ORIGINAL ARTICLE

Frequency of osteoporosis in an ambulatory setting in Lahore using quantitative calcaneal ultrasound

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Abstract

Objective: To find out the frequency of osteoporosis in an ambulatory setting using quantitative ultrasound of the calcaneus and to compare it between age and gender sub-groups.

Methods: The cross-sectional survey was conducted at Akhtar Saeed Trust Teaching Hospital, Lahore, from July to December 2011 and comprised all those who visited the out-patient department of the hospital and agreed to participate in the study. Quantitative ultrasound of the calcaneus was done to diagnose osteoporosis. SPSS 20 was used for statistical analysis.

Results: Of the 660 participants, 454 (68.8%) were women. The mean age of the participants was 34±11.8 years (range: 10-80 years). Osteoporosis was present in 123 (18.6%) and osteopenia in 423 (64.1%) of the participants. Females had greater prevalence of osteoporosis than males (n=101; 22% vs n=22; 10.7%; p<0.01). Those with age >45 years had higher prevalence of osteoporosis than with age ≤45 years (n=33; 34% vs n=90; 16%, p<0.01). Among the males with age >45 years, 20.6% had osteoporosis while among the females with age >45 years, 41.3% had osteoporosis. Mean ages of participants with normal bone mineral density, osteopenia and osteoporosis were 30.6±8.7; 33.7±11.3; and 38.1±14.4 years respectively (p<0.01).

Conclusion: Osteoporosis was found to be a common occurrence, affecting females over 45 years of age more than any other sub-group.

Keywords: Osteoporosis, Prevalence Study, Bone mineral density. (JPMA 63: 965; 2013)

Introduction

Osteoporosis has become a major public health problem worldwide with an estimated prevalence of over 200 million, of whom about 44 million belong to the United states.[1] It is estimated that about 9.9 million people in Pakistan have osteoporosis of whom 7.2 million are women. Moreover, it is estimated that about 40 million Pakistanis have osteopenia with equal distribution among males and females. The prevalence of osteoporosis in Pakistan is expected to rise in the coming years with an estimated prevalence of 11.3 million in 2020, and 12.9 million in 2050.[2]

Osteoporosis is associated with a considerable morbidity and mortality, especially among older individuals and females. The reason is increased risk of osteoporotic fractures mostly of hip, spine and the forearm. In 2000, there were about 9 million osteoporotic fractures worldwide of which 1.6 million were hip fractures; 1.7 million were forearm fractures; and 1.4 million were vertebral fractures.[3] There is currently no data available on annual incidence of osteoporotic fractures in Pakistan.

Many studies have shown that osteoporosis badly affects quality of life (QOL). A study comprised 100 post-menopausal women with osteoporosis who either had no fracture or had been treated for vertebral fracture. It found that 41% of osteoporotic females had reduced QOL as compared to 11% of the controls. Moreover, 42% of osteoporotic women had depressed mood.[4] Bone fractures, pain, limited mobility, and physical disability in osteoporosis all affect social life and psychological well-being.

The primary objective of the current study was to find out the frequency of osteoporosis in an ambulatory setting in a developed area of Lahore, Pakistan. The secondary objective was to compare the frequency of osteoporosis between age and gender sub-groups.

Patients and Methods

The cross-sectional survey was conducted at the Akhtar Saeed Trust Teaching Hospital, Lahore, from July to December 2011. Participants included all those who visited the out-patient department (OPD) of the hospital during the study period and agreed to participate. The participants were explained the purpose of the study and an informed consent was obtained. Sampling technique was non-probability convenience sampling.

