Original Research Article

A STUDY OF HEMATOLOGICAL PROFILE IN PATIENTS WITH CHRONIC KIDNEY FAILURE IN SOUTHERN INDIA

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A B S T R A C T

Background: Chronic kidney disease is associated with numerous hematological manifestations of which anemia is one such complication which adds further on the morbidity. This study aims to evaluate the clinico-hematological profile of patients with CKD.
Materials and Methods: A total of 100 patients with chronic kidney disease undergoing dialysis in the hemodialysis unit of Rangaraya Medical College, Kakinada were included. The study was conducted in the Department of Pathology, Rangaraya Medical College, Kakinada over a period of 2 years.
Results: Anemia is the most common hematological manifestation in the study. Normocytic hypochromic anemia was the most common finding in peripheral smear. Majority of the patients had leukocytosis. Thrombocytopenia was found in 48% of patients.
Conclusion: CKD causes decreased renal production of erythropoietin which is the major of anemia in them. Measures to correct anemia should be implemented in patients with CKD for better outcomes.
Keywords: anemia, chronic kidney disease, leukopenia, thrombocytosis.

INTRODUCTION

Chronic kidney disease (CKD) is a major public health problem. Approximately 10% of adult population is estimated to have chronic kidney disease. The prevalence is much higher in elderly patients and patients with diabetes, hypertension and certain communicable disease like Tuberculosis, HIV/AIDS.[1-3]

Chronic kidney disease (CKD) encompasses a spectrum of different pathophysiologic processes associated with abnormal kidney function, and a progressive decline in glomerular filtration rate (GFR). The term chronic renal failure applies to the process of continuing significant irreversible reduction in nephron number, and typically corresponds to CKD stages.[3–5]

Chronic kidney disease is associated with multi-system involvement. The hematological manifestations of CKD are anemia, thrombocytopenia, leukopenia, bleeding diathesis, splenomegaly, hypersplenism, shortened RBC life span, hemoglobinopathies, and hypocellular bone

narrow. Amongst these, anemia is the most common, and severe manifestation of all. It is found at any stage of CKD. Anemia is generally defined as hemoglobin of less than 13.0 g/dl in men and less than 12.0 g/dl in premenopausal women. Anemia in chronic kidney disease (CKD) is usually normocytic normochromic, hypoproliferative. With decrease in GFR, the severity of anemia increases and it is frequently associated with poor outcomes in CKD and increased mortality.[4,5]

Anemia of chronic kidney disease has been implicated due to reduced renal production of erythropoietin, the hormone responsible for erythropoiesis. Other mechanisms of anemia include uremia (leading to RBC deformity responsible for hemolysis), folate and vitamin B12 deficiency, iron deficiency, bleeding due to dysfunctional platelets, blood loss from hemodialysis (rare) and RBC fragmentation by injured renovascular endothelium in selected conditions such as glomerulopathy and malignant hypertension.[6]

This study was done to identify the hematological profile in patients with chronic kidney disease and

evaluate the outcomes in patients presenting to the tertiary care hospital.

MATERIAL AND METHODS

This prospective cross sectional study was conducted in the Department of Pathology, Rangaraya Medical College, Kakinada over a period of two years, i.e. from 1st August 2021 to 31st August 2023. A total of 100 patients with CKD who got admitted for undergoing dialysis were included in the study.

The present study consisted of 100 patients of CRF who were on regularly undergoing dialysis in dialysis unit of Rangaraya Medical College, Kakinada or.

Patients with acute renal failure or diagnosed with renal cancer or diagnosed with any prior hematological abnormality were excluded from the study.

Methods of data collection

A detailed clinical history and thorough general physical examination and relevant investigations were done. Data regarding the age, sex, the underlying primary renal disease, clinical and biochemical features of chronic renal failure of each patient was recorded using a standard proforma.

