ORIGINAL RESEARCH PAPER
Volume - 14 | Issue - 06 | June - 2025 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

HAEMATOLOGICAL PROFILE AND SERUM IRON INDICES IN NON DIALYSIS CHRONIC KIDNEY DISEASE PATIENTS IN A TERTIARY CARE HOSPITAL: A CROSS SECTIONAL STUDY.

General Medicine

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ABSTRACT

Background: Anemia is common and early complication of chronic kidney disease patients one contributing factor is iron deficiency which may be problematic during erythropoietin therapy.The approximate prevalence of CKD is 800 per million population, and the incidence of end stage renal disease (ESRD) is 150- 200 per million population. Anemia of chronic disease is a complex disorder determined by variety of factors. Although the primary defect is decreased erythropoietin production from the kidney, a number of other factors may play contributory roles. For example iron, folate, vitamin B12 deficiency due to nutritional insufficiency or increased blood loss, shortened RBC survival, hyperparathyroidism, mild chronic inflammation and aluminum toxicity. Anemia in CKD worsens comorbidities of diabetes and hypertension, contributing to poor outcome and high mortality. Untreated chronic anemia leads to a number of physiologic disorders including cardiovascular complications and increased mortalityand morbidity. According to GFR and 2006 NKF-K/DOQI guidelines, CKD has been divided into 5 stages 3, 4. Anemia usually appears at GFR below 60ml/min or at stage 3.Renal insufficiency is also associated with bleeding tendency attributed to platelet dysfunction due to abnormal platelet aggregation and adhesiveness, 6. White blood cell count may be decreased in uremic patients and anemia correction is followed by an increase in natural killer cells and improvement in leukocyte phagocytic function.

Aim

1. To assess hematological profile and serum iron indices in non dialysis Chronic Kidney Disease patients.
2. To detect the types of anemia in CKD patients.
3. To detect the prevalence of iron deficiency in non dialysis CKD patients according to National Kidney Foundation's

Kidney Disease Quality Iniatiative Guidelines (NKFK/DOQI). **Materials and Methods:** It is a cross-sectional study conducted in the medical wards of Santhiram medical College and General hospital, Nandyal. A total of 54 patients were included in our study who satisfied the diagnostic criteria of CKD and patients underwent clinical and renal parameters, haematological profile and iron status. For comparison of the results with the general population adequate number of controls were taken. **Results:** Our study results showed low level of Haemoglobin, and packed cell volume with icrease in severity of chronic kidney disease. Bleeding time was increased in 5.6% patients and elevated ESR was present in more than half of patients. Anemia was universal in our population. Normocytic normochromic anemia was found in 70.4% of the patients and microcytic hypochromic anemia in another 20.4%, and 9.2% had both type of peripheral smear picture. Applying the NKF-K/DOQI guidelines for nondialysis chronic kidney disease to our population it was found that nearly 38.9% of the study population did not have target serum ferritin of 100 ng/ml and 44.4% of study population did not have target TSAT of >20%. **Conclusion:** It's crucial to investigate and manage iron deficiency in patients with chronic kidney disease (CKD) to identify underlying causes and provide targeted treatment. Every effort should be made to determine the cause of anemia in CKD patients and address coexisting iron deficiency anemia. Additionally, monitoring other hematological parameters can help detect any coexisting abnormalities.

KEYWORDS

INTRODUCTION

Chronic kidney disease (CKD) has emerged as a major public health problem worldwide.

It is well accepted that low income countries are unable to afford the cost of care required to manage patients with end stage renal disease.

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.

The term end-stage renal disease represents a stage of CKD where the accumulation of toxins, fluids, and electrolytes that are normally excreted by the kidneys results in uremic syndrome.

This syndrome leads to death unless the toxins are removed by renal replacement therapy, using dialysis or kidney transplantation.

Chronic kidney disease is divided in to five stages based on the estimated GFR. To be classified as stage 1 orstage 2, there must be an accompanying structural or functional defect (eg.proteinuria, hematuria) as the GFR is normal or near normal in this stages.The most frequent cause of CKD is diabetic nephropathy most often secondary to type-2 diabetes mellitus.

