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## Anatomic Criteria Of Identification Of A Shape Of A Thyroid Gland.

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### ABSTRACT

According to literature a current problem of modern medicine is development of criteria and the correct interpretation of data on standard anatomy of a thyroid gland. Objective of this research was studying of morphological and constitutional criteria of an identification of a shape of a thyroid gland. Work is performed with using autopsy material of 120 bodies (67 men and 52 women) long lived in the territory of the Rostov region and died of the diseases which are not connected with pathology of organs of a neck. For identification of a shape of a thyroid gland used Y.V. Maleevs recommendations (2016). The shape of a neck was defined according to coefficient of proportionality of width of a neck of T.P. Tikhonova and E.V. Zakhvatova (2006), the constitutional type of the person by means of a technique of L. Rees – H.J. Eisenck (1945). The checked measurements allowed to differentiate a form of a butterfly (52.5%), a form of letter «H» (18.3%), scaphoid (20.1%) and semilunar (9.1%) shapes. Average correlation communications between a shape of a thyroid gland and given to a morphometry of a thyroid gland are defined: width, thickness of shares, height and length of an isthmus ( $r$  from 0.51 to 0.79); neck width at the level of a hypoglossal bone ( $r=0.51$ ); shape of a neck ( $r=0.51$ ) and constitutional type of the person ( $r=0.63$ ). High correlation connection ( $r=0.79$ ) is established between a shape of a thyroid gland and thickness of an isthmus. The thyroid gland in the form of a butterfly is characteristic of normostenic (58.7%) and astenic (36.5%) types from normal (35.5%) and thin (53.2%) shapes of a neck; thyroid gland in the form of letter «H» - for persons pyknic (54.5%) and normostenic (27.3%) types with a wide shape of a neck (45.5%); thyroid glands scaphoid and semilunar shapes – for persons of pyknic type (85.5% and 90.9% respectively) with a wide shape of a neck (69.6% and 72.7% respectively).

**Keywords:** thyroid shape, constitutional type

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## INTRODUCTION

In the last decade, the number of patients who need surgical treatment of the thyroid gland has increased [1,2]. A high percentage of intraoperative lesions of recurrent laryngeal nerves (up to 13.5%), thyroid arteries (up to 5%), parathyroid glands (34.5%) is due to anatomical variability of anatomical structures located in the neck [3]. The shape of the thyroid gland is characterized by exceptional variability, which should be taken into account when performing surgical interventions on the neck organs [4,5]. Y. V. Maleev showed the relationship of the topography of the thyroid gland with the data of the anthropometry of the neck. It was found that the lower edge of the thyroid gland in men with respect to the jugular tendon is higher than in women. In people of both sexes with short and thick necks, the thyroid gland is lower in relation to the jugular notch, reaching the upper edge of the sternum than in people with long and thin necks [6]. Relevant work on the relationship between the size of the thyroid gland with the constitutional types of man and the size of the neck [7,8]. Considering in account the need to take into account the typical features of the thyroid anatomy at the stage of planning surgical treatment, we consider the problem of determining the morphological and constitutional criteria for identifying the shape of the studied organ to be actual and relevant.

*The purpose of the research:* to study the morphological and constitutional criteria for identifying the shape of the thyroid gland.

## MATERIALS AND METHODS

120 non-fixed corpses of people who lived in the Rostov region for a long time and died from diseases not related to the pathology of the neck were studied. Among the surveyed were 67 men and 52 women who died at the age of 18-77 years.

The study was performed at the Department of normal anatomy of the Federal state medical UNIVERSITY of the Russian Ministry of health (head the Department – prof. Chaplygina E. V.), GBU RO "PUB" (chief physician – doctor of higher category, candidate of medical Sciences G. L. Reznikova).

In the course of work with measured the size of the lobes and isthmus of the thyroid gland. The shape of the thyroid gland was determined according to the recommendations of the Y.V. Maleev (2016) on the basis of the measurement of the axis length of the lobes, distance between the upper and lower poles of the lobes, the angle between axes of the lobes (right and left) [9].

The shape of the neck was determined according to the aspect ratio of the neck width, T.P. Tikhonova, E.V. Zakhvatova – as the ratio of neck width to the width of the jaw part of the face. At values of the coefficient of proportionality of the neck width  $1\pm 0.05$  the neck is estimated as wide, at  $0.9\pm 0.05$  the neck is estimated as normal, at  $0.8\pm 0.05$  – thin [10].

The constitutional type of a person was determined using the method L. Rees – H. J. Eisenck (1945) formula: the index of the Rees – Eisenck =  $BL \times 100 / (TDC \times 6)$ , where BL – body length, cm; TDC – transverse diameter of the chest, see the value of the index up to 96 units complies with the endomorph somatotype, 96-106 – the asthenic somatotype, more 106 – asthenic somatotype [11].

