Clinics in Surgery

Short Communication
Published: 12 Jun, 2017

Do Obtained Volumes Represent the Total Volume of the Thyroid Gland?

Ozer Makay[1], Varlik Erol[2], Yesim Ertan[3], Nazan Ozsan[3], GulKitapcioglu[4], Gokhan Icoz[1] and Mahir Akyildiz[1]*

[1]Department of General Surgery, Division Endocrine Surgery, Ege University School of Medicine, Izmir, Turkey

[2]Department of General Surgery, Baskent University School of Medicine, Izmir, Turkey

[3]Department of Pathology, Ege University School of Medicine, Izmir, Turkey

[4]Department of Biostatistics, Ege University School of Medicine, Izmir, Turkey

Abstract

Background: Determination of thyroid volume is required for making decisions on the extent of radioiodine therapy and for selection of patients to subject to minimally invasive thyroid surgery. Different principles of measuring thyroid volume have been practiced. Herein, we compared the estimated volumes to real volumes, obtained by measuring the excised gland.

Method: Eight-three patients undergoing a total thyroidectomy were selected for the study. Indications for surgery were multinodular goiter, Graves' disease and thyroid cancer. Obtained by ellipsoid volume formula with using 2 different correction factors, ultrasound based thyroid volumes were compared to post-surgical thyroid gland volume determined by Archimedes' principle.

Results: Preoperative ultrasound underestimated excised thyroid volume (30,1±2,9 and 27,2±2,6 vs. 34,2±3,5), ($p< 0.01$). This underestimation was not related to demographics, presence of multinodularity or thyroiditis.

Conclusion: Acceptable correction factors proposed by Brunn (0,479) and Brown (0,524), used by the World Health Organization for the assessment of the thyroid gland, have to be corrected with a more optional correction factor.

OPEN ACCESS

Correspondence:
Ozer Makay, Department of General Surgery, Division Endocrine Surgery, Ege University School of Medicine, Izmir, Turkey;
E-mail: ozer.makay@ege.edu.tr

Received Date: *15 Feb 2017*
Accepted Date: *29 May 2017*
Published Date: *12 Jun 2017*

Citation:
Makay O, Erol V, Ertan Y, Ozsan N, GulKitapcioglu, Icoz G, et al. Do Obtained Volumes Represent the Total Volume of the Thyroid Gland?. Clin Surg. 2017; 2: 1502.

Introduction

Determination of thyroid volume is required for making decisions on the extent of radioiodine therapy and for selection of patients to subject to minimally invasive thyroid surgery. Different principles of measuring thyroid volume have been practiced [1]. Currently, the volume estimate is generally performed by means of ultrasound [2]. The only possibility to receive correct feedback concerning thyroid volume can be obtained by measuring the postsurgical specimen.

Volumetric evaluation of the thyroid gland is based on an ellipsoid model. With this model, the height, width, and depth of each lobe are measured and multiplied. Obtained result is multiplied by a correction factor. Whereas previously 0,524 ($^{11}/_{6}$), the World Health Organization has changed this to 0,479 [3]. In this prospective study, we aimed [1] to compare the estimated volumes to real volumes, obtained by measuring the excised gland after total thyroidectomy and [2] to propose an optimal correction factor.

Material and Methods

Eighty-three patients (mean age=52±10; females 68 and males 15) undergoing a total thyroidectomy, were selected for the study. Indications for surgery were multinodular goiter (n=59), Graves' disease (n=4) and thyroid cancer (n=20). Obtained by ellipsoid volume formula with using 2 different correction factors (0,524 and 0,479), ultrasound based thyroid volumes (UV) were compared to post-surgical thyroid gland volume (SV) determined by Archimedes' principle.

Ultrasound Volume (UV)=height × width × depth × (0,524 or 0,479)

Other correction factors were used for analysis with SPSS Statistical Analysis software (release 11.7, Chicago, IL, USA). All data are expressed as mean±standard deviation. A paired Student's t-test was performed to analyze differences in initial values between the groups. P values of less than 0.05 were considered significant.

