TSH INFLUENCE ON BONE MINERAL DENSITY IN DISTHYROIDIES

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Abstract: *Thyroid disorders have a negative impact on bone metabolism; they influence bone remodelling cycle, either by changes in the circulating serum levels of the thyroid hormones, or as a result of the substitution or suppressive therapy with levothyroxine. Osteoporosis, considered a public health problem, is defined as a skeletal disease characterized by low bone strength due to the decreased bone mass and compromised bone quality. The study aims at analysing the serum variations of TSH, in the sense of increasing and decreasing its values, on bone mineral density; according to recent studies, it has been developed the idea that TSH is an important negative regulator of bone turn-over, its direct effect on bone mineral density, on formation and bone resorption indicators, being independent of thyroid hormone concentration. We analyzed a total of 650 women with and without thyroid pathology, aged between 50-70 years old, divided into three groups and three age groups. Low bone mineral density was associated both in hypothyroidism and in hyperthyroidism.*

Cuvinte cheie: *disfuncţie tiroidiană, TSH, hormoni tiroidieni*

Rezumat: *Disfuncţiile tiroidiene au un impact negativ asupra metabolismului osos; ele influenţează ciclul de remodelare osoasă, fie prin variaţiile nivelelor serice circulante ale hormonilor tiroidieni, fie ca urmare a tratamentului de substituţie sau de supresie cu levotiroxină. Osteoporoza, considerată o problemă de sănătate publică, este definită ca boală a scheletului caracterizată prin rezistenţă osoasă scăzută, datorată scăderii masei osoase şi compromiterii calităţii osului. Studiul are ca scop analiza variaţiilor serice ale TSH în sensul creşterii şi scăderii valorii acestuia, asupra densităţii minerale osoase; conform studiilor recente, s-a elaborat ideea că TSH este un reglator negativ important al turn – overului osos, efectul direct al acestuia asupra densităţii minerale osoase, asupra indicatorilor de formare şi resorbţie osoasă, fiind independent de concentraţia hormonilor tiroidieni. Am analizat un număr de 650 de femei cu şi fără patologie tiroidiană, cu vârsta cuprinsă între 50-70 ani, grupate în trei loturi şi în trei categorii de vârstă. Densitatea minerală osoasă scăzută a fost asociată, atât în situaţia de hipotiroidie cât şi în cea de hipertiroidie.*

INTRODUCTION

Thyroid disorders with a negative impact on bone metabolism include: euthyroid goiter, hyperthyroidism, hypothyroidism, thyroid cancers and thyroiditis: each of the above-mentioned diseases affect the bone remodelling cycle, either by changes in the circulating serum levels of the thyroid hormones, or as a the result of the substitution or suppressive treatment with levothyroxine. The influence of TSH on the bone was recently demonstrated by the presence of osteoblastic and osteoclastic cell precursors to those of mature osteoblasts, of TSH receptor (RTSH), this indicates the role of TSH in regulating bone remodelling.

Hyperthyroidism increases bone turnover, osteoporosis and an increased risk of fracture. In hypothyroidism, bone turnover is low with the reduction of osteoblasts and osteoclasts activity, bone mineral growth and increased susceptibility to fractures.

PURPOSE

The purpose of this study is to identify the influence of THS values on bone mineral density, both in hyperthyroidism and hypothyroidism (clinically and sub-clinically manifested).

METHODS

The study included 650 patients, aged between 50-70 years old, with and without thyroid pathology, divided into three groups, with surgery, without surgery on the thyroid gland, under hormone replacement therapy and the control group.

The data were collected between 2008 and 2012; the patients were selected based on inclusion and exclusion criteria and were within the Ambulatory Endocrinology and Recovery Clinic I of the Clinical County Emergency Hospital of Sibiu.

The patients were evaluated clinically (anamnesis), by ultrasound and biologically (hormonal dosage); osteodensitometry was performed at the level of the lumbar spine using the energy x-ray absorbmetry method – DEXA.

The measurement of bone mineral density was assessed at the level of the lumbar spine and measured in accordance with osteoporosis screening guidelines.