Investigations

After obtaining informed consent of the patient, blood sample was collected by venipuncture with necessary aseptic bio safety precautions. Complete blood picture with peripheral smear examination was done by drawing 3ml of blood via venipuncture into EDTA containing tube and processed. Bleeding time was estimated using Duke's method. Other hematological parameters like clotting time, packed cell volume, hemoglobin estimation, ESR estimation, total and differential WBC count, platelet count, and reticulocyte count were estimated.

Anemia was defined according to the World Health Organization (WHO), as hemoglobin (Hb) levels <12.0 g/dL in women and <13.0 g/dL in men. Mild anemia is defined as Hb between 10-12 g/dL, moderate anemia as Hb between 7-10 g/dL, and severe anemia as Hb <7g/dL. Life threatening anemia was defined as hemoglobin <5g/dL.[7] Bone marrow studies were done if required. Ethical committee approval was taken before start of the study.

RESULTS

The present study of "hematological profile in chronic renal failure" was conducted in the Department of Pathology, Rangaraya Medical College, Kakinada from 1st August 2021 to 31st August 2023 for a period of two years. The present study consisted of 100 patients of CRF who were admitted to the Department of Pathology, Rangaraya

Medical College, Kakinada or were on regular dialysis on OPD basis in dialysis unit.

The present study showed 2 cases (2%) of CRF in the age group of 11-20 years, 12 cases (12%) of CRF in the age group of 21-30 years, 16 cases (16%) in the age group of 31-40 years, 18 cases (18%) in the age group of 41-50 years and 52 cases (52%) in the age group of 50 years and above.

CRF is prevalent in adult population with a male predominance in older age groups. The majority of patients were in the age group of 50 years and above. In the present study there were 72 males and 28 female patients.

Hypertensive Nephropathy (37%), Diabetic nephropathy (30%), and Chronic Glomerulonephritis (18%) were the most common causes of CRF in our patients.

Out of 100 patients in our study, the majority (67%) of patients were having CRF as a result of Diabetes and Hypertension, which when detected and managed at early stages can halt the progress to chronic kidney disease and renal replacement therapy, as Diabetes and hypertension were the two important causes of CKD.

In the present study, 12 patients (12%) had a blood urea level between 50-100 mg%, 30 patients (30%) had blood urea level between 101-150 mg %, 32 patients (32%) had blood urea level between 151-200 mg % and 26 patients (26%) had blood urea level >200 mg%.

Out of 100, most of the patients had serum creatinine levels between 5.1-10 mg% (62%). 10 patients (10%) had serum creatinine level between 2-5 mg %, and 28 patients (28%) had serum creatinine level more than 10.1 mg%.

Complications like anemia, hypocalcaemia, hyponatremia and hyperkalemia were also present in significant numbers.

Anemia was most common hematological change (92%) in CRF observed in this study. 72% of the patients had their hemoglobin level in the moderate anemia (Hb = 7-10 gm%). 6% of the patients had severe anemia (Hb value < 7mg%), but 14% of the patient's had mild anemia (Hb between 10-12 g/dL). 8% had normal hemoglobin levels according to their age and sex.

75% of the patients had low hematocrit (<35%) and the rest 28% had hematocrit above 35%.

Normocytic hypochromic anemia was the most common with higher levels of Hb. Microcytic hypochromic anemia was the next common and was associated with lower levels of Hb. Abnormal red cells found in our patients were burr cells, tear drop cells and pencil shaped cells. Burr cell was a common morphological observation irrespective of the type of anemia.

The majority 56 (56%) of the cases had mild hypochromasia. Moderate hypochromasia was seen in 28 cases (28%) and marked hypochromasia was seen in 16 cases (16%).

Thrombocytopenia (platelet count less than 1.5 lakhs/cumm) was found in 48 patients (4%). Platelet

count between 1.0-1.50 lakhs was found in 36% of patients and counts <1 lakh was found in 8 cases (8%). Counts above 1.5 lakhs were found in 56 cases (56%).

Reticulocyte count was normal in 82% of the cases but it was slightly increased in 18% of the cases.

