EFFECT OF REPEATED BLOOD TRANSFUSION ON SOME BLOOD PARAMETERS

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ABSTRACT

Background: Repeated blood transfusion causes a lot of complications in the body specially iron deposition in different organs in the body. **Objective**: Investigating the changes which occurred in the human body blood parameters on repeated blood transfusion. **Subjects and methods:** This study was performed at outpatient clinic, Faculty of Medicine, Al-Azhar University Hospital (Assiut). The patients were forty patients already diagnosed as thalassemic major and exposed to repeated blood transfusion and the following parameters were measured (oral glucose tolerance, plasma glucose level, plasma insulin level, C- peptide level, lipase level, serum iron, total iron binding capacity and serum Ferritin). **Results**: The study showed that hemosidtherosis affected the level of serum lipase which decreased in thalassemic patients as a model of hyperplastic anemia. Also, C-peptide level decreased in those patients more than control. This indicated that the pancreatic functions were affected by iron deposition. Also, serum iron and serum ferritin increased which led to decrease in the level of total iron binding capacity which caused by decrease in Hb level. **Conclusion**: Blood glucose level increased significantly in thalassemic patients while insulin level decreased in them. Serum Ferritin level was increased in thalassemic patients where the hemoglobin decreased. Serum lipase and C-lipase decreased in thalassemic patient

Key words: Thalassemia, repeated blood transfusion.

INTRODUCTION

Blood transfusion has many reactions which can be classified into immune reactions due to red blood cells, white blood cells and platelet incompatibilities, and non-immune reactions due to overloading of circulation, massive transfusion, transmission of infection, fat embolism and transfusion siderosis (**Tyrrell** and **Bateman, 2012**).

In repeated blood transfusion to none bleeding patient as, in cases of hyperplastic anemia, the amount of iron in the body get increased (**Johnson-Wimbley** and **Graham, 2011**).

Circulatory overload is encountered in the transfusion of anemic patients, particularly those with severe and long standing anemia. Those patients must be transfused very slowly and only with packed cells. In some patients, an exchange transfusion has to be carried out to avoid severe congestive heart failure (**Pont-Thibodeau et al., 2014**).

There is no doubt concerning the immunosuppressive effect of blood transfusion which has indeed been employed specifically for this purpose in patients before renal transplantation to improve graft survival (**Michael et al., 2012**)

Transfusion of bank blood in quantities approaching the patient's blood volume causes a delusional thrombocytopenia and some degree of clotting factor deficiency, both of which affect haemeostasis adversely. If an amount greater than 50% of the patient's blood volume is replaced rapidly, the transfusion is deemed massive e.g. five units of blood within one hour in a 70 Kg adult (**Mannucci** and **Tripodi, 2013**).

The present work aimed to investigate the changes which occurred in the human body blood parameters on repeated blood transfusion.

SUBJECTS AND METHODS

Subjects: Forty patients (18 male and 22 females) with thalassemia major and fifteen health control children (7males and 8 females) from outpatient clinic, Faculty of Medicine, Al Azhar University Hospital (Assuit). Their age ranged between 10 and 16 years old. Patients were divided into:

Group I (15 person): Healthy control children

Group II (24 patients): Thalassemia group with intact spleen.

Group III (16 patients): Thalassemia group with splenectomy.

Informed consents were obtained from all patients and control after explanation of the study and its aim.

Methods: Collection of blood samples were obtained by clean venepuncture (2ml of blood added in plastic tubes containing 2-4 mg of EDTA salt anhydrous dipotassium salt) centrifuged, and exposed to the following tests**:**

1. Determination of oral glucose tolerance (**National diabetes data group, 1979**).

2. Determination of plasma glucose level (**Watson, 1962**).

3. Determination of plasma insulin level (**Frier et al., 1981**).

4. Determination of C- peptide level (**Heding, 1975**).

5. Determination of lipase level (**Ventrucci et al., 1989**).

6. Estimation of serum iron and total iron binding capacity (**Tietz, 1976**).

7. Estimation of serum ferritin (**Addison et al., 1972**).

Data were exposed to student's t- test, and chi-square using IBM PC micro processor. P value < 0.05 was considered significant.

RESULTS

The fasting blood glucose level of the thalassemic group with intact spleen was 80.7±10.4 mg/dl, where in control group was 73±7.2 mg/dl, and these results significantly changed, and were not significantly different from the thalassemic group with splenectomy. On the other hand, there was no significant difference between both thalassemic patients in glucose level (Table 1).

