ISSN 2515-8260 Volume 09, Issue 02, 2022

Assessment of iron overload in beta thalassemia major patients by serum ferritin level

[1]Dr. Palak Yogeshbhai Thakkar, [2]Dr. Neelaba K Mori, [3]Dr. Chandrika G Algotar, [4]Dr. Tejas S Chokshi

[1]Third Year Resident Doctor, Department of Pathology, CU Shah Medical College, Surendranagar, Gujarat, India
[2]Assistant Professor, Department of Pathology, CU Shah Medical College, Surendranagar, Gujarat, India
[3]Associate Professor, Department of Pathology, CU Shah Medical College, Surendranagar, Gujarat, India
[4]Professor, Department of Pathology, CU Shah Medical College, Surendranagar, Gujarat, India

Corresponding Author:
Dr. Palak Yogeshbhai Thakkar (palak.thakkarrjt273@gmail.com)

Abstract

Context: Beta Thalassemia major is a genetic disease with an autosomal recessive pattern of inheritance that occurs as a result of disorder in haemoglobin synthesis. In Beta Thalassaemia major patients multiple blood transfusions, ineffective erythropoiesis and increased gastrointestinal iron absorption lead to iron overload in the body. Iron overload can be determined by Serum Ferritin measurement.

Aim and Objectives

1. To Assess the average frequency of blood transfusion in Beta Thalassemia Major patients
2. To measure Serum Ferritin level in Beta thalassemia Major patients
3. To determine the association between Serum ferritin level and age, average frequency of blood transfusion in Beta Thalassemia Major Patients.

Methods and Material: Fifty blood samples of clinically diagnosed Beta Thalassemia major patients were collected for estimation of Serum Ferritin levels. Serum Ferritin measurement was performed using indirect enzyme linked immune sorbent based assay kit. Data were analysed to determine association between Serum Ferritin and age, gender and frequency of blood transfusion.

Statistical analysis used: Descriptive statistics, Regression, Correlation

Results: The mean Serum Ferritin level was found to be 3639.75 mg/ml. Five patients had Serum Ferritin <1000 mg/ml, Twenty three patients had Serum Ferritin between 1000-3500 mg/ml and twenty two patients had Serum Ferritin >3500 mg/ml.

Conclusion: The study showed high levels of Serum Ferritin in Beta Thalassemia major patients. Serum Ferritin levels should be monitored regularly to assess the status of iron overload and to rationalize the use of chelation therapy and avoid complications related to iron overload.

Keywords: Beta thalassemia, ferritin, blood transfusion, hypothyroidism

ISSN 2515-8260 Volume 09, Issue 02, 2022

Introduction

- Beta Thalassemia major is a genetic disease with an autosomal recessive pattern of inheritance that occurs as a result of disorder in haemoglobin synthesis [1].
- In Beta Thalassaemia major patients multiple blood transfusions, ineffective erythropoiesis and increased gastrointestinal iron absorption lead to iron overload in the body [1].
- Hyper-transfusion has improved the life expectancy of thalassemic patients over the decades but iron overload is an unavoidable complication suffered by thalassemia major patients as a consequence of an excessive number of blood transfusions. It is so common that it has been referred to as "second disease" during treatment of first and it results in a number of other diseases and complications [2].
- Iron overload can be determined by Serum Ferritin measurement.
- Thalassemia's complications can be a result of many mechanisms [3].
- Most complications are caused by increased iron sedimentation in tissues like heart, endocrine glands and these results in arrhythmia, hypothyroidism, diabetes mellitus etc. [4]
- One of the most common endocrine problem in Beta Thalassemia Major patients is hypothyroidism related to iron overload [5].

Material and Methods

- A total of 50 blood samples taken from β-thalassemia major patients were included in this study.
- The known cases of β-thalassemia major that had been transfused irrespective of their age and gender were selected.
- About 3 ml of patient's blood sample was collected in plain vacuette by a clean venipuncture. The blood was allowed to clot. Serum was separated. Ferritin levels were performed by using indirect enzyme linked immunosorbent assay kit.

Inclusion criteria

Confirmed case of Beta Thalassemia Major having less than 18 years of age.

Exclusion criteria

Confirmed case of Beta Thalassemia Major having more than 18 years of age.

Observation and Results

- In this study, a total of 50 Cases of Beta thalassemia major were examined, of which 32(64%) were male and 18(36%) were female, with a male to female ratio of 1.78: 1. The mean age of patients was 8.3 years. The age of patients at the time of diagnosis of thalassemia ranged from 10 months to 2 ½ years with a mean of 1 year and 4 months. The interval between successive transfusions varied between 2 weeks and 6 weeks in different patients. In 34(68%) patients the frequency of transfusion was 21 days.
- The mean serum ferritin level was 3639.75 mg/ml. Five patients had Serum Ferritin level <1000 mg/ml, Twenty three patients had Serum Ferritin level between 1000-3500 mg/ml and Twenty two patients had Serum Ferritin level >3500 mg/ml. The serum ferritin level increases as the frequency of blood transfusion and the age of the patient increases. The mean serum ferritin level in males was found to be 3464.47 mg/ml and it is comparable to the mean serum ferritin level in females i.e. 3208.24 mg/ml.

