FREQUENCY OF IRON DEFICIENCY ANAEMIA AND BETA THALASSAEMIA TRAIT AT HAEMATOLOGY DEPARTMENT OF CHILDREN HOSPITAL, LAHORE

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ABSTRACT

Beta thalassaemia and iron deficiency anaemia are the most common microcytic hypochromic anaemias in Pakistan. Both have a significant impact on the patient, the patient's family and offspring.

Study Design: A descriptive study that was designed to compare the frequency of beta thalassaemia trait with iron deficiency anaemia in children who visited Children's Hospital Lahore. Duration of study was six months from May 2005 to Oct 2005. Comparison was based on red blood cell morphology. Their demographic characteristics were also studied.

Material and Methods: Three hundred children aged 01 – 16 years who visited Children's Hospital Lahore were included in this study. Duration of study was 6 months. Criteria for selection were voluntary participation and the availability of family members. Venous blood samples were collected into EDTA. Erythrocyte subsets are reported by the Sysmex XE 5000 analyzer. Children receiving blood transfusion were excluded from the study.

Results: It was observed that the prevalence rate of iron deficiency is more common (89.7%) as compared to beta thalassaemia trait (10.3%) in children. Male children were more thalassaemic and iron deficient as compared to females. Age range of both groups of children were 1 – 4 years. Thalassaemic patients have more positive family history than iron deficiency. Peripheral blood smear of thalassaemic children showed mild anisopoikilocytosis and fragmentation. Mild to moderate microcytosis and hypochromia was observed in same group of children. On the other hand mild to moderate anisopoikilocytosis, microcytosis and hypochromia was observed in children with iron deficiency. Severe microcytosis, hypochromia and mild fragmentation was observed in the same group of children.

Conclusion: It is concluded that the frequency of iron deficiency is more common in age under 5 as compared to thalassaemia trait. Study also concluded that the percentages of iron deficiency in children studied are very high in our country as compared to other parts of the world. Positive family history of BTT may be due to marriage between close relatives, especially first cousins is a very common custom. Red cell differential is useful in distinguishing between thalassaemia and iron deficiency anaemia. In red cell morphology of both groups, fragmentation may be used to differentiate beta thalassaemia trait from iron deficiency.

Key words: Thalassaemia, iron deficiency anaemia, children.

INTRODUCTION

Thalassaemia syndromes are a group of blood disorders inherited in autosomal recessive manner[1] that cause hemolytic anaemia because of the decreased or absent synthesis of a globin chain. Imbalances of globin chains cause haemolysis and impair erythropoiesis. The one gene defect, beta thalassaemia trait (minor), is asymptomatic and results in microcytosis and mild anaemia.[2]

Thalassaemia is the most common genetic disorder worldwide.[3,4] Thalassaemia affects men and women equally and occurs in approximately 4.4 of every 10,000 live births.[5] To date, more than 200 causative molecular defects have been described in the beta globin gene causing beta thalassaemia.[6,7]

Beta thalassaemia is the most common genetic disorder in Pakistan. It has a significant impact on the patient and the patient's family and offsprings.[8] Many socio-economic factors like unawareness, poor diagnostic facilities, and cost of molecular diagnosis result in interpretation of these subjects as normal.[7] In communities especially in Pakistan with a cultural preference for consanguineous marriage, when a gene for a recessive disorder is present in kindred, there is likely to be an affected child in at least one branch of the extended family.[9]

In beta thalassaemia the concentration of haemoglobin in the RBCs is hypochromic and the cells

are microcytic. The variation in RBC size is within normal limits. In most of hypochromic cells, a thin rim of haemoglobin and the large area of central pallors present or in which the haemoglobin concentration is decreased. Peripheral blood smear demonstrates marked poikilocytosis as well as some anisocytosis, though many are microcytes.[10]

Iron deficiency anaemia (IDA) is the most common microcytic hypochromic anaemia world wide.[11,12] Iron deficiency modulates the synthesis of Hb-A_2, resulting in reduced Hb-A_2 levels in patients with IDA.[13] Affected individuals show RBC morphological change of microcytosis, hypochromia, anisocytosis and poikilocytosis. Carriers have less severe RBC morphological changes than the affected invididuals.[14] Percentage of hypochromic red cells may be high before the anaemia develops. It is found that a reduction in haemoglobin concentration is a late feature of iron deficiency. Haematinic assays is used to demonstrate reduced serum ferritin concentration in straightforward iron deficiency.[15]

Our study was designed to compare the frequency of beta thalassaemia trait with iron deficiency anaemia in children who visited Children's Hospital Lahore. Comparison was based on red blood cell morphology. Their demographic characteristics were also studied.

MATERIAL AND METHODS

We conducted a descriptive study at the Children's Hospital Lahore, which supports thalassaemia center that provide care for affected children, testing to identify carriers, counselling, and prenatal diagnosis. Duration of study was 6 months. Criteria for selection were voluntary participation and the availability of family members. Three hundred children aged 01 – 16 years were included in this study. Venous blood samples were collected into EDTA. Erythrocyte subsets are reported by the Sysmex XE 5000 analyzer. Children taking blood transfusion were excluded from the study.

