FREQUENCY OF BETA THALASSEMIA MAJOR AMONG CHILDREN WITH IRON DEFICIENCY ANEMIA IN PESHAWAR

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Abstract

Objective: To determine the frequency of beta thalassemia major among children presenting with iron deficiency anemia.

Materials and Methods: In this Cross-sectional study, 200 patients were included. The study was conducted between April-October 2020. All patients were subjected to detailed history and clinical examination. 10cc of venous blood was obtained from all patients and was sent to hospital laboratory. Mean ± SD was calculated for age, hemoglobin and Ferritin levels. Beta thalassemia major was stratified among age and gender to see the effect modifications using chi square test (p value ≤ 0.05).

Results: In this study mean age was 6 ± 3.39 years. 56% children were male, and 44% children were female. Moreover 5% children suffering from iron deficiency anemia had beta thalassemia major, and 95% children didn't have beta thalassemia major.

Conclusion: Our study concludes that the frequency of beta thalassemia major was 5% among children presenting with iron deficiency anemia.

Keywords: beta thalassemia major, children, iron deficiency anemia, Peshawar.

Introduction

Thalassemia is a common genetic Haemoglobinopathy and a major health concern affecting 2.2% - 16% of the total population across the world (1). β thalassemia occurs worldwide at a higher prevalence among Mediterranean population in the Middle East, in parts of India, Pakistan and Southeast Asia. In Pakistan, it's an important health issue at high disease burden ranging between 50,000 to 100,000 patients (2). Despite its high prevalence up to 8% the future spread of the disease is due to inefficient and scarce knowledge leading to 6000 babies been annually and a carry rate of 5-7% that constitutes about 9.8 million of total population (3).Thalassemia was first identified as a clinical entity in 1925 by Thomas Cooley and Pearl lee.[1] The examined four children from Greece and Italy who were having anemia along with characteristic facies, splenomegaly, bone deformities with profound erythroblastosis in blood and familial incidence.

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Wintrobe and coworkers reported milder variations of Cooley's anemia more than a decade later. They noticed that milder manifestations of this disorder were present in both parents of children with classic Cooley's anemia (4). In 1936, Whipple and Branford, for the first time recognized that many of thalassemic patients belong to the Mediterranean regions and invented the word "thalassemia". Beta Thalassemia is inherited disorder in which there's and abnormality of one or more globin genes, divided into two groups alpha and Beta thalassemia (5). Beta Thalassemia major causes severe anemia in the first two years of life, demanding regular red blood cell transfusions. Other symptoms include growth retardation, pallor, jaundiced, poor musculature, hepatosplenomegaly, and leg ulcers, extramedullary hematopoietic and skeletal changes that result from bone marrow expansion. Peripheral smear shows microcytotic, hypochromic, anisocytosis, poikilocytosis and nucleated red blood cells (6). Beta Thalassemia intermedia have moderate anemia and shows a markedly heterogenous hematological picture, ranging in severity from that of beta thalassemia carrier state to that of beta thalassemia major. Beta thalassemia minor/carrier are clinically asymptomatic. The characteristic hematological features are microcytotic, hypochromic and increase HbA2 levels. In our society where there are cultural, religious reasons and close netted family systems, consanguineous marriages are very common (7). Furthermore, there is no concept of premarital screening and counseling of couples with positive family history for thalassemia (8).

Iron deficiency anemia (IDA) occurs when iron levels are sufficiently depleted to produce anemia, characterized by hypochromic microcytic red blood cells. Inadequate dietary iron, iron absorption and intense exercise, along with blood loss and parasitic infestations, are some etiologies of IDA. As micronutrient deficiencies represent the most generalized form of malnutrition in the world, with the prevalence of iron deficiency anemia (IDA) estimated at approximately 42% in developing countries and 17% in developed countries (9). Individuals with thalassemia major typically develop severe anemia over their first two years of life, demanding regular red blood cell (RBC) transfusions. Growth retardation, pallor, jaundice, weak musculature, enlargement of liver and spleen, leg ulcers, formation of structures from extramedullary hematopoiesis, and skeletal abnormalities caused by bone marrow expansion are all common symptoms in people with thalassemia major who are untreated or poorly transfused (10). In one review from China, overall prevalence of β-thalassemia major ranged from 0.53-6.84% (11). Thalassemia is a major problem in Pakistani population and due to its high carrier state, a huge number of infants are born with thalassemia each year which, unless have a good frequency of blood transfusion and chelation, does not survive beyond puberty (12). The aim of current study was to determine the frequency of beta thalassemia major among children presenting with iron deficiency anemia.

MATERIAL AND METHODS

A cross sectional descriptive study was designed. Sample size was 200 keeping 4% prevalence of beta thalassemia major, 95% confidence level and with a margin of error of 3.5% as per WHO sample size calculator (13). A consecutive non-probability sampling technique was used. The inclusion criteria were all patients of either gender with IDA in age group of 1-15 years. Already diagnosed cases of Hemoglobinopathies like thalassemia major, sickle cell anemia on medical records and patients with bleeding disorders as diagnosed on history and medical records were excluded from the study. The study was conducted after approval from hospital ethical and research committee. All patients with IDA and was invited to participate in the study through OPD. All patients' families were informed about the study's purpose and benefits, and an informed consent was taken. All patients were subjected to detailed history and clinical examination. 10cc of venous blood was obtained from all patients and was sent to hospital laboratory for hemoglobin (Hb) electrophoresis to detect beta thalassemia major. Information including name, age, addresses and telephone numbers was recorded on a pre-designed proforma. All the laboratory investigations were conducted under supervision of an expert hematologist. The collected data were stored and analyzed in SPSS version 23 for windows. For numerical variables like age, hemoglobin and Ferritin levels, mean $\pm$ SD was calculated. Frequencies and percentages were calculated for categorical variables like gender and beta thalassemia major. The chi square test was used to stratify beta thalassemia major by age and gender to examine if there were any effect variations. A p-value equal or less than 0.05 was considered statistically significant.

