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Evaluation of Iron Profile in Sudanese Patients with Cardiovascular Disorders under Multiple Transfusions

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Abstract

Background: iron overload is the most common complication in patients who revived multiple red blood transfusions to correct the anemia. **Objective** this study aimed to evaluate the iron profile (serum iron, ferritin, total iron binding capacity (TIBC) and transferrin saturation percentage) in Sudanese patients with cardiovascular disorders, who revived multiple red blood transfusions. **Material and methods** this was a case control study conducted during August 2015, in Alneelain University, Faculty of Medical Laboratory Science. A total of 100 participants were enrolled in this study, 60 were Sudanese patients diagnosed with cardiovascular disorders and who received multiple blood transfusions at Alshaab Teaching Hospital Khartoum, Sudan; their mean age was (50.6±12.7) years, designated as a patient's group. Other 40 subjects were normal healthy who received no blood transfusions as control group; their mean age was 45.5±11.4 years. Venous blood was collected from all participants, and then the serum was prepared from clotted blood. The iron profile (serum ferritin, serum iron and total iron binding capacity) was carried out using automated chemical analyzer (MINDRAY BS 200-China).Data were analyzed employing statistical package for social sciences (SPSS) version 20. The p value less than 0.05 was considered significant. **Result** this study showed that the serum iron and serum ferritin were statistically significantly higher while the TIBC and transferrin saturation percentage were statistically significantly lower in cardiovascular patients who received regular blood cell, compared with those normal ho received regular packed cell with *p value* (0.01,0.04,0.04 and 0.04) respectively. **Conclusion** iron overload was present in Sudanese cardiovascular patients who received no multiple blood transfusion compared to those normal who received no blood cell.

Keywords: Serum iron; ferritin; total iron binding capacity; TIBC, iron overload; regular blood transfusion; cardiovascular disorder.

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Introduction

Iron is an essential element that forms an important component of metabolic and biological processes, but when present in excess, it can produce tissue damage due to oxidative stress [1]. Iron concentration is tightly regulated. Iron overload during iron deposition in multiple organs is along with serum ferritin value over 1000 µg/L [2]. That value is, either genetically or acquired, and may occur by several conditions such as frequent transfusions, abuse consumption of iron (often as supplement) and chronic hepatitis has a potential to cause acquired iron overload [3,4].

Hereditary hemochromatosis is the most common genetic cause of iron overload. Small intestine in patient absorbs high level iron which accumulates in liver, pancreas and some parts of brain which impairs vital functions[5].Free radical production due to iron overload causes serious complicated side effects such as mental retardation[6], impotence, infertility [7] and cardiac dysfunction [8]. Anemia is associated with worse outcomes in patients who have both acute and chronic cardiovascular disease, but it is unclear whether this association is causal or whether correction with red blood cell transfusions modifies this relation [9,10,11,12]. Anemia decreases the oxygen content of the blood supplied to the myocardium and may increase myocardial oxygen demand because a higher cardiac output is required to maintain adequate systemic oxygen delivery [13].The heart extracts a high proportion of the oxygen supplied through the coronary arteries, and therefore this circulation is potentially at higher risk from the combination of atheroma related flow limitation and anemia. Hypotension, tachycardia, and the requirement for catecholamine use (for example, during critical illness or major surgery) can further compromise the balance between oxygen supply and demand, resulting in myocardial injury. This has been termed type 2 myocardial infarction [14]. The release of troponin, a biomarker of myocardial injury, is associated with higher mortality in critically ill and perioperative populations [15, 16, 17].

Material and method:

This is a case control study conducted during August 2015 in Alneelain University, Faculty of Medical Laboratory Science. A total of 100 volunteers were selected for this study 60 were Sudanese patients with cardiovascular disorders received multiple blood transfusions at Alshaab teaching hospital Khartoum, Sudan; their mean age were 50.6±12.7 years designated as patients group. Further 40 subjects were normal healthy non received blood transfusions; their mean age was 45.5±11.4 years. This study was approved by Alshaab teaching Hospital for cardiovascular disorders, and Alneelain university ethical committee. The consent was also taken from every participant before the samples were gathering. Patients who received less than three bags of blood cells, or regular blood with iron chelating were excluded from this study. Five ml of venous blood were collected from all participants, and then the serum was prepared from collated blood. The iron profile (serum ferritin, serum iron and total iron binding capacity

were done using Automated chemical analyzer (MINDRAY BS200-China)) then transfusion saturation percentage was calculated. Data were collected by direct questioner and analyzed by using statistical package for social sciences (SPSS) version 20. T. test and ANOVA test were used from comparison of mean between different study groups, while correlation between quantitative variables was assessed with Pearson's correlation. *P.value* considered significance if less than 0.05

Result:

A100 Sudanese subjects were enrolled in this study; 60 were cardiovascular patients attended to Alshaab teaching Hospital, cardiology center for packed red blood transfusion .Further 40 normal volunteer non red blood transfusion were set as control groups.

