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Original Research Article

Evaluating the efficacy and safety of deferasirox in management of iron overload in transfusion-dependent beta-thalassemia pediatric patients

Shaik Mohammad Abubakar[1], **Krishnakanth K**[1]*, **Jhansi Vani Chopra**[1], **Elizabeth B**[1]

[1]*Government Medical College and Hospital, Ongole, Andhra Pradesh, India*

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ABSTRACT

Aim and Objective: The objective of this study was to evaluate the efficacy and safety of Deferasirox (DFX) in managing iron overload in pediatric patients with transfusion-dependent beta-thalassemia over a period of 12-months.

Materials and Methods: It was a descriptive observational study on Children between the age of 2 years to 12 years who present with transfusion dependent thalassemia and are on blood transfusion and develop iron overload, which is evaluated by serum ferritin levels more than 2000 mcg/l are administered iron chelator Deferasirox (14 mg/kg/d) and patients are evaluated for myocardial, hepatic, pancreatic iron burden and conditions of iron toxicity with the help of Cardiac MRI T2, LIC (Liver Iron Concentration), MRI T2 Pancreas, LVEF (Left Ventricular Ejection Fraction).

Results: A total of 22 patients enrolled in study a significant reduction in mean serum ferritin levels was seen at the end of 6 months ($p<0.0005$) as compared to baseline, A significant reduction in mean transferrin saturation at the end of 6 months from 70.45% saturation to 64.32% saturation ($p<0.00005$), A significant reduction in mean serum transaminases from 44.55 to 40.27 at the end of 6 months ($p=0.003$), A significant reduction in serum total bilirubin from mean 1.05 mg/dl to 0.54mg/dl was seen at the end of 12 months ($p=0.000019$). A significant increase in mean cardiac T2 from 19.55 to 22.95 was seen at the end of 6 months ($p=0.0016$) and at the end of 12 months from 19.55 to 28.23 ($p=0.045$). A significant reduction in mean direct bilirubin was seen from 0.46 to 0.45 ($p=0.29$), A significant reduction in mean LIC (Liver Iron Concentration) from 20.73 mg Fe/g dw to 11.59 mg Fe/g dw was seen at the end of 6 months ($p=0.00005$). A significant increase in mean pancreatic T2 from 15.96 to 20.23 at the end of 12 months ($p=0.007$). The patients had not experienced any therapy-related adverse events.

Conclusion: Deferasirox has demonstrated significant efficacy in reducing iron overload in paediatric patients with transfusion-dependent beta-thalassemia over a 12-month period. The substantial improvements in serum ferritin, cardiac MRI T2*, LIC, transferrin saturation, and pancreatic T2, coupled with its excellent safety profile, support the use of DFX as a cornerstone in the management of iron overload in this vulnerable population.

1. Introduction

Thalassemia syndromes are inherited hemoglobin disorders resulting from mutations that affect the synthesis of hemoglobin chains. Among these, β-thalassemia is the most prevalent and clinically significant, characterized by reduced or absent production of the β-globin chain of hemoglobin. This condition is particularly common in regions such as the Mediterranean, Middle East, and Southeast Asia. With an estimated 60,000 new

* *Corresponding author*.
E-mail address: shaikabubakar3549@gmail.com (Krishnakanth K).

