

Calcium Metabolism in Post-Menopausal Women

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To investigate some parameters involved in postmenopausal calcium metabolism we have measured FSH, LH, estradiol (E_2), parathyroid hormone (PTH) calcitonin (CT), 25-hydroxy-vitamin D_3 (25-OH- D_3), total calcium (CaT) and ionic calcium (Ca^{++}) serum levels in 20 healthy postmenopausal women and 20 premenopausal women. The results reported show that the decrease of estradiol levels are associated with a significant decrease in 25-OH- D_3 serum levels, possibly as result of a lower concentration of vitamin D binding protein, which is extremely sensitive to changes in oestrogen levels. The PTH levels were similar in both groups studied, which might be explained together with increased ionic calcium levels in postmenopausal women, by decreased parathyroid sensitivity to the blocking action of Ca^{++} .

Key words: Ionic calcium, Postmenopausal women.

The menopause appears to be associated with changes in calcium metabolism which reflect osteoporosis, and several studies have suggested that this osteoporosis may be attributed to a decrease in oestrogen levels (7, 11).

The estrogen mechanism of action on bone is not known, and the number of estrogen receptors in the bone are not sufficient for it to be considered as a target organ (4). It is possible that oestrogen effect on bone is not direct, but is mediated through some different mechanisms,

such as a variation in plasma calcitonin levels. It is known that calcitonin levels decline gradually with age (19), and that treatment of menopausal women with estrogen raises plasma calcitonin levels (12).

Other factors involved may be decreases in the parathyroid hormone or vitamin D_3 levels in the absence of estrogen since vitamin D_3 levels increase in postmenopausal women after treatment with estrogen (5).

To investigate some of the parameters involved in calcium metabolism, serum levels of gonadotrophins (FSH and LH), estradiol (E_2), parathyroid hormone (PTH), calcitonin (CT), 25-hydroxy-vita-

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min D₃ (25-OH-D₃), total calcium (CaT) and ionic calcium (Ca⁺⁺) have been measured in postmenopausal and premenopausal women.

Materials and Methods

A total of 20 healthy postmenopausal women between the ages of 50 and 75, without treatment and 20 women between the ages of 30 and 40 with menstrual cycles in the follicular phase, were studied.

Sample collection: Blood samples (10 ml) were taken anaerobically from both groups in basal conditions. Serum was obtained by coagulation and centrifuging and kept at -20°C until hormone analyses were performed.

Hormone assay: The gonadotrophins (FSH and LH), estradiol, calcitonin, parathyroid hormone and 25-OH-D concentrations were measured by RIA, using the methods described by FRANCHIMONT (6), LINDNER *et al.* (14), STEVENSON *et al.* (20), WOOD *et al.* (21) and AKSNES (1), respectively. The interassay coefficients of variation were 7, 14, 11, 10, 9 and 13 %.

Ionic calcium was measured by LADENSON *et al.* method (13) on a Space stat 20 ionized. Total calcium was measured by Ray Sarkar's colorimetric method (16).

Statistical comparisons of data were made using the Student paired *t* test.

Results

In postmenopausal women, estradiol and 25-OH-D levels were significantly lower than in premenopausal women. There was a rise in plasma gonadotrophins in postmenopausal women, particularly in follicle-stimulating hormone (FSH). Serum levels of calcitonin, PTH and total calcium were similar in both

groups. The mean plasma concentration of ionic calcium however, was higher in postmenopausal women. A positive correlation ($r = 0.5697$), between estradiol and parathyroid hormone was found only in the postmenopausal group (table I).

Discussion

The results reported in this paper show that there is a significant decrease in 25-OH-D₃ levels in postmenopausal women, compared with those in the control group. These results are in line with those reported by certain authors, who found a significant decrease in 1-25-OH-D₃ levels in osteoporotic menopausal women (2, 8, 18). This decrease may be due to a fall during menopause in the concentration of plasma vitamin D-binding protein, which is extremely sensitive to estrogen levels (3).

Serum ionic calcium levels were significantly higher in the postmenopausal group, which agrees with the findings of some authors who have observed that estrogen therapy lowers calcium and phosphate serum and urine calcium (9), while others have noted a slight increase in serum ionic calcium levels after oophorectomy (10).

The PTH levels were similar in both groups studied. This, together with increased ionic calcium levels postmenopausal women might be explained by decreased parathyroid sensitivity to the blocking action of Ca⁺⁺ in the absence of oestrogens (17).

Despite the fact that estradiol treatment increases calcitonin plasma levels in postmenopausal women, we found no significant variation in such levels, due perhaps to the fact that basal levels in premenopausal women are very low and the methods used were not sensitive enough to measure such changes.

These results suggest that decreased oestrogen levels during menopause are

Table I. Serum levels (Mean $\pm$ SEM) of gonadotrophins (FSH and LH), estradiol (E₂), parathyroid hormone (PTH), calcitonin (CT), 25-hydroxy-vitamin D₃ (25-OH-D₃), total calcium (CaT) and ionic (Ca⁺⁺) in cyclic (n = 20) and postmenopausal (n = 20) women.

	Cyclic women	Postmenopausal women
FSH ng/ml	2.10 $\pm$ 0.20	21.200 $\pm$ 2.30*
LH ng/ml	5.20 $\pm$ 0.80	8.700 $\pm$ 1.70**
E ₂ pg/ml	62.90 $\pm$ 11.00	3.400 $\pm$ 0.90*
PTH ng/ml	0.58 $\pm$ 0.15	0.550 $\pm$ 0.10
CT ng/ml	0.11 $\pm$ 0.04	0.021 $\pm$ 0.01
25-OH-D ₃ ng/ml	67.40 $\pm$ 10.50	36.000 $\pm$ 7.50*
CaT mg $\times$ 100	9.01 $\pm$ 0.40	9.800 $\pm$ 0.60
Ca ⁺⁺ mEq/l	2.02 $\pm$ 0.10	2.480 $\pm$ 0.10**

* p < 0.001; ** p < 0.05.

associated with decreased vitamin D levels. This together with simultaneous malfunction in the small intestine, may result in malabsorption of calcium (15) and thus be an important factor in menopausal bone loss.

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Resumen

Se investigan algunos parámetros relacionados con el metabolismo del calcio, en la postmenopausia, como los niveles séricos de FSH, LH, estradiol, hormona paratiroidea, calcito-

nina, 25-hidroxi-vitamina D₃ (25-OHD₃), calcio total y calcio iónico en 20 mujeres postmenopáusicas sanas y 20 mujeres premenopáusicas con ciclos normales. Los resultados muestran que la disminución de los niveles de estradiol está asociada con una disminución significativa de los niveles séricos de 25-OH-D₃, posiblemente como resultado de una baja concentración de proteína ligadora de vitamina D, la cual es extremadamente sensible a los cambios en los niveles de estrógenos. Los niveles séricos de PTH son similares en ambos grupos estudiados, lo cual unido a un aumento de los niveles de calcio iónico en mujeres postmenopáusicas se podría explicar por una disminución de la sensibilidad de la paratiroides a la acción frenadora del calcio.

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