Screening for Osteopenia and Osteoporosis in an Urban Community in India

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ABSTRACT

Osteoporosis is a disease characterized by reduction in the bone mass and disruption of bone architecture leading to impaired skeletal strength and an increased susceptibility of fractures. It is a major public health problem associated with substantial morbidity and socio-economic burden worldwide. The present study was planned to screen bone status of adults over 20 years (when peak bone mass is formed) utilizing calcaneal quantitative ultrasound (QUS) (Hologic Sahara 0058 USG) as a diagnostic tool. A screening camp was conducted in the 1st week of February 2008 at the Terna Hospital and Research Centre along with the Orthopedic Department. A questionnaire was administered to all the screened individuals which included socio-demographic data, assessment of susceptibility to osteoporosis and dietary habits. The bone mineral density (BMD) was measured at the calcaneus by QUS and T-scores were calculated based on WHO criteria. The study yielded a prevalence of 41.4% among women and 33.33% among men for Osteopenia and 12.85% among women 3.7% among men for Osteoporosis respectively. The mean age of the screened sample was 44.25 years. The mean weight, height and body mass index was 56.95 kg, 157.47 cms and 23.047 respectively. The mean bone density was -0.749. A total of 97 individuals screened; of which 70(72.1%) were females and 27(27.9%) were males. There was a significant trend of decreasing bone density with an increase in age. Age had an influence on the outcome of osteopenic and osteoporosis score in present study. The subjects with low bone mineral density (BMD) were advised to undergo a Dual energy X-ray absorptiometry (DEXA) scan in order to confirm the diagnosis. The US Preventive Services Task Force recommends routine screening for Osteoporosis in women over 65 years. In India we need to carry out further studies on whether we need to consider screening at an earlier age and also to study osteoporosis in males.

Keywords: Body mass index, Bone mineral density, Osteopenia, Osteoporosis.

INTRODUCTION

Osteoporosis is a disease characterized by reduction in the bone mass and disruption of bone architecture leading to impaired skeletal strength and an increased susceptibility of fractures.[1] It is a major public health problem associated with substantial morbidity and socio-economic burden worldwide.[2] Moreover, the proportion of elderly population is rapidly increasing in the developed as well as the developing world, which increases concern among aging population and public health workers regarding disability, dependence and the associated economic and social problems that are caused by osteoporosis. Osteoporosis does not have a dramatic clinical presentation except when fractures result.[3]

Osteopenia is a condition of bone in which there is a generalized reduction in bone mass that is less severe than that in osteoporosis, caused by the resorption of bone at a rate that exceeds bone synthesis.[4]

Measuring the bone density remains the only important tool in the early diagnosis of osteoporosis, so that effective preventive and therapeutic measures can be initiated at the earliest. The gold standard for measuring bone density is the Dual energy X-ray absorptiometry (DEXA), a useful tool for both the axial and appendicular skeleton as the detection rate of osteopenia and osteoporosis is higher with it in comparison to calcaneal quantitative ultrasound (QUS) method.[5] But the commonest used modality of measuring bone density still remains to be calcaneal QUS. It has gained the importance in the situation where tools like DEXA are not available. The calcaneal QUS is cost effective, lacks deleterious effect of radiation and is portable. Thus, it can be useful for an early diagnosis of osteoporosis so that intervention can be done at the earliest to such patients.[6]

Except in a handful of industrializied countries there is a considerable void in our knowledge of the burden of illness (BOI) of osteoporosis.[7]

Similar studies evaluating bone status outside India and within India are present in the literature but still the data is scanty. Hence, the present study was planned to screen bone status of adults over 20 years (when peak bone mass is formed) utilizing calcaneal QUS (Hologic Sahara 0058 USG) as a diagnostic tool.

MATERIALS AND METHODS

A screening camp was conducted in the 1st week of February 2008 at the Terna Hospital and Research Centre along with the Orthopedic Dept. A questionnaire was administered to all the screened individuals which included socio-demographic data, susceptibility to osteoporosis and dietary assessment.[8] The BMI was measured using Quetelet's Index (wt kg/ ht^2 m).

The bone mineral density was measured at the calcaneus by QUS and T-scores were calculated based on WHO criteria.[9]

T-score (Ratio between patients BMD and that of young adult population of same sex and ethnicity).

T-score of > -1 was taken as normal,
between -1 to -2.5 osteopenic and
< -2.5 as osteoporotic.

T-score was utilized to find out the prevalence and age wise trend of osteopenia and osteoporosis in the present study.

Statistical analysis was performed with the help of SPSS software. The statistical significance among categories variables was assessed by the use of chi-square test for trend. P value of <0.05 was considered statistically significant.

RESULTS

A total of 97 individuals were screened. There were 70 (72.1%) female and 27 (27.9%) male subjects.

Eighty one (83.5%) were married, 15 (15.5%) were unmarried and 1 was divorced as per self verdict.

The mean age of the screened sample was 44.25 years. The mean weight, height and body mass index was 56.95 kg, 157.47 cms and 23.04 respectively.

The mean bone density was -0.749.