Statistical Analysis

All qualitative variables like age distribution, gender, family history, history of taking haematinics and signs of pallor were reported by using percentages. Distribution of red cell morphology of peripheral smear including anisopoikilocytosis, microcytosis, hypochromia and fragmentation were reported as percentages of mild, moderate and marked.

Table 1: *Demographic characteristics of children with beta thalassemia trait and Iron deficiency.*

	Thalassaemia Trait Patients (31)	*Iron Deficiency (269)*
Age distribution		
1 – 4 years	16 (51.6%)	186 (69.14%)
5 – 8 years	14 (45.16%)	50 (18.58%)
9 – 12 years	01 (3.22%)	18 (6.69%)
13 – 16 years	----	15 (5.57%)
Male	18 (58.1%)	162 (60.2%)
Females	13 (41.9%)	107 (39.8%)
Family history		
Positive	16 (51.6%)	109 (40.5%)
Negative	15 (48.3%)	160 (59.5%)
History of taking Haematinics	03 (9.7%)	98 (36.4%)
Pallor	17 (54.8%)	256 (96.2%)

Table 2: *Distribution of cases on the basis of red blood cell morphology on peripheral smear.*

RBC Morphology	*Beta Thalassaemia Trait*				*Iron Deficiency*			
	Absent	*Mild*	*Moderate*	*Marked*	*Absent*	*Mild*	*Moderate*	*Marked*
Anisopoikilocytosis	9 (29%)	22 (70.9%)	—	—	59 (21.9%)	141 (52.4%)	69 (25.6%)	—
Microcytosis	—	19 (61.3%)	12 (38.7%)	—	—	86 (32.1%)	164 (60.9%)	19 (7.1%)
Hypochromia	—	19 (61.3%)	12 (38.7%)	—	—	88 (32.7%)	160 (59.5%)	21 (7.8%)
Fragmentation	15 (48.4%)	16 (51.6%)	—	—	268 (99.6%)	01 (0.4%)	—	—

Mild = < 5% Moderate = 5 – 15% Marked = > 15% (Bell 1998)

RESULTS

Demographic characteristics of children with thalassaemia trait and Iron deficiency was tabulated (Table 1). Total number of 300 children with complain of anaemia were studied. On the basis of HB A_2, it was observed that only 31 children had complaints of thalassaemia trait and 269 patients had complaints of iron deficiency anaemia. In thalassaemic patients, 58.1% were male and 41.9% were females. In iron deficient children, 60.2% were males and 39.8% were females.

Age distribution in thalassaemic patients indicate that 51.61% have an age range of 1 – 4 years, 45.16% of children were in age range of 5 – 8 years, 3.22% children were in age range of 9 – 12 years. Most of the iron deficient children were in the age range of 1 – 4 years having percentage of 69.14. On the other hand 18.58%, 6.69% and 5.57% children were in the age range of 5 – 8, 9 – 12 and 13 – 16 years respectively. Positive family history was observed in 51.6% thalassaemic patients while 48.3% had no history of thalassaemia. In iron deficient children 40.5% had positive family history of iron deficiency while in 59.5% children had no family history of iron deficiency. Among children of thalassaemia trait, 54.8% of children showed signs of pallor. On the other hand 96.2% of children had pallor as sign in iron deficiency. Intake of haemanitics was observed only in 9.7% thalassaemic patients while it was 36.4% in children with iron deficiency.

Anisopoikilocytosis, microcytosis, hypochromia and fragmentation were the main features of red cell morphology. It was observed that anisopoikilocytosis was absent in 29% thalassaemic children and mildly observed in 70.9% children of the same group. On the other hand in iron deficient children it was absent in 21.9%, mild in 52.4% and moderate in 25.6% children. Mild microcytosis was observed in 61.3% and moderate in 38.7% thalassaemic children. On the other hand it was mild in 32.1%, moderate in 60.9% and marked in 7.1% children. Hypochromia was also observed in both groups of children. Hypochromia was mild in 61.3% and moderate in 38.7%. While in iron deficient children it was mild in 32.7%, moderate in 59.5% and marked in 7.8%. Fragmentation was absent in 48.4% and mild in 51.6% thalassaemic patients. It was absent in 99.6% iron deficient children and mild in only 0.4% (Table 2).

