Risk factors associated with low bone mineral density in Ajman, UAE

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ABSTRACT

Objectives: To ascertain the determinants associated with LBMD among patients above 30 years of age.

Materials and Methods: The study was conducted over a period of two years. Age, gender, cigarette use, exposure to sunlight, physical activity, BMI, family history of osteoporosis and style of clothing were assessed using a structured, pretested questionnaire. Data were analyzed using SPSS 19 version. Chi-square test was used to find the association between bone mineral density and factors such as age, gender, physical activity, exposure to sunlight, and BMI.

Results: The study population consisted of 444 subjects, and among them 15.8% were males and 84.2% females. The results revealed that 60.8% had low bone mineral density, of whom 11 had severe osteoporosis, 99 osteoporosis, and 160 osteopenia. The risk was high in the age group 70+ (Adjusted OR=12.21), followed by 60-69 years (Adjusted OR=6.31), 50-59 years (Adjusted OR=4.70) and 40-49 years (Adjusted OR=2.15). Participants who had occasional sunlight exposure had 3.28 times higher risk of developing osteoporosis. With regard to physical activity, a risk 1.5 times higher was noticed in those without any physical activity as compared to those with some physical activity. Obesity and overweight were associated with 0.38 and 0.37 times risk of developing osteoporosis respectively. A 2.57 times higher risk was observed among participants with a positive family history of osteoporosis.

Conclusion: Ageing, lack of physical activity, excess body weight, and inadequate exposure to sunlight were identified as the major risk factors associated with low bone mineral density.

Key words: risk factors, bone mineral density, sunlight exposure

INTRODUCTION

Osteoporosis is known as thinning of bone tissue and loss of bone density over a period of time[1]. The prevalence of osteoporosis is on the increase across the world. The National Health Survey in Australia reported a prevalence of 3.4% among the total population[2] in 2008. In 2000, Europe (36.6%) witnessed the highest prevalence of osteoporosis, followed by the Western Pacific (28.6%), Americas (16.0%) and Southeast Asia (15.3%). The least prevalence was observed in the Eastern Mediterranean (2.7%) region[3].

In Sweden, an increase in prevalence of osteoporosis was observed among people above the age of 50 years[4]. In Germany the reported prevalence of osteoporosis was high in the older people. Among them, men (16.1%) and women (59.2%) above the age of 75 had high prevalence and when the gender is compared women had a higher prevalence at all age groups as compared to men in all age groups[4]. China has reported a higher prevalence at the age of ≥80 years (89.7%) and the prevalence observed in post menopausal woman was 48.3%[5-6].

Family history is a major risk factor for osteoporosis in both premenopausal and post-menopausal women. Women having one family member affected with osteoporosis have a reported risk of 1.8% as compared to those with more than one family member affected that have a 8.4% risk. In addition, the risk reported for women whose mothers had osteoporosis was high when compared to those whose mothers did not have osteoporosis[3,5]. A significant risk of osteoporosis with family history was reported in non-

Hispanic and Mexican Americans but the highest risk was observed in Hispanic blacks[5]. With osteoporosis, a typical age-related disorder, early diagnosis and treatment are the mainstay to prevent the complications associated with Low Bone Mineral Density (LBMD). This study was conducted to ascertain the determinants associated with LBMD among patients above the age of 30 years attending the department of Radio-diagnosis of Gulf Medical College Hospital, Ajman, UAE.

MATERIALS AND METHODS

People above the age of 30 and below 70 years were the study population. Pregnant and lactating mothers were excluded. The actual sample size observed was 400, while considering 10% non-response rate, the total sample size calculated was 440. A content and face-validated questionnaire was used for data collection. A standard written consent form both in English and translated into the local language was used to obtain consent from the study subjects.

After administration of the questionnaire, anthropometric measurements like height (in cms) and weight (in kgs.) were measured using a standardized instrument. Body Mass Index was calculated from this data. Dual energy X-ray absorptiometry (DEXA) was used to measure the subject's Bone Mineral Density. DEXA scanning focuses on two main areas, the hip and the spine and although osteoporosis involves the whole body, measurements of Bone Mineral Density at one site can be predictive of fractures at other sites.

