

Frequency of Low Bone Mineral Density and Osteoporosis in Children with Beta Thalassemia Major

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ABSTRACT

Background: Beta-thalassemia is a hereditary disease due to unbalanced globin chain synthesis with ineffective erythropoiesis and increased peripheral hemolysis. Expansion of bone marrow cavity results in osteoporosis. Bone disease in thalassemia is manifested as diffuse bone pain, scoliosis, spinal deformities, nerve compression, spontaneous fractures, and severe osteoporosis.

Aims: To determine the frequency of low Bone Mineral Density in children with Beta Thalassemia Major and to determine the frequency of osteoporosis in children with beta Thalassemia Major having low bone mineral density

Study design: Cross-Sectional survey

Setting : Thalassemia centre, Sir Ganga Ram Hospital, Lahore.

Methods: Children with Beta-thalassemia major visiting OPD of the department of paediatrics Sir Ganga Ram Hospital, matching the inclusion criteria were enrolled. Low Bone mineral density was calculated by DEXA scanning that was done from MAYO hospital.

Results were read by the researcher as bone mineral density Z-Score less than or equal to -2.0 and osteoporosis was labelled as z-score less than or equal to -2.5. Data was collected by written proforma and low bone mineral density was calculated.

Result: Majority of the patients were recorded between 9-10 years of age i.e., 42(28%), mean and SD was calculated as 8.23 ± 2.67 . Male were 80(53.33%) and female were 70(46.67%). Frequency of low bone mineral density in children with beta thalassemia major was recorded in 73(49%) and frequency of osteoporosis was recorded in 71(47.33%).

Conclusion: The frequency of low Bone Mineral Density and osteoporosis is high among children with Beta Thalassemia Major. So, it is recommended that every child suffering from beta thalassemia major should be sort out for low bone mineral density and osteoporosis.

Key words: Beta Thalassemia Major, Low Bone Mineral Density, osteoporosis, frequency

INTRODUCTION

β -Thalassemia, originally named Cooley anemia, initially was described by Dr. Cooley in 1925 in Detroit as an inherited blood disease¹. From recent researches it has been proved that different types of thalassemia are types of inherited anemias resulted from gene mutations on globin in chromosomes 16 and 11 and affecting the synthesis of α - or β -globin protein respectively². The β -thalassemia are commonly found in Mediterranean region, Middle East, Africa, Indian subcontinent, Burma, South Asia including southern China, Burma, Malay and Indonesia. The estimation of gene frequencies ranges from 3 to 10 percent in some areas². The thalassemia syndromes are named according to the globin chain affected or the abnormal hemoglobin produced. Thus, β -globin gene mutations give rise to β -thalassemia and alpha-globin mutations cause α -thalassemia. Beta thalassemia major represents hemoglobinopathy resulted from hereditary fault in

the production of beta chain in hemoglobin of adults which finally results in ineffective process of erythropoiesis which results in peripheral hemolysis. Its conventional management then includes blood transfusion and chelation on regular basis. Over the years, the combination of hyper transfusion and chelation therapy has significantly increased the survival of patients of beta thalassemia³. Bony deformities may be present even in well transfused and chelated patients¹. Patients face risks and complications during treatment of thalassemia. Thalassemia patients shows a variety of bony abnormalities including feeling pain in the bones, delay of bone age, bone deformity, growth retardation, rickets, compression of nerve, scoliosis, osteopenia, osteoporosis and pathological fractures. Extramedullary erythropoietic tissue formation in thorax and paraspinal region may be stimulated by increased production of erythropoietin synthesis. Marrow expansion results in typical deformities of face and skull. Focal defects in bone mineralization and Osteopenia may result in aggravation of painful periarticular syndrome includes micro fractures and

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osteomalacia⁴. Osteoporosis has characteristic low bone density and architectural deformity, which result in decreased bone strength and increases risk of the fracture. Unique to β -thalassemia major is extramedullary erythropoiesis. This may be so severe that the masses of bone marrow lead to broken bones and spinal cord compression. Sites of involvement include the sinuses and the thoracic and pelvic cavities. The expansion of the erythroid bone marrow can lead to a number of skeletal changes. In particular, characteristic changes in the facial bones and skull result in frontal bossing, overgrowth of the maxillae, and malocclusion. This has sometimes been referred to as chipmunk facies. Other bones are also affected, and premature fusion of the epiphyses results in shortened limbs. Compression fractures of the spine may occur. Even if the disease is managed appropriately with transfusions and iron chelation, patients will still suffer from osteopenia and osteoporosis. Possible mechanisms include changes secondary to hypogonadism or increased bone resorption secondary to vitamin D deficiency. (A) osteoblasts and (B) osteoclasts are two distinct types of cells which are involved in proper maintenance and renewal of bone. In the patients of thalassemia, due to imbalance between increased osteoclastic resorption and insufficient osteoblastic bone formation “Aging” of the bone starts in childhood. Osteoporosis is considered as emerging cause of morbidity in thalassemia patients^{5,6}. Bone mineral density is a new and good index of bone status and clinically important predictor of fracture risk in thalassemia patients. Dual energy X-ray absorptometry (DEXA) is best and non-invasive method for measurement of bone density because of its 1% precision rate and minimum radiation exposure⁷.

