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Prediction of thyroid hormone supplementation after thyroid lobectomy

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ABSTRACT

Background: Thyroid function, as assessed by thyroid-stimulating hormone (TSH) levels, was evaluated in patients after thyroid lobectomy. These assessments were analyzed against perioperative measurements to determine if any of these preoperative values were predictive of postoperative hypothyroidism and the need for postoperative levothyroxine treatment.
Methods: In a retrospective study, data from 276 thyroid lobectomy patients were examined. These surgeries occurred over the period from January 2003–December 2012. Age, sex, volume of resected thyroid, thyroiditis, preoperative free T4, TSH, and microsomal antibody levels were analyzed for correlation with postoperative levothyroxine supplementation.
Results: The overall percentage of the patients taking postoperative levothyroxine was 23.6%. The preoperative TSH level showed strong correlation with TSH levels measured 1-mo postoperatively ($P < 0.001$). Preoperative TSH levels >2.5 mIU/L and positive microsomal antibody showed significant correlation with postoperative levothyroxine supplementation ($P < 0.001$; relative risk, 8.933, and 3.438, respectively). By stratifying the patients based on preoperative TSH levels and presence of microsomal antibodies, in the low-risk group with TSH <2.5 mIU/L and negative microsomal antibody, 7% of patients received postoperative levothyroxine replacement but in the high-risk group with TSH >2.5 mIU/L and positive microsomal antibody, 77.8% required levothyroxine replacement ($P < 0.001$).
Conclusions: The most significant preoperative predictors for levothyroxine supplementation are preoperative TSH level and presence of microsomal antibodies. Patients with preoperative TSH <2.5 mIU/L showed a low risk of requiring postoperative levothyroxine supplementation.

1. Introduction

Thyroid lobectomy is a valid treatment option for managing patients with benign thyroid disease and may even be considered curative for patients with early differentiated thyroid carcinoma [1]. The needs of thyroid hormone supplementation for life-long period is an important consideration when deciding the extent of surgery in a patient with thyroid disease, especially when the patient's disease is on the borderline between the indication of total thyroidectomy and thyroid lobectomy. In literature, thyroid hormone supplementation is required in approximately 10%–50% of patients after thyroid lobectomy [2–6]. Numerous recent studies have focused on the prediction of thyroid hormone supplementation after thyroid lobectomy.

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However, a universally accepted definition of hypothyroidism has not been established and therefore the specific indications for thyroid hormone supplementation have not been agreed on across all institutions.

Therefore, it is important for surgeons to set up their own criteria for levothyroxine supplementation after thyroid lobectomy and thoroughly counsel the patients preoperatively regarding the probability of the need for postoperative levothyroxine supplementation. In this study, we evaluated the correlation between preoperative data and postoperative levothyroxine supplementation to give predictive information that a practitioner could use to provide preoperative counseling to the patients regarding their chances of needing postoperative levothyroxine supplementation after thyroid lobectomy.

2. Materials and methods

A retrospective chart review was authorized and drawn from patients undergoing unilateral thyroid lobectomy between January 1, 2003 and December 31, 2012. The study protocol was approved by the institutional review board at our institution (IRB No. B-1402-238-103). All surgeries were performed by one author (S.-H.A.). Cases of complete thyroidectomy, incomplete preoperative thyroid function tests, completion thyroidectomy after lobectomy, preoperative levothyroxine supplementation, and follow-up <4 mo were excluded from this study.

Parameters investigated included patient sex, age, preoperative thyroid function levels (free T4, thyroid-stimulating hormone [TSH], and microsomal antibodies), postoperative diagnosis, volume of resected thyroid, thyroiditis on pathology report, postoperative free T4, and TSH levels (1 wk, 1 mo, 4 mo, 1 y, and 2 y, postoperatively). Positive test for microsomal antibodies was defined as the presence of microsomal antibodies over 60 U/mL. Patients with TSH levels over 7.0 mIU/L were given levothyroxine supplement during the follow-up period. In addition, patients with TSH levels over 4 mIU/L and complaining of hypothyroidism symptoms (tiredness, lack of energy, discrete cognitive disorders, and mood disturbances) were also treated with levothyroxine replacement.