The mean age of the subjects (± SD) with Osteoporosis was 54.17+/-14.17 with a min age of 21 and a max age of 75 yrs. The mean age of the subjects with Osteopenia was 45.67 +/-11.98 with a minimum age of 21 and a maximum age of 65 yrs. The mean age of the subjects with Normal bone density was 40.78 +/-14.72 with a minimum age of 20 and a maximum age of 64 yrs. There was a significant trend of decreasing bone density with an increase in age (Table-2).

Table-1: Socio-demographic data

Parameter	Sample	Min	Max	Mean	SD
Age	97	20	70	44.25	14.24
Weight(Kg)	97	34	79	56.95	10.06
Height(Cms	97	131	184	157.47	8.98
BMI	97	14.52	32.89	23.05	4.12
Bone Density	97	-3.6	3.5	-0.75	1.61

Table-2: Age wise trend of bone mineral density (BMD)

AGE GROUP	GROUP BMD			Total
	Normal	Osteopenia	Os oporosis	
20-39 yrs	23	10	1	34
	46.9%	27.8%	8.3%	35.1%
40-59 yrs	17	20	6	43
	34.7%	55.6%	50.0%	44.3%
60 yrs & more	9	6	5	20
	18.4%	16.7%	41.7%	20.6%
Total	**49**	**36**	12	97
	100.0%	100.0%	100.0%	100.0%

χ^2= 10.071 DF= 4 P value = **0.039 (Significant)**
Prevalence of Osteoporosis was greater after 40 years of age.
100% of the population over 65years of age of both the sexes had Osteoporosis

There is a significant increase in the mean age of the subjects with osteoporosis (Table-3). 12.85% of women and 3.7% men had osteoporosis.38.57% of women and 33.33% of men had osteopenia (Table-4). Forty women had attained menopause. Their mean bone density was -1.205 with the lowest being -3.5 (Table-5) 17 (41%) menopausal women had osteopenia and 8 (20%) had osteoporosis (Table-6).

10.52% of the osteopenics were underweight, 57.89% were of normal wt and 31.57% are obese. 70% of the osteoporotics were of normal wt and 30% were overweight (Table-7).

Assessment of Dietary Habits: Thirty four (35.05%) were pure vegetarians. 47(48.45%) consumed fish at least once a week. 23(23.71%) did not consume any dairy products. 73(75.25%) consumed 1-2 servings of dairy products in a day. 26 (28.86%) were taking Calcium supplements.

DISCUSSION

In the present study a total of 97 individuals were screened; of which 70 (72.1%) were females and 27 (27.9%) were males. The prevalence of Osteoporosis was 12.85% among the women and 3.7% among men.

The prevalence of Osteopenia was 44.1% among women and 33.33% among men. The mean age of the screened sample was 44.25 years. The mean weight, height and

Table-3: Mean difference in age (Post Hoc Tests Bonferroni)

		Mean Difference	P value	Sig.
Normal	Osteopenia	-4.891	.322	Not significant
	Osteoporosis	-13.391*	**.009**	**Significant**
Osteopenia	Osteoporosis	-8.500	.197	Not significant

The mean age is significantly more in the osteoporosis group.

Table-4: Correlating Gender with Bone Mineral Density

Sex	Group BMD			Total
	Normal	Osteopenia	Osteoporosis	
Female	32 65.3%	27 75.0%	11 91.7%	70 72.2%
Male	17 34.7%	9 25.0%	1 8.3%	27 27.8%
Total	49 100.0%	36 100.0%	12 100.0%	97 100.0%

12.85% of women and 3.7% men had osteoporosis

38.57% of women and 33.33% of men had osteopenia

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	3.564[a]	2	.168	.186
Likelihood Ratio	4.095	2	.129	.126
Fisher's Exact Test	3.368			.206
N of Valid Cases	97			

body mass index (BMI) was 56.95 kg, 157.47 cms and 23.05 respectively. The mean bone density was -0.749.

Studies reporting bone parameters of the Indian population involving large sample sizes are not available. Shatrugna *et al*[10] carried out a study with 289 women in the 30–60 year age group to estimate the prevalence of osteoporosis and measure the bone parameters by dual energy X-ray absorptiometry (DEXA). The mean (± SD) age in their study was 41.0±8.60 years. The mean (± SD) height, weight and body mass index (BMI) were 149.1±5.49 cm, 49.2±9.85 kg and 22.1±3.99, respectively. . The prevalence of osteoporosis at the femoral neck was around 29%. Bone mineral density (BMD) and T scores at all the skeletal sites were much lower than the values reported from the developed countries and were indicative of a high prevalence of osteopenia and osteoporosis.

Sharma *et al*[11] did a preliminary screening over 6 months in women over 25 in Jammu the results suggested that a substantial female population had oesteopenia and osteoporosis after the age of 45 years. The incidence of osteoporosis was (20.25%) and osteopenia (36.79%) with maximum number of both osteoporosis and osteopenic women recorded in the age group of (55-64 years). After the age of 65 years, there was an almost 100% incidence of either osteopenia or osteoporosis, indicating that it increases with age and in postmenopausal period, thereby suggesting lack of estrogenic activity might be responsible for this increasing trend.

