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Vitamin D Levels and bone mineral density in postmenopausal women

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Abstract

Introduction and Objectives: Osteoporosis characterized by low bone mass is a major health problem in post-menopausal women. Bone Mineral Density (BMD) represents the density or thickness of bones. Vitamin D plays an important role in bone growth and maintenance. Vitamin D inadequacy is implicated in the development of osteopenia and osteoporosis. To study the Bone Mineral Density and serum 25-hydroxy Vitamin D levels in post-menopausal women.

Materials and Method: This was a cross sectional study conducted in the Gynaecology OPD at a tertiary care centre in Chennai. 3o postmenopausal women in the age group of 45 and above were chosen for the study. Bone mineral density was measured by ultrasound bone densitometer and expressed as T score. Serum 25 hydroxy vitamin D levels were estimated by Chemiluminescence method. The data was analysed using SPSS software version 16.

Results: T score of all the subjects ranged between -2.5 to -4.25. The mean serum 25-hydroxy Vitamin D level was 16.6 ± 4.8 ng/ml. Pearson correlation analysis was done. A significant correlation was seen between Age and Bone Mineral Density ($p<0.000$), 25- hydroxy Vitamin D and Bone Mineral Density ($p<0.000$), age and 25- hydroxy Vitamin D ($p<0.000$).

Interpretation: In this study the T score of all the subjects ranged from -2.5 to -4.25 which is suggestive of osteoporosis. In this study 37% of the subjects had 25-hydroxy Vitamin D levels less than 20ng/ml suggestive of Vitamin D Deficiency.

Conclusion: Vitamin D could be an important factor implicated in the development of osteoporosis in these post-menopausal women.

Keywords: Vitamin D, Bone Mineral Density, Post-menopausal Women, Osteoporosis

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Introduction

Osteoporosis is common in women over the age of 50.(1) Osteoporosis is a disease that affects the bone, characterised by low bone mass. It destroys the microarchitecture of the bone tissue thereby increasing the bone fragility and risk of fracture.(2) It is called as a silent disease, because bone loss occurs without any signs and symptoms thereby enhancing the risk of fracture.(3)

Bone mineral density represents the density or thickness of the bone. It is an indirect indicator of osteoporosis and a predictor of fracture in clinical medicine. It is also used to assess the response of the patient to treatment. Central dual energy X-ray absorptiometry or DEXA is the most widely used methodology for bone mineral density measurements. This test measures the bone density of the pelvis or spine. The bone density can also be measured at the lower arm, wrist, finger or heel by ultrasound bone densitometer.(4)

Vitamin D plays a major role in bone metabolism. Vitamin D is necessary for effective absorption of calcium. Low vitamin D states reduces calcium absorption from the intestines, thereby leading to enhanced osteoclast production which increases calcium mobilization from bone. In prolonged Vitamin D deficiency, calcitriol interacts with the osteoblastic receptors and causes increased formation of osteoclasts. These mature osteoclasts has the potential to release enzymes that cause breakdown of the bone matrix resulting in the release of calcium and other minerals into the circulation. Persistent low calcium levels stimulates the parathyroid gland to release parathyroid hormone (PTH) which in turn enhances the reabsorption of calcium from the kidneys and also osteoclast production to maintain the serum calcium level. Vitamin D is considered as a risk factor for the development of osteoporosis. In senile osteoporosis, low vitamin D levels cause secondary hyperparathyroidism. Also the osteoblastic activity decreases with age. After menopause, the sensitivity of bone to parathyroid hormone is increased, so calcium which is mobilized from bones to the circulation increases. Secondary to hypercalcemia, vitamin D production is decreased.(5,6,7)

Post-menopausal osteoporosis is characterized by decreased trabecular bone mass and vertebrae-radius fracture. Increased bone loss at rapid rate occurs in the first five years after menopause. About 3 to 5 % of bone loss occurs annually immediately following menopause, which reduces to less than 1% after 65 years of age. This is due to drop in oestrogen production resulting in higher bone resorption and reduced calcium absorption. However hormone replacement therapy reduces the risk of developing osteoporosis. Vitamin D replacement therapy causes a significant reduction in fractures, but the knowledge about the vitamin D levels in postmenopausal women which is essential to protect

bone-mass density is minimal.[4] So the aim of this study is to find the relationship between vitamin D levels and Bone Mineral Density.