Statistical analysis and data processing were performed using EXCEL 7.0 "Microsoft Office 2007 Pro" and R (version 3.2, R Foundation for Statistical Computing, Vienna, Austria) computer programs. For each studied parameter the sample average, standard deviation, standard error were calculated. The reliability of the differences in the mean values of independent samples was evaluated using the parametric Student test. The paper uses linear regression analysis to obtain correlations between morphometry and anthropometry data. To assess the strength of correlation coefficients was used the scale of Chaddock: when the values of r from 0 to 0.3, the relationship is very weak, with r between 0.3 to 0.5, the link is weak, with r between 0.5 and 0.7 – communication medium, when r from 0.7 to 0.9 – high relationship, with r of 0.9 to 1 connections are very high [12].

RESEARCH RESULTS

All the examined thyroid gland had a normal location - from the thyroid cartilage to the supraclavicular region, pathological changes of the thyroid gland were not revealed during the examination.

Taking into account the recommendations of Y. V. Maleev (2016), the following forms of the thyroid gland were differentiated: butterfly shape (52.5%), the shape of the letter "H" (18.3%), semilunar shape (9.1%), scaphoid shape (20.1%).

Thyroid gland without isthmus, asymmetric shape, thyroid gland with pyramidal lobe have not been established, which allows us to consider these forms of organ are not typical for the Rostov population. The residents of the Voronezh region have the following distribution of organ forms: the butterfly form is set at 54%, the letter "H" - at 6%, the scaphoid form – at 20.0%, the semilunar form – at 6%, the form without the isthmus – at 8%, the asymmetric form – at 6% of observations.

**Table 1: presents data on the morphometry of various forms of the thyroid gland**

Thyroid gland shapes Morphometry data	Butterfly shape, n = 63	Shape of the letter «H», n = 22	Scaphoid shape, n = 24	Semilunar shape, n = 11
The length of the axis of the right lobe, mm	43.4±1.31*¤	40.27±2.40*#©	44.52±1.74#®	54.27±3.51¤©®
The length of the axis of the left lobe, mm	43.31±1.45*¤	39.32±2.56*#©	42.87±1.41#®	52.23±3.05¤©®
The width of right lobe, mm	15.51±0.49^	14.27±0.66#©	20.70±0.96^#®	17.27±1.87©®
The width of the left lobe, mm	15.24±0.53^	14.18±0.69#	19.96±1.05^#®	16.91±1.85®
Thickness of right lobe, mm	13.38±0.65¤^	14.14±1.15©	15.13±1.04^	17.09±1.45¤©
Thickness of left lobe, mm	13.10±0.59¤^	13.80±1.36#©	15.55±1.05#^	16.55±1.36¤©
The distance between the upper poles of the lobes (AB), mm	46.63±2.51*¤	41.18±1.77*#©	47.70±3.11#	49.09±0/81¤©
The distance between the lower poles of the lobes (CD), mm	26.98±1.54*^¤#	28.52±1.14*#©	22.04±1.16^#	22.60±1.23¤©
The angle between the axis of the lobes, °	27.08±0.33*¤	22.67±0.86*©	26.00±0.43®	31.82±1.99¤©®
The height of the isthmus, mm	4.37±1.29	3.80±1.26©	5.33±1.03#	6.27±0.99¤©
The thickness of the isthmus, mm	3.60±0.14^¤#	3.59±0.22#©	5.67±0.39^#	5.64±0.35¤©
The length of the isthmus, mm	15.74±0.34^#	14.32±0.74#©	19.26±0.61^#	18.68±0.92¤©

Note: \* - significant differences in the size of the thyroid gland in the shape of a butterfly and in the shape of the letter " H " (p< 0.05);

^ - significant differences in the size of the butterfly-shaped thyroid gland and the scaphoid thyroid gland (p< 0.05);

¤ - significant differences in the size of the butterfly-shaped thyroid gland and the semilunar thyroid gland (p< 0.05);

- # - significant differences in the size of the thyroid gland in the form of the letter "H" and the thyroid gland of the scaphoid form ( $p < 0.05$ );
- © - significant differences in the size of the thyroid gland in the form of the letter "H" and the thyroid gland of the semilunar form ( $p < 0.05$ );
- ® - significant differences in the size of the scaphoid thyroid gland and the semilunar thyroid gland ( $p < 0.05$ ).

Analysis of morphometric measurements of the thyroid gland allowed to formulate the following morphological criteria for the identification of various forms of the thyroid gland in the residents of the Rostov region.

