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Original Article

Prevalence of Anemia in End Stage Renal Disease Patients on Maintenance Hemodialysis

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ABSTRACT

Anemia is a significant complication in patients with End Stage Renal Disease (ESRD), leading to increased morbidity, mortality, and reduced quality of life, particularly in that undergoing maintenance hemodialysis. **Objective:** To determine the frequency of anemia in ESRD patients receiving maintenance hemodialysis. **Methods:** This descriptive cross-sectional study enrolled consecutively all patients aged 18 to 70 years, of both genders, with ESRD on maintenance hemodialysis. Anemia was defined as a hemoglobin concentration below 13.0 g/dl in men and postmenopausal women, and below 12.0 g/dl in other women, based on diagnoses from the last three months. Baseline and predictor variables, including age, gender, duration of ESRD, duration of hemodialysis, and various laboratory parameters (hemoglobin, MCV, serum iron level, serum TIBC level, ferritin level, and Tsf level) were observed. **Results:** The study included 196 patients, with a mean age of 54.76 ± 10.38 years. Of these, 71 (36.2%) were females and 125 (63.8%) were males. The mean duration of ESRD was 5.71 ± 0.92 months, mean corpuscular volume (MCV) was 86.92 ± 13.66, serum iron level was 40.82 ± 5.23, serum total iron-binding capacity (TIBC) level was 220.82 ± 43.13. Anemia was present in 57.7% of patients. **Conclusions:** This study revealed a significantly higher prevalence of anemia in ESRD patients undergoing maintenance hemodialysis. These results highlight the significance of managing anemia in these patient population in order to improve outcomes and raise their quality of life.

INTRODUCTION

More than 20 million people in the US alone are affected by chronic kidney disease (CKD), a complicated condition [1]. The advancement of CKD is linked to a number of significant side effects, such as an increased risk of cardiovascular illnesses, hyperlipidemia, anemia, and metabolic bone disease [2]. The kidney's job is to filter blood, eliminate waste, and preserve the proper ratio of fluids and electrolytes. A glomerular filtration rate (GFR) of less than 60 ml/min/1.73 m2 and structural and functional renal abnormalities are indicators of CKD [3]. In the US, the prevalence of CKD ranges from 1.5 to 15.6 percent, with 14 percent of adults suffering from the condition between 2007 and 2010 [4]. When compared to the general population (7.6 percent), anemia is twice as common in those with CKD (15.4 percent) [5]. The prevalence of anemia increases with the stage of CKD, from 8.4% in stage I to 53.4% in stage 5 [6]. In Pakistan, the overall prevalence of CKD is reported to be 12.5% [7]. Hypertension, diabetes,

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higher triglycerides, and stroke are among the independent risk factors associated with CKD in the Pakistani population [8]. High mortality among patients with advanced renal failure is directly related to the severity of anemia and hypoalbuminemia, particularly within the first six months [9]. According to the Kidney Disease Improving Global Outcome (KDIGO) guidelines, patients should be referred to a nephrologist when their GFR is less than 60 ml/min/1.73m2 and must be referred when GFR is less than 30 ml/min/1.73m2 [10]. The treatment of CKD involves halting its progression, managing complications, and preparing patients for renal replacement therapy [11]. Anemia is a common complication of CKD and can lead to detrimental clinical outcomes. Early recognition and treatment of anemia can potentially improve cardiovascular morbidity and mortality [12, 13]. The prevalence and severity of anemia increase as renal function declines, particularly when GFR reaches 60 ml/min/1.73m2 or less [14]. Anemia of chronic disease, the second most prevalent type of anemia after iron deficiency anemia, often occurs in response to systemic illness or inflammation [15]. The study was conducted with an aim to determine the frequency of anemia among our local ESRD patients undergoing hemodialysis. With a heavy burden of anemia, policies should be developed to regularly screen CKD patients for early recognition and early treatment of anemia in order to improve quality of life of patients.