T-score and Z score are generated automatically by the machine and percentage of age matched. The percentage of young adult score can be defined as per WHO evaluation standards. The diagnosis is made as per WHO guidelines. The DEXA units measure bone mineral content in grams per centimeter squared. This was done by measuring the calcium content of the region of interest (ROI) (such as the lumbar spine or proximal femur) in grams. The bone mineral content was calculated in grams/cm squared. This value was then converted to a "T-score" and a "Z-score". The "T-score" compares the patient's BMD to a group of "young healthy adults" and the "Z- score" compares the patient's BMD to a group of individuals who are of the same age, gender, and ethnicity as the patient. Both scores are a reflection of the number of standard deviations compared to the reference group. A "T-score" that is negative means that the patient is "X" standard deviations below the reference group while a positive score means the standard deviation is above the reference group. The definitions developed by World Health Organization for osteopenia and osteoporosis are used in the study. These definitions are based on T-score value. The T-score is a measure of how dense an individual's bone is when compared to that in a normal, healthy 30-year-old adult[3,5]. SPSS 19 was used to analyze the data.

Chi-square test was used to find the association between bone mineral density and factors such as age, gender, physical activity, exposure to sunlight, and BMI. The analysis of variance (ANOVA) was used to find whether there was any significant difference in duration of commonest physical activity performed and bone mineral density. The significant variables were included in a simple binary logistic regression to calculate the crude Odds Ratio (OR) and its confidence interval to determine the significance. Finally, the significant variables were included in the multiple binary logistic regression to derive the adjusted OR and its significance. The adjusted ORs were calculated to eliminate the effect of confounders and to get the net effect of each variable on the occurrence of LBMD.

RESULTS

The study population consisted of 444 subjects, among whom 15.8% males and 84.2% females. They were categorized into five broad age groups, 30-39 years, 40-49 years, 50-59 years, 60-69 years, and 70 years and above. The highest number of participants was observed in the 50-59 years groups and the next highest was between 40-49 years, followed by 30-39

years and 60-69 years, with the fewest of participants observed in the age 70 and above group. With regard to the marital status, 89% were married. The education level of the participants showed that 41.7% had 13-18 years of education and only 2.7% had more than 18 years of education.

The results of DEXA scan showed that 11 of the subjects had severe osteoporosis, 99 osteoporosis, 160 low bone mass and 174 with normal bone mass. For further analysis, the whole group based on DEXA scan result was divided into normal and low bone mineral density categories.

The participant's socio-demographic status was compared with the status of bone mass and an age-wise progression in the status of bone mass was observed, which was more prevalent in the age group 70 years and above compared to the age group 30-39 years, was observed. The prevalence of low bone mass among participants who had more than 18 years of education was 58.3% whereas in participants with 1-4 years of education it was 77.8%. There was no statistically significant association between the gender, marital status and low bone mineral density. Body Mass Index showed that 48.9% of the participants were obese, 36.5% over weight, and 14.6% were within the normal range of body weight. Among those with normal BMD, the mean BMI was 31.6% whereas in those with LBMD the mean BMI was 30.4%. A statistically significant difference was observed between normal and Low Bone Mass with regard to BMI.

More than 75% of the participants used clothing that partially covered their bodies and the remaining used clothing that fully covered. There was a statistically significant association observed between the bone mineral density status and the clothing style. The prevalence of low bone mass was less among the partially covered group than in the fully covered group. About 67% used cotton material and the remaining had the habit of using cloth made up of mixed material. The prevalence of low bone mass was 60% and 62% respectively among participants who used cotton material and cloth made of mixed material. Around 61% did not have any colour choice, whereas 27.3%

Table 1. Analysis of Risk Factors of Osteoporosis – Crude OR

Variables	Group	Crude		Adjusted	
		OR	CI	OR	CI
Age in years	30-39	1	--	1	--
	40-49	1.54	0.89-2.66	2.15	1.14-4.02
	50-59	3.13	1.87-5.44	4.70	2.46-8.99
	60-69	3.95	1.92-8.15	6.31	2.82-14.14
	70+	7.93	2.53-24.86	12.21	3.53-42.27
Sunbath	Yes	1	--	1	--
	No	3.56	1.57-8.05	3.28	1.22-8.23
BMI	Normal	1	--	1	--
	Over weight	0.45	0.24-0.86	0.37	0.17-0.82
	Obese	0.46	0.25-0.86	0.38	0.13-1.12
Family history of osteoporosis	No	1	--	1	--
	Yes	1.92	1.08-3.42	2.57	1.37-4.85
Clothing style	Partially covered	1	--	1	--
	Fully covered	1.71	1.07-2.74	1.18	0.68-2.03

preferred to use black colour and the remaining 11% white colour. Only 6% reported that they had the practice of sunbaths. The prevalence of low bone mass was high in those participants who were not sunbaths when compared to participants who were exposed to sunbaths. Among those who had the practice of sunbaths, the prevalence of low bone mass was 32% whereas among those who were not exposed to sunbaths it was 63%.

