Evaluation of Thyroid Hormone Status and Bone Density Ratio in Euthyroid Postmenopausal Women in Early and Late Stage of Bone Loss

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ABSTRACT

Introduction: Osteoporosis is a consequence of reduction in bone mass and disorders of bone structure, which makes the bones prone to fractures (1). Physiological variations of thyroid-stimulating hormone (TSH) may be an early indicator of the predisposing basis of the emergence of osteoporosis. Aim: To evaluate the thyroid hormone status and bone density ratio in euthyroid postmenopausal women in early and late stage of bone loss. Methods: The research is an observational, intersected, controlled study involving postmenopausal women admitted to the Clinic for Nuclear medicine and endocrinology of the Clinical Center University of Sarajevo (CCUS). The study included a total of 120 postmenopausal subjects divided into two groups. First group included 60 postmenopausal patients with osteoporosis, 30 of them were at the early stage of postmenopause, and 30 were in the late postmenopausal phase. The second group consisted of 60 postmenopausal patients with preserved bone mass, 30 of which were in the early stage of postmenopause and 30 in the late postmenopausal phase. For all patients included in the study follicle-stimulating hormone (FSH), TSH, free thyroxine (FT4), free triiodothyronine (FT3) were analyzed. Results: The mean duration of the postmenopausal period was statistically significantly higher in the group of women with osteoporosis (11.4 ± 1.1 years). The mean values of FSH were statistically significantly higher in the group of women with osteoporosis (54.0 ± 2.6 IU/L). The mean level of TSH and FT3 did not statistically significantly differ in the group of women with osteoporosis compared to the control group of women. The mean FT4 level in women with osteoporosis was statistically significantly lower (14.7 ± 0.29 pmol / L) compared to the control group of women (15.95 ± 0.3 pmol / L) (p = 0.004). Conclusion: In our examined group, the FT4 patient (mean) was significantly lower in the serum of women with osteoporosis compared to subjects with preserved bone mass. It would be most effective to recognize risk factors in order to influence them on time, and to alleviate and slow down the consequences of osteoporosis. One of these possible factors is the hormonal status of the thyroid gland, that is, TSH whose physiological variations may be an early indicator of the predisposing basis for the emergence of osteoporosis. The frequency and prevalence of these medical problems require additional research, and it is also a great challenge to understand the effects of thyroid hormone on bone tissue.

Keywords: thyroid gland, thyroid hormones, osteoporosis.

1. INTRODUCTION

Osteoporosis is a consequence of reduction in bone mass and disorders of bone structure, which makes the bones prone to fractures (1). This is a systemic skeletal disease which occurs when the amount of bone decomposed in the unit of time is greater than the amount of newly born bone (1). The incidence of osteoporosis is constantly increasing. It is estimated that about 50% of women in menopause are affected by osteoporosis in the United States, and about 162,000 women are affected in Bosnia and Herzegovina.
Blood samples for laboratory analysis were taken from the study follicle-stimulating hormone (FSH), TSH, free thyroxine (FT4), free triiodothyronine (FT3) were analyzed. Blood samples for laboratory analysis were taken from the cubital vein into the gel tubes according to the standard procedure, in the morning. The results obtained were analyzed by a t-test or corresponding nonparametric tests (Mann-Whitney test), if irregular distribution of variables was found. The correlation degree was tested using the Pearson or Spearman correlation coefficient. The values of p < 0.05 were considered statistically significant.

4. RESULTS

The average age of postmenopausal women included in the study was 58.2 ± 0.7 years. The average duration of menopause was 9.8 ± 0.72 years, while the average duration of the reproductive period was 33.39 ± 0.45 years. The mean values of FSH in women included in the study were 15.1 ± 0.28 pmol / L

Analysis of the general characteristics of women with osteoporosis in relation to women with preserved bone mass (control group) in postmenopause, no significant difference was found between the average age, the average period of the last menstrual period, or the duration of the reproductive period between the group with osteoporosis compared to the control group (Table 1).

The mean duration of the postmenopausal period was statistically significantly higher in the group of women with osteoporosis (11.4 ± 1.1 years) compared to the group of women in the control group (8.5 ± 0.9 years) (p = 0.043). The mean values of FSH were statistically significantly higher in the group of women with osteoporosis compared to the control group (43.2 ± 2.5 IU / L) (p = 0.004). The mean level of TSH and FT3 did not statistically significantly differ in the group of women with osteoporosis compared to the control group of women (Table 2). However, the mean level of FT4 level in women with osteoporosis was statistically significantly lower (14.7 ± 0.29 pmol / L) compared to the control group of women (15.95 ± 0.3 pmol / L) (p = 0.004) (Table 2).

The mean level of TSH and FT3 did not statistically significantly differ in the group of women with osteoporosis compared to the control group of women (15.95 ± 0.3 pmol / L) (p = 0.004) (Table 2).

The mean level of FT4 level in women with osteoporosis was statistically significantly lower (14.7 ± 0.29 pmol / L) compared to the control group of women (15.95 ± 0.3 pmol / L) (p = 0.004) (Table 2).

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2. AIM

Aim of article was to evaluate the thyroid hormone status and bone density ratio in euthyroid postmenopausal women in early and late stage of bone loss

3. METHODS

The research is an observational, cross-sectional, controlled study involving postmenopausal women admitted to the Clinic for Nuclear medicine and endocrinology of the Clinical Center University of Sarajevo (CCUS). The research was approved by the Ethics Committee CCUS and patients gave informed consent.

