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Research Article

Comparison of prevalence of osteoporosis and the association between bone mineral density and selected risk factors among premenopausal and postmenopausal women attending a health camp in urban Sri Lanka

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Abstract

Introduction

Bone mineral density (BMD) decreases with oestrogen depletion associated with menopause, leading to osteoporosis-related morbidity and mortality in postmenopausal women.

Aims and objectives

To compare the prevalence of osteoporosis and the association between BMD and selected risk factors among premenopausal and postmenopausal women attending a health camp.

Method

Osteoporosis screening was conducted at a health camp held in base hospital Panadura, Western Province. Participants included health staff and lay women aged 27-81 years residing in Panadura. Data was collected using an interviewer-administered questionnaire by trained staff, and measurement of weight and height were taken. Heel bone mass density was obtained by trained technicians using Achilles EXPII bone ultrasonometer.

Results

305 women were screened. The mean (+/-SD) age was 51.42 (±9.33) years. Around fifty four percent (54.1%, n=165) of women were postmenopausal. The mean (+/-SD) age at menopause was 48.17 (±4.20) years. Mean (+/-SD) T score in pre and postmenopausal women were -0.46 (±0.96) and -1.22 (±0.85) respectively. The prevalence of osteoporosis and osteopenia were 1.4% and 24.3% in premenopausal women and 3.0% and 59.4% in postmenopausal women respectively. Age, age at menopause, parity, physical exercise, height, highest level of education, occupation, monthly income, previous fractures, parent fractured, current smoking, glucocorticoids, rheumatoid arthritis, secondary osteoporosis, alcohol consumption and family history showed no association with BMD ($p>0.05$) whereas weight ($p<0.05$, $r = +0.223$) and BMI ($p<0.05$, $r = +0.262$) showed a significant association with BMD in premenopausal women. In postmenopausal women, only the age showed a negative medium ($p<0.05$, $r = -0.208$) association with BMD

Conclusions

In this group of urban pre and postmenopausal women, the prevalence of osteoporosis was low. BMD in premenopausal women showed a significant positive association with weight and BMI, whereas only age had a significant negative association with BMD in postmenopausal women.

Key words: Osteoporosis, osteopenia, premenopausal, postmenopausal, bone mineral density, risk factors

Introduction

Osteoporosis is characterized by reduced bone mineral density (BMD) and deterioration of bone microarchitecture. With a worldwide ageing population, osteoporosis has been identified as a significant public health problem in most countries, mostly due to increase in the risk of fractures of the hip, spine, forearm and other skeletal sites[1].

One-third of women and one-fifth of men over the age of 50 years are estimated to experience an osteoporosis related fracture during their lifetime, with osteoporosis and osteoporosis related fractures being most common in postmenopausal women[2]. The prevalence of hip fracture is predicted to increase by 310% in men and 240% in women during the next 25 years and nearly half of these fractures will occur in Asian countries, and the most number is expected in China, the country with the largest population[3]. The prevalence of osteoporosis in postmenopausal women in seven out of nine provinces of Sri Lanka was found to be 45%[4]. The Asian osteoporosis audit published by the International Osteoporosis Foundation predicts a rise in the incidence of hip fractures in Sri Lanka from the nearly 2700 in 2006 to 4900 in 2020 and 6900 in 2041[5].

Measurement of BMD helps in determining a fracture threshold and developing a classification, and permit the identification of patients at high risk of fracture based on BMD cut-offs[6]. World Health Organization (WHO) Study Group classified patients according to the results of bone densitometry at any site (spine, hip or mid-radius), with the T score being the most commonly used, defining normal (T score over -1), osteopenic (T score -1 to -2.5), or osteoporotic (T score below-2.5)[7]. This "densitometric" definition of osteoporosis probably contributed to raising awareness of the high prevalence of low bone density in the population[8].