Mild leucopenia was seen in 8 cases, leukocytosis in 22 cases and in the remaining cases (70%) the leucocyte count was normal in number and distribution. Leukocytosis, mainly neutrophilic was observed in 13 patients. Leukocytosis could be due to the response to infection.

Myeloid Erythroid ratio was increased in 41.67% and decreased in 33.33% of cases. Bone marrow showed micronormoblastic picture in 16.6%, megaloblastic in 25% and normal in (58.3%) majority of cases.
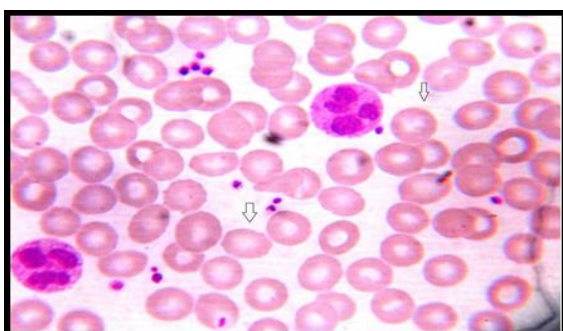
Normocytic normochromic anaemia

Figure 1: Shows normocytes (100x) in normocytic normochromic anemia
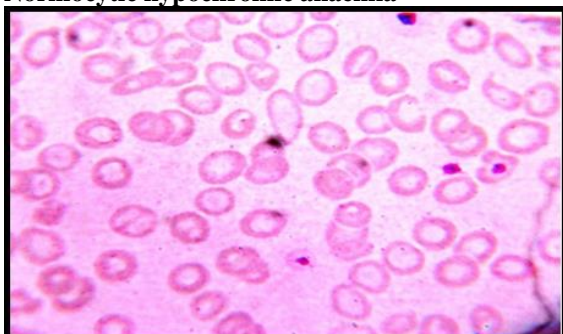
Normocytic hypochromic anaemia

Figure 2: showing normocytic hypochromic red cells under oil immersion field in normocytic normochromic anaemia
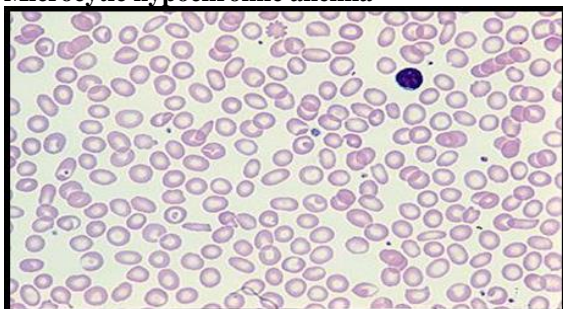
Microcytic hypochromic anemia

Figure 3: Oil immersion field shows microcytic hypochromic cells
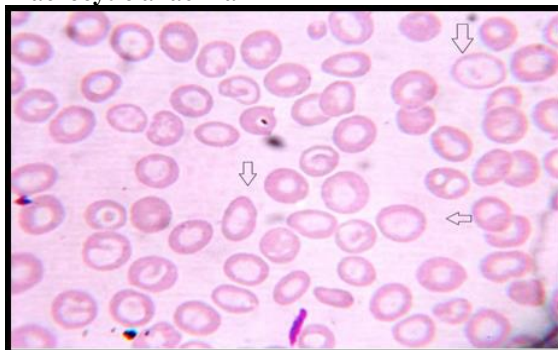
Macrocytic anaemia

Figure 4: Shows macrocytes andn macro-ovalocytes under oil immersion field
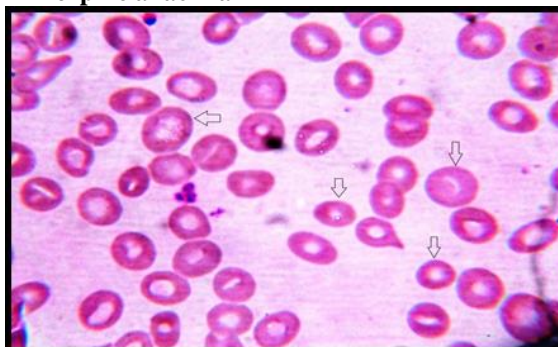
Dimorphic anaemia

