

Original Research Article

Correlation of anthropometric measurements with pretransfusion haemoglobin in transfusion dependent thalassemia major children

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ABSTRACT

Background: The etio-pathogenesis of growth failure in transfusion dependent thalassemia major (TDTM) children is mainly because of chronic anemia, iron overload and endocrine complications. Aim was to determine the association between anthropometric measurements with pre-transfusion haemoglobin in TDTM children.

Methods: Present cross-sectional study included total 55 children between 5-18 years of age who were diagnosed as TDTM. Mean pre transfusion hemoglobin of last 1 year was obtained from previous medical records. Anthropometric measurements like weight in kg and height in cm measured while body mass index (BMI) was calculated using standard formula in each patient. Weight for age, height for age, and BMI were plotted on WHO 2006 and Indian academy of paediatrics 2015 combined growth charts in terms of percentile. Data was analysed statistically.

Results: Total 55 children of TDTM between 5-18 years of age were studied. The mean age was 10.42(4.07) years. The mean weight (kg), height (cm) and BMI was 23.76 (7.5), 123.94 (18.13) and 15.24 (1.76) respectively. Fifty-one (92.73%) children were having BMI less than 3rd centile (Underweight). Forty (93.02%) and 11 (91.66%) children between age group of 5-10 years and more than 10 years were underweight and was statistically significant ($p < 0.05$). Total 50 (94.33%) children were having mean pre transfusion hemoglobin below 9 gm/dl who were underweight which was statistically significant.

Conclusions: Low pre-transfusion hemoglobin is one of the risk factors for growth failure in children with TDTM and it should be maintained above 9 gm/dl may for normal growth in children with TDTM.

Keywords: Anthropometry, Children, Transfusion dependent thalassemia major

INTRODUCTION

Thalassemia major (TM) is an inherited haematological disorder where beta globin chain production is either reduced or absent and these children will require lifelong blood transfusion along with iron chelating agents. The only curative treatment in TM is hematopoietic bone marrow transplantation.^{1,2} In India every year around 10,000-12,000 newborns are suffered from TM while in Maharashtra, India, the overall frequency of beta thalassemia carriers is 2-7%.^{3,4}

The etio-pathogenesis of growth failure in transfusion dependent thalassemia major (TDTM) children is mainly because of chronic anemia, iron overload and chelation toxicity.⁵ Also, the factors contributing to growth failure are different in various age groups. In early childhood, the factors for growth failure are chronic hypoxia because of chronic anemia, irregular blood transfusion and nutritional deficiency while in late childhood, it is due to iron overload which affects the GH-IGF-1 axis and endocrine complications.^{5,6} After the age of 10 years,

delayed puberty and psychosocial factors are the important causes for growth failure.^{5,6}

There are very few studies which reported growth failure and its association with pre-transfusion haemoglobin in TDTM children. The present study was carried with the aim of to determine the correlation between anthropometric measurements like weight, height, and BMI with mean pre-transfusion haemoglobin of last one year in TDTM children aged between 5-18 years.

METHODS

This cross-sectional study carried out in department of paediatrics at Dr. D. Y. Patil medical college hospital and research institute, Kolhapur during 1st January 2021 to 30th June 2023 after institutional research committee clearance (DYPES/DU/2020/68). Study included 55 children of 5-18 years of age who diagnosed as TDTM by either high performance liquid chromatography or Hb electrophoresis and coming for routine blood transfusion. TDTM children who were having chronic liver, respiratory and renal disease were excluded. Written informed consent of parents/guardians was obtained.

The patients demographics like age and gender along with detailed history including blood transfusion frequency was collected on predetermined questionnaire. The mean pre transfusion hemoglobin level of last one year was obtained from previous medical records of the patients which was done before giving each blood transfusion. Weight in kg and height in cm were measured by electronic weighing machine and

stadiometer respectively. BMI calculation was done by using formula of weight (kg)/ height² (meter). Weight for age, height for age, and BMI were plotted on WHO 2006 and Indian academy of paediatrics 2015 combined growth charts in percentile terms.⁷

The minimum sample size was 55 and calculated by Slovin's formula. The statistical analysis was carried out by using Microsoft excel 2016. The data was represented as frequency, percentage and mean (SD) where relevant. Chi-square test was used with the software SPSS version 28.0. The $p < 0.05$ was taken as significant.

