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RESEARCH ARTICLE

ASSESSMENT OF IRON PROFILE AMONG SUDANESE PATIENTS WITH CHRONIC RENAL FAILURE UNDERGOING HEAMODIALYSIS

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ABSTRACT

Background: Anemia is present in the majority of patients with chronic renal failure (CRF) on hemodialysis, The proximate cause of the anemia is an inadequate endogenous erythropoietin (EPO), iron is essential for hemoglobin formation and productive erythropoiesis, accurately assessing iron status is a prerequisite for diagnosing iron deficiency, monitoring the response to iron supplementation, and maintaining effective erythropoiesis in these patients.

Objectives: The aim of this study is to assess iron profile in patient with CRF undergoing hemodialysis and to correlate iron profile result with patient's age, gender and duration of dialysis.

Materials and Methods: A descriptive analytical case control study was performed in Ibn Sina Hospital, Khartoum, Sudan. A total of 80 Sudanese were enrolled in this study (40 CRF patients under hemodialysis and 40 healthy controls), 51 (64%) were male and 29 (36%) were females, their age ranged between 20 to 85 years. Serum iron, saturated transferrin and total iron binding capacity (TIBC) were measured using Biosystem 350 semi-automated spectrophotometer and serum ferritin was measured using Roche Elecsys 2010. Data were analyzed by using statistical package forsocial sciences (SPSS) verssion16.

Results: The present study showed that serum iron and serumferritin of those under hemodialysis patient were significantlyhigher compared to control group (P value 0.00) for both.Also TIBC and transferrin saturated were significantly lowered compared to control group (p value 0.00) for both

Conclusion: Patients with CRF andunder hemodialysis are prone to iron overload.

INTRODUCTION

Chronic renal failure (CRF) also called chronic kidney failure, chronic renal insufficiency, or uremia is a slowly progressive loss of renal function over a period of months or year and defined as an abnormally low glomerular filtration rates (GFR). CRF that leads to severe illness and requires some form of renal replacement therapy such as dialysis is called end-stage renal disease (Levey *et al.,* 2005). CRF occurs in 1.0 of every 5000 people, usually in middle-aged and older people, although children and pregnant women are also susceptible. Anemia commonly occurs in people with chronic kidney disease (CKD) the permanent, partial losses of kidney function. Anemia might begin to develop in the early stages of CKD, when someone has 20 to 50 percent of normal kidney function. Anemia tends to worsen as CK progresses. Most people, who have total loss of kidney function, or kidney failure, have anemia. Iron stores in normal subjects vary between approximately 800 mg to 1200 mg, depending on body size (Council on Food, 1968), although phlebotomy studies suggest that normal iron stores may be as high as 1200 to 1500 mg (Haskins *et al.,* 1952). Ferritin is a protein found inside cells that stores iron so your body can use it later. A ferritin test indirectly measures the amount of iron in your blood. The amount of ferritin in your blood (serum ferritin level) is directly related to the amount of iron stored in your body. Iron-binding capacity is usually measured by adding an excess of iron and measuring the iron retained in solution after the addition of a suitable reagent such as light magnesium carbonate or an ion-exchange resin that removes excess iron. The National Kidney Foundation-Kidney Disease Outcomes Quality Initiative (NKF-K/DOQI) Practice Guidelines recommend maintaining ferritin ≥100 ng/ml and transferrin saturation (TSAT) ≥ 20% to ensure adequate iron supply for erythropoiesis among patients with chronic kidney disease, whether or not they are dialysis-dependent (Daice and Lewis, 2011). In dialysis patients because of the persistent anemia, Red blood cells (RBC) transfusions were often necessary and recombinant human erythropoietin (rHuEPO) therapy (Stivelman, *et al.,* 1989). Regular blood transfusion

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and (rHuEPO) therapy lead to iron over load, Iron deposition in reticular endothelial system (RES) (gray-colored or bronze-colored skin, shortness of breath, arthritis, liver disease including cirrhosis or liver cancer and enlarged spleen) (McCarthy *et al.,* 1989). Functional iron deficiency is present when the usual tests for iron deficiency in dialysis patients do not indicate absolute iron deficiency (ferritin of more than 100 ng/ml; TSAT of more than 20%), but patients respond to additional iron administration with a rise in hematocrit at a stable EPO dose. Patients with functional iron deficiency therefore have apparently insufficient available iron to keep up with the demands of the stimulated erythropoiesis that occur when exogenous EPO is administered (Cavill and Macdougall, 1992).

MATERIALS AND METHODS

A descriptive analytical case control study carried out at faculty of Medical Laboratory Science, Al-neelain University, with a sample comprised of 80 Sudanese participants, recruited from Nephrology department in Ibn Sina Hospital, Khartoum, Sudan. Assigned to two groups as follow, the first group included (40) hemodialyzed patients, 62 % male and 38 % female. The second group included (40) healthy individuals as control group, 65 % male and 35 % female. Patients with liveror cardiac disease, recent sever bleeding episode were excluded. Blood specimens were taken from each participant, CRFpatient under hemodialysis and normal health control. 2.5 ml of venous blood was collected in plaincontainer. The clotted blood samples then centrifuged and the sera transferred to new containers. Chemical method Were used to measure iron profile (serum iron, saturated transferrin and TIBC) using Biosystem 350 semi-automated spectrophotometer analyzer (Biosystem- Germany), and (serumferritin) was measured by Elecsys 2010(Electrochemiluminescence immunoassay) (Roche –Germany). Data were analyzed by using statistical package for social sciences (SPSS) version 16. T. test and ANOVA test.