The most commonly used gold standard for measuring BMD is dual energy X-ray absorptiometry (DEXA). However its availability, exposure to radiation and cost precludes its use in resource limited settings. In contrast, heel bone ultrasonography which comes in a portable machine has the added advantage of being of low cost, without the emission of ionizing radiation. However its use is limited due to significant manufacture and operation variations[9]. Quantitative ultrasound has proven to be a good predictor of fracture risk in several studies[10,11,12]. Comparison of DEXA with heel ultrasonography has shown that though the sensitivity of heel ultrasonoghraphy was less than DEXA in predicting osteoporosis, its specificity was high, which makes a heel ultrasound result highly predictive of BMD-defined osteoporosis in the osteoporotic range[13].

Bone mineral density (BMD) decreases with oestrogen depletion associated with menopause, leading to an increased risk of osteoporotic fractures. It is well known that postmenopausal women have a significant increase in osteoporosis-related morbidity and mortality[14,15,16,17,18]. Thus the identification of its risk factors, and the importance of the prevention and management of osteoporotic fragility fractures are increasing over time[19].

Evaluating the local prevalence of osteoporosis and related risk factors in both menopausal and premenopausal women would enable early intervention and prevention of osteoporosis-related negative outcomes, which reduces the burden to the individuals as well as the society. This study was thus aimed at comparing the prevalence of osteoporosis and the association between BMD and selected risk factors among a group of healthy women premenopausal and postmenopausal women attending a health camp.

Materials and methods

This study was part of a community-based study for investigation of non-communicable diseases (NCDs) conducted at a health camp for three consecutive days in base hospital Panadura in October 2016.

Panadura is an urban area with a multi-ethnic and a multi religious population. All the women including health staff and lay women aged 27-81 years residing in the Panadura who visited the

exhibition centre on menopause were offered osteoporosis screening. Participants were recruited after obtaining informed consent. Data was collected by an interviewer-administered questionnaire by trained personnel to obtain information on sociodemographic variables and lifestyle habits. Anthropometric measurements (height and weight) were made using a stadiometer for height (to the nearest 0.1 cm) and a digital weighing scale (SECA 813) for weight (to the nearest 0.1 kg). Heel bone mineral density (BMD) was obtained by technicians who had a good knowledge on this subject using Achilles EXPII bone ultrasonometer. The BMD T-scores were recorded in all participants. The categorization of T scores into normal (> −1), osteopenia (between −1 and −2.5) and osteoporosis (<−2.5) was as per the world health organization (WHO) guidelines.

Statistical analysis was done using SPSS ver.23 (SPSS, Chicago, IL, US). Continuous data were described using means and standard deviations. Categorical data were described using percentages. Bivariate analysis was done using the chi square test and one-way ANOVA test.

Results

Three hundred and five women participated in the study. The mean (+/-SD) age was 51.42 (±9.33) years. Around fifty-four percent (54.1%, n=165) of women were postmenopausal. The mean (+/-SD) age at menopause was 48.17 (±4.20) years. Comparison of age, anthropometric measurements and the mean T score in the in the two groups are given in Table 1.

Mean (+/-SD) T score in pre and post-menopausal women were -0.46 (±0.96) and -1.22 (±0.85) respectively (Figure 1). The prevalence of osteoporosis and osteopenia were 1.4% and 24.3% in premenopausal women and 3.0% and 59.4% in postmenopausal women respectively (Figure 2).

Figure 01. Boxplot of average T-score of pre and postmenopausal women and all

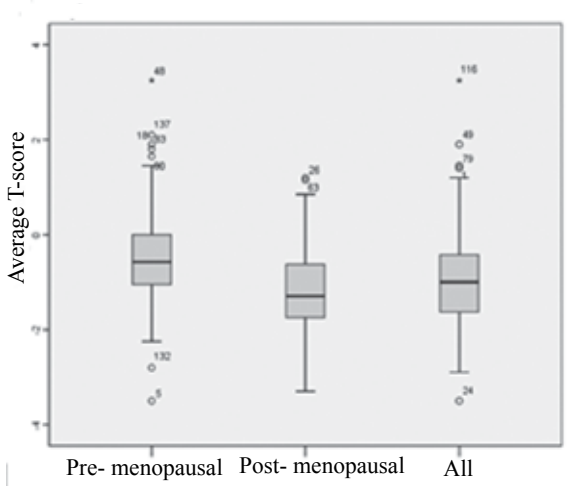

Figure 02. Prevalence of osteoporosis among premenopausal women, postmenopausal women and all participants

