Original article

Assessment of serum ferritin levels in thalassemia and non-thalassemia patients presented with anemia

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ABSTRACT

Background: Thalassemia is an autosomal genetic disease leading to anemia and remains one of the major health problems in Southeast Asia and other parts of the world. Almost 100,000 patients with major thalassemia need regular transfusion. Human hemoglobin (Hb) is the molecule that carries and transports oxygen all through the body. Ferritin is the principal iron storage protein, found in the liver, spleen, bone marrow, and to a small extent in the blood.

Objectives: The aim of this study was to assess serum ferritin levels in B-thalassemia patients, and to compare it with non-thalassemic anemia and healthy control.

Materials and methods: A prospective cross sectional study conducted at Thalassemia Center in Ibn Al- Baladi Hospital for Children and Women during the period from1st February to 30th May 2014 during their attendance to out-patient clinic. A total .number of 101 patients complaining of anemia (51 patients with thalassemia, 50 with non-thalassemia) in addition to 50 healthy subjects considered as control. All patients were tested for Serum ferritin levels and all results were obtained through automated quantitative test for use Vidas machine

Results : The mean serum ferritin levels in cases of thalassemia was 9542 $\pm$ 782 ng/ml while serum ferritin levels in control sample was 138 $\pm$323 ng/ml in male and 28$\pm$ 108 ng/ml in female . in patients with non-thalassemia anemia, the levels of serum ferritin was 1$\pm$80 ng/ml. Age of all patients in this study ranged from 3day-9year .the age of thalassemia patients ranged from 1-6 year and p-value was(0.23) while the age of patients with non-thalassemia anemia was 1-5 year and p-value was (0.11).

Conclusion: This study confirm that serum ferritin is high in patients wih thalassemia than non thalassemia.

Keywords: thalassemia, serum ferritin**.**

Introduction

Thalassemia is an autosomal genetic disease leading to anemia and remains one of the major health problems in Southeast Asia and other parts of the world where malaria is or has been endemic [(1)].

The thalassemia are a group of inherited hematologic disorders caused by defects in the synthesis of one or more of the hemoglobin chains [(2)].

Beta-thalassemia major is a common inherited hematological disorder in Asia. Almost 100,000

patients with major thalassemia need regular transfusion [3]. Iron deficiency is the most prevalent nutritional deficiency and the most common cause of anemia in the United States [4] Iron deficiency anemia is characterized by a defect in hemoglobin synthesis, resulting in red blood cells that are abnormally small (microcytic) and contain a decreased amount of hemoglobin (hypochromic) [5] ,The capacity of the blood to deliver oxygen to body cells and tissues is thus reduced. Anemia is seen in many chronic diseases such as heart failure, rheumatoid arthritis, cancer and chronic renal disease [6,7]

Human hemoglobin (Hb) is the molecule that carries and transports oxygen all through the body. It is made up of two parts: heme and globin. Heme is a porphyrin containing iron. Globin is made up of four polypeptide chains of two types two alpha and two non-alpha chains (beta â, gamma ã and delta ó). Adult and fetal hemoglobins have á-chains combined with â-chains. In normal adults, Hb A is the main type of hemoglobin (96.98%) while HbA2 and Hb F are only present in 2.3% and less than1%, respectively [8,9].

Cardiac disorders related to ventricular failure are the most frequent causes of death in this syndrome [10,11] . According to literature, heart failure from iron overload causes 71% of deaths in thalassemia major patients [12] Ferritin is the main iron-storage protein in the body. Its synthesis is regulated by quantities of iron by means of the interaction of cytoplasmic proteins bound to the messenger ribonucleic acid (mRNA), currently identified as iron regulatory proteins with specific structures of the mRNA, called iron-responsive elements [13]. Ferritin is the principal iron storage protein, found in the liver, spleen, bone marrow, and to a small extent in the blood (serum ferritin - SF) [14] the standard method of evaluating the total amount of body iron is measurement of the SF concentration in the blood [15,16] ,However the correlation between SF and body iron is not sufficiently precise to be of high prognostic value, especially when associated with inflammation or tissue damage. Moreover, alterations in the relationship between blood serum ferritin concentration and body iron content by chelation and vitamin C treatment are complex. For example, the relationship between serum ferritin and body iron appears to be singular for different hematologic conditions[3] .A variety of tests are currently used to assess iron overload, including serum ferritin level, computed tomography(CT), magnetic resonance imaging (MRI), and liver iron content (from biopsy) [17]. Among these procedures, serum ferritin level is a commonly used measurement as it is minimally invasive, inexpensive, and widely available and can be performed frequently allowing regular monitoring,and the values correlate with total body iron store [15,18]. Serum ferritin levels consistently >1000 μg/L are indicative of iron overload [15,19,20].

Materials and methods

A prospective cross sectional study conducted at Thalassemia Center in Ibn Al- Baladi Hospital for Children and Women during the period from1st February to 30th May 2014 during their attendance to out-patient clinic. A total .number of 101 patients complaining of anemia (51 patients with thalassemia, 50 with non-thalassemia) in addition to 50 healthy subjects considered as control. All patients were tested for Serum ferritin levels through Blood Samples collection by EDTA blood samples tube from thalassemia, non-thalassemia patients and healthy controls. The age of the patients ranged between 3days – 9 years.