DISCUSSION

The thalassemias are extremely heterogeneous in terms of their clinical severity, and their underlying pathophysiology relates directly to the extent of accumulation of excess unmatched globin chains: alpha in beta thalassaemia and beta in the alpha thalassaemias. However, the accumulation of each separate globin chain affects red cell membrane material properties and the state of red cell hydration very differently. These observations presumably account for the varying extent of ineffective erythropoiesis and peripheral blood haemolysis in the variants of thalassaemia.[16]

Present study observed that out of 300 children, iron deficiency is more common (89.7% as compared to beta thalassaemia trait (10.3%) in children. Most of study population belonged to low socioeconomic group. Our study is in line with some studies that reported that iron deficiency is a common disorder among paediatric population,[17,11] However in context of percentages, no study is found to be in accord with our study. A number of studies observed that the percentages of iron deficiency anaemia and beta thalassaemia were in a range of 53 – 57% and 42 – 47% respectively.[18,19,10] Studies also observed that the frequency of iron deficiency is high in low socioeconomic group. On the other hand some studies are in accord with our study observed that the prevalence of beta thalassaemia trait is in a range of 8 – 10%.[18,19] A study concluded that patients with microcytic hypochromic anaemia could be easily screened out for BTT and IDA in the absence of other complicated diseases.[22]

Present study observed that male children were more thalassaemic as well as iron deficient as compared to females. In beta thalassaemia trait male to female ratio was found to be 1.4:1 while in iron deficiency it was 1.5:1. However a study reported that iron deficiency prevalence was 17.5% among boys and 20.8% among girls making a male to female ratio of 1:1.2.[21] Most of the children of both groups were in the age range of 1 – 4 years. A number of studies[24-26] in line with our study which observed that beta thalassaemia is more prevalent under the age of 5 years. However, a cohort study of 458 children aged between 1.8 and 7.5 years with mild hypochromic microcytic anaemia reported that 243 children were confirmed with iron deficiency and 215 with beta thalassaemia.[19] A study assessed age and gender variation, in relation to indices of iron metabolism in both groups and reported that age of IDA and beta – thalassaemia significantly affect reticulocyte indices.[27]

Positive family history was observed in 51.6% thalassaemic patients. On the other hand in iron deficient children 40.5% had positive family history of iron deficiency. Number of studies observed that marriage between close relatives, especially first cousins is a very common custom and may be the reason of positive family history. In Pakistan, almost 6% of the population has the beta thalassaemia gene.[7] IDA is also the most common anaemia in Pakistan, especially in females and young chil-

dren.[28,29] A group of workers demonstrated that family history was positive in 81.8% of children with beta thalassaemia trait.[30]

Among children of thalassaemia trait, 54.8% of children showed signs of pallor. On the other hand 96.2% of children showed pallor as a sign in iron deficiency. Sign of pallor in both group was also reported.[31,32] Intake of haematinic was observed only in 9.7% thalassemic patients while it was 36.4% in children with iron deficiency.

Anisopoikilocytosis, microcytosis, hypochromia and fragmentation were the main feature of red cell morphology. Present study observed that anisopoikilocytosis was more prominent in thalassaemic children than IDA. A group of workers reported that the "experimental" morphological criteria were the presence of both microcytosis and poikilocytosis.[33]

We observed that there was mild microcytosis in 61.3% in thalassaemic children and moderate microcytosis in 38.7% children of a same group (i.e. range of 39 – 61%). On the other hand in iron deficient children, there was mild microcytosis in 32.1%, moderate in 60.9% and marked in 7.1% children (range of 7 – 61%). Our study is in agreement with a study that reported that prevalence of microcytosis was 52% in IDA and 36% in BTT.[14] A study that thalassaemia probably accounted for most red cell microcytosis.[15] Another study reported that hypochromic subset correlates with the severity of the anaemia in iron – deficient patients.[36]

Hypochromia was also observed in both groups of children. It was mild in 61.3% and moderate in 38.7% in thalassaemic children, while in iron deficient children it was slight in 32.7% moderate in 59.5% and marked in 7.8%. It is reported that the iron deficiency anaemia and beta thalassaemia trait are the most common causes of microcytic hypochromic anaemias. Study suggested that patients with microcytic hypochromic anaemia could be easily screened out for BTT and IDA through these discrimination indices in the absence of other complicated diseases.[21]

Fragmentation was mild in 51.6% thalassaemic patients. It was absent in 99.6% iron deficient children and mild in only 0.4%. A group of workers reported that increased fragmentation and decreased deformability of thalassaemic red cells have been ameliorated during exposure to agents that bind membrane iron.[37].

It is *concluded* that the prevalence rate of iron deficiency is more common in age under 5 as compared to thalassaemia trait. This study also found that the percentages of iron deficiency in children studied are very high in our country as compared to other parts of the world. However the percentage of thalassaemia trait is the same. Positive family history of BTT may be due to marriage between close relatives, especially first cousins is a very common custom. Peripheral blood smear of thalassemic children showed mild anisopoikilocytosis, mild to moderate microcytosis, hypochromia and fragmentation. Mild to moderate anisopoikilocytosis, mild to marked microcytosis, hypochromia and small fragmentation was observed in children with iron deficiency. In red cell morphology of both groups fragmentation may be used to differentiate beta thalassaemia trait from iron deficiency. Red cell differential is useful in distinguishing between the thalassaemia and iron deficiency anaemia.

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