

## VITAMIN D STATUS IN WOMEN WITH POSTMENOPAUSAL OSTEOPOROSIS

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The perturbation status of vitamin D can be manifested as insufficiency, deficiency and excessiveness. Vitamin D status within the organism is determined by measuring the level of 25(OH)D in the serum.

The aim of this paper was to determine the vitamin D status in postmenopausal women with newly diagnosed osteoporosis as well as to correlate vitamin D status with bone mineral density (BMD) and bones' fractures.

The research included 58 postmenopausal women who have recently been given the diagnosis of postmenopausal osteoporosis. All the examinees were determined with the level of 25(OH)D as well as the levels of unspecific markers of the bone metabolism. All of the examinees were defined with their bone mineral density on the lumbar spine and hip, measured with DEXA densitometer.

The average age of the examinees was 60,46±6,55 years, average duration of menopause 15,02±9,25 years and average concentration of 25(OH)D 46,45±14,68 nmol/L. Our results has shown the deficiency of vitamin D in 89,76% of the examinees with postmenopausal osteoporosis, positive correlation of the level of 25(OH)D and bone mineral density (BMD) and a significantly lower initial concentration of 25(OH)D with the examinees with prior bone fractures opposed to those without fractures (37,57±13,08 vs. 51,22±17,26 nmol/L;  $p < 0,02$ ).

The obtained results show that vitamin D deficiency in postmenopausal women with osteoporosis present important risk factors for bones fractures as well as factors for decreasing the bone mineral density. *Acta Medica Medianae 2010;49(4):16-18.*

**Key words:** Vitamin D, osteoporosis, postmenopausal women

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### Introduction

Vitamin D, its active metabolites and analogues represent the group of compounds with numerous functions within the organism. The primary role of vitamin D is in the metabolism of phosphorus and calcium. It is well-known that vitamin D increases intestinal and tubular absorption of calcium. Nowadays, it is also known that vitamin D decreases the physiological activity of parathormon (PTH) in the following ways: directly, by affecting parathyroid glands, and also indirectly by hypercalcemia (1). It is also known that vitamin D helps with bone formation. Affecting the osteoblasts via vitamin D receptors (VDR) increases the synthesis of osteocalcin, alkaline phosphatase (ALP) and the collagen type I. The

effect of vitamin D on osteoclasts is double: indirect – via osteoblasts (RANKL/RANK/osteoprotegerin system), and directly – by suppression of differentiation from promyelocytes to monocytes, that are the precursors of osteoclasts (2). By regulation of calcium metabolism in muscle cells, vitamin D affects the muscle tissue which is significant for the process of contraction and relaxation of muscle fibers (3). Besides endocrine function, vitamin D has numerous paracrine functions which it achieves by controlling over 200 genes, including genes responsible for the regulation of mineralization process, the differentiation of cells, and regulation of apoptosis and angiogenesis process (4). The status perturbation of vitamin D can be manifested as insufficiency, deficiency and excessiveness. Risk factors for insufficiency of vitamin D are: nourishment disorder, life style (sun exposure less than 15 minutes per day, old age and occult malabsorption, kidney and liver function disorder as well as the mutation of VDR (rare risk factors). Vitamin D status within the organism is determined by measuring the level of 25(OH)D in the serum (5).

## Aim

The aim of this research was to determine the status of vitamin D in women that have been recently given the diagnosis of postmenopausal osteoporosis and to correlate the status of vitamin D with bone mineral density (BMD) and previous fractures.

## Patients and methods

The research included 58 women who have recently been given the diagnosis of postmenopausal osteoporosis and who had not taken vitamin D as prevention of osteoporosis. All the examinees were determined with the level of 25(OH)D as well as the level of calcium, phosphorus and alkaline phosphatase in serum and also level of calcium and phosphorous in 24h old urine. The level of 25(OH)D were determined by ELISA method. All of the examinees were defined with their bone mineral density on the lumbar spine and hip, measured with dual energy x-ray absorptiometry on the Holgic Discovery machine. Obtained results were further analyzed by Pearson and Spearman's correlation test and student T-test.

## Results

Average age of the examinees was  $60,46 \pm 6,55$ , average duration of menopause was  $15,02 \pm 9,25$  years and average value of 25(OH)D was  $46,45 \pm 14,68$  nmol/L. With all examinees the level of Ca,P and ALP in Serum and level of Ca and P in 24h old urine were in reference limits. Insufficiency of vitamin D was determined in 52 (89,76%) of the examinees. We determined the existence of positive correlation level of 25(OH)D and BMD or T-score on lumbar spine (L1-L4), ( $46,45 \pm 14,68$  nmol/L vs.  $0,718 \pm 0,06$  g/cm<sup>2</sup> and  $46,45 \pm 14,68$  nmol/L vs.  $-2,98 \pm 0,56$ ;  $p < 0,05$ ,  $r = 0,375$ ) (Table 1).

