

Serum Ferritin Levels and their Relationship with Growth Parameters in Thalassemic Children

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Abstract

Background: Beta-thalassemia major patients suffer from anemia due to hemolysis and erythropoiesis dysfunction. Regular blood transfusions lead to the deposition of iron in the main organs, specifically if proper iron chelation therapy had not been introduced.

Objective: The present study was undertaken to determine effect of serum ferritin levels and pre-transfusion hemoglobin on growth parameters.

Methods: The study was a hospital based observational study where 30 children between age group of 2 to 18 years with confirmed diagnosis of beta thalassemia major on regular blood transfusion and chelation therapy were included.

Results: 80% of children (4 out of 5) with mean pre-transfusion hemoglobin b/w 5-8 g/dl had weight after 1 year of study below 3rd percentile. A significant association was observed between mean serum ferritin level and weight or height after 1 year of study.

Conclusion: Along with maintaining desired pre-transfusion hemoglobin level via regular blood transfusion, it is important to have effective iron chelation therapy to reduce iron overload in the body.

Keywords: Beta-thalassemia Major, Blood Transfusion, Iron Chelation, Serum Ferritin.

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Introduction

In India, thalassemia is frequently found [1]. Every year, 7,000–10,000 kids are born with thalassemia, and 3.4% of people are carriers [2]. Patients with beta-thalassemia major experience anaemia as a result of hemolysis and erythropoiesis failure. Hemoglobin level maintenance requires routine red blood cell transfusions [3]. If effective iron chelation therapy has not

been implemented, frequent blood transfusions cause iron to lodge in the major organs. Children that are [4,5] thalassemic will experience growth failure as well as other iron overload issues. According to the data, these patients' growth failure and high blood ferritin levels are significantly related [5]. The life expectancy can be increased with

treatment. Growth retardation, however, has an impact on quality of life. We conducted this investigation to ascertain the impact of pre-transfusion hemoglobin and serum ferritin levels on growth markers.

Material and Methods

This cross-sectional study was carried out on beta thalassemia major patients who were transfusion dependent at the Thalassemia Day Care Center of the Adesh Institute of Medical Science & Research, Bathinda, Punjab, between March 2019 and August 2020. The study sample consisted of 30 children with confirmed beta thalassemia major who were receiving frequent blood transfusions and chelation therapy, including 17 boys and 13 girls between the ages of 2 and 18. High Performance Liquid Chromatography or hemoglobin electrophoresis profiles were used to confirm the diagnosis of beta thalassemia major (HPLC). Patients with abnormal liver or kidney functions (not brought on by chelation therapy) as well as those with congenital heart disease, celiac disease, hypo- or hyperthyroidism, epilepsy, or diabetes mellitus were excluded from the study.

During the patients' hospital stay for routine blood transfusion, the interviewer utilized a standardized and validated proforma to collect information from all the

patients/parents and the data accessible in the hospital. Boys and girls with delayed puberty were identified by the absence of testicular development by age 14 and the absence of breast development by age 13, respectively [6].

The BC6800, Mindray (calorimetric method) was used to assess the patients' hemoglobin levels, which were taken from their prior medical records. The mean pretransfusion hemoglobin level was determined by averaging the pretransfusion hemoglobin levels over a one-year period.

After a physical examination and the collection of the necessary information, such as age, sex, weight, and height, with written consent, BMI was determined using the formula $BMI (kg/m^2) = \text{weight (kg)} / \text{height (m)}^2$. The height for age percentile was compared to norms for boys and girls to determine the patients' stature. With the TOSOH AIA System Analyzer, the serum ferritin level was examined using ST AIA-PACK FER. Data was gathered and examined. The data were contrasted using the Chi-square test.

Results

This study included 12 children between 2-5 years of age (40%), 6 children between 6-10 years (20%), 11 children between 11-14 years (36.67%) and 1 child between 15-18 years (3.33%) (table 1).

Table 1: Age-wise distribution of children

Age in years	Male	Female	Total	%
2-5 years	4	8	12	40
6-10 years	5	1	6	20
11-14 years	8	3	11	36.67
15-18 years	0	1	1	3.33
Total	17	13	30	100

Table 2: Mean pre-transfusion hemoglobin with weight after 1 year of study

Mean pre-transfusion hemoglobin (g/dl)	Weight after 1 year (percentile)			Total	p-value
	< 3 rd	3 rd – 50 th	50 th -97 th		
5-8	4	1	0	5	0.03
9-10	1	11	3	15	
>10	2	5	3	10	
Total	7	17	6	30	

After a year of study, the weight of 80% of children (4 out of 5) with mean pre-transfusion hemoglobin between 5-8 g/dl was below the third percentile. 6.7% of kids (1 out of 15) with mean pre-transfusion hemoglobin b/w 9-10 g/dl had weights below the third percentile after a year of study. 20% of kids (or 2 out of 10 kids) with mean pre-transfusion hemoglobin > 10 g/dl had weights below the third percentile after a year of study. After a year of research, a substantial correlation between weight and mean pre-transfusion hemoglobin level was found (p-value 0.03).

