Original article

Reduction of Serum Ferritin after Deferasirox Treatment in Thalassemic Children

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Abstract

Background:
Thalassemia is a prevalent genetic disorder in South Asia, including Bangladesh, where transfusion-dependent patients are at risk of iron overload. Deferasirox, an oral iron chelator, is widely used to manage iron burden.

Objective:
This study evaluates the efficacy of deferasirox in thalassemic children.

Methods:
This pretest-posttest quasi-experimental study was conducted at the Bangladesh Shishu (Children) Hospital and Institute, Dhaka, involving 50 transfusion-dependent thalassemic children aged 2–18 years. Serum ferritin was measured before and after six months of deferasirox therapy. Statistical analysis included paired t-tests, with p-values <0.05 considered significant.

Results:
The mean serum ferritin level decreased significantly from 2462±1169 ng/mL to 1874±1002 ng/mL (p<0.001), with a mean reduction of 588±367 ng/mL and a percentage reduction of 24.60±13.00%.

Conclusion:
Deferasirox effectively reduces serum ferritin levels in transfusion-dependent thalassemic children. These findings contribute to evidence-based strategies for managing iron overload in resource-limited settings.

Keywords: Thalassemia, Deferasirox, Serum ferritin, Iron overload, Pediatric hematology

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Introduction:

Thalassemia is one of the most common inherited hemoglobinopathies, posing a significant global health challenge. The disorder is especially prevalent in South and Southeast Asia, with Bangladesh experiencing a substantial burden of HbE-β thalassemia. The different forms of thalassemia collectively account for approximately 03% of the carrier population in Bangladesh, contributing to an increasing number of transfusion-dependent individuals annually.[1] Regular blood transfusions, a mainstay in managing transfusion-dependent thalassemia, are indispensable for sustaining hemoglobin levels

and reducing anemia-related complications. However, this therapeutic intervention leads to chronic iron overload, primarily affecting critical organs like the liver, heart, and endocrine glands, necessitating life-long iron chelation therapy to mitigate morbidity and mortality.[2] Iron overload results from the body's inability to excrete the excess iron introduced through transfusions, leading to systemic deposition in tissues. This accumulation triggers oxidative stress and ferroptosis, mechanisms that contribute to cardiac dysfunction, hepatic fibrosis, and endocrine complications such as diabetes and hypogonadism.[3] Without effective intervention, these complications significantly reduce the life expectancy and quality of life of affected individuals. Deferasirox, an oral iron chelator introduced for its efficacy and convenience over traditional options such as desferrioxamine, has emerged as the preferred first-line therapy. Its once-daily dosing regimen ensures better compliance, critical in pediatric populations where adherence remains a significant challenge.[4] Studies have demonstrated its efficacy in reducing liver iron concentration by up to 51% and cardiac iron by 20.5% in long-term evaluations.[5] These findings underscore the therapeutic potential of deferasirox in managing iron burden, albeit with the need for close monitoring due to its dose-dependent nephrotoxicity.[6] Adverse effects such as proteinuria, hypercalciuria, and transient increases in serum creatinine have been well-documented, necessitating periodic renal function monitoring during treatment. Longitudinal studies in pediatric patients reveal that while deferasirox is generally well-tolerated, its safety profile requires careful individualization of dosing to balance efficacy and toxicity.[7] Recent evidence highlights a critical gap in data specific to populations in low and middle income countries, such as Bangladesh, where thalassemia prevalence is high, yet treatment and monitoring resources are limited.[1] Current research on deferasirox in Bangladesh has largely focused on short-term outcomes, leaving a dearth of data on serum ferritin reduction rates in this population.[8] Serum ferritin serves as a crucial biomarker for monitoring chelation efficacy, reflecting the overall iron burden and the effectiveness of therapy over time. Several studies have reported significant reductions in serum ferritin levels in thalassemic children treated with deferasirox, with reductions ranging from 20% to 50% over one year of therapy, depending on baseline iron burden and adherence.[9,10] However, there remains a need for country-specific investigations to address the interplay of socio-demographic, genetic, and healthcare factors that influence treatment outcomes in Bangladesh. Furthermore, given the nephrotoxicity risk associated with higher doses of deferasirox, renal safety monitoring should be integral to clinical management.[11] This study seeks to address the existing research gap by evaluating the rate of serum ferritin reduction in thalassemic children treated with deferasirox in Bangladesh. By focusing on these key outcomes, the study aims to provide insights into optimizing treatment protocols and improving clinical outcomes for transfusion-dependent pediatric patients in resource-limited settings. The findings have the potential to inform guidelines and support the implementation of evidence-based practices tailored to the needs of Bangladeshi children with thalassemia.