Table 1. Correlation level of 25(OH)D and BMD or T-score

25(OH)D (nmol/L) $46,45 \pm 14,68$	BMD (g/cm <sup>2</sup> ) $0,718 \pm 0,06$	$p < 0,05$	$r = 0,375$
25(OH)D (nmol/L) $46,45 \pm 14,68$	T-score $-2,98 \pm 0,56$	$p < 0,05$	$r = 0,375$

Table 2. The level of 25(OH)D in the examinees with previous fractures and those with no fractures

	Number of patients	Level 25 (OH)D (U/I)	
with fractures	18	$37,57 \pm 13,08$	$p < 0,02$
with no fractures	40	$51,22 \pm 17,26$	

Statistically significant difference of the level of 25(OH)D was determined in the examinees with previous fractures ( $n=18$ ) in comparison to those with no fractures ( $n=40$ ) ( $37,57 \pm 13,08$  vs.  $51,22 \pm 17,26$  nmol/L;  $p < 0,02$ ) (Table 2).

## Discussion

In 1985, Peacock et al. gave the definition of vitamin D as a concentration of 25(OH)D within the serum in which there is the formation of secondary hyperparathyroidism and there is the reduction of bone mineral density (6). Since 2005, the deficiency of vitamin D is defined as the level of 25(OH)D in the serum lower than 75 nmol/l (30ng/ml), while heavy insufficiency of vitamin D as the level of 25 (OH)D lower than 25nmol/l (10ng/ml). It is considered that the normal status of vitamin D is when the level of 25(OH)D within the serum is over 75nmol (30 ng/ml) (7). There are numerous studies in which a large prevalence of deficiency of vitamin D with postmenopausal women was proven, unless it is "cut off" by 25(OH)D 75 nmol/l. The OFELY study that included 669 postmenopausal women, with the average age of 62.2 has shown that 73% of the examinees had the average concentration of 25(OH)D lower than 75nmol/l (8). Kuchuk NO, van Schoor NM et al. published their results that had been conducted in 29 countries and included 7.441 postmenopausal women. The results showed that the average concentration of 25(OH)D within the serum in examinees was 61,2nmol/l (9). Lips P. et al. showed in their study, which included 2.589 women with postmenopausal osteoporosis, that the prevalence of insufficiency of vitamin D by regions is distributed from 53,4% to 81.8%. Preliminary results of the pilot study in four centers in Serbia have shown vitamin D insufficiency in 95% women with postmenopausal osteoporosis (10). Our research, which included significantly lower number of patients, has shown the deficiency of vitamin D in 89,76% of the examinees. The results of our investigation have also shown a positive correlation of the level of 25(OH)D and bone mineral density (BMD) or T-score of lumbal spine which is in accordance with the results of a large number of studies that have confirmed the existence of this correlation. In 2005, Bischof-Ferrari HA et al. showed in metha- analysis of four randomized studies of the hip fractures (9.294 examinees) and in seven randomized studies of nonvertebral fractures (9.820 examinees) that the concentration of 25(OH)D within the serum is very important for the anti-fracture efficiency of vitamin D. It was determined that the optimal concentration for fracture prevention of 25(OH)D within the serum is 75-100nmol/l (11). However, 2005 RECORD study, which included 5.000 examinees over 70 years old

(12), and 2006 WHI study that included 36.000 examinees, did not find anti-fracture activity of vitamin D (13). With some additional analyses it was determined why there was a disaccord in previously mentioned researches and it was proved that the initial concentration of 25(OH) within the serum was very important for the anti-fracture efficiency of vitamin D. The results of our research showed a significantly lower initial concentration of

25(OH)D with the examinees with previous fractures compared to those without fractures.

### Conclusion

Our results show that the deficiency of vitamin D in women with postmenopausal osteoporosis poses a significant risk factor for bone fractures and decrease of bone mineral density (BMD).

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## STATUS VITAMINA D KOD ŽENA SA POSTMENOPAUALNOM OSTEOPOROZOM

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Poremećaj statusa vitamina D može se manifestovati kao insuficijencija (nedostatak), nedovoljnost (deficijencija) i hipervitaminoza. Status vitamina D u organizmu određuje se merenjem nivoa 25(OH)D u serumu.

Cilj našeg rada bio je da kod žena sa novodijagnostikovanom postmenopauzalnom osteoporozom odredimo status vitamina D kao i da koreliramo status vitamina D sa mineralnom koštanom gustinom (BMD) i prethodnim frakturama.

Ispitivanje je obuhvatilo 58 žena sa novodijagnostikovanom postmenopauzalnom osteoporozom. Svim ispitanicama su određivani nivoi 25(OH)D kao i nivoi nespecifičnih markera koštanog metabolizma. Svim ispitanicama određivana je i koštana mineralna gustina na lumbalnoj kičmi i kuku DEXA denzitometrom.

Prosečna starost ispitanica bila je 60,46±6,55 godina, prosečno trajanje menopauze 15,02±9,25 godina i prosečna vrednost 25(OH)D 46,45±14,68nmol/l. Naši rezultati su pokazali nedovoljnost vitamina D kod 89,76% ispitanica sa postmenopauzalnom osteoporozom, pozitivnu korelaciju nivoa 25(OH)D i mineralne koštane gustine (BMD) i značajno nižu početnu koncentraciju 25(OH)D kod ispitanica sa prethodnim frakturama u odnosu na one bez fraktura (37,57±13,08 vs. 51,22±17,26nmol/l; p<0,02).

Naši rezultati pokazuju da nedovoljnost vitamina D kod žena sa postmenopauzalnom osteoporozom predstavlja značajan faktor rizika za nastanak fraktura, kao i faktor koji doprinosi smanjenju mineralne koštane gustine. *Acta Medica Medianae* 2010;49(4):16-18.

**Ključne reči:** vitamin D, osteoporoza, menopauza