



ASSOCIATION BETWEEN SERUM FERRITIN LEVEL AND CARDIAC CHANGES IN BETA THALASSEMIA MAJOR: A HOSPITAL-BASED CROSS-SECTIONAL STUDY

General Medicine

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ABSTRACT

Background: Thalassemia is a genetic disorder causing chronic anemia and iron overload due to frequent blood transfusion, and in thalassemia major cardiac complications are a major cause of mortality. So this study was done to evaluate the relationship between serum ferritin level and cardiac changes seen on echocardiography. **Objectives:** Evaluation of cardiac changes in relation to serum ferritin level in beta thalassemia major patient. **Material and methods:** A single-centre hospital-based observational study was carried out over 1 year involving 100 patients diagnosed of beta thalassemia major by HPLC method. Serum ferritin level was analyzed by ADVIA centaur immunoassay. Cardiac changes was evaluated using 2D echocardiography which was done by using a Phillip affinity 70e machine, and all the parameter was calculated using American society of echocardiography guidelines. **Results:** Among the 100 patients enrolled, 58% were males and 42% were females. Most of the patients belonged to the 16-20 years age group (46%), followed by 13-15 years (42%), while 12% were above 20 years of age, with a mean age of 17 ± 4.5 years. A weak negative correlation was observed between serum ferritin and ejection fraction ($r = -0.2$), while weak positive correlation were noted with E/A ratio ($r = 0.13$), and LVIDD ($r = 0.15$). However, none of these correlations were statistically significant (p -value > 0.05). **Conclusion:** The Serum ferritin showed weak correlation with cardiac changes in thalassemia major, but association was statistically not significant. Hence, ferritin alone is not reliable marker for predicting cardiac dysfunction. And cardiac involvement is likely multifactorial, requiring comprehensive echocardiographic evaluation along with iron overload assessment for effective monitoring.

KEYWORDS

Thalassemia Major, Serum Ferritin, Echocardiography

INTRODUCTION

Thalassemia syndromes constitute a group of inherited disorder characterized by decreased or absent hemoglobin production of one or more globin chains, leading to chronic anaemia, Ineffective erythropoiesis, and multisystem complication. Among these β thalassemia results from genetic mutation that lead to deficient β globin chain synthesis and shows a high prevalence in geographical area with historical malaria endemicity, such as south Asia, the middle east, and the mediterranean basin.¹

The management of beta thalassemia major involves frequent blood transfusion to maintain the pre-transfusion hemoglobin of 9-10g/dl and advancement in chelation therapy, supportive care has lead to improved survival in patient with transfusion dependent β thalassemia. Chronic blood transfusion results to iron overload resulting in progressive deposition of non trans-ferritin bind iron in vital organs, especially the liver, endocrine glands and the heart.

Cardiac iron overload leads to iron induced cardiomyopathy, pulmonary hypertension, arrhythmia and congestive heart failure, which continue to be the most common fatal complication affecting transfusion dependent patients despite chelation therapy. Myocardium iron accumulation is often clinically silent in early stages.

Cardiac magnetic resonance imaging with T2 technique is considered gold standard, enabling both detection and longitudinal monitoring of cardiac siderosis. However, its widespread application is constrained by factors including high operational costs, limited availability in many healthcare settings, and the time-intensive nature of the procedure.²

Serum ferritin measurement remains the most widely employed clinical indicator of total body iron stores. And 2D echo are used to assess the cardiac dysfunction. So this study was taken into consideration that to establish link between serum ferritin and cardiac changes in beta thalassemia major.

MATERIALS AND METHODS

Study design: It is a Hospital Based Cross Sectional Study in Department of Medicine, Assam Medical College and Hospital, Dibrugarh, over a period of one year from 27 September 2024 to 26 September 2025.

Study population:

A total of 100 thalassemia major patient aged ≥ 13 years, diagnosed by HPLC method, were enrolled after informed consent and approval by the institutional ethics committee(H).

Exclusion Criteria:

Heart disease, Acute infection or inflammatory condition, Malignancy, Pregnancy and lactation.

