Weight change in patients with differentiated thyroid carcinoma after total thyroidectomy versus lobectomy

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Purpose: Thyroid hormone is an important hormone in maintaining metabolism and homeostasis in the body. There exists a common perception among patients that thyroid surgery will cause weight gain. Prevention of any undesired weight gain could be important for the maintenance of well-being in most patients. Our study compares changes in body mass index (BMI) and weight after total thyroidectomy or lobectomy in thyroid cancer patients.

Methods: A total of 967 patients with differentiated thyroid carcinoma were enrolled in the study, from March 2011 to July 2016 at Chung-Ang University Hospital. Exclusion criteria were less than lobectomy, modified radical neck dissection, recurred operation, and combined operation for other causes. Primary endpoints were change in body weight and BMI at 2 years after surgery. A subgroup analysis was performed for patients with significant weight change.

Results: There were no differences between both groups in BMI after 2 years of thyroid operation. Thyroid stimulating hormone (TSH) levels were not significantly different. Fifteen percent of patients showed significant change in body weight after 2 years of operation. The subgroup analysis of these patients showed no significant differences in gender, age, or extent of operation between those who had gained weight compared to those who had lost weight. There were also no differences in postoperative TSH levels, levothyroxine supplementation, or radioactive iodine treatment.

Conclusion: There was a minimal postoperative increase in mean BMI over the years in patients undergoing thyroidectomy for differentiated thyroid cancer. However, weight change did not differ in those undergoing thyroid lobectomy or total thyroidectomy.

Keywords: Thyroidectomy, Thyroid neoplasms, Weight, Body mass index

INTRODUCTION

The role of thyroid hormones in diverse processes related to metabolism, growth, and development is well known [1]. The effects

of excess or deficiency of thyroid hormones can be well seen in patients with hyperthyroidism or hypothyroidism. Hyperthyroid patients commonly show symptoms such as muscle weakness, tachycardia, heat intolerance and weight loss [2]. Patients with hypothyroidism usually complain of fatigue, and weight gain [3].

Thyroidectomy is a common procedure indicated primarily for thyroid cancer as well as benign multinodular goiter. There exists a common perception among patients that thyroid surgery will cause weight gain. Even though weight gain with increasing age is well known, prevention of any undesired weight gain could be important for the maintenance of well-being in most patients. Several studies have addressed this issue with a focus on outcomes of thyroidectomy in patients with hyperthyroidism [2,4,5]. Other studies compared outcomes of thyroidectomy in thyroid cancer patients compared to those with benign nodules [6-8]. Our study compares changes in body mass index (BMI) and weight after total thyroidectomy or lobectomy in thyroid cancer patients.

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METHODS

The medical records of patients who underwent thyroidectomy for thyroid cancer between March 2011 and July 2016 at Chung-Ang University Hospital were retrospectively reviewed. The study was approved by the Institutional Review Board of Chung-Ang University Hospital (IRB No. 2011-019-19342) and performed in accordance with the principles of the Declaration of Helsinki. Written informed consent was waived. Inclusion criteria were as follows—patients above 18 years of age with primary differentiated thyroid carcinoma (DTC) and preoperatively normal thyroid function. Exclusion criteria were less than lobectomy (e.g., isthmusectomy), modified radical neck dissection, recurrent operation, combined operation for other causes, and patients with other malignancies.

We collected demographic data, weight, and BMI of patients before thyroidectomy and at postoperative 1 and 2 years, as well as serum thyroid stimulating hormone (TSH) concentration, operative extent and presence of thyroiditis in pathology report. Preoperative body weight and height were measured at the time of admission for operation. Body weight was measured at each clinic attendance and BMI was calculated as body weight (kg) divided by height (m) squared. Normal range of TSH levels was between 0.55 and 4.78 μ IU/mL.

Thyroid lobectomy was performed in patients with low risk papillary thyroid cancer and follicular neoplasm. Total thyroidectomy was performed when tumor size was larger than 1 cm, in cases where there were multiple or bilateral tumors, and in patients with metastatic central lymph nodes. The first radioactive iodine (RAI) treatment was performed 3 months after surgery, and the second RAI treatment was done at 6 months after the first RAI treatment. Patients were either withdrawn from levothyroxine (LT4) for 28 days or given recombinant human TSH before each RAI treatment.

A subgroup analysis was performed for patients with significant weight change. We considered a weight change significant when the patient showed consistent weight loss or gain of at least 5% from preoperative body weight at postoperative 1 year and 2 years follow-up. Patients with weight changes within 5% (or those who had, for example, gained weight in postoperative year 1 and later lost weight after 2 years) were excluded from this analysis.

For statistical analysis, we used SPSS version 20 (SPSS Inc., Chicago, IL, USA). Categorical variables were expressed as the number and percentage, and compared using the chi-square test. Student t-test was used to assess the relationship between continuous and dichotomous categorical factors. $P < 0.05$ was considered statistically significant.