The results obtained following DEXA were classified in the three groups according to the WHO staging:

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Table no. 1. WHO staging of osteoporosis

Normal	Score T > -1
Osteopenia	Score T< -1
Osteoporosis	Score T< -2,5

RESULTS

The study is a retrospective one and analyzes a sample of 131 patients with total and subtotal thyroidectomy, a group of 257 patients with thyroid pathology and a control group of 262 patients without thyroid pathology, but with changes in bone mineral density (osteoporosis and osteopenia).

All three groups were divided into three age groups: 50-59 years old, 60-64 years old, 65-70 years old.

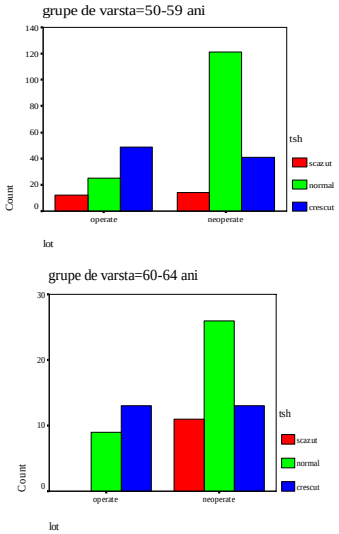
The demographic data show a predominance of the patients coming from the urban areas (80%), compared to those coming from the rural areas (20%), the distribution on the three age groups (50-59 years old, 60-64 years old, 65-70 years old) being similar proportionally, the average age of the analysed population being of 58.47 ± 5.53 years old.

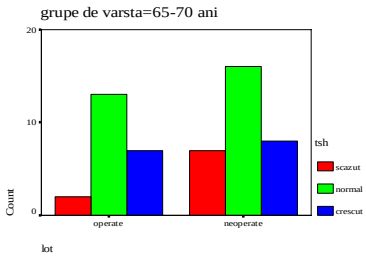
Regarding the study groups and the age groups, we analysed the distribution of TSH according to the normal values (0.4 - 4μUI / ml), the values below 0.4 μUI / ml were considered low and those over 4μUI/ml were considered high. Also, we studied the relation between TSH and bone mineral density measured by the DEXA method.

The distribution of TSH with normal values on groups of patients and age groups was as follows: within the group with thyroid pathology - 147 cases (55.7%) of the total 262, belonging to the age group of 50-59 years old, 35 cases (48, 6%) of the total of 72 were in the age group of 60-64 years old, and 29 cases (54.7%) of the total of 53 were in the age group of 65-70 years old. In the case of low TSH, the distribution was as follows: in the age group of 50-59 years old, there were 26 cases (9.9% of 262), 11 cases (15.3% of 72) in the age group of 60-64 years old and 9 cases (17% of 53) belonging to the age group of 65-70 years old.

Regarding the high values of TSH, the distribution was as follows: 90 cases (34.4% of 262) in the age group of 50-59 years old, 26 cases (36.1% of 72) in the age group of 60-64 years old, 15 (28.3%) in the age group of 65-70 years old. Note that in all cases, the control group (262) had normal TSH.

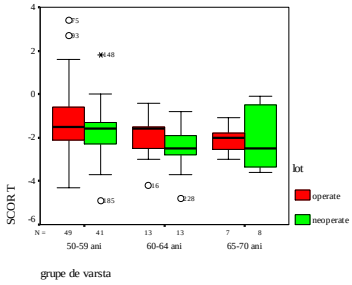
Figure. no. 1. TSH distribution per groups of patients and age groups





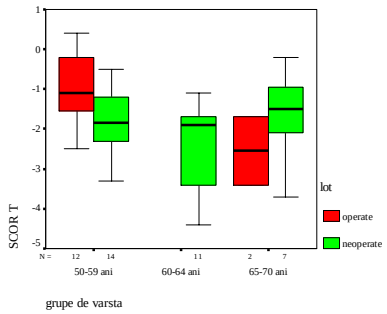
The number of cases with osteoporosis (score T <-2,5) was distributed as follows: in the age group of 50-59 years old, there were 92 cases (24,1%) of the total of 381 patients, 61 cases (38,6%) of 158 patients and in the age group of 65-70 years old, 39 cases (35,1%) of 111. In case of osteopenia (score T <-1), the distribution was as follows: in the age group of 50-59 years old, 209 cases (54,9%) of 381 patients, 81 cases (51,3%) of 158 in the age group of 60-64 years old and 60 cases (54,1%) of 111 in the age group of 65-70 years old. It may be observed that in the groups of patients with thyroid pathology, increased TSH was associated with osteopenia: in the age group of 50-59 years old, 61,1%, and in the age group of 60-64 years old, 61,5%; within the age group of 65-70 years old, the percentage was equal for osteopenia (40%) and osteoporosis (40%).

