

Correlation Between Adherence to Iron Chelation Therapy and Serum Ferritin Levels in Patients with Thalassemia Major at Gotong Royong Hospital, Surabaya, Indonesia

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ABSTRACT

Background: Thalassemia major requires lifelong regular blood transfusions, which may lead to iron overload and increased serum ferritin levels. Iron chelation therapy is needed to control ferritin levels; However, its success is influenced by patient adherence. This study aimed to analyze the correlation between adherence to iron chelation therapy and serum ferritin levels in patients with thalassemia major.

Subjects and Method: A cross-sectional study involved 35 patients with thalassemia major who underwent regular blood transfusions and received iron chelation therapy. Adherence was assessed using an eight-item adherence questionnaire, while serum ferritin levels were obtained from laboratory and medical records. Data were analyzed using descriptive statistics and Spearman's rank correlation test.

Results: Most respondents had moderate adherence to iron chelation therapy (16 patients; 45.7%), followed by high adherence (11 patients; 31.4%) and low adherence (8 patients; 22.9%). Eighteen patients (51.4%) had very high serum ferritin levels, 13 patients (37.1%) had elevated levels, and 4 patients (11.4%) had controlled levels. Spearman's rank correlation analysis demonstrated a significant moderate negative correlation between adherence to iron chelation therapy and serum ferritin levels ($r=-0.51$; $p=0.002$).

Conclusion: Adherence to iron chelation therapy was significantly and negatively correlated with serum ferritin levels in patients with thalassemia major. Higher adherence was associated with lower serum ferritin levels.

Keywords: iron chelation therapy, serum ferritin, thalassemia major, blood transfusion

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BACKGROUND

Thalassemia is an inherited hemoglobin disorder caused by impaired synthesis of globin chains, resulting in chronic anemia of varying severity. Thalassemia major re-

presents a severe clinical phenotype that commonly requires regular blood transfusions throughout life to maintain adequate hemoglobin levels and prevent complications related to chronic anemia. Trans-

fusion-dependent thalassemia requires life-long clinical management and regular monitoring (Taher et al., 2021; Farmakis et al., 2022).

Thalassemia remains an important global health problem, particularly in regions where hemoglobin disorders are prevalent. Southeast Asia is among the regions with a substantial burden of thalassemia, and Indonesia is located within the global thalassemia belt. The epidemiological burden of hemoglobin disorders and thalassemia has been documented internationally, emphasizing the need for sustained prevention, treatment, and monitoring programs (Modell and Darlison, 2008; Weatherall and Clegg, 2001).

Regular blood transfusion is an essential component of treatment for patients with transfusion-dependent thalassemia. Current guidelines generally recommend transfusion at intervals of approximately 2–5 weeks, depending on the individual patient's clinical requirements, to maintain appropriate pretransfusion hemoglobin levels (Farmakis et al., 2022). However, repeated transfusion results in progressive iron accumulation because the human body has no effective physiological mechanism for eliminating excess iron. Chronic iron overload may subsequently cause tissue injury, particularly involving the liver, heart, and endocrine organs (Borgna-Pignatti et al., 2005; Taher et al., 2021).

Serum ferritin is commonly used as a practical biomarker for monitoring iron burden in patients with transfusion-dependent thalassemia. Although serum ferritin is affected by biological and inflammatory factors and does not directly quantify tissue iron, serial measurements provide useful information about trends in iron burden and the response to iron chelation therapy (Porter and Shah, 2010; Farmakis et al., 2022). Persistently elevated serum ferritin

levels, particularly levels above 2,500 ng/mL, have been associated with an increased risk of complications related to iron overload (Olivieri et al., 1994; Telfer et al., 2000).

Iron chelation therapy is therefore a fundamental component of the long-term management of transfusion-dependent thalassemia. Available chelating agents include deferoxamine, deferiprone, and deferasirox. These agents bind excess iron and facilitate its elimination from the body, thereby reducing the risk of iron-mediated organ damage (Porter and Garbowski, 2014; Cappellini et al., 2006; Moukalled et al., 2018). The effectiveness of chelation therapy, however, depends not only on the choice and dose of the chelating agent but also on adherence to the prescribed treatment regimen.

