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Prevalence of Hypothyroidism in Beta-Thalassemia Major Patients on Oral Chelation Therapy

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SUBJECT: Prevalence of Hypothyroidism in Beta-Thalassemia Major Patients on Oral Chelation Therapy**.**

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Abstract

Background:

Beta-thalassemia major is a transfusion-dependent hematologic disorder that predisposes patients to iron overload and subsequent endocrine dysfunction, including hypothyroidism.

Objective:

To determine the prevalence and types of hypothyroidism in children with beta-thalassemia major undergoing oral chelation therapy.

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Methods:

This hospital-based cross-sectional study was conducted at Santhiram Medical College from November 2023 to November 2024. Fifty patients aged 3–13 years receiving regular transfusions and oral chelation were enrolled. Data on demographics, transfusion history, chelation duration, thyroid function, and serum ferritin were collected. Hypothyroidism was classified into subclinical and overt forms based on TSH and T4 levels. Statistical analysis included Chi-square tests using SPSS.

Results:

The mean age of participants was 7.14 ± 2.5 years. Male-to-female ratio was 1.5:1. The prevalence of hypothyroidism was 10% (n=5), including 6% subclinical and 4% overt. Hypothyroidism was significantly associated with increasing age (p=0.004) and years of transfusion (p=0.004), but not with serum ferritin, sex, or consanguinity.

Conclusion:

This study highlights that regular monitoring for thyroid dysfunction is essential in beta-thalassemia major patients, regardless of serum ferritin levels. Early detection and appropriate management can improve patient outcomes.

Keywords

Beta-thalassemia major, hypothyroidism, chelation therapy, serum ferritin, thyroid dysfunction, pediatric endocrinology

Introduction

Thalassemia major is a severe genetic blood disorder characterized by ineffective erythropoiesis and chronic anemia requiring lifelong transfusions. Repeated transfusions lead to iron overload, affecting multiple organs, including endocrine glands.

Among endocrine complications, hypothyroidism is a major concern due to its impact on growth and development. Despite advances in chelation therapy, thyroid dysfunction remains prevalent. This study aims to assess the prevalence and determinants of hypothyroidism in beta-thalassemia major patients receiving oral chelation therapy.

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Objectives

To assess the prevalence of hypothyroidism in children with beta-thalassemia major receiving oral chelation therapy.

Materials and Methods

Study Design: Prospective Cross-Sectional Study

Study Location: Santhiram Medical College, Nandyal,

Duration: November 2023 – November 2024

Sample Size: 50

Method of collection of data:

Detailed demographic, transfusion, chelation, and thyroid function data were recorded. TSH and T4 were measured. Hypothyroidism was categorized as subclinical (elevated TSH, normal T4) and overt (elevated TSH, low T4).

Inclusion Criteria: Children with beta-thalassemia major receiving blood transfusions for ≥1 year and ferritin >1000 ng/ml

Exclusion Criteria: Children with primary endocrinopathies, on hormonal therapy, or with other chronic illnesses

Statistical Analysis: using SPSS, Chi-square test determined associations. $P < 0.05$ was considered statistically significant.

Results

The mean age was 7.14 ± 2.5 years; 60% were males. Five patients (10%) were hypothyroid, with 3 cases of subclinical and 2 of overt hypothyroidism. Significant correlation was found between age group and hypothyroidism (p=0.004), and years of transfusion and hypothyroidism (p=0.004). No significant correlation with serum ferritin (p=0.38), years on chelation therapy.

Figures and Tables

Table 1: Prevalence of Hypothyroidism

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Parameter	Count	Percentage
Total Subjects	50	100%
Hypothyroid	5	10%
Subclinical	3	6%
Overt	2	4%

Hypothyroidism was noted in 10% of subjects, with 6% subclinical and 4% overt forms, indicating a notable burden of thyroid dysfunction in transfusion-dependent thalassemia patients.

Table (2): Age VS Hypothyroidism

Age Group	Hypothyroid (n)		Total (n)	
	yes	no		
3–5 yrs	0	16	16	**P value 0.04**
6–9 yrs	1	22	23	
10–13	4	7	11	

Figure -2: Age VS Hypothyroidism

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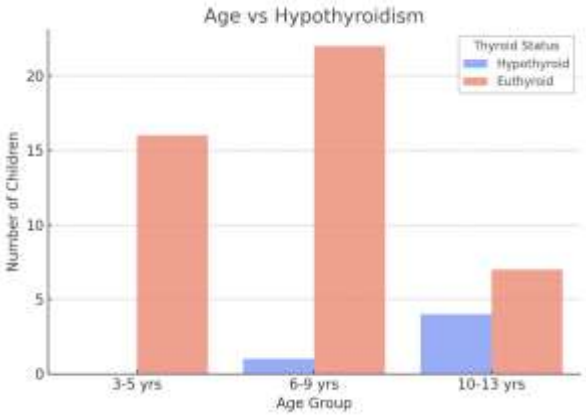
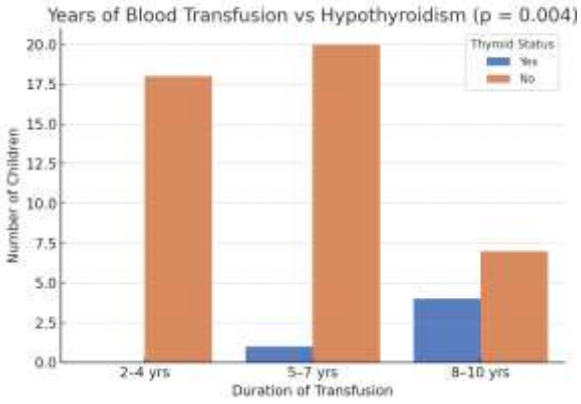


Significant rise in hypothyroidism was observed with age, especially in the 10–13 years group (36.4%), suggesting increasing risk with advancing age.