Hypertensive nephropathy is a common cause of CKD in elderly. Glomerulonephritis represents third most common cause of CKD.

Haematological Aspect Of Chronic Kidney Disease-ANAEMIA

- Anaemia is a common problem for CKD patients. The anaemia of CKD is multifactorial in origin. (But erythropoietin deficiency is the most important etiologic factor).
- Anaemia develops earlier in CKD among patients with diabetes mellitus and this magnitude of anaemia tends to be more severe than with non diabetic patients.
- Anaemia ,a multifactorial risk factor for the progression of CKD to end stage renal disease (ESRD) reduces the quality of life and associatedwith significant morbidity and mortality.

AIMS AND OBJECTIVES:

AIM :

To assess haematological profile and serum iron indices in nondialysis chronic kidney disease patients.

Objectives

1) To study the haematological profile and serum iron indices in non dialysis chronic kidney disease patients.
2) To detect the types of anemia in patients with chronic kidney disease
3) To study the prevalence of iron deficiency in non dialysis chronic kidney disease patients according to National Kidney Foundation's Kidney Disease Quality Initiative (NKF-K/DOQI) Guidelines.

MATERIALS AND METHODS

It is a cross-sectional study conducted in the medical wards of Santhiram medical College and General hospital, Nandyal.

Duration of Study: From OCTOBER 2023 to MARCH 2024.

Sample Size: 54

Methods of Data Collection: This is a hospital based cross sectional study. Detailed history and complete clinical examination were done. Haemoglobin, Red blood cell count, White bloodcell count, Haematocrit, Differential count, MCV, MCH, MCHC, Platelet count, RDW, Peripheral smear, Bleeding time Clotting time, ESR, Serum

ferritin, Total iron binding capacity, Serum iron, Peripheral smear were done.

Sampling Technique: Simple Random Sampling

Inclusion Criteria

1. Patients of chronic kidney disease of stage I – IV disease
2. GFR <60ml/min/1.73m2 on the basis of estimated GFR
3. Patients who are willing to participate and willing to give informed and written consent.

Exclusion Criteria

- Conditions that may alter the iron profile and RBC morphology were excluded on the basis of detailed history and clinical examination and basic investigations.

  They include:
- Patients undergoing dialysis
- Evidence of acute infection or trauma in the last four weeks
- History of parenteral iron injection in the last 14 days
- History of blood transfusion in the last one month
- Hemoglobinopathies
- Recent overt blood loss
- Patients who are not willing to participate and not willing to give informed and written consent

Data Analysis

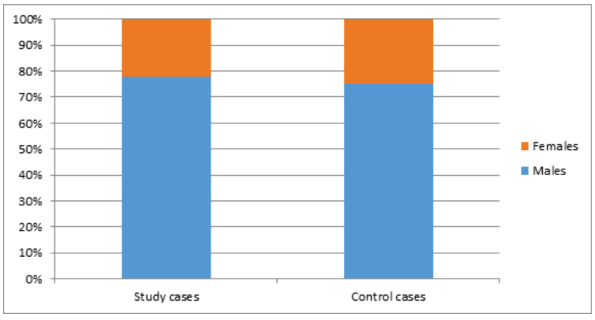
1. Data was collected using a pretested proforma meeting the study's objectives. Detailed history, physical examination, and necessary investigations were undertaken.
2. The chi-square and Fisher's exact test were used in statistical analysis to compare proportions. At a P-value of 0.05, statistical results were considered significant <0.01.

RESULTS AND ANALYSIS OF OBSERVED DATA

Sex Distribution

Sex	Studycases		ControlCases	
	No	%	No	%
Male	42	77.8	15	75
Female	12	22.2	5	25
Total	54	100	20	100

In this study out of 54 cases 42 are males and 12 are females. Males are 77.8% and females are 22.2%.



