PREVALENCE OF IRON DEFICIENCY IN THALASSEMIA TRAIT: A STUDY IN BSMMU, DHAKA

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Abstract

Background: *Thalassemia is considered the most common genetic disorder worldwide and about 7% of world populations are carriers. A vast majority of such cases have iron deficiency.*

Objective: *This study was undertaken to find out the pattern of iron status in thalassemia traits and thus to determine co-existing iron deficiency in them.*

Method: *This cross sectional study was carried out in the Department of Hematology, BSMMU, Dhaka from January 2007 to December 2007. Adult anemic patients of hypochromic microcytic blood film attending outpatient department were screened for thalassemia on the basis of clinical history, physical findings and hemoglobin electrophoresis. A total of 50 anemic patients with carrier state of thalassemia was detected and selected for evaluation of iron profile.*

Results: *Patients having iron deficiency detected by serum iron profile were compared with those without iron deficiency. The mean age in years of study subjects were 30.38 ± 9.79 years. Among the study population, 50% were male and 50% were female. Highest frequency of co-existent iron deficiency was found among the age of 21-30 years. Prevalence of iron deficiency was 30.2% among b-thalassemia trait. A statistically significant mean difference of Hb, MCV, MCH, MCHC, serum iron, TIBC, S. Ferritin, transferring saturation was found indicating study subjects without iron deficiency had higher level than with iron deficiency ($p<0.05$).*

Conclusion: *Clinical iron deficiency may occur in thalassemia trait/carriers of inherited hemoglobin disorders. The combined state should always be suspected and iron supplements are often needed to improve the status of anemia.*

Keywords: *β-Thalassemia trait, Iron Deficiency anemia,*

Introduction

The thalassemias are a heterogeneous group of genetic disorders of hemoglobin synthesis, all of which result from a reduced rate of production of one or more of the globin chains of haemoglobin[1]. Several types of thalassemias have been described and named according to the affected globin chain, the most common types of clinical importance being b, á, and äâ thalassaemia[2]. In Bangladesh, Hb E disorders are prevalent, where single mutation in globin gene is responsible for both reduced production of b-gene product and Hb E instead of Hb A. That is why it is called 'thalassemic hemoglobinopathy'.

Thalassemia is considered the most common genetic disorder worldwide[3]. The WHO estimates that about 7% of world populations are carriers[1]. 300000-500000 children are born each year with the severe homozygous states of this diseases[2]. The disease is highly prevalent in Mediterranean basin, Middle East, southern and eastern Asia, the south Pacific and south China with reported carrier rates ranging from 2% to 30%[1]. In Bangladesh no definitive data regarding the carrier status of hereditary Hb disorders exist. A conservative World Health report estimates that 3% of our populations are carriers of b-thalassemia which means that there are 3-6 million carrier of b-thalassemia in Bangladesh. Affected births per thousand of b-thalassemia are 0.106[4].

A microcytic hypochromic blood picture of the red cell is characteristic of thalassemia trait but the vast majority of such cases have iron deficiency anemia.

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Iron deficiency is widely prevalent throughout the world, particularly in developing countries like Bangladesh. Iron deficiency was found in 27.2% of b-thalassemia trait in Northern India[5]. It is often impossible to differentiate between iron deficiency anemia and thalassemia trait either by examining the red cell morphology or the red cell indices.

Under this situation, the present study has been undertaken to find out the pattern of iron status in carriers of hereditary hemoglobin disorders and to determine the presence of co-existing iron deficiency in them. In this way, assessment of iron status of thalassemia trait would assist in decisions regarding therapy with iron[5].

There are numerous conflicting findings regarding the association of thalassemia trait and iron stores. Some investigators have found normal iron store reflected by measurement of serum ferritin level[6], others have reported that b-thalassemia traits are frequently in positive iron balance and are at high risk of developing iron overload [7-9]. If severe iron overload has been described in a group of patients with thalassemia trait then administration of iron to these cases can actually be proved harmful and produce the complication of iron.

On the other hand, some have found a greater incidence of iron deficiency in thalassemia trait than in the normal population[10]. Iron deficiency is a frequent finding in female thalassemia trait of reproductive age and adequate iron supplementation should be given to these subjects after assessment of iron stores by ferritin measurement[6].

Raised haemoglobin A_2 level is an important diagnostic feature of beta thalassaemia trait. It was demonstrated that co-existing iron deficiency does not interfere with the diagnosis of beta thalassaemia trait based on the raised Hb A_2 level[11]. Contrary to above observation regarding the Hb A_2 level some investigators reported that there was reduction in Hb A_2 level with iron deficiency even in the presence of beta thalassemia trait [5, 12]. In this situation administration of iron to these subjects increases the level of HbA_2 and unmasked the diagnosis of beta thalassemia trait.

There is no previous study to explore the iron status in thalassemia trait in Bangladesh. The study was undertaken to determine the prevalence of co-existent iron deficiency and carriers of thalassemia and to develop a strategy for supplementing rational amount of iron to those subjects.

Materials and Methods

This cross sectional study was carried out in the Department of Hematology, BSMMU, Dhaka from January 2007 to December 2007**.** All clinically anemic patients attending hematology outpatient department of BSMMU were sent for CBC with PBF and those revealing microcytic hypochromic anemia were screened for thalassemia on the basis of clinical history, physical findings and ultimately hemoglobin electrophoresis. Citrate agar gel electrophoresis at alkaline pH was done. Subjects taking iron preparation or blood transfusion, suffering from acute febrile illness, inflammatory disorders, hematological malignances and liver disease were excluded from the study. A total of 50 anemic patients with carrier state of thalassemia were selected for further investigation. Red cell indices (MCV, MCH, MCHC) and iron profile (S. iron level, S. ferritin, TIBC, Transferrin saturation) were observed among the study subjects. Patients in whom the iron profile showed iron deficiency were compared with those having no iron deficiency. Relevant information was recorded in a preformed data collection sheet. Data were analyzed by using SPSS statistical package version 12.