The study included a total of 120 postmenopausal subjects divided into two groups. First group included 60 postmenopausal patients with osteoporosis, 30 of them were at the early stage of postmenopause, and 30 were in the late postmenopausal phase. The second group consisted of 60 postmenopausal patients with preserved bone mass, 30 of which were in the early stage of postmenopause and 30 in the late postmenopausal phase.

All patients included in the study were sent to the Clinic for Nuclear medicine and endocrinology with suspected osteoporosis. The study excluded all patients with diseases and conditions that can lead to increased bone tissue degradation like endocrine disorders, rheumatoid arthritis and long-term immobilization. For all patients included in the study follicle-stimulating hormone (FSH), TSH, free thyroxine (FT4), free triiodothyronine (FT3) were analyzed. Blood samples for laboratory analysis were taken from the cubital vein into the gel tubes according to the standard
Osteoporosis is an age-old illness characterized by reduced bone mass and loss of bone microarchitecture with a significantly increased risk of fractures and disabilities, which, given the demographic trends in developed countries, is a very important public health problem. It is a "silent epidemic" because the number of patients is constantly increasing and most patients do not have symptoms until the onset of the first bone fracture (1). The costs of reviewing and treating women with postmenopausal osteoporosis are increasing worldwide.

Because of all of the above, in the world, many studies have been under way to identify a link between factors that would indicate in advance the emergence of a predisposition to the emergence of osteoporosis or to the disease itself while it is still not clinically manifested, which could be preventive. It would be most effective to recognize risk factors in order to influence them on time, and to alleviate and slow down the disease and prevent the consequences of osteoporosis (5,6). The issue of clinical research is whether substitution treatment of thyroid hormones in the conditions of its reduced function (hypothyroidism) leads to undesirable effects on mineral bone density (7). The links between thyroid gland hormones, which are within physiological limits, and bone density are controversial, and existing studies are controversial, which is thought to be the consequence of a small number of patients and scant information. Kim et al. have proven that lower, but also normal TSH values are associated with low mineral bone density in healthy euthyroid women (8). The general characteristics of women in menopause in our study (mean age, duration of menopause, average BMI, average FSH) were in line with the general characteristics of women in postmenopausal other researchers (9). In our study, the average levels of TSH and FT3 did not differ significantly in the patient group with osteoporosis and the group of patients with preserved bone mass whereas the mean level of FT4 was statistically significantly lower in serum women with osteoporosis compared to women in the control group. Also, the average levels of TSH and FT3 did not significantly differ in the group of women at an early age compared to the late postmenopausal phase, while FT4 in the group of women who were in the early postmenopausal phase was statistically significantly lower than those who were in the late postmenopausal phase. Unlike our results, Garton et al. in their study stated that FT3 can regulate bone resorption (10). Williams et al. came to similar result and claimed that FT3 has a direct impact on bone remodeling and mineral bone density (11), which corresponds to results of Murphy et al. (12). In the group of patients with osteoporosis compared to the control group no statistically significant correlation was observed between thyroid hormone levels and bone mineral density (BMD), which is in line with the research carried out by Pater and et al. and they did not find the evidence that variations in TSH values in euthyroid postmenopausal women have an impact on BMD and risk for fractures (13). The results of the study conducted by Marwah et al. showed that TSH has no effect on mineral bone density in euthyroid women (14).

### 5. DISCUSSION

Osteoporosis is an age-old illness characterized by reduced bone mass and loss of bone microarchitecture with a significantly increased risk of fractures and disabilities, which, given the demographic trends in developed countries, is a very important public health problem. It is a "silent epidemic" because the number of patients is constantly increasing and most patients do not have symptoms until the onset of the first bone fracture (1). The costs of reviewing and treating women with postmenopausal osteoporosis are increasing worldwide.

### 6. CONCLUSION

The practical application of the results obtained in clinical practice is to set the cut-off value of hormone status of the thyroid gland, i.e. thyroid hormone (FT4, FT3), and especially serum TSH, which is a risk factor for bone loss. In our examined group, the FT4 patient (mean) was significantly lower in the serum of women with osteoporosis compared to subjects with preserved bone mass. It would be most effective to recognize risk factors in order to influence them on time, and to alleviate and slow down the consequences of osteoporosis. One of these possible factors is the hormonal status of the thyroid gland, that is, TSH whose physiological variations may be an early indicator of the predisposing basis for the emergence of osteoporosis. The frequency and prevalence of these medical problems require additional research, and it is also a great challenge to understand the effects of thyroid hormone on bone tissue.

|                | Osteoporosis group (N=60) (mean + SD) | Control group (N=60) (mean + SD) | p value |
|----------------|---------------------------------------|----------------------------------|---------|
| TSH (mU/L)     | 2.6±0.21                              | 2.37±0.19                       | NS      |
| FT4 (pmol/L)   | 15.1±0.28                             | 16.0±0.3                        | 0.029   |
| FT3 (pmol/L)   | 5.0±0.1                               | 5.5±0.43                        | NS      |

Table 3. Thyroid hormone levels in postmenopausal women in relation to postmenopausal period duration. NS - non significant value (16.0 ± 0.3 pmol / L) (p = 0.028) (Table 3).

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