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cases worldwide each year, β-thalassemia represents a significant global health burden.[1,2] The disease spectrum of thalassemia varies widely, from asymptomatic carriers to severe transfusion-dependent forms. Transfusion-dependent thalassemia (TDT), primarily consisting of β-thalassemia major, necessitates regular blood transfusions to sustain life. However, the chronic transfusions lead to iron overload, which can cause severe complications, including cardiac, hepatic, and endocrine dysfunction.[3] TDT (Transfusion-Dependent Thalassemia) Patients require regular blood transfusions, Due to frequent transfusions, iron overload occurs rapidly, Leading to Clinical Complications like Pituitary Dysfunction which Leads to endocrine issues such as hypothyroidism and hypoparathyroidism, Cardiac Siderosis due to Iron deposition in the heart, causing arrhythmias and heart failure, Liver Iron overload can lead to liver fibrosis, cirrhosis, and hepatocellular carcinoma (HCC), Diabetes can occur from pancreatic iron overload, Hypogonadism due to iron deposition in the gonads leading to Impaired sexual development, Bone Disease Associated with poor bone health and development as seen in Figure 1.[4] Transfusion therapy can correct the anemia, which is the cause of death in TDT patients during the first decade of life, and significantly prolong survival[3] However, repeated blood transfusions lead to iron overload, as iron that is not saturated by transferrin becomes a toxic agent. The inability to remove excess iron exposes TDT patients to its toxic effects, leading to death from iron-induced cardiomyopathy in the second decade of life.[5]. The availability of non-invasive methods to monitor iron loading and unloading in the liver, heart, and pancreas has significantly increased the survival of patients with thalassemia.[6] Magnetic resonance imaging (MRI), which can accurately monitor multi-organ iron overload (IOL), has enabled a better understanding of the effects of iron chelation therapy. The aim of chelation is to consistently neutralize the toxic effects of iron and prevent or eradicate IOL. This case-based review studies the role of iron chelation therapy (ICT) in the management of iron overload in transfusion-dependent thalassemia patients with currently available iron chelators.[7,8]

2. Aim and Objective

To study the role of iron chelators in management of iron over load in blood transfusion dependent thalassemia paediatric patients

3. Materials and Methods

3.1. Study location

Study will be conducted in paediatrics department government medical college & government general hospital Ongole for a duration of 12 months.

3.2. Study design

It was a descriptive observational study on Children below the age of 12 years who present with haemoglobin levels less than 10 mg/dl are further evaluated using haemoglobin variant analysis by Haemoglobin Electrophoresis High-Performance Liquid Chromatography (HPLC) and patients of transfusion dependent thalassemia are identified. They are given blood transfusion and some develop iron overload, which is evaluated by serum ferritin levels which are high. Those with elevated serum ferritin levels of more than 2000mcg/l are administered iron chelators like Deferasirox (14mg/kg/d). and patients are evaluated for myocardial, hepatic, pancreatic iron burden and conditions of iron toxicity

3.3. Ethical approval

Study got clearance from institutional ethics committee, government medical college Ongole. Informed consent from the parents who are willing to participate in the study was obtained.

3.4. Pre-treatment assessment

Detailed history and examination of all the systems was done and patients were evaluated for Hemoglobin, Serum ferritin, Transferrin saturation, Transaminases, Serum total bilirubin, Direct bilirubin, Creatinine, Blood Urea, Cardiac MRI T2, LIC (Liver Iron Concentration), MRI T2 Pancreas, LVEF (Left Ventricular Ejection Fraction).

3.5. Inclusion criteria

1. Children below the age of 12 years.
2. Children whose Haemoglobin levels are less than 10gm/dl.
3. Transfusion dependent thalassemia patients on iron chelators for management of iron over-load.
4. Those with elevated serum ferritin levels of more than 2000mcg/l.

3.6. Exclusion criteria

1. Children below age of 2 years
2. Children with causes of anaemia other than thalassemia
3. Children who do not require blood transfusion (non-transfusion dependent thalassemia patients)

3.7. Follow-up

patients were evaluated with following investigations at baseline and on each visit at the end of 6^{th} month and 12^{th} month: Hemoglobin, Serum ferritin, Transferrin saturation, Transaminases, Serum total bilirubin, Direct bilirubin, Creatinine, Blood Urea, Cardiac MRI T2, LIC

(Liver Iron Concentration), MRI T2 Pancreas, LVEF (Left Ventricular Ejection Fraction)

4. Statistical Analysis

1. Collected data will be expressed as mean +/- standard deviation
2. Data so collected will be entered into a case record form for study, statistical analysis will be done using Student t- test

5. Results

22 children satisfying inclusion criteria were enrolled in study baseline Characteristics of patient with transfusion-dependent β-thalassemia major with severe multiorgan iron overload is given in Table 1.