RESULTS

In this study, the frequency of beta thalassemia major among 200 children was analyzed as 10(5%) children had beta thalassemia major while 190(95%) children didn't have beta thalassemia major (**Table 1**). As per our results, 124(62%) children had hemoglobin level ≤ 9 gm/dl while 70(38%) children had hemoglobin level >9 gm/dL (**Table No 2**). Ferritin level among 200 children was found as 120 (60%) children had ferritin level ≤10 µh/L while 80(40%) children had ferritin level >10 µh/L (**Table 3**). ON the other hand, 82(41%) children were in age range 1-5 years, 86(43%) children were in age range 6-10 years and 32(16%) children were in age range 11-15 years. Mean age was 6 years with standard deviation ± 3.39. Gender distribution among 200 children was analyzed as 112(56%) children were male while 88(44%) children were female. Similarly, the stratification of beta thalassemia major with age and gender is given in **Table 4** and **5** respectively. We found that beta thalassemia major was not associated with age and gender of the patient (***p*-value > 0.05**).

TABLE 1: BETA THALASSEMIA MAJOR (n=200)

BETA THALASSEMIA MAJOR	FREQUENCY	PERCENTAGE
YES	10	5%
NO	190	95%
Total	200	100%

TABLE 2: HEMOGLOBIN LEVEL (n=200)

HEMOGLOBIN LEVEL	FREQUENCY	PERCENTAGE	**Mean** ± SD (g/dL)
≤ 9 gm/dl	124	62%	9 ± 2.13
> 9 gm/dl	70	38%	
Total	200	100%	

TABLE 3: FERRITIN LEVEL (n=200)

FERRITIN LEVEL	FREQUENCY	PERCENTAGE	**Mean** ± SD (ng/L)
≤ 10 ng/l	120	60%	10± 0.811
> 10 ng/l	80	40%	
Total	200	100%	

TABLE 4: AGE DISTRIBUTION AND STRATIFICATION (n=200)

AGE	FREQUENCY	PERCENTAGE	Mean Age ± SD (Yrs)	p-value
1-5 years	82	41%	6 ± 3.39	0.9371
6-10 years	86	43%		
11-15 years	32	16%		
Total	200	100%		

TABLE 5: GENDER DISTRIBUTION AND STRATIFICATION (n=200)

GENDER	FREQUENCY	PERCENTAGE	p-value
MALE	112	56%	0.7937
FEMALE	88	44%	
Total	200	100%	

DISCUSSION

Thalassemia is a series of hereditary disorders of globin chain production in which the α-globin and β globin chain synthesis are out of balance. In beta thalassemia, there is a decrease in β-globin chains and relatively excess of α-globin chains. When patient is homozygous for the β-thalassemia gene, they cannot make any normal β globin, refer to as β-thalassemia or β-thalassemia major (14). In United States of America (USA), an estimated 2,000 persons have β thalassemia (15). β-thalassemia is one of the major health problems in Pakistan. A study conducted in Karachi Pakistan showed a prevalence of carrier rate of β thalassemia of 5-8% (16).

In this study, mean age was 6 ± 3.39 years. 56% children were male, and 44% children were female. Moreover 5% children had beta thalassemia major, and 95% children didn't have beta thalassemia major, and 60% patients had serum ferritin level less than 10ng/mL. Our study correlated with another study conducted by Lai K et al in which the overall prevalence of β-thalassemia major ranged from 0.53-6.84% (17). In another study conducted in North Cyprus., reported that 5 years compliance with prophylactic iron supplementation (PIS) to infants suffering with beta thalassemia major significantly reduced the prevalence of iron deficiency anemia (IDA). IDA and thalassemia trait were found to be 11.2% and 4.5% respectively, while 3.4% of the infants had both IDA and thalassemia trait. Prevalence of thalassemia trait was 7.9% demonstrating approximately a 50% decline within 5 decades. In addition, prevalence of IDA was relatively low being 14.6% supporting the beneficial effect of PIS on prevention of IDA (18). Similar results were observed in another study conducted by Qazi RA et al., in which a total of 521 subjects 65.4% were females, with female to male ratio of 1.8:1. Mean age was 17.5 years. On screening diagnosis of beta thalassemia trait was made in 4.9% cases and haemoglobin electrophoresis showed mean haemoglobin A2 of 5.8% in these cases. The microscopic examinations of peripheral blood smears among the subjects with beta thalassemia trait (BTT) showed microcytic hypochromic red blood cells with presence of target cells (19). As per our results, beta thalassemia major was not associated with age and gender of the

patient (***p*-value > 0.05**), i.e., the development of the disease is unrelated to the patient's age or gender.

CONCLUSION

Our study concludes that the frequency of beta thalassemia major was 5% among children presenting with iron deficiency anemia.

Authors Contribution

Nayab Safiullah Jan (NS): Manuscript writing
Zahish Safiullah Jan (ZS): Sample collection and manuscript writing
Humaira Taj Niazi (HT): Sample collection and laboratory work
Huda Zameer (HZ): Laboratory work and manuscript writing
Qurra-tul-ain (QA): Results compilation and statistical analysis
Sidra Humayun (SH): Data analysis and manuscript compilation.

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Conflict of Interest

The authors have no potential conflict of interest relevant to this article to report.

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