There is no study available in Pakistan, regarding the frequency of low bone mineral density in thalassemia patients and extent of osteoporosis in thalassemia patients having low bone mineral density is not known and optimal treatment is not offered in children⁵. Bone mineral density (BMD) is measured by the Dual Energy X-ray Absorption (DEXA) method. It is considered the gold standard because it is the most extensively validated test for predicting osteoporosis.

MATERIAL AND METHODS

It was a cross-Sectional survey held at Thalassemia centre, Sir Ganga Ram Hospital, Lahore during 6 months duration (from July 2013 to December, 2013). All diagnosed cases of Thalassemia Major matching operational definition were included in the study.

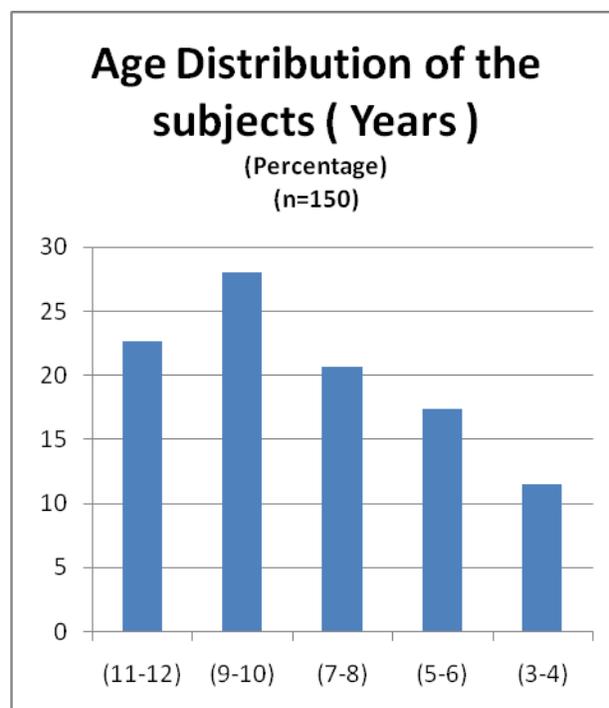
Non-probability: purposive sampling technique was used. Sample size was of 150 patients.

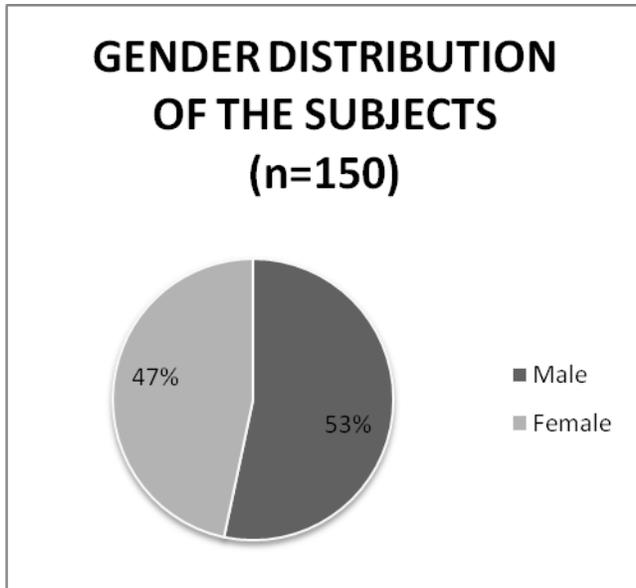
150 children with Beta-thalassemia major visited Thalassemia centre, Sir Ganga Ram Hospital, matching the inclusion criteria were enrolled. Written informed consent was taken from the parents or the guardians. Low Bone mineral density was calculated by DEXA scanning that was done from Mayo Hospital by same operator. Data was collected by written proforma and low bone mineral density was calculated as per operational definition.

Data was collected from patients and analyzed by SPSS version 17. Age was presented by calculating mean \pm S.D. Gender was presented by calculating frequency and percentage. Frequency and percentage was calculated for low bone mineral density and osteoporosis.