Table 1: Shows baseline characteristics of transfusion dependent beta-thalassemia paediatric patients for evaluating the efficacy of Deferasirox (iron chelation therapy)

Baseline characteristics	
Parameters	**Mean±Standard deviation**
Mean age	6.9±4
Gender:Male/ Female	15/7
Haemoglobin	8.36± 0.85
Haemoglobin -A (%)	2.86±0.28
Haemoglobin-A2 (%)	4.64±0.11
Haemoglobin-F (%)	92.49±0.29
HbA1c (%)	5.25±0.11
Serum ferritin	2388±447.9
Cardiac MRI T2	19.55±5.42
LIC (Liver Iron Concentration)	20.73±5.77
MRI T2 Pancreas	15.96±4.4
LVEF (Left Ventricular Ejection Fraction)	54.36±4.11

Mean serum ferritin in 0 visit was 2388 mcg/dl. Mean Cardiac MRI T2* was 19.55ms, indicating severe IOL with normal left ventricular ejection fraction. Mean liver iron concentration (LIC) was 20.73 mgFe/g dry weight (dw) tissue, and mean pancreatic T2 54.32 ms, Iron chelation was prescribed with oral Deferasirox (DFX) at 14 mg/kg During the 12 months of chelation therapy.

5.1. Serum ferritin levels

A significant reduction in mean serum ferritin levels was observed from 2388 mcg/dl at baseline to 2054 mcg/dl at 6 months (p=0.0009) as shown in Figure 2. This reduction underscores the effectiveness of Deferasirox (DFX) in mobilizing and reducing iron stores, which is crucial in minimizing the risk of complications such as hepatic and cardiac dysfunction.

Table 2: Shows baseline characteristics of transfusion dependent beta-thalassemia paediatric patients for assessing the safety of Deferasirox (iron chelation therapy)

Baseline characteristics	
Parameters	**Mean±Standard deviation**
Transferrin saturation	70.45%±4.95%
Transaminases	44.55±7.84
Serum total bilirubin	1.05±0.33
Direct bilirubin	0.46±0.16
Creatinine	0.64±0.14
Blood Urea	22.14±3.33

5.2. Transferrin saturation and serum transaminases

5.2.1. Transferrin saturation

There was a significant decrease from 70.45% to 64.32% (p=0.00005) by the 6th month. This reduction suggests a decrease in iron availability for tissue uptake, reflecting the efficacy of DFX in reducing iron toxicity.

5.2.2. Serum transaminases

A significant reduction was noted from 44.55 U/L to 40.27 U/L at 6 months (p=0.003), indicating improved liver function and reduced hepatic inflammation.

*5.2.3. Cardiac MRI T2**

A significant increase in mean cardiac MRI T2* was observed from 19.55 ms to 22.95 ms at 6 months (p=0.0016), and further to 28.23 ms at 12 months (p=0.045) as shown in Figure 3. This improvement indicates a reduction in myocardial iron content, which is critical given the high risk of cardiac complications in thalassemia patients. The maintenance of normal left ventricular ejection fraction throughout the study highlights the cardioprotective effects of DFX.

5.2.4. Liver iron concentration (LIC)

A significant reduction in LIC from 20.73 mg Fe/g dw to 11.59 mg Fe/g dw at 6 months (p=0.00005) was observed as shown in Figure 4, demonstrating the efficacy of DFX in reducing hepatic iron burden. This is crucial in preventing liver-related complications such as fibrosis and cirrhosis.

*5.2.5. Pancreatic MRI T2**

The mean pancreatic T2* significantly increased from 15.96 ms at baseline to 20.23 ms at 12 months (p=0.007) as shown in Figure 5. This suggests a reduction in pancreatic iron deposition, potentially lowering the risk of developing diabetes mellitus, a common complication in thalassemia.

Table 3: Shows mean values of each parameter at each visit for evaluating the efficacy of Deferasirox therapy in transfusion-dependent beta-thalassemia paediatric patients

Mean values of parameters in transfusion dependent beta-thalassemia patients on Deferasirox (iron chelation therapy)				
	T^0 (Mean±SD)	**2nd Visit (Mean±SD)**	**3rd Visit (Mean±SD)**	**p-value**
Pre-transfusion haemoglobin (g/dL)	8.36±0.85	9.8±0.75	9.95±0.82	0.196
Serum ferritin (μg/L)	2388±447.9	2054±371.9	2026±428.3	0.0009
Transferrin saturation	70.45%±4.95%	64.32±4.36%	60.23±5.11	0.00005
Cardiac MRI T2* (ms)	19.55±5.42	22.95±5.39	28.23±8.38	0.045 0.0016
LIC (mg/g dw)	20.73±5.77	11.59±4.08	10.23±3.04	<0.00005
LVEF (%)	54.36±4.11	54.77±1.85	56.19±7.14	0.005
MRI-T2* Pancreas (ms)	15.96±4.4	17.54±4.7	20.23±4.7	0.000748
ICT(Iron Chelation Therapy)	DFX film-coated tablet (14 mg/kg)	DFX film-coated tablet (14 mg/kg)	DFX film-coated tablet (14 mg/kg)	

