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Correlation between thyroid function and nodular goiter accompanied with gallstone

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Abstract ***Objective:*** The purpose of the study wass to explore the correlation between thyroid function and nodular goiter accompanied with gallstone. ***Methods:*** We collected 120 cases about nodular goiter accompanied with gallstone and 128 cases about nodular goiter and establish 50 healthy control groups. Detected *t* level of hyrotropic hormone (TSH), total triiodothyronine (TT_3), total thyroxine in the peripheral venous blood of these cases in the three groups by using electrochemiluminescence immunoassay, measure level of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and total bile acid (TBA) levels by using enzymic method, and observed the changes of thyroid function and blood lipid among the three groups. ***Results:*** The serum TT_3 level in nodular goiter accompanied with gallstone group and the nodular goiter group was significantly lower than that in control group ($P < 0.01$), and TSH level in the nodular goiter accompanied with gallstone group is significantly higher than that in control group ($P < 0.01$). There were no statistical significance about difference of TT_4 level among the three groups ($P > 0.05$). Accordingly, TC and LDL-C level in nodular goiter accompanied with gallstone group was significantly higher than that in nodular goiter and control group ($P < 0.01$), while TBA level in nodular goiter accompanied with gallstone group was significantly lower than that in simple nodular goiter group and control group ($P < 0.01$). There was no statistical significance about difference of TC and LDL-C level between simple nodular goiter group and control group ($P > 0.05$). The HDL-C level in nodular goiter accompanied with gallstone group and control group was higher than that in simple nodular goiter group ($P < 0.01$). ***Conclusion:*** The originating etiologic factor of nodular goiter accompanied with gallstone may be related to that the decreased TT_3 induced sub-clinical hypothyroidism.

Key words nodular goiter; gallstone; thyroid function

Etiology and pathological process of nodular goiter formation has been controversial, The concomitant diseases shows rising trend, especially nodular goiter accompanied with gallstone has gradually become the focus of attention in the field of surgery [1–2]. This paper, through the detection of thyroid function and blood lipid level of 120 patients suffering from nodular goiter accompanied with gallstone, aims to investigate the correlation between the changes of thyroid function and nodular goiter accompanied with gallstone.

Materials and methods

General data

Collection of 120 cases about nodular goiter accompanied with gallstone from which inpatients suffer, male 35 cases, female 85 cases, age ranged from 30 to 67 years, with a median age of 43.6 years. A total of 128 cases had nodular goiter, male 30 cases, female 98 cases, age ranged from 28 to 65 years, with a median age of 41.7 years. Selected 50 healthy people, male 14, female 36, age ranged from 30 to 59 years, with a median age of 40.2 years. All cases were confirmed by B ultrasound examination, operation and need the exclusion of parathyroid disease after definite diagnosis.

Methods

Collected peripheral venous blood under condition of empty stomach, separate serum. Used the Roche 2010 automatic electrochemiluminescence immunoassay analyzer for the determination of serum thyroid stimulating+ hormone (TSH), total triiodothyronine (TT_3) and total thyroxine (TT_4) level, at the same time, use enzymatic method for determination of level of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and total bile acid (TBA).

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Table 1 Comparison of serum TT_3, TT_4 and TSH levels between groups ($\bar{\chi} \pm s$)

Group	*n*	TT_3 (nmol/L)	TT_4 (nmol/L)	TSH (uIU/mL)
Accompanied with gallstone	120	1.7 ± 0.6**	103 ± 36	6.9 ± 4.5**
Nodular goiter	128	2.0 ± 0.6**	105 ± 25	5.6 ± 3.2*
Control	50	2.5 ± 0.6	107 ± 28	4.5 ± 3.5
F	–	31.80	0.33	7.84
P	–	< 0.01	> 0.05	< 0.01
Mean square within groups	–	0.36	922.085	14.612

q test: compared with the control group, * $P < 0.05$, ** $P < 0.01$

Table 2 Comparison of serum TC, HDL-C, LDL-C and TBA levels between groups ($\bar{\chi} \pm s$, mmol/L)

Group	*n*	TC	HDL-C	LDL-C	TBA
Accompanied with gallstone	120	4.47 ± 1.93	0.70 ± 0.31	1.86 ± 1.02	28.25 ± 6.31
Nodular goiter	128	0.92 ± 0.14**	0.51 ± 0.24**$^{\Delta\Delta}$	0.24 ± 0.16**	47.12 ± 8.34**$^{\Delta\Delta}$
Control	50	0.81 ± 0.05**	0.68 ± 0.24	0.05 ± 0.03**	40.23 ± 5.32**
F	–	304.20	17.02	234.43	219.52
P	–	< 0.01	< 0.01	< 0.01	< 0.01
Mean square within groups	–	1.511	0.073	0.431	50.707

q test: compared with nodular goiter accompanied with gallstone group, ** $P < 0.01$; compared with a control group, $^{\Delta\Delta}$ $P < 0.01$

Statistical analysis

Analysis of variance (ANOVA) and *q* test were used to compared mean values. Statistical analysis was conducted with SPSS 13.0 software.

