Serum iron status in beta-thalassemic patients with clinical signs of iron overload

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Abstract

Iron overload is the main complication of beta-thalassemia. This study was conducted to evaluate iron status in thalassemic patients with clinical signs of iron overload. The study was done in thalassemic centre at Ibn Al-Atheer Pediatric Teaching Hospital in Mosul, Iraq. Two groups of ten thalassemic patients for each group were included in this study. The first group included patients without clinical signs of iron overload their ages ranged between 4-13 years (mean ±SD: 7.3±3.7 years), while the second group included patients with clinical signs of iron overload, their ages ranged between 8-20 years (mean ± SD: 15.3±3.4 years). Serum iron, ferritin and percentage saturation of total iron binding capacity (TIBC) were significantly higher ($P<0.001$) in the thalassemic patients with clinical signs in comparison with the other group. However, serum transfirrin and TIBC were significantly lower ($P<0.05$) in the clinical signs patients compared with the other group. All values of serum iron status were within the normal range except the percentage saturation of TIBC in the clinical signs patients. The mean age of the clinical signs patients were significantly higher ($P<0.001$) than the mean age of the other group. In conclusion patients with thalassemia major in Iraq are poorly managed though iron chelator is used. Percentage saturation of TIBC is recommended to estimate iron overload.

Key Word: Serum iron status, thalassemia, ferritin, transferrin, total iron binding capacity.

Introduction

Beta-thalassemia syndromes are a group of hereditary disorders characterized by a genetic deficiency in the synthesis of beta-globin chains [(1)]. In the homozygous state, beta-thalassemia (thalassemia major) causes sever transfusion dependent anemia [(2)]. The major causes of morbidity and mortality are anemia and iron overload [(3)].

The clinical signs of beta-thalassemia include cardiac failure and arrhythmia, changes in liver, gall bladder and spleen, the skull and other bones may be deformed, in addition, pallor skin from anemia and jaundice[(4)].

Desferrioxamine is the current clinical chelator of choice for the treatment of iron overload patients [(5)]. The iron chelation therapy offers a secondary route of treatment to relieve the iron burden of heart and liver cells [(6)].

Laboratory assessment of iron status is necessary for determination of iron overload [(7)]. Iron overload is the most important complication of beta-thalassemia and is a major focus of management [(8)].

This study was conducted to evaluate serum iron status in beta-thalassemic patients with clinical signs and comparing these parameters with the patients without clinical signs.

Patients and Methods

This study was done in thalassemia centre at Ibn Al-Atheer Pediatric Teaching Hospital in Mosul, Iraq, from June to September 2007.

Twenty thalassemic patients treated with desferrioxamine subcutaneously (40-60 mg/kg/day for 5 days/week), were divided into two groups of ten patients for each group (5 males and 5 females). The first group included patients without clinical signs of iron overload, their ages ranged between 4 to 13 years (mean±SD: 7.3±3.7 years).

The second group included patients with clinical signs of iron overload, their ages ranged between 8 to 20 years (mean±SD: 15.3±3.4 years).

The clinical signs of iron overload included in this study were bronze colour, spleenomegaly, facial expression (mangolian face), cardiomegally and stunded growth [9].

The exclusion criteria of this study included patients with hepatitis B and C, cytomegalovirus, diabetes, and spleeneoctomy.

Seven ml of blood sample were taken from each patient and analysed for serum iron[10], serum ferritin[11], serum transferrin[12], serum total iron binding capacity (TIBC) [13] by using commercial kits (spainbio, spain).

Saturation of TIBC was obtained by the following equation [14].

$$Iron\ \ saturation\% = \frac{100 \times serum\ \ iron}{TIBC}$$

Data were presented as mean ± SD. Unpaired t-test was used to compare between parameters.

Results

In thalassemic patients with clinical signs of iron overload, serum iron, ferritin, and percentage saturation of TIBC were significantly higher ($P<0.001$) in comparison with those measurements in patients without clinical signs of iron overload, as shown, in Table 1. However, serum transferrin and TIBC were significantly lower ($P<0.05$) in the thalassemic group with clinical signs of iron overload in comparison with the other group (Table 1).

The age of the thalassemic group with clinical signs was higher ($P<0.001$) than that in the other group without clinical signs of iron overload. However, no statistical difference was found between the two groups for body mass index (BMI), (Table 1).

Discussion

The management of beta thalassemia has changed in the last few years, with the availability of better transfusion regimen, iron chelation therapy, proper management of complication and good suppurative care[14]. It is now possible for a thalassemic child to have a near normal life span with a good quality of life[14]. The combination of early diagnosis, improvement of monitoring for organ complications and advance in supportive care have enabled many patients who have severe thalassemia syndrome to live productive, active lives well into adulthood[15].

The age of the present thalassemic patients with clinical signs of iron overload was higher than that in the patients without clinical signs. It seems the duration of the disease is associated with its complications due to poor control of iron overload. Ladis et al.[16] reported that survivals, mortality and complications in thalassemia major were connected with the control of iron overload.

The more control of iron overload was associated with longer life and less complications [17]. In fact, the age of the present thalassemic patients with clinical signs of iron overload was relatively low, suggesting poor control of iron overload in the studied patients although iron chelation therapy was given for both groups. Tissue damage and fibrosis are seen in iron overload heart and liver, due to oxidative reactions initiated by redox activity of iron [8].

Serum ferritin is a useful screening test for the intial diagnosis of thalassemia[18]. However, serum ferritin protein is an acute phase reactant, rising with any inflammation process from infection through chronic disease, to determine whether a high serum ferritin protein is due to iron overload or inflammation, it has been also necessary to determine serum iron and

transferrin[19]. Transferrin has a much longer half life in plasma than iron and shows short term of fluctuation [7]. Transferrin can be measured indirectly as the ability of the plasma protein to bind iron so called TIBC [7]. Therefore, it has been necessary also to determine serum levels of iron and percentage of saturation of serum iron binding capacity [20].

The change in values of serum iron status which occurred in the patients with clinical signs of iron overload in comparison with patients without clinical signs elucidated the prognosis of the disease in the clinical signs group. However, all values of iron status were within normal range for both groups, except percentage saturation of TIBC. These results encourage the use of percentage saturation of TIBC for the determination of iron overload.

In conclusion, patients with thalassemia major in Iraq are poorly managed of iron overload, though iron chelator is used. Clinical signs of iron overload appear in young thalassemic patients due to poor control. Percentage saturation of TIBC is recommended to estimate iron overload in thalassemic patients.

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Table (1) Serum iron status, age and BMI in thalassemic patients treated with dissferioxamine group 1 and 2 present patients without and with clinical signs of iron overload, respectively.

Patients	Serum iron (µg/dL)	Serum Ferritin (µg/L)	Serum transferin (mg/dL)	Measured TIBC (µg/dL)	Saturated TIBC% (%)	Age (Years)	BMI
Group 1 (n=10)	90.97 ±12.92	134.53 ±33.41	220.8 ±33.78	272.5 ±28.5	33.4 ±4.62	7.3 ±3.7	20.43 ±7.73
Group 2 (n=10)	131.75*** ±7.57	241.31*** ±39.29	193.4* ±8.1	242.87** ±10.21	54.27*** ±2.87	5.3*** ±3.4	22.42 ±2.42

TIBC: Total iron binding capacity, BMI: Body mass index
* P<0.05, ** P<0.01, *** P<0.001.