

Prevalence of Osteoporosis in Female Population in Rural Central India [By Calcaneal Ultrasound]

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Abstract

Introduction: Osteoporosis poses a huge challenge in India, as it is a developing country due to demographic transition and aging of the population along with limited resource availability in rural India. Worldwide, osteoporosis predominantly affects postmenopausal women, and elderly population of both gender. Previously osteoporosis has been primarily considered of disease of postmenopausal women. The exact disease burden is difficult to quantify because of the limited data availability along with difficult quantification of magnitude of the problem. The World Health Organization [WHO] has developed an algorithm for estimation of ten year fracture risk, which may be used even in the absence of bone mineral density. Smoking or tobacco intake, malnourishment, alcohol has a negative effect on bone mineral density [BMD].

Purpose: The aim of this study is to evaluate osteoporosis screening of the rural female population to establish correlation of osteoporosis with age group and socioeconomic strata of the patients.

Methods and Material: A total number of 3532 rural female patients were screened and graded accordance to their demographic profile and socioeconomic strata. All the patients were screened for osteoporosis using a portable heel ultrasound bone densitometer. In all the female patients bone mineral density [BMD] was measured.

Results: Results showed significant population had lower BMD score, which suggest osteoporosis and had statistical significant correlation with their socioeconomic, literacy and emotional family backup.

However, we found that the prevalence of osteoporosis was homogenous in all the age group.

Keywords: Bone Mineral Density [BMD]; Female population; Heel ultrasound; Osteoporosis; Rural India; Socio-economic

Introduction

Osteoporosis has haunted women since the dawn of history. Egyptian mummies from 4,000 years ago have been found with the telltale dowager's hump. Osteoporosis is a major international health problem, accentuated by increasing longevity [1,2]. Osteoporosis is estimated to affect 200 million women worldwide-approximately one-tenth of women aged 60, one-fifth of women aged 70, two-fifths of women aged 80 and two-thirds of women aged 90 [3]. 1 out of 8 males and 1 out of 3 females in India suffers from osteoporosis, making India one of the largest affected countries in the world [4].

Osteoporosis is characterized by a deficiency of bone tissue relative to the volume of anatomical bone. This reduced density increases susceptibility to fracture. Such a reduction reflects either the inadequate accumulation of bone tissue during skeletal growth and consolidation, excessive losses thereafter, or both [5]. Osteoporosis is more common clinical problem in India and in throughout the world. Majority of the post-menopausal women and aged population are affected [6]. Osteoporosis is the decrease in bone mass is due to activation of osteoclasts, which enhances bone resorption. Postmenopausal osteoporosis is the most common primary type and is characterized by rapid bone loss in recently postmenopausal women and since there are no safe, effective ways to rebuild, the osteoporotic skeleton, prevention by maximizing bone mass during skeletal growth and by development and minimizing postmenopausal bone losses, emerges as the key strategy. Therefore knowledge of appropriate timing of peak bone mass and bone mineral density is essential if preventive measures are to be adequately taken. [7,8].

Aim & Objectives

Aim of this study is to evaluate the prevalence of Osteoporosis in

Female population in Rural Central India and to establish correlation of osteoporosis with age group and socioeconomic strata of the patients based on Singh's Socio Economic Emotional Scale [SSEE].

The objectives were to screen the rural female population for osteoporosis using a portable ultrasound heel bone densitometer and to correlate the level of osteoporosis with the age group of the patients and the socio economic strata of the patients.

Materials and Methods

Subject

Rural Female Population from Central India-All the female patients aged more than 20 years, belonging to rural areas from Central India who were attending outpatient clinic at Acharya Vinobha Bhave Rural Hospital, Wardha [AVBRH], Sawangi, during the year 2014 were screened for Osteoporosis. A socio economic grading of all the patients was done using SSEE Scale. A total of 3532 Female patients were screened. All female patients gave written informed consent for the same. Female patients on chronic medications known to affect the

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bone metabolism e.g. Oestrogen, diuretics, thiazides etc. were excluded. Also the patients with inflammatory arthritis, hypo- and hyperthyroidism, chronic liver and kidney disease, previous gastrointestinal surgery, malignancy mal-absorption syndrome, organ transplant or osteoporotic fractures were excluded. The female patients were graded on SSEE scale because, the poor socioeconomic condition patients cared less regarding the diet and nutrition and were more concerned regarding earning of wages.

Quantitative ultrasound [QUS] bone densitometer

A heel BMD was estimated of right foot in all the subjects using a QUS bone densitometer. Quality assurance test for device was performed on each day of screening. The measurements were carried in a room by a single technician to perform the entire test in all the subjects.

