Evaluation of Relationship Between the White Blood Cell Count and the Gingival Health of Children with Beta Thalassemia Major - An Observational Study

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Abstract

Background: Thalassemia is a hereditary disorder that impairs hemoglobin synthesis, leading to anemia, fatigue, delayed growth and craniofacial deformities. The most severe form, thalassemia major, typically manifests in early childhood and has extensive systemic and developmental impacts. Orofacial manifestations, including widely spaced teeth, pale gingiva and decreased salivary immunoglobulin A (IgA), compromise oral immune defense. Consequently, individuals with thalassemia exhibit a heightened susceptibility to gingivitis, dental caries, and other periodontal diseases, often exacerbated by structural anomalies and limitations in routine dental care.

Aim:

Evaluation of Relationship Between the White Blood Cell Count and the Gingival Health (OHI-S) of Children with Beta Thalassemia Major.

Objective:

- To check the oral health status (GI & OHI-S) of the children suffering from Beta Thalassemia Major.
- To check the plaque index (PI) of the children suffering from Beta Thalassemia Major.

Material & Methodology: An observational study was conducted with a total sample of 114 children, aged 3 to 15 years, randomly selected from Thalasssemia day care unit of a government hospital. An intraoral examination was conducted to assess their OHI-S (J.C Greene and J.R Vermillion), Plaque Index (Loe and Silness) and Gingival Index (Loe and Silness). Additionally, a complete blood examination was performed to check the total leukocyte count. The data were evaluated and processed with the help of SPSS version 25.

Result: There was a very weak, non-significant negative correlation between gingival score and WBC count (p-value-0.53). Subjects with low WBC counts had significantly higher OHI-S scores (p-value-0.21), though the differences in plaque and gingival scores were not statistically significant (p-value-0.75, p-value-0.325 respectively).

Conclusion: The findings suggest that subjects with low WBC counts had higher OHI-S scores, indicating a possible link between lower WBC counts and poor oral hygiene. However, the weak negative correlation between gingival scores and WBC count was not statistically significant, implying that the impact of WBC count on gingival health is minimal.

Keywords: β-Thalassemia Major; Gingivitis; WBC count; Relationship of WBC count and Gingivitis.

INTRODUCTION

Thalassemia, a genetic hematologic disorder first characterized by Dr. Thomas Cooley in 1925, results from defects in the synthesis of hemoglobin polypeptide chains, primarily affecting the alpha (α) or gamma (γ) globin chains. These deficiencies disrupt normal erythropoiesis and accelerate red blood cell turnover, leading to chronic anemia.[1] Thalassemia is categorized into homozygous, heterozygous, and compound heterozygous types based on clinical manifestations and genetic profiles, with thalassemia major being the most severe phenotype. Typically manifesting in early childhood, thalassemia major results in profound anemia, delayed physical growth and systemic complications such as craniofacial abnormalities, fatigue, dyspnea and jaundice.[2]

The orofacial manifestations in thalassemia are significant, including dental malocclusions, widely spaced teeth, maxillary protrusion and distinctive craniofacial abnormalities linked to compensatory bone marrow expansion. These structural changes are frequently accompanied by secondary oral health challenges, such as an increased risk of dental caries, gingival pallor, xerostomia, and decreased salivary immunoglobulin A (IgA) levels, which collectively impair salivary defenses and complicate oral health management for affected patients.[3]

Research indicates that children with beta-thalassemia major (BTM) have a higher prevalence of gingivitis compared to non-affected peers, largely due to systemic immune deficiencies and diminished salivary defense mechanisms. These patients exhibit reduced B lymphocyte activity and lower salivary IgA levels, both of which undermine their resistance to oral infections.[4]

Consequently, individuals with thalassemia are at a significantly increased risk of developing dental caries, periodontal disease and other oral infections. This heightened susceptibility is compounded by the chronic nature of the disease, barriers to routine dental care, limited oral health awareness, dietary imbalances and structural oral anomalies that make maintaining hygiene more challenging.[5]

This study aims to evaluate the relationship between the white blood cell count and the gingival health (OHI-S) of children aged 3-15 years with Beta Thalassemia Major.

MATERIAL AND METHODOLOGY

Sample Selection

An observational study was conducted with a total sample of 114 children, aged 3 to 15 years, randomly selected from thalassemia day care unit of a government hospital.

