

High risk factors for osteoporosis in women - A dexa based risks stratification study

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Abstract

Background: Osteoporosis is a skeletal disorder characterized by low bone mass and micro architectural deterioration of bone tissue, resulting in decreased bone strength and predisposition to fractures. Osteoporosis is often referred as a silent disease. Most people may not be aware that they have osteoporosis until a fractured spine, hip or wrist occurs with a simple fall. More than 200 million women worldwide have osteoporosis. Estimates indicate that the number of osteoporotic hip fractures occurring in the world each year will rise from 1.66 million to 6.26 million by the year 2050, there by implying an urgent need for preventive strategies. Several medications are available to improve bone density and decrease fractures. Adequate calcium and vitamin D intake (and treatment of vitamin D deficiency) are paramount in the management of osteoporosis.

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INTRODUCTION

Risk Factors

The two major determinants of risk in the development of osteoporosis are peak bone mass and rate of bone loss. These two determinants are influenced by a number of genetic and environmental factors. Roughly 70% of cases of osteoporosis are probably the result of genetic predisposition, including the role of genetics in dictating how an individual will respond to various exogenous stressors. The remaining 30% of cases are probably triggered by environmental influences. Ethnic or racial origin is an important risk factor for decreased bone mass. Women are more likely to have osteoporosis than men

because of a lower peak bone mass and greater rate of bone loss, especially after menopause. White and Asian women are at greatest risk, whereas blacks and Hispanics are relatively protected because of greater peak bone mass.

AIM OF THE STUDY

To study the influence of predisposing factors like Obesity, Number of years since menopause, Diabetes, Dyslipidemia and Thyroid disorders in the incidence of osteoporosis in symptomatic post-menopausal women.

MATERIAL AND METHODS

This is a prospective study done in the outpatient department of Physical Medicine and Rehabilitation at Neurofoundation hospital, Salem for a period of 2 years from March 2019 to March 2021. 200 women attending the outpatient department of Physical Medicine and Rehabilitation at Neurofoundation hospital, Salem with complaints suggestive of Osteoporosis who have attained natural or surgical menopause were included in the study. The inclusion criteria included age < 70 Years, symptomatic post-menopausal women, symptomatic post hysterectomy women, post-menopausal hypothyroid patients, post-menopausal obese patients, post-menopausal diabetic patients. The exclusion criteria included pre-menopausal women, post-menopausal women age > 70

years, women with established Osteoporosis. For each symptomatic post-menopausal woman BMD of LS (Lumbosacral) Spine was measured by DEXA scan. The World Health Organization has developed definitions for low bone mass (osteopenia) and osteoporosis. These definitions are based on a T-score for White women.

BMD T-SCORE OSTEOPOROSIS RISK

| | |
|------------------------------------|--------------|
| At or above -1SD | Normal |
| Between-1SD and -2.5SD | Osteopenia |
| At or below -2.5SD | Osteoporosis |
| At or below -2.5SD + osteoporosis. | Established |

BMI was calculated for all patients. Fasting and Post prandial blood sugar estimation, Lipid profile and Thyroid profile was done.

RESULTS

All figures are presented in numbers and percentages. Descriptive are presented as mean SD. 95% confidence interval was calculated for the incidence of low BMD assuming binominal distribution. Association between the

risk factors and the low BMD was done using Pearson's chi square test. Multivariate Logistic Regression (MLR) was used to identify significant risk factors that influence the incidence of low BMD in multivariate scenario. All variables were entered into the model using the Enter method. P' value less than 0.05 is considered statistically significant.

The mean BMI of the women during their initial visit to OPD was 26.97 + 3.98 ranging from 15.5- 36.4. Among 200 women 59(29.5%) were normal in terms of BMI. About 39(29.5%) were Overweight, 67(33.5%) were Obese. 31(15.5%) were extremely obese and 4 of them were under weight. The type of menopause was Natural in 132 and Surgical in 68 (34%). Among 200 women nearly half [99(49.5%)] were within 5years of their menopause. About [43(21.5%)] women were 6-10years of their menopause. About [25(13.5%)] were above 15years of their menopause. Among 11-15years of menopause group there were about [33(17.5%)] women. With regard to fracture risk, 82 (41%) had normal T-score and 59% had low T-score. Osteopenia was noted in 72(36%) women. Osteoporosis was seen in 46(23%).

