Serum Levels of Hormone Profiles and Urinary Excretion of Calcium in Premenopausal and Postmenopausal Women in Taiwan

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Abstract : *Serum concentrations of FSH, LH, and estradiol, and urinary excretion of calcium were assessed in 20 premenopausal women and 48 postmenopausal women. FSH, LH and estradiol were measured by immunoradiometric assays (IRMA). Urinary calcium (Ca) levels were measured by atomic absorption method, and creatinine (Cr) by Jeffe reaction. The mean concentrations of FSH and LH in postmenopausal women were 79.4 mIU/ml and 23.9 mIU/ml, which were significantly higher than 4.6 and 5.7 mIU/ml in premenopausal women, respectively. On the other hand, the mean concentration of estradiol in postmenopausal women was 11 pg/ml, which was much lower than of 122 pg/ml in premenopausal women. The mean Ca/Cr molar ratio in postmenopausal women was 0.232, whcih was significantly higher than that of 0.143 in premenopausal women. In conclusion, lower serum concentration of circulating estradiol is one of the possible factors for the increased excretion of calcium and osteoporosis in postmenopausal women. (Thai J Obstet Gynaecol 1991;3:1-5.)*

Key words : serum concentration, FSH, LH, estradiol, urinary calcium, premenopause, postmenopause

Menopause is characterized by a marked decrease in the serum level of estrogens. In menopause, estradiol production drops to 10 to 20%, and estrone to about 20 to 30% of the level of reproductive women, respectively[1,2]. Osteoporosis occurs very often in Caucasian postmenopausal women[3]. Bone loss in postmenopausal women starts at about the time

of menopause and proceeds at a rate of about 1% per year[4]. Moreover, involution of trabecular bone starts as early as 30-35 years of age, and will increase in the early menopausal period to 6%, to reach a maximum in bilaterally oophorectomized women with 9%[5]. Decrease or cessation of ovarian estrogen production seems to be associated with the increased rate of bone loss in postmenopausal women[6].

In the present study, we will measure the serum levels of follicle-stimulating hormone (FSH), luteinizing hormone (LH) and estradiol, and urinary excretion of calcium in premenopausal and postmenopausal women. We will analyse the relationship of serum levels of hormone profiles and the enhanced bone loss in postmenopausal women.

Materials and Methods

This study comprised of two groups of women, premenopausal and postmenopausal. There were 20 patients in the premenopausal group. They had regular menstruation cycles and had no endocrine or major medical diseases. The range of age was 25 to 40 years with a mean age of 32 years. The total number of postmenopausal women was 48, including 28 with surgically castrated menopause and 20 with natural menopause. The age range was 31 to 64 years with a mean age of 49 years.

Venous blood and fasting morning urine were collected at day 7 to 10 of follicular phase in premenopausal women. In postmenopausal women the specimens were collected at least one year after natural menopause or two months after surgical castration. No hormone agents were taken at least 2 months before collection of specimens.

Serum concentrations of FSH, LH, and estradiol were measured by immunoradiometric assays (IRMA) with FSH MAIAclone kit (Code 13101, Serono Diagnostics), LH MAIAclone kit (Code 13201, Serono Diagnostics) and Biodata Estradiol MAIA kit (Code 12264, Serono Diagnostics), respectively. Urinary calcium concentration was measured with atomic absorption. Urinary creatinine concentration was measured with Jeffe reaction. The calcium/creatinine concentration ratio was expressed in molar ratio.

The data obtained was analyzed by Student's t-test. A p-value less than 0.05 was considered statistically significant.

Results

The serum levels of FSH, LH, and estradiol are shown in Figure 1. The mean concentrations of FSH and LH in postmenopausal women were 79.4 mIU/ml and 23.9 mIU/ml, which are significantly higher than 4.6 and 5.7 mIU/ml, respectively, in premenopausal women. On the other hand, the serum concentration of estradiol in postmenopausal women was 11 pg/ml, which is much lower than that of 122 pg/ml in premenopausal women.

