Relation between Serum Calcium Level, Bone Mineral Density and Blood Pressure in Postmenopausal Women

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Research Article

Abstract: **Objective:** To study the correlation between serum calcium, bone mineral density (BMD) and blood pressure in postmenopausal women. **Material and methods:** The present study was a cross-sectional study. 70 postmenopausal women with age between 50 to 65 years were selected for the study with no medical, surgical or gynecological abnormalities. Body Mass Index (BMI) was calculated in each woman. Blood pressure of each woman was measured with mercury sphygmomanometer. The bone mineral density (BMD) was measured by Bone Densitometer and classified as normal, osteopenia and osteoporosis according to T-score. Serum calcium was measured on autoanalyser. **Results and Conclusion:** BMD scores were low in postmenopausal women according to T- score along with decreased Serum calcium level. There was significant association between BMD and serum calcium levels. Within postmenopausal women, there was increase in BMI with slight increase in both systolic and diastolic blood pressures with respect to age but no relation between serum calcium and blood pressure.

Key words: Postmenopausal Women, Serum calcium, Bone mineral density.

Introduction

Menopause is defined as, the time of cessation of ovarian function resulting in permanent amenorrhea[1]. In postmenopausal women, the two major causes of bone loss are estrogen deficiency after menopause and age related processes.[2] Bone turnover increases to high levels and estrogen deficiency may induce calcium loss by indirect effects on extra skeletal calcium homeostasis. Calcium ion is an essential structural component of the skeleton. BMD is a good indicator for measuring bone tissue loss in the body. It is well established from many studies that hypertension is one of the major burden in menopausal women with significant association between menopause and blood pressure with adiposity and body measurements.[3] In this view the present study is an attempt to investigate association between serum calcium, BMD and blood pressure in post menopausal women.

Objectives

To study the correlation between serum calcium, bone mineral density (BMD) and blood pressure in postmenopausal women.

Material and Methods

The present study was a cross-sectional study conducted in Department of Physiology, Government Medical College, Latur. 70 postmenopausal women between 50 to 65 years age group were selected from general population for the study. The study subjects with medical, surgical or gynecological abnormalities were excluded. Body Mass Index (BMI) was calculated in each woman. Blood pressure of each woman was measured with mercury sphygmomanometer and a stethoscope in a sitting position. The BMD was measured by Bone Densitometer and classified as normal, osteopenia and osteoporosis according to T-score given by WHO. Serum calcium was measured on autoanalyser.

Results

The results of various parameters in postmenopausal women were shown in following tables as below:

Table 1: Distribution of Females according to BMD and Postmenopausal age

Postmenopausal Age (years)	Bone Mineral Density (T-score)		Total
	>-2.5	≤-2.5	
0-5	06 (30.77%)	07 (69.23%)	13 (100%)
6-10	09 (26.67%)	21 (73.33%)	30 (100%)
11-15	02 (04.17%)	22 (95.83%)	24 (100%)
16-20	00 (00%)	03 (100%)	03 (100%)
Total	17	53	70

(χ^2 = 8.20 df= 3 p< 0.05 significant)

From table no.1 it was observed that, among 70 postmenopausal women 53 (75.71%) women shows T-score ≤-2.5 which was a sign of osteoporosis. And the association between postmenopausal age and BMD was significant. (p< 0.05)

Table 2: Distribution of Females according to Serum Calcium and Postmenopausal age

Postmenopausal Age (years)	Serum Calcium (mg/dl)		Total
	< 8.5	≥8.5	
0-5	04 (30.77%)	09 (69.23%)	13 (100%)
6-10	22 (73.34%)	08 (26.66%)	30 (100%)
11-15	22 (91.67%)	02 (08.33%)	24 (100%)
16-20	03 (100%)	00 (00%)	03 (100%)
Total	51	19	70

(χ^2=17.06 df= 3 p < 0.0001 significant)

The distribution of serum calcium and postmenopausal age was described in table no.2 and it shows that around 51 (72.86%) women have low serum calcium (< 8.5 mg/dl). The association between postmenopausal age and serum calcium levels was highly significant. (p< 0.0001)

Table 3: Distribution of Females according to BMD and Serum Calcium

Serum Calcium (mg/dl)	Bone Mineral Density (T-score)		Total
	≤ -2.5	>-2.5	
< 8.5	47 (92.15%)	04 (07.85%)	51 (100%)
≥8.5	06 (31.58%)	13 (68.42%)	19 (100%)
Total	53	17	70

