Iron overload and hypocalcemia in patients with thalassemia

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Abstract

Background: Thalassemia is a heterogeneous family of inherited disorders of hemoglobin synthesis. Thalassemia is treated with blood transfusion and chronic transfusions inevitably lead to iron overload and hypocalcaemia.

Methods: It is a prospective study done in patients diagnosed with β- thalassemia major by electrophoresis, receiving repeated blood transfusion and with serum ferritin levels more than 1000ng/ml. Serum calcium was estimated using o-Cresolphthalein (oCPC method).

Results: Among the 53 patients studied, 50 (94.3%) were on iron chelation therapy. Stunting was observed in 27 (50.9%) of these children. The mean serum calcium was 8.28 ± 0.89 mg/dl. The mean serum phosphate was 6.40 ± 0.80 mg/dl. There was a negative correlation between serum ferritin and serum calcium which is statistically significant (p value <0.001).

Conclusion: Patients of β-thalassemia major with repeated blood transfusion have low calcium level and high phosphate level,which is attributed to iron overload and therefore, should be monitored to avoid complication related to hypocalcaemia.

Key words: Beta- thalassemia major, serum calcium, serum phosphate, serum ferritin

Introduction

Thalassemia is a heterogeneous family of inherited disorders of hemoglobin synthesis. It is characterized by the complete absence or reduced synthesis of one or more types of globin chains[1]. Phenotypes are variable, ranging from severe anemia to clinically asymptomatic individuals[2,3]. Thalassemia is treated with blood transfusion to provide the patients with healthy red blood cells containing normal hemoglobin[4]. Although blood transfusions are important for patients with anemia, chronic transfusions inevitably lead to iron overload as humans cannot actively remove excess iron. The cumulative effects of iron overload lead to significant morbidity and mortality, if untreated. A unit of red blood cells transfused contains approximately 250 mg of iron, while the body cannot excrete more than 1 mg of iron per day[5].

The combination of transfusion and chelation therapy has dramatically extended the life expectancy of thalassemia patients, but with complications like hypocalcaemia. Early detection and the implementation of an appropriate transfusion regimen and chelation therapy are essential for proper management. Patients with beta-thalassemia major are prone for hypoparathyroidism; an irreversible and preventable disorder caused by iron overload.

Objectives: To estimate the serum calcium and serum phosphate levels of β-Thalassemia major patients who are receiving repeated blood transfusion and to correlate them with serum ferritin levels.

Materials and Methods

It is a prospective study conducted in HSK hospital, Bagalkot. 53 patients with β-thalassemia major, who are receiving repeated blood transfusion with chelation therapy, are taken as cases in the study. Sample size calculation was done using Open Epi software version 2.3.1. The sample size calculated was 53.

Inclusion criteria: Patients diagnosed with β-thalassemia major by electrophoresis, receiving repeated blood transfusion, serum ferritin levels more than 1000ng/ml.

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Exclusion criteria: Poor compliance for blood transfusion. Having renal disease, malabsorption syndrome, rickets.

Serum calcium was estimated using o-Cresolphthalein (oCPC method) whereas ammonium molybdate method is employed to estimate serum phosphate levels.

Results

Total of 53 transfusion dependent children who fulfilled inclusion criteria were included in the study. The mean age is 5.249 years. The study consisted of 32 (60.4%) males and 21 (39.6%) females. Maximum number of cases i.e. 29 (54.7%) were diagnosed at the age of 4-6 months. Among these 53, 50 (94.3%) were on iron chelation therapy. Stunting was observed in 27 (50.9%) of these children. The mean serum calcium is 8.28 $\pm$ 0.89 mg/dl. The mean serum phosphate is 6.40 $\pm$ 0.80 mg/dl. The serum calcium and phosphate levels are correlated with serum ferritin. There is a negative correlation between serum ferritin and serum calcium which is statistically significant (p value <0.001). There is a positive correlation between serum ferritin and serum phosphate which is statistically significant (p value <0.001). It means that, higher level of serum ferritin leads to low levels of serum calcium and serum phosphate.

Discussion

In India over 20 million people have thalassemia gene. The prevalence of the gene varies between 3 to 18% in the north and 1 to 3% in the south[6].Hypothyroidism is well known to occur in thalassemia major patients, but it is thought to be uncommon[7]. Various mechanisms have been described to be responsible for glandular injury like, free radical formation, lipid peroxidation resulting in mitochondrial, lysosomal sarcolemmal membrane damage a number of surface transferrin receptors in the cell, and the ability of the cell to protect itself against inorganic iron[8]. As we know, hypoparathyroidism leads to hypocalcaemia7. In our study, we observed that 67.9% patients had hypocalcaemia, which is consistent with the findings of several studies. Few studies also found that the serum phosphate levels were high in these patients, which too was observed in this study. In this study it was also observed that patients with high higher serum ferritin had low levels of serum calcium whereas, high levels of phosphate. Few studies have shown that there is no change in the levels of serum calcium and phosphate. Since this remains asymptomatic in the early phase, it is important to anticipate hypocalcaemia early.

Limitations: A serial monitoring of serum calcium, phosphate and measurement of PTH and ALP levels could not be carried out for reasons of practicability and financial feasibility.

Conclusion: Patients of β-thalassemia major with repeated blood transfusion have low calcium level and high phosphate level, which is attributed to iron overload and therefore, should be monitored to avoid complication related to hypocalcaemia.

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Date received: April 13th 2018

Date accepted: October 24th 2018

Conflict of interest: Nil

Source of funding: Nil