After two hours of glucose ingestion, there was no significant difference between the control group and both thalassemic groups (Table 1).

There was no significant difference in insulin level between the control group and both thalassemic groups before and after ingestion of glucose.

Table (1): Blood glucose level (fasting and post prandial) and insulin level (fasting and after 30 minutes of glucose ingestion).

Parameters / Groups	Mean ± S D			
	Blood glucose (mg%)		Insulin (IU/ml)	
	Fasting	Post-prandial	Fasting	After 30 min
Group I (15)	73±7.2	110.5±6.2	5.69±2.77	39.08±2.77
Group II (24)	*80.7±10.4	114.9±9.1	5.39±2.50	30.64±18.12
Group III (16)	*77.4±8.8	111.3±6.2	5.50±2.18	38.25±11.65

Significant
Number of each group was shown in between brackets.

The number of blood transfusions was significant between both thalassemic groups. Also, the duration of desferol therapy was significant between both thalassemic groups (Table 2).

Table (2): Frequency of blood transfusion and duration of desferol therapy/year among the studied group.

Parameters / Groups	Mean ± S D	
	Blood transfusion (times/year)	Duration of desferal therapy (year)
Group I (24)	*16±5.0	+3.7±1.3
Group II (16)	*9±1.8	4.0±1.4

+ *Insignificant*   * *Significant*
Number of each group was shown in between brackets.

The level of serum iron in the control group was 82.3±11.8 mg/dl, where in the thalassemic group with intact spleen was 179.2±16.5 mg/dl which was significantly higher than the mean serum iron level of the thalassemic group with splenectomy (101.8±17.4 mg/dl -Table 3).

The mean level of serum ferritin in the control group was 45.5±9.7, and in the thalassemic group with intact spleen was 337.9±63.7 ng/ml which was significantly higher than the serum ferritin in the thalassemic group with splenectomy (Table 3).

The total iron binding capacity in both thalassemic groups was significantly less than the control group (Table 3).

The mean hemoglobin concentration in thalassemic group with intact spleen was significantly lower than hemoglobin concentration in thalassemic patients with splenectomy and the control group (Table 3).

Table (3): Levels of serum iron, serum ferritin, total iron binding capacity and hemoglobin.

Parameters / Groups	Mean ± S D			
	Serum iron (mg/dl)	Serum Ferritin (mg/ml)	Total iron binding capacity (mg/dl)	Hemoglobin (mg/dl)
Group I (15)	82.3±4.8	45.5±9.7	328.2±70.8	13.2±0.3
Group II (24)	179.2±16.5	*337.9±63.7	*238.1±30.3	*5.9±0.8
Group III (16)	*101.8±17.5	*243.3±100.6	*294.9±31.8	*7.3±0.7

Number of each group was shown in between brackets.

There was a significant decrease in both thalassemic groups compared to the control group, while fasting peptide showed no significant changes compared to control and both thalassemic groups. On the other hand, there was a significant decrease in the level of the serum C-peptide after 30 minutes of glucose ingestion in both groups I, II compared to control group and both thalassemic groups (Table 4).

Table (4): Levels of serum lipase and C- peptide (fasting and before 30 minutes of glucose ingestion).

Parameters / Groups	Mean ± S D		
	Serum lipase (U/L)	C- peptide (ng/ml)	
		Fasting	After 30 minutes of glucose ingestion
Group I (15)	70.1±25.08	1.17±0.26	4.5±0.74
Group II (24)	*21.62±4.3	1.19±0.24	*3.4±0.52
Group III (16)	*47.7±16.3	1.09±0.26	*3.6±0.6

*Significant

Number of each group was shown in between brackets.

DISCUSSION

Thalassemia is a disorder of hemoglobin synthesis. It is characterized by complete absence of globin production, which results in decreased oxygen delivery to the tissues, ineffective erythropoiesis and severe anemia. Patients usually develop complications of chronic anemia including growth retardation **(Rachmilewitz & Giardina, 2011 and Gülhan et al., 2016)**.