TABLE 1: ASSOCIATED RISK FACTORS FOR OSTEOPOROSIS

| NO. OF RISK FACTORS | NO. OF WOMEN | % WOMEN |
|-------------------------|--------------|---------|
| LOW BMI | 4 | 2% |
| High BMI | 137 | 68.50% |
| Low socioeconomic class | 78 | 39% |
| Diabetes | 44 | 22% |
| Hypothyroid | 32 | 16% |
| Hyperthyroid | 1 | 0.50% |
| Dyslipidemia | 61 | 30.50% |

Note: F values as represented as whole numbers. Percentages are represented within parentheses

TABLE 2: COMPARATIVE ANALYSIS OF RISK FACTORS

| | Age | | | | Age Total | BMI | | | BMI Total |
|---------------------|--------|-----------|--------------|-----------|-----------|--------------|--------------|--------------|-----------|
| | 30-40 | 41-50 | 51-60 | >60 | | Low | Normal | High | |
| Normal | 4(80) | 34(21.52) | 36(40) | 8(20.51) | 82(41) | | 20(33.9) | 62(45.26) | 82(41) |
| Osteopenia | 20 | 30.3(12) | 41.11(17) | 35.9(17) | 36(46) | 1(25) | 22(37.29) | 49(35.77) | 72(36) |
| Osteoporosis | 5(5) | 18.18(66) | 18.89(90) | 43.59(39) | 23(200) | 3(75) | 17(28.81) | 26(18.98) | 46(23) |
| Total | 5(100) | 66(100) | 90(100) | 39(100) | 200(100) | 4(100) | 59(100) | 137(100) | 200(100) |
| Chi Square | | | | | | 9.67 | 9.67 | 9.67 | |
| Df | | | 6 | | | 4 | 4 | 4 | |
| P value | | | 0.004 | | | 0.046 | 0.046 | 0.046 | |

TABL 3: Comparative Analysis Of Risk Factors

| | Socioeconomic class | | Socioeconomic class TOTAL | Years of Menopause | | | | Years of Menopause Total | Type of Menopause | | Type of Menopause Total |
|-------------------|---------------------|-----------|---------------------------|--------------------|------------|------------|----------|--------------------------|-------------------|-----------|-------------------------|
| | Low | High | | <5 years | 6-10 years | 11-15years | >15years | | Natural | Surgica | |
| Normal | 12 (15.4) | 70 (57.4) | 82 (41) | 56 (56.6) | 13 (30.2) | 10 (30.3) | 3 (12) | 82 (41) | 54 (40.9) | 28 (41.1) | 82 (41) |
| Osteopenia | 28 (35.9) | 44 (36.1) | 72 (36) | 32 (32.3) | 18 (41.9) | 15 (45.5) | 7 (28) | 72 (36) | 49 (37.1) | 23 (33.8) | 72 (36) |

| | | | | | | | | | | | |
|---------------------|-----------|--------------|-----------|-----------|-----------|----------|-------------|-----------|--------------|-------------|--------------|
| Osteoporosis | 38 (48.7) | 8 (6.56) | 41 (23) | 11 (11.1) | 12 (27.9) | 8 (24.2) | 15 (60) | 46 (23) | 29 (21.9) | 17 (25) | 46 (23) |
| Total | 78 (100) | 122 (100) | 200 (100) | 99 (100) | 43 (100) | 33 (100) | 25 (100) | 200 (100) | 142 (100) | 68 (100) | 200 (100) |
| Chi Square | 57.2 | 57.2 | | | | | 36.598 | | | 0.31554 | |
| Df | 2 | 2 | | | | | 6 | | | 2 | |
| P value | 0 | 0 | | | | | 0 | | | 0.854 | |

TABLE 4: Comparative Analysis Of Risk Factors

| | Diabetes | | Diabetes Total | Hypothyroid | | Hypothyroid Total | Dyslipidemia | | Dyslipidemia Total |
|---------------------|----------|----------|-------------------|-------------|----------|----------------------|--------------|----------|--------------------|
| | Normal | Diabetic | | Normal | Low | | Negative | Positive | |
| Normal | 63(40.4) | 19(43.2) | 82(41) | 68(40.5) | 13(41.9) | 81(40.7) | 55(39.6) | 27(44.2) | 82(41) |
| Osteopenia | 60(38.5) | 12(27.3) | 72(36) | 63(37.5) | 9(29) | 46(23.1) | 50(35.9) | 22(36.1) | 72(36) |
| Osteoporosis | 33(21.2) | 13(29.6) | 46(23) | 37(22) | 9(29) | 46(23.1) | 34(24.5) | 12(19.7) | 46(23) |
| Total | 156(100) | 44(100) | 200(100) | 168(100) | 31(100) | 200(100) | 139(100) | 61(100) | 200(100) |
| Chi Square | | 2.31 | | | 1.088 | | | 0.651 | |
| Df | | 2 | | | 2 | | | 2 | |
| P value | | 0.32 | | | 0.58 | | | 0.722 | |

