Preliminary screening of osteopenia and osteoporosis using Quantitative Ultra Sound bone densitometry: A study from South India

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ABSTRACT *Osteoporosis, silently progressing metabolic bone disease is widely prevalent in India. The osteoporosis condition can be present without any symptoms for decades unless bone fractures. The early detection of low bone mass status is the best means of predicting the osteoporosis risk and reducing the fracture rates. In view of the need of prior identification of risk levels, the present study is focused on preliminary screening of osteoporosis in 152 urban women (35-74 years) in Andhra Pradesh using the cost effective bone densitometry technique, Quantitative Ultra Sound (QUS) bone densitometry. The results indicate an increasing trend of osteoporosis with the advancing age from younger (9.5 percent) towards elderly (73.1 percent). It is interesting to observe that nobody in the elderly group experiences normal bone status indicating suffering from either osteopenia or osteoporosis. The study represents the incidence of 32.9 percent osteoporosis in women screened for osteoporosis.*

Introduction

Osteoporosis is defined as "a systemic skeletal disease characterized by low bone mass and micro architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture". It becomes a major public health problem world wide and its prevalence is increasing with rise in the ageing population. The population in India will increase to 1367 million by 2020 and 1613 by 2050 of which 9.8 % (134 million) and 19.6% (315 million) respectively will be adults over 60 years. These staggering numbers emphasized greater threat for osteoporosis in India in the years to come. [1, 2]

The low bone mass and bone quality both play an important role in osteoporosis. The former can be easily measured and hence has become the diagnostic tool for osteoporosis. Although several techniques are available to measure the bone density levels in women, Quantitative Ultra Sound (QUS) bone densitometry method gains much popularity owing to its portability, non-invasiveness, no irradiation and relatively inexpensive. All the advantages make the QUS procedure as the major means of establishing the incidence data base at community level and serves as the preliminary screening tool to identify patients at risk of osteoporosis. [3]

Materials and methods
Sample
The initial first phase of the study is planned to examine bone mineral density (BMD) using QUS technique for preliminary screening of osteoporosis in a group of urban women constituting about 152 women aged around 35 to 74 years. The study group is categorized into four different age groups viz., 35-44 years (n=42), 45-54 years (n=46), 55-64 years (n=38) and 65-74 years (n=26). The experiment is carried out among the voluntarily participating women at different BMD campaigns organized at the local orthopedic clinic of Tirupati in Andhra Pradesh, South India with the prior consent from the concerned medical authorities.

BMD analysis using QUS bone densitometry
The BMD is measured at calcaneous bone using QUS and categorized the sample into normal, osteopenia and osteoporosis based on WHO criteria of BMD T-score standard deviation (SD) against young normal adult mean. The women with BMD T-score up to -1.0 SD were considered as normal, -1.0 to -2.5 SD as osteopenia and more than -2.5 SD as os-

teoporosis. [4]

Statistical analysis The results obtained are expressed as means ± standard error and at 95% confidence intervals. The mean difference in BMD T-scores of osteopenic and osteoporotic women against normal individuals is tested statistically by analysis of variance using SPSS 11.5 version.

Results and discussion
The prevalence of osteopenia and osteoporosis in the select urban group and level of significance were presented in table-1. The data from the table clearly indicated considerable percentage of low bone mass (osteopenia) about 36.8 % and poor bone mass condition (osteoporosis) to the extent of 32.9%. The overall mean BMD T-score found to be varied from -0.31 to -4.13. The prevalence rates represented an immediate need to care of the general bone health to minimize further bone loss as an individual reached to geriatric age.

Table 1 about here
The differences in mean BMD T-scores of normal, osteopenic and osteoporotic women obviously showed highly significance (p<0.001) as bone mineral densities regressed from normal towards osteopenia and then to osteoporosis. In other words, the bone started to weaken when it looses bone strength from normal to low bone mass condition of osteopenia and worsen as it shifted towards osteoporosis with gradual increase in porosity.

The mean BMD T scores of normal, osteopenic and osteoporotic women in four different age groups viz., 35-44 years (young), 45-54 years (middle), 55-54 years (aged) and 65-74 years (elderly) were tabulated in the table-2. The results were very much interesting where the trend of gradual decline in bone density with the progressive age was noticed among all normal (-0.55±0.15 to -0.78±0.08), osteopenic (-1.75±0.47 to -2.39±0.07) and osteoporotic women (-2.39±0.07 to -3.36±0.44). Other important noteworthy point observed that all of the elderly women suffer from either osteopenia or osteoporosis and nobody had normal bone status (65-74 years). The observations thus obtained denoted that age was the most important independent and unavoidable risk factor leading to reduced bone densities with the advanced age.

