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Original Research Article

A Cross-Sectional Study on Hepatic, Renal and Endocrine Parameters in Children with Beta Thalassemia Major

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Abstract

Introduction: Beta-thalassemia, a common blood disorder, causes severe anemia in children with Beta-Thalassemia Major (BTM). This study at a tertiary care center in India aims to identify liver, kidney, and hormone function in children with BTM, a disease highly prevalent in this region.

Methods: This hospital-based study observed children under 15 with BTM. With parental consent, researchers collected detailed medical histories, demographics, and conducted physical exams. Blood samples (3ml) were drawn for tests like liver and kidney function, blood counts, and hormone levels. Blood was stored cold for further analysis.

Results: The study enrolled 38 children with BTM, with an average age of 9.4 years. There were more boys than girls (boy: girl ratio of 0.9). The study found that 40% of the children had liver involvement and 7.9% had thyroid involvement. The children also required an average of 9.8 blood transfusions per year.

Conclusion: This study in children with BTM identified potential liver involvement in 40% and thyroid dysfunction in 7.9%. The high transfusion burden (9.8 annually) highlights the need for iron chelation therapy to manage complications. These findings emphasize the importance of monitoring liver, thyroid function, and iron overload for better BTM management.

Keywords: Beta-Thalassemia Major (BTM), Iron Overload, Liver Involvement, Thyroid Dysfunction, Transfusion Dependence.

Introduction

Thalassemia, a prevalent cause of hypochromic microcytic anemia, stems from diminished or absent synthesis of the globin chain in hemoglobin. [1] Unlike sickle cell disease, which results from structural or qualitative defects in hemoglobin, thalassemia involves a quantitative deficiency in hemoglobin synthesis. Beta-thalassemia, an inherited condition resulting from mutations in the beta-globin gene, manifests as Beta Thalassemia Major (BTM), typically appearing between 6 and 24 months if undetected prenatally. [2] BTM presents with severe anemia, feeding difficulties, failure to thrive, pallor, irritability, hepatosplenomegaly, and other symptoms. Beta-thalassemia minor, or carrier state, is usually asymptomatic with mild anemia.

Compound heterozygosity in mutations leads to a spectrum of anemias, such as Beta-thalassemia Intermedia (BTI) and BTM, which can be differentiated by transfusion dependence. BTM requires routine transfusions, while BTI does not. The highest prevalence of BTM is observed among individuals of Mediterranean, Asian, and Middle Eastern descent, with over 200 different thalassemia-causing mutations identified in the beta-globin gene, resulting in diverse genotypes and phenotypes. [3]

India, according to the National Health Mission (NHM), bears the highest burden of children with Thalassemia Major globally, with approximately 1 to 1.5 lakh cases and around 42 million carriers. Each year, 10,000-15,000 babies with Thalassemia Major are born in India alone. [4] Globally, around 5% of the population carries a pathological hemoglobin gene, with approximately 300,000 infants born annually with thalassemia syndromes or sickle cell anemia. Given the significant

prevalence and impact of this disorder, the study was conducted at a tertiary care center to address the issue. The aim of this study is to identify various hepatic, renal and endocrine parameters in children with BTM.

Methods

It was a Hospital based Cross-sectional observational study, conducted in the department of Paediatrics, GSL Medical College, Rajahmundry. Study was conducted between January 2021 to March 2022. Study protocol was approved by the Institutional Ethics Committee. Informed written consent was taken from the study members. The inclusion criteria encompassed children under 15 years with confirmed BTM diagnosis, registered at pediatric OP, with parental consent. Excluded were children with incomplete data and those diagnosed with hemoglobinopathies other than BTM. Sample size was calculated by considering the prevalence as per D Mohanty et al. [5] study.

Following institutional ethics committee approval, this study ensured confidentiality for all participants. Comprehensive histories, including personal and familial backgrounds, were obtained. Demographic data such as age and gender were recorded, and clinical examinations were conducted. Information was entered into a designated case record form for statistical analysis. Blood samples were collected for various tests including blood grouping, complete blood count, renal and liver function tests, Hb electrophoresis, thyroid profile, and viral markers for hepatitis and HIV. Approximately 3ml of blood was collected with EDTA added, allocating 0.5ml for complete blood count and the remainder for immunology tests. Parameters assessed included children's age, gender, family history of hemoglobinopathies, SGOT, SGPT, TSH, total bilirubin, serum albumin, blood urea, serum creatinine, and hormonal levels. Samples were maintained in a cold chain during transportation to the immunology department for further analysis.

