinico-Hematological Study of Chronic Kidney Disease

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ABSTRACT

***Background**: Chronic kidney disease (CKD) is a major public health problem throughout the world. Number of prevalent CKD patients will continue to rise, reflecting the growing elderly population and increasing numbers of patients with diabetes and hypertension. **Objectives:** The objective of the study was to study the hematological manifestations of chronic kidney disease and to correlate the hematological abnormality with the clinical stage. Method: 100 chronic kidney disease patients were selected. The stage of kidney disease was evaluated by estimating Glomerular Filtration Rate. Complete hematological investigation was performed using Abbott cell-3700 dyn hematology analyzer and peripheral smear using Giemsa stain. **Results:** CKD was seen in all age groups with a mean age of 50.03 years and predominantly in males (60%). Majority of patients were in stage V CKD (85%). The mean hemoglobin was 9.1g/dl and mean RBC count was 3.47 x1012/L. The fall in hemoglobin and RBC count inversely correlated with the clinical stage of CKD. Interpretation and **Conclusion:** Chronic kidney disease is seen across all age groups with a male preponderance. The anemia of CKD is a normocytic normochromic anemia with increasing prevalence as the stage progresses. The fall in hemoglobin is due to low RBC count due to decreased erythropoiesis.*

KEYWORDS : Anemia, Chronic kidney disease, Hemoglobin

INTRODUCTION

Chronic kidney disease (CKD) is a major public health problem throughout the world[1]. Number of prevalent CKD patients will continue to rise due to increased life expectancy and increasing incidence of diabetes and hypertension[2]. Symptoms and overt signs of kidney disease are often absent until renal failure supervenes[3]. The major outcomes of chronic kidney disease include progression to kidney failure and development of cardiovascular disease. Increasing evidence shows that early detection and therapeutic interventions in the earlier stages may prevent or ameliorate some of these complications, as well as slow progression to kidney failure[1]. Main risk factors for chronic kidney disease are older age, family history, diabetes mellitus, high blood pressure, autoimmune diseases, urinary tract infections, etc. Anemia is an almost constant complication of chronic kidney disease that significantly contributes to the symptoms and complications of the disease[4]. It affects up to 90% of patients[5]. It is caused by failure of the renal excretory and endocrine function[4].

Due to its insidious onset, anemia associated with CKD is often asymptomatic and only picked up on routine blood analysis. Delayed diagnosis and treatment of anemia associated with chronic kidney disease may increase the risk of cardiovascular complications including coronary artery disease, left ventricular disorders and cardiac failure. Undetected and therefore untreated anemia also leads to cognitive impairment, altered menstrual cycles, impaired immune response, erectile dysfunction, increased fatigue and consequently impaired quality of life. Due to the public health burden caused by renal anemia it is important to raise awareness of this condition and encourage early diagnosis and treatment[5].

MATERIAL AND METHOD

Source of data: Patients with chronic kidney disease admitted in Medicine department of Sir. T. Hospital, Bhavnagar were included in the study. Method of collection of data:

The clinical diagnosis of CKD was done based on elevation of Serum Creatinine for more than 3 months. Estimated Glomerular Filtration Rate (eGFR) was calculated by the

Cockcroft-Gault equation

$$\text{i.e.,} \frac{140 - \text{age} \times \text{body wt(kg)}}{72 \times \text{S.Creatinine(mg/dl)}}$$

Based on eGFR, patients are categorized in various clinical stages of CKD as in Table 1.

Table:1 Clinical stages of Chronic Kidney Disease

STAGE	eGFR, ml/min per 1.73m^2
0	>90
1	≥90
2	60-89
3	30-59
4	15-29
5	<15

Detailed clinical history was collected from the patient. Details were collected from hospital records also.

Patients in various stages of the disease were studied for changes in clinical manifestations and hematological parameters.

