Original Article

Comparison of Bone Mineral Density and Its Variables Between Premenopausal and Postmenopausal Women

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Abstract :

Objectives: To compare the bone mineral density (BMD) and its variables in premenopausal and postmenopausal women.

Methods: In this cross sectional study, 62 premenopausal and 62 postmenopausal apparently healthy women were evaluated by a questionnaire. The dietary intake of calcium was evaluated by 24 hours recall method and using table for proximate principle of common Indian food by Indian Council of Medical Research (ICMR). BMD at lumbar spine, femoral neck and Ward's triangle were measured by dual energy X-ray absorptiometry (DXA). A correlation between BMD and various variables were calculated for each of the two groups. **Results:** The mean age of premenopausal and postmenopausal women was 32.46 ± 7.8 and 51.74 ± 7.1 years respectively. The body mass index (BMI), height and weight were comparable in both the groups. The daily intake of calcium was significantly higher in premenopausal women ($p < 0.01$). Approximately, 17% of the postmenopausal women and 9.6% of the premenopausal women were having osteoporosis; 28.56% of the postmenopausal women and 43.54% of the premenopausal women were having osteopenia at the lumbar spine. The BMD at lumbar spine was found to be statistically significantly higher in premenopausal women than that in postmenopausal women ($p = 0.03$). BMD at lumbar spine, femoral neck and Ward's triangle were positively correlated with height, weight, BMI in premenopausal as well in postmenopausal women. **Conclusion:** A significant number of women had osteopenia during premenopausal period and osteoporosis in postmenopausal phase. By increasing awareness towards bone health in second and third decade, morbidity of osteoporosis can be reduced.

Key words: osteoporosis, osteopenia, dietary calcium, premenopausal women

Introduction

Osteoporosis is an important global health problem. It is characterized by a disturbance in the relationship of resorption to synthesis of the bone. The ability to

predict increased risk of osteoporosis is important when selecting patients for preventive measures. Bone mass is affected by a wide variety of factors including age, life style, genetic, nutritional, hormonal and mechanical. Peak bone mass is achieved in the third decade of life, after which it declines. Dual energy X-ray absorptiometry (DXA) is considered as the gold standard modality to measure bone mineral density (BMD). The purpose of study was to compare the BMD in pre and postmenopausal women and to find out the relationship of BMD with factors that could put a woman at risk for osteoporosis.

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Material and Methods

Subjects

A total of 62 premenopausal women and 62 postmenopausal women were recruited between June 2006 and June 2007. Women with any current or past chronic disease (hypothyroidism, collagen diseases, renal, gastrointestinal or lung disorder), pregnancy, those on oral contraception or postmenopausal hormone replacement therapy or taking drugs which interfere with calcium metabolism were excluded. All premenopausal women had normal regular menstrual cycles.

Methods

After an informed consent was obtained from each participant, they were evaluated by a questionnaire which dealt with detailed demographic, menstrual, obstetrical history and factors that could put a woman at risk for osteoporosis. BMD was measured by using the Prodigy DXA system (software version: 8.50) manufactured by GE Medical Systems LUNAR at lumbar spine (L2-L4), femur neck and Ward's triangle. Subjects with lumbar osteophytes or deformation were excluded. The dietary evaluation of all the subjects was done by

using the 24-hours recall method. All the subjects were asked to report whatever they consumed in the previous three days. The charts provided by the ICMR which gives the amount of calcium contained within particular food item, were used to find out the total desired content¹. The daily amount of calcium was calculated by taking the mean value of the three days for each foodstuff.

Statistical analysis

Student's t-tests were used to compare age, body composition indices, daily calcium intake and BMD. The data was entered and analyzed in SPSS software version 12. Mann-Whitney's test was used to compare per capita income and parity between pre and postmenopausal women. Correlation of BMD at lumbar spine, femoral neck and Ward's triangle with variables was calculated by Spearman's rho correlation coefficient test. $P \leq 0.05$ was considered statistically significant.

