


A Comparative Analysis of Anemia Prevalence in Renal Failure Patients and Healthy Controls

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Abstract

Background: Anemia is a common complication in patients with renal failure, defined by reduced hemoglobin levels or red blood cell counts.

Objective: This study aimed to provide a comprehensive comparative analysis of anemia in patients with renal failure and healthy persons

Methodology: Fifty participants, including 25 renal failure patients and 25 healthy individuals, were included in this study. Blood samples were collected, and CBCs (CBC) were performed to assess various parameters, including ferritin, mean corpuscular volume (MCV), hemoglobin (Hb), and red blood cell count (RBC). Data was analyzed using SPSS software, employing various statistical tests to compare the two groups.

Results: The study found that 88% of renal failure patients experienced severe anemia, highlighting its higher prevalence in this group. Additionally, 56% of renal failure patients had elevated MCV, aligning with previous research. Furthermore, 36% of renal failure patients exhibited lower ferritin levels, suggesting potential associations between anemia and systemic inflammation

Conclusion: Anemia in renal failure patients is more prevalent and severe, emphasizing the importance of timely intervention to enhance their well-being. Iron supplementation and erythropoiesis-stimulating agents play a pivotal role in managing anemia in this population.

Keywords: anemia; renal failure; hematological parameters; ferritin levels

Introduction

Anemia is a common medical illness that is primarily common in patients with renal failure [1-3]. It is defined by a decrease in hemoglobin levels or red blood cell count [4]. Improving the general health and quality of life of individuals with renal failure requires an

understanding of the unique characteristics of anemia [5-7]. Through the examination of several clinical data sets, such as hematological parameters, comorbidities, and treatment results [8], this study attempts to improve our knowledge of the effects of anemia on patients with renal failure.

This study aimed to provide a comprehensive comparative analysis of anemia in patients with renal failure and healthy persons. In order to provide insight into the different prevalence, severity, and underlying causes of anemia in these two different groups, this study aimed to identify specific variables that contribute to anemia in the setting of renal failure. Its ultimate goal is to aid in the creation of management and intervention techniques that are more successful. It is expected that the results of this study would direct medical professionals in providing individualized treatment, eventually enhancing the quality of life for those suffering from both anemia and renal failure. By conducting a thorough analysis, this study will close the knowledge gap in the industry and present fresh ideas on the treatment of anemia when renal failure is present.

Materials and methods

Sample Size

Fifty people in all, including 25 patients with renal failure and 25 healthy persons, took part in the study in the Lady Reading Hospital, Peshawar, Pakistan. The availability of appropriate volunteers and pragmatic concerns were taken into account while choosing this sample size.

Inclusion Criteria

To participate in this study, individuals must have stable kidney function, demonstrated by blood tests conducted between March 2022 and July 2022. Additionally, they must not have received erythropoietin or a blood transfusion within the three months preceding the study commencement.

Exclusion Criteria

To maintain the study's integrity and ensure the validity of the results, certain individuals were excluded from participation. These exclusions included those who had experienced an acute illness within the previous two weeks, lacked essential clinical or biochemical data, were taking immunosuppressant medications or undergoing chemotherapy, had received a blood transfusion or were taking erythropoietin within the previous three months, or exhibited macrocytic anemia (iron deficiency) or microcytic anemia (vitamin B12 and folate deficit).

Data Collection

Every individual had a 2.5 ml sample of blood drawn using reusable, sterilized syringes. To avoid clotting, the blood samples were gently mixed and rinsed right away in an EDTA container. To guarantee traceability, the participant's identification number was written on the tag of each container.

Laboratory Analysis

A hematological analyzer was used to perform a CBC, which yielded information on 20 parameters, including ferritin, MCV, hemoglobin (Hb), and RBC.

Data Analysis

The Statistical Package for Social Science (SPSS) software, version 22, was used to evaluate the data that had been gathered. To assess the significance of differences between the healthy persons and patients with renal failure, a range of statistical tests were utilized. For all analyses, a p-value of less than 0.05 was deemed statistically significant, signifying the existence of significant correlations or variations in the data.

Ethical approval

The ethical permission for this research was received from Lady Reading Hospital, Peshawar, Pakistan and it was carried out in accordance with ethical principles. Prior to being included in the study, each subject gave their informed permission. The research has been complied with all relevant national regulations, institutional policies and in accordance with the tenets of the Helsinki Declaration.