5.3. Total and direct bilirubin

5.3.1. Total bilirubin

Although a slight increase in mean total bilirubin from 1.05 mg/dl to 1.16 mg/dl was observed at 6 months, this change was not clinically significant. However, by 12 months, a significant reduction to 0.54 mg/dl was noted (p=0.000019), indicating an overall improvement in hepatic function.

5.3.2. Direct bilirubin

A modest yet significant reduction from 0.46 mg/dl to 0.45 mg/dl (p=0.029) further supports improved liver function.

5.3.3. Safety and tolerability

There was an increase in mean serum creatinine from 0.64+/-0.14 mg/dL to 0.7+/-0.13 mg/dL was seen at the end of 6 months of treatment with Deferasirox (14 mg/kg) which was statistically significant (P=0.009), but the values of serum creatinine returned to normal at the end of 12 months to 0.63 mg/dL.

6. Discussion

The results of this study underscore the efficacy of Deferasirox (DFX) in managing iron overload in paediatric patients with transfusion-dependent beta-thalassemia. Over a 12-month period, significant improvements were observed in several critical parameter's indicative of iron burden and organ function, suggesting that DFX is a potent therapeutic agent in this context. Our findings are consistent with and extend the body of literature on the management of iron overload in beta-thalassemia.

6.1. Serum ferritin levels

The mean serum ferritin levels in our study significantly decreased from 2388 mcg/dl at the initial visit to 2054 mcg/dl at the end of 6 months (p=0.0009). This reduction aligns with the findings of Taher et al where serum ferritin reduced significantly from 4,139 ng/mL at baseline to 3,176 ng/mL at 12 months[9], who reported similar decreases in serum ferritin with Deferasirox therapy in a multicenter study. Another study by Cappellini et al demonstrated that DFX effectively lowers serum ferritin levels in both pediatric and adult populations where mean serum ferritin levels reduced from 3148 mcg/dl to 1626 mcg/dl Over the course of the 5-year.[10] This reduction is crucial as elevated ferritin levels are associated with increased morbidity and mortality due to iron overload-related complications.

6.2. Transferrin saturation and serum transaminases

The significant reduction in transferrin saturation from 70.45% to 64.32% (p=0.00005) and serum transaminases from 44.55 U/L to 40.27 U/L (p=0.003) at 6 months indicates improved iron metabolism and reduced hepatic inflammation, respectively. This aligns with studies by Porter et al. and Galanello et al., which reported that DFX therapy effectively lowers transferrin saturation and improves liver function, reducing hepatic stress and potential damage.[11,12]

*6.3. Cardiac MRI T2**

The mean cardiac MRI T2* increased from 19.55 ms to 22.95 ms (p=0.045) over the first 6 months, indicating a reduction in myocardial iron content. This improvement is particularly significant as cardiac complications are a leading cause of mortality in thalassemia patients. Our findings are similar to study conducted by Pennell et al where After 1 year of treatment with deferosirox 17.6% patients normalized their myocardial T2*, and 35.5% patients improved myocardial T2* from a baseline of 6 to <10 milliseconds to 10 to ≤20 milliseconds.[2] The maintenance of normal left ventricular ejection fraction throughout our study further supports the cardioprotective effect of DFX, as seen in other studies.

