Serum Calcium, Parathyroid Hormones and Risk of Fracture in Premenopausal and Postmenopausal Women.

Guncha Kalia¹, Gagan Deep²
¹Assistant Professor, Department of Orthopaedics, Maharishi Markandeshwar Medical College and Hospital, Kumarhatti, Solan.
²Associate Professor, Department of Medicine, K D Medical College Hospital and Research Centre, Mathura.

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ABSTRACT

Background: Calcium is one of the most important mineral for bones; various evidences suggest that proper nutrition is important to maintain the health of bones and joints. Osteoporosis is characterised by imbalance of nutrition with endocrinial disorders. Absorption of calcium from intestine decreased in postmenopausal women. In addition calcitonin decreases the bone resorption and decrease the bone loss. Therefore, the present study was designed to evaluate the serum calcium and parathyroid hormones status in pre-menopausal and postmenopausal women to evaluate the risk of fracture in post menopausal women. Methods: This was a cross sectional type of study which was conducted on 55 premenopausal women (age 37±4.2 yrs) and 63 postmenopausal women (age 52±4.2 yrs). All the subjects were recruited from general population of Himachal Pradesh who were examined at MMU (Maharishi Markandeshwar Medical College and Hospital), Kumarhatti, Solan. Serum calcium, serum parathyroid hormone and calcitonin were estimated in premenopausal and postmenopausal women. Bone Mineral Density Test (BMD) was measured at lumbar spine and femoral neck in both groups of women. Results: There was an insignificant difference between height (p>0.05), weight (p>0.05) and BMI (p>0.05) of pre menopausal women and post menopausal women. The serum calcium (p<0.03) of post menopausal women was significantly lower in comparison to pre menopausal women. Further, PTH (p<0.05) was significantly high in post menopausal women in comparison to pre menopausal women. There was an insignificant difference between serum calcitonon level (p>0.05) of post menopausal women and pre menopausal women. Conclusion: Postmenopausal women have low calcium level along with higher parathyroid level which results in osteoporosis in female population after menopause. However, incidents of fractures can be decreased by maintaining calcium level in postmenopausal women. Nonetheless, more research is required to establish relationship between osteoporosis and postmenopause age.

Keywords: Postmenopausal women, serum calcium, BMD, osteoporosis.

INTRODUCTION

Calcium is one of the most important mineral for bones; various evidences suggest that proper nutrition is important to maintain the health of bones and joints. Osteoporosis is characterised by imbalance of nutrition with endocrinial disorders. Concentration of calcium ions depends on different factors like absorption of calcium from the intestine, excretion of calcium from the kidney. Further, uptake and release of calcium from bone depends on various hormones and vitamin including parathyroid hormones (PTH), calcitonin Hormone and vitamin D. Quality, quantity and ratio of bone mineralization and turnover depend upon a number of hormones. Parathyroid hormone induces resorption of calcium from the bone and maintain the serum calcium level. Bone strength is predicted by both BMD and bone architecture. The WHO classified BMD into categories of normal (T-score<-1), Osteopenia (-1<T-score<-2.5), Osteoporosis (T-score<-2.5), and severe osteoporosis (T-score<-2.5 with a fragility fracture).

Oestrogen hormone inhibits the production of inflammatory maker IL 6 which in turn inhibits the osteoclast apoptosis and leads to decrease bone resorption resulting in re-modelling of bones in females. Therefore, deficiency of estrogens may cause longer life span of osteoclast. In the age group of 40 to 50 years females menstrual cycle becomes irregular, failure of ovulation in menstrual cycle and cessation of menstrual cycle occur..

Name & Address of Corresponding Author
Dr. Gagan Deep
Associate Professor,
Department of Medicine,
K D Medical College Hospital and Research Centre,
Mathura.
ultimately which is known as menopause. Bone turnover becomes higher in female as soon as menopause occur. Moreover, deficiency of estrogens hormones leads to calcium loss as it has an indirect effect on calcium haemostasis of bones. Decrease of calcium leads to osteoporosis. – Increased osteoporosis leads to increase risk of fracture. -- Further, as per WHO Bone mineral density (BMD) 2.5 or more standard deviations below that of a young adult (T score) at any site is osteoporosis. Prevalence of osteoporosis is found high in postmenopausal women. Furthermore, it has been observed that absorption of calcium from intestine decreased in postmenopausal women. In addition calcitonin decreases the bone resorption and decrease the bone loss. Therefore, the present study was designed to study the serum calcium and parathyroid hormones status in pre-menopausal and postmenopausal women and evaluate the risk of fracture in post menopausal women.

MATERIALS AND METHODS
This was a cross sectional type of study which was conducted on 55 premenopausal women (age 37±4.2 yrs) and 63 postmenopausal women (age 52±4.2 yrs). All the subjects were recruited from general population of Himachal Pradesh who were examined at MMU, Kamarhatti, Solan. Female suffering from any types of chronic disease like hypertension, diabetes mellitus, tuberculosis, endocrinal disorders etc and history of hormonal therapy, fracture and hystectomy were excluded from the study.

Measurement
Height (cm) and weight (kg) of each subject was measured by the standard scale to determine the Body Mass Index (BMI).

Collection of sample
5 ml of venous blood was collected from every subject to determine the serum calcium level, parathyroid hormones and calcitonin level.