Inclusion criteria

1. Children diagnosed with beta thalassemia major.
2. Children aged 3 to 15 years.
3. Children undergoing blood transfusions.
4. Children not planned for a bone marrow transplant.
5. Children with no other systemic diseases.
6. Children whose parents provided consent to participate in the study.

Exclusion Criteria

1. Children not undergoing blood transfusions.
2. Children planned for a bone marrow transplant.
3. Children with other systemic diseases.

Clinical Parameters

An intraoral examination was conducted to assess oral hygiene status using the Oral Hygiene Index Simplified (J.C. Greene and J.R. Vermillion, 1964)[6], as well as the Plaque Index (Silness and Loe) and Gingival Index (Loe and Silness)[7]. In addition, a complete blood cell count was carried out to measure the total leukocyte count.

The oral hygiene assessment was based on the Oral Hygiene Index Simplified, which evaluates six specific index teeth for debris and calculus buildup. The Plaque Index involved inspecting four gingival areas of each selected tooth—the disto-facial, facial, mesio-facial, and lingual surfaces. The Gingival Index was used to determine the severity of gingivitis on these same teeth. [8]

Autoclaved plane mouth mirrors and explorers were utilized for the oral cavity examination. A single examiner and a single recorder were consistently employed throughout the study period to ensure uniformity.

Statistical Analysis

The data were organized in an Excel sheet and processed using SPSS version 25.0 (Statistical Package for the Social Sciences). The Shapiro-Wilk test was employed to assess the probability distribution, which indicated that the data were not normally distributed. Consequently, non-parametric tests of significance were applied. Descriptive statistics were performed, and inter-group comparisons were conducted using the Kruskal-Wallis test. A p-value <0.05 was interpreted as the threshold for statistical significance.

Results

The median age of the participants was 11 years, with an interquartile range of 7 to 14 years. Most of the participants were aged between 11 and 15 years. Out of 114 participants, 76 (66.1%) were male and 39 (33.9%) were female. Most participants had normal white blood cell (WBC) counts (58.8%), while 22.8% had low WBC counts and 18.4% had elevated counts. The Oral Hygiene Index Simplified (OHI-S) score was significantly higher in subjects with low WBC counts compared to those with elevated counts. Although plaque and gingival scores were also highest in the low WBC group, the differences were not statistically significant ($p > 0.05$) (Table 1, Figures 1 and 2). Furthermore, a very weak negative correlation was observed between gingival scores and WBC counts, which was not statistically significant ($p > 0.05$) (Figure 3).

Table 1. OHI-S, plaque index score and gingival index score of the subjects.

Variable	All subjects	WBC count			
		Low	Normal	High	p-value
OHI-S score	2.5 (1.8- 2.8)	2.6 (2.4- 3.8)	2.4 (1.6- 2.7)	2.3 (1.9- 2.8)	.021*
Plaque score	1.2 (0.8- 1.5)	1.3 (1.0- 1.8)	1.1 (0.8- 1.4)	1.1 (0.8- 1.6)	.074
Gingival score	1.0 (0.6- 1.5)	1.1 (0.6- 1.6)	1.1 (0.6- 1.5)	1.0 (0.5- 1.3)	.352

Kruskal-Wallis test. *p-value<.05 was considered statistically significant.

Figure.1. OHI-S Score, Gingival Score and Plaque Score .

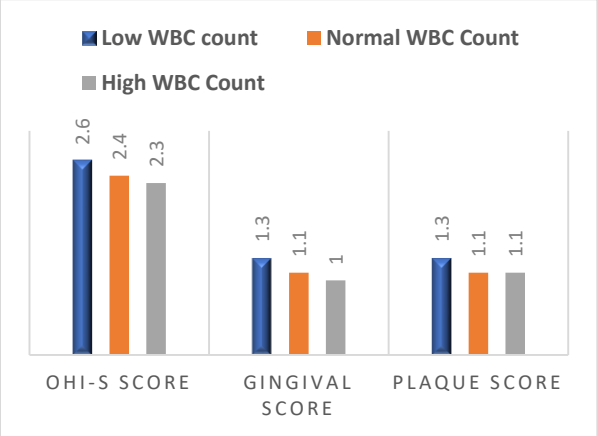
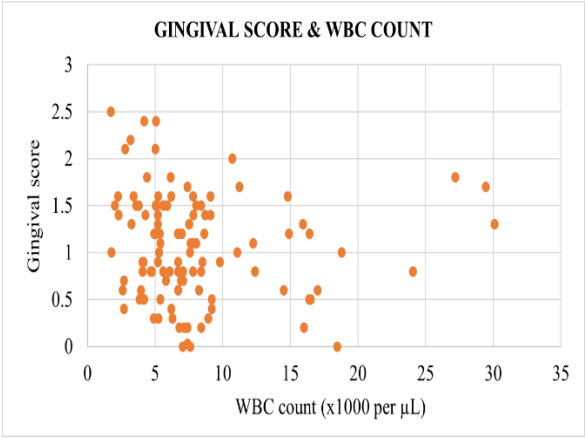


Figure 2. Correlation between gingival score & WBC count.