(χ^2= 24.43 (Yates' corrected) df = 1 p < 0.0000 significant)

The distribution of serum calcium and BMD among postmenopausal women was shown in table no.2. Around 47 (92.15%) women shows serum calcium levels <8.5mg/dl with BMD ≤ -2.5. The association between serum calcium and BMD was highly significant. (p< 0.0000)

Table 4: Distribution of Females according to Blood Pressure and Serum Calcium

Blood Pressure (mm of Hg)	Serum Calcium (mg/dl)		Total
	< 8.5	≥8.5	
< 140/90	21 (72.41%)	08 (27.59%)	29 (100%)
≥140/90	30 (73.17%)	11 (26.83%)	41 (100%))
Total	51	19	70

(p=0.9, not significant)

The distribution of serum calcium and blood pressure in postmenopausal women was described in table no.4. It shows that around 30 (73.17%) women have low serum calcium (< 8.5 mg/dl) along with increase blood pressure. But there was no association between blood pressure and serum calcium levels among postmenopausal women.

Discussion

The present cross-sectional study was carried out in Postmenopausal women. This study was conducted to study to investigate association between serum calcium, BMD and blood pressure in post menopausal women. The results of the present study indicated that the level of serum calcium was declined significantly in post menopausal women with respect to their age. The mean of serum calcium was 8.34±0.47. The difference between postmenopausal age and serum calcium was statistically significant. (χ^2=17.06, p < 0.0001). Calcium ion is an essential structural component of the skeleton. Estrogens deficiency after menopause induces calcium loss by indirect effects on extra skeletal calcium homeostasis as well as decrease intestinal calcium absorption. Deficiency of calcium and malabsorption due to hormonal imbalance may lead to disorders of bone mainly osteopenia and osteoporosis.[4, 5] The results also stated that BMD in post menopausal women decrease with like serum calcium and difference between them was statistically highly significant. (χ^2=24.53, p < 0.0001). Biochemical parameters give an idea about the rates of bone formation (serum calcium) and resorption.BMD is a measure of calcium and other minerals in the bone giving it strength. High rate of bone turnover correlates with low bone mass. Estrogen deficiency at menopause increases the rate of bone remodelling which results in high turnover bone loss.[6] Estrogen influences all aspects of bone physiology throughout life. The hormone maintains bone mass in adult women partly by slowing the bone remodelling and partly by maintaining a balance between osteoblasts and osteoclasts. When estrogen is deficient, there is an increase in the activation of new bone remodelling units. Both formation and resorption are altered with the result that resorption exceeds formation, producing a negative balance resulting in postmenopausal bone loss. Once the bone mass falls below a critical threshold level, person is diagnosed to have osteoporosis when the bone density falls. Normal BMD scores are: T score of 1 or > is normal. T score -1.0 and -2.5 is 'low bone mass' or osteopenia. T score -2.5 or below is osteoporosis. Thus while BMD provides a static picture of the skeleton, the biochemical markers of bone turnover provide dynamic measures of bone remodeling and thus potentially useful in predicting the course of changes in bone mass.[7] In the present study we found that both the systolic and diastolic blood pressure were increased slightly in post menopausal women with mean of 137.3±12.4 and 86.2±8.2 for systolic and diastolic respectively. There was no any correlation between serum calcium and blood pressure in post menopausal women. The similar results have been found in many other studies like Staessen et al. 1989; Pelt et al. 2001; Garauet 2002; Sipila 2003; Skrzypezak and Szwed 2005; Kaur and Mogra 2006. The increase in blood pressure in post menopausal women may probably due to increasing age and higher BMI. In older age arteries get stiffed which causes higher blood pressure.[3] Other reason may be due loss of ovarian hormones (estrogen and progesterone) which are vasodilators of vessels, which lead to increase blood pressure in post menopausal women.[3] Hence, the drop of female sex

steroids and increase of androgen after menopause affect the balance between different vasoactive hormones in the female body which lead to increase blood pressure with menopause. The reasons responsible for increasing of blood pressure in post-menopausal women are multi-factorial and complex interrelated.

Conclusion

This study suggests that there was positive association between serum calcium and BMD. The decreased concentration of calcium and BMD scores in postmenopausal women indicates that they are more prone to fractures and osteoporosis. There is no link between blood pressure and BMD in postmenopausal women. There does not appear to be an independent relationship between serum calcium and blood pressure. The resultant increase in blood pressure was due to age and BMI.

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