Data analysis

Total Subjects were divided into the following category:

- i) Age Group I: <30 years
- ii) Age group II: 31–45 years
- iii) Age group III: Greater than 46 years and less than 76 years

The mean ± SD values of estimated heel BMD was calculated in each group. The calculated mean and SD for estimated heel BMD in the sub-group of healthy young subjects was used to calculate T-scores in men and women separately as follows:

$$T\text{-score} = \frac{\text{Measurement value} - \text{Sex-matched Young adult mean}}{\text{Sex-matched Young adult population SD}}$$

Results

Total number of sample size was 3532 and the mean age was 29.32 ± 9.8. Out of 1141 patients in age group of < 30 years there were 373 Normal Bone Mineral Density patients, 398 Osteopenic patients, and 379 osteoporotic patients. In age group between 31–45 years there were 378 Normal bone mineral density patients, 431 Osteopenic patients and 384 Osteoporotic patients making a total of 1190 patients. In the age group of more than 46 years there were 382 normal bone mineral density patients, 435 Osteopenic patients and 372 osteoporotic patients making a total of 1201 patients (Tables 1,2).

The total numbers of patients were 3532 in number with 1133 normal patients, 1264 Osteopenic patients and 1135 Osteoporotic patients. Our study revealed a prevalence of osteoporosis in 32.13% and osteopenia in 35.78% of females in age between 20 and 76 years when measured by calcaneus ultrasound. (Figure 1).

Age group	Normal	Osteopenic	Osteoporotic	Total
<30	373	398	379	1141
31-45	378	431	384	1190
>46	382	435	372	1201
Total	1133 (32.07%)	1264 (35.78%)	1135 (32.13%)	3532 (100%)

Table 1: Age wise distribution of Normal, Osteoporotic and Osteopenic patient. Calculated:

In patients with age of less than 30 years BMD gm/cm² was 0.389 ± 0.035 and the T-score was -0.21 ± 1.41.

In patients between 31–45 years of age the BMD gm/cm² was 0.371 ± 0.089 with the T-score of -1.09 ± 2.97. Patients with age more than 46 years the BMD gm/cm² was 0.332 ± 0.026 and the calculate T-score was -1.94 ± 1.25.

Analysis of variance test reveals that there is no statically significant difference in the prevalence of Osteopenia or Osteoporosis among various age group applying the One-Way ANOVA Test the p value was 0.621, which was non-significant.

SSEE scale	Total number of patients	Percentage (%)	MEAN BMD
Below 6	1343	38.02	-0.11 ± 1.65
6-9	1232	34.88	-1.09 ± 1.57
Above 9	957	27.09	-2.29 ± 1.04

Table 2: Distribution of patients by Singh's socio-economic-emotional scale (SSEE scale).

Minimum SSEE scale of a patient is 3 and maximum is 13. Mean scale is 7.8 Patients were distributed according to SSEE scale into 3 groups. 27% of patients had scale above 9 whereas 38% of patients were having below 6 score. Best score was 3 whereas worst score was 13.

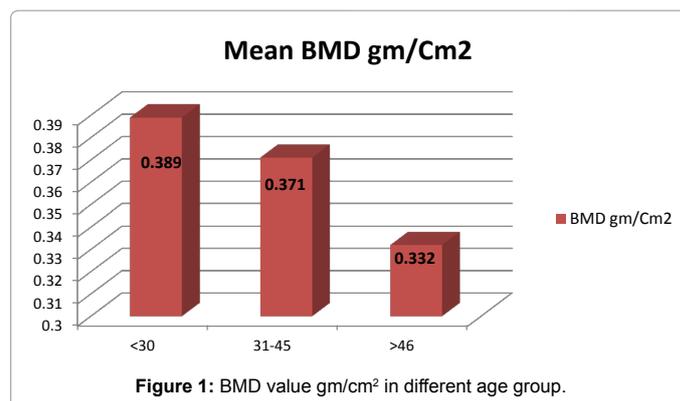


Figure 1: BMD value gm/cm² in different age group.

Discussion

Osteoporosis is defined as a progressive systemic skeletal disease characterized by low bone mass and micro-architectural deterioration of bone tissue with consequent increase in bone fragility and vulnerability to the fracture [9]. Osteoporosis is characterized by low BMD and a resultant increased risk for fractures. It is estimated that as many as 1 in 2 women and 1 in 5 men are at risk for an osteoporosis-related fracture during their lifetime [10]. However, women aged 30-60 years from low-income groups, bone mineral density [BMD] at all skeletal sites was much lower than values reported from developed countries, with a high prevalence of osteopenia [52%] and osteoporosis [29%] [11]. The prevalence of osteoporosis in rural Indian population has not been studied yet. We found the prevalence in our population 32.47%.

The prevalence of osteoporosis has been studied widely in Indian population and a study of Indian population by RK Marwaha et al. revealed that osteoporosis was present in 42.5 % of female subjects and osteopenia in 44.9% in population more than 50 years of age [12].