Table 1. Clinicopathological characteristics

Characteristics	Lobectomy (n = 148)	Total thyroidectomy (n = 819)	P-value
Female sex	119 (80.4)	641 (78.3)	0.559
Age (yr)	46.65 $\pm$ 12.70	47.56 $\pm$ 11.65	0.387
Preoperative weight (kg)	63.40 $\pm$ 13.72	63.12 $\pm$ 11.94	0.795
Preoperative BMI (kg/m ²)	24.31 $\pm$ 4.14	24.19 $\pm$ 3.69	0.707
Preoperative TSH (μ IU/mL)	1.75 $\pm$ 0.92	1.85 $\pm$ 0.93	0.238
CND	108 (73.0)	747 (91.2)	< 0.001
Tumor size (cm)	0.87 $\pm$ 0.83	0.94 $\pm$ 0.76	0.295
T stage			< 0.001
T1a	96 (64.9)	340 (41.5)	
T1b	24 (16.2)	77 (9.4)	
T2	5 (3.4)	16 (2.0)	
T3	23 (15.5)	383 (46.8)	
T4a	0	3 (0.4)	
N stage			< 0.001
N0	114 (76.5)	374 (45.7)	
N1a	22 (15.4)	417 (50.9)	
Nx	12 (8.1)	28 (3.4)	
Thyroiditis			0.008
Hashimoto's	26 (17.4)	226 (27.6)	
Lymphocytic	24 (16.1)	111 (13.6)	

Values are presented as number (%) or mean $\pm$ standard deviation.

BMI, body mass index; TSH, thyroid stimulating hormone; CND, central neck dissection.

RESULTS

A total of 967 patients with DTC were enrolled in the study, including 148 who underwent thyroid lobectomy. The mean age of patients was 47.36 $\pm$ 11.73 years (range, 18–81 years). The patients of 78.6% were female. Patient characteristics for each group are shown in Table 1. There were no significant differences in both groups in gender, age, preoperative weight or BMI, and preoperative TSH levels. More patients who underwent total thyroidectomy had undergone central neck dissection (CND; 91.2% vs. 73.0%, $P < 0.001$) and had higher T stage and N stage in final pathology ($P < 0.001$). However, there were no differences in tumor size (0.94 $\pm$ 0.76 cm vs. 0.87 $\pm$ 0.83 cm). Among the 819 patients who underwent total thyroidectomy, 561 patients (68.5%) received RAI treatment.

Table 2 shows the preoperative and postoperative differences in BMI. There were no differences in BMI after 1 or 2 years of thyroid operation. Postoperative TSH levels at 1 year after operation were higher in the total thyroidectomy group (11.29 $\pm$ 44.17 μ IU/mL vs. 2.62 $\pm$ 20.25 μ IU/mL, $P < 0.001$). TSH levels at 2 years after operation were not significantly different. Postoperative LT4 supple-

Table 2. Postoperative changes in lobectomy versus total thyroidectomy patients

Variable	Lobectomy (n = 148)	Total thyroidectomy (n = 819)	P-value
Postoperative 1-yr BMI (kg/m ²)	24.36 ± 3.80	24.20 ± 3.61	0.609
Postoperative 2-yr BMI (kg/m ²)	24.51 ± 4.16	24.25 ± 3.65	0.433
Postoperative 1-yr TSH (μIU/mL)	2.62 ± 20.25	11.29 ± 44.17	< 0.001
Postoperative 2-yr TSH (μIU/mL)	1.65 ± 1.15	1.97 ± 9.55	0.683
Postoperative LT4 supplementation	107 (72.3)	819 (100)	< 0.001
RAI treatment	0	561 (68.5)	< 0.001

Values are presented as mean ± standard deviation or number (%).

BMI, body mass index; TSH, thyroid stimulating hormone; LT4, levothyroxine; RAI, radioactive iodine.

mentation was given in 72.3% of lobectomy patients. RAI treatment was performed in 68.5% of total thyroidectomy patients.

One hundred forty-five patients (15.0%) showed significant change in body weight after 2 years of operation. Sixty-one patients had significant weight loss, while 84 patients had significant weight gain. Clinicopathological features of each group are summarized in Table 3. There were no significant differences in gender, age or extent of operation. The weight loss group had higher preoperative BMI (26.04 ± 4.08 kg/m² vs. 23.00 ± 3.24 kg/m²) and mean body weight (66.72 ± 11.89 kg vs. 59.64 ± 9.29 kg) compared to the weight gain group ($P < 0.001$). There were no differences in postoperative TSH levels, LT4 supplementation, or RAI treatment.