Methods:

This quasi-experimental study was conducted at the Thalassemia Center, Department of Hematology & Oncology, Bangladesh Shishu (Children) Hospital and Institute, Dhaka, from June 2019 to July 2021. The study population included 50 purposively sampled thalassemic children aged 2–18 years who met specific inclusion criteria. Eligible participants were those with beta-thalassemia major or E-beta thalassemia, a history of at least 10–20 blood transfusions, serum ferritin levels >1000 ng/mL, no prior deferasirox treatment, and no chelation therapy in the past year. Patients were excluded if they had abnormal renal function, known diabetes mellitus, hypertension, renal disease, or were taking nephrotoxic drugs. Data were collected using a structured questionnaire. Quantitative data were summarized using frequencies and percentages, while qualitative data were represented by mean and standard deviations. Statistical analyses were performed using SPSS version 23. Paired t-tests were employed to evaluate differences in pre- and post-treatment parameters, with p-values <0.05 considered statistically significant. Ethical clearance was obtained from the ethical review committee of Bangladesh Shishu Hospital.

Informed consent was secured from the parents or legal guardians of all participants after explaining the study's nature, purpose, and potential benefits in the local language. Participants were assured of their rights to withdraw at any time, and confidentiality was strictly maintained. To minimize participant burden, costs for reagents and other investigations were borne by the researcher with institutional approval.

Results:

Majority of the children was 5 years or less (66%) with a mean age of 5.21±1.72 years, female predominance (54%). 64% of them had history of consanguinity, whereas 36% reported no such familial relations (Table-I).

Table-I: Demographic characteristics of study participants (N=50)

Variables	no. (%)
Age (years)	
≤5	33(66)
>5	17(34)
Mean±SD	5.21±1.72
Gender	
Male	23(46)
Female	27(54)
History of consanguinity	
Yes	32(64)
No	18(36)

Among the study subjects, the distribution of thalassemia types was nearly equal, with 52% diagnosed with β-thalassemia major and 48% with HbE-β thalassemia. The mean age of diagnosis was 1.41±0.86 years. Participants required an average of 10.12±2.86 transfusions annually, with a cumulative mean of 38.60±22.01 transfusions. Regular transfusion schedules were followed by the majority (76%), while 24% had irregular transfusion patterns. Regarding prior iron chelation therapy, 78% of participants had no history of chelation, while 16% and 6% had previously received deferiprone and desferrioxamine, respectively (Table-II).

Table-II: Clinical characteristics of the study participants (N=50)

Clinical Characteristics	no. (%)
Type of thalassemia	
β thalassemia major	26(52)
HbE-β thalassemia	24(48)
Age of diagnosis(years)	1.41±0.86
Frequency of transfusion (Times per year)	10.12±2.86
Total transfusion	38.60±22.01
Regularity of transfusion	
Regular	38(76)
Irregular	12(24)
Prior Iron chelation therapy	
Deferiprone	8(16)
Desferrioxamine	3(6)
No prior Iron chelation therapy	39(78)

The mean serum ferritin level at baseline was 2462±1169 ng/mL, ranging from 1148 to 8000 ng/mL. After treatment, the mean serum ferritin level significantly decreased to 1874±1002 ng/mL, with a range of 900 to 6259 ng/mL.The reduction in serum ferritin levels after treatment was 588±367 ng/mL ($p<0.001$), corresponding to a mean percentage change of 24.60±13.00%, indicating the efficacy of deferasirox treatment in lowering serum ferritin levels in the study population. Despite the reduction, the levels remained above the normal reference range of 15–300 ng/mL, highlighting the substantial but incomplete reduction in iron burden following deferasirox treatment in the study population (Table-III).

Table-III: Serum Ferritin at Baseline and After Treatment (N=50)

Serum ferritin (ng/ml)	Mean±SD	Range	p-value
At baseline	2462±1169	(1148-8000)	<0.001
After treatment	1874±1002	(900-6259)	
Reduced	588±367		
Change (%)	24.60±13.00		

Discussion:

The current study evaluated the demographic, clinical, and biochemical characteristics of thalassemic children treated with deferasirox, focusing on serum ferritin reduction. Our findings contribute to the growing body of evidence on the effectiveness of deferasirox in managing transfusion-dependent thalassemia. The demographic analysis revealed that the majority of participants were ≤5 years old, with a slight female predominance and a high rate of consanguinity (64%). These findings align with reports from Yemen and Pakistan, where consanguinity rates among thalassemic families ranged from 60% to 74%.[12,13] Consanguinity is a well-established risk factor for thalassemia, contributing significantly to the disease burden in South Asia. The slight female predominance observed in our study population contrasts with other studies showing a male bias, potentially reflecting regional variations in healthcare access and reporting.[1] The average age of diagnosis in our study population was 1.41 years, earlier than reported in Indian and Iranian study populations.[9,14] Notably, 78% of our participants had no prior chelation therapy, underscoring gaps in treatment access. Deferasirox therapy resulted in a significant reduction in serum ferritin levels (mean reduction: 588 ng/mL, 24.6%, $p<0.001$), consistent with other studies demonstrating similar efficacy. For instance, Batool et al reported a 47% reduction in serum ferritin over one year, while Dhamija et al observed a decline from 4354 ng/mL to 3042 ng/mL over three years.[9,10] The reduction in our study population was modest compared to these studies, likely due to differences in baseline ferritin levels and treatment duration. Despite the reduction, ferritin levels remained above the normal range, highlighting the need for prolonged therapy and regular monitoring. In conclusion, deferasirox demonstrated significant efficacy in reducing serum ferritin levels in Bangladeshi children with transfusion-dependent thalassemia. Comparative analyses with regional and international studies highlight the need for context-specific interventions to improve outcomes in thalassemic children in resource-limited settings.