Results

Table 1 presents the baseline characteristics and BMD of pre and post menopausal women. Mean ages were

Table 1.
Comparison of baseline characteristics and BMD in pre & postmenopausal women

S.No.	Mean $\pm$ SD	Premenopausal N=62	Postmenopausal N=62	P-value
1.	Height (cm)	152.89 $\pm$ 5.5	153.3 $\pm$ 4.9	0.37
2.	Weight (kg)	58.5 $\pm$ 15.8	58.4 $\pm$ 11.0	0.07
3.	BMI (kg/m ²)	24.9 $\pm$ 6	24.6 $\pm$ 4.5	0.08
4.	Daily calcium intake(gms)	515.77 $\pm$ 145.2	442 $\pm$ 157.7	0.01
5.	BMD spine g/cm ² (L2-L4)	1.092 $\pm$ .161	1.022 $\pm$ .211	0.03
6.	Z score spine	-0.61 $\pm$ 1.2	0.068 $\pm$ 1.7	0.015
7.	T score spine	-0.84 $\pm$ 1.3	-0.57 $\pm$ 1.9	0.36
8.	BMD femur neck g/cm ²	0.882 $\pm$ 0.125	0.965 $\pm$ 0.238	0.06
9.	Z- score femur neck	-0.95 $\pm$ 1.2	1.52 $\pm$ 2.4	0.0001
10.	T-score femur neck	-1.27 $\pm$ 0.9	0.60 $\pm$ 2.5	0.0001
11.	BMD Ward's triangle g/cm ²	0.753 $\pm$ 0.146	0.864 $\pm$ 0.316	0.08
12.	Z-score Ward's triangle	-0.92 $\pm$ 1.0	1.03 $\pm$ 2.3	0.0001
13.	T-score Ward's triangle	-1.1 $\pm$ 1.1	0.17 $\pm$ 2.4	0.001

P value <0.05 significant

BMD Bone mineral density

Table 2.
T-Score of pre & postmenopausal women

Postmenopausal T score	Lumbar spine		Femoral neck		Femoral Ward's triangle	
	N	%	n	%	n	%
-1 to -2.5	14	28.56	14	22.58	13	20.96
Less than -2.5	11	17.74	6	9.6	8	12.90
Premenopausal T score						
-1 to -2.5	27	43.54	35	56.45	28	45.16
Less than -2.5	6	9.6	4	6.45	6	9.6

T score (-1 to -2.5) = Osteopenia

T score (less than -2.5) = Osteoporosis

Table 3.
Z-Score of pre & postmenopausal women

Postmenopausal Z score	Lumbar spine		Femoral neck		Femoral Ward's triangle	
	n	%	n	%	n	%
-1 to -2.5	12	19.35	8	12.90	10	16.12
Less than -2.5	3	4.83	2	3.22	3	4.83
Premenopausal Z score						
-1 to -2.5	23	37.09	24	38.70	31	50
Less than -2.5	4	6.45	0	0	0	0

32.46±7.8 and 51.74±7.1 years, mean parity were 2.53±1.2 and 3.56±1.8 in premenopausal and postmenopausal women respectively.

T- scores at lumbar spine, femoral neck and Ward's triangle are shown in Table 2. It showed that premenopausal females were more osteopenic than postmenopausal women but osteoporosis was more prevalent in postmenopausal females. Table 3 showed Z score in both the groups. Z score compares BMD with person of same age, sex, weight and race. A

negative number means thinner bone. Table 4 presents correlation coefficient between BMD (lumbar spine, femoral neck and Ward's triangle) and various variables. Age, height, weight and body mass index (BMI) had significant correlation with BMD.

