International Journal of Medical Research Professionals
P-ISSN: 2454-6356; E-ISSN: 2454-6364
DOI: 10.21276/ijmrp

IJMRP

Original Research Article.

To Evaluate the Parathyroid Hormones and Serum Calcium Levels and Risk of Fractures in Postmenopausal Women: An Institutional Based Study

Ajeet Kumar[1], Deepak Chahar[1*]

[1]Assistant Professor, Department of Orthopaedics, Muzaffarnagar Medical College, Muzaffarnagar, UP, India.

ABSTRACT

Background: A reduced level of estrogen because of menopause is associated with age-related factors which disproportionately increases the risk of developing cardiovascular disease, osteoporosis, Alzheimer's disease, and oral diseases. The present study was conducted to evaluate the parathyroid hormones and serum calcium level and risk of fracture in postmenopausal women.

Materials and Methods: The present study was conducted on 80 post-menopausal women to evaluate the parathyroid hormones and serum calcium level and risk of fracture in postmenopausal women. Equal no. of premenopausal women was included in the study for comparison. Complete history and demographic details were collected. Collection of sample 5 ml of venous blood was collected from every subject to determine the serum calcium level, parathyroid hormones, and calcitonin level. T-score was calculated. The recorded data was compiled, and data analysis was done using SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). P-value less than 0.05 was considered statistically significant.

Results: In the present study 80 post-menopausal women were selected for the study. Equal no. of premenopausal women was selected for comparison with post-menopausal women. The serum calcium of post-menopausal women was lower in comparison to premenopausal women. Further, PTH was significantly high in post-menopausal women in comparison to premenopausal women. The serum calcitonin level of post-menopausal women was less than premenopausal women. The t score of post-menopausal women was -2.45+/-0.65g/cm^2 and premenopausal women (-1.463+/-0.521 g/cm2). There was a significant difference between t score of post-menopausal women (-2.891+/-0.719 g/cm2) and premenopausal women -1.23+/-0.23g/cm^2.

Conclusion: The present study concluded that postmenopausal women have low calcium level and high parathyroid level which causes osteoporosis in female population after menopause. T score was more in post-menopausal women.

Keywords: Post-Menopausal, Parathyroid Hormones, Serum Calcium Level, Premenopausal, Calcitonin Level, T-Score.

***Correspondence to:**

Dr. Deepak Chahar,
Assistant Professor,
Department of Orthopaedics,
Muzaffarnagar Medical College, Muzaffarnagar, UP, India.

Article History:

Received: 02-04-2019, **Revised:** 18-04-2019, **Accepted:** 07-05-2019

Access this article online	
Website: www.ijmrp.com	Quick Response code
DOI: 10.21276/ijmrp.2019.5.3.077	

INTRODUCTION

Osteoporosis is a disorder characterized by compromised bone strength which increases risk of fragility fractures. A patient with osteoporosis may have a lifetime fracture risk as high as 40%. Osteoporotic fractures impair mobility, independence, and quality of life; fractures of the hip also increase mortality by up to 20%.[1] The diagnostic criteria for osteoporosis are defined in terms of bone mass, but the true clinical consequences are the fractures. Twenty percent of Caucasian women older than 50 years have osteoporosis in both the hip and the spine. The classical osteoporosis fractures are in the wrist, the upper arm, the spine, the ribs, the pelvis, and the hip.[2,3]The prevalence of osteoporosis increases with age. In the decade following menopause, most women experience rapid bone loss[2,3] due to estrogen deficiency.[4] The most common etiologies of osteoporosis in women are thus estrogen deficiency and later on in life the functional changes caused by aging. However, there are numerous causes of secondary bone loss, including adverse effects of drug therapy, endocrine disorders, eating disorders, immobilization, marrow-related disorders, disorders of the gastrointestinal or biliary tract, renal disorders, and cancer.[5]

Quality, quantity and ratio of bone mineralization and turnover depend upon several hormones. Parathyroid hormone induces resorption of calcium from the bone and maintain the serum calcium level.[6] Bone strength is predicted by both BMD and bone architecture.[7] 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).[8] The present study was conducted to evaluate the parathyroid hormones and serum calcium level and risk of fracture in postmenopausal women.

MATERIALS AND METHODS

The present study was conducted in Department of Orthopaedics, Muzaffarnagar Medical College, Muzaffarnagar, Uttar Pradesh (India) on 80 post-menopausal women to evaluate the parathyroid hormones and serum calcium level and risk of fracture in postmenopausal women. Before the commencement of the study ethical approval was taken from the Ethical Committee of the institute and written consent was taken from the patient after explaining the study. Equal no. of premenopausal women was included in the study for comparison. 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.