The beta-thalassemia trait identified through clinical evaluation and laboratory tests, Hemoglobin electrophoresis

(Hb electrophoresis) is used as a screening test to identify variant and abnormal hemoglobin, including hemoglobin A_1 (HbA_1), hemoglobin A_2 (HbA_2), hemoglobin F (HbF; fetal hemoglobin), hemoglobin C (HbC), and hemoglobin S (HbS). analyzed using HPLC (high-performance liquid chromatography), (VARIANT β-thalassemia Short Program, Bio-Rad Laboratories) .

Serum ferritin levels were obtained through automated quantitative test by using vidas machine or using ELFA technique (enzyme linked fluorescent assay),using vidas biomerieux france. The limits for normal ferritin levels 138-321 in man and 27.15-102 ng/ml in woman.

Results

A total of 151 cases, 51 cases of B- thalassemia, 50 cases non-thalassemia and 50 healthy control sample major were enrolled in this study

In B-Thalassemia group there were 31(69.78%) males and 20 (39.22%) females with a male to female ratio of 1.5: 1. The age of patients B-thalassemia at the time of diagnosis ranged from 10 months to 6 years, Age of male in this study was from10 month to 6 years where's female age was from1 years to 4 years , Table 1 describe age of all patients.

The mean serum ferritin levels in cases of B-thalassemia were 9542 ±782 ng/ml. Only one patients(1.96%) had serum ferritin levels of less than 1000 ng/ml. Sixteen patients (31.37%) had serum ferritin levels between 1000 – 2000 ng/ml, while 23 patients (54.90%) had values levels between 2000-4000ng/ul ,five patients (9.80%) had serum ferritin levels between 4000-8000 ng/ml and one patients (1.96%)more than 8000 ng/ml (Table 2). Serum Ferritin Levels in control group (50 sample), 25(50%) was male 25(50%) female , mean Serum Ferritin Levels in male was 138 ± 323 and 28 ±108ng/ml in female table3.

Table1: Age and gender Distribution in Beta Thalassemia group and healthy controls group .

age	Thalassaemia pateints (n=51)	Male:female	Healthy (n,50)	Male:female	p-value
<1year	1(1.96%)	(1,0)	6(12%)	(4,2)	
1-2year	8(15.69%)	(5,3)	10(20%)	(6,4)	
2-3year	16(31.37%)	(11,5)	14(28%)	(8,6)	
3-4year	14(27.45%)	(6,8)	11(22%)	(3,8)	
4-5year	11(21.57%)	(7,4)	5(10%)	(2,3)	
>5year	1(1.96%)	(1,0)	4(8%)	(2,2)	
					0.23695

Table 2: Serum Ferritin levels in Beta Thalassemia group

Levels	Patients no.	Percent	Male	female
<1000ng /ml	1	1.96%	1	0
1000-2000ng /ml	16	31.37%	11	5
2000-4000ng/ml	28	54.90%	16	12
4000-8000ng/ml	5	9.80%	2	3
>8000ng/ml	1	1.96%	1	0

Table 3: serum ferritin levels in control sample (healthy).

Age	Number of control		percent	Serum ferritin level
5m-5years	Male	25	50%	324+138
5m-5.5year	female	25	50%	108+28

In patient with non-thalassemia group there were 26(52%) male and 24(48%) female ,the age of patient ranged from 3month-6years for female and 9days - 9 years for male table 4. The serum ferritin levels in this group was as follows : one patient (2%) had value < 1ng/ml ,sixteen patients (32%) had serum ferritin level between 1-10 ng/ml ,14 patient (28%) 10-20ng/ml table 5 .

Table 4: Age Distribution of the Patients with non-thalassemic anemia and healthy controls.

age	Non-Thalassaemia pateints (n=50)	(male,female)	Healthy Controls(n,50)	(male,female)	p-value
<1year	5(10%)	(3,2)	6(12%)	(4,2)	
1-2year	13(13%)	(7,6)	10(20%)	(6,4)	
2-3year	9(18%)	(4,5)	14(28%)	(8,6)	
3-4year	8(16%)	(4,4)	11(22%)	(3,8)	
4-5year	10(20%)	(5,5)	5(10%)	(2,3)	
>5year	5(10%)	(3,2)	4(8%)	(2,2)	
					0.112275

Table 5:serum ferritin levels in patients with non-thalassemic anemia

Levels	Number of patients	percentage	number of male	numbre of female
<1ng/ml	1	2%		1
1-10ng/ml	16	32%	8	8
10-20ng/ml	14	28%	5	9
20-40ng/ml	10	20%	7	3
40-80ng/ml	4	8%	2	2
<80ng/ml	5	10%	4	1

Discussion

Ferritin is the main source of stored iron whereas hemosiderin is described as degraded form of ferritin [21] appearing as blue intracellular granules that are large enough to be viewed by a light microscopy [22]. Iron was taken from plasma to cytosol of young erythroid cells in the bone marrow for heme synthesis via transferrin-transferrin receptor pathway [23] Certain previous studies have shown that patients with beta thalassemia have levels of serum ferritin far more than the patients presented with anemia due non-thalassemic causes as shown in (Table 6).

Table 6: studies of serum ferritin in thalassemia

Nadeem *et al*(24)	2004	3390 ng/ml
Zahra *et al* (25)	2007	3200 ng /ml
Ivan et al(26)	2008	4930 ng/ml
Sonali *et al*(27)	2012	2543ng/ml
Present study	2014	8000ng/ml

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