DISCUSSION

This study aimed to assess the relationship between white blood cell (WBC) count and gingival health, alongside evaluating Oral Hygiene Status, Plaque Index and Gingival Index in children aged 3 to 15 years diagnosed with Beta-Thalassemia major. The findings highlight the substantial oral health challenges faced by this vulnerable population and illustrate the interconnectedness of systemic health and oral hygiene practices.

Beta-thalassemia major is a chronic hematological disorder characterized by ineffective erythropoiesis, leading to varying degrees of anemia and multi-system complications. A significant consequence of this condition is its impact on the immune system, which can worsen oral health issues.[9] In this study, a large proportion of participants exhibited poor oral hygiene, as indicated by elevated scores in the Oral Hygiene Index Simplified (OHI-S), Plaque Index (PI), and Gingival Index (GI). These results align with studies conducted by Singh *et al.* (2013) in India, Akcail *et al.* (2015) in Turkey and Das *et al.* (2024), which reported a higher prevalence of gingivitis and plaque in children with thalassemia compared to healthy peers, with statistically significant differences. This suggests that children with chronic illnesses may prioritize managing their systemic health over maintaining oral hygiene, contributing to a further decline in their oral health.[10,11,12]

The findings of this study are in contrast with those reported by Caliskan *et al.* (2011), Hattab *et al.* (2012) and Shadlinskaya *et al.* (2020), which did not find significant differences in gingivitis or plaque accumulation. These discrepancies may be due to differences in study design, sample size, or population characteristics. Nonetheless, it is clear that individuals with beta-thalassemia are at a greater risk of oral health complications, emphasizing the need for comprehensive dental care, regular monitoring and focused management of contributing factors.[13,14,15]

Additionally, xerostomia (dry mouth), a common problem in thalassemia patients, further complicates oral hygiene maintenance. Saliva plays a critical role in neutralizing acids, removing food particles and providing antimicrobial properties. Consequently, these factors collectively heighten the risk of periodontal disease and other oral infections, accelerating the overall deterioration of oral health in children with beta-thalassemia major.[16,17]

Furthermore, the impaired immune response in these patients characterized by inadequate B lymphocyte activity and unchanged salivary immunoglobulin levels reduces their ability to effectively combat gingival inflammation. As a result, children with beta-thalassemia are less able to rely on the salivary immune defenses that are typically critical for preventing gingivitis and other oral infections. [18]

It is also important to consider the psychosocial factors that may affect the oral health of children with beta-thalassemia. Chronic illness can place significant emotional and psychological stress on both patients and their families, often resulting in a reduced quality of life. This stress can lead to the neglect of preventive health measures, such as oral

hygiene. The focus on managing systemic health can overshadow the importance of maintaining good oral health practices, perpetuating a cycle of neglect that worsens dental problems. [19]

Although this study identified a weak, statistically non-significant negative correlation between gingival scores and WBC count, this observation warrants further investigation. The complexity of the relationship between systemic health and oral hygiene may be influenced by additional factors, such as age, dietary habits, and overall health status. For instance, dietary imbalances related to thalassemia and its treatments can exacerbate oral health issues, increasing the risk of dental caries and periodontal diseases. Additionally, structural anomalies like malocclusion, commonly observed in thalassemia patients, can hinder effective oral hygiene practices, compounding the oral health challenges faced by these individuals.

CONCLUSION

This study evaluates the link between WBC count, oral hygiene, plaque index and gingival health in children with beta-thalassemia major. The results highlight the need for regular dental check-ups, targeted education on oral hygiene and specific interventions to address their unique challenges. Integrating dental care into the overall management of beta-thalassemia could improve both systemic and oral health, enhancing patient quality of life. Future research should explore larger cohorts and investigate the mechanisms behind oral health deterioration in these children, to develop more effective care strategies.

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