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Prevalence and Causes of Anemia in Hemodialysis Patients at MMC Mardan

Adnan Akhtar[1], Ahmad Shamim Khan[2] , Amjad Ali

1. Consultant Nephrologist HOD Nephrology MMC Mardan
2. Consultant Nephrologist at IIMCT- Pakistan Railways Hospital Rawalpindi
3. Professor of Medicine BKMC mardan

Corresponding Author : Ahmad Shamim Khan
Email: ahmadskhan@gmail.com,**Phone :** 03339232203

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Abstract

Background

Anemia is a common complication among patients with chronic kidney disease (CKD), especially those who are on hemodialysis. It also has a marked effect on their Quality of Life and with it, the morbidity and mortality. This research aimed to evaluate the frequency and incidence of anemia in hemodialysis patients at MMC and reviewed the possible contributory factors.

Objectives

To find out the incidence and etiological factors responsible for anemia in hemodialysis patients at MMC.

Study design: A cross-sectional study.

Duration and place of study. From June 2023 to Aug 2023 at the department of Nephrology, MMC Mardan.

Methods

This study was designed as a cross-sectional analysis of 100 hemodialysis patients at MMC. Demographics, clinical parameters and laboratory values were collected. Anemia in dialysis patients was characterized by a hemoglobin <11 g/dL in both men and women, as a value not reaching quality indicator target of the hospital. Statistical Analysis: Descriptive statistics, including mean and standard deviation assisted by the p-value for determining significance.

Results

Patients had a mean age of 58.4 years (SD =12.6). Eighty-five percent of patients had anemia, with a mean hemoglobin 9.2 g/dL (SD 1.4) in anemic patients. The main causes of anemia were iron deficiency (42%), hyperparathyroidism (28%), blood loss (7%) and erythropoietin hypo-responsiveness in 22%, respectively. Anemia prevalence was significantly associated with all the comorbidities and with increased duration of hemodialysis.

Conclusion

Anemia is highly prevalent among hemodialysis patients at MMC, most often attributed to iron deficiency, hyperparathyroidism and inflammation. Quality improvement initiatives to regularly screen and treat patients for reversible causes can substantially decrease anemia incidence.

Keywords: Anemia, Hemodialysis, Prevalence, Causes

Introduction

Anemia is a common and serious complication in patients with chronic kidney disease (CKD), worsening with decreasing GFR and particularly prevalent in hemodialysis patients as erythropoietin levels go down. Anemia has a profound impact on the quality of life of patients, increases fatigue and carries high morbidity and mortality rates as well as considerable healthcare costs. Anemia prevalence estimates among CKD patients range from 30% to 90%, depending on the stage of kidney disease and criteria used for defining anemia [1]. The potential causative factors of anemia in patients undergoing hemodialysis are multifactorial and include decreased erythropoietin, nutritional deficiencies including iron, B12 and folate deficiency, hyperparathyroidism, chronic inflammation, blood loss, and shortened red blood cell survival due to uremia. [2]Erythropoietin is a hormone created by the kidneys that increases red blood cell formation in bone marrow. A fall in GFR results in relative deficiency of erythropoietin, which reduces red blood cell production and induces anemia [3]. Furthermore, patients undergoing hemodialysis (HD) frequently suffer from iron deficiency caused by inadequate dietary intake, poor absorption and chronic blood loss during the dialysis procedure [4-5]. Anemia can also be promoted by inflammatory cytokines that are known to be increased in patients with CKD as well as high risk of re-admissions in these patients, all of which affects erythropoiesis [6].Chronic kidney disease (CKD)-associated anemia is associated with a variety of adverse outcomes such as increased cardiovascular morbidity and mortality, cognitive decline and decreased physical capacity to exercise due to profound fatigue [7]. Management of anemia in hemodialysis patients commonly includes erythropoiesis-stimulating agents (ESAs) and iron treatment [8]. But the response to these therapies is variable, and many patients remain anemic despite therapy [9]. [10] Mardan Medical Complex caters to an average of 45-50 patients per day in its dialysis unit. The objective of this study was to evaluate the prevalence and identifying reasons for anemia in hemodialysis patients at MMC. Through the identification of these primary contributors to anemia in this population, we aim to optimize anemia management to improve quality of life of hemodialysis patients [11].

