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Original Research Article

Height velocity and its relation with serum ferritin and pretransfusion haemoglobin in thalassemia patients: results from a tertiary center in Northeast India

Bikashita Mahanta*, Ananta Kumar Nath, Pranabjit Biswanath

Department of Pediatrics, Jorhat Medical College, Jorhat, Assam, India

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***Correspondence:**
Dr. Bikashita Mahanta,
E-mail: mahantabikashita@gmail.com

ABSTRACT

Background: ß-thalassemia syndromes are the commonest single gene disorders in the Indian population and growth failure remains a major concern among these patients.
Methods: We studied the relation of height velocity with serum ferritin and pretransfusion hemoglobin in 30 transfusion dependent thalassemia patients aged 1-12 years attending our centre. The height measurements were taken every 6 months for one year. Serum ferritin was measured 3 monthly and pretransfusion hemoglobin was measured at each visit.
Results: The prevalence of impaired height velocity in transfusion dependent thalassemics in our study was 56.67%. The mean pretransfusion hemoglobin was 7.8±1.065 g/dl and the mean serum ferritin level in our study was 2426±872 ng/ml. In thalassemia patients with height velocity < 3rd percentile mean serum ferritin level was 2637±892.84 ng/ml while the mean serum ferritin level in patients with height velocity >3rd percentile was 1875±564.007 ng/ml with a statistically significant relation (p=0.012). Although the mean pretransfusion hemoglobin in children with height velocity <3rd percentile was found to be lower compared to their counterparts with height velocity >3rd percentile (7.42±0.879 g/dl vs. 7.96±0.998 g/dl), this relation was found to be statistically insignificant (p value=0.127).
Conclusions: Our study highlights that even though regular blood transfusions are essential in thalassemic patients, maintaining an optimal ferritin level is equally essential in influencing growth in these children.

Keywords: Height velocity, Thalassemia, Serum ferritin

INTRODUCTION

ß-thalassemia syndromes result from a decrease in ß-globin chains which leads to a relative excess of α-globin chains.[1] It is the commonest single gene disorder in the Indian population. 10% of the world thalassemics are born in India every year. The clinical severity is highly variable among patients and some children with mild anemia may require occasional RBC transfusion while others may have severe anemia which may be fatal without regular transfusion. Majority of the children cannot afford the only curative therapy of bone marrow transplantation (BMT) and among those who undergo BMT, the success rate is highly variable.[2] One of the complications of thalassemia is growth failure and remains to be a major concern among the patients, especially among those with thalassemia major (TM).[2] The Thalassemia International Federation recommends a regular transfusion program every 2 to 5 weeks to maintain the pretransfusion hemoglobin level above 9 to

10.5g/dl the aim of which is to promote growth and adequately suppress the ineffective erythropoiesis.[3] There is a dearth of sufficient data regarding the growth pattern of thalassemic patients and if any existing serological parameters has a relation with growth pattern or disorders. A study was thus undertaken in a tertiary care hospital in Northeast India to study the relation of serum ferritin and pretransfusion hemoglobin with height velocity. We report here the results of our study of height velocity and its relation to serum ferritin levels and pretransfusion hemoglobin levels in 30 transfusion dependent ß-thalassemia patients from our centre.

METHODS

An observational prospective study was conducted between June 2020 to May 2021 in the department of Paediatrics, Jorhat Medical College & Hospital (JMCH), Assam. All the children in the age group of 1-12 years who were diagnosed with transfusion dependent ß-thalassemia and were receiving regular blood transfusions at Jorhat medical college & hospital (JMCH), Assam were included in our study. Children with chronic illnesses (any malignancy, tuberculosis, congenital heart diseases etc.) were excluded from the study. None of the study participants were on any long-term medication known to affect growth. The standing height measurements were obtained using a free-standing stadiometer. For each measurement, the mean value from three readings was taken. Height was measured to nearest 0.1 cm. The height measurements were taken every 6 months for one year. Height velocity was calculated by determining the increment of height between the successive visits. Reference data from Tanner and Whitehouse, for longitudinal standards for height velocity were used. Data regarding socio-demographic profile, pretransfusion hemoglobin levels in the past 12 months, the mean hemoglobin level were recorded. Serum ferritin was measured by immunometric assay and was done every 3 monthly and average of all the readings was taken.

