Hypothyroidism after Hemithyroidectomy: The Incidence and Risk Factors

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Objective: *To evaluate the incidence of post-hemithyroidectomy hypothyroidism and identify possible risk factors that indicates whether patients require thyroid function monitoring after surgery.*
Material and Method: *A retrospective review of patients with benign non-toxic thyroid disease undergoing hemithyroidectomy between April 2004 and November 2008 in the Department of Otorhinolaryngology, Siriraj Hospital was conducted. All patients were in euthyroid state preoperatively. Thyroid specimens were examined for pathological diagnosis and degree of lymphocytic infiltration in thyroid tissue, and thyroid function was evaluated again six weeks after surgery.*
Results: *One hundred patients who received hemithyroidectomy were recruited for the present study. All had normal preoperative thyroid function. Six weeks after surgery, 27% of the cases developed hypothyroidism (6% overt or symptomatic hypothyroidism and 21% subclinical hypothyroidism). The mean preoperative thyrotropin level was significantly higher in the hypothyroid group than in the euthyroid group (1.9±1.2 vs. 1.1±0.7 micro IU/ml). Fifty-eight point three percent of patients with preoperative thyroid stimulating hormone (TSH) level more than or equal 2 micro IU/ml developed hypothyroidism in comparison to only 17.1% of those with preoperative TSH <2 micro IU/ml (odds ratio 6.8). Fifteen patients had significant lymphocytic infiltration (grade 2-4); nine of those (60%) had post-operative hypothyroidism. In contrary, only 18 of 85 patients (21.2%) with minimal infiltrates (grade 0-1) developed hypothyroidism (odds ratio 5.6).*
Conclusion: *Twenty-seven percent of the patients in the present study developed hypothyroidism after hemithyroidectomy. Preoperative TSH more than or equal 2 micro IU/ml and significant lymphocytic infiltration in thyroid tissue or thyroiditis warrant post-operative close TSH monitoring. The awareness of such risk factors for post-operative hypothyroidism would improve patients care.*

Keywords: *Hemithyroidectomy, Hypothyroidism, Risk factors*

J Med Assoc Thai 2016; 99 (1): 77-83
Full text. e-Journal: *http://www.jmatonline.com*

Hemithyroidectomy is a commonly performed surgical procedure to treat a wide variety of benign thyroid lesions. This surgery is indicated in patients who have a unilateral thyroid mass with suspicions or intermediate result from fine needle aspiration, compressive symptom, or cosmetic concern[1-4]. Hemithyroidectomy is associated with a lower incidence of post-operative hypocalcaemia, hypothyroidism, and laryngeal nerves injury comparing to total thyroidectomy. In general, the residual thyroid lobe should have enough capacity both qualitatively and quantitatively to keep serum thyroid stimulating hormone (TSH) at normal level and maintain the euthyroid state. Although there is a transient feedback response of pituitary gland to raise serum TSH to induce hyperplasia of the residual thyroid gland immediately after thyroid surgery, this usually returns to normal level within six to 12 weeks[1,2,5-7].

Routine levothyroxine prescribed for patients after hemithyroidectomy was a common practice in the past to prevent recurrent nodules in the residual thyroid; to decrease risk of malignant conversion in recurrent follicular adenoma, or to treat hypothyroidism, but this concept recently fell out of favor due to its questionable efficacy and associated side effects[1-4,6,8]. Long-term administration of levothyroxine could cause up to three times higher risk of arrhythmia, atrial fibrillation, or osteoporosis/osteopenia in elderly especially postmenopausal women[2,4,5]. In addition, the number of patients who developed hypothyroidism was poorly anticipated and inconsistent. Recently, most patients at risk should be followed clinically for signs of growth or recurrence and only patients with overt or symptomatic hypothyroidism receive levothyroxine.

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The purpose of the present study is to evaluate the incidence of post-hemithyroidectomy hypothyroidism, to identify the possible risks for this condition, and to determine which patients require closed thyroid functions monitoring after surgery.

Material and Method

A retrospective medical record review of all patients with benign non-toxic thyroid disease that underwent hemithyroidectomy (unilateral lobectomy with ischmusectomy) between April 2004 and November 2008 in the Department of Otorhinolaryngology, Faculty of Medicine Siriraj Hospital, Mahidol University was conducted. Exclusion criteria were applied to patients with preoperative abnormal thyroid function tests, thyroid carcinoma, previous radioactive iodine treatment, or radiation therapy in the head and neck region, or taking medications that might affect thyroid functions such as contraceptive pills or thyroid hormone. The present study was approved by the Institutional Review Board.