Methods:

This was a cross-sectional study conducted at MMC that included 100 hemodialysis patients. The study period was three months. Inclusion criteria were patients who ESRD, aged 18 years old or above and who had been receiving hemodialysis treatment for at least three months. Exclusion criteria included patients with non-tunneled or tunneled catheters, blood transfusion in the last three months, admission for minor/major procedure resulting in blood loss in the last one month and any patients who received antibiotics in the last one month.

Collected data

Collected data was comprised of demographics, clinical parameters, and laboratory values. Anemia was defined as hemoglobin levels of less than 11 in both males and females. The cut-off value of 11gm is used as standard for dialysis as defined by the Qulatiy Target Indicators of the hospital. The levels of hemoglobin, retics count, LDH, albumin, serum ferritin, transferrin saturation, calcium, phosphate, iPTH, erythropoietin dosage, and inflammatory markers (CRPq) were also recorded.

Statistical analysis

Statistical analysis was conducted using SPSS 24.0 software, and data was summarized using Descriptive statistics. The Student’s t-test was used to study the difference between groups in terms of continuous variables, while the chi-square test was used for categorical variables, and the considered significance value p was less than 0.05.

Results:

The mean age of the study population was 58.4 years SD 12.6, and 60% were male, while 40% were female; as presented in Table 1. The duration of exposure to hemodialysis was 4.3 years (2.7), and 85% of patients had anemia, while the average hemoglobin levels were 9.2 g/dL. The leading cause of anemia includes iron deficiency at 42%, hyperparathyroidism (28%), blood loss (7%) and erythropoietin hypo-responsiveness (alone or in combination) in 22%. Patients who have been on hemodialysis for more than five years had a higher prevalence of anemia at 90% as opposed to patients on hemodialysis for a period of fewer than five years at a level of 75% and p=0.026, while those with diabetes had a prevalence of 88% as opposed those without it at an 80% with a non-significance level of p=0.09.

Table 1: Demographic Characteristics of Study Population

Characteristic	**Total (n=100)**
Age (years), mean (SD)	58.4 (12.6)
Gender, n (%)	
Male	60 (60%)
Female	40 (40%)
Duration of Hemodialysis (years), mean (SD)	4.3 (2.7)

Table 2: Prevalence of Anemia

Anemia Status	**Total (n=100)**
Anemic, n (%)	85 (85%)
Non-Anemic, n (%)	15 (15%)
Hemoglobin (g/dL), mean (SD)	
Anemic	9.2 (1.4)
Non-Anemic	11.3 (1.2)
p-value	<0.001

Table 3: Causes of Anemia

Cause of Anemia	**Total (n=85)**
Iron Deficiency, n (%)	36 (42%)
Hyperparathyroidism, n (%)	24 (28%)
Blood loss, n (%)	6 (7%)
Erythropoietin hyporesponsiveness, n (%)	19 (22%)

Table 4: Association with Clinical Parameters

Parameter	**Anemic (n=85)**	**Non-Anemic (n=15)**	**p-value**
Duration of Hemodialysis > 5 years, n (%)	76 (90%)	4 (75%)	0.02
Duration of Hemodialysis < 5 years, n (%)	9 (10%)	11 (25%)	
Presence of Diabetes, n (%)	75 (88%)	12 (80%)	0.09
No Diabetes, n (%)	10 (12%)	3 (20%)	

