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Haemoglobin and Iron Studies in Chronic Kidney Disease Stage-5 Patients yet Not on Dialysis

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ABSTRACT

Objective: To look for the low levels of haemoglobin and ferritin among the patients of chronic kidney disease (CKD) Stage-5 not undergoing dialysis and factors related to the presence of low levels of haemoglobin and ferritin.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Nephrology, Pak Emirates Military Hospital, Rawalpindi Pakistan, from Feb 2019 to Jan 2021.

Methodology: A total of 800 cases were included in the study, diagnosed as chronic kidney disease Stage-5 in the nephrology outpatient department (OPD) by a consultant nephrologist who did not require hemodialysis. Haemoglobin and ferritin levels were recorded in all patients at the time of assessment in the outpatient department. In addition, the relationship of various factors was assessed with low haemoglobin and ferritin among the study participants.

Results: Out of 800 non-dialysis chronic kidney disease patients in the study, 421(52.7%) patients were males and 379(46.3%) were females. Of the participants, 471(58.9%) had either low ferritin or hemoglobin levels, while 329(41.1%) did not show low haemoglobin and/or ferritin levels. Long duration of illness and female gender was significantly associated with low haemoglobin/ferritin levels among the non-dialysis patients of chronic kidney disease Stage-5 (p-value<0.05).

Conclusion: Low levels of hemoglobin and ferritin were found in most patients suffering from chronic kidney disease Stage-5 and not undergoing hemodialysis. Therefore, special attention should be paid to female patients and patients with a longer duration of chronic kidney disease.

Keywords: Chronic kidney disease, Ferritin, Hemoglobin.

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INTRODUCTION

Non-communicable diseases relevant to the renal system, especially chronic kidney diseases, have been one of the leading causes of mortality and morbidity in patients across the globe.[1] Prevalence of this condition is high in lower and middle-income countries and still rising in the last few years.[2,3] Management options for chronic kidney disease include medications, renal replacement therapy and renal transplant.[4]

Patients with chronic renal disease may have complex pathophysiology of various systems leading to changes in blood indices. These changes may be pathological in a few patients and diagnosed as separate clinical entities requiring the attention of a multidisciplinary team for adequate management.[5] Iron deficiency anaemia by now has been an established entity with CKD, may it be dialysis-dependent or non-dependent.[6,7]

Studies have been done regarding looking for the presence of deranged blood indices in patients suffering from dialysis-dependent &non-dialysisdependent patients of CKD.[8] Eisenga *et al.* came up with the findings that ferritin and transferrin levels were consistently deranged in such patients and transferrin levels were more sensitive to determining an iron deficiency in these patients. The presence of iron deficiency anaemia was associated with poor outcomes among their study participants.[9]

This aspect of CKD has been studied less frequently in our set-up. There is a huge chunk of non-dialysis dependent CKD patients in our set-up. If this multisystem illness is not catered for in all aspects, especially its haematological and biochemical manifestations, it may lead to dangerous consequences, adding insult to injury. A local study was published in Pakistan Armed Forces Medical Journal regarding the association between anaemia and bone profile and patients suffering from non-dialysis-dependent CKD.[10] Limited local data has been available regarding Stage 5 CKD patients from this aspect. We, therefore, planned this study with the rationale to look for the presence of low levels of haemoglobin and ferritin among the patients of chronic kidney disease (CKD) Stage-5 not undergoing dialysis and factors related to the presence of low levels of haemoglobin and ferritin.

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METHODOLOGY

This cross-sectional study was conducted at the Department of General Medicine/Nephrology,Pak Emirates Military Hospital, Rawalpindi Pakistan, from February 2019 to January 2021. The Ethical Review Board Committee of the Hospital was approached to get ethical approval for this study (Ser No 250/2/22). The sample size was calculated by WHO Calculator with the population proportion of anaemia in non-dialysis dependent chronic kidney disease as 20.6%.[11] Non-probability Consecutive sampling technique was used to gather the sample.

Inclusion Criteria: All patients of CKD, aged 18 to 65 who were not dependent on any dialysis were included in the study.

Exclusion Criteria: Patients with anaemia prior to diagnosis of CKD, malignancies (solid or haematological), severe infection or organ failure other than kidneys in the past six months were excluded. In addition, patients who had vitamin B-12 or folate deficiency or replacement therapy, had recent surgery, had NSAID abuse or any autoimmune disorder, were using illicit drugs, or those whose follow-up was not possible were excluded from the study.

Diagnosis and staging of CKD were made as per National Kidney Foundation/Kidney Disease Outcome Quality Initiative (NKF/KDOQI) 2002.[12] Written informed consent was taken from all the potential participants of this study before the start after a complete description of the study. Non-dialysis-dependent CKD patients fulfilling the above-mentioned inclusion and exclusion criteria presenting at nephrology OPD were included in the study. Venous blood was taken from the participants between 9 and 11a.m. after 12 hours of fasting. Complete blood count (CBC) and serum ferritin were assessed for all the individuals at the presentation time. CBC was measured by using an automated analyzer. Serum ferritin was measured according to the standard methods at the hospital laboratory. Haemoglobin values of <12g/dl were taken as low haemoglobin levels, and serum ferritin levels <15ng/mL were taken as low.[13,14]

All statistical analysis was performed using Statistics Package for Social Sciences version 24.0 (SPSS-24.0). Characteristics of participants and the distribution of the haemoglobin and ferritin levels were described using descriptive statistics. In addition, Chi-square was applied to find the association of age, gender, CKD duration and BMI with low haemoglobin and ferritin levels among the target population. Differences between groups were considered significant if *p*-values were less than or equal to 0.05.