Data Collection:

Venous blood samples were collected and was send for serum ferritin testing which were measured using chemiluminescence assay. All the participants underwent transthoracic 2D echocardiology using a Phillip affinity 70e using an adult transducer called as phase array with frequency of 1-5mHz performed and parameter which were calculated was left ventricular internal end diastolic diameter (LVIDD), E/A ratio, ejection fraction(EF) using American society of echocardiography guidelines. Statistical Analysis: All data was analysed with SPSS V20 and the association between serum ferritin levels and 2D echocardiographic parameters like EF, E/A ratio, left ventricular internal end diastolic diameter (LVIDD) were analysed using one way ANOVA. And $p < 0.05$ show statistical significance.

RESULTS

Among 100 patients, 58% were male and 42% were female. And 42% were between ≥ 13 -15 years of age, 46% where between 16-20 years of age and 12% where ≥ 20 years of age with mean age 17 ± 4.5 years.

Table 1: Comparison Between Serum Ferritin and Mean EF

Serum ferritin (ng/ml)	Mean EF (%)	r	P-value
<1000	64	-0.2	>0.05
1001-1500	65.38		
1501-2000	60.50		
2001-2500	61.50		
>2500	61.00		

Table 2: Comparison Between Serum Ferritin and Mean E/A

Serum ferritin(ng/ml)	Mean E/A ratio	r	P-value
<1000	1.60	0.13	>0.05
1001-1500	1.70		

1501-2000	1.56		
2001-2500	2		
>2500	2		

Table 3: Comparison Between Serum Ferritin And Mean LVIDD

Serum ferritin	Mean LVIDD (cm)	r	P-value
<1000	4.30	0.15	>0.05
1001-1500	4.43		
1501-2000	4.55		
2001-2500	4.65		
>2500	4.70		

DISCUSSION:

The present study included 100 beta thalassemia major patients admitted to Assam Medical College and Hospital over a period of one year.

Among the 100 patients, 58 were male and 42 were female, which showed male predominance.

In the study population, 42% where between ≥13-15 years of age, 46% where between 16-20 years of age and 12% where ≥20 years of age with mean age 17 ± 4.5 years. Similar to **Patel et al.**³ who showed predominance between 13-20 years of age.

Serum ferritin vs EF:

When EF was compare across different serum ferritin categories, it was seen that there was weak negative correlation but it was statistically insignificant (p-value>0.05), which is similar to **Das et al**⁸ which showed weak negative correlation between serum ferritin and EF but statistically not significant (p-value 0.059).In **Romit Jain et al.**⁵ showed very weak negative correlation (r -0.14) with statistically insignificant (p-value 0.30) which was comparable to present study. In **Eghbali et al.**³ showed a weak positive correlation (r = 0.3) and was statistically significant difference was observed (p-value 0.05) which is contrast to the present study. According to **Khanum S et al.**⁶ showed a very weak negative correlation (r -0.114) but statistically insignificant (p-value 0.382)

Serum ferritin vs E/A ratio

When serum ferritin was compared with E/A ratio it showed very weak positive correlation (r =0.13) between serum ferritin and E/A ratio but it was statistically insignificant (p-value>0.05)

According to **Dewanta CN et al.**⁷ when serum ferritin was compared with E/A ratio should moderate positive association (r =0.667) which reach statistically significance, which is in contrast to the present study. According to **Romit Jain et al.**⁴ showed a very weak positive association (r =0.109) but statistically it was not significant (p-value 0.453), which is similar to present study. According to **Das et al.**⁸ showed weak to moderate positive association (r 0.29) and it reache statistical significance (p- value 0.0074).

Serum ferritin vs LVIDD:

When serum ferritin was compared with LVIDD showed very weak positive correlation (r =0.15) but statistically insignificant (>0.05%).Which is similar to **Chanpura VR et al.**⁹ when serum ferritin was analyzed for correlation with LVIDD within case group, no statistical association was observed (>0.05%). **Rao JS et al.**¹⁰ also showed comparison between LVIDD between case and control which showed statistical significance (p-value <0.001).

CONCLUSION:

From the above study it is seen that cardiac changes in beta thalassemia major are not solely due to iron deposition but may also be influenced by chronic anemia. Although serum ferritin reflects body iron stores, it does not reliably indicate early cardiac structural or functional abnormalities. Therefore, it should not be used alone to assess cardiac siderosis or complications. Regular echocardiographic screening is recommended in asymptomatic patients.

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