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Comparative thyroid gland volume by two methods: Ultrasonography and planar scintigraphy

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Summary

Background:

Knowledge of thyroid gland volume plays a key role in the treatment of thyroid diseases by radioactive iodine ¹³¹I. Radioiodine therapy is a routine procedure of treatment hyperthyroidism for over 50 years.

Material/Methods:

Today modern diagnostic has a number of medical diagnostics instruments whose using to estimate of thyroid volume. Undoubtedly these method we can include a ultrasonography (US) and planar scintigraphy (PS) whose characterized by noninvasive.

Results/Conclusions:

The aims of this papers is evaluate of thyroid volume on the basis of method ultrasonography and planar scintigraphy.

Key words:

thyroid volume • planar scintigraphy • ultrasonography

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Background

Knowledge of thyroid gland volume plays a key role in the treatment of thyroid diseases by radioactive iodine ¹³¹I [1]. Radioiodine therapy is a routine procedure of treatment hyperthyroidism for over 50 years [2].

Today modern diagnostic has a number of medical diagnostics instruments which are used to estimate of thyroid volume. Undoubtedly these method we can include a ultrasonography (US) and planar scintigraphy (PS) which are characterized by noninvasive.

Ultrasonography is a primary imaging method of thyroid. The study is a safe, cheap and generally available. It provides information about thyroid size and structure [2,9,10]. The method makes the most of ultrasonic waves which are penetrating deep into the neck and then record the returning waves-bounced.

Radioisotope methods obtains information not only thyroid size but also on it's a morphology and function. The source of this information are quanta gamma whose the most commonly used emitters are ¹³¹I and ^{99m}Tc [4-6].

The aims of this papers is evaluate of thyroid volume on the basis of methods: ultrasonography and planar scintigraphy.

Material and Methods

All patients who were found to have hyperthyroidism at 109 Military Hospital were examined by US and PS. Patients (40 women) diagnosed in this period were qualified to radioiodine therapy.

Ultrasonography

The study was realized on a apparatus SANOACE PICO MEDISON with a head linear part 7.5 MHz frequency. In study patients had a toss head. During the study measured the maximum dimensions of thyroid panels: length (L), width (W) and thickness (T). Additionally it evaluated echogenicity as well as to states a presence of goiters changes in the glandular tissue.

Thyroid volume was calculated using Braun [7] expression:

$$V_{US}=0.479 \cdot L \cdot W \cdot T \quad (1)$$

Table 1. The statistic results of thyroid volume for ultrasonography (US) and planar scintigraphy (PS).

Variable	Mean	Median	Mode	Minimum	Maximum	SD
US	28.98	27.40		11.41	54.54	11.41
PS	30.62	26.33	13.90	11.78	62.55	14.09

For in the each lobes was calculated its volume and then thyroid lobes volume added together:

$$V_{\text{Thyroid}} = V_{\text{RL}} + V_{\text{LL}} \quad (2)$$

Planar scintigraphy

The study was realize on gamma camera TH/33 MEDISO POLSKA company with HEGP (High energy general purpose) collimator, often with a special design to reduce the distance between the collimator face and the thyroid, and a computer matrix size of 128×128 pixels are used. Acquisition time of a 5 minutes after tracer administrations (24 h) about 4 MBq activity, energy windows set to 131I. Thyroid volume was calculated using Interview program using Himanka and Larson expression [11]. ROI (area of interest) was set manually for each patient.

$$V_{\text{PS}} = 0.33 \cdot A^{3/2}, \quad A - \text{thyroid area} \quad (3)$$

Statistics

The analysis was performed STATISTICA 6.0. Calculated arithmetic mean, standard deviation (SD), mode, median, minimum and maximum values, determined correlation between V_{US} vs. V_{PS} .

Results

Both variables had normal distribution tested Chi-squared method. Table 1 shows the results of thyroid volume for both method.

A average volume of thyroid gland obtained by US was 28.98 ml, for PS 30.62 ml.

Figure 1 shows linear dependence V_{US} vs. V_{PS} ($r=0.94$).

Discussion

Ultrasonography is a essential study of thyroid gland that only limitation is the inability of showing gland located under breastbone notch. The exact calculation of thyroid volume is a essential parameter for calculated of therapeutic radioiodine dose [8].

In the literature there are reports which stressed usefulness both methods (US and PS) to assess a thyroid volume and thus to calculated radioiodine dose.