Statistical analysis

The statistical analysis of all the data was performed using the computer program, Statistical Package for Social Sciences (SPSS for Windows, version 20.0 Chicago, SPSS Inc.) and Microsoft Excel 2010. All statistical analysis was done using the Student t test. Significance was assessed at 5% level of significance (p value<0.05).

RESULTS

During the study period, thirty (30) patients of transfusion dependent thalassemia who fulfilled the inclusion criteria were included in the study. The maximum number of patients was seen in the 5-10 years age group with 15 (50%) patients, which was followed by the age group of less than 5 years with 10 (33.33%) patients. In the age group of more than 10 years, there were 5 (16.67%) patients (Table 1).

Table 1: Age distribution of thalassemia patients.

Age group (years)	N	%
<5	10	33.33
5-10	15	50.00
>10	5	16.67
Total	30	100.00
Mean±SD	6.7±2.91 years	

Table 2: Gender distribution of thalassemia patients.

Gender	N	%
Male	17	56.67
Female	13	43.33
Total	30	100

Table 3: Socioeconomic classification of thalassemia patients.

Socio economic status	N	%
Class I (upper class)	0	0.00
Class II (upper middle class)	5	16.67
Class III (middle class)	9	30.00
Class IV (lower middle class)	11	36.67
Class V (lower class)	5	16.67
Total	30	100

Total 17 (56.67%) patients were male while 13 (43.33%) patients were female (Table 2). 20 out of 30 (67%) belonged to class III (middle class) and class IV (lower middle class) (30% and 36.67% respectively), 5 (16.67%) cases belonged to class II (upper middle class), 5 (16.67%) belonged to class V (lower class) according to the modified BG Prasad's classification (Table 3).

Table 4: Pretransfusion hemoglobin in thalassemia patients.

Pretransfusion Hb (g/dl)	N	%
<6	1	3.33
6-8	21	70.00
>8	8	26.67
Total	30	100.00
Mean±SD (g/dl)	7.8±1.065	

The prevalence of impaired height velocity in transfusion dependent thalassemics in our study was 56.67%. 17 out of 30 (56.67%) cases had impaired height velocity (height velocity<3rd percentile). 13 out of 30 (43.3%) cases had height velocity above 3rd percentile. In our study, 21 out of 30 (70%) thalassemia patients had pretransfusion hemoglobin between 6-8gm/dl, while the pre-transfusion hemoglobin was more than 8 g/dl in 8 (26.67%) patients. 1 (3.33%) patient had pretransfusion hemoglobin less than 6g/dl. The mean pretransfusion hemoglobin was

7.8±1.065 g/dl (Table 4). We found that 19 (63.3%) out of 30 cases had serum ferritin levels above 2000 ng/ml, 2 (6.67%) out of 30 cases had serum ferritin level less than 1000 ng/ml and 9 (30%) patients had serum ferritin levels between 1000-2000 ng/ml (Table 5).

Table 5: Serum ferritin in thalassemia patients.

Serum ferritin (ng/ml)	N	%
<1000	2	6.67
1000-2000	9	30.00
>2000	19	63.33
Total	30	100.00
Mean±SD (ng/ml)	2426±872	

We then compared the serum ferritin levels with the height velocity in the thalassemic patients to find out if any significant relation existed between them. The mean serum ferritin level in thalassemia patients with height velocity <3rd percentile was 2637±892.84 ng/ml while the mean serum ferritin level in patients with height velocity >3rd percentile is 1875±564.007 ng/ml. The mean serum ferritin levels in thalassemic children with impaired height velocity was higher than their counterparts with normal height velocity and this relation was found to be statistically significant (p value=0.012) (Table 6). We found the mean pretransfusion hemoglobin in children with height velocity <3rd percentile to be lower compared to their counterparts with height velocity >3rd percentile (7.42±0.879 g/dl vs. 7.96±0.998 g/dl). However, this relation between the two groups was not statistically significant (p value=0.127) (Table 7).

Table 6: Mean serum ferritin in children with height velocity <3rd percentile and height velocity >3rd percentile.

Serum ferritin (ng/ml) Mean±SD	Height velocity <3rd percentile (N=17)	Height velocity >3rd percentile (N=13)	P value
	2637±892.84	1875±564.007	0.012

Table 7: Mean pretransfusion hemoglobin in thalassemic children with height velocity <3rd percentile and height velocity >3rd percentile.

