Study on the Prevalence of Osteoporosis and the Association between the Serum Calcium Levels and the Bone Mineral Density Levels in Postmenopausal Women

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ABSTRACT

Introduction: The prevalence of postmenopausal osteoporosis is increasing day by day in post-menopausal women due to hormonal imbalance, deficiency or malabsorption of calcium which reduces bone mineral density. The present study was aimed to find out the prevalence of osteoporosis in postmenopausal women and the association between the serum calcium levels and the bone mineral density levels.

Material and methods: It was a cross sectional study comprising of 60 post-menopausal women in a range of 45 to 58 years. The serum calcium levels were measured using COBAS INTEGRA automatic analyzer and the bone mineral density was measured by using Dual energy x – ray absorptiometry (DEXA). The WHO criteria for osteoporosis using T score were considered to classify the post-menopausal women.

Results: The incidence of the bone mineral density changes in post-menopausal women was reported as 1.6% was normal, 21.6% were in the stage of osteopenia and 76.66% were in the stage of osteoporosis. The mean bone mineral density was observed as -2.75 ± 1.09. The mean serum calcium levels in postmenopausal women were reported as 8.47 ± 1.13mg/dl. Weak positive correlation was observed with R value as 0.042, but statistically not significant association was observed.

Conclusion: The prevalence of osteoporosis is very high in the post-menopausal women. The correlation between the serum calcium and the bone mineral density was observed to be positive but not statistically significant.

Keywords: Menopause, Bone Mineral Density, Serum Calcium, Osteoporosis, Osteopenia

INTRODUCTION

Menopause is a natural physiological condition characterised as at least twelve consecutive months of amenorrhea resulting from primary ovarian failure secondary to apoptosis and without any pathological cause. On the onset of menopause, the estradiol decreases and the follicle stimulating hormone (FSH) increases. Most of the women experiences hot flushes, sleeplessness, mood swings, night sweats, dyspareunia, vaginal atrophy and dryness during the transition period of menopause. Other than these symptoms, osteoporosis is the major problem in post-menopausal women which leads to fractures and affects the quality of life.[1] Osteoporosis is a multifactorial systemic skeletal disease. It is characterized by low bone mineral density (BMD) and micro-architectural deterioration of skeletal tissue resulting in bone fragility which leads to fractures.[2]

The prevalence of osteoporosis and its related fractures are much higher in postmenopausal women than in older men of the same age group, as in women the estrogen plays an important role in maintaining bone health.[3] According to the previous studies the estimated rate of prevalence of osteoporosis is going to rise from 1/3 of the people at the age of 50 to 60years and more than 50% of the people above 80 years. By 2050, the people affected osteoporosis is going to reach 6 million globally, in which 3/4 of them will belongs to developing countries.[4,5]

At the menopausal stage the normal bone turnover cycle is impaired because of estrogen deficiency. During post-menopausal period the osteoclastic resorption activity increases and the osteoblastic activity decreases. So the rate of the bone resorption increases which leads to a net loss of bone. Estrogen receptors are present in the osteoclast progenitor cells and also in the multi-nucleated osteoclasts. Overall bone resorption increases due to a weakened inhibition effect caused by the reduced amount of available estrogen on both osteoclastogenesis and osteoclast activity. The increased expressions of cytokines to stimulate osteoclastogenesis are IL-1, IL-6, and TNF, or increased expression of macrophage colony-stimulating factor and RANKL in osteoblasts/stromal cells play an important role in bone resoroption. The effect of estrogen on bone formation is mediated by estrogen-receptor-responsive elements on promoters for genes involved in bone matrix biosynthesis.[6] The calcium ion is an essential and structural component of the bone. The estrogens deficiency in postmenopausal phase induces calcium loss by indirect effects on extra skeletal calcium homeostasis as well as decreases the intestinal calcium absorption. So the deficiency of calcium and its malabsorption due to hormonal imbalance may lead to disorders of bone mainly osteopenia and osteoporosis.[7,8] The bone mineral density is measured by dual X-ray absorptiometry. It is the gold standard method to

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diagnose osteoporosis. World health organization defines the osteoporosis as the T Score is less or equal to -2.5 and the osteopenia as -1.0 to -2.5.[9] The present study was aimed to find out the prevalence of osteoporosis in postmenopausal women and the association between the serum calcium levels and the bone mineral density levels.