Adherence to iron chelation therapy is an important challenge in the long-term management of thalassemia. Previous studies have demonstrated that inadequate adherence is associated with greater iron burden and may contribute to complications related to iron overload (Trachtenberg et al., 2011; Sidhu et al., 2021). A systematic review among children and adolescents with thalassemia also reported that greater adherence to iron chelation therapy was associated with lower serum ferritin levels and better clinical outcomes (Reddy et al., 2022). However, adherence may be affected by treatment duration, medication-related factors, treatment burden, adverse effects, and patient or family-related factors (Delea et al., 2007; Reddy et al., 2022).

The relationship between adherence to iron chelation therapy and serum ferritin levels is therefore clinically relevant, particularly in settings where serum ferritin is routinely used to monitor iron burden. In Gotong Royong Hospital, Surabaya, serum ferritin testing is routinely performed through the hospital laboratory and provides

objective laboratory data for monitoring patients with thalassemia major.

Despite the importance of adherence in the management of transfusion-dependent thalassemia, data regarding the relationship between adherence to iron chelation therapy and serum ferritin levels in patients at Gotong Royong Hospital, Surabaya, remain limited. Therefore, this study aimed to analyze the correlation between adherence to iron chelation therapy and serum ferritin levels in patients with thalassemia major at Gotong Royong Hospital, Surabaya.

SUBJECTS AND METHOD

1. Study Design

This study used an observational analytic design with a cross-sectional approach. The study was conducted from January to March 2026 at the Pediatric Thalassemia Unit, Laboratory Unit, and Medical Record Unit of Gotong Royong Hospital, Surabaya, Indonesia.

2. Population and Sample

The study population comprised patients with thalassemia major who underwent regular blood transfusions, received iron chelation therapy, and had serum ferritin examination data during the study period. A total of 35 patients who met the eligibility criteria were included in the study using total sampling. All eligible patients registered during the study period were included as study participants.

3. Inclusion and Exclusion Criteria

Inclusion criteria were thalassemia major diagnosis, regular blood transfusions, iron chelation therapy, available serum ferritin data, and willingness to participate. Patients with incomplete records or acute infection, fever, active inflammatory disease, hepatitis, or other conditions affecting serum ferritin were excluded.

4. Study Variables

The independent variable was adherence to iron chelation therapy. The dependent variable was serum ferritin level.

5. Operational Definition of Variables

Adherence to iron chelation therapy

was defined as the degree to which patients followed the prescribed iron chelation therapy regimen. Adherence was assessed using an eight-item questionnaire. The total score ranged from 0 to 8 and was categorized as low adherence (<6), moderate adherence (6 to <8), and high adherence (8).

Serum ferritin level was recorded in ng/mL from laboratory or medical records, using the result obtained on the assessment date or the closest result within 30 days. Levels were categorized as controlled (500–1,000 ng/mL), elevated (>1,000–2,500 ng/mL), and very high (>2,500 ng/mL), with values <500 ng/mL recorded separately. Information on chelator type, dose, frequency, and treatment duration was obtained from medical records when available.

6. Data Analysis

Univariate analysis was performed using frequencies and percentages. The correlation between adherence and serum ferritin was assessed using Spearman's rank correlation test. A p-value <0.05 was considered statistically significant.

7. Research Ethics

Ethical approval was obtained from the Health Research Ethics Committee of Yayasan Ngudia Husada Madura, Universitas Ngudia Husada, Indonesia, approval No. 3583/KEPK/UNIV-NHM/EC/II/2026. Patient data were kept confidential, and results were reported in aggregate.

RESULTS

1. Characteristics of Respondents with Thalassemia Major

A total of 35 patients with thalassemia major were included in this study. All respondents

received regular blood transfusions and iron chelation therapy and had available serum ferritin data. The characteristics of the respondents are presented in Table 1.

Table 1. Characteristics of respondents with Thalassemia major

Characteristics	n	%
Regular blood transfusion	35	100
Iron chelation therapy	35	100
Available serum ferritin data	35	100

2. Univariate Analysis of Adherence to Iron Chelation Therapy and Serum Ferritin Levels

The univariate analysis showed that moderate adherence to iron chelation therapy was the most common category, accounting for 16 respondents (45.7%), followed by high

adherence in 11 respondents (31.4%) and low adherence in 8 respondents (22.9%). Regarding serum ferritin levels, 18 respondents (51.4%) had very high levels, 13 (37.1%) had elevated levels, and 4 (11.4%) had controlled levels, as shown in Table 2.