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Participants with chronic steroid use and rheumatoid arthritis, and bed-ridden subjects were excluded. The study was approved by the ethical committee of the hospital. We estimated that a sample size of at least 483 participants would be required with 95% confidence limits and 3% margin of error with expected prevalence of osteoporosis to be 13%.[5]

A structured questionnaire was designed and basic demographic details like name, age, and gender were collected. Osteosys Sonost-3000 ultrasound machine was used to calculate estimated bone mineral density (BMD) of the right heel . The ultrasound machine uses Broadband Ultrasound Attenuation (BUA) and Speed of Sound (SOS) to calculate BMD. The temperature of the room was maintained at 37°C during the procedure. BMD values calculated by ultrasound machine were converted into T-scores. In line with the recommendations of World Health Organisation (WHO), T-score <-1 was considered normal; -1 to -2.5 was considered osteopenia; and T-score of -2.5 or above was taken as osteoporosis.[6]

SPSS version 20 was used to analyse the data. Frequencies and percentages were calculated for gender, osteopenia and osteoporosis. Age was expressed as mean ± standard deviation (SD). Age was further categorised as ≤45 and >45 years. The mean ages of the participants with normal BMD, osteopenia, and osteoporosis were compared through analysis of variance (ANOVA). Percentages of osteopenia and osteoporosis in males and females, and in age groups ≤45 and >45 years were compared with each other by using chi-square for trend test. P value <0.05 was considered significant.

Results

A total of 660 participants were included in the study. There were 454 (68.8%) females. Overall age was 34±11.8 years (Range: 10 to 80 years). Age group ≤45 years comprised 563 (85.3%) of the sample and 97 (14.7%) had age >45 years. Among the patients with age ≤45 years, 172 (30.6%) were males and 391 (69.4%) were females. While among the patients with age >45 years, 34 (35.1%) were males and 63 (64.9%) were females.

Osteoporosis was present in 123 (18.6%) and osteopenia in 423 (64.1%) of participants. Only 14 (17.3%) participants had normal BMD. Females had greater prevalence of osteoporosis than males (Table). Among the males 44 (21.4%) had normal BMD; 140 (68%) had osteopenia; and 22 (10.7%) had osteoporosis. While among the females 70 (15.4%) were normal; 283 (62.3%) had osteopenia; and 101 (22.2%) had osteoporosis (P for males vs. females <0.01). Similarly participants with age >45 years had higher prevalence of osteoporosis than with age ≤45 years (Table). Among participants with age >45 years, 7 (7.2%) had normal BMD; 57 (58.8%) had osteopenia; and 33 (34%) had osteoporosis. While among the participants in age group ≤45 years, 107 (19%) were normal; 366 (65%) had osteopenia; and 90 (16%) had osteoporosis (P for >45 years vs. ≤45 years, <0.01).

Overall 33 (34%) participants with age >45 years had osteoporosis. Among the males with age >45 years, 7 (20.6%) had osteoporosis while among the females with age >45 years, 27 (41.3%) had osteoporosis. Mean ages of participants with normal BMD, osteopenia, and osteoporosis were 30.6±8.7, 33.7±11.3, and 38.1±14.4 years respectively (p<0.01).

Discussion

Osteopenia and osteoporosis are characterised by decreased bone mineralisation. Diagnosis of osteoporosis rests on the measurement of BMD by ultrasound or by dual-energy X-ray absorptiometry (DEXA) scan. Though DEXA scan is superior to ultrasound, significant correlations between BMD values for both techniques have been reported in previous studies.[7,8] Ultrasonic method of measuring BMD is non-invasive, less costly than DEXA, and measures BMD of the heel. BMD values are converted into T scores by comparing them with values of normal adult population. WHO defines osteoporosis as T-score of 2.5 or more below the mean of healthy adult population.[6]

Our study found that more females had osteoporosis than males (22.2% and 10.7%). Similarly, older people had higher prevalence of osteoporosis than the younger

Table: Bone mineral density among age and gender sub-groups.