Results

A total 50 subjects with microcytic hypochromic anemia of were selected among whom proportion of male and female were equal. Age range was 16-52 years. Frequency of Iron deficiency was 30.2% among b-thalassemia trait but none of the Hb E trait were iron deficient (Table I & Fig. 1). The mean age in years of study subjects were 30.38±9.79 years. Highest frequency of co-incident iron deficiency was found among the age of 21-30 years (Table II).

Table I

Distribution of the iron deficiency by carriers of thalassemia

Iron deficiency	Inherited hemoglobin disorders		
	Beta thalassemia trait (%)	E trait (%)	Total (%)
Present	13 (30.2)	0 (.0)	13 (26.0)
Absent	30 (69.8)	7 (100.0)	37 (74.0)
Total	43 (100.0)	7 (100.0)	50 (100.0)

Table II

Distribution of the study subjects by age

Age (in year)	Frequency(n)	Percent(%)
≤20	7	14.0
21-30	25	50.0
31-40	8	16.0
40-50	8	16.0
>50	2	4.0
Total	50	100.0
Mean ± SD (Range)	30.38 ± 9.79	(16-52)

Table III

Distribution of Hb, MCV, MCH, MCHC, S.Iron, TIBC, S. Ferritin, Transferrin saturation among study subjects.

	Mean	SD		p value*
Hb (g/dl)	With iron deficiency	6.88	1.17	0.001
	Without iron deficiency	10.23	1.47	
MCV (fl)	With iron deficiency	51.54	5.24	0.001
	Without iron deficiency	72.05	5.24	
MCH (pg)	With iron deficiency	15.15	2.21	0.001
	Without iron deficiency	21.65	2.69	
MCHC (g/dl)	With iron deficiency	29.69	2.21	0.923
	Without iron deficiency	29.78	2.81	

*t test was done to measure the level of significance

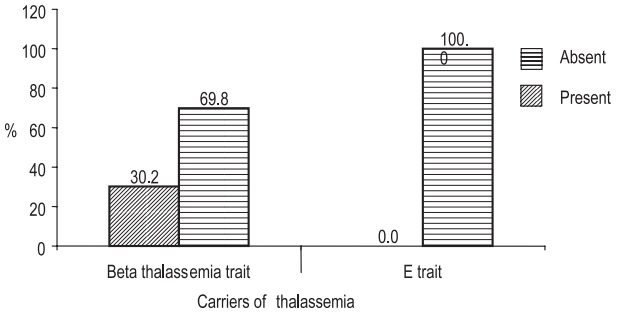

Fig.-1: *Bar chart of the iron deficiency among the carriers of thalassemia*

A statistically significant differences regarding the means of Hb, MCV, MCH, MCHC was found among the study subjects without iron deficiency and the subjects with iron deficiency (p value = 0.001) [Table III]. All these parameters found higher among the iron rich people than the iron deficient people.

Discussion

b-thalassemia trait produces mild ineffective erythropoiesis associated with increased iron absorption. It might therefore be expected to give some degree of protection against iron deficiency, but this might not be true in all the cases. Most of the subjects with thalassemia trait produce microcytic hypochromic blood picture, but this change might not be solely due to subnormal production of globin chains. A good proportion of such cases have iron deficiency that contributes to the blood picture and they require iron supplementation to replenish the deficient iron status to raise their Hb level. Earlier diagnosis of the Hb disorders and restriction of iron intake by the first physicians might play a major role for this clinical entity. On the basis of red cell morphology it is often impossible to differentiate iron deficiency and thalassemia trait and co-existence of both.

Iron deficiency was found in a quarter of traits, mostly among the age group 21-30 years.

A statistically significant mean difference of Hb was found indicating study subjects without iron deficiency had higher (10.23 g/dl) Hb level than subjects with concurrent iron deficiency (6.88 g/dl). The mean MCV (72.05 fl vs. 51.54 fl) and MCH (21.65 pg vs. 15.15 pg) were also high in the group without iron deficiency and statistically significant higher mean difference was found in relation to iron deficient group (p = 0.001) (Table III). Same were observed in other study[13].

The finding of the study shows that in a considerable number of subjects 13 (26%) of beta thalassemia trait with low level of (<12 µg/l) of serum ferritin indicating co-existing iron deficiency. On the other hand, among the study group, 7 patients had Hb E trait and their serum ferritin level were found normal.

This finding of the present study is also consistent with other study which was carried out on British Asian children [13, 14]. The co-existence might be due to different gastrointestinal disorders, chronic blood loss due to different helminthes infestation which is very common in Bangladesh. A poor bioavailability and low iron content of food, late weaning, low birth weight baby, pre-existing iron deficiency should come under consideration of co-existing iron deficiency in context of Bangladesh. Last of all, fear of iron overload and its complications may persuade the physicians and their thalassemic patients to practice a strict iron-free diet from the time of diagnosis.

Conclusion:

The phenotypic expression of thalassemia trait is very diverse and it has been thought that iron absorption

in these individuals is increased. But this observation does not always exclude iron deficiency to have a contribution to anemia among the thalassemia trait. Clinical iron deficiency anemia may frequently co-exist with beta thalassemia trait and iron supplementation is invariably needed in deficient subjects. So, co-existing iron deficiency should always come under consideration among anemic individuals with thalassemia trait in the context of low socio-economic condition of Bangladesh.

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