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CLINICAL SIGNIFICANCE OF DEXA SCAN IN EARLY DIAGNOSIS OF OSTEOPOROSIS IN MULTI TRANSFUSED THALASSEMIA MAJOR PATIENTS

General Medicine

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ABSTRACT

Aim – to study the importance of dexa scan over S. calcium level in early diagnosis of osteoporosis in thalassemia major patients
Material and methods - This is retrospective analytical study of 100 thalassemia major patients and their dexa scan and other reports were evaluated and DEXA scan reports were interpreted according to WHO criteria.
Results – DEXA scan reports were abnormal in all 100 thalassemia patients among which osteoporosis , osteopenia and osteopenia to porosis was observed in 65 %, 13% and 22% respectively. Serum calcium level was normal in 88% of patients.
Conclusion- DEXA scan is helpful for early prediction of low bone mass (osteopenia) hence we can prevent the osteoporosis by starting early treatment of osteoporosis in those who had osteoporosis on DEXA scan and normal serum calcium level.

KEYWORDS

dexa scan, thalassenia major , osteoporosis, s.calcium level

INTRODUCTION

Thalassemia is the most common monogenic disorder in the world. Thalassaemia diseases are a group of hereditary disorders of haemoglobin synthesis. Thalassemia major (β-thalassemia) affects a significant segment of the population in certain areas of the world. Alterations in migration patterns have changed the geographic distribution of this disease and made it a worldwide health problem with a high frequency in Africa, India, Southeast Asia and the Mediterranean area.[1] Bone disorders and secondary osteoporosis are one of the most common findings in Thalassemia major patients. Delay in bone formation due to bone marrow expansion causes cortical thinning, increased instability and bone fragility.[2] Also, Baldini et al explained the chronic requirement to produce blood cells as an important contributor in osteoporosis. Overstimulation of haematopoietic system increases the number of osteoclasts and osteoblasts that increases bone turn-over and bone loss.[3] Iron overload or haemochromatosis is a major complication of hyper-transfusion treatment of thalassaemia and as it continues, iron interferes with osteoid maturation and mineralisation. Binding of iron to calcium hydroxyapatite crystals affects hydroxyapatite crystals growth and increases osteoid tissue in bone. On the other hand, iron overload leads to major complications include hypogonadism, diabetes, hypothyroidism and other endocrine disorders, that by themselves are risk factors for osteoporosis.[4] More puzzling, however, is the observation that, despite the normalization of hemoglobin levels, adequate hormone replacement, and effective iron chelation, patients continue to show an unbalanced bone turnover with an increased resorptive phase resulting in seriously diminished bone mineral density(BMD).[5,6]Dual X-ray absorptiometry (DEXA) is an excellent non-invasive investigation of choice for repeated measurements of any temporal changes of BMD because of its low radiation exposure.[7] Since Osteoporosis is progressive disease, early diagnosis and prevention are more effective way of treatment for it.

MATERIALS AND METHODS:

This is retrospective analytical study of 100 patients attending our outpatient department, department of Medicine and admitted at thalassemia ward in P.D.U. Medical College and Civil Hospital, Rajkot during the period of 1 year, from July,2018 to June,2019. The study received approval from institutional ethical committee of P.D.U. medical college. Those, who were already diagnosed with thalassemia major and above 12 years of age, were retrospectively enrolled in this study. Patient's data regarding their age, sex, laboratory investigation-Serum Calcium level, serum ferritin level and radiological investigation-DEXA (Dual-energy X-ray absorptiometry) scan reports were collected from clinical records and statistical analysis done.

Bone mineral density (BMD) of lumbar spine (L1-L4) and neck femur was performed using by dual x-ray energy absorptiometry (DEXA) using lunar DPX DXA system (by GE healthcare). DEXA scan study was interpreted according to WHO criteria and expressed in T-Score i.e. number of standard deviation above or below the mean results. According to which Osteopenia is defined as a T score between -1 and -2·5 and osteoporosis below -2·5 (World Health Organization Study Group, 1994).

Blood samples were collected from all patients. Serum calcium was done by the Arsenazo test kit. Normal value of serum calcium is 8.6-10.3 mg/dl and serum ferritin is 24 to 336 µg/l for men and 11 to 307 µg/l for women.

RESULTS:

Clinical records of 100 thalassemia major patients, admitted in thalassemia ward and those who attended outpatient department, department of Medicine at P.D.U. Medical College and Civil Hospital,Rajkot were evaluated. All patients were above the age of 12 years and undergone multiple blood transfusions. In this study,there were 60 male and 40 female patients.

Table 1 :Serum calcium level in study participants

		Sex	
		Male	Female
Serum calcium level	Normal	54	34
	Low (<8.5 mg/dl)	6	6
	Total	60	40

As shown in table 1, 12 patients had low serum calcium level (below 8.5 mg/dl) among 100 thalassemia major patients in the study with 6 patients each in male and female, while 54 and 34 patient had normal serum calcium level respectively in male and female.