ISSN 2515-8260 Volume 09, Issue 02, 2022

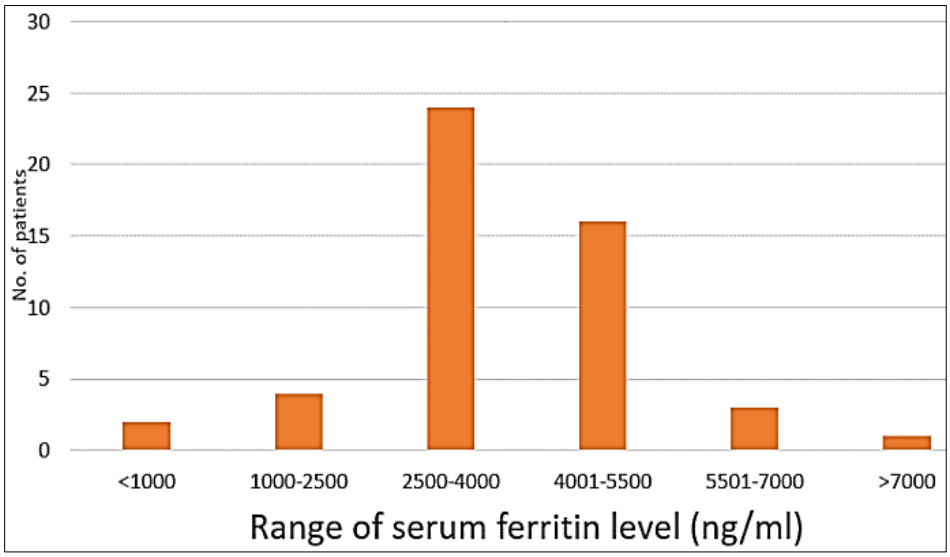

Fig 1: Range of Serum ferritin level observed in subjects studied

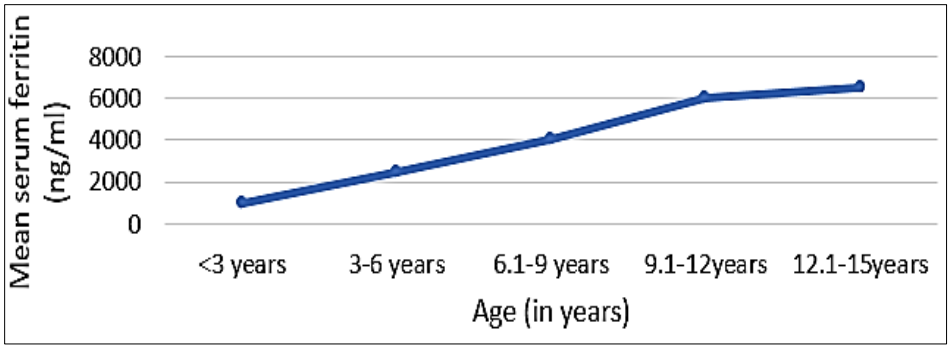

Fig 2: Relationship between age and serum ferritin levels

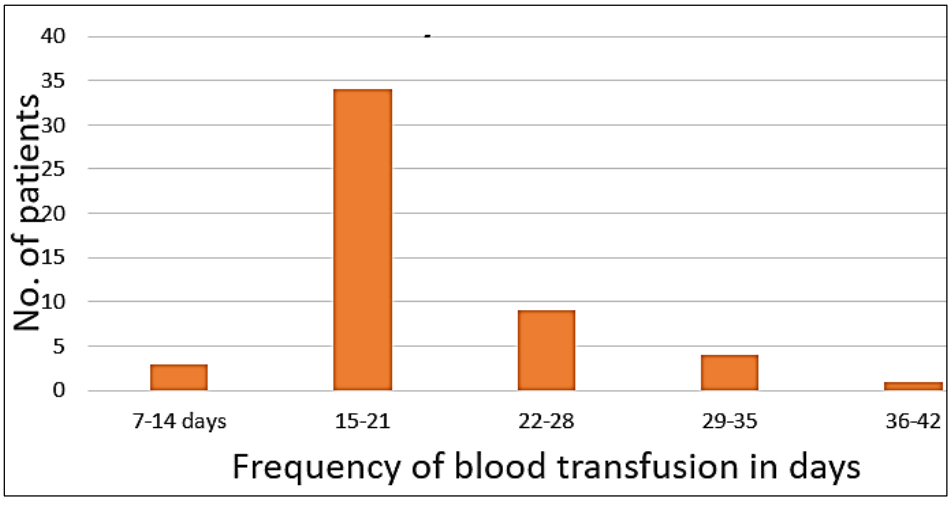

Fig 3: Clinical history of frequency of blood transfusion in the studied subjects