In the present study too there is a significant trend of decreasing bone density with an increase in age. The mean age of the subjects with Osteoporosis was 54.17 +--14.173 with a minimum age of 21 and a maximum age of 75 yrs. The mean age of the subjects with Osteopenia was 45.67 +--11.98 with a minimum age of 21 and a maximum age of 65 yrs. The mean age of the subjects with normal bone density was 40.78 +--14.72 with a minimum age of 20 and a maximum age of 64 yrs. There is a significant increase in the mean age of the subjects with osteoporosis.

Ahuja[12] in a necropsy study on variation in the bone density reported that 44% of the persons studied over 50 yrs of age exhibited significant osteoporosis. The apparent bone density showed a progressive and significant decline with age in all the trabecular bones. It is possible that nutritional factors such as protein calorie malnutrition may be responsible for this high incidence.

Most of the studies on osteoporosis are carried out among women as it is more common among them. Shankar Acharya *et al*[13] studied Indian women between 40-60 yrs and found that spinal osteoporosis was widely prevalent in them especially after the age of 50. The Peak bone mass refers to the genetic potential for bone density. By the age of 20, the average adult has acquired most of his/her skeletal mass. A large decline in bone mass occurs in older adults, increasing the risk of osteoporosis. For women this occurs around the time of menopause.[1] In the present study too, 40 women had attained menopause. Their mean bone density was -1.205 with the lowest being -3.5. 17(41%) menopausal women had osteopenia and 8 (20%) had osteoporosis. Melton L J III[14] estimate that 30% of postmenopausal women white women in the USA are

Table-5: Anthropometric profile of women who had attained menopause in the study population (n = 40)

Parameter	Sample (n)	Min	Max	Mean	SD
Age	40	33	70	53.125	8.361
Weight(Kg)	40	34	79	56.20	10.51
Height(Cms)	40	144	164	152.35	4.197
BMI	40	14.52	32.89	24.184	4.217
Bone Density	40	-3.6	3.5	-1.205	1.6322

40 women had attained menopause. Their mean bone density was -1.205 with the lowest being -3.5. 17(41%) had osteopenia and 8 (20%) had osteoporosis.

Table-6: Correlating menopausal status with bone mineral density

Menopause Attained	GROUP BMD			Total
	Normal	Osteopenia	Osteoporosis	
NO	18	10	3	31
	56.2%	37.0%	27.3%	44.3%
YES	14	17	8	39
	43.8%	63.0%	72.7%	55.7%
Total	32	27	11	70
	100.0%	100.0%	100.0%	100.0%

χ^2= 3.722 DF= 2 P value = 0.156 NS

Table-7: Co-relating BMI with bone density

BMI	N	Mean	Std. Deviation	Minimum	Maximum	F	P value	Sig.
Normal	47	22.157	4.4708	11.0	32.9	1.276	.284	Not Significant
Osteopenia	35	23.601	3.9929	17.3	32.9			
Osteoporosis	12	23.392	3.9687	17.7	29.8			

10.52% of the osteopenics were underweight, 57.89% were of normal wt and 31.57% are obese.
70% of the osteoporotics were of normal wt and 30% were over weight

affected by Osteoporosis and the proportion increases to 70% for women over 80yrs. The International Osteoporosis Foundation report how fragile is her future?[15] Revealed that despite the vast progress made in osteoporosis research and education over the last decade, bone loss is still not being detected early enough to protect postmenopausal women from osteoporosis-related fractures.

In the present study the younger age group 20-39yrs (26.31%) had osteopenia. The National Institute of Nutrition (NIN) studies[16] reveal that Indian women experience early onset of Osteoporosis due to diets low in calories, proteins and Calcium. They also breastfeed their infants for prolonged periods. In light of the exclusive breastfeeding recommendation we need to carry out large field studies to assess the bone status of the population. It is important for young girls to reach their peak bone mass in order to maintain bone health throughout life. A person with high bone mass as a young adult will be more likely to have a higher bone mass later in life. Inadequate calcium consumption and physical activity early on could result in a failure to achieve peak bone mass in adulthood.

There was no significant difference in the dietary habits and lifestyle of the subjects with normal and low bone density but their role needs to be substantiated by conducting larger studies in future.

Also 100% of the study population over 65 yrs were osteoporotic including the males. We also need to study osteoporosis in males since most of the previous studies have focussed on females.

Screening for osteopenia and osteoporosis in an Urban population using calcaneal QUS method utilizing WHO T score criteria yielded a prevalence of 41.4% among women and 33.33% among men and 12.85% among women 3.7% among men respectively. Age had an influence on the outcome of osteopenic and osteoporosis score in the present study. For the subjects screened in the present study those with low BMD were advised to undergo a Dual energy X-ray absorptiometry (DEXA) scan in order to confirm diagnosis.

The US preventive services task force[17] recommends routine screening for Osteoporosis in women over 65years. In India we need to carry out further studies on whether we need to consider screening at an earlier age and also to study osteoporosis in males.

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