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RESEARCH ARTICLE

CHANGES OF RED BLOOD CELLS PARAMETERS AND MORPHOLOGY IN CHRONIC KIDNEY DISEASE: A CROSS SECTIONAL STUDY IN A TERTIARY CARE HOSPITAL

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Abstract

Introduction :Chronic kidney disease(CKD) is a dreadful condition leading to drastic decline in renal function resulting in renal failure,cardiovascular illness and early mortality. Numerous haematological and biochemical changes are one of the major manifestations of progressive deterioration in kidney function.The aim of the present study is to study various changes in red cell parameters and morphology in the CKD patients.

Materials and methods: 100 patients with CKD were included in this study. Age, gender,RBC count, haemoglobin(Hb), haematocrit, Mean corpuscular volume(MCV), Mean corpuscular haemoglobin(MCH), Mean corpuscular haemoglobin (MCHC), and peripheral smears were studied. Results were analyzed using SPSS20.0 version.

Results: Of the 100 CKD patients, the most common group sampled were male patients(60%) with the mean age of 53 years(±6 years). The study revealed that Haemoglobin(Hb),Red blood cell(RBC), Packed cell volume(PCV) were low in CKD patients. The most common type of anemia was normocytic normochromic type, followed by dimorphic anemia.

Conclusion: Anemia is a common clinical manifestation in chronic kidney disease patient. From CBC and peripheral smears findings, the types of anemia, degree of haemolysis can be analysed which helps in appropriate treatment and underlying cause.

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Introduction:-

Chronic Kidney Disease (CKD) is a major health care problem worldwide, with a global prevalence of 8-16%.[1] The National Kidney Foundation in India states that, kidney diseases rank 3rd amongst life threatening disease after cancer and heart disease.[2] Anaemia is a common manifestation among Chronic Kidney Disease patients.[3,4] Anaemia is associated with reduced quality of life and increased cardiovascular mortality and morbidity.[5]Erythropoietin(EPO) deficiency remains the major cause of anaemia in CKD patients due to the decrease in renal EPO production.[6] So,

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our present study is undertaken to analyze the changes of Red Blood cell parameters and morphology in Chronic Kidney Disease patients

Aims and objectives:-

- To analyze the changes in various RBC parameters (Haemoglobin, hematocrit and RBC indices).
- To analyze the various morphology of RBCs in peripheral smears findings.

Materials and methods:-

Study design: A hospital based cross-sectional study.
Place and duration of study: This study was carried out in the Department of Pathology at Shija Academy of Health Sciences (SAHS), Langol, Imphal, Manipurover a period of 6 months (January 2025 to June 2025).
Inclusion criteria: All the patients suffering from Chronic Kidney Disease and age >15 years.
Exclusion criteria: 1. Patient with recent blood transfusion (< 3 months).
2. Any known haematological malignancy causing secondary renal failure.
3. Aplastic anaemia.
Data collection: The documentation included the patient's name, age, gender, lab. no., haematological parameters.

Study procedure:-
Haemoglobin concentration (Hb%), Packed cell volume (PCV), Red blood cell count (RBC), MCV, MCH, MCHC were done on standardised quality controlled and maintained automated 5-parts cell counter SYSMEXXN-350. Peripheral smears were prepared in all the samples and Leishman's staining was done. All the stained slides were examined under the microscope and reported.
Ethical consideration:
Patient details were collected from TRF and haematological parameters findings were noted accordingly. Ethical clearance was obtained from the Institutional Ethics Committee. The identities of patients were not revealed.

Statistical analysis:
The haematological data were entered in MS-Excel spreadsheet and statistical analysis was performed by SPSS 20.0 version.

Results:-

A total of 100 patients with CKD were included in this study and following results were obtained.
The age of the patients were between 18 to 79 years with the mean age of 53 years***(±6)*** years. Among 100 cases, 60 cases (60%) were males and 40 (40%) were females.

Table 1: Mean score RBC, Hb, PCV, MCV, MCH and MCHC

Parameters	**Mean**
RBC	3.53
Hb	9.56
PCV	29.39
MCV	83.57
MCH	27.14
MCHC	32.48

Table 2: Comparison of mean RBC, Haemoglobin and PCV in Chronic Kidney Disease

Mean values	**Present study**	**Wasti et al.[7]**	**Suresh et al.[8]**	**Shittu et al.[9]**	**Alghythan and Alsaeed[10]**
RBC count x $10^6/\mu l$	3.53	3.3	3.06	2.82	4.13
Hb %	9.56	9.2	8.83	7.6	11.7
PCV %	29.39	28	27.13	24.41	35.14

The RBC count, Haemoglobin concentration and hematocritwas decreased in chronic renal failure patients, which is statistically significant (p=0.0001). MCV, MCH and MCHC values were normal in more than 75% of patients. The

most frequent peripheral smear picture seen was predominantly normocytic normochromic (54%), followed by microcytic hypochromic (25%).

Table 3: Types of anaemia in peripheral smear

Morphological parameter	Frequency	Percentage
NCNC	54	54
MCHC	25	25
Dimorphic anaemia	21	21

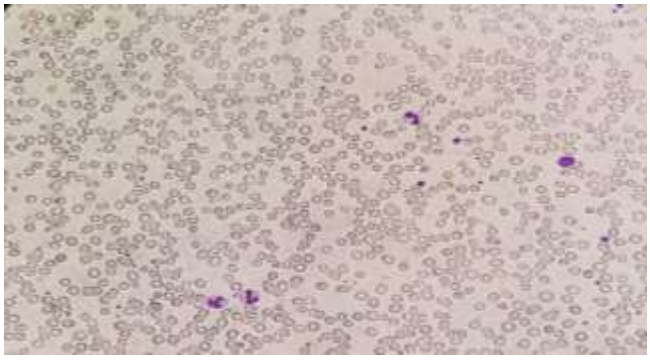

Figure 1: Peripheral smear picture of dimorphic anaemia.