Table (3): No. Of years of Blood Transfusion vs Hypothyroidism

Transfusion Duration	Hypothyroid		Total	p-value
	Yes	No		
2–4 yrs	0	18	18	**0.004**
5–7 yrs	1	20	21	
8–10 yrs	4	7	11	

Figure – 3 : No. Of years of Blood Transfusion vs Hypothyroidism



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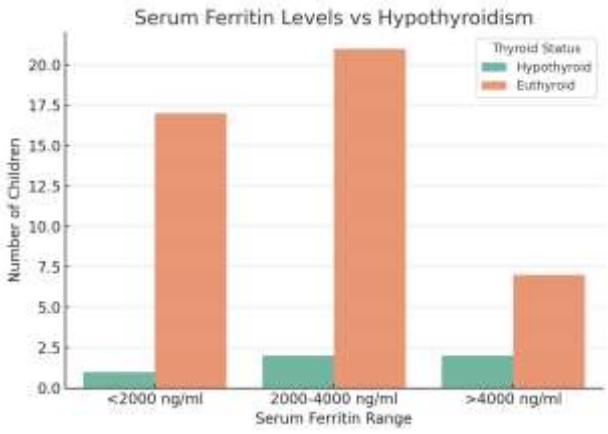
Prevalence of hypothyroidism increased with transfusion duration, being highest (36.4%) in those receiving transfusions for over 8 years.

Table (4): Serum Ferritin Levels vs Hypothyroidism

Ferritin Range	Hypothyroid		Total (n)	p-value
	yes	no		
<2000 ng/ml	1	17	18	
2000–4000 ng/ml	2	21	23	
>4000 ng/ml	2	7	9	**0.38**

Figure 4 – Serum Ferritin Levels Vs Hypothyroidism



Though not statistically significant, hypothyroidism was more common in patients on chelation therapy for longer durations (≥4 years).

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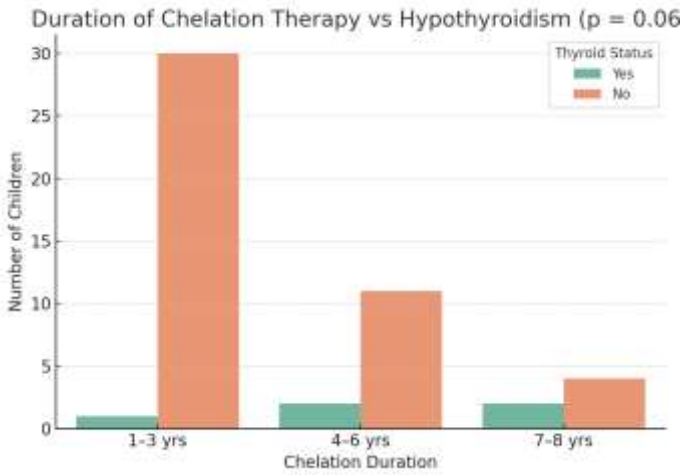
Table (5): No. Of Years on Chelation Therapy Vs Hypothyroidism

Chelation Duration	Hypothyroid		Total (n)	p-value
	yes	no		
1–3 yrs	1	30	31	
4–6 yrs	2	11	13	
7–8 yrs	2	4	6	**0.06**

Figure – 5 : No. Of Years on Chelation Therapy Vs Hypothyroidism



No significant association was seen between ferritin levels and hypothyroidism, indicating ferritin alone may not predict thyroid dysfunction.

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Discussion

This study demonstrated a 10% prevalence of hypothyroidism among children with transfusion-dependent beta-thalassemia major, a figure that aligns with prior national and international research. Notably, subclinical hypothyroidism was more frequent than overt forms, consistent with the early endocrine manifestations typically observed in this patient population.

While iron overload remains a central pathogenic mechanism, the lack of a statistically significant association between serum ferritin levels and hypothyroidism in this cohort suggests that ferritin may not be a reliable standalone biomarker for predicting thyroid dysfunction. These findings support emerging evidence indicating that chronic tissue hypoxia, oxidative stress, and parenchymal iron deposition may independently or synergistically contribute to endocrine gland impairment, particularly within the thyroid.

A significant association was observed between both increasing age and duration of blood transfusion with the development of hypothyroidism. This highlights the progressive nature of endocrine complications in thalassemia and underscores the importance of initiating early screening protocols. Although chelation therapy is crucial in mitigating iron overload, the data also suggest suboptimal efficacy or adherence, as reflected by persistent endocrine abnormalities in some patients with extended chelation history.

These findings underscore the importance of comprehensive endocrine surveillance in thalassemia care and highlight the need for multidisciplinary management approaches, including patient education, monitoring adherence to chelation regimens, and integrating routine thyroid function testing into long-term follow-up protocols.

Conclusion

Children with beta-thalassemia major, particularly those undergoing chronic transfusion therapy, are at a significant risk of developing thyroid dysfunction. The study reinforces

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that the risk increases with age and duration of transfusions, necessitating proactive surveillance strategies.

Although serum ferritin levels are widely used to assess iron burden, their lack of correlation with thyroid dysfunction in this study indicates the need for more direct or tissue-specific markers and stresses the importance of not relying solely on ferritin in endocrine risk assessment.

Routine thyroid function testing, even in asymptomatic patients, should be incorporated into the standard care protocols for thalassemia. Emphasis should also be placed on optimizing chelation therapy compliance, as early and effective iron removal is critical in preventing irreversible endocrine complications.

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