



International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

<http://gssrr.org/index.php?journal=JournalOfBasicAndApplied>



Assessment of Iron Overload and its Effect on Liver Function Tests (ALT, AST) in Multiple Blood Transfusion Sudanese Pediatrics Patients

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Abstract

Recipients frequently need blood transfusions; can be at risk for developing iron overload. The aim of the current study was to assess the iron overload and its effect on liver function tests (ALT, AST) in multiple blood transfusion Sudanese pediatrics patients compared with apparently healthy children. Case-control and hospital based study conducted in Khartoum state in Omdurman pediatric hospital during the period of February-May 2015, (test group n=100) 49 of them were males and 51 were females and aberrantly healthy children (control group n=100) were enrolled in the study, age and gender of the test group were matched with the control group, blood samples obtained from each group for measuring serum level of AST,ALT by automated machine (mindary) and TIBC by spectrophotometry in multiple blood transfused blood pediatric children. The results show that case and controls (100 in each arm) were matched in their basic clinical data. The (mean \pm SD) was calculated. T test or ANOVA was used for comparison between groups using SPSS v16.

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The serum iron in patients and controls respectively were ($287\pm 235,74\pm 17$ Micro g/dl), serum TIBC patients and controls respectively were ($194\pm 107,219 \pm 72$ micro g/dl), serum ALT in patients and controls respectively were ($29\pm 36,19\pm 8$ IU/L) and serum AST in patients and controls respectively were ($76\pm 73,24\pm 9$ IU/L). Serum iron, ALT and AST iron were significantly increased and TIBC was decreased in pediatric multiple blood transfusion patients compare to healthy pediatric individual (p. value $<0.000, 0.000, 0.000, 0.000$) respectively. In this study the serum level of iron, ALT and AST were significantly increased in pediatric multiple blood transfusion patients, TIBC was significantly decreased in pediatric multiple blood transfusion patients and significant with different sex and age of disease.

Keywords: Iron over load; Sudanese; Blood transfusion.

1. Introduction

Iron is the most abundant of all essential elements; iron participates in many biochemical processes including cellular oxidative mechanisms and oxygen transport [1]. The major heme proteins (hemoglobin and myoglobin) are the most abundant iron containing compound in the body. Hemoglobin transport oxygen from the lung to the organ. Where it is used in respiration and myoglobin store oxygen in the skeletal muscles. Iron itself is also essential for transport function of the electron transport chain and, hence, respiration, it is a major component of several cytochromes. Where it acts as an electron acceptor or donor during oxidation phosphorylation. Additionally, several enzymes require iron as a cofactor including cytochrome oxidase xanthine oxidase, peroxidase, catalase, and NADH dehydrogenase. Transferrin is a glycoprotein that is synthesized by the liver and which contain two iron binding sites. Its primary function is to transport intestinally absorbed iron in the plasma to the sites of erythropoiesis and to the liver, where excess iron is stored in hepatocytes as ferritin or hemosiderin. Under normal condition approximately one third of serum transfer in binding sites are bound with iron. Transferrin also carries iron taken up by macrophages subsequent to its release as hemoglobin from the breakdown of old erythrocytes. TIBC is has seen limited use since the advent of improved transferrin assay [2]. Iron overload can lead to end organ damage of the heart, liver, and pancreas in patients with hemochromatosis (3). The clinical laboratory offers several tests for the assessment of liver function. The enzymes alkaline phosphatase, ALT, AST, GGT, and 5-nucleotidase are helpful in the assessment of the proper functioning and inflammatory status of the liver [4]. Aminotransferases (ALT and AST) are two enzymes widely used to assess hepatocellular damage. AST is found in all tissues, especially the heart, liver, and skeletal muscles. ALT is present primarily in the liver to a lesser extent in kidney and skeletal muscle, making it more (liver-specific) [5].