Pretransfusion hemoglobin (g/dl) Mean±SD	Height velocity <3rd percentile (N=17)	Height velocity >3rd percentile (N=13)	P value
	7.42±0.879	7.96±0.998	0.127

DISCUSSION

Thalassemia syndromes are a group of inherited blood disorders which are considered to be one of the major public health issues in many populations. We conducted this study in our centre to find out if there was any relation between serum ferritin and pretransfusion hemoglobin levels with the height velocity among thalassemic children. The mean hemoglobin level (7.8±1.065 g/dl) of the patients in this study was lower than that recommended by the international guidelines. The reason for the low hemoglobin level could be the noncompliance to regular transfusion due to economic constraint. We also compared the findings of our study with available studies (Table 8).

Table 8: Comparison of mean pretransfusion hemoglobin levels with other studies.

Studies	Mean pretransfusion hemoglobin (g/dl)
Nokeaingtong et al[3]	8.0±0.8
Moiz et al[4]	7.66±1.34
Harish et al[5]	9.2
Present study	7.8±1.065

Regular blood transfusion therapy plays a central role in the management of thalassemia. It dramatically improves the quality of life and reduces the complications of severe thalassemia. However, chronic blood transfusions along with an increased gastrointestinal absorption of iron result in iron overload. Chronic anemia and iron overload lead to several complications of thalassemia especially endocrinopathies, cardiovascular complications, and liver diseases.[3] The serum ferritin levels help us gauge the iron status of the patient and plan chelation therapy accordingly. In our study the mean serum ferritin observed in the study was 2426±872 ng/ml, which was comparable to some of the available studies (Table 9).

Table 9: Comparison of mean serum ferritin levels with other studies.

Studies	Mean serum ferritin (ng/ml)
Mishra et al[6]	2767.52±1849.1
Riaz et al[7]	4236.5±2378.3
Harish et al[5]	3138±1499
Present study	2426±872

In the present study, 56.67% (17 out of 30) cases had impaired height velocity (height velocity < 3rd percentile). 43.3% (13 out of 30 cases) had height velocity >3rd percentile. Thalassemic children with impaired height velocity had significantly higher mean serum ferritin levels compared to children with normal height velocity (2637.76±892.84 ng/ml vs. 1875±564.007 ng/ml) (p value=0.012). It was also noted that thalassemic children with impaired growth velocity had lower pretransfusion hemoglobin compared to their counterparts with normal height velocity. However, the difference was not significant with a p value of 0.127. When compared to a study by Hamidah et al the prevalence of impaired growth velocity (i.e., growth velocity less than the third percentile) amongst the transfusion dependent thalassemics was 57.7%.[8] It was noted that patients with a

height velocity <3rd percentile had higher mean ferritin levels than patients with a height velocity > 3rd percentile which is consistent to the findings of the present study. No significant association was found between height velocity and pretransfusion hemoglobin which is in line to the findings of the present study. Soliman et al reported that the prevalence of impaired growth velocity among transfusion dependent thalassemics was 56%. Serum ferritin was correlated negatively with height velocity. The findings of the study are similar to that of the present study.[9] Based on the findings presented by our study, we can postulate that optimal chelation therapy is very important to prevent complications of thalassemia related to iron overload and also to ensure optimal growth. In this study majority of children belonged to middle or lower socioeconomic classes and economic restraint may be a contributing factor to inadequate and irregular chelation therapy and also to irregular transfusion therapy. The study however, had certain limitations. The potential role of other factors like genetic factors, nutritional deficiencies, endocrinopathies like GH deficiency were not taken into account while assessing the height velocity of the thalassemic children. Moreover, a longitudinal study design with a larger sample size would have shed further light in the understanding of growth pattern and the influence of various factors on growth of thalassemic children. In summary, regular blood transfusions can maintain pretransfusion Hb levels and thus prevent chronic hypoxia. However, if serum ferritin levels are higher than the desired levels, it can have negative impact on the physical growth of these children. Thus, along with maintaining Hb levels, it is important to have effective iron chelation therapy to minimize retardation of growth in patients with transfusion-dependent thalassemia.

CONCLUSION

Current study highlights that even though regular blood transfusions are essential in thalassemic patients, maintaining an optimal ferritin level is equally essential in influencing growth in these children.

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