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The Study of Serum Calcium, Phosphorus and Alkaline Phosphatase Levels in Thalassemia Major Children

Gursharan Singh[1], Jagroop Singh Sangha[2], Tarvinderjit Khurana[3], Maninder Kaur[4]

[1]Professor, Department of paediatrics, Gian sagar medical college, Ex G. M. C. Patiala.
[2]Junior Resident, Department Of Paediatrics, GMC, Patiala.
[3]Assistant professor, Department of Medicine, Adesh Medical College and Hospital Mohri Shahbad, Ex G. M. C Patiala.
[4]Profesor, Department Of Biochemistry, GMC, Patiala.

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ABSTRACT

Background: Serum calcium, phosphorus and alkaline phosphatase are characteristically altered with bone impairment in patients with thalassemia. Calcium is the 5th most plentiful element in human body playing a major role in skeletal mineralization. Alkaline phosphatase is responsible for phosphorus promoting bone mineralization by increasing the local concentration of inorganic phosphorus. Hence in our study we aim to determine the prevalence of hypoparathyroidism in thalassemia major patients by assessing the levels of serum calcium, serum phosphorus and serum alkaline phosphatase levels. **Methods:** The present study is a type of cross sectional study and was conducted on 100 beta Thalassemia major children enrolled at Thalassemia unit, Department of Pediatrics, Rajindra Hospital, Patiala and analysis was done in the department of bio-chemistry, Govt. Medical College, Patiala. **Results:** Mean serum calcium levels in the cases receiving blood transfusion every 11-15 days were 8.41±0.49 mg/dl. Levels were 8.61±1.00 mg/dl and 8.63±0.11mg/dl in the ones receiving blood transfusion every 16-20 days and 21-25 days respectively. The correlation between serum levels of calcium, phosphorus and alkaline phosphatase was found using Pearson correlation. There was negative correlation between serum calcium levels and serum phosphorus levels which was highly significant (p-value <0.05). **Conclusion:** Beta thalassemia is one of the most common genetic disorder. It has high prevalence in India especially in Punjab, the population to which Rajindra Hospital caters to Iron overload leading to various organ dysfunctions is the common complication of beta thalassemia especially parathyroid dysfunction.

Keywords: Serum Calcium, Phosphorus, Alkaline Phosphatase.

INTRODUCTION

The thalassemias are a group of anemias that result from inherited defects in the production of hemoglobin. The thalassemias are among the most common genetic disorders worldwide, occurring more frequently in the Mediterranean region, the Indian subcontinent, Southeast Asia, and West Africa.[1] The recommended treatment for beta-thalassemia major involves regular red blood cell transfusions throughout life. Transfusion-induced hemosiderosis becomes the major clinical complication of transfusion-dependent thalassemia.[2] Iron overload may be due to ineffective erythropoiesis, increased gastrointestinal absorption, lack of physiologic mechanism for excreting excess iron, and above all multiple blood transfusions. A unit of red blood cells contains approximately 250mg of iron while the body cannot excrete more than 1 mg per day. Initially, iron is deposited in the liver. Liver hemosiderosis develops after 1 year of chronic transfusion therapy and is followed by iron deposition in the endocrine system. This leads to hypothyroidism, hypogonadotropic hypogonadism, growth hormone deficiency, hypoparathyroidism, and diabetes mellitus. After 10 years of transfusion, cardiac dysfunction secondary to hemosiderosis develops. Eventually, most patients not receiving adequate iron chelation therapy die from cardiac failure and /or arrhythmias.[2] Hypocalcaemia and hyperphosphatemia seems to be related to hypoparathyroidism, a well-known clinical condition associated with thalassemia major. Repeated blood transfusion results in iron deposition in the parathyroid gland which affects its normal functioning.[8] Serum calcium, phosphorus and alkaline phosphatase are characteristically altered with bone impairment in patients with thalassemia. Calcium is the 5th most plentiful element in human body playing a major role in skeletal mineralization. Alkaline phosphatase is responsible for phosphorus,[3] promoting bone mineralization by

Name & Address of Corresponding Author
Dr Tarvinderjit Khurana
Assistant professor, Department of Medicine,
Adesh Medical college and Hospital Mohri Shahbad,
Ex G. M. C Patiala.

increasing the local concentration of inorganic phosphorus. Hence in our study we aim to determine the prevalence of hypoparathyroidism in thalassemia major patients by assessing the levels of serum calcium, serum phosphorus and serum alkaline phosphatase levels.

Aims And Objectives

To evaluate Serum Calcium, Phosphorus and Alkaline phosphatase levels in Thalassemia Major Children.

MATERIALS AND METHODS

The present study is a type of cross sectional study and was conducted on 100 beta Thalassemia major children enrolled at Thalassemia unit, Department of Pediatrics, Rajindra Hospital, Patiala and analysis was done in the department of bio-chemistry, Govt. Medical College, Patiala.

Inclusion Criteria

- Patients in the age group of more than or equal to 4 years to less than or equal to 18 years, who are diagnosed case of beta thalassemia.(4-18 years)
- Patients with diagnosed Beta thalassemia enrolled at Thalassemia unit, Department of Pediatrics, Rajindra Hospital, Patiala.
- Receiving repeated blood transfusion.
- History of taking iron chelating therapy.
- Not receiving Calcium and Vitamin D supplementaion.

Exclusion criteria

- Patients with age more than 18 years and less than 4 year.
- Those receiving Calcium and Vitamin D supplementation.