All recruited patients had serum T3, T4/FT4, and TSH measured and were in euthyroid state preoperatively. In some suspected patients, preoperative serums anti-thyroid microsomal antibody (TMA) and anti-thyroglobulin antibody (TGA) were also analyzed. All thyroid specimens were examined histologically and one experienced pathologist was asked to review either the presence or absence of lymphocytic infiltration in thyroid tissue and quantify the degree of lymphocytic infiltration on a 0 to 4 scale as had been described previously[2,3]. Grade 0 represents nearly no lymphocytic infiltration, grade 1, scattered lymphocytic infiltration without follicle formation, grade 2, lymphocytic infiltration with one or two follicle formations on low power field (x40), grade 3, lymphocytic infiltration with three or more follicle formation on low power field, and grade 4, diffusely lymphocytic infiltration with germinal center. Specimens with scattered lymphocytes surrounding thyroid nodule was indicated as reactive hyperplasia and considered to be of no significance. Histological diagnosis of thyroiditis included diffusely dense infiltration of small lymphocytes in the thyroid and follicle atrophy (grade 4)[2,9-11].

A post-operative thyroid function test was performed six weeks after thyroid surgery in all patients. All patients with elevated TSH should also be evaluated for clinical symptoms of hypothyroidism such as exhaustion, generalized edema, weight gain, muscle pain, constipation, and cold intolerance, and correlated to their serum T3, T4/FT4, and TSH. Hypothyroidism was classified as subclinical and overt type on the basis of TSH, T3, and T4/FT4 level. The reference range for normal TSH assay measured in the present study was 0.23-4.0 micro IU/ml; for T3, 80-180 ng/dl; for T4 4.5-11.7 ng/dl and for FT4, 0.9-1.9 ng/dl. Patients with TSH >4 and low T3, T4/FT4 were classified as overt hypothyroidism. Subclinical hypothyroidism was defined with TSH >4 with normal T3, T4/FT4 level. Thyroxine replacement therapy was recommended only in patients with overt or subclinical hypothyroidism with symptoms. Subclinical hypothyroidism patients without symptoms should have serial TSH monitoring to detect ongoing overt hypothyroidism.

Statistical analysis

The predictive analytics software PASW Statistics 19 (IBM SPSS, Armonk, New York) was used for statistical analysis in the study. All continuous data were presented as mean and standard deviation; unpaired t-test was used to compare two different means. Frequency and percentage were represented those categorical data and Chi-square test or The Fisher's exact test was used to determine the difference between each category. A p-value <0.05 was considered as statistically significant.

Results

One hundred patients who obtained hemithyroidectomy in the Department of Otorhinolaryngology, Faculty of Medicine Siriraj Hospital, Mahidol University between April 2004 and November 2008, and met the eligible criteria were recruited for the present study. Ninety-three patients were female and seven were male. The mean age was 43.6±12.2 years (range 17-72 years). Fifty-two thyroid nodules were located on the right side of the neck, 48 were located on the left.

The size of thyroid nodules ranged from 2 to 7 cm (mean size 3.4±1.2 cm). All recruited patients had normal preoperative thyroid function. Preoperative TMA was performed in 40 suspected patients and 37 cases had negative ratio, whereas TGA negative cases were observed in 40 of 41 patients. The final pathological report after surgery included 39 cases of nodular goiter, 29 follicular adenoma, 14 adenomatous/multinodular goiters, nine follicular neoplasm, five chronic lymphocytic thyroiditis, two Hurthle cell adenoma, and two thyroid cyst. Lymphocytic infiltration in the resected thyroid was

reviewed by one pathologist who was blinded from patients' thyroid functional status and determined as grade 0 in 39 cases, grade 1 in 46, and grade 2, 3, and 4 in nine, one, and five cases respectively.

By the end of the first 6-week post-operative visit, thyroid function was determined, and overt and/or symptomatic hypothyroidism was detected in 6% of the cases, whereas subclinical hypothyroidism was found in 21%. Therefore, the overall prevalence of post-hemithyroidectomy hypothyroidism in the present study was 27%.

The demographic data of patients in both euthyroid and hypothyroid group were shown in Table 1; there was no significant difference in term of age, sex, size of thyroid nodule, and histopathological diagnosis between groups.

