Anemia and Biochemical Profile of Thalassemia Patients

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Abstract

Context: Thalassemia is a group of inherited hemoglobin disorders characterized by reduced synthesis of one or more of the globin chains leading to imbalanced globin synthesis which is the major factor in determining the severity of the disease in the thalassemia syndromes. The objectives of this study was to analyze the anemia and biochemical profile in thalassemia major patients as very few studies have been done in this region of country. *Aims:* Determination of anemia and biochemical profile of thalassemia patients. *Settings and Design:* Cross-sectional study. *Methods and Material:* The study was done at a tertiary care hospital from January 2014 to December 2014. 35 thalassemia major patients who received blood transfusions in the hospital were included in this study. Complete blood count, Peripheral Smear Examination, Serum Ferritin and Fasting plasma glucose was done. *Statistical analysis used:* The data was analysed using SPSS version 20. Categorical data was expressed in terms of rates, ratios and percentage. *Results:* Male to female ratio of 4:1. About 51.43 % of patients were aged between 10 to 12 years. Mean hemoglobin was 6.8 gm±1.08 gm% and peripheral smear examination showed microcytic hypochromic anemia in most of the patients (74.29%)The raised serum ferritin levels were noted in 94.29% of the patients. The activity of all the liver enzymes AST, ALT and ALP were raised. *Conclusions:* The patients with transfusion dependent thalassemia major are at risk of developing severe anemia and biochemical abnormalities. Hence screening is essential as per guidelines.

Keywords: Thalassemia; Anemia; Biochemical Profile; Ferritin.

Introduction

Thalassemia is a group of inherited hemoglobin disorders characterized by reduced synthesis of one or more of the globin chains leading to imbalanced globin synthesis which is the major factor in determining the severity of the disease in the thalassemia syndromes. Beta-thalassemia results from a defect in beta globulin chain production and ranges from clinically silent heterogeneous thalassemia minor to severe transfusion-dependent thalassemia major [1,2].

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Various complications caused by this disease including growth retardation, endocrine dysfunction, hypothyroidism, progressive liver failure and abnormal kidney function. Trace metals, especially iron, are implicated as causative agents in excessive generation of free radicals which are capable of causing oxidative damage to erythrocytes [3].

Iron metabolism in human is unidirectional because of being unable to be eliminated by the excretory route. Therefore, excess of iron is deposited in vital organs such as heart, liver, spleen and endocrine organs [4-6].

Several authors have reported a high incidence of endocrine abnormalities in children, adolescents and young adults suffering from thalassemia. However, the incidence of endocrinopathies varies among different series of the patients. Trace minerals have been shown to have influence on growth and hormones

e.g. zinc deficiency is considered a causative factor in osteoporosis and endocrinopathies [7-8].

The aim of this study is to evaluate the clinical parameters, hematological parameters, liver function tests and iron overload by serum ferritin in thalassemia patients.

The thalassemia major patients require regular blood transfusions to survive. Regular transfusion is recommended to maintain a pretransfusion hemoglobin threshold not exceeding 9.5 g/dl, which seems to be associated with relatively low iron burden and with adequate marrow inhibition [9]. The combination of regular blood transfusions along with chelation therapy has dramatically increased the life expectancy of thalassemics. However, endocrinopathies have become common as the age of child advances because of chronic anemia and iron overload. There is lack of data in this region of country which provides description of anemia and biochemical profile of thalassemia major patients hence this study was undertaken.

Materials and Methods

The present cross-sectional study was done at a tertiary care teaching hospital from January 2014 to December 2014. Universal sampling method was used and 35 thalassemia major patients who received blood transfusions were selected during the study period. Prior to the commencement, ethical clearance for the study was obtained from the Institute ethics committee. The objectives of this study were determination of clinical, hematological and biochemical profile in the thalassemia major patients.

All known diagnosed cases of thalassemia major who and have received blood transfusions at two to four weeks intervals with or without iron chelation therapy in the tertiary care hospital were included in the study. Patients who are known cases of other types of hemoglobinopathies and anemias were excluded from the study. The eligible patients were briefed about the nature of the study and a written informed consent was obtained from the selected patients. These patients were interviewed for the demographic details and history of disease. The clinical examination was done for all patients. Under sterile conditions, about 5 mL of blood was collected into EDTA vacutainers through venipuncture. An aliquot of blood (2.0 mL) was taken, transferred to another tube for hematological tests The tube containing the remaining 3 mL blood sample was then centrifuged for 15 min at 3,000 rpm and plasma samples were collected in Eppendorf tubes using Pasteur pipette for biochemical tests. The following tests were done complete blood count, liver function tests, renal function tests, random blood sugar and serum ferritin. The data obtained was entered in datasheet and data was analysed using SPSS version 20. Categorical data was expressed in terms of rates, ratios and percentage. Continuous data was expressed as Mean ± standard deviation, median and range.

Results

This study was done for period of one year. There are 28 male patients and 7 female patients with male to female ratio was 4:1. The commonest age group was

Table 1: Characteristics of the thalassemia major patients including the hematological profile

Variable	Mean		Median	Range	
	Mean	SD		Min	Max
Age (Years)	13.46	3.67	12	10	23
Age at diagnosis (Months)	8.94	6.15	8	3	36
Duration of disease (Years)	12.29	3.66	11.5	6	22
Frequency of transfusion (/Month)	1.09	0.28	1	1	2
Haemoglobin (gm%)	6.85	1.08	6.8	4	10
RBC count (million/cumm)	2.76	0.53	2.61	2	4
Packed cell volume (%)	20.97	3.51	21.1	13	31
Total leukocyte count (/cumm)	8853.71	5217.30	7000	4250	29500
Neutrophils (%)	50.66	9.44	51	25	69
Lymphocytes (%)	47.57	12.41	47	27	93
Eosinophils (%)	1.46	0.56	1	0	2
Monocytes (%)	2.03	0.98	2	0	4
Platelet count (lacss/cumm)	4.03	1.90	3.805	2	10
MCV (fL)	78.29	6.79	78.6	63	93
MCH (pg)	24.84	2.74	24.8	20	31
MCHC (%)	30.70	2.78	31.00	25.00	36.30
RBC distribution width (%)	21.82	4.95	21	14	33