Following investigations were done-

- Investigations for assessment of renal failure: Serum Creatinine
- Investigations for assessment of hematological changes: Complete hemogram, and Peripheral smear study.

Complete hemogram was done using Abbott cell-3700 dyn. Automated 5-part hematology analyzer. Hematological parameters obtained were HB, RBC, MCV, MCH, MCHC, RDW, WBC, NEUT%, LYMPH%, MONO%, EOSINO%, BASO%, PLT. Peripheral smear examination was done using Giemsa stain.

Statistics: Results are expressed as mean SD, range values, number and percentage. One way ANOVA was used for multiple group comparisons. The association was considered to be statistically significant if $p < 0.0001$.

RESULT

One hundred cases with chronic kidney disease were included in this study.

There were 60 males (60%) and 40 females (40%).

The age of the study population ranged from 14 to 87 years, with the mean age being 53.07 years.

Majority of the patients (29%) belonged to the age group of 51-60 years.

Majority of the patients (85%) in the study were in stage V CKD, followed by stage IV (8%) and stage III (7%). No cases of stage I and II were seen.

Majority of the patients (75%) in the study had anorexia, followed by generalized weakness(68%), breathlessness(63%), pedel edema(54%), oliguria(43%), fever(27%) and facial puffiness(15%).

Hemoglobin ranged from 4 g/dl to 15 g/dl, with a mean hemoglobin of 9.1 g/dl. There is fall in hemoglobin level as there is progression of CKD.
There is significant inverse correlation between the hemoglobin levels with the stage of CKD (Table 2).

Table:2 Hemoglobin distribution in various stages of Chronic Kidney Disease

Hemoglobin (g/dl)	No. Of cases(%)	Stage III	Stage IV	Stage V
<4	1%	0	0	1
4.1-6	3%	0	0	3
6.1-8	42%	0	1	41
8.1-10	32%	1	1	30
10.1-12	15%	2	6	7
12.1-14	6%	4	0	2
>14.1	1%	0	0	1
Mean	-	12.05	10.25	8.31
SD	-	1.46	1.71	1.77

ANOVA, F=18.009, P<0.0001, SIGNIFICANT

The RBC count ranged from 1.6 – 5.6 $x10^{12}$/l with a mean of 3.47$x10^{12}$/l.There is fall in RBC count as the stage progresses.The fall in RBC count with the progression of the stage of CKD is statistically significant (Table 3).

Table:3 Distribution of RBC count in various stages of Chronic Kidney Disease

RBC count ($x10^{12}$/l)	Stage III	Stage IV	Stage V	**Total**
1.51-2.5	0	0	19	19(19%)
2.51-3.5	0	3	40	43(43%)
3.51-4.5	2	4	22	28(28%)
4.51-5.5	5	1	2	8(8%)
>5.51	0	0	2	2(2%)
Mean	4.74	3.71	3.21	
SD	0.63	0.73	0.79	

ANOVA, F=13.317, P<0.0001, SIGNIFICANT

RDW-CV was increased in 53 cases of CKD and normal in the rest. RDW-CV ranged from 11.6-25.2, with a mean of 15.4. The Red cell distribution width increases as the stage progresses. The variation of RDW-CV in different stages of CKD is not significant (Table 4).

Table:4 Red cell distribution width in various stages of Chronic Kidney Disease

Stage of Chronic kidney disease	Mean RDW SD
Stage III	14.9 0.8
Stage IV	15.0 0.8
Stage V	15.5 2.1

ANOVA, F=0.4533, P=0.8486, NOT SIGNIFICANT

The most frequent peripheral smear picture seen was Normocytic normochromic anemia (57 cases), followed by Microcytic anemia (20 cases). Normocytic hypochromic was seen in 4 cases and Macrocytic anemia in 4 cases. 15 cases had Normocytic normochromic blood picture.

The predominant poikilocytes seen on the peripheral smear in CKD were the burr cells. Other poikilocytes like pencil shaped cells, elliptocytes, fragment cells were occasionally seen.