The mean preoperative thyrotropin level was significantly higher in the hypothyroid group (1.9±1.2 micro IU/ml) compared to the euthyroid group (1.1±0.7 micro IU/ml) with $p<0.001$. To identify a TSH level where the proportion of patients were more likely to develop post-operative hypothyroidism, the patients were divided into two groups based on their preoperative TSH level (<2 or level more than or equal 2 micro IU/ml). It was noticeable that 58.3% of patients who had preoperative TSH level of more than or equal 2 micro IU/ml, developed hypothyroidism, whereas hypothyroid was found only 17.1% from those with preoperative TSH <2 micro IU/ml. The differences in the rate of hypothyroidism between each group (by univariate analysis) confirmed that patients with pre-operative TSH level more than or equal 2 micro IU/ml were nearly seven times more likely to develop post-operative hypothyroidism than those with low TSH (odds ratio, 6.8; 95% CI 2.5-18.6; $p<0.001$).

All patients with positive either TMA alone or both TMA and TGA tests in the present study subsequently developed post-operative hypothyroidism. In TMA test, the rate of post-operative hypothyroidism among patients with elevated thyroid antibody had statistically significant difference from those with negative TMA result ($p = 0.037$). However, it showed no significant difference for hypothyroidism among patients with positive and negative TGA titer ($p = 0.37$). (Table 2)

From histologic review of the resected gland, 15% of the patients had significant lymphocytic infiltration (grade 2-4) and nine of 15 patients (60%) became hypothyroid post-operatively. In contrary, only 18 of 85 patients (21.2%) who had minimal infiltrates (grade 0-1) developed hypothyroidism. It showed statistically significant difference in the incidence of hypothyroidism between the two groups with $p = 0.004$. In addition, patients with pronounced lymphocytic infiltration were nearly six folds more likely to develop post-operative hypothyroidism than those with non-significant lymphocytic infiltration by univariate analysis (odds ratio 5.6; 95% CI 1.8-17.8). Four patients with chronic lymphocytic thyroiditis in the present study had grade 4 lymphocytic infiltration and all developed hypothyroidism subsequently. Two were overt or symptomatic hypothyroidism and the other two had subclinical hypothyroidism. However, one patient with focal lymphocytic thyroiditis showed grade 2 lymphocytic infiltration in the histologic review and could maintain the euthyroid state through the end of the present study.

Multivariate analysis demonstrated that risk factors for post-hemithyroidectomy hypothyroidism include a preoperative TSH level >2, elevated titer of

Table 1. Demographic data for post-hemithyroidecomy patients (n = 100)

Patient characteristic	Hypothyroid (%) (n = 27)	Euthyroid (%) (n = 73)	*p*-value
Gender			
Male	4 (14.8)	3 (4.1)	0.083
Female	23 (85.2)	70 (95.9)	
Age (years)			
Range	23-65	17-72	
Mean ± SD	44.2±11.7	43.3±12.4	0.739
Nodule size (cm), mean ± SD	3.5±1.3	3.4±1.2	0.721
Pathologic results			
Nodular/adenomatous goiter	12 (44.4)	41 (56.2)	0.062
Follicular adenoma/neoplasm	10 (37.1)	28 (38.3)	
Thyroiditis	4 (14.8)	1 (1.4)	
Hürthle cell adenoma	1 (3.7)	1 (1.4)	
Thyroid cyst	0 (0)	2 (2.7)	

Table 2. Biochemical and pathological data for patients underwent hemithyroidectomy (n = 100)

	Hypothyroid (%) (n = 27)	Euthyroid (%) (n = 73)	*p*-value
Preoperative TSH (μIU/ml)			
Mean ± SD	1.9±1.2	1.1±0.7	<0.001
Median	2.00	0.95	
Preoperative TSH			
≥2 μIU/ml	14 (58.3)	10 (41.7)	<0.001
<2 μIU/ml	13 (17.1)	63 (82.9)	
Microsomal antibody			
Abnormal (>1:100)	3 (100)	0 (0)	0.037
Normal (≤1:100)	11 (29.7)	26 (70.3)	
Thyroglobulin antibody			
Abnormal (>1:20)	1 (100)	0 (0)	0.366
Normal (≤1:20)	14 (35.0)	26 (65.0)	
Lymphocytic infiltration			
Abnormal (grade 2-4)	9 (60.0)	6 (40.0)	0.004
Normal (grade 0-1)	18 (21.2)	67 (78.8)	
Post-operative TSH (μIU/ml)			
Mean ± SD	7.0±3.2	2.2±1.0	<0.001
Median	5.9	2.2	

TSH = thyroid stimulating hormone

thyroid auto-antibodies, and significant lymphocytic infiltration. The adjusted OR for preoperative TSH >2 to develop post-operative hypothyroidism was 4.9 (95% CI 1.7-14.6; $p = 0.004$) and the adjusted odds ratio for significant lymphocytic infiltration in the resected gland was 2.8 (95% CI 0.8-10.4; $p = 0.11$).