RESULTS

The results of the present study showed that the serum iron and serum ferritin of the patients under dialysis were significantly higher as compared to healthy control group (P value 0.000 and 0.000) respectively as shown in Table 1. While the total iron binding capacity and transferrin saturated in hemodialysis patients were significantly lower as compared to healthy control individuals (P value 0.00) for both as shown in Table 1.

Table 1. ANOVA test of study parameters in different study groups

	Group	N	Mean	Std. Deviation	*p.value*
S. iron	case	40	107.5	42.8	0.00
	control	40	77.9	15.7	
TIBC	case	40	231.6	56.6	0.00
	control	40	311.4	35.6	
S.Ferritin	case	40	504	272.7	0.00
	control	40	92.5	50.1	
S.Transferrin	case	40	142.15	48.5	0.00
	control	40	247.2	53.8	

The results of correlation of the study parameters and the gender of the patient showed no statistically significant correlation between gender of the patient and neither serum iron, nor serum ferritin, nor total iron binding capacity, nor saturated transferrin with P value (0.423, 0.897, 0.522, and 0.587) respectively as shown in Table 2. While the correlation results between the study parameters and age of the patientsshowed a significantly correlation with TIBC and mild significant correlation withs.transferrin, (P value 0.042, 0.057) respectively, but no significant correlation with serum iron and serum ferritin (p value 0.246, 0.235) respectively. Also the results of correlation of the study parameters and the duration of hemodialysis showed no statistically significant correlation between duration of the dialysis and neither serum iron, nor serum ferritin, nor total iron binding capacity, nor s.transferrin with P value (0.086, 0.734, 0.700, 0.465) respectively as shown in Table3.

Table 2. Correlation between study parameters and gender of patients

	Gender	N	mean	Std.deviation	*p.value*
S. Iron	Male	25	115.6	44.6	0.423
	Female	15	94	37.3	
TIBC	Male	25	235.2	55.6	0.522
	Female	15	225.5	59.7	
S.Ferritin	Male	25	521.8	211.2	0.897
	Female	15	474.4	359.5	
S.Transferrin	Male	25	146.8	47	0.587
	Female	15	134.4	51.7	

Table 3. Correlation of study parameters and duration of dialysis

	Duration	N	Mean	Std. Deviation	*p.value*
s. iron	5months -4years	24	117.0417	41.40309	.086
	>4 years	16	93.2500	42.30603	
TIBC	5months -4years	24	228.7500	59.53607	.700
	>4 years	16	235.9375	53.67242	
S.Ferritin	5months -4years	24	491.8750	260.08733	.734
	>4 years	16	522.3750	298.59468	
S.Transferrin	5months -4years	24	137.5000	48.94273	.465
	>4 years	16	149.1250	48.66467	

DISCUSSION

Chronic kidney disease (CKD) is an irreversible progressive reduction in renal function an important source of long term morbidity and mortality. It has been estimated that CKD effect more than 20 million people in the united estate (National Kidney Foundation, 2002). Anemia commonly occurs in people with CKD, when kidneys are damaged, they do not make enough EPO as a result the bone marrow makes fewer red cells, causing anemia. Other causes of anemia in CKD in include blood loss from steps of hemodialysis, to prevent of anemia to need frequent red blood cell transfusion and EPO therapy, due to blood transfused and EPO therapy to lead of iron over load (Eschbach and Adamason, 1994). This study was carried out in Ibn Sina Hospital, Khartoum, Sudan. And aimed to assess the iron profile among chronic renal failure in Sudanese patients undergoing hemodialysis, its included 40 subject known diagnosed with chronic renal failure compared with 40 normal health individual as control group. The present study revealed that increase serum iron and serum ferritin level (107±42.8 p value 0.000, 504±272.7 p value 0.000) respectively. And lowered TIBC and serum saturated transferrin level (231±56.6 p value 0.000, 142.15±48.5 p value 0.000) respectively, were statistically significant different in patient with chronic renal failure compared with control group

(p value 0.000) for all. This findings in concordance to recently three different studies in literature; First study in 1994 done by *Joseph W. EschbacH et al*., who studied 166 hemodialysis patients and reported that the iron status was increase, second study done by *Canavese C, Bergamo D, Ciccone G, et al*. in 2004 who was evaluatethe iron profile in 40 transfused hemodialysis patients and reported that 30% of the patients were normal and 70% iron were over load. Third study by *Ramakrishna Devaki1, Pragna Rao*et al. in 2013 who studied 290 hemodialysis patients and reported that 31% of the dialyzed patients were over load and lowered transferrin level in compared with control group (Eschbach and Adamason, 1994; Canavese *et al.,* 2004; Chinnapu Reddy *et al.,* 2013). The analysis result of this study showed that a significant correlation between the age of patients and TIBC (p value 0.042) followed by mild significant correlation between the age of and serum saturated transferrin levels (p value 0.057) and no statistical significant between age and serum iron and serum ferritin.According to the patients gender and duration of hemodialysis this study found that their no statistical significant correlation between iron profile and patients gender and duration of dialysis. The major limitations in the present study are the small sample size, and relatively short study period.

Conclusions

In summary we conclude that chronic renal failure patients under hemodialysis presented with Increase level of serum iron and serum ferritin and decreases total iron binding capacity and serum transferrin saturated and these changes are not influenced by the gender of the patient or duration of dialysis.

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