



Changes of bone mineral density, bone metabolism indices and cell factors in patients with hyperthyroidism

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ABSTRACT

Objective: To observe the changes of bone mineral density, bone metabolism indices and cell factor in patients with hyperthyroidism. **Methods:** A total of 116 cases of hyperthyroidism patients from June 2015 to June 2016 in our hospital were selected. as the object of observation group. Then, 120 cases of healthy people were selected as the object of control group. Thyroid function indexes (TT3, TT4, FT3, FT4, TSH), bone mineral density (BMD), bone metabolism indexes (PTH, BGP, PINP) and cell factors (IL-2, IL-6) in both groups were detected and compared. **Results:** TT3, TT4, FT3, FT4, TSH in control group were (1.40±0.81) nmol/L, (94.36±32.10) nmol/L, (5.04±1.18) pmol/L, (15.37±4.60) pmol/L, (2.55±1.21) mU/L. TT3, TT4, FT3, FT4, TSH in observation group were (5.48±2.36) nmol/L, (405.55±71.48) nmol/L, (16.27±5.14) pmol/L, (46.83±12.66) pmol/L, (0.04±0.01) mU/L. TT3, TT4, FT3, FT4 in the observation group were higher than that in control group obviously. TSH in the observation group was lower than that in observation group obviously. The difference between two groups was considered statistically significant. BMD, PTH in observation group were (0.62±0.08) g/m², (26.25±9.16) pg/mL, which were obviously lower than BMD (1.23±0.11) g/m², PTH (37.13±8.05) pg/mL in control group. The difference between two groups was considered statistically significant. BGP, PINP in observation group were (14.51±6.25) ng/mL, (223.63±10.38) μg/L, which were obviously higher than BGP (5.97±1.98) ng/mL, PINP (33.18±6.15) μg/L in control group. The difference between two groups was considered statistically significant. IL-2 in observation group was (1.60±0.51) ng/L, which was obviously lower than IL-2 (4.72±1.29) ng/L, in control group. IL-6 in observation group was (1.98±0.34) pg/L, which was obviously higher than IL-6, (1.50±0.23) pg/L, in control group. The difference between two groups was considered statistically significant. **Conclusion:** Bone mineral density in patients with hyperthyroidism decreased and bone metabolism in patients with hyperthyroidism was active. The significant changes of IL-2, IL-6 also can be seen. In the clinical ,We should enhance the detection of these indexes, so as to take measures to prevent and cure the complications such as osteoporosis.

1. Introduction

Hyperthyroidism is a common disease of endocrine[1]. The prevalence rate of hyperthyroidism in China has reached 1.10%, mainly in young and mid-aged women[2,3]. The clinical manifestations of hyperthyroidism are excessive drinking

and eating, sweating, weight loss and heart palpitations. In addition ,osteoporosis, fracture and other complications may be caused by metabolic disorders[4,5], which is harm to health. However, the control of hyperthyroidism is mainly focused in the clinical, ignoring the bone density, bone metabolism and other abnormality[6]. In addition, there is a close relationship between hyperthyroidism and related cell factors[7]. Therefore, this study was to observe changes of bone mineral density, bone metabolism indices and cell factors in patients with hyperthyroidism, providing scientific evidence for clinical diagnosis and treatment.

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2. Materials and methods

2.1 General information

A total of 116 cases of hyperthyroidism patients from June 2015 to June 2016 in our hospital were selected. as the object of observation group.

Inclusion criteria (1) meets diagnostic criteria of hyperthyroidism[8]. (2) It is the first time for patients admitted to hospital. Without drug-taking history of anti thyroid drugs, glucocorticoids or other drugs that affect bone metabolism.(3) the patients have signed the informed consent.

Exclusion criteria: (1) pregnant, maternal or lactating women. (2) With hypercortisolism, rheumatic arthritis and other diseases affecting endocrine and bone metabolism. (3) With serious liver and renal dysfunction. Then, 120 cases of healthy people were selected as the object of control group. In the observation group, there were 21 males and 95 females, the minimum age was 22 years old, the maximum was 69 years old and the average age was 44. In the control group, there were 21 males and 99 females, the minimum age was 20 years old, the maximum was 70 years old and the average age was 46. There had no differences in the sex , age and other general information, and there was no statistical significance , with a balanced comparability.

2.2 method

Fasting venous blood of all objects in two groups were collected in the morning . And then serum separating was performed.

(1) determination of thyroid function: Serum thyronine (TT3), total thyroid hormone (TT4),]free triiodothyronine (FT3), free thyroid hormone (FT4) and thyroid stimulating hormone with high sensitivity(TSH) were detected by Ultra-weak chemiluminescence

analyzer of Abbot ARCHITETC i2000.