Table 2 about here

The age wise prevalence levels depicted in the figure-1 showed high incidence of osteoporosis (73.1%) in the elderly women. The normal percent distribution curve seemed to be declined steeply from younger towards middle aged, then slight declination towards aged women and with 0 % incidence of normal bone density levels in the elderly group indicating maximum of younger women contained normal bone mass (64.3%). The osteopenic percent distribution curve raised towards middle aged from younger age and later lowered gradually in the aged and elderly women because of more shift towards osteoporotic stage in aged and elderly groups. The osteoporotic percent distribution curve was much evidenced by the highest peak for the incidence of osteoporosis in elderly women denoting more threat of osteoporosis in the elderly age. It was noticed that the decreased bone densities are triggered remarkably from the middle aged group (45-54 years) and intensified in the elderly with absolute incidence of either osteopenia or osteoporosis as mentioned earlier. A previous osteoporosis prevalent study conducted in urban women from Jammu also represented 100 % incidence of either osteopenia or osteoporosis after the age of 65 years. [5]

Figure 1 about here

Few studies in India at different regions also highlighted the high prevalence of osteoporosis and poor bone density among women. The study on the prevalence of osteoporosis among postmenopausal women above the age of 60 years reported an incidence of 53 % from Delhi and 76 % from rural Haryana representing higher incidence in rural women than urban affluent. [6] The osteoporosis prevalence cross-sectional study carried out over the 45 years aged peri and post menopausal women from Chandigarh city, India recorded very high risk of osteoporosis condition about 53% with mean age of 52.5 ±5.94 years. [7]

The relationship examined between occupational work and bone health in women workers from low socio-economic group from Hyderabad, India. The bone parameters were measured by dual-energy X-ray absorpsiometry in 158 women from low income group involved in three occupations with different bone loading patterns (beedi-makers, sweepers and construction workers). Femoral neck and hip BMD were not differed in spite of marked differences in activity patterns. However lumbar spine BMD was significantly low among sweepers than other groups. The overall prevalence of osteoporosis at lumbar spine was noted as high about 49.1%. The study also highlighted the fact that under nutrition as indicated by low body weights and low body mass index coupled with inadequate calcium intakes as the major determinant of poor bone health in these women. [8]

The cross-sectional study conducted in 105 women to analyze bone mineral density using Dual Energy X-ray Absorptiometry (DEXA) reported 31.4 % of osteopenia and 14.3 % as osteoporosis. The present study results on osteopenia seemed to closer but represented higher percent prevalence of osteoporosis. The difference might be associated with varied factors such as variations in nutrient intake, physical activity, reproductive behavior and life style patterns. Similar to the present study almost 100% incidence of either osteopenia or osteoporosis was noted in the elderly women aged above 60 years. [9]
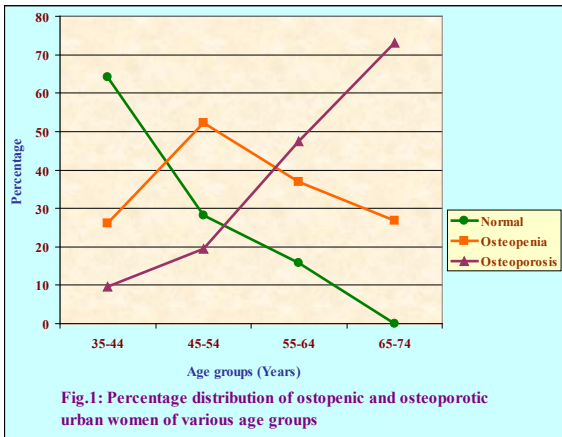
The findings indicated high prevalence of osteopenia and osteoporosis. Osteoporosis usually termed as "a pediatric disease with geriatric outcome" and was multifactorial including inheritance. Thus as genetics was an unavoidable risk factor , one should develop healthy living habits and appropriate care since the childhood years to avoid further bone losses during ageing process and to restore better bone health. Extensive epidemiological studies at community level with large sample size would provide a good data base for establishment of osteoporosis prevalence in India. Coupling with nutrition education on measures to reduce or prevent osteoporosis would be helpful for achieving good bone health status among women.

Table 1: Prevalence of osteopenia and osteoporosis and bone mineral density (BMD) status of urban women assessed by Quantitative Ultra Sound (QUS) bone densitometry method

WHO Criteria of osteoporosis	Subjects (n) (Percent)	Mean BMD T score ±SE*	95% CI*		Range	P-Value**
			Lower	Upper		
Normal	46 (30.3)	-0.62 ±0.02	-0.67	-0.57	-0.92 to -0.31	
Osteopenia	56 (36.8)	-2.02 ±0.05	-2.12	-1.93	-2.48 to -1.02	<0.001
Osteoporosis	50 (32.9)	-3.06 ±0.06	-3.17	-2.94	-4.13 to -2.56	
Total	152 (100.0)	-1.94 ±0.08	-2.10	-1.77	-4.13 to -0.31	

* Mean ± Standard Error and 95% confidence intervals

** P Value: Significant at 1 percent level

Table 2: Mean BMD T-scores of osteopenic and osteoporotic urban women of different age groups assessed by QUS bone densitometry method

WHO Criteria of osteoporosis	Age groups(Years) – Mean BMD T-scores							
	35-44		45-54		55-64		65-74	
	Subjects (n)	Mean BMD T-score	Subjects (n)	Mean BMD T-score	Subjects (n)	Mean BMD T-score	Subjects (n)	Mean BMD T-score
Normal	27	-0.55 ±0.15	13	-0.68 ±0.14	6	-0.78 ±0.08	Nil	Nil
Osteopenia	11	-1.75 ±0.47	24	-2.01 ±0.25	14	-2.09 ±0.6	7	-2.39 ±0.07
Osteoporosis	4	-2.62 ±0.63	9	-2.91 ±0.15	18	-2.91 ±0.23	19	-3.36±0.44

Fig.1: Percentage distribution of ostopenic and osteoporotic urban women of various age groups

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