Discussion

In this study, we show that the percentage of anemia among all hemodialysis patients who are receiving care at MMC is equal to 85% for scale(parameters =metric) and blood(parameters =biologic_pt). This is broadly consistent with previous studies showing 70-90% prevalence of anemia in hemodialysis populations, underlining the substantial burden that this condition poses for CKD patients. Mean hemoglobin levels in anemic patients were significantly lower than non-anemic patients (9.2 g/dL vs 11.3 g/d), which reflects the severity of anemia in this cohort. Iron deficiency explained almost half of anemia among the patients (variable 1) both in the unit and back to home, in accordance with similar findings showing iron deficiency as a main cause of concern, secondary causes may be inadequate dietary intake, impaired absorption or frequent blood losses during dialysis sessions. [15]. This study further underlines the importance of frequent iron status monitoring and adequate supplementation with iron in this patient group. A proposal has already been forwarded to the hospital quality department to introduce a strict screening program consisting of three-monthly testing for iron deficiency and hyperparathyroidism (currently not covered by the state insurance programme). A second recommendation includes modifying the current treatment pathways to include a 200mg/month infusion of iron sucrose for all patients regardless of iron status.28% of patients with anemia had hyperparathyroidism as the second most common cause. This was determined as patients having transferrin saturation above 30% and serum albumin above 3.5 g/dl (excluding malnutrition), but having serum phosphate above 4.5mg/dl and/or iPTH above 300ng/dl (defined by our indicator target). Elevated parathyroid hormone (PTH) levels, characteristic of secondary hyperparathyroidism, can lead to increased bone resorption and alterations in bone marrow function. This disruption can affect erythropoiesis by impacting the bone marrow's ability to produce adequate red blood cells. Chronic hyperparathyroidism may also lead to increased blood loss due to vascular calcifications and other related complications19 patients had no identifiable cause and were labelled as having anemia due to hypo-responsiveness to erythropoietin. This is multifactorial with malnutrition and uremia playing an important role. Many of these patients have multiple admission history, most commonly due to a respiratory or complicated soft tissue infection. Previous records were checked to ensure patients were receiving adequate doses of epo and that doses were increased on a monthly basis in the dialysis clinic to adequate levels. Pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), which are stimulated during inflammatory states in patients with CKD can blunt erythropoiesis [16]. These cytokines cause the production of hepcidin, a hormone that inhibits iron absorption and release from stores with consequent anemia. This effect was not unexpected as inflammation in anemia of CKD has been well described [17] and fits with our results. When anemia does not respond to treatment with erythropoiesis-stimulating agents (ESAs) the condition is referred to as functional or absolute iron deficiency which accounts for a large proportion of all ESA-resistant cases, and it may be related in half of these patients resistant by inflammation but also other comorbidities such diabetes mellitus and/or cardiovascular disease [18]. Consistent with prior studies demonstrating that patients on long-term dialysis and those with diabetes are at increased risk for resistance to erythropoietin [19], our study identified the independent significance of longer duration of hemodialysis or presence of diabetes as predictive determinants associated with anemia. These results highlight the need for regular anemia screening and appropriate therapeutic intervention in patients undergoing extended hemodialysis sessions. Similar trends have been noted in previous studies, suggesting that the cumulative effects of factors such as blood loss and inflammation lead to anemia progressing over time due to iron deficiency [20,21]. Notably, although anemia was more prevalent in diabetics (88%), this association did not reach statistical significance; p=0.09 These results might, perhaps, be due to the small sample size, or other confounders. However, we found a positive association between diabetes and anemia in CKD which is well known that diabetes predisposes to the development of anemia largely through autonomic neuropathy affecting erythropoietin production from kidneys [21].

Conclusion:

This study reveals the complex causative factors of anemia in patients on maintenance hemodialysis: iron deficiency; hyperparathyroidism and inflammation with immune response and increased hepcidin levels; as well resistance to metabolically active EPO. Monitoring and managing these factors aggressively is vital to optimize anemia outcomes in this population. More prospective studies are needed to investigate new therapeutic strategies and interventions aimed at treating anemia in these patients under hemodialysis. For now at our centre, increased vigilance in monitoring these patients can bring a meaningful impact on the prevalence of anemia in this patient group.