Table 3: Mean pre-transfusion hemoglobin with height after 1 year of study

Mean pre-transfusion hemoglobin (g/dl)	Height after 1 year (percentile)			Total	p-value
	< 3 rd	3 rd – 50 th	50 th -97 th		
5-8	4	1	0	5	0.017
9-10	1	12	2	15	
>10	1	8	1	10	
Total	6	21	3	30	

After a year of study, the height of 80% of children (4 out of 5 children) with mean pre-transfusion hemoglobin b/w 5-8 g/dl was below the third percentile. 6.7% of children (1 out of 15) with mean pre-transfusion hemoglobin b/w 9-10 g/dl had height that was below the third percentile after a year of study. After a year of study, 10% of kids (1 out of 10 kids) with mean pre-transfusion hemoglobin > 10 g/dl had height below the third percentile. After a year of research, a substantial correlation between the mean pre-transfusion hemoglobin level and height was found (p-value 0.017).

Table 4: Mean serum ferritin with weight after 1 year of study

Mean serum ferritin (ng/ml)	Weight after 1 year (percentile)			Total	p-value
	< 3 rd	3 rd – 50 th	50 th -97 th		
< 1000	0	2	0	2	0.035
1000 – 2499	1	11	5	17	
2500 – 4000	4	4	1	9	
>4000	2	0	0	2	
Total	7	17	6	30	

After a year of investigation, 5.9% of kids (1 out of 17 kids) with mean serum ferritin levels between 1000 and 2499 ng/ml had weights that were below the third percentile. After a year of investigation, the weight of 44% of kids (4 out of 9 kids) with mean serum ferritin levels between 2500 and 4000 ng/ml was below the third percentile. After a year of investigation, the weight of all children (2 out of 2) with mean serum ferritin levels above 4000 ng/ml was below the third percentile. After a year of research, a substantial correlation between the mean blood ferritin level and weight was found (p-value 0.035).

Table 5: Mean serum ferritin with height after 1 year of study

Mean serum ferritin (ng/ml)	Height after 1 year (percentile)			Total	p-value
	< 3 rd	3 rd – 50 th	50 th -97 th		
<1000	0	2	0	2	0.004
1000 - 2499	0	15	2	17	
2500 - 4000	4	4	1	9	
>4000	2	0	0	2	
Total	6	21	3	30	

89% Children with mean ferritin levels of 2499 had an average height between the third and fiftyth percentile (17 out of 19). After a year of investigation, the height of 44% of kids (4 out of 9 kids) with mean serum ferritin levels between 2500 and 4000 ng/ml was below the third percentile. After a year of investigation, the height of all children (2 out of 2) with mean serum ferritin levels above 4000 ng/ml was below the third percentile. After a year of research, a substantial correlation between the mean blood ferritin level and height was found (p-value 0.004).

Discussion

Thalassemia major is a frequent hemoglobinopathy in India. In patients with thalassemia, secondary iron excess frequently results in growth failure. Therefore, these individuals need to have their iron overload properly monitored along with their haemoglobin level and extensive chelation therapy. Serum ferritin levels were assessed in the current investigation as a marker of iron excess.

In this study, a strong correlation between weight after a year of study and mean pre-transfusion haemoglobin level between 5-8 g/dl was found (p-value 0.03). Pre-transfusion Hb 8g/dl was statistically related to weight for age, according to Simhachalam M *et al* (p-value 0.001).⁷ Pre-transfusion haemoglobin and child weight were shown to be positively correlated in the study by Mukherjee S *et al* (p-value 0.005) [8].

After a year of research, the current study found a strong correlation between height and mean pre-transfusion haemoglobin levels of 5-8 g/dl (p-value 0.017). Pre-transfusion Hb 8g/dl was statistically linked with height for age, according to Simhachalam M *et al* (p-value 0.00).⁷ Pre-transfusion haemoglobin and child height were shown to be positively correlated in the study by Mukherjee S *et al* (p-value < 0.001) [8].

After a year of research, this study found a substantial correlation between mean serum ferritin levels (>2500 ng/ml) and weight (p-value <0.035). In their study, Huang Yong-Lan *et al.* found that patients with weights below the third percentile had greater serum ferritin levels than those with weights above the third percentile (p <0.05) [9].

After a year of research, there was a strong correlation between mean serum ferritin levels (>2500 ng/dl) and height (p-value 0.004). Similar findings were found by Pemde *et al.* who revealed a significant connection (p 0.000) of higher mean ferritin levels in individuals with short stature than in patients with normal height (3720 1512 ng/ml vs. 2570 1196 ng/ml) [10]. Similar to this, Hamidah A *et al.* found that patients with heights above the third percentile had better mean serum ferritin levels (2271.0 ng/ml) than patients with heights below the third percentile (4567.0 ng/ml, p = 0.01) in a different study [11]. Serum ferritin level and short stature were found to be significantly correlated in another investigation by Bash HS *et al.* [12]

Conclusion

In addition to maintaining the ideal pre-transfusion haemoglobin level with routine blood transfusion, it's critical for children with beta thalassemia major to get efficient iron chelation therapy to lessen iron overload in the body and diminish growth parameter retardation. The study's sample size was limited, which was a drawback, but the findings were in line with those of other studies.

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