(2)determination of bone mineral density and bone metabolism index: Bone mineral density was detected by dual energy x ray absorptiometry of US Norland XR-36. Detection sites are L2-4 lumbar spine. Serum parathyroid hormone (PTH) were detected by Ultra-weak chemiluminescence analyzer of Abbot ARCHITETC i2000 . The kits were from instrumental reagent. Bone gla protein(BGP), type I procollagen amino terminal peptide (PINP) were detected by ELISA. The kits were purchased from Shanghai Caiyou Industrial Co., Ltd.

(3) cell factors: IL-2,IL-6 were detected by radio immunoassay. The kits were purchased from US R&D.

2.3 Statistical Methods

SPSS 19.0 statistical package was conducted for statistical analysis. Relevant data indexes were described as mean \pm standard deviation,. Intergroup comparison was conducted by t test. Values of $P < 0.05$ were considered to be statistically significant.

3 Results

3.1 Comparison of Thyroid function index in the two groups

TT3, TT4, FT3, FT4, TSH in control group were (1.40 \pm 0.81) nmol/L, (94.36 \pm 32.10) nmol/L, (5.04 \pm 1.18) pmol/L, (15.37 \pm 4.60) pmol/L, (2.55 \pm 1.21) mU/L. TT3, TT4, FT3, FT4, TSH in observation group were (5.48 \pm 2.36) nmol/L, (405.55 \pm 71.48) nmol/L, (16.27 \pm 5.14) pmol/L, (46.83 \pm 12.66) pmol/L, (0.04 \pm 0.01) mU/L. TT3, TT4, FT3, FT4 in the observation group were higher than that in control group obviously. TSH in the observation group was lower than that in observation group obviously. The difference between two groups was considered statistically significant($P < 0.05$). See Table 1.

Table 1.

Comparison of Thyroid function in the two groups.

groups	n	TT3 (nmol/L)	TT4 (nmol/L)	FT3 (pmol/L)	FT4 (pmol/L)	TSH (mU/L)
Observation	116	5.48 \pm 2.36	405.55 \pm 71.48	16.27 \pm 5.14	46.83 \pm 12.66	0.04 \pm 0.01
Control	120	1.40 \pm 0.81	94.36 \pm 32.10	5.04 \pm 1.18	15.37 \pm 4.60	2.55 \pm 1.21
t		23.911	58.355	31.213	34.284	30.266
P		<0.001	<0.001	<0.001	<0.001	<0.001

Table 2.

Comparison of bone mineral density, bone metabolism indices in the two groups.

group	n	BMD (g/m ²)	PTH (pg/mL)	BGP (ng/mL)	PINP (μ g/L)
Observation	116	0.62 \pm 0.08	26.25 \pm 9.16	14.51 \pm 6.25	223.63 \pm 10.38
Control	120	1.23 \pm 0.11	37.13 \pm 8.05	5.97 \pm 1.98	33.18 \pm 6.15
t		22.112	2.997	19.121	46.342
P		<0.001	<0.001	<0.001	<0.001

2.2 Comparison of bone mineral density, bone metabolism indices in the two groups

BMD, PTH in observation group were (0.62 ± 0.08) g/m², (26.25 ± 9.16) pg/mL, which were obviously lower than BMD (1.23 ± 0.11) g/m², PTH (37.13 ± 8.05) pg/mL in control group. The difference between two groups was considered statistically significant ($P<0.05$). BGP, PINP in observation group were (14.51 ± 6.25) ng/mL, (223.63 ± 10.38) μg/L, which were obviously higher than BGP (5.97 ± 1.98) ng/mL, PINP (33.18 ± 6.15) μg/L in control group. The difference between two groups was considered statistically significant ($P<0.05$). See table 2.

2.3 Comparison of cell factors in the two groups

IL-2 in observation group was (1.60 ± 0.51) ng/L, which was obviously lower than IL-2 (4.72 ± 1.29) ng/L, in control group. IL-6 in observation group was (1.98 ± 0.34) pg/L, which was obviously higher than IL-6 (1.50 ± 0.23) pg/L, in control group. The difference between two groups was considered statistically significant ($P<0.05$). See table 3.

Table 3.

Comparison of cell factors in the two groups.