Discussion

Hypothyroidism has been an obvious effect after total, near total, or subtotal thyroidectomy; however, it recently becomes increasing concerns for post-hemithyroidectomy. The incidence of hypothyroidism in patients undergoing hemithyroidectomy remained inconclusive ranging from 5 to 35% and depends on the defined hypothyroidism and its follow-up interval[1-6,10,11]. Most patients with hypothyroidism after surgery would develop sign or symptoms within six months. In fact, the half-life of thyroxine that was produced by thyroid gland is seven days and we should allow four to five half-life of thyroxine to get an accurate assessment of the residual thyroid lobe capacity. Therefore, the optimal time for post-operative TSH evaluation should start beyond six weeks[1,2,5,11,12]. In our study, by post-operative 6-week serum TSH evaluation, hypothyroidism could be detected in 27% of the cases and overt hypothyroidism, which was then treated by thyroxine replacement, was found in 6%.

Many contributing factors had been related to increasing risk of hypothyroidism after thyroid lobectomy such as age, sex, thyroid remnant (<6 ml), multinodular goiter, preoperative serum TSH, circulating thyroid antibodies (anti-microsomal and thyroglobulin antibodies) and the degree of lymphocytic infiltration in the resected thyroid[3,5-7,10]. Our study confirmed that only preoperative high normal serum TSH, abnormal TMA, histologic thyroiditis, and pronounced lymphocytic infiltration in the resected gland could predict this complication.

TSH in the upper end of the normal laboratory range in many studies has been emphasized as a sensitive indicator to predict subsequent development of hypothyroidism. The higher TSH levels may indicate the relatively decrease in both quantitative and qualitative thyroid reserve but hypothyroidism after this condition is rarely progressive and usually mild in nature[5]. Hypothyroid patients tended to have higher preoperative TSH level when compared to those euthyroid patients; and our finding was in accordance with others. The mean preoperative serum TSH level in our hypothyroid group was significantly higher than those in the euthyroid groups (1.9 vs. 1.1 micro IU/ml, $p<0.001$). Patients with preoperative serum TSH >2 had 6.8 folds higher risk for developing hypothyroidism than those with low normal preoperative TSH (adjusted OR, 4.9; 95% CI 1.6-14.6).

The presence of lymphocytes in the thyroid gland that could diminish the ongoing biosynthesis of thyroxine in the remaining thyroid lobe has also been related as the indicator to predict subsequent hypothyroidism and diagnose thyroiditis[9,10,13,14]. The occurrence of hypothyroidism usually associates with the high degree of lymphocytic infiltration. In fact, focal lymphocytic infiltration in thyroid gland may be a normal finding since it could be found in up to 20 to 45% in general population[5]. In most study, chronic inflammation (marked lymphocytic infiltration) in the thyroid could be detected post-hemithyroidectomy in 45 to 50% of cases among hypothyroid group whereas it was only 6 to 10% among euthyroid patients[10]. In our study, one third of the cases among hypothyroid group had chronic inflammation with grade 2 to 4 lymphocytic infiltration and 8.2% among euthyroid group.

Chronic autoimmune thyroiditis is the end result of inflammatory process by thyroid antigen and its antibody, which could be predicted preoperatively through serum TMA and TGA in addition to fine needle aspiration finding[15]. Thyroiditis is the most common cause of spontaneous hypothyroidism and it has a trend towards long-term hypothyroidism by progressive tissue destruction from this chronic inflammation. Although TMA and TGA could predict hypothyroidism preoperatively, it could also be found up to 7% in normal population and TGA was found to be less relevant than TMA in detecting thyroiditis. Therefore, histologic thyroiditis does not necessarily correlate with the level of circulatory antibodies (serologic thyroiditis) in all cases[5]. Most chronic lymphocytic thyroiditis patients in our study had diffused lymphocytic infiltration with germinal center formation (grade 4) in their histology and all develop subsequent hypothyroidism. However, only two patients in this group had mild elevation (1/1,600) of TMA levels preoperatively.