MATERIAL AND METHODS

The present study was a cross sectional study comprising of 60 post-menopausal women with in the age group of 45 to 58 years. All the post-menopausal women were explained about the study and the procedures to be carried out in detail. The women who were on calcium supplementation were excluded from the study. Written informed consent was obtained from the research participants and the study was approved by the institutional ethical clearance. The serum calcium was measured using COBAS INTEGRA automatic analyzer and the bone mineral density was measured by using Dual energy x – ray absorptiometry (DEXA). The WHO criteria for osteoporosis using T score were considered to classify the post-menopausal women into 3 groups. Non osteoporotic or normal (BMD > -1.0), osteopenia (BMD is -1.0 to -2.5 SD) and osteoporosis (BMD < -2.5 SD).

RESULTS

The average age of the post-menopausal women was observed as 50.8 years. The mean body mass index of the post-menopausal women was 22.53 ± 4.14 kg/m^2. The incidence of the bone mineral density changes in post-menopausal women was reported as 1.6% (1/60) were normal, 21.6 (13/60) were in the stage of osteopenia and 76.66% (46/60) were in the stage of osteoporosis (Figure 1). The bone mineral density was ranging from -1.8 to -4. The mean bone mineral density was observed as -2.75±1.09.

The serum calcium levels in the postmenopausal women were ranging from 3.2 to 10mg/dl. The mean serum calcium levels in postmenopausal women were reported as 8.47 ± 1.13mg/dl. Pearson correlation coefficient test was performed to find out the association between the serum calcium and the bone mineral density levels. Weak positive correlation was observed with R value as 0.042, but statistically not significant association was observed as the P value was 0.75.

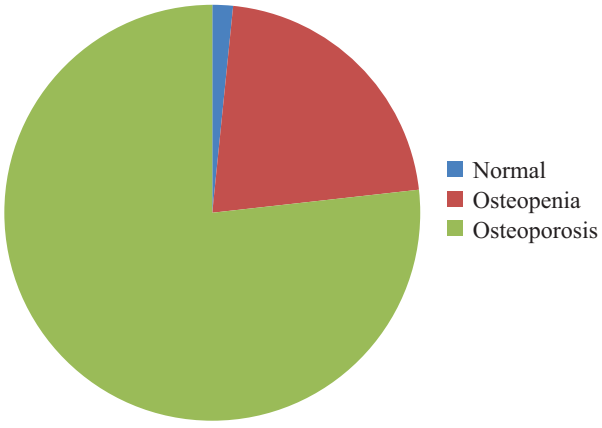

Figure-1: Showing the incidence of the osteoporosis in post-menopausal women.

DISCUSSION

Bone remodeling takes place constantly that is replacing the old bone with new bone content. Bone remodeling is dependent on several factors like mechanical stresses, hormones like calcitonin, parathyroid hormone, growth hormone and estrogen, vitamin D, and locally produced cytokines, prostaglandins and growth factors. The reduced production and availability of these factors in old age may leads to osteoporosis. On the other side the calcium balance is also equally and critically important to maintain the bone mass. The calcium balance depends on several factors like, the availability of calcium in the diet, the efficacy of absorption by intestine and excretion of calcium.[10] The prevalence of osteoporosis is silently increasing in India. Osteoporosis is a main cause of fractures leading to morbidity and mortality in adult Indian women. Thus the present study was focused on the prevalence of osteoporosis in post-menopausal women and the association between the serum calcium and the bone mineral density level.

In the present study the incidence of bone mineral density changes in post-menopausal women was reported as 1.6% was normal, 21.6% were with osteopenia and 76.66% were in the stage of osteoporosis. A positive correlation between the serum calcium levels and the bone mineral density levels were also observed in the present study which is similar to the other Indian study conducted by Sasmitha Mishra et al., who found 80% of post-menopausal women suffering with osteoporosis, remaining 20% women in the stage of osteopenia and none of the post-menopausal women were normal according to the T score of BMD. The mean serum calcium in post-menopausal women was 8.28mg/dl and they reported the strong positive correlation between the serum calcium levels and BMD and also with the age.[11] In another study by Pratima D et al., higher prevalence of osteoporosis was reported compared to the present study, which was 92.15% of post-menopausal women with osteoporosis and also low serum calcium levels that means <8.5mg/dl with BMD ≤ -2.5. They also found highly significant association between serum calcium and BMD.[12]

CONCLUSION

Within the limitations of the present study the prevalence of osteoporosis is very high in the post-menopausal women. There was a positive association between the serum calcium and the bone mineral density but statistically not significant. Further studies should be carried on large population to find out the association between the bone mineral density and the serum calcium level.

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