Group	n	IL-2 (ng/L)	IL-6 (pg/L)
Observation	116	1.60±0.51	1.98±0.34
Control	120	4.72±1.29	1.50±0.23
t		8.256	4.334
P		<0.001	<0.001

4. Discussion

Hyperthyroidism is a common disease of endocrine[9]. The clinical manifestations of hyperthyroidism are excessive drinking and eating, sweating, weight loss and heart palpitations[10]. Investigation on the thyroid diseases in 2010 of 10 main cities of China showed that the prevalence rate of hyperthyroidism in China has reached 1.10%[11]. Hyperthyroidism, as an endocrine disease, not only cause the abnormality of hormone indexes, but also influence the bone mineral density and bone metabolism, causing osteoporosis, fractures and other complications[12]. So, patients should pay more attention on the aspect.

We can know the changes of hormone in patients with hyperthyroidism by learning indexes of thyroid function. The results of table 1 showed that TT3, TT4, FT3, FT4, TSH in healthy control group were (1.40 ± 0.81) nmol/L, (94.36 ± 32.10) nmol/L, (5.04 ± 1.18) pmol/L, (15.37 ± 4.60) pmol/L, (2.55 ± 1.21) mU/L. And the TT3,

TT4, FT3, FT4 in observation group were higher than that in the healthy control group. TSH was lower than that in healthy control group. We can see that, in addition to TSH is inhibited, the rest of the thyroid hormone all increased in patients with hyperthyroidism. However, a large number of thyroid hormone will seriously affect the normal bone metabolism. It can enhance bone metabolism by stimulating the bone cells, enhancing the activity of the bone cells and increasing the rate of bone turnover. And then ,the function of bone were destroyed. And the balance between bone formation and bone resorption were lose, leading to eventual bone loss[13]. The table 2 showed that BMD in observation group were (0.62 ± 0.08) g/m² which was obviously lower than BMD (1.23 ± 0.11) g/m², in control group. The difference between two groups was considered statistically significant ($P<0.05$). It showed that the appearance of bone mineral density decreased was existed in patients with hyperthyroidism, which was consistent with the results of Li Li's[14]. Bone mineral density can identify that whether there is a reduction in bone mass and whether there is osteoporosis. But it can not be timely and sensitively reflect the short-term changes in bone and further explain the bone metabolism[10]. PTH, BGP, PINP, as bone metabolism indicators ,can be timely and accurately reflect the situation of bone metabolism[15-17]. The results of table 2 showed that PTH in observation group were obviously lower than that in control group. BGP, PINP in observation group were obviously higher than that in control group. The difference between two groups was considered statistically significant ($P<0.05$). PTH, a kind of proteohormone, is synthesized and secreted by the cells of the parathyroid hormone. It is composed of 84 amino acid residues, which is involved in the maintenance of serum calcium level. Serum calcium level negatively regulates PTH. There are a large number of thyroid hormones in vivo when hyperthyroidism, which promotes the body bone turnover rate, destroyed the balance between bone resorption and bone formation. It makes bone resorption more than bone formation. So, the increasing calcium into blood makes the blood calcium increased. Then, the synthesis and secretion of PTH was inhibited. Therefore , the PTH in patients with hyperthyroidism in observation group were lower than hat of the control group[18,19]. BGP is a non collagen protein synthesized by mature osteoblasts. It is involved in the maintenance of normal mineralization rate of bone. It is an important symbol to reveal osteoblast activity, bone formation condition and the rate of bone turnover. Collagen type I is one of the major components of the organic part of the bone matrix. PINP can reflect the synthetic rate of type I collagen, and it is also proved to be a sensitive indicator of bone turnover[14]. The excess thyroid hormone will stimulate bone cells , which promotes bone metabolism and forms high conversion rate of bone[10]. Therefore, BGP, PINP of the patients in the observation group were higher than that in the control group, which was consistent with the results of

Wang Liang's[11].

This study also found that IL-2 in observation group was (1.60±0.51) ng/L, which was obviously lower than IL-2 (4.72±1.29) ng/L, in control group. IL-6 in observation group was (1.98±0.34) pg/L, which was obviously higher than IL-6 (1.50±0.23) pg/L, in control group. The difference between two groups was considered statistically significant ($P<0.05$). IL-2 is a cytokine produced by Th1 cells. IL-6 is a cytokine produced by Th2 and other cells. Its excessive activation can promote the differentiation of B cells, making plasma cells produced. Also, secretion of IgG will enhance the humoral immunity. Finally, the hyperthyroidism were appeared. So the IL-6 of the patients with hyperthyroidism are high, IL-2 of the patients with hyperthyroidism are low[20-22].

In conclusion, bone mineral density in patients with hyperthyroidism decreased and bone metabolism in patients with hyperthyroidism was active. The significant changes of IL-2, IL-6 also can be seen. In the clinical, We should enhance the detection of these indexes, so as to take measures to prevent and cure the complications such as osteoporosis.

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