2. Materials and methods

This case-control and hospital based study conducted in Khartoum state in omdorman pediatric hospital during February 2015 on Sudanese multiple blood transfused blood pediatric children (test group $n=100$) 49 of them were males and 51 were females and aberrantly healthy children (control group $n=100$). Permission of this study was obtained from to local authorities in the area of the study. An informed consent was obtained from each participant in the study after explaining objectives of the study. Using local antiseptic for the skin (70% ethanol), a sample of venous blood (3ml) was collected from each participant. The blood samples were

centrifuged at 4000 rpm for 5 minutes to obtain the serum. Then the serum iron and TIBC measured using spectrophotometer (biosystem) . ALT and AST measured using automated machine (mindary). Interview with the test group and control were done to obtain the clinical data. A questionnaire was specifically designed to obtain information which help either including or excluding certain individual in or form study respectively. Data was presented inform in table and figure. The data collected in this study was analyzed using SPSS. The mean \pm SD serum (iron , TIBC , ALT and AST) will calculated the test was used for comparisons. (p value \leq 0.05 is considered to be significant).

3. Results

100 multiple blood transfused pediatric patients were participate in this study as test group and 100 apparently healthy children as control group were. There was no Iron supplementation to control and test group. The two groups were age matched (2-15) years, serum iron, TIBC, ALT and AST were measured for all groups. The serum iron (mean \pm sd) in patients and controls respectively were (287 \pm 235, 74 \pm 17 micro.g/dl). Iron were significantly increased in multiple blood transfused pediatric patients compared to healthy children (p. value < 0.050) as in table (1)

Serum TIBC patients and controls respectively were (194 \pm 107,219 \pm 72 micro.g/dl). TIBC were significantly decreased in multiple blood transfused pediatric patients compared to healthy children (p. value < 0.050) as in table (1) Among the transfused patients,80% with iron overload. Among the 80 patients with iron overload, 35% with elevated ALT and 68% of iron overload had elevated AST, in patients and controls respectively were (76 \pm 73,24 \pm 9 IU/L) as in table (1).

Table 1: Geometric mean (SD) of Iron TIBC, ALT and AST between patient and control

Variable	Cases (n=100)	Control (n=100)	P –value
Iron micro.g/dl	287(235)	74(17)	0.000
TIBC micro.g/dl	194(107)	219 (72)	0.000
ALT IU/L	29(36)	19(8)	0.000
AST IU/L	76(73)	24(9)	0.000

Serum ALT in patients and controls respectively were (29 \pm 36,19 \pm 8 IU/L) (p.value<0.050) The serum ALT level was significant positively correlated with iron concentration as Show in figure (1)

4. Discussion

Iron toxicity is dose related. A study of anemic showed improved survival in patients with no iron overload [6]. In a study of pediatric oncology patients who underwent bone marrow transplantation, Lee and colleagues [7] found an increased survival rate in patients with pretransplant ferritin levels of less than 1,000 ng/mL. Another study of MDS revealed that patients treated with iron chelation therapy had improved survival compared with

patients who did not receive treatment [8]. Pediatric patients with Hodgkin disease demonstrated poor progression-free survival with high ferritin levels [9]. Iron overload can occur in patients who receive blood transfusions, particularly patients with thalassemia and sickle cell anemia. Blood transfusions in children with sickle cell anemia demonstrated a positive correlation between hepatic iron overload and transfusion volume [10]. Reducing the iron burden has been shown to improve outcomes in a number of settings.