Discussion

This study revealed that age had negative correlation with BMD in both premenopausal as well as postmenopausal females. This correlation had been

Table 4.
Correlation between BMD & various variables in pre and postmenopausal women

Variables		BMD Lumbar spine		BMD Femoral neck		BMB Femoral Ward's triangle	
		Pre	Post	Pre	Post	Pre	Post
Age (years)	r	-0.188	-0.337	0.506	-0.174	-0.161	-0.161
	p	0.14	0.01*	0.69	0.17	0.21	0.21
Height(cms)	r	0.088	0.273	0.015	0.422	-0.026	0.257
	p	0.54	0.03*	0.91	0.09	0.84	0.04*
Weight(Kg)	r	0.344	0.567	0.449	0.290	0.245	0.282
	p	0.01*	0.0001*	0.0001*	0.02*	0.06	0.02*
BMI (kg/m ²)	r	0.360	0.488	0.467	0.248	0.272	0.091
	p	0.01*	0.0001*	0.0001*	0.05	0.032*	0.83
Calcium (gms)	r	0.10	0.171	0.217	0.043	0.179	0.011
	p	0.44	0.18	0.09	0.74	0.16	0.93

* Significant

r = Correlation coefficients

p = p value

found statistically significant in postmenopausal females due to the fact that decreasing level of estrogen and less degree of activity in this period, affect bone mineral loss².

The premenopausal females were more osteopenic than postmenopausal females but osteoporosis was more prevalent in postmenopausal females (Table 2). It represents that the factors which negatively affect bone mass consistently persisted in premenopausal as well as postmenopausal period. These factors combined with estrogen deficiency then made these women osteoporotic after the attainment of menopause. Osteoporosis not only affects the elderly but young adults as well. This is determined by ideal peak bone mass. The peak bone mass is usually achieved in the thirties and then it declines². Those young adults who do not achieve their ideal peak bone mass, develop osteoporosis at much earlier age. Many factors adversely affect peak bone mass and cause osteoporosis in earlier life like history of osteoporosis or fracture or stooped posture in mother or grandmother, weight less than 127 pounds, sedentary lifestyle, cigarette smoking, early menopause, low estrogen level, low calcium and vitamin D intake³. The premenopausal

females had more negative Z score (6.45%) at spine than postmenopausal women (4.83%). It indicates that they might be having a secondary form of osteoporosis. The factors other than aging (estrogen deficiency) might be responsible for this.

This study showed a high positive correlation between BMD at spine and femur neck with BMI in both pre and postmenopausal groups (Table 4). Voluntary weight loss results in bone loss in both young and elderly females. In postmenopausal women, BMD is expected to fall, however the value of BMD is high in postmenopausal woman who have more BMI as compared to others. Prospective study indicates that early postmenopausal women with lower BMI, lose more bone as compared to those with higher BMI^{4,5}. As thinness is related to both osteoporosis and increased fracture risk, low BMI was included in the risk assessment tools for evaluation of osteoporosis and osteoporotic fracture risk^{6,7}. BMD depends on the bone size and body size^{8,9} and that the different BMD could be the consequence of the difference in those parameters. Age and menopause were significantly associated with BMD in the spine. Body size, bone size and mechanical stress on bone is greater in obese than slender people^{10,11}. The BMD at

the femoral neck and Ward's triangle was found to be more in postmenopausal women. This may result from increasing abnormal calcifications in this age group¹². Calcium intake was statistically more in premenopausal females than in postmenopausal, but no significant effect of dietary calcium on bone mass was observed. Many longitudinal and intervention trials have observed the effect of dietary calcium on bone mass consistently, whereas cross sectional studies have shown mixed results^{12,13}. Variation with bioavailability of calcium in individuals is one of the important factors responsible for these results. The absorption of calcium is affected by many non-modifiable factors like age, vitamin D, plant substances, phytic acid, oxalic acid etc. Most of the Indian population is vitamin D sufficient as the Indian subcontinent has adequate sunshine throughout the year¹³.

Positive measures to improve bone mass so as to attain adequate peak bone mass at a younger age will go a long way to reduce osteoporosis later in life. Therefore there is need to improve awareness about bone health as well as requirement of early interventions in second and third decades of life to reduce the morbidity of osteoporosis.

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