Variable		Bone Mineral Density [n(%)]			P value
		Normal	Osteopenia	Osteoporosis	
Gender	Male	44 (21.4)	140 (68)	22 (10.7)	<0.01
	Female	70 (15.4)	283 (62.3)	101 (22.2)	
Age (years)	>45	7 (7.2)	57 (58.8)	33 (34)	<0.01
	≤45	107 (19)	366 (65)	90 (16)	

ones (34% and 16%). About 41% of the females with age >45 years had osteoporosis. In a study conducted in Quetta among adult females using ultrasonography to calculate BMD, 12.9% of females had osteoporosis.[5] An Indian study reported 22.25% prevalence of osteoporosis in urban women,[9] which is similar to results of our study. Another study conducted in Peshawar on post-menopausal women assessed BMD of heel using ultrasonography. It found that 24.5% of post-menopausal women had osteoporosis,[10] while in our study 41% of females with age >45 years had osteoporosis. Overall, our study reports a higher prevalence of osteoporosis in females compared with previous studies. Our sample included participants from a well-developed part of the Lahore city which could have higher prevalence of osteoporosis due to sedentary lifestyle and Westernised diet.

In our study, females had double the prevalence of osteoporosis than that of males (22.2% vs 10.7%). There are many reasons for higher prevalence of osteoporosis in females. First, females start with a low bone mass than their male counterparts. Second, males achieve their peak bone mass later than females because of delayed puberty and they maintain it afterwards. Third, in both males and females, the bone mass decreases with advancing age, but the rate of decline is higher for females. Fourth, after menopause, bone mass in females declines rapidly because of decreased levels of oestrogens.[11,12]

Although much less than females but 10.7% of males had osteoporosis which rose to 20.6% for males with age >45 years. Osteoporosis in males is usually neglected because of the misconception that it is a disease of females only. A review article reported that about 6% of males over age 50 have osteoporosis and this percentage is expected to increase in the coming years because of increasing life expectancy. Although osteoporotic hip fractures are more common in females, the morbidity and mortality associated with these fractures is greater in males.[13]

Calcium and vitamin D is required for normal bone growth and mineralisation. According to the Institute of Medicine, United States, the recommended dietary allowance (RDA) of calcium for females is 1000-1300mg with increasing requirement in pregnancy and lactation.[14] Decreased calcium intake leads to demineralisation and mobilisation of calcium from bones which decreases bone mass and results in osteoporosis.[15] Older persons are particularly prone to decreased calcium intake and absorption. In females, oestrogens indirectly stimulate calcium absorption from intestine and promote calcium re-absorption from the kidneys. Moreover, oestrogens promote mineralisation of bone. This is one of the reasons of rapid decrease in bone mass in females after menopause. Administration of calcium with oestrogens after menopause results in greater degree of recovery in bone mass than the administration of calcium alone.[15]

A high percentage of Pakistani population has deficiency of calcium and vitamin D. A hospital-based study from Karachi reported that 92% of the out-patients had vitamin D deficiency with female-to-male ratio of 5:1. Majority had severe deficiency (62%). Patients with rickets, osteomalacia and chronic kidney disease were excluded from that study.[16] In another study, the daily calcium intake of an adult Pakistani was between 400mg and 600mg, in contrast to the recommended daily intake of 1000-1200mg.[17] Another study compared nutrient intake of an adult Pakistani, European and Africo-Caribbean community residing in Manchester City, Britain. It found that Pakistani females were obese and the calcium intake of the Pakistani community was lower than other communities.[18]

Our study had some limitations. First, it was a hospital-based study which might have over-estimated the prevalence of osteoporosis. Second, we used quantitative ultrasound of calcaneus to calculate BMD. Although BMD values obtained with quantitative ultrasound of calcaneus correlate with those obtained from DEXA scan, but DEXA is the gold standard and should be used when available. But due to limited resources and cost issues, we could not opt for it. However, quantitative ultrasound of calcaneus is a reliable method and has been used successfully in many studies on osteoporosis.

There is need for large-scale population-based studies using DEXA scan to assess the prevalence of osteoporosis in the community. Furthermore, people should be educated about the morbidity associated with osteoporosis and the need for increased intake of calcium, especially for females and older persons, must be advocated.

Conclusion

One out of every five females of all ages and two out of five females of age >45 years had osteoporosis. Overall, every 10th male has osteoporosis. Women over 45 years of age represented the most vulnerable sub-group.

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