AGE: It is found from the table that the percentage of normal level of BMD was highest (80 %) among 30-40 years women. The percentage of osteopenia was highest (41.11 %) among the women in 50-60 years. The percentage of osteoporosis was highest (43.59 %) among the age group above 60 years and the same was lowest and equal (18.18 %) among 40-50 and 50-60 years. It is also noted from the table that the 'p' value is less than 0.05 and hence the result is significant. From the analysis it is concluded that there is highly significant association between the age of the women and the level of fracture risk.

BMI: Among the four in low BMI group one had T-score in the osteopenic level and the rest had T-score in the osteoporotic level. Fracture risk is 100% in underweight women [low BMI]. In contrast in high BMI group nearly half of them had normal BMD. 'p' value is less than 0.05 and hence the result is significant.

SOCIO ECONOMIC CLASS: Osteoporosis was highest 48.72% among low Socio-economic class. Women belonging to high Socio-economic class, more than half had normal BMD. 'p' value is less than 0.05 and hence the result is significant.

YEAR OF MENOPAUSE: The percentage of normal BMD was highest (56.57%) among women whose year of menopause was up to 5 years. Moderate level of fracture risk was highest (87.31%) among women with 6-15 years of menopause. High fracture risk (60%) was seen in women with above 15 years of menopause. The 'P' value is less than 0.05 and hence the result is significant.

TYPE OF MENOPAUSE: It is noted that there is not much difference between Natural and Surgical menopause in normal BMD category. Osteopenia was more among Natural menopause group. Osteoporosis was menopause group. and hence the result is not significant. more among Surgical. It is also noted from the above table that the 'p'

value is greater than 0.05 and hence the result is not significant.

DIABETES: It is found from the table that the percentage of normal level of BMD was highest (43.18 %) among diabetes. The percentage of osteopenic level of fracture risk was the highest (38.46 %) among the women in Non Diabetes. The percentage of osteoporosis level of fracture risk was highest (29.55 %) among the Diabetes. It is also noted that the 'p' value is greater than 0.05 and hence the result is not statistically significant.

HYPOTHYROID: The percentage of osteoporosis is highest in normal group compared to Hypothyroid. The percentage of osteopenic level of fracture Risk was 9% in Hypothyroid group. 'p' value is greater than 0.05 and hence the result is not significant.

DYSLIPIDEMIA: It is found from the table that the percentage of osteopenia was almost equal in both groups. The percentage of osteoporosis was highest (24.46%) in patients without dyslipidemia. 'p' value is greater than 0.05 and hence the result is not significant.

DISCUSSION

Osteoporosis is associated with low bone mass and high predisposition to fractures and resulting in high morbidity. Osteoporosis can occur in any age but most commonly follows menopause in women.

Multiple risk factors exist for osteoporosis. In various studies secondary osteoporosis accounts for about 40% of total.

Identification of women at risk for osteoporosis is of great importance for the prevention of osteoporotic fractures.

In this study prevalence of low BMD is found to be 59% [95%CI: -2.326,2.050].

Osteopenia [T-score -1SD to -2.5SD] was noted in [36%] [95%CI: -1.825,-1.614].

Osteoporosis (T-score below $-2.5SD$) was noted in [23%] [95%CI: $-3.077, -2.766$]

There were more osteoporotic women in above 60 years age. There was statistically significant association between Age and low BMD. ($p < 0.004$)