Method

Patients were verified for fulfilling inclusion criteria and ruled out for presence of exclusion criteria. Informed consent was taken from family members after briefing them about the study in their vernacular language. A detailed history, clinical examination, laboratory workup was done, (serum calcium, phosphorous, Alkaline phosphatase), Reference Values: calcium (8.4 -10.4 mg/dl), Phosphorous Adults: 2.5 - 5.0 mg/dl ,Children : 4.0 - 7.0 mg/dl, Alkaline Phosphatase: Children 60-360 IU /L.

RESULTS

The present study is a type of cross sectional study. The study group comprised of 100 beta Thalassemia major children enrolled at Thalassemia unit, Department of Pediatrics, Rajindra Hospital, Patiala. The observations are as under:- This study included 100 thalassemia major cases, which were further divided according to the age groups. There were 41 (41%) cases in age group 4-8 years, 42 (42%) cases in 9-13 years and 17(17%) cases who belonged to age group 14-18 years. The mean age was 9.68± 3.66 years.

It was observed that 35 (35%) cases were transfused at an interval of 11-15 days. 23 (23%) and 24 (24%) cases received transfusion every 16-20 days and 21-25 days respectively. 18 (18%) were transfused at a gap of 26-30 days. Mean serum calcium levels in the cases receiving blood transfusion every 11-15 days were 8.41±0.49 mg/dl. Levels were 8.61±1.00 mg/dl and 8.63±0.11mg/dl in the ones receiving blood transfusion every 16-20 days and 21-25 days respectively. Mean serum calcium levels in the cases receiving blood transfusion every 11-15 days were 8.41±0.49 mg/dl. Mean serum phosphorus levels in the cases receiving blood transfusion every 11-15 days were 5.45±1.16mg/dl. Levels were 4.98±0.82mg/dl and 5.03±0.83mg/dl in the ones receiving blood transfusion every 16-20 days and 21-25 days respectively. Cases receiving transfusion every 26-30 days had mean serum phosphorus levels of 4.72±0.72m .The difference in serum phosphorus levels in the cases receiving blood transfusion every 11-15 days as compared to the levels in cases receiving blood transfusion every 26-30 days was statistically significant as p value was <0.05. It was not significant in the other groups.

Mean serum alkaline phosphatase levels in the cases receiving blood transfusion every 11-15 days were 187.17±75.16IU/L. Levels were 216.39±93.28IU/L and 191.21±93.45IU/L in the ones receiving blood transfusion every 16-20 days and 21-25 days respectively. Cases receiving transfusion every 26-30 days had mean serum alkaline phosphatase levels of 169.17±56.63IU/L. The difference in serum alkaline phosphatase levels in different groups was statistically insignificant as p value was >0.05.

The correlation between serum levels of calcium, phosphorus and alkaline phosphatase was found using Pearson correlation. There was negative correlation between serum calcium levels and serum phosphorus levels which was highly significant (p-value <0.05).

DISCUSSION

Table 1: Comparison Of Age Distribution With Various Studies

Studies	Range (years)
Aleem et al[5] (2000)	11-16
Shah et al[4] (2015)	5-20
Agrawal et al[9] (2018)	2-18
Aslam et al[2] (2018)	5-11
Present Study	4-18

Table 2: Comparison of Prevalence of Hyperphosphatemia With Various Studies

Studies	%age
Hasan et al6] (2008)	19.75
Mirhosseini et al[8] (2013)	18.2
Agrawal et al[9] (2018)	36.67
Present Study	13

Table 3: Comparison Of Prevalence Of Elevated Levels Of Alkaline Phosphatase With Various Studies

Studies	%age
Pirinccioglu et al[10] (2017)	6.6
Agrawal et al[9] (2018)	3.3
Present Study	3

Table 4: Comparison Of Prevalence Of Hypocalcemia With Various Studies

Studies	%age
Hasan et al[6] (2008)	21.75
Eithar et al[7] (2013)	40
Mirhosseini et al[8] (2013)	22
Agrawal et al[9] (2018)	25
Present Study	29

Table 5: Comparison Of Mean Serum Calcium Levels With Various Studies

Studies	Mean±SD (mg/dl)
Shah et al[4] (2015)	8.46±0.94
Sultan et al[12] (2016)	8.1±0.8
Agrawal et al[9] (2018)	9.67±0.94
Aslam et al[2] (2018)	7.9± 0.6
Present Study	8.57±0.52

Correlation among Serum Calcium, Phosphorus And Alkaline Phosphatase

In this study we observed the correlation between serum levels of calcium, phosphorus and alkaline phosphatase using Pearson Correlation. There was negative correlation between serum calcium levels and serum phosphorus levels which was highly significant (p value < 0.05), which could be suggestive of Parathyroid dysfunction. Studies showing similar results could not be traced in literature.

CONCLUSION

Beta thalassemia is one of the most common genetic disorder. It has high prevalence in India especially in Punjab, the population to which Rajindra Hospital caters to Iron overload leading to various organ dysfunctions is the common complication of beta thalassemia especially parathyroid dysfunction. Efforts in early detection and management of the same save valuable years and millions of viable human hours which can be put into building a better future.

The important message to be put out from this study is that regular checkup of Serum Calcium, Phosphorus and Alkaline phosphatase should be done in beta thalassemia children to monitor parathyroid dysfunction. Iron chelators are given to prevent excessive iron overload. Our study has revealed parathyroid dysfunction suggested by low serum calcium and high phosphorus levels. From this study we also concluded that parathyroid dysfunction increases with age. Hence early evaluation of Serum Calcium, Phosphorus and Alkaline phosphatase and calcium and vitamin D supplements should be advised.

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