1. The thyroid is the butterfly-shaped is characterized by the length of the axis of the right lobe  $43.43 \pm 1.31$  mm, length axis of the left lobe  $43.31 \pm 1.45$  mm, which significantly exceeds the corresponding dimensions of the thyroid gland in the form of the letter "N". The distance between the upper poles of the lobes is  $46.63 \pm 2.51$  mm, which is significantly larger than the corresponding size of the thyroid gland in the shape of the letter "H", and significantly smaller than the size of the thyroid gland of the semilunar shape. The distance between the lower poles of the lobes of the gland of this form is  $26.98 \pm 1.54$  mm, which is significantly less than the size of the thyroid gland in the form of the letter "H" and more than the size of the scaphoid and semilunar shapes. The angle between the axes of the lobes of the thyroid gland of this shape ( $27.08 \pm 0.33$  mm) is greater than that of the gland in the shape of the letter "H" and less than that of the thyroid gland of the semilunar shape. The thickness and length of the isthmus of the thyroid gland is butterfly-shaped ( $3.60 \pm 0.14$  mm and of  $15.74 \pm 0.34$  mm, respectively) were significantly less than corresponding dimensions of the glands of the navicular (of  $5.67 \pm 0.39$  mm, of  $19.26 \pm 0.61$  mm, respectively) and the lunate ( $5.64 \pm 0.35$  mm, is  $18.68 \pm 0.92$  mm, respectively) shapes.

2. The thyroid gland in the shape of the letter "H" is characterized by the minimum values of the length of the axes of the right ( $40.27 \pm 2.40$  mm) and left ( $39.32 \pm 2.56$  mm) lobes compared to all other forms. The distance between the upper poles of the lobes of the gland of this form is  $41.18 \pm 1.77$  mm, which is significantly less than the corresponding size of the thyroid gland of the butterfly shape, semilunar and scaphoid shapes. The distance between the lower poles of the thyroid lobes ( $28.52 \pm 1.14$  mm) exceeds the size of all other shapes. The angle between the axes of the thyroid lobes ( $22.67 \pm 0.86$  mm) is the smallest compared to the size of other shapes. The size of the isthmus of the thyroid gland in the form of the letter "H" (the height of the isthmus is  $3.80 = 1.26$  mm, the thickness of the isthmus is  $3.59 = 0.22$  mm, the length of the isthmus is  $14.32 = 0.74$  mm) is comparable to the size of the gland in the shape of a butterfly and is significantly smaller than the size of the thyroid gland of the scaphoid and semilunar shape.

3. The scaphoid thyroid gland is characterized by the length of the axis of the right ( $44.52 \pm 1.74$  mm) and left ( $42.87 \pm 1.41$  mm) lobes, which significantly exceed the corresponding size of the thyroid gland in the shape of the letter "H", but significantly less than the size of the thyroid gland of the semilunar shape. The width of the right ( $20.70 \pm 0.96$  mm) and left ( $19.96 \pm 1.05$  mm) lobes of the scaphoid thyroid is significantly higher than the corresponding sizes of all other shapes. Thickness of the right and the left lobe ( $15.13 \pm 1.04$  mm and of  $15.55 \pm 1.0$  mm) the shape than the corresponding values of the sizes of shapes of a butterfly and the letter "H". The distance between the upper poles of the lobes of the gland of this shape is  $47.70 \pm 3.11$  mm, which significantly exceeds the size of the thyroid gland in the shape of the letter "H". The distance between the lower poles of the thyroid lobes ( $22.04 \pm 1.16$  mm) is significantly less than the corresponding size of the thyroid glands in the shape of a butterfly and in the shape of the letter "H". The thickness ( $5.67 \pm 0.39$  mm) and length ( $19.26 \pm 0.61$  mm) of the isthmus significantly exceed the corresponding size of the thyroid glands in the shape of a butterfly and in the form of the letter "H".

4. The thyroid gland of the semilunar shape has a length of the axes of the right ( $54.27 = 3.51$  mm) and left ( $52.23 = 3.05$  m) lobes, significantly exceeding the length of the corresponding sizes of all other shapes. The thickness of the right and left lobes ( $17.09 \pm 1.45$  mm and  $16.55 \pm 1.36$  mm) of this shape exceeds the corresponding values of the size of the butterfly and the letter "H". The distance between the upper poles of the lobes ( $49.09 \pm 0.81$  mm) exceeds the corresponding sizes of the thyroid glands in the shape of a butterfly and in the shape of the letter "H". The distance between the lower poles of the lobes ( $22.60 \pm 1.23$  mm) is significantly lower than the corresponding sizes of the thyroid glands in the shape of a butterfly and in the shape of the letter "H". The angle between the axes of the lobes of the gland of this shape ( $31.2 \pm 1.9^\circ$ ) exceeds the corresponding dimensions of the thyroid glands of all other shapes. Height ( $6.27 \pm 0.99$  mm), thickness ( $5.64 \pm 0.35$  mm), length ( $18.68 \pm 0.92$  mm) of the isthmus exceed the corresponding size of the thyroid glands in the shape of a butterfly and in the shape of the letter "H".