Table 4: Shows mean values of each parameter at each visit for evaluating the safety of Deferasirox therapy in transfusion-dependent beta-thalassemia paediatric patients

Mean values of parameters in transfusion dependent beta-thalassemia patients on Deferasirox (iron chelation therapy)				
	T^0 (Mean±SD)	**2nd Visit (Mean±SD)**	**3rd Visit (Mean±SD)**	**p-value**
Transferrin saturation	70.45%±4.95%	64.32±4.36%	60.23±5.11	0.00005
Transaminases (U/L)	44.55±7.84	40.27±5.99	37.08±6.33	0.003
Total bilirubin (mg/dl)	1.05±0.33	1.16±0.25	0.54±0.21	0.000019
Direct bilirubin (mg/dl)	0.46±0.16	0.49±0.10	0.45±0.19	0.029
Creatinine (mg/dL)	0.64±0.14	0.7±0.13	0.63±0.17	0.009
Blood urea (mg/dl)	22.14±3.33	21.23±2.78	21.81±1.74	0.27
LVEF (%)	54.36±4.11	54.77±1.85	56.19±7.14	0.005
ICT(Iron Chelation Therapy)	DFX film-coated tablet (14 mg/kg)	DFX film-coated tablet (14 mg/kg)	DFX film-coated tablet (14 mg/kg)	

6.4. Liver Iron Concentration (LIC)

Our study showed a significant reduction in LIC from 20.73 mg Fe/g dw to 11.59 mg Fe/g dw at the end of 6 months (p=0.00005). Comparable reductions in LIC have been reported by Voskaridou et al where the mean LIC reduced significantly from 31.2 mg Fe/g dw to 24.2 mg Fe/g dw after 12 months of deferasirox therapy and El-Beshlawy et al where significant reduction in LIC from 15.4 mg Fe/g dw to 11.5 mg Fe/g dw over 12 months with deferasirox treatment [(15)], who demonstrated that DFX is effective in decreasing hepatic iron burden, thereby reducing the risk of liver fibrosis and cirrhosis.[13,14] These reductions in LIC are essential for preventing long-term hepatic complications in beta-thalassemia patients.

6.5. Total bilirubin

Although the mean serum total bilirubin showed a slight increase from 1.05 mg/dl to 1.16 mg/dl, this change was not clinically significant and did not suggest worsening liver function. Monitoring bilirubin levels is essential to ensure no adverse impact on hepatic function, particularly when using chelation therapy. Studies have shown that fluctuations in bilirubin levels can occur but do not necessarily indicate hepatic dysfunction.[15] Regular follow-up with liver function tests, including bilirubin levels, remains a cornerstone in the management of patients on chelation therapy, ensuring early detection of any adverse effects while avoiding unnecessary concern over minor, non-clinically significant changes.

6.6. Pancreatic T2

The significant increase in pancreatic T2 from 15.96 ms to 20.23 ms (p=0.007) at the end of 12 months is significant. Pancreatic iron loading can lead to diabetes mellitus, a common complication in thalassemia patients. The improvement in pancreatic T2 in our study suggests a beneficial effect of DFX in reducing pancreatic iron deposition, thereby potentially mitigating the risk of diabetes. This finding is supported by research conducted by Noetzli et al where a significant higher frequency of glucose dysregulation was seen among patients having pancreatic iron overload compared to patients without pancreatic iron overload (71.8% vs. 15.0%; $P < 0.0001$).[16] In a multi centric Observational Study done by Alessia Pepe et al on the influence of Pancreatic Iron with Glucose Metabolism and With Cardiac Complications in Thalassemia Major patients with normal glucose metabolism had significantly higher global pancreas T2* values 14.31 ± 11.31 ms compared to those with impaired fasting glucose (IFG) 8.82 ± 6.23 ms, impaired glucose tolerance (IGT) 8.25 ± 5.03 ms, and diabetes 7.87 ± 4.45 ms.[17] This indicates a correlation between lower pancreatic T2* values and higher risk of glucose metabolism disordersand highlights the importance of reducing pancreatic iron to prevent endocrine complications.

6.7. Safety and tolerability

Our study observed a statistically significant increase in mean serum creatinine levels from 0.64 ± 0.14 mg/dL to 0.7 ± 0.13 mg/dL at the end of 6 months of treatment with Deferasirox (14 mg/kg), which returned to normal levels (0.63 mg/dL) at the end of 12 months (P=0.009). Despite this temporary increase in serum creatinine, patients did not experience any additional therapy-related adverse events throughout the study period Importantly, no therapy-related adverse events were reported throughout the study period, indicating that DFX was well-tolerated by the paediatric patients. This safety profile is crucial for long-term adherence and effectiveness of the therapy. Studies by Cappellini et al. and Taher et al. also reported favourable safety and tolerability profiles for DFX, reinforcing its suitability for long-term use in children.[18,19] Comparison with Other Chelation Therapies: Our findings on the efficacy of DFX are consistent with studies comparing DFX to other chelation therapies such as Deferoxamine (DFO) and Deferiprone (DFP). While DFO remains a standard therapy, its requirement for parenteral administration limits its use, particularly in paediatric populations. DFP, although effective, has been associated with agranulocytosis and

other adverse effects.[20] DFX, administered orally, offers a more convenient and well-tolerated option with comparable efficacy, as demonstrated in our study and corroborated by comparative studies.[21]