METHODS

The descriptive cross-sectional study was conducted in the Department of Nephrology at Liaquat University of Medical and Health Sciences in Jamshoro from July 2021 to Dec 2021. Non-probability consecutive sampling technique was employed, and the sample size was determined using OpenEpi with expected prevalence of anemia as 53.4% with a margin of error of 7% and a confidence level of 95%, resulting in a sample size of 196 cases 18 to 70 years, of both genders, with end-stage renal disease on maintenance hemodialysis for at least 3 months (i.e., thrice per week hemodialysis sessions, each lasting 4 hours). Patients with other genetic causes of anemia such as sickle cell anemia or thalassemia, as well as those taking drugs likely to cause bone marrow suppression, were excluded from the study. Data were collected from patients after taking informed written consent. The principal investigator collected the patients' history, specifically focusing on symptoms of anemia such as fatigue, weakness, palpitations, shortness of breath, dizziness, or light-headedness, as well as decreased energy levels and physical capacity. Investigations were done to measure hemoglobin concentrations, mean corpuscular volume (MCV), and the iron profile, which included the levels of serum iron, ferritin, and transferrin saturation. Additionally, measurements of body mass index (BMI), weight, and height were taken. On a pre-made proforma, all the data that were gathered were recorded. In order to analyze the data, SPSS version 21.0 was used. Descriptive statistics and the post-stratification chi-square test were used to analyze the data using SPSS version-21, with a p-value of 0.05 or less being considered statistically significant.

RESULTS

196 individuals with end-stage renal disease who were receiving continuous hemodialysis were included in the study. The mean age of the patients was 54.76 ± 10.38 years, with 76 patients (38.8%) aged 55 years or younger and 120 patients (61.2%) older than 55 years. Among the participants, 71 (36.2%) were females and 125 (63.8%) were males. The mean weight, height, and BMI of the patients were 60.11 ± 5.08 kg, 1.54 ± 0.05 m, and 27.85 ± 4.74 kg/m^2, respectively. A total of 110 patients (56.1%) had a BMI of 30 kg/m2 or lower, while 86 patients (43.9%) had a BMI higher than 30 kg/m^2 (Table 1). An average of 5.71 0.92 months passed during the course of end-stage renal illness, with 112 patients (57.1%) having a duration of 7 months or less and 84 patients (42.9%) having a period more than 7 months. The average time spent receiving hemodialysis was 7.27 0.69 months, with 50 patients (25.5%) receiving it for fewer than 5 months and 146 patients (74.5%) receiving it for more than 5 months. Diabetes and hypertension were observed in 124 individuals (63.3%) and 136 patients (69.4%), respectively (Table 1).

Table 1: Baseline characteristics of patients (n=196)

Characteristics		Mean ± SD
Age (Years)		54.76 ± 10.38
Weight (Kg)		60.11 ± 5.08
Height, (M)		1.54 ± 0.05
BMI (Kg/m^2)		27.85 ± 4.74
Duration of ESRD (Months)		5.71 ± 0.92
Duration of Hemodialysis (Months)		7.27 ± 0.69
Hypertension N (%)	Present	136 (69.4%)
	Absent	60 (30.6%)
Diabetes Mellitus N (%)	Present	124 (63.3%)
	Absent	72 (36.7%)

Regarding laboratory parameters, the mean hemoglobin level was 10.67 ± 2.54 g/dl, mean corpuscular volume (MCV) was 86.92 ± 13.66, serum iron level was 40.82 ± 5.23, serum total iron-binding capacity (TIBC) level was 220.82 ± 43.13, ferritin level was 3854.3 ± 1687.9, and transferrin saturation (Tsf) level was 48.83 ± 13.74. Anemia was present 57.7% of the patients (Table 2).