Table 2. Distribution of adherence to iron chelation therapy and serum ferritin levels

Variables	Category	n	%
Adherence	Low	8	22.86
	Moderate	16	45.71
	High	11	31.43
Serum ferritin	Controlled (500–1,000 ng/mL)	4	11.43
	Elevated (>1,000–2,500 ng/mL)	13	37.14
	Very high (>2,500 ng/mL)	18	51.43

3. Bivariate Analysis of Adherence to Iron Chelation Therapy and Serum Ferritin Levels

Bivariate analysis using Spearman's rank correlation test demonstrated a significant negative correlation between adherence to

iron chelation therapy and serum ferritin levels ($r = -0.51$; $p = 0.002$). This indicates that higher adherence scores were associated with lower serum ferritin levels, as presented in Table 3.

Table 3. Correlation between adherence to iron chelation therapy and serum ferritin levels

Variable	n	Spearman's r	p
Adherence to iron chelation therapy vs. serum ferritin level	35	-0.512	0.002

DISCUSSION

This study found that most patients with thalassemia major had moderate adherence

to iron chelation therapy (45.7%), while 22.9% had low adherence and 31.4% had high adherence. These findings indicate that

adherence to long-term iron chelation therapy remains an important clinical consideration in patients requiring lifelong treatment. Iron chelation therapy is essential for reducing iron accumulation resulting from repeated transfusions, but its effectiveness depends substantially on consistent treatment administration (Farmakis et al., 2022; Delea et al., 2007).

The relatively high proportion of patients with moderate adherence may reflect the complexity and long-term nature of chelation therapy. Previous studies have reported that adherence can be affected by treatment burden, medication administration difficulties, adverse effects, forgetfulness, and other patient- or treatment-related factors (Trachtenberg et al., 2011; Sidhu et al., 2021). In patients receiving transfusion-dependent thalassemia care, maintaining adherence over many years can therefore be challenging.

In this study, 51.4% of patients had very high serum ferritin levels, while only 11.4% had controlled serum ferritin levels. This finding indicates that a substantial proportion of the study population had evidence of a high iron burden based on serum ferritin. Repeated transfusions are an important source of iron accumulation in transfusion-dependent thalassemia because the body has limited physiological capacity to eliminate excess iron (Borgna-Pignatti et al., 2005; Porter and Garbowski, 2014).

Serum ferritin is widely used as a practical marker for monitoring iron burden because it can be measured repeatedly and is relatively accessible. However, serum ferritin should be interpreted as a marker of iron burden rather than a direct measurement of tissue iron. Its concentration may also be influenced by inflammatory conditions and other biological factors (Porter and Shah, 2010). For this reason, serial trends in

serum ferritin are generally more informative than an isolated measurement.

The principal finding of this study was a significant moderate negative correlation between adherence to iron chelation therapy and serum ferritin levels ($r=-0.512$; $p=0.002$). This finding indicates that patients with higher adherence tended to have lower serum ferritin levels. The direction of this association is consistent with previous evidence showing that inadequate adherence to iron chelation therapy is associated with greater iron burden and poorer clinical outcomes (Trachtenberg et al., 2011; Sidhu et al., 2021).

A systematic review of children and adolescents with thalassemia reported that greater adherence to iron chelation therapy was associated with lower serum ferritin levels and improved cardiac, hepatic, and endocrine outcomes (Reddy et al., 2022). Another systematic review among adults also demonstrated substantial variation in adherence measurement and reported adherence levels across studies, highlighting the importance of standardized assessment methods (Locke et al., 2022). These findings support the clinical relevance of adherence assessment in patients receiving long-term iron chelation therapy.

The biological explanation for the observed association is plausible. Iron chelators bind excess iron and facilitate its elimination from the body. Consistent administration therefore facilitates ongoing removal of transfusion-derived iron, whereas inadequate treatment administration may result in insufficient iron removal and continued accumulation (Porter and Garbowski, 2014; Moukalled et al., 2018). Clinical trials have demonstrated the efficacy of deferasirox, deferiprone, and deferoxamine in reducing or controlling iron burden in patients with thalassemia (Cappellini et

al., 2006; Pennell et al., 2006; Tanner et al., 2007).

Nevertheless, adherence should not be considered the only determinant of serum ferritin levels. Iron burden in transfusion-dependent thalassemia is influenced by several factors, including transfusion intensity, duration of transfusion exposure, type and dose of chelation therapy, baseline iron burden, treatment interruptions, and inflammatory conditions (Porter and Shah, 2010; Farmakis et al., 2022). Therefore, the moderate correlation observed in this study suggests that adherence is associated with serum ferritin but does not explain all of the variation in serum ferritin levels.