Complete history and demographic details were collected. 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.[9] Serum parathyroid hormone and calcitonin were estimated by enzyme linked immunosorbent assay (ELISA).[10] Bone Mineral Density Test BMD was measured by dual electron x-ray absorptiometry (DXA) at lumbar spine and femoral neck.[11] T-score was calculated.[8] The recorded data was compiled, and data analysis was done using SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). P-value less than 0.05 was considered statistically significant.

Table 1: Serum calcium, parathyroid hormones, and calcitonin in pre-menopausal women and post-menopausal women.

Parameters	Premenopausal women (N=80)	Post-menopausal women (N=80)
Serum calcium (mg/dl)	9.87±1.5	8.01±0.89
Serum calcitonin (pg/ml)	7.1±1.26	5.4±1.24
Serum PTH (pg/ml)	35.6±7.87	58.2±12.3

Table 2: T-score in premenopausal women and post-menopausal women

	t-score
Premenopausal women (N=80)	-1.23+/-0.23g/cm^2
Post-menopausal women (N=80)	-2.45+/-0.65g/cm^2

RESULTS

In the present study 80 post-menopausal women were selected for the study. Equal no. of premenopausal women was selected for comparison with post-menopausal women. The serum calcium of post-menopausal women was lower in comparison to premenopausal women. Further, PTH was significantly high in post-menopausal women in comparison to premenopausal women. The serum calcitonin level of post-menopausal women was less than premenopausal women. The t score of post-menopausal women was -2.45+/-0.65g/cm^2 and premenopausal women (-1.463+/-0.521 g/cm2). There was a significant difference between t score of post-menopausal women (-2.891+/-0.719 g/cm2) and premenopausal women -1.23+/-0.23g/cm^2.

DISCUSSION

Bone mineral density (BMD) as assessed by dual x-ray absorptiometry (DXA) is the most reliable test available to estimate bone strength.[12] The World Health Organization defines osteoporosis as BMD 2.5 standard deviations below the mean for young healthy women (a T-score of <-2.5 SD).[13]

PTH is most responsible for maintaining serum-ionized calcium concentrations within a narrow range through its actions in the kidney—to stimulate renal tubular calcium reabsorption and the conversion of 25-hydroxyvitamin D to 1,25-dihydroxyvitamin D and thereby the calcium absorption and in the bone—to increase bone turnover.[14,15] PTH acts in bone to increase the number and activity of osteoblasts and osteoclasts and increases bone turnover. With sustained elevations in PTH, osteoclastic activity could exceed that of osteoblasts, which results in a net release of calcium from bone and a decrease in BMD. On the contrary, single daily injections of PTH could increase osteoblastic activity preferentially, thereby increasing BMD and bone strength.[16,17]

In the present study 80 post-menopausal women were selected for the study. Equal no. of premenopausal women was selected for comparison with post-menopausal women. The serum calcium of post-menopausal women was lower in comparison to premenopausal women. Further, PTH was significantly high in post-menopausal women in comparison to premenopausal women. The serum calcitonin level of post-menopausal women was less than premenopausal women. The t score of post-menopausal women was -2.45+/-0.65g/cm^2 and premenopausal women (-1.463+/-0.521 g/cm2). There was a significant difference between t score of post-menopausal women (-2.891+/-0.719 g/cm2) and premenopausal women -1.23+/-0.23g/cm^2.

Study by B.E. Christopher Nordin et al. in healthy postmenopausal women had found a late age-related decrease in calcium absorption and that decrease could be due to a decline in either the active calcium transport or diffusion component of the calcium absorption system.[18] They also found that urinary calcium was significantly higher in postmenopausal women and it was due to reduced tubular resorption.[19]

In one of the studies in India done by Tirth Bhattari et al. found that the serum calcium levels were significantly reduced in the postmenopausal group compared to premenopausal women. They attributed these findings to the decreased estrogen levels resulting in the increased synthesis of cytokines by osteoblasts, monocytes and T cells and thereby stimulate bone resorption.[20]

The low estrogen levels lead to low calcium in the body. This in turn increases PTH levels which further leads to the release of calcium from bones. This leads to the weakening of bones and making them more prone to diseases like osteoporosis and fractures. With estrogen deficiency causing calcium level to oscillate downwards, it also causes the Parathyroid hormone levels to go up. Parathyroid hormone is an important hormone in calcium turnover with its main function being the maintenance of the calcium level in extracellular fluid. The secretion of parathyroid hormone is stimulated by hypocalcemia and suppressed by hypercalcemia.[21]

According to Gallagher JC et al., the decrease in female hormones, especially estradiol, suppresses the intestinal absorption of calcium.[22]

The 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.[10] 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.[23]

CONCLUSION

The present study concluded that postmenopausal women have low calcium level and high parathyroid level which causes osteoporosis in female population after menopause. T score was more in post-menopausal women.