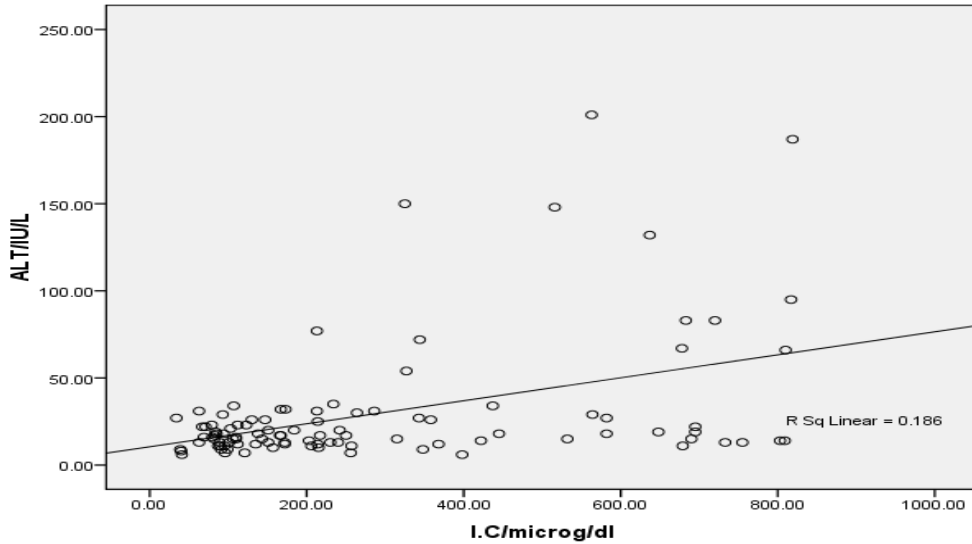


Figure 1: scatter between Iron concentration and ALT for Patient

There was strong relation between multiple blood transfusion and iron overload figure (2).

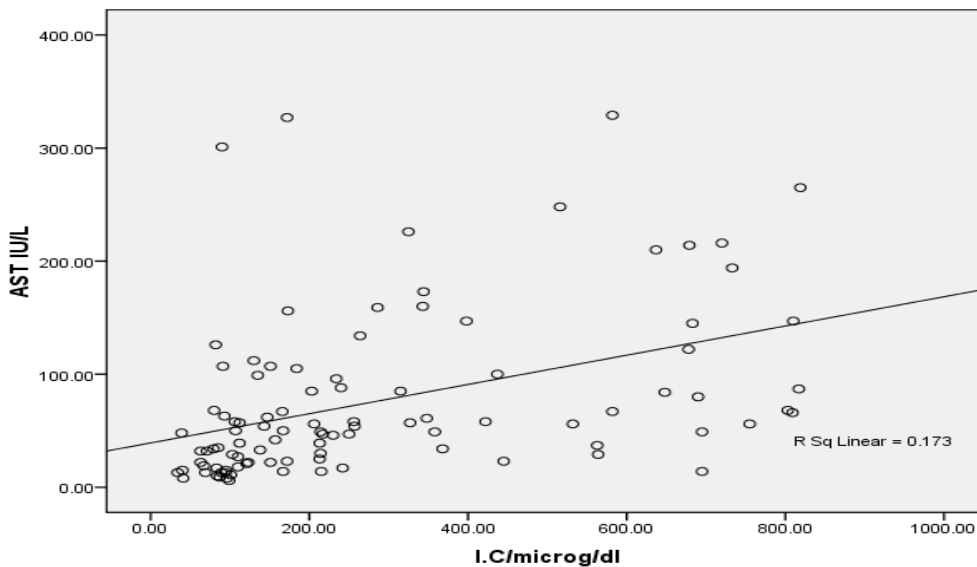


Figure 2: scatter between Iron concentration and AST for Patient

Bomford and coworkers observed an increase in 5- and 10-year survival rates in patients with idiopathic hemochromatosis who were treated with venesection [11]. Similarly, another study of patients with hereditary hemochromatosis demonstrated improved survival in patients treated with phlebotomy [3]. Elevated serum iron levels (>108ng/mL) were associated with decreased overall survival and increased incidence of liver diseases. Since phlebotomy may have an important role in preventing complications from iron.

5. Conclusion

This study concluded that the levels of iron, ALT and AST and iron significantly increased in pediatric multiple blood transfusion patients and TIBC was significantly decreased in pediatric multiple blood transfusion patients when compared with normal healthy children. The serum concentrations of iron, ALT and AST were increased and TIBC was decreased in the different age and sex.

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