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SERUM CALCIUM AND PHOSPHATE LEVELS IN PATIENTS WITH β- THALASSEMIA MAJOR

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ABSTRACT

β-Thalassemia represents a group of recessively inherited hemoglobin disorders characterized by reduced synthesis of β-globin chain. The homozygous state results in severe anemia, which needs regular blood transfusion. The combination of transfusion and chelation therapy has dramatically extended the life expectancy of thalassemia patients, but with complications like hypocalcemia. ***Aims and objectives:*** *To estimate the serum calcium and phosphate levels of β-Thalassemia major patients who are receiving repeated blood transfusion.* ***Methods and materials:*** *25 patients with β-thalassemia major who are receiving repeated blood transfusion with chelation therapy, within the age group of 5 to 20 years, are taken as cases and 25 age, sex matched healthy controls are taken in the study. Serum calcium level was determined by OCPC method and serum phosphate level by ammonium molybdate end point method in semi auto analyzer.* ***Result:*** *All cases are receiving blood transfusion every 6 to 8 weekly. All cases are given chelation therapy. The mean serum calcium level is 8.37±0.20mg/dl in cases and 9.74±0.43mg/dl in controls. The serum calcium level is low in cases than controls which is highly significant (p value <0.001). The mean serum phosphate level is 4.87±0.37mg/dl in cases and 4.30±0.36 in controls. All cases have high phosphate level than controls, which is statitically significant (p value<0.001).* ***Conclusion:*** *Patients of β-thalassemia major with repeated blood transfusion have low calcium level and high phosphate level, which should be monitored to avoid complication related to hypocalcemia.*

KEY WORDS

β *-Thalassemia major, serum calcium, serum phosphate.*

INTRODUCTION

β-Thalassemia major was first described by Cooly and Lee in 1925[1]. 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 [2, 9]. β-Thalassemia major is a hemoglobinopathy caused by a defect in the production of the β globin chain[1]. The affected infants present with pallor, poor growth and abdominal enlargement due to hepatosplenomegaly. In untreated children, characteristic bone changes appear, such as thinning of cortex of long bones, widening of medullary spaces, bossing of skull, widening of diploic spaces and prominence of the upper incisors and separation of orbit. The main stay of treatment of severe β-thalassemia is regular blood transfusion (PCV infusion) with an attempt to maintain hemoglobin levels greater than 10 g/dl [2, 9]. The combination of transfusion and chelation therapy has dramatically extended the life expectancy of thalassemia patients who can now survive into their fourth and fifth decades of life [3]. On the other hand, repeated blood transfusion results in citrate toxicity and leads to

iron deposition in the parathyroid gland, which in turn may cause decrease parathyroid level which in turn decreases calcium level. A few studies have reported that some of the thalassemic patients on regular PCV infusion develop hypoparathyroidism, especially after 10 years of age [2]. Several workers have found out low level of calcium level and high level of phosphate level in β-thalassemia major [1, 2, 3, 4, 6], while in contrast few workers found out no change [7, 8], so paucity of data and lack of studies in Indian population prompted us to plan this work where serum calcium and phosphate level are measured in patients with β-Thalassemia major patients who has been given repeated blood transfusion and chelation therapy [2, 9].

MATERIALS AND METHOD

This study was conducted in department of Biochemistry, J.J.M.Medical College, Davangere from November 2011 to October 2012. Patients admitted in the Bapuji hospital (it is attached to our teaching institute), are enrolled in the study. Twenty five patients of β-thalassemia major, who are diagnosed by electrophoresis, between the age group of 5 to 15 years of both sex, who are receiving regular blood transfusion with chelation therapy, were selected for the study. Blood transfusion was given every 4-6 weeks to maintain the hemoglobin level and chelation therapy with desferrioxamine and/or deferipone was given. Results were compared to twenty five normal healthy age and sex matched controls.

The mean age of cases and controls are 11.72±2.64 years and 11.88±2.68 years respectively. All the patients were on regular blood transfusion which started at age between 8 months to 1.5 years. Inclusion criteria: (a) Age group between 5 to 20 years. (b) Receiving blood transfusion with chelation therapy. Exclusion criteria: (a) Poor compliance (b) Infection, (c) Very sick patients, (d) Having renal disease, (e) Malabsorption syndrome, (f) Any drug which affect calcium level. Informed consent was taken from the patients and controls. Approval from the ethical committe was also taken.

