

Assessment of Serum Ferritin Level among Chronic Renal Failure Patients Subjected to Frequent Hemodialysis and Blood Transfusions

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Abstract: Anemia due to blood loss during hemodialysis is commonly encountered in patients of chronic renal failure. It is managed with frequent blood transfusions that may be accompanied by iron overload. The present study aimed to assess serum Ferritin level among chronic renal failure patients with frequent blood transfusions. This was a case control study conducted in Sudanese Kidney Transplanted Association Hospital in Khartoum-Sudan during the period from November 2018 to February 2019. A total of 50 participants were enrolled for this study consisting of 25 patients undergoing regular hemodialysis and received multiple blood transfusions and 25 matched patients under hemodialysis but without blood transfusions. Serum Ferritin was measured using fully automated chemistry analyzer Cobas®-e411. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 16.0. Mean serum Ferritin level of patients under hem-dialysis and regular blood transfusion was significantly increased compared to those under hem-dialysis without blood transfusion (p value = 0.0000). Moreover, serum Ferritin level showed significant positive correlation with the number of blood units transfused (p value = 0.000, r = 0.855). At the other hand, no significant differences in serum Ferritin level between the study groups according to age and gender of the patients (p values = 0.285 and 0.353 respectively). Patients of chronic renal failure under frequent hemodialysis and blood transfusions are prone to iron overload.

Keywords: Hemodialysis, blood transfusion, serum ferritin, chronic renal failure

1. Introduction

Chronic kidney disease (CKD) may associate with various complications including anemia. Renal anemia may begin to develop in the early stages of CKD commonly due to blood loss from hem-dialysis and tends to worsen as CKD progresses [1]. Moreover, decreased production of erythropoietin, the principal growth factor involved in erythropoiesis and Iron deficiency are another contributing factors in renal anemia [2,3].

Ferritin is a protein found inside cells that stores iron for later use. Measurement of serum Ferritin level is directly related to the amount of iron stored in the body and it is a profound marker of iron status. It appears that pathologic and inflammatory conditions affect this serum constituent too [3,4]. In developing countries, serum Ferritin level is still used as the principal marker for the diagnosis of iron overload or iron deficiency in hemodialysis patients [5]. Clinical guidelines for the use of Fe preparations in hemodialysis patients include an upper limit of serum Ferritin above which cautions with continuation or recommend discontinuation of Fe therapy due to concerns about toxicity [6–8].

Iron overload is a major concern in patients' dependent on regular transfusions as each transfused blood unit contains approximately 200-250 mg of iron per unit. The body has no mechanism for excreting this excess iron. Excess iron deposition may cause organ damage which may involve the liver, endocrine organs, and most importantly the heart [9]. So the early and regular monitoring of serum Ferritin at the beginning of blood transfusion is necessary to avoid such problems.

2. Materials and methods

This was a case control study conducted in Sudanese Kidney Transplanted Association Hospital in Khartoum –Sudan during the period from November 2018 to February 2019. Ethical clearance was taken from faculty of medical laboratory sciences at Sudan International University. Informed consent was taken from each candidate before participation, given that all data and findings are applied for academic research only and ensuring confidentiality of patients' data. A total of 50 CRD patients were included in this study, 25 received multiple blood transfusions (defined as 3 transfusions or more) as cases while the rest 25 without blood transfusions as controls. The cases and controls were matched in terms of general characteristics including age and gender. Venous blood sample (2.5 ml) was collected without anti-coagulant from each participant and left for clotting. Serum was prepared from clotted samples by centrifugation, separated and kept at -20°C for subsequent analysis. Sandwich Immunoassay method was used to measure serum Ferritin using fully automated chemistry analyzer Cobas®-e411 (Roche). Data were analyzed by using the Statistical Package for Social Sciences (SPSS) version 16.0. Mean and SD were calculated for numerical variables, while frequencies and percentages for categorical variables. Independent sample T test and one-way ANOVA were used for comparisons. Pearson's correlation was used for correlation testing. For all tests, p values of < 0.05 were considered statistically significant.