Indian Council for Medical Research [ICMR] carried out a large multicenter study, which confirmed data from smaller, single-center studies, and showed that Indians have lower mean BMD [13]. Numerous studies equate DXA to heel ultrasound when used to measure BMD for screening, as DXA is not cost effective and is not available everywhere, especially when a need arises to screen larger populations [14]. Prevalence of osteoporosis among women aged older than 50 years was significantly higher based on Caucasian T-scores as opposed to using peak BMD/standard deviation values from the population under review at lumbar spine. However, there was no major difference observed at femoral neck [15]. Our prevalence of osteoporosis and osteopenia among rural women age between 20 and 76 was 32.47% when measured at heel by ultrasound.

The peak value of estimated heel BMD [g cm-2] achieved in the age group 20-40 years was 0.522 and 0.528 in the rural and urban women respectively [16]. The percentage loss in estimated heel BMD [g cm-2] between the age groups of 20-40 and 41-59

was 17.1% and 8.4% in rural and urban women respectively. Also, the percentage loss in estimated heel BMD between the age groups of 20-40 and greater than 60 years was 33.6% and 21.6%. Whereas our study showed in heel BMD was 0.354 ± 0.096 gm/cm². The mean BMD T Score was 1.24 in over all patients, which shows the prevalence of osteopenia is generally prevalent in the rural female community. We noticed a loss of estimated heel BMD of 4.62% and 14.65%, for age group of 31 – 45 years and more than 45 years respectively, when compared against females of less than 30 years. A loss of 10.51% of estimated heel BMD was noted when compared between 31–45 years and more than 45 years of age group subject. However, there was no significant difference in the BMD T Score when compared within different age group. (Table 3).

The prevalence of osteoporosis and osteopenia in our study was found to be high [32.47%] in all the age groups and which was correlated in our study with the Singh's Socio Economic Emotional [SSEE] status of our patients. There was a significant positive correlation between increasing age, nutritional intake, socio economic status, lack of exercise, and low BMD. In rural Indian females nutritional status of females is directly affected by socioeconomic status, and emotional back up this patients have from their families and relatives. Our patients were rural females, and most of the patients had high SSEE index score, and were least supported emotionally and economically. The patients had least caring regarding the diet and their diet did not consist of milk or milk products in view of male dominance of Indian society. Poor economic status and illiteracy caused lack of awareness about nutrition

Age group	MEAN BMD gm/Cm ²	Calculated T-score	One way ANOVA Test
<30	0.389 ± 0.035	-0.21 ± 1.41	p value 0.621
31-45	0.371 ± 0.089	-1.09 ± 2.97	
>46	0.332 ± 0.026	-1.94 ± 1.25	NS
Total	0.354 ± 0.096	-1.24 ± 3.87	

Table 3: BMD and T Score accordance to their age group.

The chart shows the calculated Mean BMD gm/cm² in patients less than 30 years to be 0.389, in patients with 31–45 years to be 0.371 and in patients with more than 46 years of age to be 0.332.

Emotional support	Score
Grade I–Full emotional support with full time relatives to attend the patient	1
Grade II–Average emotional support by relatives	1
Grade III– Minimum emotional support by the relatives	1
Grade IV– No emotional support by the relatives	1
Literacy level:	1
Grade I-Graduate	1
Grade II-High school	1
Grade III-Primary	1
Grade IV-Not educated	1
Modified Prasad's socio-economic status²²⁸	1
I-Indian Rupees ₹ 5156 and above	1
II-Indian Rupees ₹ 2578-5155	1
III-Indian Rupees ₹ 1547-2577	1
IV-Indian Rupees ₹ 773-1546	1
V-Below Indian Rupees ₹ 773/-	1
Best score-3; Worst score-13	Total: 13
The SSEE scoring system gives one point each to level of emotional support, literacy and socio economic status of the individual and is a comprehensive tool based on Indian scenario, especially in rural and underdeveloped regions of India and hold true in aspects related to social, economic and literacy level.	

Table 4: Singh's socio-economic-emotional scale.

and exercises and forced them to be a daily wage earner rather than concentrating on exercises and high calcium diet. Most patients were from the poor, economically and emotionally deprived background, hence the nutritional status of these patients was poor. This is possible reason of high prevalence of osteoporosis in rural females among those patients who had higher SSEE scale. That shows the cause of osteoporosis and osteopenia is related with socio economic status of the patients. (Table 4). Assessment of osteoporosis at rural health care level, and the SSEE score are the major milestones toward assessing the osteoporosis and risk factors.

Conclusions

Our study conclude that the prevalence of osteoporosis in rural community has less linear correlation with age group of the patients; rather it is closely related with socio economic strata of the patients. Treating physicians should keep in mind the socioeconomic as well as emotional family support to the female patients while managing this disease.

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