Lucas [1] presents usefulness of US in the calculated therapeutic radioiodine dose. In conducting the study on 121 patients in 74 (98,6%) states the usefulness effectiveness of

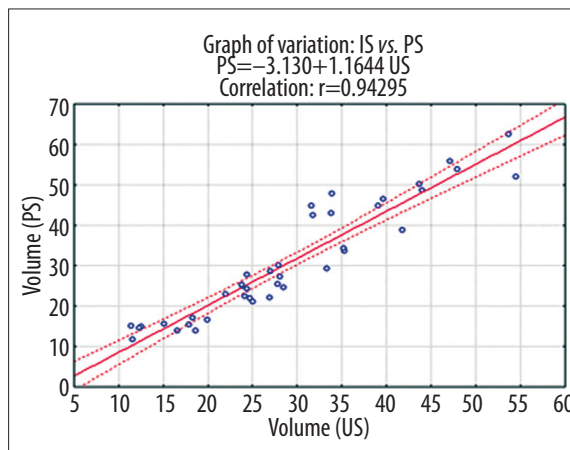


Figure 1. The relationship between two methods of evaluating an thyroid gland volume: ultrasonography and planar scintigraphy.

treatment of hyperthyroidism by radioactive iodine ^{131}I . In the remaining group of 13 patients showed normal function thyroid, at 61 patients appeared hypothyroidism after therapy. Washe [12] shows that thyroid volume calculated by Himaka expression is on average 33% higher that the values obtained by US method. Isselt [13] in compared thyroid volume four methods: US, PS, SPET (Single Photon Emission Tomography) and MRI (Magnetic Resonance Imaging). In study included 25 patients (3 man and 22 women) whose diagnosed with GB (Graves Basedov) disease who referred to radioiodine treatment. The mean thyroid volume were: 26.1 ml, 35.2 ml, 29.6 ml and 33.9 ml. Correlation coefficient of PS vs. MRI ($r=0.61$) was less than the ultrasound vs. MRI ($r=0$). In the present work compared thyroid volume gland using US I PS method. The results obtained Himaka expression proved to be comparable with ultrasound. Measurements based on the interpretation of scintigraphy study are performed by the error resulting from the lack of measurement of the depth and precision mark of the thyroid gland area. The resulting of correlation ratio is comparable to obtained by Isselt for US vs. MRI.

Accuracy also depends on the behavior of the measurement geometry: the distance detector neck. Error interpretation of the results of ultrasound is directly related both to the characteristics of the person conducting the test, its experience and its manual capacity.

Conclusions

1. There is a correlation between thyroid volume obtained by US vs. PS
2. The impact on the outcome of the skills contractors.

References:

1. Lucas KJ: Use of thyroid ultrasound volume in calculating radioactive iodine dose in hyperthyroidism. *Thyroid*, 2000; 10(2): 151–55
2. Ueda D: Normal volume of the thyroid gland in children. *J Clin Ultrasound*, 1990; 18: 455–62
3. Nygaard B, Nygaard T, Court-Payen M: Thyroid Volume Measured by Ultrasonography and TC. *Acta Radiologica*, 2002; 43: 269–74
4. Hayes AA, Akre CM, Gorman CA: Iodine-131 treatment of Graves' disease using modified early iodine-131 uptake measurements in therapy dose calculations. *J Nucl Med*, 1990; 31(4): 519–22
5. Robins RJ, Schlumberger MJ: The evolving role of ¹³¹I for the treatment of differentiated thyroid carcinoma. *J Nucl Med*, 2005; 46: 28–37
6. Burke G, Halko A, Silverstein GE et al: Comparative thyroid uptake studies with ¹³¹I and ^{99m}TcO₄. *J Clin Endocrinol Metab*, 1972; 34: 630–37
7. Ramos CD, Zantut-Wittmann DE, Tambascia MA et al: Thyroid suppression test with L-thyroxine and [^{99m}Tc] pertechnetate. *Clin Endocrinol*, 2000; 52: 471–77
8. Crawford DC, Flower MA, Pratt BE et al: Thyroid volume measurement in thyrotoxic patients: comparison between ultrasonography and iodine-124 positron emission tomography. *E J Nucl Med*, 1997; 24: 1470–78
9. Vitti P, Martino E, Aghini-Lombardi F et al: Thyroid volume measurement by ultrasound of children as a tool for the assessment of mild iodine deficiency. *J Clin Endocrinol Metab*, 1994; 72(2): 600–3
10. van Isselt JW, de Klerk JM, van Rijk PP et al: Comparison of method for thyroid volume estimation in patients with Graves's disease. *E J Nucl Med*, 2003; 30: 523–31
11. Himanka E, Larsson L: Estimation of thyroid volume. *Acta Radiologica*, 1955; 43: 125–31
12. Wesche ME, Tiel-van Buul MM, Smits NJ et al: Ultrasonographic versus scintigraphic measurement of thyroid volume in patients referred for ¹³¹I therapy. *Nucl Med Communications*, 1998; 19: 341–46