Certain Serum Enzymes Study of β-Thalassaemia Major Among Mosul Population

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Abstract

Ninety-seven blood samples of the β-thalassaemia major were collected from patients registered in Mosul thalassemic center (Ibn Al-Ather pediatric hospital) for the period 2001-2002, distributed in 52 males and 45 females aged 3.5-24.0 yrs old, and 87 blood samples of apparently healthy volunteers aged 3.5-24.0 yrs old too, distributed in 56 males and 31 females for the same aged and the period time . Hb conc., sGPT, sGOT, and ALP values were determined in addition to the age estimation for the two trails.

Statistical analysis, show there were significant differences ($p<0.05$) within Hb conc. of the normal individuals aged 3.5-6.0 and 18.0-24.0 yrs old. The Hb means conc. of both β-thalassaemia major and normal (control) were directly proportional to the sGPT and sGOT. while the Hb mean conc. of the β-thalassaemia major only was directly proportional to the ALP. The sGPT (17.64 u/l) , sGOT (13.99 u/l) , and ALP (16.43 u/l) values of the β-thalassaemia major was higher than that values (4.74 u/l , 10.95 u/l, and 4.65 u/l respectively) of the normal individuals .

دراسة مستوى بعض انزيمات مصل الدم عند مرضى الثلاسيميا في مدينة الموصل

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المستخلص

سبعة وتسعون عينة دم جمعت من مرضى الثلاسيميا المسجلين بمركز الموصل للثلاسيميا (في مستشفى أبن الأثير للأطفال) للفترة 2001-2002، وكانت العينات موزعة بواقع 52 عينة ذكرية و45 عينة انثوية للاعمار من 3.5 الى 24 سنة، كما جمعت 87 عينة دم طبيعية أستخدمت عينات سيطرة للدراسة، جمعت من متطوعين أصحاء موزعة بواقع 56 عينة ذكرية و 31 عينة انثوية لذات العمر وفترة الحياة، تم تقدير قيم الهيموكلوبين وأنزيمات مصل الدم: الكلوتاميت بايروفيت ترانس امينيز sGPT، الكلوتاميت اوكزالوأسيتيت ترانس امينيز sGOT والفوسفاتيز القاعدي ALP لكل من عينات البيتا- ثلاسيميا والسيطرة.

بين التحليل الاحصائي بأن هناك فروقات معنوية عند مستوى احتمالية ($p<0.05$) بين متوسطات قيم تركيز الهيموكلوبين للفئات العمرية 3.5-6 و 18-24 سنة لعينات السيطرة . كما وجدت علاقات طردية لمتوسطات قيم الهيموكلوبين لعينات البيتا- ثلاسيميا والسيطرة مع مستوى انزيمات مصل الدم (sGPT, sGOT) ، كما وجد أيضا أن قيم الهيموكلوبين تتناسب طرديا مع مستوى انزيم الفوسفاتيز القاعدي ALP عند مرضى البيتا- ثلاسيميا. ووجد أيضا" أن مستويات انزيمات sGPT, sGOT والفوسفاتيز القاعدي في مصل دم مرضى البيتا- ثلاسيميا هي أعلى (17.64 و13.99 و16.43 وحدة/لتر على التوالي) من مثيلاتها عند الأصحاء (11.74 و 10.95 و11.65 وحدة/لتر على التوالي) .

Introduction

Thalassaemia are group of an autosomal recessive genetic disorders characterized by unbalanced synthesis of α and no α (β) globin chains . In some thalassaemia no globin chain is synthesized at all, whereas in others some globin is produced but a reduced rate (1). the primary biochemical abnormality is a quantitative defect in the biosynthesis of one type of Hb chain. this defect leads to overall deficient of Hb accumulation in the erythrocyte (2) . Pathological features range from asymptomatic carrier to severe anemia necessitating chronic blood transfusions, splenectomy, iron chelating therapy and bone marrow transfusion as a therapy of thalassaemia major (2,3). However β-thalassaemia major syndrome is a rare fetal disease occurs mostly in the Mediterranean, meddle eastern and Asian eastern countries (4) .

Awad (2) was studied the β-thalassaemia major in Mosul population in correlation with sex, blood group and age, He concluded that the mean age of live for the thalassemic males was 6.77 years, and for thalassemic females was 7.03 years .

