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ORIGINAL ARTICLE

Prevalence of Iron Deficiency Anemia in Hemodialysis patients at NIKD

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ABSTRACT

Background: Iron deficiency is a cause of anemia in many hemodialysis patients. It remains under diagnosed in patients with kidney diseas and it leads to inappropriate response to erythropoietin. Early diagnosis of this anemia before usage of erythropoietin is important, to prevent prescription of expensive erythropoietin and unnecessary costs to the patient and the health care system. This study was conducted to determine prevalence of iron deficiency anemia in hemodialysis patients.
Methods: This study was cross-sectional comparative study and was conducted at National Institute of Kidney Disease. Sheikh Zayed hospital nephrology department after taking permission from concerned department. Informed consent was taken from patients also. We measured serum ferritin, serum iron, Total iron binding capacity, complete blood count, hemoglobin in 140 hemodialysis patients. Serum samples were taken, processed and assessed for ferritin levels using commercially available ELISA kits. P value less than ≤ 0.05 was considered statistically significant.
Results: Out of 140 hemodialysis patients, 34 had Iron deficiency anemia . (IDA).
Conclusion: Iron deficiency anemia was observed in 24.2 % of hemodialysis patients.

INTRODUCTION

Anemia is very common in hemodialysis patients. Anemia causes pallor, fatigue, shortness of breath, early heart failure and early death. Thus it is important to diagnose and treat anemia early. There are many cause of anemia in hemodialysis patients such as erythropoietin deficiency, erythropoietin resistance, iron deficiency, functional iron deficiency and hyperparathyroidism[1]. Hyperparathyroidism causes anemia by down regulating erythropoietin receptors. Erythropoietin deficiency is caused by chronic infection or cancer[2].

Iron deficiency anemia also called classic iron deficiency or Absolute (true) iron deficiency is defined as hemoglobin less than 11g/dl, transferrin saturation less than 20% and serum ferritin concentration is less than 100 ng/ml .[3] This type of iron deficiency in present in upto 20 to 40% of CKD patients[4]. Absolute iron deficiency is caused by iron malabsorption, iron deficient diet or by increased blood loss. Factors that contribute to ongoing blood loss include occult gastrointestinal blood loss in the gastrointestinal tract, blood retained in the dialyzer machine and repeated blood sampling to test for urea, creatinine[5] Patients with absolute iron deficiency must be treated with intravenous iron. Intravenous iron is effective treatment for them[6]. Therefore it is important for clinicians to diagnose Iron deficiency to prevent inappropriate prescription of erythropoietin (an expensive drug) to treat iron deficiency which is a major cause of lack of response to erythropoietin. Such practice will reduce unnecessary costs to patients and health care system[7].

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It is estimated that there are about 5 million patients on dialysis all over the world. So about 1 million patients might be suffering from iron deficiency anemia worldwide[8].We conducted this study to evaluate whether iron deficiency is a major cause of anemia in our population.

MATERIALS AND METHODS

This study was conducted in National institute of Kidney diseases (NIKD) Sheikh Zayed hospital complex after getting approval from Nephrology Department and Sh. Zayed Post Graduate Medical Institute. It was a cross-sectional, comparative study conducted from December 2017 to December 2018. 140 hemodialysis patients of National institute of Kidney disease Sheikh Zayed Hospital were selected. All these patients were on regular hemodialysis for 4-5 hours 3 times a week .The blood flow was between 200 and 300ml/min with the dialysate flow of 500 ml/min. Ultrafiltration varied according to the patient weight. All patients were dialyzed using low-flux polysulphone membrane and low- flux modified cellulose membrane with a bicarbonate buffered dialysate.

The inclusion criteria were patients undergoing hemodialysis for at least 6 months, Adults (Age more than 18 years). The exclusion criteria were : from Positive for

HIV, Hepatitis B ,Hepatitis C, Evidence of significant bleeding during last 6 months , Sepsis ,Hemolytic anemia ,Thrombosis ,Acute cardiovascular complications like acute heart failure , Iron replacement/supplementation during last 6 months ,Blood transfusion during last 6 months, thalassemias, hyperparathyroidism.

Patients were asked for their written informed consent .A demographic questionnaire recorded patient name, age, gender, hospital registration number, length of time receiving hemodialysis. Pulse, temperature, RR was recorded to rule out any acute infection. Acute infection increases ferritin levels. A total of 5ml of venous blood sample was collected prior to dialysis session and before heparin administration. From this 2ml was used in a separate EDTA anticoagulated viol to measure complete blood count including haemoglobin .It was measured by a Automatic cell counter (Abacus 380 Diatron. Budapest, Hungary). Samples were allowed to clot at room temperature overnight. Serum was separated from blood by centrifugation at the rate of 5000 revolution per minutes for 10 minutes and frozen at -20C till the test was performed. 1 ml was used to calculate serum iron and total iron binding capacity at Biochemistry laboratory Sheikh Zayed Hospital by Autoanalyzer. Transferrin saturation was calculated by serum IRON/TIBC X100. 1 ml was used to measure serum ferritin by ELISA Kit. (Chemus bio Science USA, human Ferritin ELISA kit Cat No 10601) 1ml was used to measure Parathyroid hormone (PTH) by ELISA Kit (Diametra, Italy ,Ref DK0157, lot 4424). Serum PTH was measured to rule out secondary renal anemia due to hyperparathyroidism.

