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Original Article

Anthropometry in Children with Transfusion-Dependent Beta-Thalassemia Major

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ABSTRACT

Objective: To determine the abnormal anthropometric findings among children diagnosed with and managed for transfusion-dependent beta-thalassemia major.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Paediatric Medicine, Pak Emirates Military Hospital, Rawalpindi Pakistan, from Sep 2019 to Aug 2020.

Methodology: This study involved 310 children of both genders aged 2 to 18 years presenting with beta-thalassemia Major receiving multiple blood transfusions. Anthropometric findings, including height and weight for age, were measured and plotted via World Health Organization-2007 growth charts in all the study participants. Relevant socio-demographic variables, including serum ferritin, were correlated with abnormal anthropometric findings among these children.

Results: The mean age of the patients was 8.87±7.42 years. 170(54.8%) male and 140(45.2%) female patients were in the study group. Most of the children [218 (70.3%)] had any abnormal an-thropometric findings, either weight or height for age, while 92 (29.7%) had no anthropometric abnormality. Majority of the patients [198 (63.8%)] patients had stunted growth, while 170 (54.8%) were underweight. Longer duration of transfusion and raised serum ferritin levels had a statistically significant correlation with any anthropometric abnormality among the beta-thalassemia major patients (p-value<0.05).

Conclusion: More than 70% of the patients suffering from beta thalassemia major had abnormal anthropometric findings. Height was affected more than weight among these individuals. Patients with longer duration of transfusion dependence and raised serum ferritin levels were more at risk of developing anthropometric abnormality in our target population.

Keywords: Anthropometry, β-Thalassemia major, Socio-demographic variables.

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INTRODUCTION

Thalassemias are genetically transmitted disorders characterized by abnormal production of haemoglobin, leading to various haematological and systemic abnormalities among children.[1,2] This disorder has been highly prevalent in our part of the world due to various biological and social reasons.[2] Over 4000 cases of β-thalassemia major who may require long-term transfusion born each year in Pakistan.[3,4] Improved facilities related to transfusions and chelation therapies have improved the life expectancy of these patients in Pakistan.[5] Despite remarkable improvement in life expectancy, transfusions have certain adverse effects ranging from infections to serious metabolic abnormalities and stunted growth.[6]

Patients with beta thalassemia major not only have complica-tions related to abnormal haemoglobin production they also have number of adverse effects related to repeated transfu-sions. Metabolic and endocrine abnormalities lead to various skeletal abnormalities, especially weight and height abnormalities.[7] Treatment physicians should have a fair idea about these complications so they can be picked up early and addressed adequately.[8]

Longevity with a good quality of life is usually the ultimate goal for managing any chronic disorder. This becomes more important when treatment options have considerable and serious adverse effects.[9] A similar study was done in a thalassemia centre in Karachi by Moiz *et al*. revealed that the median height-for-age z-score of children was low at -2.69 and (-1.46 to -3.80) and 65.4% of children had stunted growth (height for age z-score <-2). There was a significant negative correlation between height for age z-score and serum ferritin levels (p<0.001). Stunting of growth began early during 5-10 years of age but increased markedly with the progress of time.[10] We designed this study to determine the abnormal anthropometric findings among children diagnosed with and managed for transfusion-dependent beta-thalassemia major in our centre.

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METHODOLOGY

The cross-sectional study was conducted at the Department of Paediatric Medicine, Pak Emirates Military Hospital Rawalpindi, Pakistan from September 2019 to August 2020 after IERB approval (letter number A/28/EC/206/2020). The sample size was calculated using the WHO sample size calculator by keeping the proportion of complications in thalassemia patients at 75%.[11] The non-probability consecutive sampling technique was used to gather the sample.

Inclusion Criteria: Patients aged 2 to 15 years suffering from beta thalassemia major receiving multiple blood transfusions with chelation therapy were included in the study.

Exclusion Criteria: Patients already diagnosed with other growth problems or had comorbid another diagnosis that may affect the height and weight of the individual were excluded from the study. Children with other delayed milestones and a history of developmental delays before the age of two years, patients with causes of altered ferritin metabolism or endocrinopathies other than thalassemia were also not included.

Diagnosis of thalassemia was made upon patients having repeated blood transfusions (≥10) and haemoglobin electrophoresis reporting 100% HbF (foetal haemoglobin).[12] World Health Organization (WHO) 2007 growth charts were used for boys and girls to assess their physical growth. Body mass index (BMI) was computed as weight in kg/height in square meters.[13]

Patients of thalassemia major who met the inclusion criteria were enrolled on this study. Detailed history and written informed consent were obtained from the patient's attendants. Anthropometry was done in the clinic as the patient presented as recorded in the proforma designed for this study. Serum ferritin levels were also performed at the presentation and interpreted as within normal limits or raised (>140 ng/mL).[14]

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was set as the cut-off value for significance.

RESULTS

A total of 310 children with transfusion-dependent beta-thalassemia major were included in the study. The mean age of the patients was 8.87±7.42 years (Table-I).