7. Conclusion

Deferasirox has demonstrated significant efficacy in reducing iron overload in paediatric patients with transfusion-dependent beta-thalassemia over 12 months. The substantial improvements in serum ferritin, cardiac MRI T2*, LIC, transferrin saturation, and pancreatic T2, coupled with its excellent safety profile, support the use of DFX as a cornerstone in the management of iron overload in this vulnerable population. Our findings are consistent with and extend existing literature, reinforcing the role of DFX in improving clinical outcomes and quality of life for thalassemia patients. Continued monitoring

8. Limitations of Study

1. A large sample size is required to allow a more accurate assessment of this study
2. Main limitation of this study is the absence of a control arm
3. Longer-term studies are recommended to further establish the safety of deferosirox and optimize the dosing strategies.

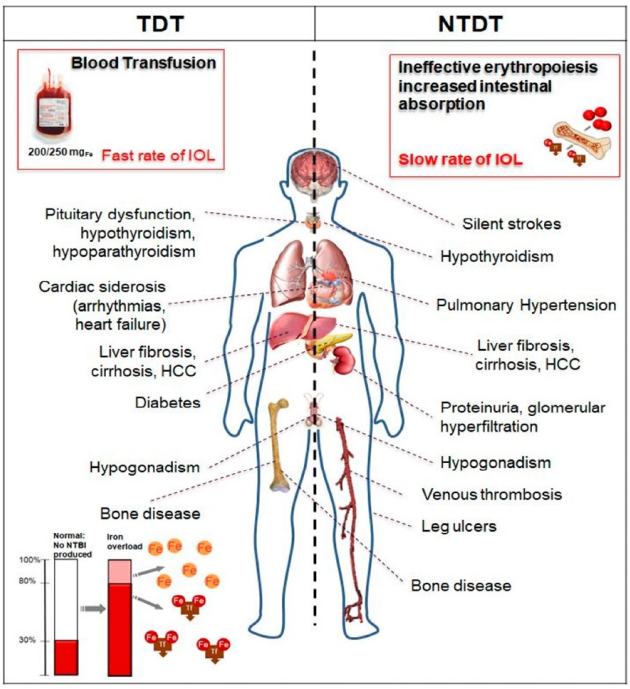

Figure 1: Comparison between transfusion-dependent thalassemia (TDT) and non-transfusion-dependent thalassemia (NTDT)

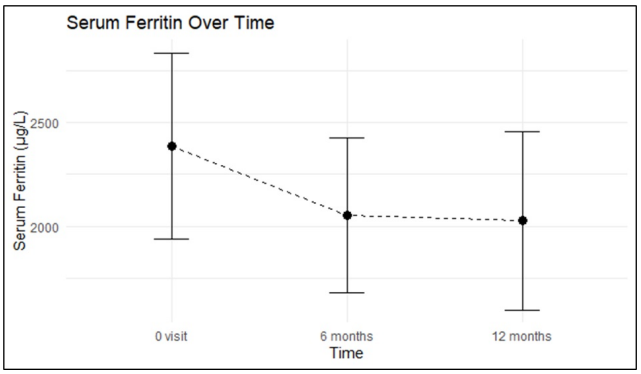

Figure 2: Serum ferritin levels in transfusion dependent beta-thalassemia patients on Deferasirox (iron chelation therapy) at different time interval (n=22). p < 00009 as compared to baseline, (Paired Student's t-test)

