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Analysis of Risk Factors of Osteoporosis among Premenopausal Women And Postmenopausal Women at a Tertiary care Teaching Centre

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ABSTRACT

Introduction: Osteoporosis is a serious health concern that affects millions of people around the world. Especially osteoporosis in postmenopausal women is one of the major public health concerns growing worldwide. In order to prevent osteoporosis there is a need to understand its risk factors. So the present study is designed to assess and compare the risk factors of osteoporosis among women and BMD at lumbar spine and femur neck in premenopausal and postmenopausal women.

Materials and Methods: This hospital based prospective study was conducted on 350 women aged 30-65 years referred to the department of Radio diagnosis for Dexa scan as suspected cases of osteoporosis form various outpatient department. The data collected was evaluated using standardized statistical methods in order to derive a logical conclusion i.e. mean, standard deviation and Pearson Chi-square test.

Results: A highly significant difference was observed b/w two groups in age, weight, BMI, WC, HC, BMDLS, LS T &Z score, FNBMD, FN T & Z score of normal and low BMD group of Postmenopausal group. A highly significant difference was observed b/w two groups in Age, weight, BMI, Waist circumference, Hip circumference, BMD Lumbar, Lumbar spine T score & Lumbar spine Z score, BMD Femur neck, Femur neck T score & Femur neck Z score of normal and low BMD group of Postmenopausal group.

Conclusion: Based on the result of our study we conclude that postmenopausal women with older age, Low socioeconomic status and with low level of physical activity were at higher risk of low BMD. Body mass index found to be positively associated with Bone mineral density in postmenopausal women only whereas negative correlation was found with age in both pre and postmenopausal women.

Keywords: Osteoporosis; Premenopausal; Postmenopausal; Woman.

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INTRODUCTION

Osteoporosis is a serious health concern that affects millions of people around the world. Especially osteoporosis in postmenopausal women is one of the major public health concerns growing worldwide. According to the literature it is suggested that osteoporosis affects 200 million women worldwide and causes more than 8.9 millions fractures annually.[1] Osteoporotic fractures, particularly of hip are associated with higher mortality rates and loss of independence.[2] Increase in incidence of osteoporosis is seen worldwide as population starts aging. Studies have shown that approximately 30% of postmenopausal Caucasian women in the USA have Osteoporosis with the proportion of women with osteoporosis increasing to 70% in women over the age of 80 years.[3] This silently progressive metabolic bone disease is widely prevalent in India in both sexes and occurs at younger age than in western population. Rapid bone loss occurs in postmenopausal women due to hormonal factors. Indians have low bone density compared to Caucasians due to high prevalence of vitamin D deficiency, major factor for poor bone health in India. Agarwal VK et al mentioned in their study that a major effect of osteoporosis is fractures with nearly 1.5 million fractures annually attributable to osteoporosis.[4]

Generally, bone loss develops over a prolonged time and its pathogenesis can occur without warning symptoms. The pathogenesis of osteoporosis is an aberration in normal bone turnover, involving an imbalance between the processes of bone resorption and bone formation. Osteogenesis occurs rapidly during growth and leads to denser, longer, and heavier bones,

resulting in skeletal growth. Bone density in adults is a reflection of modifiable conditions at puberty, with the highest bone mass being attained at 30 years of age. Thus, this benchmark age is considered to be an important predictor for the subsequent development of osteoporosis. Currently, osteoporosis is a significant human and economic burden and will become even more significant in an aging society, giving rise to the decline in bone mass and an increased risk of fracture. Overall, hip fracture, one of the most serious outcomes of osteoporosis, is most frequent as life expectancy increases at a rate of 1–3% each year globally, and this is more pronounced in postmenopausal women.[5] Physical activity is protective against bone loss due to increase muscle mass. In postmenopausal women adipose tissue is the main site of androgen conversion to estrogen by enzyme aromatase.[6] Body weight contributes to the skeletal load and is therefore an important factor in increasing bone density and reducing bone turn over, so weight controlled exercise is advocated as a strategy for preventing osteoporosis.[7]

Some studies showed that bone of both the peripheral and axial skeleton is stable in women before menopause[8,9] but other studies suggested bone loss from the spine and femur begins in young adulthood.[10] In their lifetime 30-50% of women and 15-30% of men are at risk for osteoporosis and its related fractures all over the world.[11]

The mounting evidence suggesting beneficial effects on bone, increased body weight has emerged in recent years as a potential modifier of osteoporosis risk. In order to prevent osteoporosis there is a need to understand its risk factors. So the present study is designed to assess and compare the risk factors of osteoporosis among women and BMD at lumbar spine and femur neck in premenopausal and postmenopausal women.

