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Changes of thyroid function, autoantibodies, bone mineral density and bone metabolism indexes in patients with hyperthyroidism

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ABSTRACT

Objective: To investigate the changes of thyroid function, autoantibodies, bone mineral density and bone metabolism in patients with hyperthyroidism. **Methods:** A total of 216 cases of hyperthyroidism in our hospital from December 2015 to January 2015 were selected as the case group, 216 cases of healthy people selected the same period in our hospital physical examination center as the control group, detected thyroid function, autoantibodies, bone mineral density and bone metabolism indexes of all the studied subjects and compared with each other. **Results:** In this study, it was found that diastolic blood pressure, BMI, triglyceride, total cholesterol, HDL-C, VLDL-C, TSH were all significantly lower than the control group (P<0.05), systolic blood pressure, LDL-C, GLU, T_3, T_4, FT_3, FT_4, HTG, TG-Ab, TPO-Ab in case group were significantly higher than the control group (P<0.05). Right calcaneal speed of sound (SOS) in case group was significantly lower than the control group (P<0.05), BGP, PTH in case group were significantly higher than the control group (P<0.05). **Conclusions:** Hyperthyroidism can cause thyroid hormone levels abnormal, abnormal increase autoantibodies, decrease bone density, bone metabolism actively, easy to form osteoporosis, clinical treatment of hyperthyroidism in the same time, should actively prevent the occurrence of osteoporosis

1. Introduction

Hyperthyroidism is an endocrine disease with abnormally elevated thyroid hormone in vivo that caused by various factors[1], the clinical manifestations are increased appetite, weight loss, heat, sweating, palpitation and irritability[2]. In 2010, the ten major cities prevalence of hyperthyroidism found the prevalence rate of hyperthyroidism was about 1.10%[3], and the majority were young women[4]. Hyperthyroidism can lead to female infertility, osteoporosis, fractures and other diseases[5], which brought a heavy burden to the society. Our study aims to investigate the changes of thyroid function, autoantibody, bone mineral density and bone metabolism indexes in patients with hyperthyroidism, and to provide theoretical basis for clinical diagnosis and treatment.

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2. Materials and methods

2.1. Clinical data

A total of 216 cases with hyperthyroidism who were admitted in the Department of Endocrinology, in our Hospital from January 2015 to December 2015 were selected as the case group, male 71 cases, female 145 cases, with an average age as (37.35±8.85) years. Inclusion criteria were as follows: 1) all patients meet the diagnostic criteria for hyperthyroidism[6]; 2) all patients had not been treated with anti thyroid drugs, glucocorticoids or other drugs that affect bone metabolism before the examination; 3) all patients had signed the informed consent. Exclusion criteria were as follows: 1) patients with heart, lung, stomach, liver, renal insufficiency, bone and joint diseases, endocrine diseases, pregnancy and lactation women; 2) patients who had a history of anti thyroid drug therapy, the use of hormone or other drugs that affect bone metabolism, smoking and alcoholism patients; 3) patients who did not cooperate with this study. Another chose 216 cases healthy people who took

the physical examination in the same period in our hospital were selected as the control group, male 69 cases, female 147 cases, with an average age (38.21±7.54) years. Two groups research objects had no statistically significant differences in gender, age (P>0.05) and were comparable.

2.2. Sample collection and detection

A total of 5 mL morning fasting peripheral venous blood were extracted from all subjects. Serum was separated and put in the low temperature freezer. Simultaneously morning urine was collected for detection. The triiodothyronine (T3), thyroxine (T4), free triiodothyronine (FT3), free thyroxine (FT4), thyrotropin (TSH), thyroglobulin (HTG), antithyroglobulin antibody (TG-Ab) , anti-thyroid peroxidase antibody (TPO-Ab) and parathormone (PTH) were detected by chemiluminescence immunoassay. Abbott ARCHITETC i2000 chemiluminescence detector and the chemical reagents were also from Abbott Company; Triglycerides, total cholesterol, high density lipoprotein cholesterol (HDL-C), low density lipoprotein cholesterol (LDL-C), very low density lipoprotein cholesterol (VLDL-C) and fasting blood glucose (FPG) were detected by enzyme assay, used Abbott ARCHITETC C8000 automatic chemical analyzer; Osteocalcin (BGP) were detected by enzyme linked immunosorbent assay.

2.3. Bone mineral density measurement

ALOKA AOS-100 of aluoka supersonic bone density measuring instrument was used. The measurement site was the right leg calcaneal, the parameter was ultrasonic velocity along the axis of the bone (Sound of Speed, SOS), and the unit was m/s.

2.4. Physical examination

Systolic blood pressure, diastolic blood pressure, and BMI measurements were performed on all subjects.

2.5. Statistical analysis

Epi Data 3.0 software was used to enter the survey data, and SPSS 20.0 software was used for statistical analysis. The measurement data were expressed as mean±sd, count data were compared with *chi* square test, Z test for group design data. $P < 0.05$ was considered as significant difference.

3. Results

3.1. General situation

The diastolic pressure, BMI, triglyceride, total cholesterol, HDL-C, VLDL-C in the case group were all significantly lower than those in the control group (P<0.05), while the systolic pressure, LDL-C and FPG in the case group were all significantly higher than those in the control group (P<0.05) (Table 1).

Table 1
General situation.