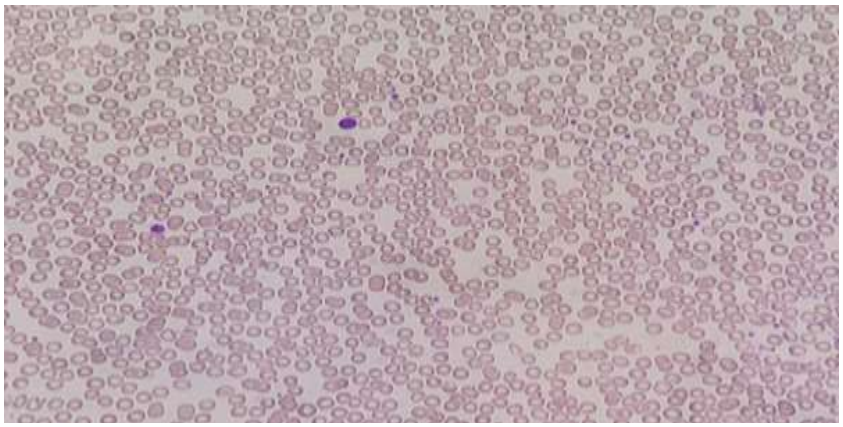

Figure 2: Peripheral smear picture of normocytic normochromic anaemia.

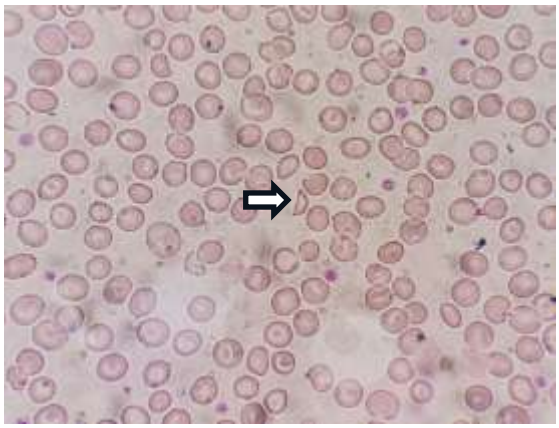

Figure 3: Peripheral smear picture showing fragmented RBC (marked with white arrow).

Discussion:-

Chronic Kidney Disease (CKD) is defined by the presence of kidney damage or decreased kidney function for three or more months, irrespective of the cause. Anaemia is seen consistently in these patients contributing towards the morbidity and mortality.

In the present study, the mean age of the patients was found to be 53 years which is comparable to the findings by Christina et al.[11] and Singh S et al.[12] where they found the mean age to be 54 years and 51.21 years respectively. Male predominance with male patients comprising 60% of the total cases was seen in our study and similar results were also observed in the studies by Debbarma et al.[13], Neetha et al.[14] and Dewan et al.[15]where the study population constituted of 68.5%, 70.9% and 84.37% male patients respectively.

In our study, the RBC count, haemoglobin and hematocrit were found to be decreased in chronic renal failure patients. Similar findings were also seen in the studies by Wasti et al.[7], Suresh et al.[8] and Shittu et al.[9]. The mean RBC count in the present study was found to be 3.53 and it was comparable with Wasti et al.[7] where their study had a mean RBC count of 3.3. This value was also in consensus with the findings of Suresh et al.[8] and Shittu et al.[9] where the calculated mean RBC count were noted to be3.06 and 2.82 respectively.

The CKD patients in our study had a mean haemoglobin of 9.56 which was similar with the mean haemoglobin values of 9.2, 8.83 and 7.6 obtained respectively in the studies by Wasti et al.[7], Suresh et al.[8] and Shittu et al.[9]. The mean hematocrit was 29.39 in our study and it was observed that the studies done by Wasti et al.[7], Suresh et al.[8] and Shittu et al.[9]also showed comparable mean hematocrit values of 28, 27.13 and 24.41 respectively. However, the values of these parameters in the study conducted by Alghythan and Alsaeed[10] were higher compared to the present study with the mean values of RBC count, haemoglobin and hematocrit being 4.13, 11.7 and 35.14 respectively. MCV, MCH and MCHC values were normal in majority of patients which is in concensus with the findings by Christina et al.[11]

Normocytic normochromic was the most frequent peripheral blood smear picture seen in the present study. Similar to our finding, Debbarma et al.[13] and Mori et al.[16] also observed normocytic normochromic as the most common picture on peripheral blood smear examination in chronic renal failure patients.

Conclusion:-

From the present study, it can be concluded that patients with chronic renal failure show abnormal haematological parameters with anaemia being the most common clinical manifestation. Normocytic normochromic was the most common type of anaemia seen here followed by microcytic hypochromic type. Also seen in the peripheral smears were macrocytes.

Thus, it is recommended that Vitamin B12 level and folate assay may be done. Around 25% of microcytic hypochromic anaemia were seen indicating requirement of iron and EPO supplementation to all CKD patients. Various therapeutic options available for the anaemia of CKD include red blood cell transfusion, treatment of underlying cause and use of erythropoietin.

Additional information:-

Author contribution

Concept and design: NongmaithemKaruna, Jessica Moirangthem
Drafting the manuscript: NongmaithemKaruna
Critical review: NongmaithemKaruna, ThangjamShitalmala
Supervision: NongmaithemKaruna, JessicaMoirangthem

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