DISCUSSION

In this study, we compared changes in body weight and BMI in DTC patients undergoing thyroid lobectomy or total thyroidectomy. Patients did not differ in preoperative anthropometric measurements or preoperative TSH levels. It can be noted that more patients in the total thyroidectomy group underwent CND, and had higher T stage and N stage. This is owed to the fact that total thyroidectomy was performed in patients with larger tumor size, and in cases with metastatic central lymph nodes.

Mean BMI gradually increased in postoperative 1 year and 2 years. However, there were no differences in postoperative BMI between lobectomy or total thyroidectomy patients. Differences in postoperative LT4 supplementation were obvious as all total thyroidectomy patients would require hormonal supplementation. Higher TSH levels at postoperative 1 year in the total thyroidectomy group can be attributed to the RAI treatment. Nevertheless, TSH levels at postoperative year 2 were similar between both groups, and weight change did not differ in both groups.

Weight gain after thyroidectomy has been a concern in patients

Table 3. Subgroup analysis of patients with significant weight change

Variable	Weight loss (n = 61)	Weight gain (n = 84)	P-value
Female sex	53 (56.9)	69 (82.1)	0.166
Age (yr)	48.39 ± 13.45	44.45 ± 11.60	0.061
Preoperative weight (kg)	66.72 ± 11.89	59.64 ± 9.29	< 0.001
Preoperative BMI (kg/m ²)	26.04 ± 4.08	23.00 ± 3.24	< 0.001
Preoperative TSH (μIU/mL)	1.97 ± 1.08	1.71 ± 0.88	0.109
Operation			0.954
Thyroid lobectomy	9 (14.8)	12 (14.3)	
Total thyroidectomy	52 (85.2)	72 (85.7)	
CND	52 (85.2)	77 (91.7)	0.479
Thyroiditis			0.347
Hashimoto's	23 (37.7)	20 (23.8)	
Lymphocytic	6 (9.8)	16 (19.0)	
Postoperative 1-yr BMI (kg/m ²)	23.79 ± 3.87	25.48 ± 3.62	0.008
Postoperative 2-yr BMI (kg/m ²)	23.81 ± 3.66	25.51 ± 3.62	0.006
Postoperative 1-yr TSH (μIU/mL)	11.75 ± 33.76	18.00 ± 40.79	0.330
Postoperative 2-yr TSH (μIU/mL)	1.47 ± 4.53	1.90 ± 6.50	0.655
Postoperative LT4 supplementation	55 (90.2)	81 (96.4)	0.080
RAI treatment	37 (60.7)	57 (67.9)	0.391

Values are presented as number (%) or mean ± standard deviation.

BMI, body mass index; TSH, thyroid stimulating hormone; CND, central neck dissection; LT4, levothyroxine; RAI, radioactive iodine.

with Graves disease [2,4] and some studies of patients with hypothyroidism have shown weight gain even with normal thyroid function tests [9]. In this study, we excluded cases of abnormal thyroid function before thyroidectomy. Furthermore, patients undergoing thyroidectomy for thyroid cancer usually receive a suppressive dose, or at least a euthyroid dose, of LT4 after surgery. Postoperative normal to low TSH levels could be an explanation to the minimal increase in mean BMI in this study.

Weight gain comes naturally with the increase in age, particularly in the perimenopausal period [10,11]. In a study by Jonklaas and Nsouli-Maktabi [9], change in weight was reviewed in 120 euthyroid patients undergoing thyroidectomy, compared to patients with preexisting Hashimoto's hypothyroidism (n = 120), no thyroid disease (n = 120) and, thyroid cancer (n = 120). Patients who had undergone thyroidectomy gained more weight than the other groups (3.1 kg vs. 2.2, 1.3, 1.2 kg; $P < 0.05$), and the greatest weight gain was in menopausal women (4.4 kg vs. 2.3 kg in premenopausal women; $P = 0.007$). In contrast to this previous report, although statistically insignificant, patients who had gained weight were younger than those who had lost weight, in this study.

Fifteen percent of patients showed significant change in body weight after 2 years of operation. In contrast to the weight loss

group, those with lower preoperative BMI and mean body weight were subjected to significantly gain weight after thyroidectomy. However, postoperative LT4 supplementation or postoperative TSH levels were similar between both groups. Total thyroidectomy, CND or RAI treatment were not associated with weight gain.

There are some limitations to this study, including its retrospective nature. Moreover, any efforts to lose weight on the part of the patients, as well as eating habits were unaccounted for. Nonetheless, by including only preoperatively euthyroid patients, the possible effects of preoperative thyroid dysfunction on weight gain were controlled. In order to compare the effects of extent of thyroidectomy (lobectomy versus total thyroidectomy), the patients were limited to those with DTC alone. The results from our study may be applicable to patients undergoing thyroidectomy for differentiated thyroid cancer.

In conclusion, there was a minimal postoperative increase in mean BMI over the years in patients undergoing thyroidectomy for differentiated thyroid cancer. However, weight change did not differ in those undergoing thyroid lobectomy or total thyroidectomy.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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