MATERIALS AND METHODS

This hospital based prospective study was conducted on 350 women aged 30-65 years referred to the department of Radio diagnosis for Dexa scan as suspected cases of osteoporosis form various outpatient department. The study was approved by the ethical committee of SMS Medical College and hospitals, Jaipur, Rajasthan, India. An informed consent was obtained from each female for inclusion in this study.

WHO estimates of 33% for prevalence of osteoporosis among the females in India is taken as reference for arriving at the projected sample size. Assuming a prevalence of 33% and absolute precision of 5% with 95% confidence, the required sample size will be estimated to be 350 as per seed article (Jain V et al, 2013). This sample size is adequate for other objectives also.

Inclusion criteria comprised of age group of 30-65 years female as suspected cases of osteoporosis. Exclusion criteria was women with surgical menopause, pregnant and lactating women, carrying any disease or receiving treatment that could affect BMD, suffering from chronic renal disease, having endocrinopathies , liver disease ,scoliosis. Women in sample after DEXA scan were categorized in two groups: group A comprised of women those having normal BMD, considered as control group and group B comprised of women with low BMD either osteopenia or osteoporosis included in this group. Further in above both groups the females were categorized according to menopausal status i.e. premenopausal women (regular menses in past 12 Months) and postmenopausal women (absence of menses in past 12 months). Demographic details on age, socioeconomic status, geographical location, were collected.

Bone Density Measurement: Measurements of BMD (gm/cm^2) was done by using whole body densitometer, DEXA Scan 'T' scores. BMDs of the lumbar vertebrae (L2–L4) and femoral neck was measured according to protocols. The diagnosis of osteoporosis/osteopenia was done according to T-score values: normal if T-score ≥ −1.0; osteopenia if −2.5 < T-score < −1.0; osteoporosis if T-score ≤ −2.5. All the data were collected according to the recommendations of the International Society for Clinical Densitometry. WHO classification of BMD by T-score value; Normal: T-score at or above -1 SD Osteopenia: T-score between -1 and -2.5 SD Osteoporosis: T-score at or below -2.5 SD Established osteoporosis: T-score at or below -2.5 SD, plus fragility fracture. All data were correlated, calculated, compared and evaluated under guidance from Department of Statistics.All the clinical findings and Dexa scan were analysed. The data collected was compiled, tabulated, analyzed and subjected to statistical tests and was evaluated using standardized statistical methods in order to derive a logical conclusion i.e. mean, standard deviation and Pearson Chi-square test.

Table 1: Description of risk factors among the Premenopausal group:

Variables	Normal (80)		Osteopenia + osteoporosis (31)		Chi square	p value
	N	%	N	%		
Geographical location						
Urban	73	65.7	20	18.0	11.8(1)	.001*
Rural	07	6.3	11	9.9		
Socio economic status						
Upper	53	47.7	2	1.8		
Middle	24	21.6	11	9.9	51.2(2)	<0.01*
Lower	3	2.7	18	16.2		
Physical activity						
Low	16	14.4	17	15.3		
Moderate	55	49.5	11	9.9	14.0(2)	.001*
High	09	8.1	2	1.8		

*: statistically significant

Table 2: Mean description of various parameters among the Premenopausal group

Variables	Normal		Osteopenia + osteoporosis		p value
	Mean	SD	Mean	SD	
Age	41.08	5.42	44.06	4.42	.007*
Weight	67.26	11.05	59.80	10.13	0.001*
BMI	26.93	4.76	25.51	4.27	0.15
Waist circumference	34.41	3.80	33.54	3.09	0.25
Hip circumference	38.73	3.67	34.25	3.44	0.000*
BMD Lumbar Spine	1.19	0.12	0.90	0.10	<0.001*
Lumbar spine T score	0.26	0.76	-1.18	0.61	<0.001*
Lumbar spine Z score	0.52	0.83	-1.64	0.59	<0.001*
BMD Femur neck	1.05	0.14	0.73	0.10	<0.001*
Femur neck T score	-0.08	0.67	-1.65	0.46	<0.001*
Femur neck Z score	0.29	0.75	-0.87	0.74	<0.001*

Table 3: Description of risk factors among the Postmenopausal group

Variables	Normal (59)		Osteopenia + osteoporosis (180)		Chi square	p value
	N	%	N	%		
Geographical location						
Urban	50	20.9	125	52.3	5.31(1)	.021*
Rural	09	3.7	55	23.0		
Socio economic status						
Upper	33	13.8	9	3.7		
Middle	23	9.62	55	23.0	98.0(2)	<0.001*
Lower	3	1.2	116	48.5		
Physical activity						
Low	39	16.3	76	31.7		
Moderate	16	6.6	102	42.6	18.8(2)	<0.001*
High	04	1.6	2	0.8		