Table 2: Laboratory parameters of patients (N=196)

Parameters	Mean ± SD
Hemoglobin (g/dl)	10.67 ± 2.54
MCV (fl)	86.92 ± 13.66
Serum Iron (mcg/dL)	40.82 ± 5.23

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Parameters	Mean ± SD
Serum TIBC (mcg/dL)	220.82 ± 43.13
Ferritin (ng/mL)	3854.3 ± 1687.9
Transferrin Saturation (%)	48.83 ± 13.74

Comparison of anemia with baseline characteristics shown in table 3.

Table 3: Comparison of anemia with baseline characteristics (N=196)

Characteristics	Anemia	No Anemia	p-value
Age (Years)			
≤55	42 (55%)	34 (45%)	0.590
>55	71 (59%)	49 (41%)	
Gender			
Male	62 (50%)	63 (50%)	0.002
Female	51 (72%)	20 (28%)	
BMI (Kg/M^2)			
≤30	62 (56%)	48 (44%)	0.679
>30	51 (59%)	35 (41%)	
Duration of Hemodialysis (Months)			
≤5	30 (60%)	20 (40%)	0.697
>5	83 (57%)	63 (43%)	
Duration of ESRD (Months)			
≤7	64 (57%)	48 (43%)	0.867
>7	49 (58%)	35 (42%)	
History of Hypertension			
Yes	73 (54%)	63 (46%)	0.090
No	40 (67%)	20 (33%)	
History of Diabetes Mellitus			
Yes	71 (57%)	53 (43%)	0.883
No	42 (58%)	30 (42%)	

DISCUSSION

The goal of this study was to determine the prevalence of anemia among patients with end-stage renal disease (ESRD) receiving maintenance hemodialysis. Patients with ESRD who were receiving hemodialysis and were both genders, between the ages of 18 and 70, were included in the study. This study's findings showed that anemia occurs frequently—57.7 percent of the time. These results are in line with a prior investigation i.e. Nurko *et al.*, who reported the prevalence of anemia as 53.4% [16]. Chronic kidney disease (CKD) is recognized to be accompanied by the complication of anemia, which has negative clinical effects. Early recognition and treatment of anemia can potentially improve cardiovascular morbidity and mortality as reported in study by Dowling *et al.*, [17]. The prevalence and severity of anemia increase as renal function declines, particularly when the glomerular filtration rate (GFR) reaches 60 ml/min/1.73m^2 or less. This is may be due to the presence of erythropoietin deficiency which is also reported as the primary cause of anemia in CKD by Zarychanski and Houston in 2008 [18]. Halting the progression of renal disease in pre-dialysis patients with stage 2-4 CKD can improve energy, work capacity, health-related quality of life, and cardiac function. Anemia of chronic disease, which develops in response to systemic illness or inflammation, is highlighted by the findings of this study as via lower MCV levels. This type of anemia is also reported by Mc Clellan *et al.*, as the second most prevalent form of anemia after iron deficiency anemia [19]. Anemia in CKD patients is associated with various adverse outcomes, including mortality, CKD progression, coronary heart disease, stroke, hospitalization, and decreased quality of life. Effective treatment of anemia is crucial in pre-ESRD patients, and efforts should be made to ensure appropriate therapy. Roxadustat, the only oral hypoxia-inducible factor prolyl hydroxylase inhibitor (HIF-PHI), has been found to be effective in treating renal anemia [20]. Iron deficiency plays a significant role in CKD-related anemia, either due to a true shortage of iron stores (absolute iron deficiency) or a relative (functional) deficiency that impairs the use of available iron stores [21]. It is important to acknowledge that this study had limitations, including its single-center nature and limited sample size. Additionally, important predictor variables such as nutritional assessment and laboratory parameters were not reported. Further large-scale longitudinal studies are recommended to validate the findings of this study.

CONCLUSIONS

This study observed a significantly higher prevalence of anemia among patients with end-stage renal disease (ESRD) who are undergoing maintenance hemodialysis.

Authors Contribution

Conceptualization: RM
Methodology: BD, SK, BH
Formal analysis: RM, MTK
Writing-review and editing: MTK, SB, BH

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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