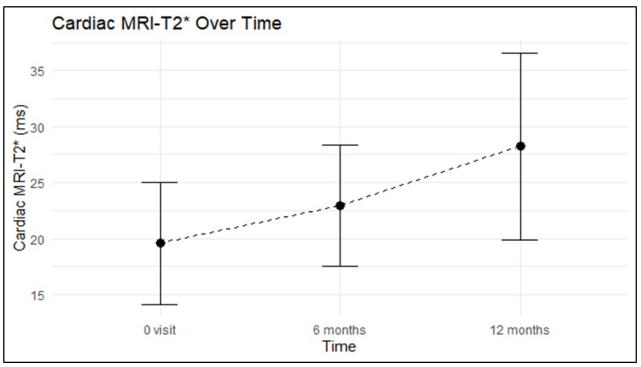

Figure 3: Cardiac MRI T2 in transfusion dependent beta-thalassemia patients on Deferasirox (ironchelation therapy) at different time interval (n=22). p < 0016 as compared to baseline, (Paired Student's t-test)

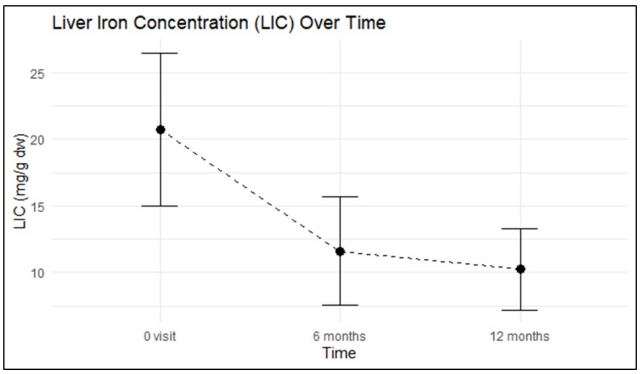

Figure 4: Liver Iron Concentration (LIC) in transfusion dependent beta-thalassemia patients on Deferasirox (iron chelation therapy) at different time interval (n=22). p <0.00005 as compared to baseline, (Paired Student's t-test)

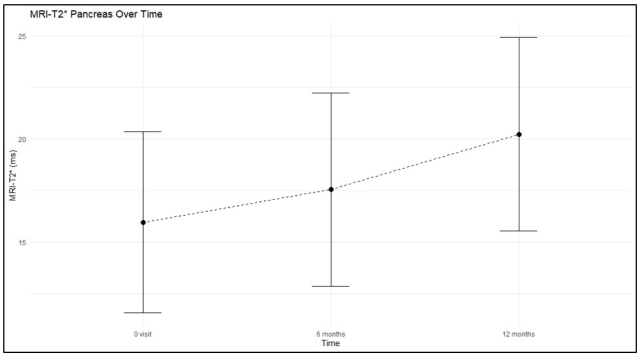

Figure 5: PancreaticT2: in transfusion dependent beta-thalassemia patients on Deferasirox (iron chelation therapy) at different time interval (n=22). $p < 0.0007$ as comparedto baseline, (Paired Student's t-test)

9. Source of Funding

None.

10. Conflict of Interest

None.