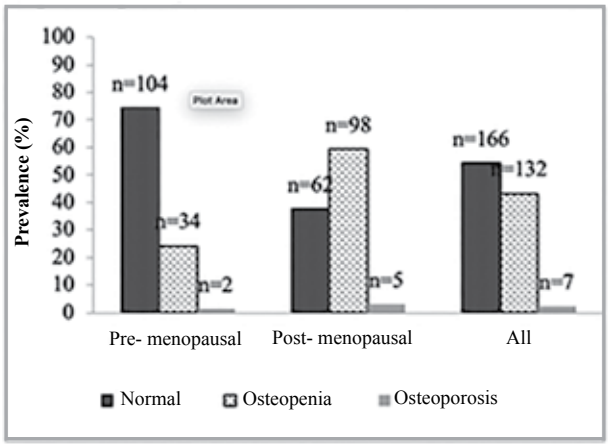

Table 1 : Descriptive statistics of age, age at menopause and anthropometric parameters

Parameter	Mean ± SD		
	All	Pre-menopausal	Post-menopausal
Age (Years)	51.42 ± 9.21	44.44 ± 5.98	57.33 ± 7.09
Mean T score	-0.87 ± 0.98	-0.46 ± 0.96	-1.22 ± 0.85
Weight (kg)	61.62 ± 10.55	62.93 ± 10.95	60.51 ± 10.11
Height (cm)	153.16±5.94	154.69±5.84	151.87±5.74
BMI (kg/cm^2)	26.20 ± 3.82	26.23 ± 3.92	26.18 ± 3.75

Age, age at menopause, number of pregnancies, physical exercise (30 minutes at least for 3 days a week), height, highest level of education, previous fracture, parent fractured, current smoking, glucocorticoids, rheumatoid arthritis, secondary osteoporosis, alcohol consumption and family history ($p>0.05$) showed no association with BMD whereas weight ($p<0.05$, $r = +0.223$) and BMI ($p<0.05$, $r = +0.262$) showed an association with BMD in premenopausal women. But only the age showed a negative medium ($p<0.05$, $r = -0.208$) association with BMD in postmenopausal women (Table 2 and 3).

Discussion

Panadura is an urban area in Sri Lanka, with good access to education and healthcare. In this study among women attending the health camp in Panadura, the prevalence of osteoporosis was low in the total population (2.3%), premenopausal women (1.4%) and also postmenopausal women (3.0%). Lekamwasam et al. in 2007 reported an osteoporosis prevalence of 44.9% in a study of 1642 community-dwelling postmenopausal women in seven provinces in Sri Lanka using AccuDEXA3. Here, phalangeal T-score with a low-

Table 2 : Association of BMD with selected risk factors using ANOVA

Risk factor	Premenopausal	Postmenopausal
	P value	P value
Monthly income	0.029*	0.91
Lack of regular physical exercise	0.781	0.579
History of previous fracture	0.526	0.365
History of parental fractured	0.976	0.264
Current smoking	N/A	N/A
Current use of glucocorticoids	0.198	0.765
Presence of rheumatoid arthritis	0.225	0.578
Presence of secondary osteoporosis	0.654	0.693
Current consumption of alcohol	N/A	N/A
Family history of osteoporosis	0.953	0.61