The WBC count ranged from 3.7 – 60 $x10^9$/l, with a mean value of 10.7$x10^9$/l.

The Platelet count ranged from 20 - 550 $x10^9$/l, with a mean value of 275$x10^9$/l.

DISCUSSION

Chronic kidney disease is progressive renal disease characterised by various manifestations and haematological abnormalities.

The present study shows mean age falling in the 6th decade which is similar to the study by Anees et al[6] and Moranne et al[7]. Study by, Talwar et al[8] report lower mean age and studies by Sardenberg et al[9] and Agarwal et al[10] report higher mean age. This can be due to geographical differences in the studies as a result of higher life expectancy in the western world.

The present study showed that CKD affects all age groups with increasing prevalence in the elderly population. This high prevalence of CKD in the elderly reflects the presence of a variety of different risk factors for CKD such as diabetes and hypertension in older individuals.

The present study agrees with all the other studies in terms of increased male preponderance, which is attributed to the high prevalence of risk factors for CKD in males.

Majority of the cases belonged to stage V CKD with 85 cases, followed by stage IV with 8 cases. 7 cases were in stage III, while none of the cases were in stage I and II.

The present study shows an increased prevalence of CKD patients in stage V. Morranne et al[7] and Agarwal et al[10] observed an increased prevalence in stage III and IV.

This is because of the fact that the present study is a hospital based study and hospitalisation occurs more in stage V as a result of complications and co-morbidities. Anorexia, generalized weakness, dyspnea, pedal edema and oliguria were the most frequent presentation seen more commonly in stage V CKD which was also observed in other studies.

CKD is associated with anemia in a majority of patients. The mean hemoglobin in the present study in 9.1g/dl which is higher than study by Talwar et al[8] and Singh et al[11] and lower than study done by Agarwal et al[10].

Hemoglobin levels fall with the progression of the stages in CKD. The present study demonstrated a significant fall in hemoglobin as the stage progresses. This fall in hemoglobin is statistically significant and correlated well with the stage of CKD.

The present study demonstrated that the average RBC count is low in CKD. The RBC indices are within the normal range which is well correlated with studies by Talwar et al[8] and Singh et al[11]. The fall in RBC significantly correlates with the stage of CKD, with lower counts observes as the stage progresses.

The gradual increase in anemia seen correlating with the stage of CKD is due to the gradual fall in the RBC count.

In the present study, normocytic normochromic picture was the predominant finding in the peripheral smear and the anemia also being of the normocytic normochromic type in the majority. Macrocytic anemia is seen in only 4 cases in the present study. This is because of the low frequency of occurrence of Vitamin B12 deficiency in CKD as vitamin B12 levels are increase in renal failure as a result of decreased clearance by the failed kidneys.

There were 20 cases of microcytic anemia in the present study, further iron studies in these cases show that microcytic anemia occurs in CKD even with adequate iron stores as a result of decreased iron utilization due to an inflammatory block caused by circulating inflammatory mediators in CKD.

The results of the present study are similar to the study by Singh et al[11]. The differences in the smear findings between different studies are due to the variation in the sample size and difference in the study population.

Although the mean WBC count is within the normal range in the present study, but it is slightly high compared to other studies and significant number of cases had leucocytosis. This can be explained by the frequent occurrence of secondary infections in our study population.

The mean platelet count in CKD in the present study is normal. The

difference in the platelet count in different studies is attributed to the differences in the sample size and the study group characteristics.

CONCLUSION

CKD is seen across all age groups with increased prevalence in the age group 51-60 years and is predominantly seen in males. Anemia is a common complication of CKD which is of normocytic normochromic type and with increasing prevalence as the stage progresses. The fall in hemoglobin is due to the low red blood cell count as a result of decreased erythropoiesis. An inflammatory state observed as neutrophilia is a common feature in all the stages of CKD.

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