Association Between CKD Stages and Haematological Parameters

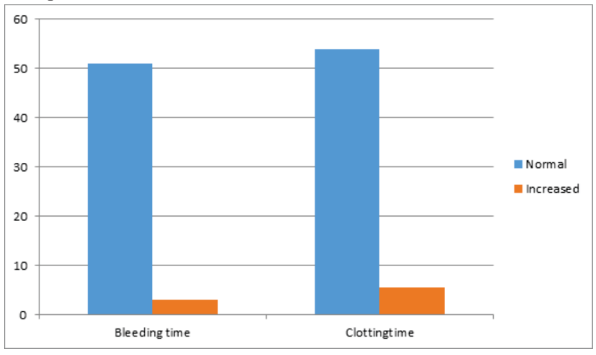
Variable	Study Group		Control Group		'p'
	Mean	SD	Mean	SD	
Hb(gm/dl)	8.01	1.78	13.34	0.85	0.0001 Significant
RBCcount (million/cumm)	3.18	0.7	4.58	0.45	0.0001 Significant
PCV%	25.58	4.36	40.37	3.18	0.0001 Significant
Plateletcount (lakhs/cumm)	3.33	0.69	2.94	0.77	0.0517 NotSignificant
MCV(fL)	80.83	14.12	83.82	4.03	0.7104 Notsignificant
MCH(pg)	26.15	5.12	28.72	1.64	0.0775 Notsignificant
MCHC(g/dl)	31.38	4.06	33.0	1.01	0.2786 Notsignificant
RDW%	15.92	4.33	13.93	0.63	0.1902 Notsignificant
ESR(mm/hr)	26.81	16.5	15.65	3.08	0.0056 Significant

There were statistically significant associations between Hb% (p= 0.0002), PCV (p<0.005) and duration of illness and CKD stages. (p< 0.05). As the CKD stage increases, the level of hemoglobin, packed cell volume decreases. These relationships have got statistical significant

Bleeding Time and Clotting Time

Parameter	Bleeding time in minutes		Clotting time in minutes	
	No	%	No	%
Normal	51	94.4	54	100
Increased	3	5.6	-	-
Total	54	100	54	100

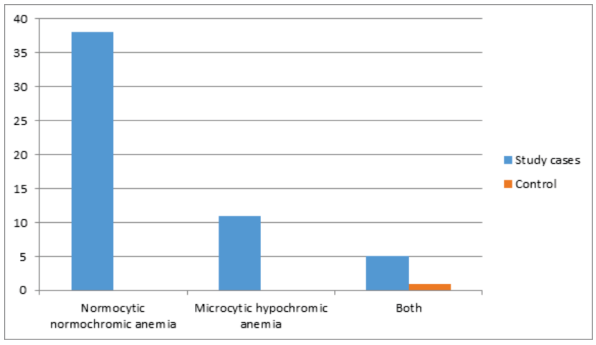
Bleeding time increased in 3 patients (5.6%). Clotting time was normal in all patients.



Peripheral Smear

Peripheralsmear	Study Cases		Control Cases	
	No	%	No	%
Normocyticnormochromicanemia	38	70.4	-	-
Microcytichypochromicanaemia	11	20.4	-	-
Bothtypespresent	5	9.2	1	5
Normal	-	-	19	95
Total	54	100	20	100
'p'	0.0001 Significant			

All the patients in the study cases had anaemia whereas only 5% in the controlgroup had it. This difference was statistically significant (p = 0.0001). When analyzing above data 38 patients (70.4%) had normocytic normochromic anemia, 11patients (20.4%) had microcytic hypochromic anemia and 5 patients (9.2%) had both type of morphology in peripheral smear picture.



Relationship Between Type of Peripheral Smear and Serum Ferritin (µg/l);Transferrin Saturation %(TSAT)

PeripheralSmear Type	Noofcases	MeanTSAT	Mean FERRITIN
Normocytic normochromic	38	32.46	381.98
Microcytic hypochromic	11	12.61	26.58
Both	5	14.26	43.82

There was a statistically significant relationship between peripheral smear type and TSAT (p=<0.001) and also significant relationship between peripheral smear type and ferritin (p=<0.002). Serum ferritin level and transferrin saturation was low in patients with microcytic hypochromic anemia.