Limitations:

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion:

This study demonstrates the efficacy of deferasirox in reducing serum ferritin levels in thalassemic children in Bangladesh, with significant improvements observed after treatment. Given the high prevalence of transfusion-dependent thalassemia and limited access to prior chelation therapy in this study population, these results underscore the importance of individualized treatment strategies and robust follow-up protocols to optimize outcomes. Future studies should focus on long-term effects, contributing to evidence-based management guidelines in resource-limited settings.

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Conflict of interest: None declared

References:

1. Hossain B, Man S, Chowdhury Banu NA, Wahab A. Efficacy and Safety of Deferasirox in Pediatric Thalassemia Patients: Experience from a Tertiary Care Children Hospital of Bangladesh. ijmsci. 2021 Sep 11;8(09): 5621–5626. doi:10.18535/ ijmsci/v 8i09.07
2. Galanello R, Piga A, Forni GL, Bertrand Y, Foschini ML, Bordone E, et al. Phase II clinical evaluation of deferasirox, a once-daily oral chelating agent, in pediatric patients with beta-thalassemia major. Haematologica. 2006 Oct;91(10):1343–51.
3. Mancardi D, Mezzanotte M, Arrigo E, Barinotti A, Roetto A. Iron Overload, Oxidative Stress, and Ferroptosis in the Failing Heart and Liver. Antioxidants (Basel). 2021 Nov 24;10(12):1864. doi: 10.3390/antiox 10121864.
4. T aher A, Jefri AA, Elalfy MS, Zir KA, Daar S, Damanhouri G, et al. Deferasirox (Exjade®) Treatment in Pediatric β-Thalassemia Patients with High Iron Burden: 2.8 Years Results from ESCALATOR Trial. Blood. 2008 Nov 16;112(11):3879. doi:10.1182/blood. V112.11.3879.3879
5. Wood JC, Otto-Duessel M, Gonzalez I, Aguilar MI, Shimada H, Nick H, Nelson M, et al. Deferasirox and deferiprone remove cardiac iron in the iron-overloaded gerbil. Transl Res. 2006 Nov;148(5):272-80. doi:

10.1016/j.trsl.2006.05.005.

6. Vichinsky E, Onyekwere O, Porter J, Swerdlow P, Eckman J, Lane P, et al; Deferasirox in Sickle Cell Investigators. A randomised comparison of deferasirox versus deferoxamine for the treatment of transfusional iron overload in sickle cell disease. Br J Haematol. 2007 Feb;136(3):501-8. doi: 10.1111/j.1365-2141.2006.06455.x.
7. Tony S, Al-Khabori MK, Saad AA, Daar S, Zachariah M, Wali Y. Dose Optimization of Deferasirox in Chelation Naıve Children with Thalassemia Major. Blood. 2011 Nov 18;118(21):5294.
8. Jahir SJ, Anwar S, Morshed AA, Islam A, Islam K. Comparative study of Deferiprone versus Deferiprone with Deferasirox as iron chelation therapy in Thalassemic children. Bangladesh Journal of Child Health. 2019;43(3):152–156. doi:https://doi.org/10.3329/bjch.v43i3.49571
9. Dhamija M, Mahajan A, Kalra M, Virmani A. Deferasirox in Indian children with thalassemia major: 3 years experience. Indian J Med Paediatr Oncol. 2013 Jan;34(1):16-20. doi: 10.4103/0971-5851.113407.
10. Batool R, Qureshi S, Yousafzai MT, Kazi M, Ali M, Qamar FN. Risk Factors Associated with Extensively Drug-Resistant Typhoid in an Outbreak Setting of Lyari Town Karachi, Pakistan. Am J Trop Med Hyg. 2022 Mar 28;106(5):1379–83. doi: 10.4269/ajtmh.21-1323
11. Younis MA. Evaluation of Serum Ferritin, Creatinine and Liver Enzymes in Patients with Я-thalassemia After Administration of Deferasirox. Tikrit Journal of Pharmaceutical Sciences. 2017;12(1):68–75.
12. Al-Kherbash HA, Al-Awdi A, Hasan NS. Pattern and clinical profile of thalassemia among pediatric patients attending the Yemeni Society Centers for Thalassemia and Genetic Blood Disorders in Yemen. The Scientific Journal of Al-Azhar Medical Faculty, Girls. 2017;1:43–56. doi:10.4103/sjamf. sjamf-15-17
13. Khan MS, Ahmed M, Khan RA, Mushtaq N, Wasim Ullah Shah M. Consanguinity ratio in b-thalassemia major patients in District Bannu. J Pak Med Assoc. 2015 Nov;65(11):1161-3.
14. Miri-Moghaddam E, Yaghoobi M, Naderi M, Nootizaei A. Demographic and Laboratory Characteristics of β-Thalassemia Major Patients in Zahedan, Southeast of Iran. Iranian Journal of Pediatric Hematology and Oncology. 2016 Jun 10;6(2):93–9.