RESULTS

The target population was all the non-dialysis dependent CKD Stage-5 patients. However, after applying inclusion and exclusion criteria and the consent of the individuals, 800 patients were finally recruited in the study from whom data could be collected and analyzed. Out of 800 non-dialysis chronic kidney disease patients in the study, 421 (52.7%) patients were males, and 379(46.3%) were females. The mean age of the study participants was 33.343±6.431 years, and the mean duration of CKD was 3.237±8.781 years. In addition, 426(53.25%) patients had haemoglobin levels within the normal range, while 374(46.75%) patients had low haemog-lobin levels. In addition, 449(56.2%) patients had normal ferritin levels, while 351(43.8%) patients had low ferritin levels (Table-I).

Table-I: Characteristics of Non-Dialysis Dependent Chronic Kidney Disease Patients Included in the Study (n=800)

Study Parameters	n (%)
Age of Patients (years)	
Mean±SD	33.343±6.431
Range (min-max)	19-64
Gender	
Male	421 (52.6%)
Female	379 (47.4%)
Mean duration of chronic kidneydisease	3.237±8.781 years
Hemoglobin levels	
Normal	426 (53.25%)
Low	374 (46.75%)
Ferritin levels	
Normal	449 (56.2%)
Low	351 (43.8%)
Type II Diabetes mellitus	
No	388 (48.5%)
Yes	412 (51.5%)
Hypertension	
No	410 (51.25%)
Yes	390 (48.75%)

It was found that long duration of illness (*p*-value<0.001) and female gender (*p*-value-0.004) had a significant association with the presence of low haemoglobin/ferritin levels among the non-dialysis patients of chronic kidney disease Stage-5. In contrast, age of the patients (*p*-value-0.084) and body mass index (*p*-value-0.215) had no such association with low blood indices in our study (Table-II).

DISCUSSION

Chronic kidney disease evolves as a multisystem disorder in most patients affecting the whole homeo-

stasis and hemostasis of the body. Haemo-globin level falls gradually in these patients due to multiple factors.

Table-II: Outcome of Various Variables Studied in the Analysis (n=800)

Factors Studied Total	Normal Hemoglobin and Ferritin (n=329)	Low Hemoglobin or Ferritin (n=471)	*p*-value
Age			
18-50 years	207(62.9%)	324(68.8%)	
50-65 years	122(37.1%)	147 (31.2%)	0.084
Gender			
Male	193(58.6%)	228(48.4%)	
Female	136(41.4%)	243(21.6%)	0.004
Duration of chronic kidney disease			
<2years	234(71.1%)	256(54.3%)	<0.001
>2 years	95(28.9%)	215(45.7%)	
Body Mass Index			
Normal	245(74.5%)	332(70.5%)	0.215
Obese or over weight	84(25.5%)	139(29.5%)	

The treating team needs to be well aware of all these individuals' pathological processes so they can be addressed timely to improve and maintain their overall health-related quality of life. Low iron reserves and anaemia may lead to multiple symptoms in these patients requiring a holistic approach from the treating physicians. We planned and conducted this study intending to look for the presence of low levels of haemoglobin and ferritin among patients of chronic kidney disease (CKD) Stage-5 not undergoing dialysis and factors related to the presence of low levels of haemoglobin and ferritin.

Shiferaw *et al.* conducted a meta-analysis regarding risk factors for anaemia in patients suffering from chronic kidney disease. They came up with the findings that female gender, Stage-5 disease, BMI ≥30 kg/m^2, comorbid illnesses and hypocalcemia were the risk factors associated with the presence of anaemia in CKD patients.[15] Our findings supported the results generated in this recent meta-analysis as female gender and duration of illness were associated with low haemoglobin and ferritin in our study participants.

Anaemia and depleted iron reserves were observed by Wong *et al.* in 2019 among patients of non-dialysis dependent chronic kidney disease Stage 3 to 5.[16] It were concluded that anaemia and iron deficiency were commonly found in non-dialysis CKD patients regardless of their race and ethnicity. Anaemia in patients suffering from CKD was studied from an interesting dimension in 2018 by Hildegard Stancu *et al*.[17] They associated hydration status with the presence of anaemia in these patients. It was concluded that haemoglobin was positively correlated with estimated glomerular filtration rate (eGFR), serum albumin, and transferrin saturation but inversely with OH. Variables we studied for having an association with anaemia in non-dialysis CKD patients were different. A study of anaemia in non-dialysis-dependent chronic kidney disease with special reference to serum hepcidin was published by Goyal *et al.* in 2017. They revealed low ferritin and haemo-globin levels in high-Stage CKD patients. Also, hepcidin levels were associated with iron depletion.[18] We found that low levels of haemoglobin and ferritin were common findings in our data set, and female patients and those with longer duration of illness suffered more from this problem.

STUDY LIMITATIONS

Transferrin levels and total iron binding capacity would have given better results for iron indices but were not done because of cost issues.

CONCLUSION

Low levels of haemoglobin and ferritin were found in most patients suffering from chronic kidney disease Stage-5 and not undergoing hemodialysis. Therefore, special attention should be paid to female patients and patients with a longer duration of chronic kidney disease.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SA & JAK: Conception, study design, drafting the manuscript, critical review, approval of the final version to be published.

FAS & FA: Data acquisition, data analysis, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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