Figure 5: showing both macrocytes and microcytes (under oil immersion field) in dimorphic anemia
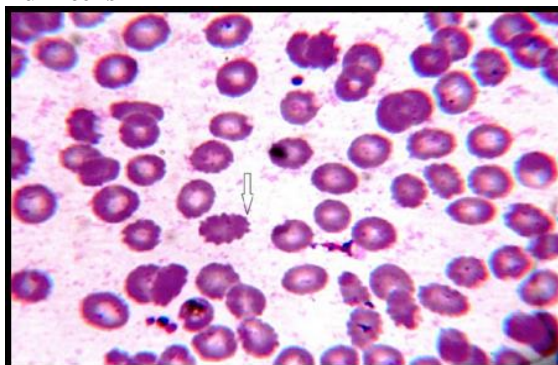
Burr cells

Figure 6: Shows burr cells (100x) in CRF irrespective of type of anemia

Figure 7: Laboratory Centrifuge used for performing PCV

Figure 8: Laboratory equipment used for performing haemogram

Figure 9: Laboratory equipment used for performing bone marrow aspiration

Table 1: Etiology of CRF

Etiology	Percentage (%)
Chronic Glomerulonephritis	18
Diabetic Nephropathy	30
Hypertensive Nephropathy	37
Obstructive Uropathy	8
Polycystic Disease Of Kidney	4
Chronic Pyelonephritis	3
Total	**100**

Table 2: Type of RBC's on peripheral smear

Type of Anemia	No of cases	Percentage (%)
Normocytic Normochromic	14	14
Microcytic Hypochromic	20	20
Macrocytic	4	4
Dimorphic	6	6
Normocytic Hypochromic	56	56
Total	100	100

Table 3: Clinical Presentation

Presenting Complaints	No of cases	Percentage (%)
Generalized Weakness	48	48
Puffiness of Face	36	36
Swelling of Lower Limbs	64	64
Fever/ Loss of Appetite	32	32
Easy fatiguability	62	62
Oliguria	12	12
Hematuria	22	22
Headache	14	14
Vomiting	26	26
Dyspnea	40	40

In the present study pedal edema was most common clinical presentation seen in 64 % of cases, followed by easy fatigability in 62 % of cases. 48 % cases had generalized weakness and 36% cases had facial puffiness.

Table 4: Analysis of Bone marrow study

Myeloid : Erythroid Ratio	No of cases
< 3:1	4
3:1	3
> 3:1	5
Total	12

Table 5: Erythropoiesis

Erythropoiesis	No of cases	Percentage (%)
Micronormoblastic	2	16.7
Normal	7	58.3
Megaloblastic	3	25
Total	2	100

DISCUSSION

Chronic renal insufficiency is characterized by elevation in serum urea nitrogen and serum creatinine concentration with or without reduced urine output. It leads ultimately to functional disorders involving every organ system in the body including fluid, electrolyte and metabolic disturbances.

The present study consisted of 100 patients of CRF who were admitted to the hospital or were on regular dialysis on OPD basis. These patients fulfilled the criteria set by the National Kidney Foundations' Kidney Disease Outcome Quality Initiative for diagnosing CRF. In the present study the hematological changes in 100 cases of chronic renal failure were analyzed.

In our study the youngest patient was 18 years of age and the oldest 82 years of age. The majority of patients were in the age group of 50 years and above. This shows a broad variation in age in our study group highlighting the preponderance of CRF across a very large age group.

Out of 100 patients with CRF, 72 patients (72%) were males and 28 patients (28%) were females. In our study of 100 patients there was a male: female ratio of 2.57:1. Diabetes and hypertension, both of which are etiological factors of CKD are prevalent more in older age group and male sex.

Anemia was present in majority of the patients with CRF, accounting for 92%. In studies done by Panduranga et al,[8] and Chakravarthy et al,[9] anemia was seen in all (100%) of the study participants.