The risk factors observed were age, sunbath, BMI, family history and style of clothing. When age was considered, the risk was high in the age group 70+ (Adjusted OR= 12.21), 60-69 years (Adjusted OR=6.31), 50-59 years (Adjusted OR= 4.70) and 40-49 years (Adjusted OR = 2.15).The participants who sunbathed occasionally had 3.28 times higher risk of developing osteoporosis. Obesity and overweight showed 0.38 and 0.37 times risk of developing osteoporosis. A 2.57 times higher risk was seen in participants who had a family history of osteoporosis. The crude OR and Adjusted OR of risk factors are given in the Table 1.

DISCUSSION

This study showed an increased risk of LBMD as age increased. This is in accordance with the study conducted by Cummins et al.[7]. The study by Ferrari et al. pointed out the importance of non-modifiable factors like age, height and family history for bone health[8]. This study reported a 2.5 fold higher chance of getting LBMD among those with family history of osteoporosis. The study by Ferrari et al.[8] showed that 60–80% of bone mass is hereditary, which support the findings of the present study. Fatima et al. also observed a twofold high chance of osteoporosis among familial peripheral osteoporotic fractures[9]. Those who had a fully covered clothing style had a net effect of a 1.2 times higher chance compared to those with partially covered clothing style, but the OR was not statistically significant. A study in Pakistan reported that clothing style, especially that of covering the body fully, was one of the risk factors among both men and women who had concealed their body fully. The study also reported that wearing a veil increased the risk 2.29 fold as compared to those who did not[9].

Keramat et al. reported that height, weight and BMI were risk factors for LBMD among Iranian and Indian women. They observed that BMI above 26 was associated with a 3.9 times higher chance of LBMD developing among Iranian women and 3.6 times higher chance among Indian women compared to those with BMI less than or equal to 26[10]. The observation of the present study is not in accordance with the study by Keramat et al.[10]. In the present study a 2.57 fold higher chance of LBMD among subjects with a family history of LBMD compared to those who did not was observed. Robitaille et al.[5] reported that after adjusting for all other confounders, a 2.35 times higher chance of getting LBMD family history of osteoporosis existed, after adjusting all other confounders. This observation is in accordance with the results of the present study.

CONCLUSION

The study shows that the prevalence of low bone mineral density was higher among females than in males and as age increased the prevalence too increased. The independent risk factors observed were age and family history. Sunbathing and BMI were the protective factors observed in the study.

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REFERENCES

1. PubMed Health. The US national library of medicine. Disease and Conditions. Osteoporosis. Available from: URL: http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0001400/[Accessed on 2012 Jan 10].
2. Authoritative information and statistics to promote better health and wellbeing. Australian Institute of Health and Welfare 2011. A snapshot of osteoporosis in Australia 2011. Arthritis series no. 15. Cat. No. PHE 137. Canberra: AIHW. Available from: URL: http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=10737418747&libID=10737418746. [Accessed on 2012 Jan 10].

3. Johnell O &Kanis JA. An estimate of the worldwide prevalence and disability associated with osteoporotic fractures. Osteoporosis Int 2006;17:1726-1733.

4. Ahlborg HG, Rosengren BE, Järvinen TLN, et al. Prevalence of osteoporosis and incidence of hip fracture in women - secular trends over 30 years. BMC Musculoskeletal Disorders 2010;11:48

5. Robitaille J, Yoon PW, Moore CA, et al. Prevalence, Family History, and Prevention of Reported Osteoporosis in US Women. Am J Prev Med 2008;35(1):47-54.

6. WU XP, Liao EY, Luo XH, et al. Age-related variation in quantitative ultrasound at the tibia and prevalence of osteoporosis in native Chinese women. The British Journal of Radiology 2003;76:605–610.

7. Cummins NM, Jakeman PM, Sestak I, et al. The effect of behavioural risk factors on osteoporosis in Irish women. Ir J Med Sci DOI 10.1007/s11845-012-0840-7.

8. Ferrari S, Rizzoli R, Slosman D, et al. Familial resemblance for bone mineral mass is expressed before puberty. J ClinEndocrinolMetab1998;83 (2):358-361.

9. Fatima M, Nawaz H, Kassi M, et al. Determining the risk factors and prevalence of osteoporosis using quantitative ultrasonography in Pakistani adult women. Singapore Med Original Article J 2009;50(1):20-28.

10. Keramat A, Patwardhan B, Larijani B, et al. The assessment of osteoporosis risk factors in Iranian women compared with Indian women. BMC Musculoskeletal Disorders 2008;9:28. doi:10.1186/1471-2474-9-28. Available from: URL:http://www.biomedcentral.com/1471-2474/9/28 [Accessed on 2012 Jan 16]