Table-I: Baseline Characteristics of Study Sample (n=310)

Characteristics	n(%)
Age (years) (mean±SD)	8.87±7.42 years
Age Groups	
2-5 years	100(32.2%)
6-9 years	150(48.4%)
10-15 years	60(19.3%)
Gender	
Male	170(54.8%)
Female	140(45.2%)
Anthropometric findings	
Stunted growth	198(63.8%)
Underweight Children	
Ferritin levels	170(54.8%)
Normal	184(59.4%)
Raised (>140ng/ml)	126(40.6%)

Most of the children [218 (70.3%)] had any abnormal an-thropometric findings, either weight or height for age, while 92 (29.7%) had no anthropometric abnormality. Majority of the patients [198 (63.8%)] had stunted growth, while 170 (54.8%) were underweight. Table-II shows that, longer duration of transfusion and raised serum ferritin levels had a statistically significant correlation with any anthropometric abnormality among the patients of beta-thalassemia major (*p*-value<0.05).

Table-II: Relationship of Various Factors with Abnormal Anthropometric Findings (n=310)

	Normal Anthropometric Findings	Abnormal Anthropometric Findings	*p*-value
Age			
8 year or less	72(78.3%)	168(77.1%)	0.817
>8 years	20(21.7%)	50(22.9%)	
Gender			
Male	56(60.8%)	114(52.3%)	0.164
Female	36(39.2%)	104(47.7%)	
Serum Ferritin Levels			
Within range	68(73.9%)	116(53.2%)	0.001
Raised	24(26.1%)	102(46.8%)	
Duration of Getting Transfused			
<3 years	52(56.5%)	79(36.2%)	0.001
>3 years	40(43.5%)	139(63.8%)	

DISCUSSION

Iatrogenic complications have always been an area of interest for clinicians and researchers. Some-

times, the spectrum of these complications becomes blurred, and it cannot be figured that complications are due to the pathophysiology of the underlying illness or the treatment offered for the illness. Thalassemia major has a chronic course, and the patient requires lifelong blood transfusion, which leads to several complications.[13,14] Advancements in chelation therapies have made the situation better in this regard, and complications tend to appear late due to iron chelation, preventing iron overload and related complications. We conducted this study to determine the abnormal anthropometric findings among children diagnosed with and managed for transfusion-dependent beta-thalassemia major in our thalassemia centre.

Sharma *et al*. determined the growth and hormonal abnormalities among children suffering from thalassemia major and getting repeated transfusions along with chelation therapy.[15] They revealed that more than half of patients had stunted growth while more than 25% were underweight during observations. Almost half of the patients had one or more endocrinopathies as well. Our results were slightly different as we included all the patients who were on chelation therapy or not. More than 70 per cent of our patients had stunted growth, while more than half had weight less than desired weight for age. Dhouib *et al*. performed a similar study. They evaluated growth-related problems among the pediatric population suffering from beta-thalassemia major.[16] They revealed that more than half of their patients had stunted growth. Delayed puberty and low bone mass were other common complications their patients encountered. They also observed multiple endocrine abnormalities during the study.

A study done in Cyprus by Toumba *et al*.[17] concluded that short stature was found in 35% of the thalassemia major patients, acquired hypothyroidism was found in 5.9%, hypoparathyroidism in 1.2% and diabetes mellitus in 9.4% of the patients. A slowing down of growth velocity and a reduced or absent pubertal growth spurt were observed in early adolescence, leading to short adult height. Our data revealed that more than 70% of the patients had stunted growth, almost double that of the patients studied by Toumba *et al*.

Delvecchio and Cavallo extensively reviewed the literature to ascertain the growth and endocrine dysfunction among patients receiving multiple transfusions for beta-thalassemia major.[18] They evaluated more than a hundred relevant research papers. They concluded that disproportionate short stature is frequent and became more evident at puberty because of the lack of growth spurt. Later on, partial height recovery may occur.

Long-term treatment with recombinant human GH seems ineffective in improving final height. Multiple endocrine abnormalities were also noted in most of the patients who were dependent on regular blood transfusions for thalassemia major. Raised ferritin was a strong predictor of anthropometric abnormalities in our study and a longer duration of transfusion dependence.

LIMITATIONS OF STUDY

There were a few limitations in our study. We did a study in one military centre only, and not all thalassemia centres were recruited in our study. We also did not observe the effect of chelation on our results because that may be a major contributing factor to the development of transfusion-related complications among these patients. Future studies with the involvement of multiple centres and emphasizing probable causes of anthropometric complications may generate better and more useful results.

CONCLUSION

More than 70% of the patients suffering from beta thalassemia major had abnormal anthropometric findings. Height was affected more than weight among these individuals. Patients with longer duration of transfusion dependence and raised serum ferritin levels were more at risk of developing anthropometric abnormality in our target population.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

NUN: Conception, study design, drafting the manuscript, approval of the final version to be published.

FI, & MT: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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