Materials and Method

This was a cross sectional study conducted in the Orthopedics OPD at a tertiary care centre in Chennai. The study was conducted after obtaining ethical clearance from the Institutional ethical committee.30 postmenopausal women in the age group of 45 and above attending the OPD were chosen for the study based on our inclusion and exclusion criteria.

Inclusion criteria

- Women in the age of 45 and above
- Women who have attained menopause
- Women on hormone replacement therapy

Exclusion criteria

- Women on vitamin D supplementation
- Kidney disease
- Bone disease
- Liver disease

Informed consent was obtained from them. Demographic data including medical history were obtained from all the subjects. Blood was collected in yellow topped gel vacuum tubes. The samples were centrifuged half an hour after collection. Serum 25 hydroxy vitamin D levels were estimated in the samples by chemiluminescence immunoassay method in Vitros ECi. Bone mineral density was measured by ultrasound bone densitometer CM 200 in the heel.The values for BMD was expressed as T score. The data was analysed using SPSS software version 16.

Results

Pearson correlation analysis was done to establish the relation between the variables age, 25-hydroxy Vitamin D and Bone Mineral Density. Table 1 shows the mean value of 25-hydroxy Vitamin D and the T score. Table 2 shows the interpretation of T score. Table 3 shows the interpretative levels of 25-OH Vitamin D.

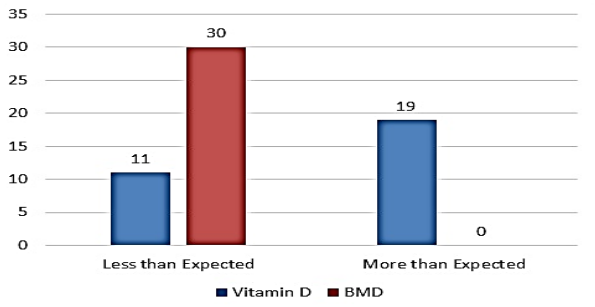

Fig. 1: Vitamin D levels & Bone Mineral Density & with low Vit D Levels: 37%, % with low BMD: 100%