There is no universally accepted guideline for post-thyroid lobectomy thyroid function monitoring[3,16,17]. For patients who had preoperative low normal TSH or non-thyroiditis and the first visit (6 weeks) had normal TSH result, thyroid function might be monitored every six months for the first year and on a yearly basis thereafter, since it is rarely developing hypothyroidism. However, patients with normal TSH level at the first post-operative visit but with numerous risk backgrounds such as preoperative high normal serum TSH, elevated thyroid antibodies titers, or marked lymphocytic infiltration in the resected thyroid, should have serum TSH monitoring follow-ups that include scheduled serial TSH draws at 3, 6, 12 months and on a yearly basis post-operatively to detect the possible late development of hypothyroidism[3,11,18].

It is a standard care to treat overt hypothyroid patients with thyroxine replacement therapy. Periodic serum TSH evaluation during the follow-up period may guide the dose adjustment. Many investigators had suggested a wait-and-see policy to patients with subclinical hypothyroidism especially those with preoperative high normal serum TSH without other risk factors since this condition is rarely progressive and up to 70% of the cases will recover normal function without any intervention[2,5,7,12,15,16]. In these patients, serum TSH should be monitored every six months until it reaches normal level or patients develop symptoms. However, long-term observation of persistent subclinical hypothyroidism in those chronic thyroiditis patients is associated with left ventricular hypertrophy, unfavorable lipid profile, and increased risk of developing a major depressive or mood disorder. Therefore, early low dose thyroxine replacement in this group could reduce these complications[3,15,18].

Conclusion

Over a quarter of the patients in the present study (27%) developed hypothyroidism after hemithyroidectomy. Preoperative high normal TSH (>2 micro IU/ml) or elevation of thyroidantibodies, the presence of thyroiditis on histology, and significant lymphocytic infiltration in thyroid tissue warrant post-operative TSH close monitoring. The awareness to identify such risk factors for developing hypothyroidism would improve management strategy and better patient care. Thyroxine replacement therapy should be applied only to that overt or symptomatic hypothyroidism, in patients with subclinical hypothyroidism, some could be carefully observed without replacement.

What is already known on this topic?

Routine levothyroxine had been prescribed after hemithyroidectomy to prevent recurrent nodules in the residual thyroid, to decrease risk of malignant conversion in recurrent follicular adenoma, or to treat hypothyroidism. However, this practice recently fell out of favor since the incidences of post-operative hypothyroidism were hard to anticipate and the incident rates were inconsistent among different

studies. Moreover, the efficacy of the drug is doubtful and its side effect can be severe.

What this study adds?

Over a quarter of our patients developed hypothyroidism after hemithyroidectomy. Post-operative euthyroid patients who were diagnosed as thyroiditis, had preoperative high normal TSH level, or had pronounced lymphocytic infiltration in the thyroid specimens should have close thyroid function monitoring to detect late hypothyroid development. Levothyroxine should be prescribed to those developed overt hypothyroid. For patients with subclinical hypothyroidism after surgery and had such risk factors, careful follow-up or low dose thyroxine replacement is recommended to prevent further overt hypothyroidism or its complications.

Acknowledgement

The authors would like to thank Dr. Chulaluk Komoltri for statistical advices and Ms. Jeerapa Kerdnoppakhun for manuscript assistance.

Author's contribution

Chotigavanich C, Sureepong P - project co-design, data analysis, manuscript preparation; Ongard S, Eiamkulvorapong A, Chongkolwattana C - data collection, literature reviews; Boonyaarunnate T - histopathology reviews; Metheetrairut C - project design, data analysis, manuscript preparation and editing; All authors read and approved the final manuscript.

Potential conflicts of interest

None.