Table 1: Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
Frequency of BT	50	27	15	42	22.54	.797
Ferritin	50	8378.52	682.28	9060.80	3639.7556	275.30277
Valid N (list wise)	50					

ISSN 2515-8260 Volume 09, Issue 02, 2022

Table 2: Descriptive Statistics

	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
Frequency of BT	5.632	1.352	.337	2.438	.662
Ferritin	1946.68455	1.027	.337	1.169	.662

Regression

Table 3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.786[a]	.617	.609	1216.99126	2.220
a) Predictors: (Constant), VAR00001.					
b) Dependent Variable: VAR00002.					

So, there is positive correlation between serum ferritin and frequency of blood transfusion.

Correlation

Table 4: Correlations

		Frequency of BT	Ferritin
Frequency of BT	Pearson Correlation	1	-.786**
	Sig. (2-tailed)		.0001
	N	50	50
Ferritin	Pearson Correlation	-.786**	1
	Sig. (2-tailed)	.0001	
	N	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

As the P value is 0.0001, there is significant correlation between serum ferritin level and frequency of blood transfusion. As the frequency of blood transfusion also increases; serum ferritin level increases.

Discussion

- Effective management of iron overload requires frequent evaluation of the body iron stores. There is, therefore, a need for quantitative, non-invasive methods for measuring body iron that are safe, accurate and readily available. The iron status of the body in overload conditions can be assessed by different methods. Serum ferritin measurement, although easy to perform frequently, offers variable results, still at present, no other serum test is a better predictor.
- The serum ferritin level could not be controlled well as only few patients fully complied with recommended regimen of chelation therapy at home. Similarly, in our study, the mean serum ferritin level was 3639.75 mg/ml, which is markedly higher than the normal recommended levels for normal individuals. Normal values of serum ferritin for men and women are 12-300 mg/mL and 12-150 mg/mL, respectively.

Conclusion

The study showed high levels of Serum Ferritin in Beta Thalassemia major patients. Serum Ferritin levels should be monitored regularly to assess the status of iron overload and to rationalize the use of chelation therapy and avoid complications related to iron overload.

References

1. Amit Kumar Mishra, Archana Tiwart. Iron Overload in Beta Thalassaemia Major and Intermedia Patients. 2013 Sep;8(4):328-332.
2. Thyroid dysfunction in thalassemic patients: ferritin as a prognostic marker and combined iron chelators as an ideal therapy, Valeria Chirico1, Lacquaniti Antonio2,3, Salpietro Vincenzo1, Nicoletta Luca1, Ferrau` Valeria1, Piraino Basilia1,Rigoli Luciana1, Salpietro Carmelo1 and Arrigo Teresal.
3. He Cutoff of Ferritin for Evaluation of Hypothyroidism in Patients with Thalassemia**,** Baghersalimi A, *et al*. J Pediatr Hematol Oncology, 2019.
4. Argyropoulou MI, Astrakas L. MRI evaluation of tissue iron burden in patients with beta-thalassaemia major. Pediatr Radiol. 2007;37:1191-200.
5. Assessment of thyroid function in two hundred patients with beta-thalassemia major. Zervas A, *et al*. Thyroid. 2002.'
6. Aydinok Y, Darcan S, Polat A, Kavakli K, Nigli G, Coker M, *et al*. Endocrine complications in patients with b-thalassemia major. Journal of Tropical Pediatrics. 2002;48:50-54. (doi:10.1093/tropej/48.1.50)
7. Abdulzahra MS, Al-Hakeim HK, Ridha MM. Study of the effect of iron overload on the function of endocrine glands in male thalassemia patients. Asian Journal of Transfusion Science. 2011;5:127-131.
8. Malik SA, Syed S, Ahmed N. Frequency of hypothyroidism in patients of b-thalassemia. Journal of Pakistan Medical Association. 2010;60:17-29.
9. Angelucci E, Brittenham GM, McLaren CE, Ripalti M, Baronciani D, Giardini C, *et al*. Hepatic iron concentration and total body iron stores in thalassemia major. New England Journal of Medicine. 2000;343:327-331. (doi:10.1056/NEJM200008033430503)
10. Fung EB, Harmatz P, Milet M, *et al*. Morbidity and mortality in chronically transfused subjects with thalassemia and sickle cell disease: A report from the multi-centre study of iron overload. Am J Hematology. 2007;82:255-65.