The present study has several limitations. First, its cross-sectional design prevents determination of a temporal or causal relationship between adherence and serum ferritin levels. Second, the sample size was relatively small, with only 35 patients from a single hospital, which may limit the generalizability of the findings. Third, adherence was assessed using a questionnaire and may therefore be affected by recall and social desirability bias. Fourth, serum ferritin is an indirect marker of iron burden and may be influenced by biological and inflammatory factors. Finally, potentially relevant clinical variables, such as transfusion frequency, duration of thalassemia, type and dose of chelation therapy, and treatment duration, were not incorporated into a multivariable model.

Despite these limitations, the findings provide preliminary evidence of a significant association between adherence to iron chelation therapy and serum ferritin levels among patients with thalassemia major at Gotong Royong Hospital, Surabaya. Regular assessment of adherence, continued patient and family education, and routine monitoring of serum ferritin may help clinicians identify patients who require additional

support in maintaining their treatment regimen.

There was a significant moderate negative correlation between adherence to iron chelation therapy and serum ferritin levels in patients with thalassemia major at Gotong Royong Hospital, Surabaya ($r = -0.512$; $p = 0.002$). Higher adherence was associated with lower serum ferritin levels. Regular assessment of adherence and serum ferritin is recommended, while further longitudinal studies with larger samples are needed to clarify this relationship and other contributing factors.

AUTHOR CONTRIBUTION

All authors contributed to the conception and design of the study, data collection, data analysis and interpretation, drafting and critical revision of the manuscript, and approved the final version of the manuscript for publication.

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CONFLICT OF INTEREST

The authors declare there is no conflict of interest.

REFERENCES

- Borgna-Pignatti C, Cappellini MD, De Stefano P, Del Vecchio GC, Forni GL, Gamberini MR, et al. (2005). Survival and complications in thalassemia. *Ann N Y Acad Sci.* 1054:40–47. doi:10.1196/annals.1345.006.
- Borgna-Pignatti C, Rugolotto S, De Stefano P, Piga A, Di Gregorio F, Gamberini

- MR, et al. (1998). Survival and disease complications in thalassemia major. *Ann N Y Acad Sci.* 850:227–231. doi: 10.1111/j.1749-6632.1998.tb10479.x.
- Bou-Fakhredin R, Bazarbachi AH, Chaya B, Sleiman J, Cappellini MD, Taher AT (2017). Iron overload and chelation therapy in non-transfusion dependent thalassemia. *Int J Mol Sci.* 18(12):-2778. doi:10.3390/ijms18122778.
- Brittenham GM, Griffith PM, Nienhuis AW, McLaren CE, Young NS, Tucker EE, et al. (1994). Efficacy of deferoxamine in preventing complications of iron overload in patients with thalassemia major. *N Engl J Med.* 331(9):567–573. doi:10.1056/NEJM199409013310902.
- Cao A, Galanello R (2010). Beta-thalassemia. *Genet Med.* 12(2):61–76. doi: 10.1097/GIM.0b013e3181cd68ed.
- Cappellini MD, Cohen A, Piga A, Bejaoui M, Perrotta S, Agaoglu L, et al. (2006). A phase 3 study of deferasirox (ICL670), a once-daily oral iron chelator, in patients with β -thalassemia. *Blood.* 107(9):3455–3462. doi:10.1182/blood-2005-08-3430.
- Cappellini MD, Porter J, El-Beshlawy A, Li CK, Seymour JF, Elalfy M, et al. (2010). Tailoring iron chelation by iron intake and serum ferritin: the prospective EPIC study of deferasirox in 1744 patients with transfusion-dependent anemias. *Haematologica.* 95(4):557–566. doi:10.3324/haematol.2009.014-696.
- Delea TE, Edelsberg J, Sofrygin O, Thomas SK, Baladi JF, Phatak PD, et al. (2007). Consequences and costs of noncompliance with iron chelation therapy in patients with transfusion-dependent thalassemia: a literature review. *Transfusion.* 47(10):1919–1929. doi:10.1111/j.1537-2995.2007.01-416.x.
- Farmakis D, Porter J, Taher A, Cappellini MD, Angastiniotis M, Eleftheriou A (2022). 2021 Thalassaemia International Federation Guidelines for the Management of Transfusion-dependent Thalassemia. *HemaSphere.* 6(8): e732. doi:10.1097/HS9.0000000000-000732.
- Galanello R, Origa R (2010). Beta-thalassemia. *Orphanet J Rare Dis.* 5:11. doi: 10.1186/1750-1172-5-11.
- Galanello R, Piga A, Forni GL, Bertrand Y, Foschini ML, Bordone E, et al. (2006). Phase II clinical evaluation of deferasirox, a once-daily oral chelating agent, in pediatric patients with beta-thalassemia major. *Haematologica.* 91(10):1343–1351. <https://pubmed.ncbi.nlm.nih.gov/17018383/>.
- Haghpanah S, Zarei T, Zahedi Z, Karimi M (2014). Compliance and satisfaction with deferasirox compared with deferoxamine in patients with transfusion-dependent beta-thalassemia. *Hematology.* 19(4):187–191. <https://doi.org/10.1179/1607845413y.0000000121>.
- Maggio A, D'Amico G, Morabito A, Capra M, Ciaccio C, Cianciulli P, et al. (2002). Deferiprone versus deferoxamine in patients with thalassemia major: a randomized clinical trial. *Blood Cells Mol Dis.* 28(2):196–208. doi:10.10-06/bcmd.2002.0510.
- Maggio A, Vitrano A, Capra M, Cuccia L, Gagliardotto F, Filosa A, et al. (2009). Long-term sequential deferiprone-deferoxamine versus deferiprone alone for thalassemia major patients: a randomized clinical trial. *Br J Haematol.* 145(2):245–254. <https://doi.org/10.1111/j.1365-2141.2009.07609.x>.
- Mobarra N, Shanaki M, Ehteram H, Nasiri H, Sahmani M, Saeidi M, et al. (2016). A review on iron chelators in treatment of iron overload syndromes. *Int J*