Table 2 : correlation of sex with osteoporosis

	Osteo-porosis	Osteopenia to porosis	Osteo-penia	Total
Male	39	16	5	60
Female	26	6	8	40

As shown in table 2, osteoporosis was present in 39 out of 60 (65%) male patients and 26 out of 40 (65%) female patients. Osteopenia was present in around 8.3% of male and 20% of female patients while osteopenia to porosis in 26.67% of male and 15% of female patients. So it can be concluded that as such there is no correlation between sex and osteoporosis disease process.

Table 3 : Interpretation of DEXA scan study reports (acc. To WHO criteria)

T score	Interpretation	Number of patients
At or above -1 SD	Normal	0
Between -1 and -2.5 SD	Osteopenia	13
At or below -2.5 SD	Osteoporosis	65
Some value below -2.5 SD and other in between -1 to -2.5 SD	Osteopenia to porosis	22
	Total	100

As per DEXA scan report of these 100 thalassemia major patients, 65 patients had T-Score below -2.5 SD and so osteoporosis according to WHO criteria. 13 patients had diagnosis of osteopenia as per T-Score and 22 patients had mixed picture of bone mineral density at different site from osteopenia to osteoporosis. None of the patients in study had normal DEXA scan report.

Table 4 : S. Ferritin value and it's correlation with osteoporosis

		Total No. Of patients	Patients with Osteoporosis
Serum ferritin value (µg/l)	<2000	23	15
	>2000	77	50

The mean serum ferritin value during the study was 5243.28 µg/l (range 412-18242 µg/l). All patients in this study had serum ferritin value above normal range. Serum ferritin value was more than 2000 µg/l in 77 out of 100 patients and less than 2000 µg/l in remaining 23 patients. 65% of patients in each group of serum ferritin value above or below 2000 µg/l had osteoporosis so as such there is no correlation of osteoporosis with serum ferritin value.

DISCUSSION:

The reported frequency of osteoporosis in thalassemia major patients is around 90% (range 52-96%).[8,9] Incidence of fracture rate is 70% above the fracture rate in general population.[10] These deformities and fracture occurance in Thalassemia major patient mainly due to low bone mass which is either due to disease process or due to iron overload because of multiple blood transfusion, a part of treatment. These can be prevented if we diagnose and treat osteopenia and osteoporosis changes in bone at a earlier age.

In present study, all 100 thalassemia major patients had abnormal DEXA scan findings. This is comparable with Jensen et al study[11] and maher abo bakr al amir et al study [12] which showed 96.31% and 98.75% abnormal DEXA scan findings respectively.

Among these patients, 65% of patients had osteoporosis and 13% patients had osteopenia changes on DEXA scan. Remaining 22% patients had both osteoporosis and osteopenia like changes at different sites on DEXA scan. These findings were supported by Hashemieh and colleagues [13] who reported abnormal DEXA findings in 274 (84.2%) thalassemia patients (214 (65.5%) patients had osteoporosis and 60 (18.7%) patients had osteopenia).

Benigno et al study[14](n=25) showed that 20% patients had osteopenia and 64% patients had osteoporosis on DEXA scan. Maher abo bakr al amir et al study showed 42.5% osteoporosis, 7.5% osteopenia and 48.7% both osteoporosis and osteopenia. These differences in finding between osteoporosis and osteopenia may be due to age, geometric variation or genetic interference.

In present study, 88% Thalassemia major patients had normal serum calcium level and only 12% patient had serum calcium level below 8.5mg/dl. These findings are comparable with Maher abo bakr al amir et al study, merchant r et al study [15] and ashraf Soliman et al study [16] which showed 15%, 16% and 16.67% hypocalcemia respectively in their studies. Serum calcium level was normal in all patients in mahachoklertwattana p et al study.[17]

As we can see that 88 % had normal serum calcium level but those patient had either osteoporosis or osteopenia changes on DEXA scan. If we start treatment for prevention of osteoporosis in patients with osteopenia findings on DEXA scan, then we can prevent osteoporosis related fractures, its other complication and related morbidities. Also in those patients who had osteoporosis findings yet normal serum calcium level, if we consider treatment options for osteoporosis, we can prevent further damage and deformities as well as halt the disease progression.

CONCLUSION :

Among studied 100 thalassemia major patients, 88% had normal serum calcium level, while all patients had abnormal DEXA scan finding in form of osteopenia or osteoporosis. So it concludes that DEXA scan is helpful for early prediction of low bone mass (osteopenia) hence we can prevent the osteoporosis by starting early treatment of osteoporosis in those who had osteoporosis on DEXA scan and normal serum calcium level. So DEXA scan should be done on two or three yearly in Thalassemia mdajor patients to prevent morbidity.

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