Statistical Analysis: The data was entered and analyzed using IBM-SPSS (Statistical Package for Social Sciences) version 20. Mean±SD was given for quantitative variables i.e., age, ferritin concentration, transferrin saturation, duration on dialysis , serum iron, total iron binding protein, hemoglobin, mean corpuscular hemoglobin, mean corpuscular volume and mean corpuscular hemoglobin concentration. Chi square test was to determine the gender difference between groups. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

In this study there were 140 hemodialysis patients . 0ut of them 34 had Iron deficiency anemia (IDA). (24.2%). There were 78 male patients and 62 female patients. Out of 78 males, 19 had IDA. (24.3%) Out of 62 females, 15 had IDA. (24.1%). We found no significant gender difference between patients with Iron deficiency anemia (p value 0.387)

Following table compares the mean of various variables in all hemodialysis patients with mean of variables in patients with iron deficiency anemia.

Table 1: Biochemical characteristics of all hemodialysis patients and patients with iron deficiency anemia

	All Hemodialysis Patients	IDA patients	P value
Age	51 ±13.8	52 ± 11.6	0.455
Gender M/F	78/62	19/15	0.860
Ferritin	487± 316.2	50 ±10.9	< 0.001
Transferrin saturation %	28.2±12.4	10.4 ±4.2	< 0.001
Time duration on hemodialysis of patients	4.0 ±3.93	3.0 ±3.66	0.892
Serum Iron	41.0 ±12.3	40.0 ±9.3	0.483
Total iron binding capacity	233.8±68.3	205.0± 53.8	0.121
Hemoglobin (g/dl)	11.9 ±0.89	9.0±1.03	0.707
Mean Corpuscular volume	76.9±6.5	70.6±5.1	0.108
Mean corpuscular Hemoglobin (Picograms)	27.6 ±2.5	26.8±2.7	0.263
Mean corpuscular hemoglobin concentration	35.6 ±2.0	34.0 ±2.8	0.181

DISCUSSION

Many articles define Iron deficiency anemia as serum ferritin less than 100ng/ml, transferrin saturation less than 20%, Hemoglobin less than 11g/dl. We also used the same criteria for the definition of Iron deficiency anemia[9]. In this study the mean age of all hemodialysis patients (51.7±13.8 years) was similar to mean age of IDA hemodialysis patients (52±11.6 years). The mean duration of years on hemodialysis in all patients was 4.0±3.93 years and patients with Iron deficiency was 3.0±3.66 years. There was no significant difference in duration of years on hemodialysis in both groups (P=0.892). So time duration on hemodialysis and age of patients has no relation to iron deficiency anemia .

In the present study the mean Transferrin saturation of patients with iron deficiency (10.4±4.2%) was less than the mean transferrin saturation of all hemodialysis patients (28.2 ±12.4%). This significance is in accordance with the definition of iron deficiency[14]. Similarly mean serum ferritin concentration of all hemodialysis patients was 487±316.2 ng/ml, on the other hand the mean ferritin concentration of IDA patients was 50± 10.9 ng/ml .In the same way the hemoglobin concentration of IDA patients was significantly less than all other hemodialysis patients as per definition of Iron deficiency anemia.

Our study showed there is no significant difference in mean of serum iron, MCHC, MCV, MCH, and total iron binding capacity between both groups. Thus they cannot be used in the assessment and diagnosis of this disease. Similarly Fusaro et al (2005) Enko et al (2015), Bovy et al in 2007 also found no clear cut advantage in using MCV, MCHC, MCH as indicators of Iron deficiency[10]. None of the patients had hyperparathyroidism.

This study had some limitations. First the patients in our study were ethnically Punjabis and hence caution should be exercised when extrapolating our results to other ethnic groups. Second, this was a single centre study. Third we did not study risk factors for Iron deficiency anemia as our main objective was to determine the prevalence of Iron deficiency anemia among hemodialysis patients in Lahore. The known risk factors are iron deficient

diet, blood loss due to blood retained in dialyzer machine & repeated blood sampling. We did not observe any difference in the prevalence of Iron deficiency anemia among developed and developing countries. In other studies like Biniaz et al (2014) and plastina et al in 2019; no difference was observed in the prevalence of Iron deficiency anemia among developed and developing countries also. Although bone marrow biopsy remains the gold standard for iron deficiency anemia but it is a invasive and complicated procedure .It is reported in literature that erythropoietin deficiency and chronic inflammation are major causes of anemia in chronic kidney disease patients, however our aim is to raise awareness of Iron deficiency anemia in hemodialysis patients to control the serious impact of anemia on hemodialysis patients[11].

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