Impact Of Body Mass Index On Bone Density Of Menopausal Women In Hamadan Province, Iran

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Abstract: Osteoporosis and obesity are among the most common diseases in the world, especially in women. The goal of the present study was to clarify the effect of Body Mass Index on bone density in women population. Among three hundred and twenty five women referred for bone mass densitometry test in Hamadan province, Iran, Body Mass Index were recorded and compared in healthy and osteoporotic women. The Body Mass Index in healthy women was significantly higher (p=0.010), with median of 28 versus 27. Decision making tree analysis revealed the Body Mass Index of 31.8 as the cutoff value for osteoporosis. Low Body Mass Index is a risk factor for osteoporosis, so preventive measures in this group might be considered.

Key words: Osteoporosis; Body Mass Index; Bone Densitometry; Menopause.

INTRODUCTION

Osteoporosis is among the most common diseases in the world with an increasing prevalence due to the fact that the world population is getting older and less active (McLeod, Johnson 2009, Slavkin 2000). BMD testing is suggested to be done in all 56.5 years old or more age Iranian females and less than 56.5 age if she is menopause without estrogen therapy for equal or more than 6 years(Arab and et al 2011).

About 250 million adults are obese by definition of Body Mass Index (BMI) of 30kg/m2 or more (Zhao and et al 2008). High BMI might be somehow protective against osteoporosis (De Laet and et al 2005, Roy and et al 2003, Willig, luukinen, Jalovaara 2003) but, obesity is a risk factor for co-morbidities such as diabetes, hypertension and cardiovascular diseases (De Laet and et al 2005). Some studies suggest only the fat mass and not the lean mass to be related to bone density and osteoporosis. Many factors are suggested as how the fat mass and BMI influence the bone density. Genetic factors might be considered, due to genetic impact on both bone density and fat mass. Common cellular origin of osteoblasts and adipocytes may play a role (Reid 2002). Higher weight and more load bearing in people with higher BMI are also regarded as factors which might increase the bone density. Higher levels of circulating estrogen, insulin and nutrition-related growth factors in people with higher BMI might be effective in causing higher bone density among them (Reid 2008). In a study of female employees below 55 years old in Hamadan province, located in the western region of Iran, 41.3% were overweight and obese (Jamshidi and et al 2008). The world health organization report indicates that 67% of general female population is either overweight or obese (Arab and Nasrolahi, 2006, WHO, 2002). The aim of the present study was to investigate the effect of BMI on bone density and its role in the process of osteoporosis.

MATERIALS AND METHODS

Three hundred and twenty five women referred for bone mass densitometry (BMD) were included in this study. This study was approved by the ethics committee of Islamic Azad University, Hamadan, Iran. All participants signed an informed consent before entering the study. The Body Mass Index (BMI) was calculated based on the weight in kilograms divided by the square of height in meters. Some other probable risk factors of osteoporosis were recorded in a questionnaire before BMD testing. Description of osteoporosis was based on densitometry finding of L2-L4 T-score of less than -2.5. All women with T-score results above -2.5 were regarded healthy. The BMI in two groups of healthy and osteoporotic women were compared. Statistical analysis was performed using SPSS 17.0. To describe the data Mean ± SD, Median and Range were used. To compare factors between osteoporosis and non osteoporosis group, we utilized chi-square or t-test. Factors with P-values of less than 0.20 were included in a logistic regression with backward elimination method to indicate
most important factors and used to construct a predictive model. Critical values were identified using decision tree (based on CRT method).

**Results:**

Mean age ± SD for all participants was 57±9 (Median: 56, range: 23-81), and the mean BMI value was 27.7(±4.2) and the median was 27.9 (18-41). Most of the women, 314 out of 325 (97%), were menopause women. Osteoporosis was found in 202(62.2%) of this population and the other 123 (37.8%) were healthy. Healthy group had a statistically significant higher BMI than osteoporotic group (p= 0.010). Median BMI in the osteoporotic group was 27.4(17-40) versus 28.3(18-41) in the healthy group. Decision tree analysis (CRT method) revealed a BMI cutoff value of 31.8 for osteoporosis. Osteoporotic finding in women with BMI of more than above mentioned cutoff value consisted 21 out of 50 (42%) and in women with BMI of less than cutoff value included 181 out of 275 (66.8%) (p=0.001). Logistic regression analysis was performed for all other probable risk factors of osteoporosis. Eight factors including history of fracture, thyroid hormone levels, estrogen levels, corticosteroid therapy, Ca- VitD supplement therapy, menopausal years, age and the number of children were studied to establish a relation with osteoporosis but just Ca-VitD supplement therapy (p=0.04) and age (p=0.000) caused statistically significant difference and no estrogen therapy was nearly significant (p=0.07). Decision tree analysis studied the effect of Ca-VitD supplement therapy, age and estrogen therapy in osteoporosis of the women above or below cutoff value (figure 1). In the subgroup of women above BMI cutoff value, who used Ca-VitD, 14 out of 36 (38.2%) and if they did not use calcium 7 out of 14 (50%) had osteoporosis (Figure 1). In the subgroup of women below BMI cutoff value, if they were menopause for 6 years or more, 139 out of 182 (76.4%) and if they were menopause for less than 6 years, 42 out of 93 (45.2%) were osteoporotic (Figure 1). In the subgroup of below cutoff BMI who were menopause for 6 years or more, if estrogen therapy was done, 15 out of 30 (50%) and if estrogen therapy was not done 124 out of 152 (81.3%) showed osteoporosis (Figure 1). In the subgroup of below cutoff BMI value who were menopause for 6 years or more and did not receive estrogen therapy, in women aged more than 68 years, 32 out of 33(97%) and in less than 68 years old women 92 out of 119(77.3%) were osteoporotic. (Figure 1)

**Fig. 1:** Decision tree of osteoporosis case finding in BMD test according to BMI, Ca-VitD, menopausal years and age.(*Sums are presented as n(%))
Discussion:
The population of the present study was mostly comprised of postmenopausal women with the median age of 56, mostly overweight or obese with the median BMI of 28, and mostly osteoporotic with prevalence of 62.2%. Statistically significant impact of lower BMI as a risk factor and higher BMI as a protective factor for osteoporosis was confirmed here like some other studies (Slavkin, 2000, Zhao and et al, 2008, Reid, 2008, One, 2008, Heaney and Rafferty, 2008).

According to decision tree analysis, BMI of 31.8 was osteoporosis cutoff point in the present study. Although the literature cannot set an exact BMI cutoff for osteoporosis, in a patient with BMI of less than 22-24, bone density is lower throughout the body in comparison to a patient with BMI of 26-28 or more. Studies have confirmed 4-8% greater lumbar spine bone density and 8-9% greater hip bone density in the people with BMI of 30 or more (Wardlaw, 1996). When comparing the present study with other studies, one should consider characteristics of our study group who were mostly overweight-obese and osteoporotic. Another point is the measurement method used in our study which was BMD test result of less than -2.5 T-score in lumbar spine.


In our study decision tree analysis revealed the definite role of calcium and VitD therapy in preventing osteoporosis among patients with BMI of more than 31.8.

Conclusion:
Our findings highlight low BMI as a risk factor for osteoporosis. Effective point in preventive measures such as Estrogen therapy should be considered in women with low BMI to prevent osteoporosis.

REFERENCES