There was no statistically significant difference ($p = 0.854$) in the proportions of osteoporosis between Natural and Surgical menopause, implying that the type of menopause did not influence osteoporosis. When considering the number of years since menopause there was statistically highly significant ($p < 0.00$) association between the years of menopause and osteoporosis. Majority 60% of women above 15 years of menopause had osteoporosis compared to 11.11% in up to 5 years of menopause. 87.31% of osteopenia in 6-15 years of menopause. The risk of bone loss increases significantly after 5 years of menopause and the risk increases by fivefold after 15 years of menopause. When considering the association between BMI and the low BMD, low BMI women (underweight) were 100% osteoporotic with high fracture risk. And there was statistically significant correlation between the low BMI and low BMD. [$p < 0.046$]. In contrast there was no statistically significant difference [$p < 0.199$] in the high BMI group. In this study when considering the socio-economic class there was statistically significant difference [$p < 0.00$] in the proportions of osteoporosis and low socio-economic class [4 and 5]. The individual risk factors like Diabetes, Hyperthyroid, Hypothyroid and Dyslipidemia all were compared with the low BMD. Among the above risk factors none were clinically significant. In this study there was not much difference in the percentages of low BMD between diabetes (56.82%) and Non diabetes (59.61%) group. And the 'p' value is [$p = 0.315$] above 0.05 and hence not statistically significant. In this study among Diabetes all were with Type 2 Diabetes and none were with Type-1 Diabetes. As per NOF [National Osteoporosis Foundation] guidelines Type-1 Diabetes is more prone for bone loss compared to Type 2 Diabetes. In this study 32 patients were Hypothyroid. And the fracture risk was 58.06% in Hypothyroid 59.52% in normal women. 'p' value is not statistically significant. [$p < 0.580$] Among 200 postmenopausal women only one woman had Hyperthyroid and her BMD was normal. The patient is not on any treatment. In 55.74% of patients with Dyslipidemia [61] the BMD was low compared to 60.43% in normal women. 'p' value is not statistically significant. [$p < 0.722$]

MULTIVARIATE ANALYSIS

The significance of the risk factors has to be tested in multivariate situations in spite of their statistical significance in univariate analysis discussed so far. Multivariate analysis was done with T-score as a dependent variable and age group, BMI, years of

menopause and other risk factors as dependent variables in the multivariate model.

LOW BMD

Low BMI [$p < 0.00$] and years of menopause ($p < 0.00$) are the variables that influence the low T-score value among postmenopausal women. Age [$p = 0.4631$], Type of menopause [$p = 0.5031$] or other hypothesized risk factors such as Diabetes, [$p = 0.9013$] Thyroid ($p = 0.2818$), Dyslipidemia [$p = 0.6493$] did not indicate low BMD.

CONCLUSION

The significance of risk factors in detecting women with osteoporosis is highlighted in this study. Increasing age, Low BMI (< 18.5), Low socio-economic class [class 4 and 5] and the number of years since menopause (above 5 years onwards) are found to be significant risk factors in univariate analysis. Low BMI and Increasing years of menopause both showed a significant 'p' value in multivariate analysis. Since osteoporosis is a silent disease and routine BMD measurement is not feasible for all patients in our population identification of high-risk subset of women is an important element of effective preventive strategies.

DEXA scan should be done for patient with low BMI/ low socio-economic class/ more than 5 years of menopause /Hyperthyroid/Type-1 Diabetes. When the morbidity is significant and the tools to diagnose and intervene are easily accessible leaving osteoporosis is no longer acceptable.

REFERENCES

1. Wildner M, Peters A, Raghuvanshi VS, et al. Superiority of age and weight as variables in predicting osteoporosis in postmenopausal white women. *Osteoporosis International*. 2003 Nov; 14(11):950-6.
2. Dargent-Molina P, Poitiers F, Breart G. In elderly women weight is the best predictor of a very low bone mineral density: evidence from the EPIDOS study: EPIDOS Group : *Osteoporosis International*. 2000; 11(10): 881-8.
3. Juan Zhao, Hui Jiang, Christopher, J Papiasian. *Journal of Bone and Mineral Research*; Correlation of Obesity and Osteoporosis: Effect of Fat Mass on the Determination of Osteoporosis. *Lan- January 2008*; 23: 17-29
4. Thomas J Beck, Moira A Petit, Guanglin Wu, Does Obesity Really Make the Femur Stronger? BMD, Geometry, and Fracture Incidence in the Women's Health Initiative-Observational Study. *Journal of Bone and Mineral Research August 2009*; 24:1369-1379.
5. Guney E, Kisakol G, Ozgen G, et al. Effect of weight loss on bone metabolism: Comparison of vertical banded gastroplasty and medical intervention. *Obes Surg*. 2003; 13:383-388
6. Radak TL. Caloric restriction and calcium's effect on bone metabolism and body composition in overweight and obese premenopausal women. *Nutr Rev*. 2004; 62:468-481.
7. Wardlaw GM. Putting body weight and osteoporosis into perspective. *Am J Clin Nutr*. 1996; 63:433S-436S.

8. Kameda T et al. Estrogen inhibits bone resorption by directly inducing apoptosis of the bone-resorbing osteoclasts. *J Exp Med.* 1997;186:489-495.
9. Reid IR. Relationships among body mass, its components, and bone. *Bone.* 2002;31:547-555.
10. Rosen CIMB. Mechanisms of Disease: Is osteoporosis the obesity of bone? *Nat ClinPractRheumatol.* 2006;2:35-43.

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