- Hematol Oncol Stem Cell Res. 10(4): 239–247. <https://pmc.ncbi.nlm.nih.gov/articles/PMC5139945/>.
- Modell B, Darlison M (2008). Global epidemiology of hemoglobin disorders and derived service indicators. Bull World Health Organ. 86(6):480–487. doi: 10.2471/BLT.06.036673.
- Moukalled NM, Bou-Fakhredin R, Taher AT (2018). Deferasirox: over a decade of experience in thalassemia. Mediterr J Hematol Infect Dis. 10(1):e2018066. <https://doi.org/10.4084/mjhid.2018.066>.
- Olivieri NF, Brittenham GM, Matsui D, Berkovitch M, Blendis LM, Cameron RG, et al. (1995). Iron-chelation therapy with oral deferiprone in patients with thalassemia major. N Engl J Med. 332(14):918–922. doi:10.1056/NEJM-199504063321404.
- Olivieri NF, Nathan DG, MacMillan JH, Wayne AS, Liu PP, McGee A, et al. (1994). Survival in medically treated patients with homozygous beta-thalassemia. N Engl J Med. 331(9): 574–578. doi:10.1056/NEJM1994090-13310903.
- Pennell DJ, Berdoukas V, Karagiorga M, Ladis V, Piga A, Aessopos A, et al. (2006). Randomized controlled trial of deferiprone or deferoxamine in beta-thalassemia major patients with asymptomatic myocardial siderosis. Blood. 107(9):3738–3744. doi:10.1182/blood-2005-07-2948.
- Pennell DJ, Porter JB, Piga A, Lai YR, El-Beshlawy A, Elalfy M, et al. (2014). A 1-year randomized controlled trial of deferasirox versus deferoxamine for myocardial iron removal in beta-thalassemia major. Blood. 123(10):1447–1454. doi:10.1182/blood-2013-04-497842.
- Pepe A, Meloni A, Rossi G, Cuccia L, D'Ascola DG, Santodirosso M, et al. (2013). Cardiac and hepatic iron and ejection fraction in thalassemia major: multicentre prospective comparison of combined deferiprone and deferoxamine therapy against deferiprone or deferoxamine monotherapy. J Cardiovasc Magn Reson. 15:1. doi:10.1186/1532-429X-15-1.
- Piga A, Longo F, Origa R, Roggero S, Pinna F, Zappu A, et al. (2014). Deferasirox for cardiac siderosis in β -thalassemia major: a multicentre, open-label, prospective study. Br J Haematol. 167(3): 423–426. doi:10.1111/bjh.12987
- Pinto VM, Forni GL (2020). Management of iron overload in beta-thalassemia patients: clinical practice update based on case series. Int J Mol Sci. 21(22):8771. doi:10.3390/ijms21228771
- Poggiali E, Cassinerio E, Zanaboni L, Cappellini MD (2012). An update on iron chelation therapy. Blood Transfus. 10(4):411–422. doi:10.2450/2012.00-08-12.
- Porter JB (2001). Practical management of iron overload. Br J Haematol. 115(2): 239–252. doi:10.1046/j.1365-2141.20-01.03195.x.
- Porter JB, Garbowski MW (2014). The pathophysiology of transfusional iron overload. Hematol Oncol Clin North Am. 28(4):683–701. doi:10.1016/j.hoc.2014.04.003.
- Reddy PS, Locke M, Badawy SM (2022). A systematic review of adherence to iron chelation therapy among children and adolescents with thalassemia. Ann Med. 54(1):326–342. doi:10.1080/07853890.2022.2028894
- Rofail D, Abetz L, Viala M, Gait C, Baladi JF, Payne KA (2009). Satisfaction and adherence in patients with iron overload receiving iron chelation therapy