*: statistically significant

Table 4: Mean description of various parameters among the Postmenopausal group

Variables	Normal		Osteopenia + osteoporosis		p value
	Mean	SD	Mean	SD	
Age	54.21	3.50	59.75	4.83	<0.001*
Weight	69.89	12.28	56.99	9.83	<0.001*
BMI	29.00	5.40	23.41	4.46	<0.001*
Waist circumference	36.20	3.70	32.97	3.88	<0.001*
Hip circumference	40.37	4.22	37.21	3.96	<0.001*
BMD Lumbar Spine	1.16	1.30	0.80	0.14	<0.001*
Lumbar spine T score	-0.06	0.80	-2.48	0.98	<0.001*
Lumbar spine Z score	0.47	2.05	-0.95	1.40	<0.001*
BMD Femur neck	1.05	0.13	0.68	0.15	<0.001*
Femur neck T score	-1.50	0.70	-2.03	0.88	<0.001*
Femur neck Z score	0.24	1.0	-0.86	1.03	<0.001*

RESULTS

Table 1 shows description of risk factors among the Premenopausal group. A highly significant difference was observed b/w two groups in Hip circumference, BMD Lumbar Spine, Lumbar spine T score & Lumbar spine Z score, BMD Femur neck, Femur neck T score & Femur neck Z score significant difference in terms of age & weight and no significant difference was observed in BMI & waist circumference among the normal and premenopausal group (table 2).

Table 3 shows description of risk factors among the Postmenopausal group. A highly significant difference was observed b/w two groups in Age, weight, BMI, Waist circumference, Hip circumference, BMD Lumbar, Lumbar spine T score & Lumbar spine Z score, BMD Femur neck, Femur neck T score & Femur neck Z score of normal and low BMD group of Postmenopausal group (table 4).

DISCUSSION

In current study we assess the risk factor of osteoporosis among premenopausal and postmenopausal women. Of the 139 normal patients 80 (31%) were in premenopausal status and 59 (16.9%) in postmenopausal. Whereas in group 2 i.e. patients with osteoporosis and osteopenia 31 patients (8.9%) were in premenopausal and 180 (51.4%) were in postmenopausal state. Postmenopausal patients were found to be significantly associated with osteoporosis as compared to premenopausal women (p<0.01). Eisman J et al[12] reported that that among the randomly selected postmenopausal women, 29% reported having had one or more low-trauma fractures after menopause (44% substantiated in current records).

In present study we assess the risk factor of osteoporosis among the women so women were divided in to premenopausal and postmenopausal groups. Further pre and postmenopausal women again divided into normal and low BMD group. Of the 111 premenopausal women 80 were normal and 31 were in low BMD group whereas of the 239 post-menopausal women 59 were normal and 180 were in low BMD group.

In both the premenopausal and postmenopausal women geographical location either rural or urban was associated with Bone mineral density. Urban women had significantly lower BMD as compare to the rural women in both pre and postmenopausal women. Of the 180 postmenopausal women 125(69.4%) were belonged to urban areas.

In both pre and postmenopausal women socioeconomic status was significantly (p<0.001) related to the BMD. Low socioeconomic status was a good predictor of low BMD in both pre and postmenopausal women.

Women with low and moderate physical activity were more prone to the low BMD in both pre and postmenopausal women. Physical activity enhances the Bone mineral density in both pre and postmenopausal women.

Rapid bone loss is generally observed in elderly individuals and tends to worsen with advancing age. BMD of women decreases with age, indicating bone loss with age and menopause.

The mean and standard deviation of age in the premenopausal normal women was 41.08 ± 5.42 and in women with low BMD was 44.06 ± 4.42 years. Inthe postmenopausal normal women mean and standard deviation of age was 54.21 ± 3.50 and in women with low BMD was 59.75 ± 4.83 years. A significant difference was observed between normal and low BMD women in term of age in both groups.

Montazerifar F et al[13] included 80 postmenopausal women in their study. The mean age of women with normal BMD was 52.7 ± 8.years. Women with osteopenia and osteoporosis had the mean age 53.7±7.2 and 58 ± 8.4 years respectively. There was a significant difference between the mean age in patients with osteoporosis and control group (P < 0.05). Nidhi S Kadam et al[14] found the mean age of osteoporotic postmenopausal women was

57.5 ± 6.7. They also concluded that postmenopausal women with increasing were more susceptible for low BMD. Behzad Heidari et al[15] reported that age, anemia, inhaled corticosteroids and fracture history were associated with lower bone mineral density and higher prevalence of osteoporosis.