Most of the patients had moderate anemia (72%) with Hb between 7-10 g/dL. It is well established that anemia develops in the course of chronic renal disease and is nearly universal in patients with chronic renal failure. Lower hemoglobin levels may result from a loss of erythropoietin synthesis on the kidneys and/or the presence of inhibitors of erythropoietin synthesis.

McGonigle, Wallin,[10] et al studied 863 patients for anemia and found up to 90% of patients to have hemoglobin less than 10 g/dL. Reza et al,[11] also had observed majority of the study population having moderate anemia. They also established that erythropoietin deficiency and disorders related to its synthesis are the main cause of anemia in patients with CRF. These findings are consistent with our study. Furthermore they also established that the severity of anemia is related to duration and extent of kidney damage.

Normocytic hypochromic blood picture was the most common in the study with 56%, followed by microcytic hypochromic and normocytic normochromic pictures. Studies done by Talwar et al,[12] Chakravarthy et al,[9] Dewan et al,[13] and Panduranga et al 8 also reported the same scenario. Normocytic normochromic picture was associated with higher Hb levels and microcytic hypochromic picture with lower Hb levels.

Some of the peripheral smears showed elliptocytes, ovalocytes, spherocytes and target cells. 4 patients showed presence of a few macrocytes though a well-defined macrocytic picture was not seen in this study. 35 smears showed presence of burr cells.

Burr cells are known to be associated with anemia in CKD. Ellliptocytes were predominantly associated with microcytic hypochromic picture and ovalocytes with macrocytes.

In present study, 72% have decreased hematocrit. In studies done by Panduranga et al,[8] Chakravarthy et al,[9] and Dewan et al,[13] decreased levels of hematocrit was seen in all stages of CKD.

Proliferative activity is assessed by determining the absolute reticulocyte count, the reticulocyte index and the reticulocyte production index. The normal reticulocyte count (RC) ranges from 40,000 to 50,000 cells/µL of whole blood.[14] Majority of the patients had normal reticulocyte count which was comparable to that of Talwar et al.[6] Thrombocytopenia (platelet count less than 1.5 lakhs/ cu mm) was found in majority of the CKD patients. This is in accordance with study by Akbar et al.[15]

Patients with CKD are predisposed to inflammatory illnesses such as pneumonia, bacteremia, or urinary tract infections. These inflammatory processed may promote the progression of kidney disease. In present study, leucopenia was seen in 8% of patients, leukocytosis in 22% of cases and the rest 70% of patients had normal leukocyte counts. Most of these patients had clinical evidence of infection mainly UTI. It is possible that infections could be due to impaired leukocyte function although they are increased in number. Rajiv et al,[16] in their study noted that leukocyte count was 1.5 to 3 fold higher in patients with CKD than the normal adult population.

EPO is known to stimulate erythropoiesis selectively with little effect on granulopoiesis. A fall in the leucocyte count is due to the sequestration of neutrophils within the dialyzer and in the lungs although studies with labeled cells show that they later return to the circulation. The type of leukocytosis was neutrophilic (13), lymphocytic (2) and eosinophilic (5). Monocytosis was seen in 2 cases. In cases of neutrophilia, neutrophils with hypersegmented nuclei and coarse granulation of cytoplasm were common features. Co existent respiratory infections were seen in two of them. Eosinophilia was seen in five cases. Eight of them showed leucopenia. Rajiv et al,[16] observed higher number of granulocytes and eosinophils than lymphoctyes in their study.

M: E ratio of < 3:1 was found in 4 patients in the present study. It was >3:1 in 5 patients. Erythroid hyperplasia was seen in 41.67% (5) of cases, the degree of which varied from case to case. Perl's stain done to demonstrate iron stores showed depleted iron stores in patients with microcytic hypochromic blood picture confirming the status of iron deficiency.

CONCLUSION

This study concludes that hematological complications in chronic kidney disease are common and add up to significant morbidity. Anemia is the most common hematological manifestation in patients with chronic kidney disease.

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