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อุบัติการณ์และปัจจัยเสี่ยงในการเกิดภาวะต่อมไทรอยด์ทำงานต่ำ ภายหลังการผ่าตัดต่อมไทรอยด์ออกข้างเดียว

ฉันทิชา โชติกวณิชย์, ไพบูลย์ สุรีย์พงษ์, สุนันท์ องอาจ, อาภาภรณ์ เอี่ยมกุลวรพงษ์, ถิรพล บุญญาอรุณเนตร, จีระสุข จงกลวัฒนา, โชคชัย เมธีไตรรัตน์

วัตถุประสงค์: *เพื่อศึกษาอุบัติการณ์การเกิดต่อมไทรอยด์ทำงานต่ำ ภายหลังการผ่าตัดต่อมไทรอยด์ออกข้างเดียว และหาปัจจัยเสี่ยงในการเกิดภาวะดังกล่าว เป็นแนวทางในการเฝ้าติดตามและรักษาผู้ป่วยกลุ่มเสี่ยงต่อไป*
วัสดุและวิธีการ: *ทำการศึกษาผู้ป่วยที่รับการผ่าตัดต่อมไทรอยด์ออกข้างเดียว ที่ภาควิชาโสต นาสิก ลาริงซ์วิทยา คณะแพทยศาสตร์ศิริราชพยาบาล ตั้งแต่ พ.ศ. 2547 ถึง พ.ศ. 2551 โดยผู้ป่วยทุกรายจะได้รับการเจาะเลือด เพื่อตรวจภาวะการทำงานของต่อมไทรอยด์หลังผ่าตัด 6 สัปดาห์ และชิ้นเนื้อจากการผ่าตัดจะถูกประเมินลักษณะ lymphocytic infiltration โดยพยาธิแพทย์*
ผลการศึกษา: *มีผู้ป่วยที่เป็นก้อนที่ต่อมไทรอยด์ชนิดไม่เป็นพิษ และมีผลการทำงานของต่อมไทรอยด์ปกติ ได้รับการผ่าตัดต่อมไทรอยด์ออกข้างเดียวในช่วงดังกล่าว จำนวน 100 ราย ผลการตรวจการทำงานของต่อมไทรอยด์ภายหลังผ่าตัด 6 สัปดาห์ พบว่า เกิดภาวะต่อมไทรอยด์ทำงานต่ำ 27% (เป็นต่อมไทรอยด์ทำงานต่ำ ชนิด overt 6% และต่อมไทรอยด์ทำงานต่ำ ชนิด subclinical 21%) ผู้ป่วยที่เกิดต่อมไทรอยด์ทำงานต่ำหลังผ่าตัดมีค่าเฉลี่ยของ TSH ก่อนผ่าตัดสูงกว่ากลุ่มที่เป็น euthyroid อย่างมีนัยสำคัญทางสถิติ p<0.001 (1.9±1.2 vs. 1.1±0.7 micro IU/ml) ผู้ป่วยที่มีค่า TSH ก่อนผ่าตัดมากกว่า 2 micro IU/ml มีโอกาสเสี่ยงเกิดภาวะต่อมไทรอยด์ทำงานต่ำ (58.3%) มากกว่ากลุ่มที่มี TSH น้อยกว่า 2 micro IU/ml (17.1%) ถึง 6.8 เท่า พบว่า 9 ใน 15 ราย (60%) ของผู้ป่วยที่มี lymphocytic infiltration (grade 2-4) ในชิ้นเนื้อต่อมไทรอยด์ มีโอกาสเสี่ยงเกิดภาวะต่อมไทรอยด์ทำงานต่ำ ซึ่งอัตราเสี่ยงนี้เป็น 5.6 เท่า เมื่อเทียบกับกลุ่มที่มี lymphocytic infiltration น้อยกว่า grade 2 (18 ใน 85 ราย, 21.2%)*
สรุป: *อุบัติการณ์การเกิดภาวะต่อมไทรอยด์ทำงานต่ำ ในการศึกษานี้เท่ากับ 27% พบว่าระดับ TSH ในเลือดก่อนผ่าตัดที่มากกว่า 2 micro IU/ml การตรวจพบ lymphocytic infiltration จำนวนมาก (grade 2-4) ในเนื้อเยื่อของต่อมไทรอยด์ หรือ ได้รับการวินิจฉัยว่าเป็น chronic thyroiditis เป็นปัจจัยเสี่ยงให้เกิดต่อมไทรอยด์ทำงานต่ำหลังผ่าตัด และผู้ป่วยที่มีปัจจัยเสี่ยงดังกล่าว ไม่ว่าจะเกิดต่อมไทรอยด์ทำงานต่ำหลังผ่าตัดหรือไม่ ควรที่จะได้รับการตรวจติดตามอย่างใกล้ชิดเพื่อคุณภาพชีวิตผู้ป่วยที่ดีต่อไป*
