

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.

Received: June 2017

Accepted: July 2017

Copyright: © the author(s), publisher. It is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

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 endocrinal 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 post menopausal 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 ($p=0.012$) was significantly high in post menopausal women in comparison to pre menopausal women. There was an insignificance difference between serum calcitonon level ($p<0.12$) 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 endocrinal disorders.^[1] 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.^[2] 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.^[3] Bone strength is predicted by both BMD and bone architecture.^[4] 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).^[5]

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.³ 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.^[6] Bone turnover becomes higher in female as soon as menopause occur.^[7] Moreover, deficiency of estrogens hormones leads to calcium loss as it has an indirect effect on calcium haemostasis of bones.^[8] 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.^[9] Prevalence of osteoporosis is found high in postmenopausal women.^[10] Furthermore, it has been observed that absorption of calcium from intestine decreased in postmenopausal women.^[11] In addition calcitonin decreases the bone resorption and decrease the bone loss.^[12] 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, Kumarhatti, Solan. Female suffering from any types of chronic disease like hypertension, diabetes mellitus, tuberculosis, endocrinal disorders etc and history of hormonal therapy, fracture and hysterectomy 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).^[13] Serum parathyroid hormone and calcitonin were estimated by enzyme linked immunosorbent assay (ELISA).^[14]

Bone Mineral Density Test BMD was measured by dual electron x-ray absorptiometry (DXA) at lumbar spine and femoral neck.^[15]

T-score =(subject^ sBMD value-Mean yong normal BMD value)/(ISD young normal BMD).^[16]

Statistical analysis

All the results were expressed as Mean±SD. Un paired 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. [Table1]

[Table 2] shows the serum calcium (p<0.03) of post menopausal women was significantly lower in comparison to pre menopausal women. Further, PTH (p=0.012) was significantly high in post menopausal women in comparison to pre menopausal women. There was an insignificance difference between serum calcitonon level (p<0.12) of post menopausal women and pre 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), [Table 3]. There was a significant difference between t score of post menopausal women (-2.891+/-0.719 g/cm2) and pre-menopausal women (-1.463+/-0.521 g/cm2). (Fig1)

Table 1: Anthropometric Parameters of pre-menopausal women and post-menopausal women.

Parameter s	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

Values are presented as Mean±SD, NS- Non-significant

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

Parameter s	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 levels 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

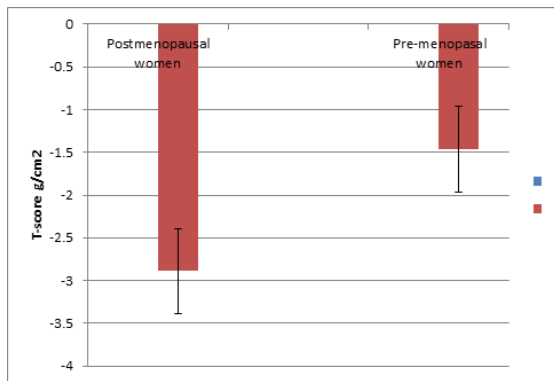


Figure 1: t-score in postmenopausal women and premenopausal women.

DISCUSSION

Serum calcium is an important mineral for the strength of bones and decrease of calcium leads to osteoporosis.^[1] 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.^[10,17] 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.^[18] Moreover, decrease of oestrogen hormones may leads to decrease absorption of intestinal calcium as well as decreased conservation of renal calcium.^[7,8] This decrease of calcium can lead to osteoporosis which is one of the major causes of fracture in postmenopausal women.^[10]

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.^[19,20]

Parathyroid hormones gradually increased with the age in women and it has been found associated with increase turnover of bone.^[21] 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.^[22] Calcitonin has an anti resorptive effects on bones and it is bind with the osteoclast membrane.^[22]

Decrease of oestrogen hormones may play an important role in age related rise of parathyroid hormones and bone turnover.^[23] 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.^[10,17]

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.^[14] 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.^[24]

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.