Clinical features of β-thalassaemia major was presented at one year old, anemia is presented as a progressive life threatening pallor. Hepatomegaly and splenomegaly causing abdominal distension. Jaundice and failure to thrive result in growth retardation and recurrent attacks of infections, which are due to impaired neurophil chemotaxis and altered T and B lymphocytes percentages. Thalassaemia patients suffer from repeated attack of infection by Yersinia microorganism enhanced by iron overload and immunological defect (2, 5, 6). Also the measurements of the activity of enzymes in blood are considered a good value in the diagnosis and management and in the monitoring of the case progress of thalassaemia major (7). So the aim of this study was to evaluate the relationship of serum GPT, GOT and ALP values to β-thalassaemia major among Mosul population with age ranged between 3.5-24.0 years old .

Materials, Patients and Methods

. Normal and thalassaemic subjects: This study was conducted on 97 thalassaemic patients with ages ranged between 3.5-24.0 years old (52 males and 45 females) registered to Ibn Al-Ather pediatric hospital in Mosul city, during 2001 to 2002. Normal subjects (the control group) consists of 87 healthy volunteers with age ranged between 3.5-24.0 years old (66 males and 21 females) at the same experimental

studying period and from the same region . age group in both normal and thalassaemic patients were divided into four groups : group 1 (3.5-6 yrs) , group 2 (6.5-12 yrs) , group 3 (12.5-17 yrs) , group 4 (18-24 yrs) .

2. Blood-samples: At the morning about 5ml of fasting venous blood was drawn from capital vein using disposable needle and syringe, collected blood, divided into two parts, the first part (1ml) added to ethylene diamine tetracetic acid (EDTA) anticoagulant tube, which used for hemoglobin (Hb) conc. Determination, the second part (4ml) was pored in clean dry plastic tube, allowed to clot at 37℃ for 25 minutes, centrifuged, serum separated and used for the determination of serum enzymes activitiy: glutamate pyruvate transaminase (sGPT) u/l, glutamate oxaloacetate transaminase (sGOT) u/l , and ALP (Alk. phosph.) u/l .

3. Hemoglobin conc. determination: Hb conc. g/dl was measured using Randox kit based on the conversion of Hb to cyanomethemoglobin complex; light absorption of the product was measured spectrophotometrically at wave length 540 nm.

4. Serum GPT, GOT, alk. phosph. (u/l): Serum transaminases were measured using the Randox kits and expressed as u/l. the ALP was measured using the Boimerieux kit and expressed u/l .

5.Hp ratio calculation

Hb ratio of normal or β – thalassaemic group was calculated as:

$$\text{Hb ratio} = \frac{\text{Partial Hb group}}{\text{Total mean Hb group}}$$

6.Statistical analysis: Data were analyzed using the factorial experimental conducted completely randomized design (CRD) according to Steel and Torrie (8) using the analysis of variance and Duncan multiple range test (SPSS computer program Ver. 11) at probability ($p<0.05$).

Results

Table (1) showed the distribution of Hb mean conc. g/dl of both sex of normal and β-thalassaemic patients in relation to the age ranged from 3.5-24.0 yrs old .

The Hb mean conc. of normal individuals were 13.39, 13.14, 12.97 and 13.13 g/dl, while the Hb conc. of β-thalassaemic patients were 8.02, 8.24, 7.76 and 7.56 g/dl for group 1,2,3 and 4 respectively. With general total mean Hb conc. 13.13 g/dl of normal individuals and 7.88 g/dl of β-thalassaemic patients (this Hb conc. is equaled to 60% of the normal Hb conc.)

The Hb ratio of normal individuals (1.02, 1.00, 0.99 and 0.85) were more deterred, may be due to the adolescent situation period, while the Hb ratio of β-thalassaemia patients were 1.02, 1.05, 0.98 and 0.96 for the age groups 1,2,3 and 4 respectively. The β-thalassaemia status was improved at the age ranged between 6.0-12.0 yrs only.

Table (2) showed the distribution of sGPT of normal and β-thalassaemic patients and Hb ratio in relation to age . were in age groups 1,2,3 and 4, values of sGPT in control group are (12.63, 11.58, 12.50 and 11.33(u/l) respectively) comparing with β-thalassaemic patients (17.56, 16.16, 13.89 and 16.33 (u/l) respectively) with total range of sGPT (11.74 u/l).

