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ORIGINAL ARTICLE

# Volume changes in remnant thyroid tissue after thyroidectomy in Graves disease

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**KEYWORDS**
Graves disease;
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volume

*Background/Purpose:* Surgery is one of the treatment choices for Graves disease. The residual thyroid tissue may shrink or become larger. The object of this study was trying to find out what factors affect the residual thyroid gland volume change after thyroidectomy in Graves disease.
*Methods:* We followed thyroid volume changes by ultrasonography in 101 patients with Graves disease who underwent one side lobectomy and another side subtotal thyroidectomy from 1996 to 2006. These patients were divided into three groups according to the residual thyroid size increasing, no change in size, and shrinking. We checked the factors as follows: age, body weight, thyroid-stimulating hormone (TSH) level, TSH-receptor antibody level, anti-thyroid peroxidase (TPO) antibody level, total thyroid volume before and after thyroidectomy, and degree of lymphocyte infiltration.
*Results:* We found that young age and lower residual volume ratio were the most powerful two factors affecting remnant thyroid gland volume changing. We also found that there is no significant correlation between TSH levels and thyroid volume change, nor TSH-receptor antibody titer or thyroid volume change.
*Conclusion:* Age and residual volume ratio were the most powerful two factors in this study.


Conflicts of interest: The authors have no conflicts of interest relevant to this article.

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## Introduction

The prevalence of hyperthyroidism is approximately 1%—2% in women and 0.1% in men.[1] Treatments for Graves disease include antithyroid drugs, radioactive iodine ablation, and surgery. It is unclear which of these therapies is optimal. For patients with intractable hyperthyroidism or large goiters, surgery is the favored means of treatment.[1]

In clinical practice, residual thyroid gland volume may variously change. Ultrasonography is a useful tool for thyroid examination and is widely used to assess thyroid gland size.[2,3] To date, however, there have been no reports published describing serial residual thyroid changes as determined by neck ultrasound following thyroidectomy.

Thyroid-stimulating hormone (TSH)-receptor antibody (TSHRAb) and TSH are potent goitrogenic factors.[4—6] Physiologically, TSH affects thyrocyte function and can promote cellular hypertrophy. The majority of TSHRAbs have TSH-like effects, while TSHRAbs exert stimulatory, neutralizing, and antagonistic effects. Few investigations have focused on the hyperplastic thyroid cell in studies pertaining to the involvement of growth factors in the development of thyroid cancer. The aim of this study was to determine if any clinical, biochemical, or histological factors are related to changes in residual thyroid volume in patients with Graves disease after thyroidectomy.

## Materials and methods

A total of 101 patients with Graves disease who underwent one side lobectomy and another side subtotal thyroidectomy were studied from 1996 to 2006. There were 88 women and 13 men with a mean overall age of 39 $\pm$ 12.4 years (range: 18—73 years). The TSH, TSHRAb, and antithyroid peroxidase antibody (ATPO) levels were all measured postoperatively. We measured TSHRAb concentrations by radioreceptor assay using the porcine TSH receptor by electrochemiluminescence immunoassay (ECLIA) with the Roche Elecsys® 2010 assay (Roche Diagnostic Systems, Mannheim, Germany). We reviewed the surgical specimens and assessed the degree of lymphocyte infiltration subjectively with a classification of slight, moderate, and severe. The volume of residual thyroid tissue was determined by ultrasonography every 3 to 6 months for 1 to 10 years. The mean follow-up duration was 2.5 years, and the mean number of thyroid ultrasonography performed was 11.2 times. All thyroid remnants weighed less <3 g after thyroidectomy. Fifty percent patients had subclinical hypothyroidism during follow-up, and ten percent developed clinical hypothyroidism. There was no patient have recurrent thyrotoxicosis. During the follow-up period, no patients received antithyroid medication or thyroxin supplement. For those 10% of patients who later developed clinical hypothyroidism, we started eltroxin supplement and stopped collecting their TSH level and other laboratory data.

All measurements were made by the same operator to reduce interobserver error (intraobserver error was <2.5%). The rate of volume change was defined as follows: Vn-V1/V1, where V1 is the initial examination volume, and Vn is the final examination volume. The year-volume change rate was defined as the volume change rate over time.

Other variables assessed included age at the time of surgery, body weight, surface area, TSHRAb level (expressed as times of upper normal limit), TSH level (expressed as the log value), anti-TPO antibody (ATPO), duration of follow-up, total thyroid volume before thyroidectomy, residual volume ratio (residual volume/total volume), and degree of lymphocyte infiltration.[7] Thyroid volume was calculated as follows: (length $\times$ width $\times$ height)/2. A volume change rate of less than 7% was defined as no volume change in this study. This study was reviewed and approved by the Institutional Review Board committee and informed consent was obtained from all patients.

## Statistical analysis

Data are reported as mean $\pm$ standard deviation. Analysis was performed with the statistical package SPSS 17.0 (IBM Software). Differences between parameters were compared with the Chi-square test (Cramer *V*), two-way analysis of variance (ANOVA). Relationships among parameters were tested by the Pearson correlation coefficient. Study parameters that had non-Gaussian distributions were transformed to log values. Results were considered statistically significant at $p < 0.05$.

## Results

There were significant inverse correlations between the rate of volume increase and patient age ($r = -0.230$, $p = 0.030$; Fig. 1) and residual volume ratio ($r = -0.249$, $p = 0.015$; Fig. 2). There was no significant relationship

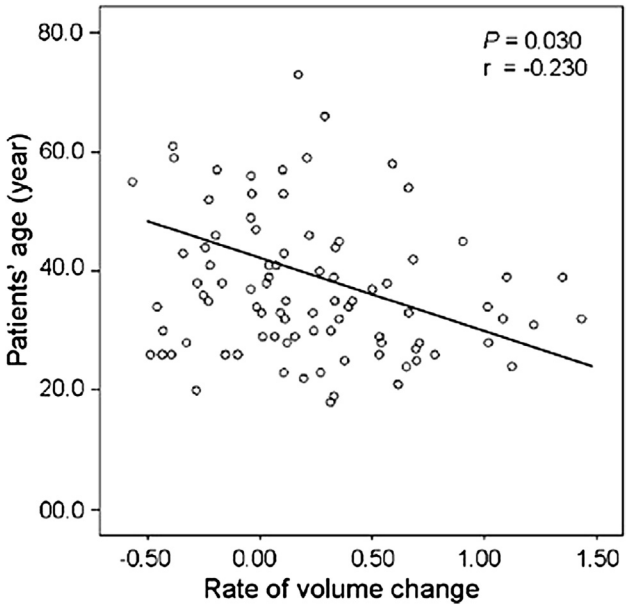


**Figure 1** Relationship between the rate of volume change and patient age. There was a negative correlation between the rate of volume change and patient age ($r = -0.230$, $p = 0.030$).