Results

Fifty participants participated in the study; of these, male patients made up twenty-one (42%) and female patients made up twenty-nine (58%). CBC tests were performed on both normal and renal failure patients. Of the normal male and female patient populations, there were 18.00% and 32.00% of each, respectively, while 24% and 26% of the renal failure patient populations were male (n = 12) and female (n = 13; Table 1).

Table 1: Gender Distribution and Anemia Prevalence among Patients with Renal Failure and Normal Individuals

Gender	Total	Normal	Patients With Renal Failure
Male	21 (42%)	(9) 18%	(12) 24%
Female	29 (58%)	(16) 32%	(13) 26%
Total	50	25	25

Of the twenty-five normal persons, eighteen patients (72%) had severe anemia, while seven patients (28%) did not. Of the 25 individuals suffering from renal insufficiency, three patients (12%) with renal failure did

not have severe anemia, but 22 patients (88%) with renal failure did (Table 2).

Table 2: Anemia Prevalence by Participant Group

Participant Group	Severe Anemia (Yes)	Severe Anemia (No)	Total Participants
Normal Individuals	18 (72.00%)	7 (28.00%)	25
Patients with Renal Failure	22 (88.00%)	3 (12.00%)	25
Total	40	10	50

The MCV and the participants' correlation revealed that, among the 25 patients with renal failure, 14 (56%) and 19 (76%) had low MCVs, respectively (Table 3).

Table 3: MCV Status by Participant Group

Participant Group	MCV Low (Yes)	MCV Low (No)	Total Participants
Normal Individuals	19 (76.00%)	6 (24.00%)	25
Patients with Renal Failure	14 (56.00%)	11 (44.00%)	25
Total	33	17	50

Additionally, 18 individuals (72%) have normal ferritin levels, but 7 (28%) of the 25 normal patients have low ferritin levels. Moreover, low ferritin levels are present in 9 (36%) of the 25 individuals with renal failure (Table 4).

Table 4: Ferritin Level Status in Different Participant Groups

Participant Group	Ferritin Low (Yes)	Ferritin Normal (No)	Total Participants
Normal Individuals	7 (28.00%)	18 (72.00%)	25
Patients with Renal Failure	9 (36.00%)	16 (64.00%)	25
Total	16	34	50

Discussion

Hb levels were not substantially lower in the patients with renal failure or the normal persons in our research. Our results are in line with earlier studies by Cook et al. from 2003 [9], which documented regular patterns in CBC data. Interestingly, our investigation found that patients with renal failure had significantly higher MCV, which is consistent with previous findings [10–12]. Numerous researches have confirmed that although the RBC count is much lower in patients with renal failure, this result is consistent with previous studies [1, 13, 14].

According to our investigation, there was a decrease in RBC formation as a result of chronic renal failure. It is noteworthy that individuals with CKD usually have higher levels of the acute phase reactant ferritin. Given that ferritin synthesis reacts to inflammatory cytokines, elevated ferritin levels in CKD are probably the consequence of systemic inflammation. However, several studies have also suggested that ferritin levels, whether normal or increased, do not provide protection against CKD [15].

Anemic individuals were eliminated in line with prior research findings in order to preserve the study's emphasis on hemoglobin concentration and minimize the impact of other hematological variables that could be impacted by metabolic disorders. Since Hb concentration and RBC count are closely connected, it is important to understand that anything impacting one would also influence the other. Autonomic neuropathy may have an impact on the reduction of sympathetic stimulation of

erythropoietin production after renal denervation, as evidenced by the association between reduced erythropoietin production and the prevalence of CKD in patients.

Conclusion

The results of the study indicate that RBC production, functioning, and morphological characteristics are all significantly impacted by renal failure. Moreover, a shorter RBC lifetime may result from the presence of many chronic diseases. It is claimed that the main cause of chronic anemia is the body's incapacity to produce more erythropoietin in reaction to a drop in hemoglobin levels. Iron deficiency, a disorder that may be treated, is often linked to anemia in people with CKD. The most common treatments for anemia in patients with CKD are iron supplements and erythropoiesis-stimulating agents.

Conflict of interest

The authors state no conflict of interest.

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