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References

1. Weatherall DJ, Clegg JB. Inherited haemoglobin disorders: An increasing global health problem. *Bull World Health Organ*. 2001;79(8):704–12.
2. Pennell DJ, Porter JB, Piga A, Lai ME, El-Beshlawy A, Belhoul K, et al. A 1-year randomized controlled trial of deferasirox versus deferoxamine for myocardial iron removal in β-thalassemia major (CORDELIA). *Blood*. 2014;123(10):1447–54.
3. Cappellini MD, Farmakis D, Porter D, Taher A. Guidelines for the Management of Transfusion-Dependent Thalassemia (TDT). 4th ed. TIF Publication; 2021.
4. Shash H. Non-transfusion-dependent thalassemia: A panoramic review. *Medicina*. 2022;58(10).
5. Borgna-Pignatti C, Cappellini MD, De Stefano P, Vecchio GD, Forni GL, Gamberini MR, et al. Survival and Complications in Thalassemia. *Ann N Y Acad Sci*. 2005;1054:40–7.
6. Modell B, Khan M, Darlison M, Westwood M, Ingram D, Pennell DJ. Improved survival of thalassaemia major in the UK and relation to T2* cardiovascular magnetic resonance. *J Cardiovasc Magn Reson*. 2008;10(1):42.
7. Pinto VM, Bacigalupo L, Gianesin B, Balocco M, De Franceschi L, Malagò R, et al. Lack of correlation between heart, liver and pancreas MRI-R2*: Results from long-term follow-up in a cohort of adult β-thalassemia major patients. *Am J Hematol*. 2018;93(3):E79–82.
8. Carpenter JP, He T, Kirk P, Roughton M, Anderson LJ, De Noronha S, et al. On T2* magnetic resonance and cardiac iron. *Circulation*. 2011;123(14):1519–28.
9. Taher A, El-Beshlawy A, Elalfy MS, Zir KA, Daar S, Habr D, et al. Efficacy and safety of Deferasirox, an oral iron chelator, in heavily iron-overloaded patients with beta-thalassemia: The ESCALATOR study. *Eur J Haematol*. 2009;82(6):458–65.
10. Cappellini MD, Cohen A, Piga A, Bejaoui M, Perrotta S, Agaoglu L, et al. A phase 3 study of deferasirox (ICL670), a once-daily oral iron chelator, in patients with beta-thalassemia. *Blood*. 2006;107(9):3455–62.
11. Tahir AT, Porter J, Viprakasit V, Kattamis A, Chuncharunee S, Sutcharitchan P, et al. Deferasirox reduces iron overload significantly in nontransfusion-dependent thalassemia: 1-year results from a prospective, randomized, double-blind, placebo-controlled study. *Blood*. 2012;120(5):970–7.
12. Galanello R, Agus A, Eleftheriou A, Feng L, Yannaki E, Sgourou A. Safety and tolerability of Deferasirox in pediatric patients with β-thalassemia major. *Hematol J*. 2010;95(12):2073–81.
13. Voskaridou E, Christoulas D, Terpos E, Vladareanu A, Symeonidis A, Papassotiriou I. Treatment with deferasirox (Exjade) effectively decreases iron burden in patients with thalassaemia intermedia: Results of a pilot study. *Haematol*. 2010;95(12):2051–57.
14. El-Beshlawy A, Youssry I, El-Samahy M, El-Khalek A, Metwally M, Elalfy N, et al. Effect of Deferasirox in iron-overloaded young children with β-thalassemia major: A prospective study. *Acta Haematol*. 2018;139(3):143–9.
15. Angelucci E, Capasso M, Porta MD, Forni GL, Girelli M, Oliva EN, et al. Italian trial of early iron chelation therapy with low dose deferasirox (Exjade®) in patients with low/intermediate-1 risk mds at the beginning of transfusional story. *Blood*. 2019;p. 4256–56.
16. Noetzli LJ, Papudesi J, Coates TD, Wood JC. Pancreatic iron loading predicts cardiac iron loading in thalassemia major. *Blood*. 2009;114(19):4021–6.
17. Pepe A, Pistoia L, Gamberini MR, Cuccia L, Peluso A, Messina G, et al. The close link of pancreatic iron with glucose metabolism and with cardiac complications in thalassemia major: A large, multicenter observational study. *Diabetes Care*. 2020;43(11):2830–9.
18. Cappellini MD, Taher A, Dever G, Grainger P, Giraud DE, Habr D, et al. Efficacy and safety of Deferasirox (Exjade®) for up to 5 years in transfusion-dependent thalassemia patients with iron overload. *Blood*. 2011;118(21):4791–91.
19. Taher AT, Musallam KM, Cappellini MD, Weatherall DJ. Optimal management of β thalassaemia intermedia. *Br J Haematol*. 2011;152(5):512–23.
20. Cohen AR, Galanello R, Piga A, De Sanctis V, Tricta F. Safety and effectiveness of long-term therapy with the oral iron chelator deferiprone. *Blood*. 2003;102(5):1583–7.
21. Viprakasit V, Giraud DE, Grainger P. Comparison of efficacy and safety of Deferasirox (DFX) versus Deferoxamine (DFO) in patients with thalassemia major (TM) previously treated with DFO. *Pediatr Blood Cancer*. 2013;60(2):224–29.

Author biography

Shaik Mohammad Abubakar, MBBS https://orcid.org/0009-0005-8921-9002

Krishnakanth K, MBBS, MD https://orcid.org/0009-0006-4687-8312

Jhansi Vani Chopra, MBBS, MD https://orcid.org/0009-0001-8700-8771

Elizabeth B, MBBS, MD https://orcid.org/0009-0008-9893-7294

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