- as assessed by a newly developed patient instrument. *Value Health*. 12(1):109–117. doi:10.1111/j.1524-473-3.2008.00390.x.
- Rund D, Rachmilewitz E (2005). Beta-thalassemia. *N Engl J Med*. 353(11):1135–1146. doi:10.1056/NEJMra-050436.
- Saliba AN, Harb AR, Taher AT (2015). Iron chelation therapy in transfusion-dependent thalassemia patients: current strategies and future directions. *J Blood Med*. 6:197–209. doi:10.-2147/JBM.S72463.
- Scalone L, Mantovani LG, Krol M, Rofail D, Ravera S, Bisconte MG, et al. (2008). Costs, quality of life, treatment satisfaction and compliance in patients with beta-thalassemia major undergoing iron chelation therapy: the ITHACA study. *Curr Med Res Opin*. 24(7):1905–1917. doi:10.1185/030079-90802160834.
- Sidhu S, Kakkar S, Dewan P, Bansal N, Sobti PC (2021). Adherence to iron chelation therapy and its determinants. *Int J Hematol Oncol Stem Cell Res*. 15(1): 27–34. doi:10.18502/ijhoscr.v15i1.52-47.
- Taher AT, Musallam KM, Cappellini MD (2021). β -Thalassemias. *N Engl J Med*. 384(8):727–743. doi:10.1056/NEJM-ra2021838.
- Taher AT, Porter JB, Viprakasit V, Kattamis A, Chuncharunee S, Sutcharitchan P, et al. (2012). Deferasirox reduces iron overload significantly in non-transfusion-dependent thalassemia: one-year results from a prospective, randomized, double-blind, placebo-controlled study. *Blood*. 120(5):970–977. doi:10.1182/blood-2012-02-412-692.
- Taher AT, Saliba AN (2017). Iron overload in thalassemia: different organs at different rates. *Hematology Am Soc Hematol Educ Program*. 2017(1):265–271. <https://doi.org/10.1182/asheducation-2017.1.265>.
- Tanner MA, Galanello R, Dessi C, Smith GC, Westwood MA, Agus A, et al. (2007). A randomized, placebo-controlled, double blind trial of the effect of combined therapy with deferoxamine and deferiprone on myocardial iron in thalassemia major using cardiovascular magnetic resonance. *Circulation*. 115(14):1876–1884. doi:10.1161/-CIRCULATIONAHA.106.648790.
- Telfer PT, Prescott E, Holden S, Walker M, Hoffbrand AV, Wonke B (2000). Hepatic iron concentration combined with long-term monitoring of serum ferritin to predict complications of iron overload in thalassaemia major. *Br J Haematol*. 110(4):971–977. doi:10.10-46/j.1365-2141.2000.02298.x.
- Trachtenberg F, Vichinsky E, Haines D, Pakbaz Z, Mednick L, Sobota A, et al. (2011). Iron chelation adherence to deferoxamine and deferiasirox in thalassemia. *Am J Hematol*. 86(5):433–436. doi:10.1002/ajh.21993.
- Weatherall DJ, Clegg JB (2001). Inherited haemoglobin disorders: an increasing global health problem. *Bull World Health Organ*. 79(8):704–712. <https://pmc.ncbi.nlm.nih.gov/articles/PMC2566499/>.