3. Results

A total of 50 participants were enrolled in this study consisting of 50% (25/50) hem-dialyzed patients received multiple blood transfusions and 50% (25/50) hem-dialyzed patients without blood transfusions. There were 48 % (24/50) males and 52 % (26/50) females included in this study. The mean age of study participants is 47 years (Range 25-70 years).

Results showed that, mean serum Ferritin level of patients under hem-dialysis and multiple blood transfusion was significantly higher than those under hem-dialysis without blood transfusion (p . value = 0.000) as shown in Table1.

Table 1: Comparison of mean and standard deviation of ferritin in study and control group

	Cases: n=25 Mean \pm SD	Controls: n=25 Mean \pm SD	p . value
S. Ferritin level (ng/ml)	1992 \pm 1323	635 \pm 164	0.000

Pearson's correlation test showed a significant positive correlation between the number of blood units transfused and serum Ferritin level (p . value = 0.000, r value = 0.855).

At the other hand, serum Ferritin level showed no significant differences between study groups according to age and gender of patients (p . values = 0.285 and 0.353 respectively) Tables 2 and 3.

Table 2: Comparison of mean S. Ferritin level in the study group according to age groups.

Age group	S. Ferritin level (ng/ml) Mean \pm SD	p .value
10-20 years	2015 \pm 1819	0.285
21 – 40 years	1448 \pm 580	
>41 years	2511 \pm 113	

Table (3): Comparison of mean S. Ferritin level in study group according to gender distribution.

S. Ferritin level (ng/ml)	Males (n=13)	Females (n=12)	p . value
Mean \pm SD	2247 \pm 1496	1716 \pm 1104	0.353

4. Discussion

The aim of this study was to evaluate the serum Ferritin level among CKD patients under hem-dialysis and regular blood transfusions. The results revealed significant elevation of serum Ferritin level among patients who received multiple blood transfusions compared with the non-transfused patients (p . value = 0.000). This finding is in agreement with another Sudanese study which reported statistically significant difference in serum Ferritin level between CKD patients received multiple blood transfusions compared with non-transfused patients (p . value 0.01) [10]. Also this finding is in accordance with another studies which reported iron overload in 70% found that iron overload 31% of CKD patients who were subjected to frequent blood transfusions [11,12]. Despite the variable percentages, these findings strength the evidence for the association of frequent blood transfusions with iron overload in CKD patients as indicated by elevated serum Ferritin level. Moreover, this study revealed a significant positive correlation between serum Ferritin and the number of blood units (p . value= 0.000). This finding is consistent with a previous study conducted in sub-Saharan Africa, which reported a positive correlation between the number of transfusion bags and serum Iron as well as serum Ferritin [13]. On the other hand, this study showed no statistically significant differences in serum Ferritin level between study groups according to the age and gender of CKD patients. This finding is in agreement with a previous Sudanese study which reported no association

of gender with serum Ferritin level (p . value = 0.897) [14]. The major limitation in the present study is the small sample size which is related to the financial issue, availability of reagent kits in the market and the relatively short time period of the study.

5. Conclusion

In summary we conclude that CKD patients under hemodialysis and frequent blood transfusions had elevated serum Ferritin level. This elevation is proportional to the number of blood units received by the patients. Periodical evaluation of serum ferritin could be applied to monitor the regular blood transfusion hem-dialysis patients to avoid the risk of iron overload.

Authors contribution

Ahmed, Raja, Sebah and Zuleikha conceptualized and designed the study. Raja, Sebah and Zuleikha conducted the research and wrote the original draft, May wrote the final manuscript. Ahmed revised the final version, then all authors approved the final version of the manuscript.

Data Availability

The data supporting the findings in this study are available to researchers who meet the criteria for access to confidential data from the corresponding author upon request. This will be done after approval of the request by department of hematology, faculty of medical laboratory sciences at Sudan international university.

Conflict of interest

The authors declare no conflicts of interest regarding the publication of this paper.

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