**Relationship is significant at 0.05 level of significance*

Table 3 : Correlation of BMD with some selected parameters

Risk factor	Premenopausal		Postmenopausal	
	Pearson r	P value	Pearson r	P value
Age	-0.017	0.842	-0.208	0.007*
Number of pregnancies	0.052	0.563	-0.508	0.542
Exercise time per week (min)	-0.304	0.364	-0.125	0.658
Weight (kg)	+0.223	0.009*	+0.088	0.260
Height (m)	+0.006	0.947	+0.115	0.143
BMI (kg/m^2)	+0.262	0.002*	+0.037	0.636

**Relationship is significant at 0.05 level of significance*

er cut off value of ≤-2 was used for diagnosing osteoporosis. The greater sensitivity of DEXA in detecting osteoporosis, the difference in the cut-off values used, and the difference in sample sizes may explain the differences in the prevalence of two studies. In our study however, the prevalence of osteopenia was much higher, with 24.3% in premenopausal women and 59.4% in postmenopausal women, making the total percentage of women with low BMD adding up to very high values, with over 25% and over 60% in pre and postmenopausal groups respectively. Furthermore, Lekamwasam et al. in 2007 studied community dwelling women, whereas this study was conducted 12 years later, on women with health seeking behavior, and included a greater proportion of healthcare staff who could be me knowledgeable on osteoporosis and its prevention, both factors which may have influenced the study findings[3].

A study on osteoporosis among female healthcare workers in Tamil Nadu, India, using calcaneal quantitative ultrasonography, revealed that (28.39%) had osteopenia and (8.02%) had osteoporosis[20]. The percentage of low BMD in our study is greater, though the percentage diagnosed as osteoporosis is less. This may be attributed to several reasons, including regional and dietary variations, inclusion of both healthcare workers and lay persons and free education and free healthcare for all in Sri Lanka. Karunanayake et al, studying the prevalence and predictors of osteoporosis in urban Sri Lanka using DEXA found that 9% women <50 years and 27% of women >50 years had osteoporosis[1]. This too could be due to the greater sensitivity of DEXA over calcaneal ultrasonography.

This study also revealed that the mean BMI in both pre and postmenopausal women were in the overweight category (>26 kg/m2). This is considered as being overweight as defined by the WHO expert consultation (2004) for South Asians. A recent study in Colombo, Sri Lanka revealed that >90% of the adults were overweight or obese, and that in females >40 years this figure rose to over 95%[22]. Weight increases during menopausal transition and the increased weight is associated with multiple comorbidities in the postmenopausal women, in Sri Lanka and worldwide[23,24].

Lower monthly income in this study had a significant association with low BMD among all women, both pre and postmenopausal. Low income is recognized to be associated with osteoporosis, as it is likely to be associated with suboptimal nutrition, education and healthcare[25,26,28].

Low BMI and advancing age are well known risk factors for low bone mass and osteoporosis[27,29]. The significant positive associations with BMD in premenopausal women in this study were only weight and BMI, and in postmenopausal women it was only advancing age. It is not clear why these associations were not detected in both pre and postmenopausal women. A study by Karunanayake et al, also revealed that in women over 50 years, low BMI (OR 3.1) and low level of education (OR 1.7) had a significant positive association with osteoporosis[1].

Though lack of exercise, parental fracture, past history of fracture, steroid use, smoking and alcohol are recognized risk factors for osteoporosis, such associations were not found in this study[8,14,7,28,29,30]. It could be that there were only very few women with the above risk factors, excepting exercise.

This study reveals important findings regarding a group of pre and postmenopausal urban women in Sri Lanka, with findings compatible to this of other studies in Sri Lanka, Asia and worldwide. However, this study was conducted on a selected group of women who voluntarily participated in a health camp, which may indicate that these were relatively health conscious women. Thus larger scale population studies need to be done to further elucidate these findings.

Conclusions

This study revealed that in a group of urban per and postmenopausal women, the prevalence of osteoporosis was low, though that of low BMD and obesity were high. BMD showed a significant positive association with monthly income in all

women. In premenopausal women BMD showed a significant positive association with weight and BMI whereas in postmenopausal women BMD showed a significant negative association with age.

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