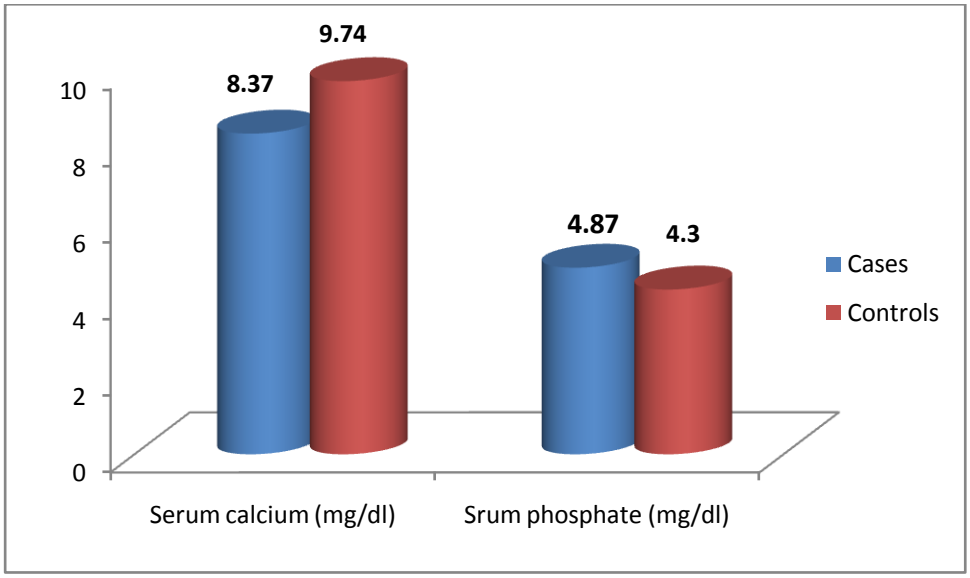
Five ml of venous blood was taken in a plain bulb. Serum is separated and anaysed with the ERBA CHEM-5 v2 plus semiautoanalyser. Serum calcium and serum phosphate are analysed by commercialy available kit method. Results were analysed by student't' test.

RESULTS

As shown in **Table 1**, the mean age of cases and controls are 11.72±2.64 years and 11.88±2.68 years respectively. The mean age of blood transfusion started is 10.68±2.70 months. The mean age of starting of chelation therapy is 77.52±10.02 months. As shown in table 1, 84% Patients with β-Thalassemia major have low serum calcium level with the mean value of 8.37±0.20 mg/dl. The serum calcium level is 9.74±0.43 mg/dl in controls. As shown in table 2 the serum calcium level is significantly low than controls which is highly significant (p value <0.001). The serum phosphate level in patients with β- Thalassemia major have normal phosphate level but in higher range with the mean value of 4.87±0.37 mg/dl and the mean serum phosphate level is 4.30±0.36 mg/dl in controls. The serum phosphate level is significantly higher in cases than controls, which is statitically significant.

Parameters/Age	Cases	Controls	p value
Mean age (years)	11.72±2.64	11.88±2.68	-
Serum calcium (mg/dl)	8.37±0.20	9.74±0.43	<0.001
Serum phosphate (mg/dl)	4.87±0.37	4.30±0.36	<0.001

Table 1: Mean age, serum calcium and serum phosphate level in β-Thalassemia patient and healthy controls. p value <0.001 is highly significant.



Graph: Graphical representation of mean levels of calcium and phosphate levels in cases and controls

DISCUSSION

Hypoparathyroidism is well known to occur in thalassemia major patients, but it is thought to be uncommon [4]. The cause of hypoparathyroidism in thalassemia is assumed to be iron deposition in the parathyroid glands [10]. A number of possible mechanisms have been described to be responsible for glandular damage through iron overload. These include free radical formation and lipid peroxidation resulting in mitochondrial, lysosomal and sarcolemmal membrane damage [11] and a number of surface transferrin receptors in the cells and the ability of the cell to protect itself against inorganic iron [12]. Further hypoparathyroidism in turn is also known to cause hypocalcemia[2]. The changes in serum phosphorous levels are due to effect of PTH supression[5].

In this study it is found out that 84% patients with thalassemia major in spite of chelation therapy have hypocalcamia, this finding is consistent with the finding shown by the several workers [1, 2, 3, 4, 6, 13]. In several studies it is found out that phosphate level is also high in comparision with the control group [1, 2, 3, 4, 6], this finding is also consistent with our finding in which phosphate level is significantly high than controls. Few studies also get findings that there are no alteration in the calcium and phosphate levels in thalassemia patients [7, 8, 14, and 15].

Almost all the thalassemic patients reported who developed hypocalcemia were above the age of 10 years except two, so this complication in

thalassemia mainly occurs in the second decade of the life. It is obvious that although optimal chelation therapy has been given, complications are prone to occur like hypoparathyroidism which in turn causes hypocalcemia[4]. Non compliance can also become a problem and can compromise optimal chelation therapy until some effective oral chelation theraoy is not found.

In conclusion serum calcium and serum phosphate levels are altered in β-thalassemia major patients, which is one of the complication occuring due to repeated blood transfusion and should be monitored regularly mostly in the late first decade and second decade to improve the life expectancy of the patients.

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