Statistical Analysis: All statistical analyses were conducted using SPSS software trial version 20.0 and MS Excel-2010. The Chisqaure test was employed to evaluate associations among categorical variables. A P value of <0.05 was deemed statistically significant, indicating meaningful associations between variables.

Results

Total 38 (100%) BTM children were included in the research, mean age was 9.4 ± 3.8 years and boy girl ratio was 0.9. Mean values were 102.1±32 mg/dl (RBS), 22.4±4.3 mg/dl (urea), 0.7±0.46 mg/dl (creatinine), 53.15±38.7 U/L. (SGOT), 62.84±42.98 U/L (SGPT), 5.5±1.6 g/dL (total protein), 3.2±1.37 g/dl (albumin). Hepatic involvement was seen in 40%. Mean T3 levels were 1.39±0.38, T4 8.5±2.3, TSH 2.85±1.3 MIU/L and thyroid involvement in 7.9%. Consanguinity was seen in 5 children and mean number of blood transfusions were 9.8±2.5 annually.

Discussion

This study included 38 children with Beta-Thalassemia Major (BTM), with a mean age of 9.4 years. Interestingly, there was a slightly higher prevalence of boys compared to girls (boy:girl ratio of 0.9). This finding aligns with some previous research on BTM demographics. Studies suggest a potential male predominance in BTM cases, although the reasons remain unclear [6, 7]. However, it's important to acknowledge that other studies haven't observed a significant gender bias. [8] Larger studies with robust methodology are needed to definitively determine if a gender disparity exists in BTM prevalence.

This study analyzed various blood chemistry parameters in children with BTM. The mean values for blood urea (22.4 mg/dL) and serum creatinine (0.7 mg/dL) fall within the normal reference ranges for healthy children. [9] This suggests that overall kidney function in these BTM patients might not be significantly compromised. However, long-term studies are crucial to monitor for potential renal complications, as some research indicates a risk of kidney dysfunction in BTM patients over time. [10, 11] The study also reported elevated mean values for liver enzymes SGOT (53.15 U/L) and SGPT (62.84 U/L). This suggests potential liver involvement in a significant portion (40% as reported by the study) of the BTM children. Iron overload, a consequence of chronic blood transfusions, is a known risk factor for liver damage in BTM patients. [12] Studies have shown that effective iron chelation therapy can minimize this risk. [13]

Furthermore, the mean values for total protein (5.5 g/dL) and albumin (3.2 g/dL) were slightly lower than the expected healthy range. This could indicate potential malnutrition or impaired protein synthesis in some BTM children. Nutritional deficiencies are a concern in BTM patients due to factors like decreased appetite and increased metabolic demands. [12]. Overall, the blood chemistry findings in this study highlight the importance of closely monitoring liver and kidney function in children with BTM. Early detection and management of potential complications are essential to improve their long-term health outcomes.

The reported 40% prevalence of hepatic involvement aligns with concerns regarding iron overload in BTM patients. Chronic blood transfusions are essential for BTM management, but excess iron accumulates in the liver, potentially

leading to damage. [14] Studies suggest that effective iron chelation therapy can significantly reduce this risk. [15] The slightly elevated TSH levels (2.85 mIU/L) might indicate subclinical hypothyroidism in some BTM children (7.9% prevalence). Research suggests a potential link between chronic blood transfusions and altered thyroid function in BTM patients. [16] Close monitoring of thyroid hormone levels is crucial for early detection and treatment of any thyroid dysfunction.

The presence of consanguinity in 5 children suggests a potential role of genetic inheritance in their BTM. Consanguinity is known to increase the risk of autosomal recessive disorders like BTM. [17] The average of 9.8 blood transfusions annually highlights the ongoing need for this life-saving treatment in BTM patients. However, this high transfusion burden also emphasizes the importance of iron chelation therapy to prevent future complications.

This study in children with BTM identified potential liver involvement in 40% and thyroid dysfunction in 7.9%. The high transfusion burden (9.8 annually) highlights the need for iron chelation therapy to manage complications. These findings emphasize the importance of monitoring liver, thyroid function, and iron overload for better BTM management.

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