Serial measurements of TSH levels and distribution of TSH levels within the patient group (0–2.5 mIU/L, 2.5–4.0 mIU/L, 4.0–7.0 mIU/L, 7.0–10.0 mIU/L, and >10.0 mIU/L) were evaluated during the follow-up period. The percentage of patients requiring levothyroxine supplementation stratified according to the preoperative TSH level and duration between the operation and levothyroxine supplementation was also evaluated.

All the statistical analyses were performed using the SPSS for Windows version 20.0 software package (SPSS Inc, Chicago, IL). Pearson bivariate correlation was examined between postoperative 1-mo TSH level and age, resected thyroid volume, preoperative free T4, and TSH level. The mean of postoperative 1-mo TSH level was compared with independent sample *t*-test according to the sex, thyroiditis, and microsomal antibody. After grouping, univariate analysis about the risk of thyroid hormone replacement was performed using Kaplan–Meier analysis and with selected variables, Cox regression analysis with enter method was performed for the multivariate analysis.

3. Results

A total of 276 patients qualified for our study. Table 1 shows demographic and perioperative data for these patients. In general, 65 patients out of 276 (23.6%) required levothyroxine replacement therapy over the postoperative follow-up period. Average starting point of levothyroxine treatment was 3.2 mo after surgery (1 wk–21.8 mo). Fifty-seven percent of patients started their levothyroxine regimen within 2 mo after surgery. At 6 mo after surgery, 90% of the patients requiring levothyroxine during the follow-up period had started the medication (Fig. 1). Among these, 65 patients were treated with levothyroxine, 17 patients (26.2%) could discontinue levothyroxine therapy after an average of 16.4 mo (range, 3.1–43.5 mo) due to normalization of TSH levels.

Table 2 shows the correlation between TSH levels measured 1-mo postoperatively and preoperative findings and pathologic findings. The resected thyroid volume showed significant negative correlation with postoperative TSH levels at 1 mo. The preoperative TSH level showed strong positive correlation with postoperative TSH levels at 1 mo. Sex, thyroiditis, or presence of microsomal antibodies did not show a significant difference in TSH levels at 1 mo.

Postoperative TSH levels were stratified into the following groups: 0–2.5 mIU/L, 2.5–4.0 mIU/L, 4.0–7.0 mIU/L, 7.0–10.0 mIU/L, and >10.0 mIU/L. The number of patients in each group at each postoperative time point is shown in Figure 2. Postoperatively, the percentage of patients with normal TSH level (<4 mIU/L) ranged from 52.1%–66.1%. At postoperative 1 wk, 17 out of 221 cases (7.7%) showed >7.0 mIU/L of TSH level. With follow-up, 18 out of 268 cases (6.7%) after 1 mo, 12 out of 269 cases (4.4%) after 4 mo, and 6

Table 1 – Demographic and perioperative data (*N* = 276).

Age	49.0 (20–80)
M:F	80:196
Preoperative TSH level (mIU/L), *n* (%)	
0–2.5	198 (71.7)
2.5–4.0	53 (19.2)
4.0–7.0	22 (8.0)
7.0–10.0	3 (1.1)
Preoperative microsomal antibody (*n* = 252)	
Positive	27 (9.8)
Negative	225 (81.5)
Diagnosis	
Papillary thyroid carcinoma	176 (63.8)
Follicular adenoma	48 (17.4)
Adenomatous goiter	42 (15.2)
Follicular thyroid carcinoma	6 (2.2)
Others*	4 (1.5)
Volume of resected thyroid (mean ± 95% CI)	28.75 ± 3.10 cm^3
Thyroiditis on pathology report	
Positive	50 (18.1)
Negative	225 (81.5)
Postoperative levothyroxine supplementation	65 (23.6)
Follow-up duration	28.8 mo (3.67–105)

*1 case of medullary thyroid carcinoma, 1 case of well-differentiated tumor with uncertain malignant potential, 1 case of degenerated benign cyst, and 1 case of malignant lymphoma.