Results

Nodular goiter accompanied with gallstone group and nodular goiter group, of which serum TT_3 level was significantly lower than that in the control group ($P < 0.01$); TSH level in nodular goiter accompanied with gallstone group is significantly higher than that in the control group ($P < 0.01$); there was no statistical significance about difference of TT_4 level in the three groups ($P > 0.05$; Table 1).

Serum TC and LDL-C in nodular goiter accompanied with gallstone group, were significantly higher than those of nodular goiter group and the control group ($P < 0.01$), while TBA was significantly lower than that in nodular goiter group and the control group ($P < 0.01$); there was no statistical significance about difference of TC and LDL-C level in nodular goiter group and the control group ($P > 0.05$), while HDL-C level in nodular goiter accompanied with gallstone group and control group, was significantly higher than that in simple nodular goiter group ($P < 0.01$; Table 2).

Discussion

Goiter is common and frequently-occurring disease and is mainly divided into sporadic nodular goiter and endemic goiter. With economic development of China and the growth in living standards, improvement in drinking water of residents, the popularization of iodized salt and change in the dietary structure of residents, endemic goiter has been basically brought under control, while the nodular goiter, especially nodular goiter accompanied with gallstone incidence increases continuously [2]. There are still more controversies about formation mechanism of thyroid nodule and research on nodular goiter accompanied with gallstone [2–3]. However, decreased thyroid hormone level results in increase of TSH so as to cause hyperplasia of epithelial cell of thyroid follicle that prompt formation of thyroid nodule, which is approved by the vast majority. The research results show that serum TT_3 level in nodular goiter accompanied with gallstone group, nodular goiter group is significantly lower than that in the control group ($P < 0.01$), TSH level in nodular goiter accompanied with gallstone group is significantly higher than that in control group ($P < 0.05$), which explain that decrease of serum TT_3 level and increase of TSH level are closely relevant with the formation of nodular goiter.

Bergman and other people, by conducting experiment on rats in 1966, show that thyroxine level can affect the formation process of gallstone [4]. Data of this research show that patients of 56.7% (68/120) have medical history of gallstone disease or cholecystectomy operation due to gallstone before the discovery of nodular goiter. Others believe that hypothyroidism is one of the main factors resulting in gallstone formation [5–6]. In this research, serum TC and LDL-C in nodular goiter accompanied with gallstone group are significantly higher than those in nodular goiter group and control group, while serum TBA in nodular goiter accompanied with gallstone group is significantly lower than that in nodular goiter group and control group, which suggests that gallstone forma-

tion is certainly relevant with increase of serum level of TC and decrease of TBA. The possible mechanism, on the one hand, is due to decrease in serum TT_3 level, systemic metabolic activity weakens, biliary system shows that hepatocyte bile secretion reduce, bile flow slows down, cholestasis occurs further, bile salt separates out and deposits so as to form calculus, calculus and inflammation affect each other, which further leads to the formation of gallstone. On the other hand, under normal circumstances, by increasing the 72-hydroxylase and cholesterol side chain oxidase activity, TT_3 makes bile acid increase through cholesterol oxidation, thereby reducing plasma cholesterol and LDL, further reducing TBA. Because the thyroid gland secretion decreases TT_3 level, regulating effect on cholesterol metabolism weakens, especially the regulating effect on serum cholesterol and LDL significantly weakens, resulting in the decrease of concentration of bile acids in bile, weakening of the dissolution of cholesterol and bile pigment solubilizing action, which is in favor of formation of gallstone.

To sum up, originating etiologic factor of nodular goiter accompanied with gallstone may be due to gradual sub-clinical hypothyroidism caused by the decrease of serum TT_3 in patients. A decrease in serum TT_3 decrease leads to decrease of bile secreted by the hepatocyte, bile flow slows down, cholestasis occurs, meanwhile, bile salt separates out and deposits so as to form calculus because of increase of serum TC, and decrease of TBA. However, long-term low thyroid hormones level can promote epithelial proliferation of thyroid follicle so as to cause formation of nodular goiter. Therefore, whether the exogenous supplement of L-thyroxine sodium salt, apart from surgical operation excision, is priority treatment for nodular goiter accompanied with gallstone, of which the clinical significance and therapeutic prospect are broad and profound, and in-depth research of pathogenesis of nodular goiter accompanied with gallstone and biological relevance between nodular goiter and gallstone still requires further exploration.

Conflicts of interest

The authors indicated no potential conflicts of interest.

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