In the present study, the level of blood glucose increased in both groups of the thalassemic patients, where the insulin level was affected slightly especially in the patient with intact spleen. This work was in agreement with the work done by **Simeox and McClain (2013)** who stated that the risk of development of diabetes in patients with thalassemia who are receiving frequent transfusion has generally been thought to be due to direct toxic effects of iron on the pancreatic islets that lead to insulin deficiency.

In the present work, the level of serum iron was significantly higher in the thalassemic groups than the control group, and also in the thalassemic group with intact spleen more than that with splenectomy. This could be attributed to the hemosiderosis resulting from frequent blood transfusion (**Genc et al., 2016**).

The present study showed that the level of serum ferritin was significantly lower in control group than that of thalassemic patients with splenectomy which was lower than that of patients with intact spleen. These results were in agreement with the finding of **Eugene et al, (2011)** and **Mishra** & **Tiwari (2013)** who reported that the serum iron and ferritin level increased in thalassemic patients, and the increase in the serum iron and ferritin levels may be due to defective iron utilization with increased iron absorption.

Total iron binding capacity in both thalassemic groups of this work decreased significantly than the control group denoting a full saturation of total iron binding capacity of the patient due to repeated blood transfusion. This was approved before by **Verma et al. (2014)** who reported that serum level of total iron

binding decreased in thalassemic patients than the control.

The fasting C-peptide level in this work had no significant difference in both thalassemic groups in comparison with control. However, after 30 minutes of glucose ingestion, there was a significant decrease in C-peptide level when compared with control groups. This could be due to reduction in □-cells secretion as a result of direct impairment of secretory function by chronic iron overloaded as tissue damage from iron overload (**Jones and Hattersley, 2013**). The heavy iron deposit was seen in Kupffer cells as in hepatocytes surrounded by fibrosis around the portal tracts. The iron deposition in liver may produce insulin resistance by interfering with the ability of insulin to suppress hepatic glucose production (**Kew, 2014**).

This study showed a significant decrease in lipase level in thalassemic patients with intact spleen more than those with splenectomy, and this finding was in agreement with **Ashar et al. (2015)** who reported that serum lipase is significantly lower in thalassemic children.

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تأثير نقل الدم المتكرر على بعض قياسات الدم

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خلفية البحث: لنقل الدم المتكرر وبكميات كثيرة تأثيراته الضارة على الجسم و خاصة ظاهرة ترسب الحديد فى أجهزة الجسم المختلفة.

الهدف من الدراسة: دراسة التغيرات التى تحدث على بعض قياسات الدم من تأثير نقل الدم المتكرر**.**

المرضى وطرق البحث: أجريت هذه الدراسة على المرضى المصابين بأنيميا البحر الأبيض المتوسط المترددين على العيادات الخارجية لمستشفى جامعة الأزهر الجامعى بأسيوط. وقد كان عدد المرضى ٤٠. وتم تشخيصهم بأنهم مصابون بأنيميا البحر الأبيض المتوسط وأنهم قد تعرضوا لنقل دم متكرر وقد أجريت لهم قياسات العوامل الدم الآتيه (إختبار تحمل السكر- مستوى الجلوكوز فى الدم - مستوي الإنسولين بالدم - مستوى سي ببتايد فى الدم - مستوى الليباز - مستوى الحديد - قياس قدرة الدم على حمل الحديد - قياس الفرتيين فى المصل).

النتائج: نتج عن ترسب الحديد إنخفاضا فى إنزيم الليباز الذى يقل فى مرضى الثلاسيميا مقارنة بالمجموعة الضابطة- وكذلك يقل نسبة السي بيبتد فى المرضى عنه فى المجموعة الضابطة -وكذلك تبين نتائج هذه الدراسة تأثر البنكرياس بنسبة الحديد المترسب به، وقد زادت نسبة الحديد فى مصل الدم فى المرضى عنه فى المجموعة الضابطة مما أدى إلى زيادة نسبة الفرتين وقلت نسبة إرتباط الحديد مما أدى الى إنخفاض نسبة الهيموجلوبين فى الدم.

الإستنتاج: إرتفع مستوى السكر في الدم بشكل ملحوظ في مرضى الثلاسيميا في حين إنخفض مستوى الإنسولين فيها. وكذلك لوحظ زيادة مستوى فيريتين مصل الدم في مرضى الثلاسيميا حيث إنخفض الهيموجلوبين. وكذلك إنخفض مستوى الليباز و سى ليباز في مريضى الثلاسيميا.