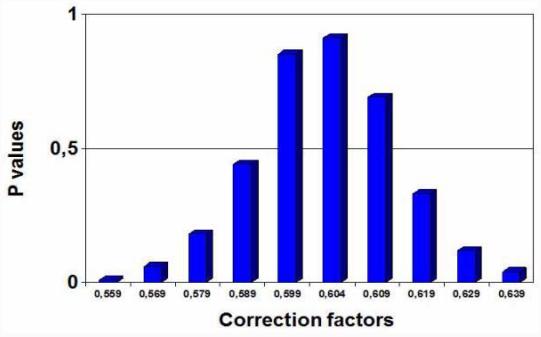

Figure 1: Correction factors used to calculate thyroid volume (resulting p values are shown).

Results

While the UV perfectly matched with SV in 9 (10,8%) patients, there was no documented case with overestimation. Evaluating the total sample, preoperative ultrasound underestimated excised thyroid volume (30,1±2,9 and 27,2±2,6 vs. 34,2±3,5), ($p< 0,01$).

In an attempt to identify characteristics for the differences, patients were divided with regard to pathology, nodule size (less or more than 3,5 cm), presence of thyroiditis, nodule nature (colloid, cystic or solid) and volume estimated by ultrasound (less or more than 25 mL). When patients were divided on the basis of these parameters, none of these expressed any significant difference between groups ($p >0,05$).

Since correction factors 0,524 and 0,479 were not useful in predicting thyroid volume, other correction factors - able to reduce the underestimation of SV – were used for statistical testing and a p value for each correction was obtained. In the range of 0,569–0,639, paired Student's t tests showed no statistically significant differences between calculated volumes and SV (Figure 1). The correlation coefficient between the UV, using correction factor 0,604, and SV was $r=0,96$.

Discussion

Evaluating thyroid volume correctly is of an utmost importance in monitoring the gland, estimating radioiodine dosage and also patient selection for minimally invasive surgery [4]. Results of this study show that preoperative ultrasound underestimates the real thyroid volume in nearly 90% of cases. When analyzing data with regard to parameters that might have an impact on this underestimation, there was no significance in means of thyroid pathology, nodule size and nature, presence of thyroiditis and larger volumes of the thyroid gland.

The search to find an answer for which correction factor was more precise, resulted in efforts for a new correction factor, since both recommended correction factors revealed significant errors in the estimation of the thyroid volume. Introducing a mathematical adjustment in the formula used for the measurement became essential.

It may be inferred that post-surgical measurement of thyroid volume does not reflect gland volume since it does not take into account dryness and bleeding of the gland after dissection. In this context, it is worth mentioning that in case of dryness and bleeding preoperative measurements are expected to overestimate thyroid's real volume, while in most studies, including this current study, it is the contrary [5].

Acceptable correction factors proposed by Brunn et al. (0,479) [6] and Brown et al. (0,524) [7], used by the World Health Organization for the assessment of the thyroid gland, have to be corrected with the more optional correction factor 0,604.

References

1. Nygaard B, Nygaard T, Court-Payen M, Jensen LI, Søe-Jensen P, Gerhard Nielsen K, et al. Thyroid volume measured by ultrasonography and CT. Acta Radiol. 2002;43(3):269-74.
2. Hussy E, Voth E, Schicha H. [Sonographic determination of thyroid volume--comparison with surgical data]. Nuklearmedizin. 2000;39(4):102-7.
3. Shabana W, Peeters E, De Maeseneer M. Measuring thyroid gland volume: should we change the correction factor? AJR Am J Roentgenol. 2006;186(1):234-6.
4. Miccoli P, Minuto MN, Orlandini C, Galleri D, Massi M, Berti P. Ultrasonography estimated thyroid volume: a prospective study about its reliability. Thyroid. 2006;16(1):37-9.
5. Ruggieri M, Fumarola A, Straniero A, Maiuolo A, Coletta I, Veltri A, et al. The estimation of the thyroid volume before surgery--an important prerequisite for minimally invasive thyroidectomy. Langenbecks Arch Surg. 2008;393(5):721-4.
6. Brunn J, Block U, Ruf G, Bos I, Kunze WP, Scriba PC. [Volumetric analysis of thyroid lobes by real-time ultrasound (author's transl)]. Dtsch Med Wochenschr. 1981;106(41):1338-40.
7. Brown MC, Spencer R. Thyroid gland volume estimated by use of ultrasound in addition to scintigraphy. Acta Radiol Oncol Radiat Phys Biol. 1978;17(4):337-41.