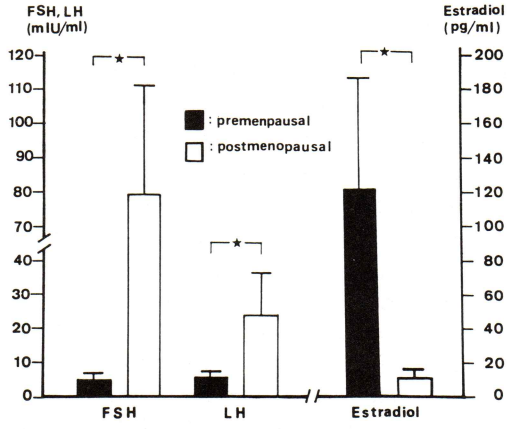


Fig. 1 Comparison of serum concentrations of FSH, LH and estradiol between premenopausal and postmenopausal women. Each column and vertical bar represent mean and one standard deviation.
* = $p<0.01$.

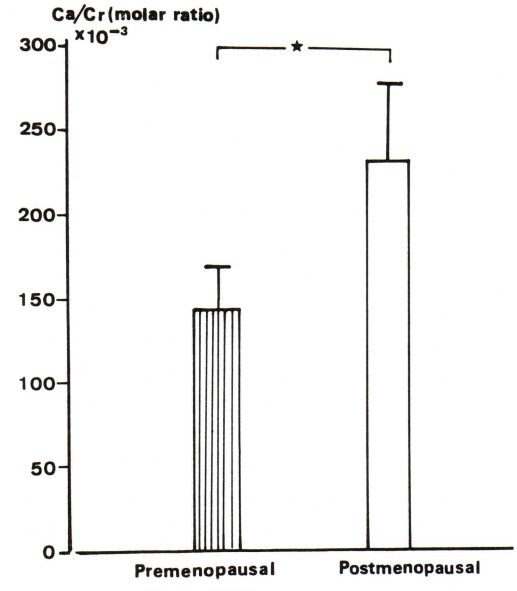


Fig. 2 Comparison of urinary calcium/creatinine molar ratio between premenopausal and postmenopausal women. Each column and vertical bar represent mean and one standard deviation.
* = $p<0.01$.

Figure 2 shows the fasting urinary calcium/creatinine (Ca/Cr) molar ratio in these two groups of women. The mean Ca/Cr molar ratio in postmenopausal women was 0.232, which is significantly higher than that of 0.143 in premenopausal women.

Discussion

From the present study, we found that the rate of urinary excretion of calcium was much higher in postmenopausal women. The Ca/Cr ratio was 0.232 in postmenopausal women, which is almost two-fold higher than that of 0.143 in premenopausal women. On the other hand, the circulating level of estradiol in postmenopausal women was less than 12% of the premenopausal level. The Ca/Cr molar ratio seems to be inversely related with the circulating concentration of estradiol. The pituitary gonadotropins (FSH, LH) levels in postmenopausal women were much higher than those in premenopausal women. The FSH/LH ratio was greater than 3 in postmenopausal women, which is quite contrary to that in the premenopausal group.

Nordin et al[7,8] pointed out that the rise in fasting urine calcium reflected an increase in total bone resorption. In 1977, Lindsay et al[9] also reported that the fasting urinary Ca/Cr ratio was inversely related to the circulating estradiol concentration. A lower amount of circulating estrogen was considered as one of the factors responsible for the increased urinary

calcium excretion and the negative calcium balance[10]. Young and Nordin[11] suggested that loss of estrogenic activity at natural or artificial menopause resulted in increased bone resorption. Throughout life the bones exchange calcium with the extracellular volume, i.e. from the bones as a result of resorption and to the bones as a result of bone formation. Osteoclasts are responsible for bone resorption and osteoblasts for bone formation. Bone resorption is always followed by a period of bone formation[12]. The pathogenesis of the postmenopausal bone loss is still not fully understood, although its close relationship to female sex hormones is widely established. Recent studies have demonstrated evidence for the presence of estrogen receptors in normal human osteoblast-like cells, and have pointed out that estrogen can act directly on human bone cells by a classical estrogen receptormediated mechanism[13,14].

In conclusion, the present study suggests that a lower serum concentration of circulating estradiol is one of the possible pathophysiologic factors for the increased urinary excretion of calcium and osteoporosis in postmenopausal women.

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