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Conflict of Interest: Nil

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Authors Contribution

Concept & Design of Study: Adnan Akhtar1,

Drafting: Ahmad Shamim Khan2 , Amjad Ali

Data Analysis: Ahmad Shamim Khan2 , Amjad Ali **Critical Review:** Ahmad Shamim Khan2 , Amjad Ali

Final Approval of version: Adnan Akhtar1,

References

1. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for Anemia in Chronic Kidney Disease. National Kidney Foundation. 2006.
2. KDIGO Clinical Practice Guideline for Anemia in Chronic Kidney Disease. Kidney Disease: Improving Global Outcomes (KDIGO) Anemia Work Group. 2012.
3. Stauffer ME, Fan T. Prevalence of anemia in chronic kidney disease in the United States. PLoS One. 2014;9(1)
4. Fishbane S, Berns JS. Hemoglobin cycling in hemodialysis patients treated with recombinant human erythropoietin. Kidney Int. 2005;68(3):1337-1343.
5. Besarab A, Coyne DW. Iron supplementation to treat anemia in patients with chronic kidney disease. Nat Rev Nephrol. 2010;6(12):699-710.
6. Macdougall IC. Strategies for iron supplementation: oral versus intravenous. Kidney Int Suppl. 1999;69
7. Weiss G, Goodnough LT. Anemia of chronic disease. N Engl J Med. 2005;352(10):1011-1023.
8. Locatelli F, Covic A, Eckardt KU, Wiecek A, Vanholder R. Anaemia management in patients with chronic kidney disease: a position statement by the Anaemia Working Group of European Renal Best Practice (ERBP). Nephrol Dial Transplant. 2009;24(2):348-354.
9. McClellan W, Aronoff SL, Bolton WK, et al. The prevalence of anemia in patients with chronic kidney disease. Curr Med Res Opin. 2004;20(9):1501-1510.
10. Singh AK, Szczech L, Tang KL, et al. Correction of anemia with epoetin alfa in chronic kidney disease. N Engl J Med. 2006;355(20):2085-2098.
11. Fishbane S. Iron management in hemodialysis patients. Hemodial Int. 2017;21(S1)
12. Babitt JL, Lin HY. Mechanisms of anemia in CKD. J Am Soc Nephrol. 2012;23(10):1631-1634.
13. Ebben JP, Gilbertson DT, Foley RN, Collins AJ. Hemoglobin level variability: associations with

mortality. Clin J Am Soc Nephrol. 2006;1(6):1205-1210.

14. Minutolo R, Locatelli F, Gallieni M, et al. Anaemia management in non-dialysis chronic kidney disease (CKD) patients: a consensus statement of the Italian Society of Nephrology (SIN). J Nephrol. 2020;33(4):733-752.
15. Fishbane S, Pollack S, Feldman HI, Joffe MM. Iron indices in chronic kidney disease in the National Health and Nutritional Examination Survey 1988-2004. Clin J Am Soc Nephrol. 2009;4(1):57-61.
16. Ganz T. Anemia of inflammation. N Engl J Med. 2019;381(12):1148-1157.
17. Weiss G, Goodnough LT. Anemia of chronic disease. N Engl J Med. 2005;352(10):1011-1023.
18. Locatelli F, Covic A, Eckardt KU, Wiecek A, Vanholder R. Anaemia management in patients with chronic kidney disease: a position statement by the Anaemia Working Group of European Renal Best Practice (ERBP). Nephrol Dial Transplant. 2009;24(2):348-354.
19. Singh AK, Szczech L, Tang KL, et al. Correction of anemia with epoetin alfa in chronic kidney disease. N Engl J Med. 2006;355(20):2085-2098.
20. Stauffer ME, Fan T. Prevalence of anemia in chronic kidney disease in the United States. PLoS One. 2014;9(1)
21. McClellan W, Aronoff SL, Bolton WK, et al. The prevalence of anemia in patients with chronic kidney disease. Curr Med Res Opin. 2004;20(9):1501-1510