RESULTS

Total 55 children of TDTM between age of 5-18 years were enrolled in this study. The mean age was 10.42 (4.07) years. Mean weight (kg), height (cm) and BMI was 23.76 (7.5), 123.94 (18.13) and 15.24 (1.76) respectively.

Among 55 children with TDTM, 4 (7.27%) children were having normal BMI and 51 (92.73%) children were having BMI less than 3rd centile (Underweight) (Table 1).

Forty (93.02%) and 11(91.66%) children between age group of 5-10 years and more than 10 years were underweight ($p < 0.05$) (Table 2).

Total 53 and 2 children had mean pre transfusion haemoglobin less than 9 and more than 9 gm/dl respectively. The pre transfusion haemoglobin has significant correlation with BMI ($p < 0.05$) (Table 3).

Table 1: Nutritional status in TDTM children.

Nutritional status (N)	Mean age, (SD)	Mean weight, (SD)	Mean height, (SD)	Mean BMI, (SD)
Normal (4)	14.75 (3.77)	34.85 (7.37)	134.25 (13.79)	19.11 (0.50)
Underweight (51)	10.06 (3.92)	22.89 (6.81)	123.13 (18.28)	14.92 (1.36)

Table 2: BMI and various age group in transfusion dependent TM children.

Age groups (In years)	BMI (kg/m ²), n (%)		Total, n (%)	P value
	Underweight	Normal		
5-10	40 (93.02)	03 (6.97)	43 (100)	0.030
>10	11 (91.66)	01 (8.34)	12 (100)	
Total	51 (92.73)	04 (7.27)	55 (100)	

Table 3: Mean pre-transfusion haemoglobin and BMI in transfusion dependent TM children.

Mean pre-transfusion haemoglobin (gm/dl)	BMI (kg/m ²), n (%)		Total, n (%)	P value
	Underweight	Normal		
<9	50 (94.33)	3 (5.67)	53 (100)	0.01
≥9	1 (50)	1 (50%)	02 (100)	
Total	51 (92.73)	04 (7.27)	55 (100)	

DISCUSSION

In our study we included 55 children of 5-18 years of age with TDTM. Nutritional status was measured by BMI by using standard formula. Fifty-one (92.75 %) children were having BMI less than 3rd centile (Underweight).

Study done by Rathaur et al, Sangha et al and Shaikh et al observed 77%, 41.1% and 58.89% children were underweight respectively.⁸⁻¹⁰

About 50 (94.33%) children were having mean pre transfusion hemoglobin below 9 gm/dl who were underweight which was statistically significant. Similar to our observation Shaikh et al observed 96.6% children were having low pre-transfusion hemoglobin less than 8.9 gm/dl.¹⁰ While a study done by Moiz et al observed 83% children had low pre transfusion hemoglobin.¹¹ Chandra et al and Simhachalam et al found that lower pretransfusion hemoglobin in 64% and 49% children respectively who were undernourished.^{12,13}

Growth impairment in TDTM children occurs because of many factors like chronic anemia, nutrition deficiency, iron overload, chelation toxicity and endocrine complications. Because of chronic anemia there will be hypoxia at cell level which will ultimately leads to growth impairment in TDTM children. To assess chronic anemia, we studied mean pre-transfusion hemoglobin of last one year which was a surrogate marker for chronic anemia. We observed mean pre transfusion hemoglobin below 9 gm/dl is one of the important causes of growth failure in TDTM children. The limitations of this study we have not studied serum ferritin level for iron overload and not taken consideration for endocrine complications. Further multicentric study with large sample size was needed.

CONCLUSION

Low pre-transfusion hemoglobin is one of the risk factors for growth failure in children with TDTM and it should be maintained above 9 gm/dl may for normal growth in children with TDTM.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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