Prevalence of osteoporosis, serum vitamin D and serum calcium deficiency cases among women: A hospital based retrospective study

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Abstract

Introduction: Osteoporosis is a disorder of the bones characterized by low bone mass.One out of three women in India suffers from osteoporosis. Vitamin D deficiency prevails as an epidemic in India and a formidable issue. The present study was done to estimate prevalence of osteoporosis rates among women and correlation of BMD with serum vitamin D and calcium levels.

Materials and Methods: The present retrospective study was conducted on162 women who attended orthopedic OPD at KLE's hospital, Belagavi.Cases were evaluated for serum 25 (OH) vitamin D, serum calcium and bone mineral density by DEXA (Lumbar spine) scan.Data analyzed by SPSS version 20.

Results: Results of our study showed 54.3% of women were osteoporotic, 26.5% were osteopenic and 19.1% were having a normal BMD. The highest hypovitaminosis D was seen in 60 above age group. There was a significant and positive correlation between BMD scores with vitamin D (r=0.6644, p=0.0001) and calcium (r=0.5974, p=0.0001)at 5% level was observed. A statistically significant association was found between age group and BMD (chi-square=14.9597, p=0.0004), and serum vitamin D status in women (chi-square=11.8052, p=0.0189). Further, multiple linear regression analysis indicated, the influence of vitamin D and calcium on BMD is positive and significant (t=35.2502, p=0.0001).

Conclusion: Serum vitamin D and calcium were the significant predictors of BMD in women. It was compelling to observe age was an important factor for high prevalence of low BMD.Hence, prevention and early detection of hypovitaminosis D and hypocalcemia is the key to reduce the incidence of osteoporosis among women.

Keywords: Bone mineral density, Osteoporosis, 25 hydroxy vitamin D, Hypocalcemia, DEXA scan.

Introduction

Osteoporosis is a specific term referring to a state of reduced mass per unit volume of a mineralized bone because of decreased bone proteins.[1] According to International Osteoporosis Foundation (IOF), one out of three women in India suffers from osteoporosis.[2] Low bone density exhibits the main risk factor for osteoporosis, other risk factor includes progressive age, early menopause and reduced intake of calcium and vitamin D along with lack of sunlight exposure.[3,4] There is an increased prevalence of osteoporosis among postmenopausal women and the elderly.[5] Nearly 30 percent of all postmenopausal women across globally have osteoporosis. It is estimated that 50 percent of women will be experiencing osteoporotic related fractures.[6]

According to our knowledge few studies were done on prevalence of osteoporosis in this part of southern India. Reports of studies from Andhra Pradesh, Tamil Nadu concluded that low dietary calcium intake and lack of limited exposure to sunlight are associated with low bone mineral density.[7,8] Hence the present hospital based study was done to estimate the osteoporotic, serum vitamin D and calcium deficiency cases among women of different age groups and correlation of BMD with serum vitamin D and calcium levels.

Materials and Methods

The present retrospective study was conducted on women, who visited orthopedic OPD under executive health check-up at KLE Society's Dr. Prabhakar Kore Charitable Hospital, Belagavi, India, between 2014 and 2016. The total numbers of 252 cases were evaluated and after fulfilling the selection criteria, 162 women case reports were taken up for the study. Cases with renal disease, malnutrition, thyroid, parathyroid diseases, history of cancer, estrogen replacement therapy or therapy with any other drug that affect skeleton like steroids, anti-Convulsants and anticoagulants were excluded. Further, based on age women were grouped into three categories as 20-40 years (n=24), 41-59 years (n=49) and > 60 years (n=89). The parameters for serum 25 (OH) vitamin D, serum calcium and DEXA (Lumbar spine) scan reports were collected from the medical record department.The study was approved by the institutional ethical and research committee.

The serum 25 (OH) vitamin D and calcium samples were estimated by chemiluminescent immunoassay and Bis (o-Aminophenoxy)ethane-tetra-acetic acid)-BAPTA method respectively on Roche/Hitachi cobas c analyser. As per latest recommendation on serum 25(OH) vitamin D levels subjects were grouped as vitamin D deficient with ≤ 20 ng/ml, insufficient with 21-29 ng/ml and sufficient with>30ng/ml.[9,10] Bone mineral density (g/cm^2) measurement was estimated

using DEXA scan of GE Wipro and Lunar densitometer at lumbar spine (L1-L4 level). Subjects were divided as normal T-scores of -1 or above, osteopenia with T- score between -1.0 and -2.5 and osteoporosis with T-score of -2.5 or lower.[2, 11]

Statistical analysis was performed using the SPSS Software, version 20.0 for windows. Continuous variables were expressed as mean, median± S.D and qualitative data were expressed in percentages. Chi-Square test was used to associate the parameters with age groups. The correlation between continuous variables was done by Karl Pearson's coefficient correlation method. p-value < 0.05 was considered as significant.

Results

In the present study, out of 162 women, 14.8% were in 20-40 age groups, 30.2% were in 41-59 age groups and 55% were in 60 above age group. Mean values for BMD (g/cm^2) was 0.91±0.21, 25(OH) vitamin D (ng/ml) was 15.23±11.73 and Calcium (mg/dl) was 8.36±2.53. However, maximum patients were osteoporotic (54.3%) compared to osteopenia (26.5%) and normal (19.1%). The association between age group and BMD status was found to be statistically significant (chi-square=14.9597, p=0.0004) as shown in Table.1

A statistically significant association was found between age group and serum vitamin D status in women (chi-square=11.8052, p=0.0189). Maximum patients were vitamin D deficient (73.4%) compared to insufficient (10.5%) and normal (16%) cases. Among deficient cases (n=119), the highest number of patients belonged to 60 above age group (n=74) as shown in Table 2.