Figure no. 2. T score distribution per age groups and groups of patients (increased TSH)



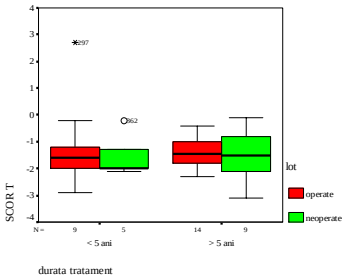
At the level of the entire group of patients with thyroid pathology, in the case of low TSH, the incidence of osteopenia was higher than in case of osteoporosis in all age groups.

Figure no. 3. T score distribution per age groups and groups of patients (low TSH)



In the case of high TSH associating low FT4 (clinically manifested hypothyroidism), we noticed whether the duration of the substitution treatment influences the value of the T score. Of the total batches with disthyroidies, a number of 37 cases meet these criteria, of which with a duration of therapy higher than 5 years - 23 patients (64.3%) and 14 patients (35.7%) were with a duration of treatment under 5 years. In the above-mentioned cases, there was an increased incidence of osteopenia 71.4% for the patients with treatment duration less than 5 years, 69.6% for those with more than 5 years (p = 0.57).

Figure no. 4. T score distribution per age groups and groups of patients (increased TSH and low FT4)



In the case in which TSH is low and FT4 is increased (clinically manifested hyperthyroidism), only 9 cases in the group of patients without surgical intervention do not meet these criteria, 5 patients with a treatment duration more than 5 years and 4 cases with a duration less than 5 years. The incidence of osteopenia is increased in this situation.

DISCUSSIONS

The study investigated the influence of TSH values on bone mineral density values in different situations in patients with thyroid pathology of the described batches, grouped into three age categories. The results showed that if TSH is increased, there is no statistically significant difference between the groups regarding the age category ($p = 0.87$).

Several studies have shown that with age, TSH concentration increases. From our study, it shows that elevated TSH values are directly proportional to age, being consistent with the literature data.(4)

In the cases in which TSH is low, there are statistically significant differences between the group of patients operated and those unoperated regarding the three age groups ($p = 0.017$); we interpreted that this situation might be due the compliance/non-compliance of the therapeutic indications by both groups of patients.

We analysed the value of the T score on the three groups of patients and according to the age groups and we noticed the existence of significant statistically differences regarding the T scores in the age groups of 50-59 years old and 60-64 years old ($p=0,000$, $p= 0,049$) between the three groups of patients. Also, the T score registered the highest values in the age group of 50-59 years old (figure no. 2).

Recent studies have shown that increased TSH is associated with a higher bone density, compared with the situation in which TSH is low; however, hypothyroidism is accompanied by an increased risk of fracture, probably because of poor quality of bone (8); it is considered that TSH achieved an independent control of both the formation and resorption of bone. In our study, elevated TSH is associated with osteopenia, which is observed in the entire group of patients with thyroid pathology. Also, there is a proportional decrease with age of the T score, on the whole study group, there were differences between the operated and unoperated patients in favour of those operated (figure no. 2).

In the two analysed groups, in case of low TSH, there has been an increased incidence of osteopenia. If TSH is associated with high values of FT4, the results are similar, with reserves concerning the strength of the statement, due to the limited number of patients in this category.

If high TSH is associated with low FT4, osteopenia is prevalent on the two groups of patients with thyroid pathology.(5)

From the previous analysis regarding the duration of treatment (over and under 5 years), it showed that bone mineral density is not significantly affected, the weight of osteopenia being the same in the patients with overt hypothyroidism and in those with hyperthyroidism clinically manifested.

CONCLUSIONS

Our study demonstrates that the incidence of hypothyroidism increases with age, statement reinforced by numerous studies in the literature.(4,7)

Irrespective of the aetiology of the thyroid insufficiency with TSH within the limits of the suclinical form of hypothyroidism, a decrease of bone mineral density has been noticed.

The previous conclusions show that besides the variations of the thyroid hormones and/or of the TSH, there are also other factors which contribute to the decrease of the bone mineral density, especially the old age.

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