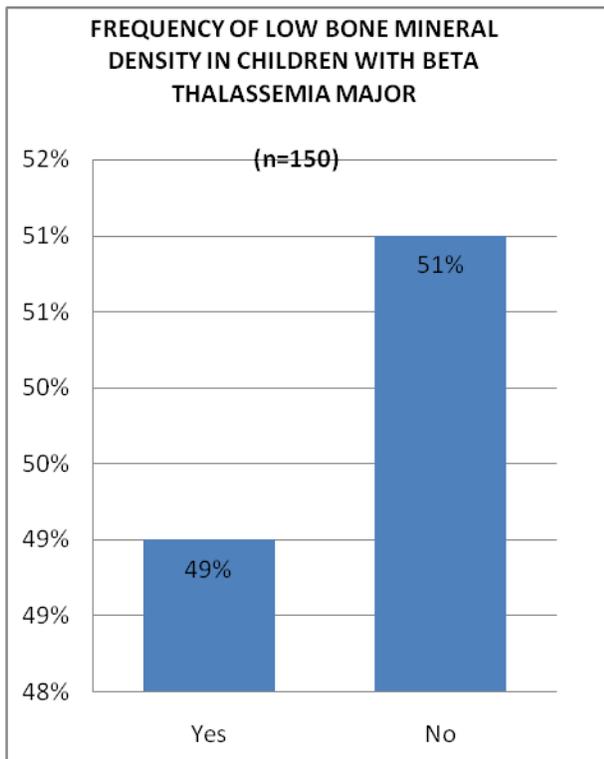
RESULTS

In this research, majority of the patients were recorded between 9-10 years of age i.e., 42(28%), 34(22.6%) were between 11-12 years of age, 31(20.67%) were between 7-8 26(17.33%) were recorded between 5-6 years of age and only 17(11.3%) were between 3 to 4 years of age. Mean and SD was calculated as 8.23 \pm 2.67. Gender distribution of the patients reveals 80(53.33%) male and 70(46.67%) were female.

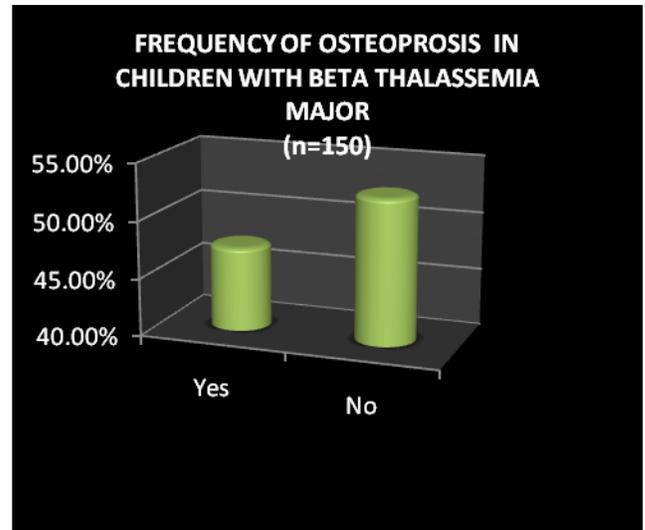




Frequency of low bone mineral density in children with beta thalassemia major was recorded in 73(49%) while 77(51%) were not found with low bone mineral density.



Frequency of osteoporosis in children with beta thalassemia major was recorded in 71(47.33%) while 79(52.67%) were not found with osteoporosis.



DISCUSSION

The thalassemia syndromes are group of congenital haemolytic anemias comprises of decreased or absent synthesis of one or more globin chains of haemoglobin. It is a proved fact that the patients of thalassemia are more susceptible to osteoporosis. Osteoporosis is a complex disease caused by multiple factors including environment, diet intake and genetics. Osteoporosis is an important cause of morbidity in the patients of β -thalassemia major.

In our study, 73(49%) out of 150 Registered Beta Thalassemia patients had low bone mineral density while 71(47.33%) had osteoporosis, bone scanning was done with the help of DXA, which is still the most common method. DXA have the advantage of low radiation exposure, availability and less time of procedure.

The authors in a study investigated the prevalence of low bone mass in patients from the city of Tehran, Iran, with diagnosis of beta-thalassemia major (n=203), aged 10-20 years, and the potential risk factors for osteoporosis in this specific patient population. Study showed that prevalence of osteoporosis found to be 50.7% with no difference in male and female patients. Findings of this study are comparable with our study⁸.

T F Leung and colleagues found in a study, that 62% of TM patients having bone mineral density (BMD) deficits which is in favor of literature¹.

Karimi M and workers calculated bone mineral density (BMD) and bone mineral content (BMC) in patients with thalassemia major and intermedia in their research. They correlated BMD and BMC with biochemical and hematological profile of the patients. They concluded that patients with thalassemia major and intermedia, who were younger

than twenty years, showed lower BMD and concluded that bone marrow density (BMD) is a good index of bone status in the patients with Thalassemia and should be done in all these patients annually⁶.

Another evident study by OS Salama and colleagues who conducted a research study to evaluate the bone health status in twenty five patients (13 males, 12 females; 15-23 years old) diagnosed cases of beta-thalassemia major and their data showed that low bone marrow density (BMD) is usually present in patients with thalassemia, although diagnosis is late. As in their research, they concluded that early diagnosis of low bone marrow density should be done during childhood, in order to improve the quality of life in adulthood⁹.

CONCLUSION

The frequency of low Bone Mineral Density (BMD) and osteoporosis are high among the children with Beta Thalassemia Major. So, it is recommended that every children who is suffering from beta thalassemia major should be sort out for low bone mineral density and osteoporosis and optimal treatment should be offered. However, it is also required that every setup should have their surveillance in order to know the frequency of this problem so that some influential steps be taken to control this problem.

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