Serum Iron Indices and CKD Stage

CKDstage	Value(Mean+SD)of			
	Iron(µg/l)	TIBC(µg/l)	TSAT%	Ferritin(µg/l)

3	70.7+32.8	269.9+76.2	31.6+23.5	357.9+519.8
4	69.3+39.4	300.3+77	25.3+16.7	254.8+254.5
5	67.2+25.2	286+80.5	25.4+11.6	256.1+294.4
'p'	0.7939 Not significant	0.4799 Not significant	0.7688 Not significant	0.9591 Not significant

Serum iron indices and severity of CKD did not have statistically significant relationship with serum iron profile.

Serum Iron Indices

Serum Iron Indices	Study group		Control group		'p'
	Mean	SD	Mean	SD	
Iron (µg/l)	68.7	31.9	82.7	25.4	0.0182 Significant
TIBC(µg/l)	287.4	77.7	300.2	45.5	0.7936 Not significant
TSAT %	26.74	16.5	28.8	10.09	0.2896 Not significant
Ferritin(µg/l)	278.3	340.4	109.4	62.0	0.0479 Significant

Among the serum iron indices between study and control cases, Iron and Ferritin values were significantly different, ($p < 0.05$). TIBC, TSAT values were not significantly different.

DISCUSSION

Chronic kidney disease (CKD) poses a significant global health burden, contributing substantially to illness and death. While the early stages of CKD are more common, they often go undetected due to a lack of symptoms. Consequently, stages 4 and 5 of CKD are more frequently diagnosed because patients typically seek medical help only when symptoms become severe.

Anemia in CKD has multiple causes and is recognized as a major concern, negatively affecting patients' quality of life and leading to irreversible heart damage. It is both a manageable aspect of end-stage renal disease and an independent predictor of cardiovascular disease and mortality. Red blood cell production depends on adequate levels of both iron and erythropoietin (EPO), making iron status a critical factor in treatment. Though no test can perfectly assess iron stores, transferrin saturation (TSAT) and serum ferritin levels are the most reliable markers available. TSAT below 20% and ferritin under 100 ng/mL are typically indicative of iron deficiency. Therefore, non-dialysis CKD patients should maintain TSAT >20% and serum ferritin >100 ng/mL.

A bone marrow study by Gotloib et al. found severe iron deficiency in nearly all CKD patients examined. In this study, the mean serum ferritin was 278.3 ng/mL, and 16.67% of participants had levels exceeding 500 ng/mL. Elevated ferritin levels can result from inflammation, which is common in CKD and may mask actual iron deficiency.

In conclusion, anemia in CKD is often due to iron deficiency, influenced by inflammation, poor nutrition, and EPO resistance. It is essential to identify and treat iron deficiency anemia in CKD patients while monitoring other hematological parameters to detect any coexisting disorders.

CONCLUSION

This cross-sectional study, conducted at Santhiram Hospital, aimed to evaluate the hematological profile and iron status in non-dialysis patients with chronic kidney disease (CKD.The study found that CKD primarily affected the middle-aged population and that anemia was a universal finding, particularly normocytic normochromic anemia (70.4%) and microcytic hypochromic anemia (20.4%). A combined pattern was seen in 9.2% of patients.

There was a notable decline in hemoglobin and packed cell volume with advancing CKD stages. Elevated erythrocyte sedimentation rate (ESR) was seen in over half the patients, and prolonged bleeding time was observed in 5.6%. Those with microcytic hypochromic anemia had lower serum ferritin and transferrin saturation (TSAT), indicating iron deficiency.

Applying NKF-K/DOQI guidelines, 38.9% of patients had suboptimal serum ferritin (<100 ng/ml) and 44.4% had TSAT <20%. These findings highlight the need for early identification and treatment of iron deficiency anemia in CKD patients. Iron supplementation—either oral or parenteral—should be initiated before starting dialysis or erythropoietin therapy. Monitoring other hematological parameters is also essential to detect coexisting abnormalities.

Ultimately, while managing complications like anemia can improve survival, emphasis should be placed on CKD prevention through early screening, hypertension and diabetes control, and minimizing the use of nephrotoxic drugs such as NSAIDs.

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