The sGPT of β-t halassaemic patients were distributed in decreasing order 20.36, 18.08, 15.30 and 17.40u/l with the increasing age from 3.5-6, 6-12, 12-18, and 18-24.0 yrs old. The β-thalassaemic sGPT general mean was higher (17.75u/l) than that value of normal sGPT (11.80u/l),

Table (3) showed the distribution of serum glutamate oxaloacetate transaminase (sGOT) of the normal and β-thalassaemic patients and their samples % and Hb conc.s in relation to the age ranged form 3.5-24.0 yrs old. The Hb conc. and sGOT general mean of normal and β-thalassaemic patients were distributed directly between them and each another and indirectly against age groups 3.5-6, 6-12, 12-18 and 18-24.0 And 11.33(u/l) respectively) comparing with β-thalassaemic patients (17.56, 16.16.13.89 and 16.33 (u /I)espectively) with total range of sGPT (11.74 u /I)

While the Hb conc. and sGOT of β-thalassaemic patients were found to be 8.02, 8.24, 7.76 and 7.56 g/dl and 17.00,12.82, 15.25 and 11.00 u/l respectively for the age groups 3.5-6.0, 6-12, 12-18 and 18-24.0 yrs old respectively,phosphatase values were distributed in increasing order as 7.60, 8.00, 9.00, 10.00, 11.00, 12.00 and 16.00 ku/dl respectively for the age group 3.5-6.0 yrs old. On the other hand, the Hb conc.s of β-thalassaemic patients were distributed as 8.30, 5.30, 8.15, 8.30, 8.63, 9.30, 6.30, 7.00, 8.00, 7.30 and 8.67 g/dl (with total mean Hb conc. equal to 8.02g/dl) and. ALP values were distributed in increasing order as 10.00, 12.00, 13.00, 14.70, 16.30, 16.60, 17.00, 24.00, 25.00, 27.00, and 32.00 Ku/dl respectively for the age group 3.5-6.0 yrs old.

sALsALP were increased (10.51 to 12.50 u/dl) for the aged group increased from 3.5 to 24.0 yrs old, while Hb conc. of β-thalassaemic patients were directly proportional to sALP values, as the Hb conc. decreased from 8.02 to 14.65 ku/dl for the aged groups increased from 3.5 to 24.0 yrs old

Table (1) : Hemoglobin (Hb g/dl) and Hb ratio distributions of normal individuals and ß-thalassaemic patients in relation to the age

Age	Normal individuals (control)		ß- thalassaemic Patients	
	Hb mean ± S.E (g/dl)	Hb ratio	Hb mean ± S.E (g/dl)	Hb ratio
3.5-6.0 (group 1)	13.39 ± 0.99	1.02	8.02 ± 1.13*	0.61
6.5-12.0 (group 2)	13.14 ± 1.04	1.00	8.24 ± 0.93*	0.63
12.5-17.0 (group 3)	12.97 ± 0.70	0.99	7.76±0.94**	0.59
18.0-24.0 (group 4)	11.17 ± 1.82	0.85	7.56±0.62**	0.58
Total range 3.5-24.0	13.13 ± 1.14	1.00	7.88±0.92**	0.60

Hb: Hemoglobin, S.E: Standard error, * Significant values, ** highly significant values.

Table (2) : Hb ratio and serum glutamate pyruvate transaminase (Sgpt) (u/l) relationship of normal individuals and ß-thalassaemia patients in relation to the age.

Age	Normal individuals (control)		ß- thalassaemic Patients	
	sGPT (u/l)	Hb ratio	sGPT (u/l)	Hb ratio
3.5-6.0 (group 1)	12.63	1.08	17.56	0.65
6.5-12.0 (group 2)	11.58	1.06	16.16	0.66
12.5-17.0 (group 3)	12.50	1.04	13.89	0.62
18.0-24.0 (group 4)	11.33	0.90	16.33	0.61
Total range 3.5-24.0	11.74	1.00	17.64	0.63

Table (3) : Hemoglobin (g/dI) and serum glutamate oxalate Transaminase (s G O T) relation ship and distribution of normal individual and ß - thalassemic patients in relation to the age in Mosul population.