REFERENCES

1. Rachner TD, Khosla S, Hofbauer LC. Osteoporosis: now and the future. Lancet. 2011; 377:1276– 87.

2. The Writing Group of the PEPI Trial. Effects of hormone therapy on bone mineral density: results from the postmenopausal estrogen/progestin intervention (PEPI) Trial. JAMA 1996; 17: 138996

3. Kanis JA, Johnell O, Oden A, De Laet C, Mellstrom D. Epidemiology of osteoporosis and fractures in men. Calcif Tissue Int. 2004;75:909.

4. Keating FSJ, Manassiev N, Stevenson JC. Estrogen and osteoporosis. In: Lobo RA, Kelsey J, Marcus R, editors. Menopause. USA: Academic Press; 2002. 5106.

5. Fitzpatrick LA. Secondary causes of osteoporosis. Mayo Clin Proc. 2002;77:45368.

6. Garneo P, Delmas PD. Bone turnover markers. In: Encyclopedia of Endocrine Diseases.Eds MartinL.California:Elsevier Inc;2004:401–13.

7. 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 2008; 49:99–104.

8. World health organisation (1994) Assessment of fracture risk and its application to screening for postmenopausal osteoporosis. Geneva, Switzerland: WHO.

9. Burtis CA, Ashwood ER, Bruns DE. Teitz fundamentals of clinical chemistry. Saunders An imprint of Elsevier. 6th edition. 2010: 422-24.

10. Erhardt JG, Estes JE, Pfeiffer CM, Biesalski HK, Craft NE. Combined measurement of ferritin, soluble transferring 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.

11. 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 Obstetrics and Gynecology of India (January–February 2016) 66(1):52–56; DOI 10.1007/s13224-014-0629-x

12. NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy. Osteoporosis prevention, diagnosis, and therapy. JAMA 2001 Feb 14;285(6):785-95. doi: 10.1001/jama.285.6.785.

13. WHO Scientific Group on the Assessment of Osteoporosis at Primary Health Care Level. Available at http://www.who.int/chp/topics/Osteoporosis.pdf

14. Brown EM, Pollak M, Seidman CE, et al. Calcium-ion-sensing cell surface receptors. N Engl J Med 1995; 333:234–40.

15. Potts JT, Juppner H. 1996. Parathyroid hormone: molecular biology and regulation. In: Bilezikian JP, Raisz LG, Rodan GA (eds). Principles of bone biology. New York: Academic Pr, pp 325–41.

16. Podbesek R, Edouard C, Meunier PJ, et al. Effects of two treatment regimes with synthetic human parathyroid hormone fragment on bone formation and the tissue balance of trabecular bone in greyhounds. Endocrinology 1983; 112:1000–6.

17. Tam CS, Heersche JN, Murray TM, et al. Parathyroid hormone stimulates the bone apposition rate independently of its resorptive action: differential effects of intermittent and continuous administration. Endocrinology 1982; 110:506–12.

18. Nordin BE, Need AG, Morris HA, O'Loughlin PD, Horowitz M. Effect of age on calcium absorption in postmenopausal women. Am J Clin Nutr. 2004; 80:998– 1002.

19. Nordin BE, Need AG, Morris HA, Horowitz M, Robertson WG. Evidence for a renal calcium leak in postmenopausal women. J Clin Endocrinol Metab.1991; 72(2):401-7.

20. Tirtha Bhattarai, Koushik Bhattacharya, Prasenjit Chaudhuri, Pallav Sengupta. Correlation of Common Biochemical Markers for Bone Turnover, Serum Calcium, and Alkaline Phosphatase in Post-Menopausal Women. Malays J Med Sci.2014; 21(1): 58-61.

21. Ganong WF. Review of Medical Physiology. Singapore: McGraw Hill; 2005. p. 395.

22. Gallagher JC, Lawrence Riggs B, Deluca HF. Effect of estrogen on calcium absorption and serum vitamin D metabolites in postmenopausal osteoporosis. J Clin Endocrinol Metabol 1980;51:1359-64.

23. 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.

Source of Support: Nil. **Conflict of Interest:** None Declared.

Cite this article as: Ajeet Kumar, Deepak Chahar. To Evaluate the Parathyroid Hormones and Serum Calcium Levels and Risk of Fractures in Postmenopausal Women: An Institutional Based Study. Int J Med Res Prof. 2019 May; 5(3): 332-34.
DOI:10.21276/ijmrp.2019.5.3.077