Alonge TO et al[16] suggested that most significant factors associated with osteoporosis were increasing age, female sex, lack of formal education, lack of engagement in occupational activities and living with relatives/friends. Our results are in agreement with the author.

The mean and standard deviation of weight in the premenopausal normal women was 67.26 ± 11.05 and in women with low BMD was 59.80 ± 10.13kg. In the postmenopausal normal women mean and standard deviation of weight was 69.89 ± 12.28 and in women with low BMD was 56.99 ± 9.83 kg. A significant difference was observed between normal and low BMD women in term of weight in both groups. The mean weight of low BMD group was less than compare to normal group in both pre and postmenopausal women.

In our study we found that postmenopausal women with low BMD had comparatively less weight than the premenopausal women. Kadam NS et al[14] found the weight of post-menopausal women was 66.3 ± 12.2kg and premenopausal women were 67.6 ± 12.5kg. They did not found any significant difference between the weight of both groups.

Montazerifar F et al[13] found that postmenopausal women in osteopenia and osteoporotic group had less mean weight 69 ± 10.4 and 63 ± 10.2kg respectively, as compare to the normal group mean weight that was 82 ± 12.4kg.

KA Al-Shoumer KA et al[17] in their study reported that overweight and obese had significantly higher BMD than normal weight postmenopausal women. BMD of the spine, femur neck, and femur total demonstrated significant positive correlations with body weight whereas they demonstrated significant negative correlations with age.

In our study the mean and standard deviation of BMI in the premenopausal normal women was 26.93 ± 4.76 and in women with low BMD was 25.51± 4.27kg/m2. We found a statistically no significant difference in the BMI of premenopausal women among normal and low BMD group (p=0.15). In the postmenopausal normal women mean and standard deviation of BMI was 29 ± 5.40 and in women with low BMD was 23.41± 4.46. A highly significant difference was observed between normal and low BMD women in postmenopausal women (p<.001). Overweight postmenopausal women had a high Bone mineral density than the normal weight women. Several studies showed the effect of body mass index on BMD in postmenopausal women.

Montazerifar F et al reported that BMI in postmenopausal women with normal BMD was 33.5± 7.1, in osteopenic and osteoporotic postmenopausal women BMI was

27.9 ± 4 and 26.2 ± 3.6 respectively; mean BMI were found to be significantly lower in patients with low BMD as compared to the normal group (P < 0.0001). They concluded that obese postmenopausal women had high BMD.

Chowdhury B et al[18] reported in their cross sectional study of 90 postmenopausal women aged 45–85 years, that BMI had significant association with BMD with a correlation of .846. Low weight and BMI predict osteoporosis and were associated with increased risks in postmenopausal women.

Douchi T et al[19] observed that In postmenopausal women, lean mass amount, total fat mass amount were significant determinants of BMD (R2=0.273, P<0.001). In premenopausal women total fat mass amount and percentage of body fat were not significant determinants of BMD. They concluded the effect of overall adiposity on BMD is more prominent in postmenopausal women than in premenopausal women.

Kumar A et al[20] found in their study that BMI was significantly associated with low BMD at both sites in premenopausal women, while the association was lost in postmenopausal females. According to them BMI is an important determinant of BMD in Indian females and the association is not present in postmenopausal women with osteopenia. They concluded that increase in BMI on BMD has a ceiling effect, and moderate to morbid obesity might not actually be a preventive factor for osteopenia.

In present study we found a non-significant relationship between the waist circumference of premenopausal women in both the normal and low BMD group (p=0.25) where as a significantly lower waist circumference was observed in postmenopausal women (p<0.001). In our study mean waist circumference of postmenopausal women with normal BMD was 36.20 ± 3.70 and in Low BMD group this was 32.97± 3.88 inches. Tariq S et al[21] in their study found that mean waist circumference of postmenopausal women with normal BMD was 38.70 ± 1.36 and in osteopenic and osteoporotic group this was 39.3± 1.19 inches& 38.7± 1.45inches respectively; they found a non-significant relationship of waist circumference in both the normal and low BMD group in postmenopausal women (p=0.433).

CONCLUSION
Based on the result of our study we conclude that postmenopausal women with older age, Low socioeconomic status and with low level of physical activity were at higher risk of low BMD. Body mass index found to be positively associated with Bone mineral density in postmenopausal women only whereas negative correlation was found with age in both pre and postmenopausal women.

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