Age	Normal individuals (control)		ß- thalassaemic Patients	
	sGPT (u/I)	Hb ratio	sGPT (u/I)	Hb ratio
3.5-6.0 (group 1)	12.47	1.06	13.56*	0.64
6.5-12.0 (group 2)	11.72	1.04	12.33*	0.66
12.5-17.0 (group 3)	11.22	1.03	11.61	0.62
18.0-24.0 (group 4)	9.57	0.89	12.73*	0.60
Total range 3.5-24.0	10.95	1.00	13.99**	0.62

S:serum, Hb : Hemoglobin , S.E: Standard error , * Significant values, ** highly significant values

Discussion

Enzymes are present in blood as a result of normal cell turnover. When damage to cell occurs, increased the amount of enzymes, which will be released and their concentrations in blood will rise (7). Table (1) showed no significant differences ($p<0.05$) between the four groups of β-thalassaemic major patients and groups 1 and 2 of normal individuals. But there were significant differences ($p<0.05$) within the 1st and 4th groups of the normal individuals under study. The insignificant differences were agreed with the conclusion of Awad (2) and Al-Anzy (3), while the significant differences of 1st and 3rd groups were disagreement withthese references. The Hb mean conc. of β-thalassaemia major were lower than that Hb conc. of normal individuals , and this result was already deu to presence of anemia in β-thalassaemic patients,results were in agreement with the results reported by Awad (2) and Al-Anazy, (3) Pearson (9). Both Hb mean conc. of normal and β-thalassaemia major patients were adversely proportional to the studied age groups, as the Hb conc. reduced (8.02, 8.24, 7.76 and 7.56 g/dl) for β-thalassaemic major patients and (13.39, 13.14, 12.97 and 11.17 g/dl) for normal individuals the age groups increased (3.5-6, 6-12, 12-18 and 18-24.0 yrs old respectively). These results were in agreement with the results obtained by Al-Anzy, (3). The Hb ratio value (1.05) indicate that the best life period of the β-thalassaemia major patients was in their age ranged from 6.0 to 12.0 years old. The Hb conc. were deterred and reduced from 8.24 to 7.76 g/dl. In this case the patients needs one or combined therapy to elevate the Hb conc. Table (2) showed significant differences ($p<0.05$) within the Hb conc. of β-thalassaemic major in age groups ranged between 12-18 yrs old. Also

there were significant differences ($p<0.05$) within Hb conc. of normal individuals in age groups ranged between 3.5-6.0 and 12.0-24.0 yrs old only, While there were no significant differences in the other groups of normal individuals and β-thalassaemia major patients. In general, the enzymes sGOT, sGOT and sALP activities increasing levels in circulating blood may be return to the iron overload in various tissues of β -thalassaemia patients, iron overload may cause RBCs damage increased the amount of enzymes, which will be released and their concentrations in blood will rise, (10). Whereas, the sGPT values of β-thalassaemia major patients were higher than that value of the normal individuals , this may be return to the sGOT abnormal activity in liver function, (11), in addition, may be due to the increasing enzyme activity level with the increasing age of β-thalassaemic patients (12).

Whereas, the sGOT values of β-thalassaemia major patients were higher than that value of normal (control) individuals, increasing sGPT enzyme activity level in circulating blood used as indication to the liver and bone tissues damaged (13), and there was no information and allot of studies about this enzymes in β-thalassaemic patients (14).

While Williams *et al.*, (15) studied the activity of this enzyme in β-thalassaemic major patients, and he did not found any increase in its activity. The sGOT value of β-thalassaemia major patients was higher (13.99 u/l) than that value of the normal individuals (10.95u/l). The ALP value of the β-thalassaemia major patients (16.43ku/l) was higher than that value of normal (control) individuals (11.65ku/l), the increasement of ALP activity in β-thalassaemic patients may return to the defect of liver function , (16).

Table(4) showed the distribution of ALP of normal and ß–thalassaemia patients and their samples % and HB conc. In relation to age groups ranged from 3.5 to 24.0 yrs old.

Age	Normal individuals (control)		ß- thalassaemic Patients	
	sALP (u/l)	Hb ratio	sALP (u/l)	Hb ratio
3.5-6.0 (group 1)	10.18	1.08	19.87**	0.65
6.5-12.0 (group 2)	11.07	1.06	16.98*	0.67
12.5-17.0 (group 3)	12.01	1.05	15.74*	0.63
18.0-24.0 (group 4)	12.01	0.90	15.24*	0.61
Total range 3.5-24.0	11.65	1.00	16.43**	0.63

S:serum , Hb:Hemoglobin, Significant values, ** highly significant values.

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