Indexes	Case group (n=216)	Control group (n=216)	Z value	P value
Systolic pressure (mmHg)	145.60±20.50	118.40±16.50	15.191	0.000
Diastolic pressure (mmHg)	61.50±8.40	75.80±8.90	17.173	0.000
BMI (kg/m^2)	20.15±3.20	23.49±3.91	9.715	0.000
Triglyceride (mmol/L)	0.81±0.62	1.31±0.63	8.314	0.000
Total cholesterol l(mmol/L)	3.79±0.89	4.89±0.74	13.967	0.000
HDL-C (mmol/L)	1.15±0.31	1.38±0.28	8.092	0.000
LDL-C (mmol/L)	3.69±0.18	2.59±0.53	10.740	0.000
VLDL-C (mmol/L)	0.71±0.45	0.92±0.36	5.356	0.000
FPG (mmol/L)	5.14±0.49	4.46±0.81	10.557	0.000

3.2. Thyroid function

TSH in the case group was significantly lower than that in the control group (P<0.05), while the T3, T4, FT3 and FT4 in the case group were significantly higher than those in the control group (P<0.05) (Table 2).

Table 2
Thyroid function.

Indexes	Case group (n=216)	Control group (n=216)	Z value	P value
T3 (nmol/L)	5.49±2.37	1.41±0.82	23.910	0.000
T4 (nmol/L)	405.56±71.49	94.37±32.11	58.358	0.000
FT3 (pmol/L)	16.28±5.15	5.05±1.19	31.225	0.000
FT4 (pmol/L)	46.84±12.67	15.38±4.61	34.293	0.000
TSH (mu/L)	0.05±0.02	2.56±1.22	30.233	0.000

3.3. Autoantibody indexes

t HTG, TG-Ab and TPO-Ab in the case group were significantly higher than those in the control group (P<0.05) (Table 3).

Table 3
Autoantibody indexes.

Indexes	Case group (n=216)	Control group (n=216)	Z value	P value
HTG (ng/mL)	29.48±19.65	21.37±19.44	4.312	0.000
TG-Ab (IU/mL)	432.85±213.57	46.69±29.55	26.323	0.000
TPO-Ab (IU/mL)	182.57±156.83	21.46±14.29	15.036	0.000

3.4. Bone mineral density and bone metabolism indexes

Right leg SOS in the case group was significantly lower than that in the control group (P<0.05), while BGP and PTH in the case group were all significantly highert (P<0.05). (Table 4).

Table 4
Bone mineral density and bone metabolism indexes.

Indexes	Case group (n=216)	Control group (n=216)	Z value	P value
Bone density				
Right leg SOS (m/s)	1490.40±56.95	1611.50±45.80	24.354	0.000
Bone metabolism				
BGP (ng/mL)	14.50±6.24	5.98±1.99	19.118	0.000
PTH (pg/mL)	36.48±9.15	32.74±8.06	4.508	0.000

4. Discussion

Hyperthyroidism as an endocrine disease, will lead to the hormone indexes and bone density abnormalities[7], Our study aims to investigate the changes of thyroid function, autoantibody, bone mineral density and bone metabolism indexes in patients with hyperthyroidism, and to provide theoretical basis for clinical diagnosis and treatment.

We found that hyperthyroidism can lead to the abnormally elevated autoantibody indexes, that HTG, TG-Ab and TPO-Ab. HTG is produced by the thyroid gland and stored in the thyroid follicles. The only source of HTG in peripheral blood is thyroid tissue, hyperthyroidism can lead to an increase follicle HTG production, and the release of HTG into the peripheral blood is also increased[8]; Thyroid peroxidase is located on the top cell membrane of thyroid follicular epithelial cells, and it does not exist in the peripheral blood when thyroid function is normal. However, when hyperthyroidism, the gland follicular epithelial apical cell will damage, TG and TPO will appear in the peripheral blood, then T lymphocyte function abnormal, which will cause B lymphocytes to produce TG-Ab and TPO-Ab, finally causing the increased blood TG-Ab and TPO-Ab[9–12].

Hyperthyroidism will cause osteoporosis due to thyroid hormone secretion which increase bone resorption, resulting in bone resorption greater than bone formation[13]. Bone density measurement is the major method for osteoporosis diagnosis, dual energy X - ray absorptiometry (DEXA) is considered to be the gold standard for osteoporosis diagnosis, it can measure bone density and identify patients with bone loss and osteoporosis and normal people. However, the relatively high cost of DEXA leads to the difficulty in a wide range of applications of this method for osteoporosis diagnosis. Our study uses the ALOKA AOS-100 aluoka supersonic bone density measuring instrument, it has the advantages of simple operation, no radiation, non-invasive, cheap and free evaluation of bone status and fracture risk, high detection accuracy and precision, small detection error, safe and convenient[14]. We found the right leg SOS in hyperthyroidism patients was lower than that in the control group and the difference was statistically significant (P<0.05), this is consistent with the results of Schouten[15], which indicated that there was a decrease in bone density in patients with hyperthyroidism.

Although the ultrasonic bone density measurement instrument can be used to diagnose osteoporosis, but can not reflect the short period of bone changes, and can not reflect the situation of bone metabolism accurately and timely. Bone metabolic indexes such as BGP and PTH can reflect the bone metabolism timely and accurately and can be used for osteoporosis treatment effect evaluation, treatment tracking and differential metabolic bone disease diagnosis[16–19]. Our study found that BGP and PTH in hyperthyroidism patients were higher than those in the control group and the differences were statistically significant (P<0.05), it was consistent with the results of other scholars[20–22], which suggested the accelerated bone formation, the active bone metabolism and osteoporosis presented in hyperthyroidism patients.

In summary, the thyroid hormone level is abnormal in hyperthyroidism patients, the abnormal elevation of autoantibody, decreased bone density and active bone metabolism are easy to form osteoporosis and increase fracture risk. So clinical treatment should be actively resisted hyperthyroidism, and meanwhile close monitoring bone density and bone metabolic indexes, if finding abnormality, as soon as possible to take treatment measures to reduce the incidence of osteoporosis.

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