The current study revealed that the serum iron and serum ferritin were statistical significant higher in cardiovascular patients who received multiple packed cell compared with control group (*P.value* = 0.01 and 0.04 respectively (Table 1).

The present study showed that the total iron binding capacity and transferrin saturation percentage parameter was statistically significantly lower in cardiovascular patients who received multiple packed cell in comparison with those normal non received multiple packed cell with *P. value* 0.04 (Table1).

Table1: Comparison of iron profile in study groups.

parameters	*Transfused patients*	*Normal non transfused*	*P. value*
Serum iron	129.9±66.1	95.9±53.8	0.01
serum ferritin	49.7±48.4	34.3±19.8	0.04
TIBC	167.7±96.4	209.0 ±100.4	0.04
S %	25.44±17.94	45.21 ±25.64	0.04

P.value considered significance if less than 0.05

The present study showed no statistically significant correlation between each of serum iron, serum ferritin, TIBC and transferrin saturation percentage and patients' age (*P.value* = 389, 0.278, 0.792 and 0.067) respectively (Table 2).

Table 2: Correlation between iron profile and patients age

parameter	*Correlation coefficient*	*Age*
Serum iron	Correlation coefficient	0.133
	P value	0.389
Serum ferritin	Correlation coefficient	0.142
	P value	0.278
TIBC	Correlation coefficient	0.130
	P value	0.792
S %	Correlation coefficient	0.275
	P value	0.067

In this study the correlation results between the study parameters and the number of bags received by the patients showed that no significantly correlation with serum iron, (*P value* 0.147), serum ferritin, (*P value* 0.132) and with TIBC (P value 0.563) as shown in (Table 3).

Table 3: Correlation between serum iron, ferritin and TIBC and the number of bags blood received.

parameter	*Correlation coefficient*	*Number of bags*
Serum iron	Correlation coefficient	0.189
	P value	0.147
Serum ferritin	Correlation coefficient	0.196
	P value	0.132
TIBC	Correlation coefficient	0.076
	P value	0.563
S%	Correlation coefficient	0.278
	P value	0.005

P.value considered significant if< 0.05

Discussion

Anemia is common in patients with heart disease. It is present in approximately one third of patients with congestive heart failure (CHF) and 10% to 20% of patients with coronary heart disease (CHD) [18-19]. Iron overload is the accumulation of excess body iron in different organs [20]. Besides being a crucial component of hemoglobin with a key role in erythropoiesis, oxygen transportation and storage, iron also has further important functions as part of several enzymatic systems and metabolic processes [21] to prevent of anemia occurs due heart weakness we need frequent red blood cell transfusion and EPO therapy, due to blood transfused and EPO therapy to lead of iron over load [22]. Among serum iron markers, serum ferritin is most commonly used as an indirect estimate of body iron store. However, reliance on ferritin alone can lead to an inaccurate assessment [23]. The literature reported the percentage of patients who received of blood as corrected an anemia were wide in range ,in the United States,

7.8% to 92.8% of adults undergoing cardiac surgery are transfused[24,25].This study aimed to the evaluation the serum iron, ferritin, TIBC and transferrin saturation percentage in Sudanese patients with cardiovascular disorders received multiple red blood transfusions regardless the causes cardiac disease.The present study revealed that the iron profile (serum iron, serum ferritin) were statistically significant higher and (TIBC and transferrin saturation percentage) significant lower in patient with chronic cardiovascular disorders received multiple blood transfused compared with those normal healthy control group. These findings were in agreement with Gujja P *at el* (2010) and Murphy, Oudit (2010), who concluded that iron overload has been found, resulting from the accumulation of iron in the myocardium mainly because of genetically determined disorders of iron metabolism or multiple transfusions**[26,27].**Our finding support that the iron overload were occurred in many disorders as result of in transfusion-dependent patients such as, those with thalassaemia major, sickle cell disease ,myelodysplastic syndromes and chronic renal failure **[**[28,29,30]**.**

The current study showed that there is no significant correlation between thenumber of transfusion bags with serum iron and serum ferritin levels. These findings were in contrast of abd alla *et al* (2016) in Sudanese patients and with study by Rerambiah *et al* in (2015) who reported a positive correlations between the number of transfusion bags and serum iron as and serum ferritin, and this different might be attribute to the small number samples size in our study [31, 32].In agreement with study published by abd alla *et al* showed that there is statistical significant correlation between iron profile and patients' age [31].

Conclusion

The present study concluded that multiple blood transfusions for cardiovascular patients increased the levels of serum iron and serum ferritin and decreased total binding capacity, and we recommended that the iron chelation therapy should be used to prevent the accumulation of iron in the patient who received multiple blood transfusions.

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