Table 2: Biochemical Profile of Thalassemia patients

Variable	Mean		Median	Range	
	Mean	SD		Min	Max
Liver Function Tests					
Direct bilirubin (mg/dL)	1.16	0.43	1.2	0	3
Total proteins (gms/dL)	7.09	0.69	6.9	6.00	8.30
Serum albumin (gms/dL)	5.41	6.75	4.2	3	44
A:G ratio	1.17	0.35	1.1	1	2
AST (IU/L)	59.21	19.69	53	14	99
ALT (IU/L)	57.58	21.02	65	14	104
ALP (IU/L)	238.97	89.16	242.00	82.00	490.00
Renal Function Tests					
Blood Urea (mg/dL)	25.28	4.85	25	13	36
Serum Creatinine (mg/dL)	0..74	0.16	0.7	0.5	1.1
Other Parameters					
Fasting plasma glucose (mg/dL)	82.34	15.13	79.00	60.00	125.00
Serum ferritin (ng/mL)	3664.14	2330.97	3570	343	10710

10 to 12 years comprised of 51.43% of the patients followed by 13-15 years age group (25.71%). Majority of the patients were on chelation therapy (71.43 %). The study showed the mean age was 13.46 ± 3.67 years and median age was 12 years as shown in Table 1.The youngest patient was 10 years and oldest was 23 years. Physical examination splenomegaly and hepatomegaly were present among 65.71% and 14.29% of the patients respectively. In the present study the complete blood count findings showed all the patients (100%) with haemoglobin levels < 12.5 gm%, the mean hemoglobin being 6.8 gm% and peripheral smear examination showed microcytic hypochromic anemia in most of the patients (74.29%).The complete blood counts and RBC indices are depicted in Table 1. Liver function tests revealed raised mean liver enzymes AST, ALT and ALP along with iron overload indicated by significantly raised serum ferritin as depicted in Table 2. None of the patients had deranged renal parameters. Hence the patients had severe anemia , iron overload and deranged activity of liver enzymes.

Discussion

Thalassemia major is a homozygous state which causes hemolytic anemia demanding regular blood transfusions. However, frequent blood transfusions has led to iron overload which causes cardiac, metabolic, endocrine, neurological and hepatic complications including transfusion transmitted infections. Endocrine abnormalities are also seen in thalassemia major patients due to chronic iron overload.

In the present study on transfusion dependent thalassemia major patients, nearly half of the study population was aged between 10 to 12 years (51.43%). The mean age was 13.46 ± 3.67 years and median age was 12 years with younger patients being 10 years and oldest being 23 years. The mean age observed in the present study was close to that of Chern et al. [10] (14.8 ± 6.9 years) and comparable with the other study from Tehran (15.20 ± 3.1 years). In a study by Najafipour F et al. [9] in Iran reported mean age was 15.62 ± 4.44 with youngest patient being 10 years and oldest being 27 years. In another study by Khalifa et al [11] showed age range of patients to be 10-30 years as compared to the present study where the age range is 10-23 years. In the present study 17.14% of the patients had history of splenectomy which is close to 20.2% patients who underwent splenectomy in a study done by Chern et al [10].

In the present study majority of the patients (80%) were males with male to female ratio of 4:1. Similarly, study done by Khalifa et al [11] showed majority of patients were males. The sex distribution pattern observed in the present study was similar to other studies from Kolkata [12].

In the present study, 29 (94.29%) patients had raised serum ferritin levels. Mean and SD is 3570±2330 ng/mL with range from 3570ng/mL to 10710 ng/mL which indicate severe iron overload in all the patients. The activity of all the liver enzymes AST, ALT and ALP were raised as indicated by their mean value which was similar to study done by Karim et al [3] in Bangladesh The mean creatinine level (0.74 ± 0.16 µg/dL) was lower than the study by Karim et al. However, the renal function of patients was not deranged in our study.

Liver disease has emerged as a major cause of mortality in patients with b thalassemia major. The manifestations of liver disease include decreased

albumin concentrations, hepatomegaly, increased aspartate and alanine transaminase enzymes, hepatitis B and C . Hepatic fibrosis is frequent and is due to iron overload which can be attributed to hypertransfusion, inadequate chelation, RBC catabolism and iron hyperabsorption. The following measures would be optimum for the thalassemia care. Programs that provide acceptable care, including transfusion of safe blood and supportive therapy including chelation, must be established. Estimation of serum ferritin must be done regularly to assess iron overload so as to facilitate chelation therapy if required. Screening of thalassemia major patients for biochemical abnormaities and other complications must be started at appropriate age as per the guidelines is recommended. ICET [13]. Thalassemia International Federation also recommends regular monitoring of these patients with blood counts, liver function tests, renal function tests and serum ferritin at regular interval to prevent complications.

Conclusion

The patients with transfusion dependent thalassemia major are at risk of developing severe anemia and biochemical abnormalities. Overall, the present study showed risk of severe anemia inspite of regular blood transfusions, iron overload and impaired liver function in thalassemia major patients which necessitates the regular monitoring of these patients as per guidelines of Thalassemia International Federation with complete blood counts and biochemical tests for a watchful follow up to prevent the complications.

Key Messages

Anemia profile and biochemical profile is needed for patients to screen at appropriate age for abnormalities as per guidelines

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