Biochemical estimation
Serum calcium was measured by colorimetric method (Randox kit.). Serum parathyroid hormone and calcitonin were estimated by enzyme linked immunosorbent assay (ELISA). Bone Mineral Density Test BMD was measured by dual electron x-ray absorptiometry (DXA) at lumbar spine and femoral neck.

T-score = (subject’s BMD value-Mean young normal BMD value)/(ISD young normal BMD).

Statistical analysis
All the results were expressed as Mean±SD. Unpaired student’s t-test was used to assess if there is any significance difference between both groups. Pearson’s correlation coefficient was used to evaluate if there was any correlation between different parameters.

RESULTS
There was an insignificant difference between height (p>0.05), weight (p>0.05) and BMI (p>0.05) of pre menopausal women and post menopausal women. There was no significant difference between serum calcium, PTH and calcitonin level in pre menopausal and post menopausal women. However there was insignificant correlation of age with serum calcium, PTH and calcitonin in both pre-menopausal and postmenopausal women (p>0.05). There was a significant difference between t score of post menopausal women and pre menopausal women. Further, PTH (p=0.012) was significantly high in post menopausal women in comparison to post menopausal women. There was an insignificance difference between serum calcitonon level (p<0.12) of post menopausal women and pre menopausal women.

| Table 1: Anthropometric Parameters of pre-menopausal women and post-menopausal women. |
| Parameter | Premenopausal women (n=55) | Postmenopausal women (n=63) | p-value |
| Age (years) | 37±4.2 yrs | 52±4.2 yrs | -- |
| Height (cm) | 153.72±4.94 | 153.59±5.27 | NS |
| Weight (kg) | 66.07±10.98 | 65.17±11.78 | NS |
| BMI (kg/m2) | 26.6 | 26.2 | NS |

Table 2: Serum calcium, parathyroid hormones and calcitonin in pre menopausal women and post menopausal women.

| Parameter | Premenopausal women (n=55) | Postmenopausal women (n=63) | p-value |
| Serum calcium (mg/dl) | 9.11±0.93 | 8.12±1.17 | <0.03 |
| Serum calcitonin (pg/ml) | 6.5±1.96 | 5.2±1.18 | <0.12 |
| Serum PTH (pg/ml) | 33.24±9.45 | 56.16±20.23 | <0.01 |

| Table 3: Correlations of age with serum calcium, parathyroid hormone and calcitonin in pre menopausal women and post menopausal women. |
| Correlation between | Premenopausal women (n=55) | Postmenopausal women (n=63) | r value | p value | r value | p value |
| Age and serum calcium | 0.004 | 0.087 | -0.119 | 0.057 |
| Age and serum PTH | 0.021 | 0.76 | -0.317 | 0.076 |
| Age and serum calcitonin | -0.179 | 0.35 | 0.217 | 0.97 |
well as decreased conservation of renal calcium. Moreover, decrease of oestrogen hormones may play an important role in age related rise of parathyroid hormones and increased parathyroid hormones level and increased bone turnover. Decrease of calcium ion with increase of parathyroid hormones may leads to osteoporosis in postmenopausal women. Moreover, decrease calcium level along with osteoporosis increase the incidence of bone fracture in postmenopausal women.

DISCUSSION
Serum calcium is an important mineral for the strength of bones and decrease of calcium leads to osteoporosis. Results of the present study has revealed that there was significantly lower serum calcium level in post menopausal women in comparison to pre-menopausal women. The findings of the presents study are consistent with the previous study of Agarwal N et al and Kanis J et al in which they observed low level of serum calcium in postmenopausal women. This decrease of calcium in postmenopausal women may be due declining ovarian functions after menopause characterised by altered calcium metabolism along with reduction in bone mass. Moreover, decrease of oestrogen hormones may leads to decrease absorption of intestinal calcium as well as decreased conservation of renal calcium. This decrease of calcium can lead to osteoporosis which is one of the major causes of fracture in postmenopausal women.

Further, present study recorded significant difference between the parathyroid hormones of postmenopausal women and premenopausal women which are very similar to the findings of the previous studies of Cammozi V et al and Safi S et al in which they observed that parathyroid hormone was significantly low in postmenopausal women. Parathyroid hormones gradually increased with the age in women and it has been found associated with increase turnover of bone. Furthermore, there was an insignificant difference in calcitonin level of postmenopausal women and premenopausal women. These findings are similar to the previous study of Taboulet J et al. Calcitonin has an anti resorptive effects on bones and it is bind with the osteoelast membrane. Decrease of oestrogen hormones may play an important role in age related rise of parathyroid hormones and bone turnover. In addition present study has shown that t score of postmenopausal women was significantly decreased in comparison to pre-menopausal women. These findings are consistent with the previous studies of Agarwal N et al and Kanis J et al.

This decrease t score may be due to decrease of serum calcium and vitamin D leading to decrease in absorption of intestinal calcium along with increased parathyroid hormones level and increased bone turnover. Decrease of calcium ion with increase of parathyroid hormones may leads to osteoporosis in postmenopausal women. Moreover, decrease calcium level along with osteoporosis increase the incidence of bone fracture in postmenopausal women.

CONCLUSION
Postmenopausal women have low calcium level along with higher parathyroid level which results in osteoporosis in female population after menopause. However, incidences of fractures can be decreased by maintaining calcium level in postmenopausal women. Nonetheless, more research is required to establish relationship between osteoporosis and postmenopausal age.

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