REFERENCES

1. Sheweita S, Khoshal K. Calcium metabolism and oxidative stress in bone fractures: role of antioxidants. *Curr Drug Metab* 2007;8:519–25.
2. Guyton AC, Hall JE. Parathyroid hormone, calcitonin, calcium and phosphate metabolism, vitamin D, bone and teeth. *Text book of Medical Physiology* 11th ed. Philadelphia:Elsevier Saunders; 2006.pp.901,940,978–95.
3. Garneo P, Delmas PD. Bone turnover markers. In:Encyclopedia of Endocrine Diseases. Eds Martin L. California: Elsevier Inc; 2004.pp.401–13.
4. Amelio PD, Rossi P, Isaia G, Lollino N, Castoldi F, Girardo M, Dettoni F, Sattin F, Delise M, Bignardi C. Bone Mineral Density and Singh Index Predict Bone Mechanical Properties of Human Femur; *Connective Tissue Research*, 49:99–104, 2008.
5. World health organisation (1994) Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Geneva, Switzerland: WHO.
6. Riggs BL, Melton LJ. Medical progress series: involutional osteoporosis. *N Engl J Med* 1986;314:1676–86.
7. Uebelhart D, Schlemmer A, Johansen JS, Gineyts E, Christiansen C, Delmas PD. Effect of menopause and hormone replacement therapy on the urinary excretion of pyridinium cross-links. *J Clin Endocrinal Metab* 1991;72:367–73.
8. Gennari C, Agnusdei D, Nardi P, Citvitelli R. Estrogen preserves a normal intestinal responsiveness to 1.25-dihydroxy vitamin D3 in oophorectomized women. *J Clin Endocrinal Metab* 1990;71:1288–93.
9. Tuchendler D, Bolanowski M. Assessment of bone metabolism in premenopausal females with hyperthyroidism and hypothyroidism. *Endokrynol Pol.* 2013;64(1):40-4.
10. Agarwal N, Raveendran A, Khandhelwal N, Sen RK, Thakur JS, Dhaliwal LK, Singhla V, Manoharan SRR. Prevalence and related risk factors of osteoporosis in peri- and postmenopausal Indian women *J Midlife Health.* 2011 Jul-Dec; 2(2): 81–85.

11. Nordin BC, Need AG, Morris HA, O'loughlin PD, Horowitz M. Effect of age on calcium absorption in postmenopausal women. *Am J Clin Nut* 2004;80:998–1002.
12. Nieves JW, Komar L, Cosman F, Lindsay R. Calcium potentiates the effect of estrogen and calcitonin on bone mass: review and analysis. *Am J Clin Nutrit* 1998;67:18–24.
13. Burtis CA, Ashwood ER, Bruns DE. Teitz fundamentals of clinical chemistry. Saunders An imprint of Elsevier. 6th edition. 2010: pp. 422-24.
14. Erhardt JG, Estes JE, Pfeiffer CM, Biesalski HK, Craft NE. Combined measurement of ferritin, soluble transferrin receptor, retinol binding protein, and C-reactive protein by an inexpensive, sensitive, and simple sandwich enzyme-linked immunosorbent assay technique. *J Nutr*. 2004;134(11):3127-32.
15. Kumar A, Sharma AK, Mittal S, Kumar G. The relationship between body mass index and bone mineral density in premenopausal and postmenopausal north indian women. *The Journal of Obstetric and Gynecology of India*;10/1007s13224-014-0629-x
16. World health organisation (1994) Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Geneva, Switzerland: WHO.
17. Kanis JA, Burlet N, Cooper C, Delmas PD, Reginster JY, Borgstrom F, Rizzoli R. European guidance for the diagnosis and management of osteoporosis in postmenopausal women. *Osteoporos Int* (1997) 7:390–406.
18. Garton M, Martin J, New S, Lee S, Loveridge N, Milne J et al. Bone mass and metabolism in women aged 45–55. *Clin Endocrinol (Oxf)*. 1996;44:563–73.
19. Cammozi V, Lumachi F, Mantero F, Piccolo M, Luisetto G. Phalangeal quantitative ultrasound technology and dual energy X-ray densitometry in patients with primary hyperparathyroidism: influence of sex and menopausal status. *Osteoporosis International*; July 2003, Volume 14, Issue 7, pp 602-608
20. Safi S, Hassikou H, Messary A, Boumdin H, Hadri L, Zouhair A. Severe primary hyperparathyroidism and vitamin D deficiency. *Ann Endocrinol (Paris)* 2004 May;65(3):226-32.
21. Eastell R, Yergey AL, Vieira N, Cedel SL, Kumar R, Riggs BL. Interrelationship among vitamin D metabolism, true calcium absorption, parathyroid function and age in women: evidence of an age-related intestinal resistance to 1, 25 (OH)₂D action. *J Bone Miner Res* 1991;6:125–32.
22. Taboulet J, Frenkian M, Frenjo JL, Feingold N, Jullienne A, de Vernejoul MC. Calcitonin receptor polymorphism is associated with a decreased fracture risk in postmenopausal women. *Human Mole Genet* 1998;7:2129–33.
23. Khosla S, Elizabeth J, Atkinson L, Melton III J, Riggs BL. Effects of age and estrogen status on serum parathyroid hormone levels and biochemical markers of bone turnover in women: A population based study. *J Clin Endocrinol Metabol* 1997;82:1522–7.
24. Dawson-Hughes B, Harris SS, Krall EA, Dallal GE. Effects of calcium and vitamin D supplementation on bone density in men and women 65 years of age or older. *N Engl J Med* 1997;337:670–76.

How to cite this article: Kalia G, Deep G. Serum Calcium, Parathyroid Hormones and Risk of Fracture in Premenopausal and Postmenopausal Women. *Ann. Int. Med. Den. Res.* 2017; 3(5):OR24-OR27.

Source of Support: Nil, **Conflict of Interest:** None declared