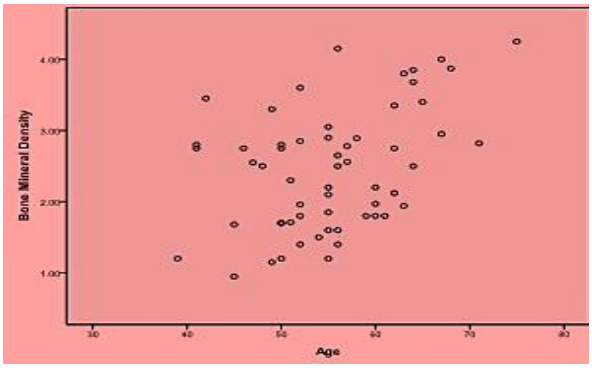

Fig. 2: Correlation Plat-Bone Mineral Density & Age

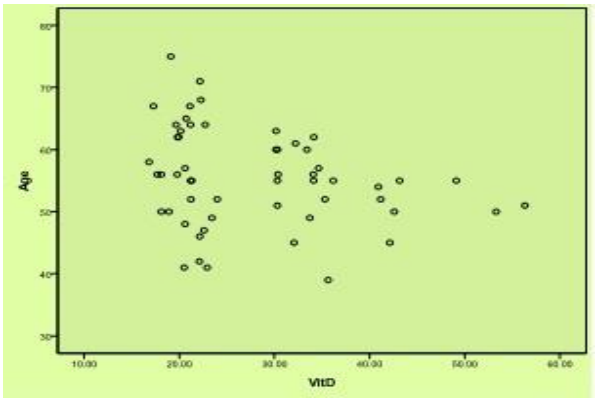

Fig. 3: Correlation Plot-Age and Vitamin D

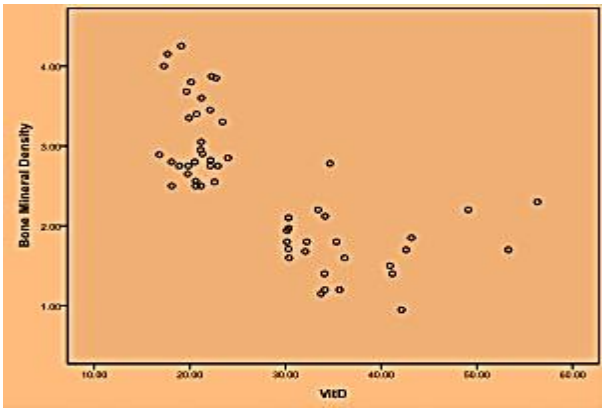

Fig. 4: Correlation Plot-Bone Mineral Density and Vitamin D

Table 1: Mean value of 25-OH Vitamin D

Variable	Mean value
25-OH Vitamin D	16.6±4.8 ng/ml

Table 2: Interpretation of T score

T Score	Interpretation
-1.0 of Higher	Normal
-1.0 to -2.5	Osteopenia
-2.5 or Lower	Osteoporosis

Table 3: Interpretative levels of 25-OH Vitamin D

Endocrine Society	Range
Vitamin D deficiency	<20 ng/ml
Vitamin D insufficiency	21-29 ng/ml
US Institute of Medicine	
Vitamin D levels of 20 ng/ml or above is adequate for bone health	

Discussion

Osteoporosis is a major health problem in developing countries. Patients with osteo porosis have low bone mass which is established by measuring the bone mineral density. A Bone Mineral Density test measures the density or thickness of bones and compares it to that of an established normal or standard to give a T score. A score of 0 indicates BMD is equal to the norm for a healthy young adult. The difference in measurements between subject and normal adults are expressed in standard deviations. In this study, the T score of all the subjects ranged from -2.5 to - 4.25. From Table 2, we know that the T score range obtained is suggestive of osteoporosis.

Many studies have shown that vitamin D deficiency is implicated in the development of osteoporosis. Table 1 shows that the mean serum 25-hydroxy Vitamin D level was 16.6 ± 4.8 ng/ml. In a similar study by Rabia et al, the mean value of Vitamin D level in osteoporotic subjects was 22.3 ± 10.9 ng/ml which was more than the mean got in our study.[4] However in another study, the mean Vitamin D level was 17.8 ng/ml which is rather similar to our present study.[5] Fig. 1 shows that in this study 37% of the subjects had 25-OH Vitamin D levels less than 20 ng/ml. A similar studied showed that 44.7% of the subjects had Vitamin D deficiency.[4] Another study showed a 40% prevalence of Vitamin D deficiency in the European population.[6] A study conducted in Austria showed that 26% of the subjects had Vitamin D levels less than 20 ng/ml.[7] There is a significant correlation between age and Bone Mineral Density with a p value <0.000 as shown by Fig. 2. Fig. 3 shows that 25-OH Vitamin D and Bone Mineral Density are significantly correlated (p<0.000). Fig. 4 shows that age and 25-OH Vitamin D are also correlated well with a significant p value <0.000. Hereby our study shows that age, 25-OH Vitamin D and Bone Mineral Density are well correlated.

Conclusion

All the subjects had low bone mass given by the bone mineral density measurements. Also there was a significant correlation between bone mineral density and 25-hydroxy Vitamin D levels among the study subjects. Thereby this study shows that Vitamin D deficiency could be an important factor in the development of osteoporosis in post-menopausal women. However the establishment of which would require long term cohort studies in a larger group of people. Also vitamin D supplementation may be given for all post-menopausal women to prevent the development of osteoporosis.

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