Table 3 shows the association of age groups with serum calcium level among women. Calcium deficiency cases were maximum (67.2%) compared with hypercalcaemia (8.1%) and normal (20.3%). However, the association between age groups and serum calcium was found to be statistically significant (chi-square=11.069, p=0.0258).

Table 4 shows a significant and positive correlation between BMD with 25 (OH) vitamin D (r=0.6644, p=0.0001) and BMD with calcium (r=0.5947, p=0.0001) at 5% level was observed. It means that the BMD, serum 25 (OH) vitamin D and serum calcium are dependent on each other. Further, multiple linear regression analysis indicated that serum 25 (OH) vitamin D and serum calcium were the significant predictors of BMD in women. It means that the influence of 25(OH) vitamin D and calcium on BMD is positive and significant (t=35.2502, p=0.0001) as shown in Table 5.

Table 1: Association between Age group and BMD in women

Age group (n=162)	Normal (T-score of -1 or above)	%	Osteopenia (T- score -1.0 to-2.5)	%	Osteoporosis (T-score -2.5 or lower)	%	Total		Chi-square	p-value
							n	%		
20-40	6	25	10	41.6	8	33.3	24	14.8	14.9597	0.0004*
41-59	14	28.5	15	30.6	20	40.8	49	30.2		
60>	11	12.3	18	20.2	60	67.4	89	55		
Total	31	19.1	43	26.5	88	54.3	162	100		

*p<0.05

Table 2: Association between age group and serum vitamin D in women

Age group (n=162)	Deficient (≤ 20 ng/ml)	%	Insufficient (21-29 ng/ml)	%	Sufficient (≥ 30ng/ml)	%	Total		Chi-square	p-value
							n	%		
20-40	16	66.6	4	16.6	4	16.6	24	14.8	11.8052	0.0189*
41-59	29	59.1	6	12.2	14	28.5	49	30.2		
60>	74	83.1	7	7.8	8	8.9	89	54.9		
Total	119	73.4	17	10.5	26	16	162	100		

*p<0.05

Table 3: Association between Age group and serum calcium in women

Age group (n=162)	Normal (8-11 mg/dl)	%	Hypocalcemia (≤ 8 mg/dl)	%	Hypercalcemia (≥ 11 mg/dl)	%	Total		Chi-square	p-value
							n	%		
20-40	4	17.3	16	66.6	4	17.3	24	14.8	11.069	0.0258*
41-59	17	34.6	25	51.0	7	14.2	49	30.2		
60>	12	13.4	68	76.4	9	10.1	89	54.9		
Total	33	20.3	109	67.2	20	8.1	162	100		

*p<0.05

Table 4: Correlation between BMD with serum vitamin D and serum calcium in women by Karl Pearson's correlation coefficient method

Independent variables	Correlation between BMD with		
	r-value	t-value	p-value
25(OH) Vitamin D (ng/ml)	0.6644	10.4833	0.0001*
Calcium (mg/dl)	0.5947	8.3562	0.0001*

*p<0.05

Table 5: Multiple linear regression analysis of BMD by serum 25(OH) vitamin D and serum calcium in women

Independent variable	Co-efficient	SE of co-effcient	t-value	p-value
Intercept	0.7241	0.0205	35.2502	0.0001*
25(OH) Vitamin D (ng/ml)	0.0120	0.0011	11.2448	0.0001*
Calcium	0.0305	0.0212	8.7895	0.0001

*p<0.05

Discussion

Osteoporosis is the general metabolic bone disease in clinical practice, its prevalence is incremental with the rise in ageing population and it is vital health problem worldwide.[12]

In this hospital based retrospective study out of 162 women, maximum patients were osteoporotic (54.3%) compared to osteopenia (26.5%) and normal (19.1%). Similar study in Vellore, reported 48% prevalence of osteoporosis among women.[4] In our study there was significant association found between age groups and lumbar spine- BMD. This indicated that as the age increases, there is a decrease in BMD status. In comparative studies, they concluded that age correlated with lower BMD values.[13,14]

The study showed the highest percentage of vitamin D deficiency were observed among women of more than 60 years age group. All the deficient individuals were osteoporotic or osteopenic. A similar observation was reported by Harinarayan et al., the highest hypovitaminosis D were seen in 60 above age group and 83.1% women were vitamin D deficient.[7] In contrary to our study, A.P.S Narang concluded that there was no significance with age and vitamin D levels.[15]

The correlation between serum calcium and serum 25(OH) vitamin D was found out to be significant and the parameters were dependent on each other along with BMD. There was a positive correlation between BMD at lumbar spine and serum 25 (OH) vitamin D status. It was evident that 25(OH) vitamin D status influenced BMD positively. Similar findings were reported by many studies.[16-20]

Conclusion

In conclusion, the present study demonstrates the prevalence of osteoporosis, vitamin D deficiency and hypocalcemia cases were reported maximum among women. It was compelling to observe age was an important factor for high prevalence of low BMD and vitamin D deficiency. Serum 25(OH) vitamin D and serum Calcium were the significant predictors of BMD. The routine use of biochemical parameters like serum 25(OH) vitamin D, serum calcium and DEXA scan would aid in the early diagnosis and prevention of osteoporosis and its related fractures. These findings would help health professionals to create awareness about vitamin D deficiency among women.

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