The data of correlation analysis allowed to establish a connection between the shape of the thyroid gland and morphometry data (table 2).

**Table 2: Correlation coefficient between thyroid gland shape and morphometry data**

Morphometry data	Correlation coefficient between thyroid gland shape and morphometry data
The length of the axis of the right lobe, mm	r=0,43
The length of the axis of the left lobe, mm	r=0,33
Width of the right lobe, mm	r=0,52
Width of the left lobe, mm	r=0,53
Thickness of the right lobe, mm	r=0,51
Thickness of the left lobe, mm	r=0,58
The height of the isthmus, mm	r=0,63
The thickness of the isthmus, mm	r=0,79
The length of the isthmus, mm	r=0,64
The distance between upper poles of lobes (AB), mm	r=0,34
The distance between the lower poles of the lobes (CD), mm	r= -0,47
AB/CD	r=0,51
The angle between the axes of the lobes°	r=0,23

The correlation analysis was used to assess the relationship between the shape and thyroid morphometry data. The average correlations (r from 0.51 to 0.63) between the shape of the thyroid gland and the width, thickness of the lobes, the ratio of the distance between the upper poles of the lobes to the distance between the lower poles of the lobes, the height and length of the isthmus were established. A high correlation was established between the shape of the thyroid gland and the thickness of the isthmus (r=0.79).

Data correlation analysis and morphometry of the thyroid gland (table. 1-2) allowed establishing the following regularities.

1. The dimensions of the width and thickness of the scaphoid and semilunar shape prevail over the corresponding sizes of the gland in the shape of a butterfly and in the shape of the letter "H".
2. The size of the isthmus of the thyroid glands of the semilunar and scaphoid shapes are large in comparison with the size of the thyroid glands in the shape of a butterfly and in the shape of the letter "H".
3. In the thyroid gland in the shape of the letter " H " the ratio of the distance between the upper poles of the lobes to the distance between the lower poles of the lobes (AB/CD) has the lowest values, in the thyroid gland of the semilunar shape – its maximum values.

Correlations between the shape of the thyroid gland and anthropometric parameters of the neck, the shape of the neck and the constitutional type of a person were established (table 3).

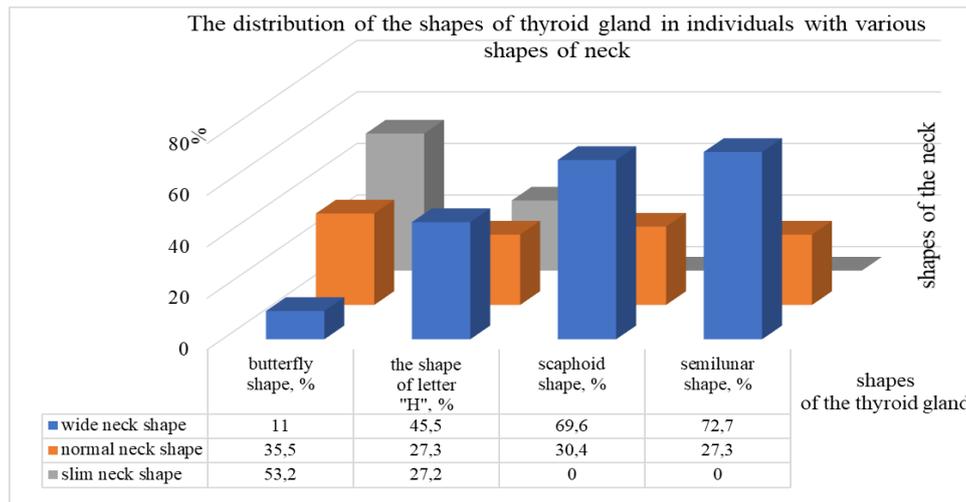
**Table 3: The correlation Coefficient between the shape of the thyroid gland and anthropometry data**

Data anthropometry	The correlation Coefficient between the shape of the thyroid gland and anthropometry data
Neck circumference at the level of the hyoid bone, cm	r=0.36
Neck circumference at its base, cm	r=0.40
The width of the neck at the level of the hyoid bone, conv. unit	r=0.51
The width of the neck at its base, conv. unit	r=0.41
Upper anterior-posterior diameter of the neck, conv. unit	r=0.16
Lower anterior-posterior diameter of the neck, conv. unit	r=0.25
Neck height front, cm	r=0.35
The height of the neck in the back, cm	r=0.21

The shape of the neck, conv. unit	r=0.51
Somatic type, conv. unit	r=0.63

The data of table 3 allowed us to consider the most significant relationship between the shape of the thyroid gland with the width of the neck at the level of the hyoid bone (r=0.51), the shape of the neck (r=0.51) and the somatic type of person (r=0.63).

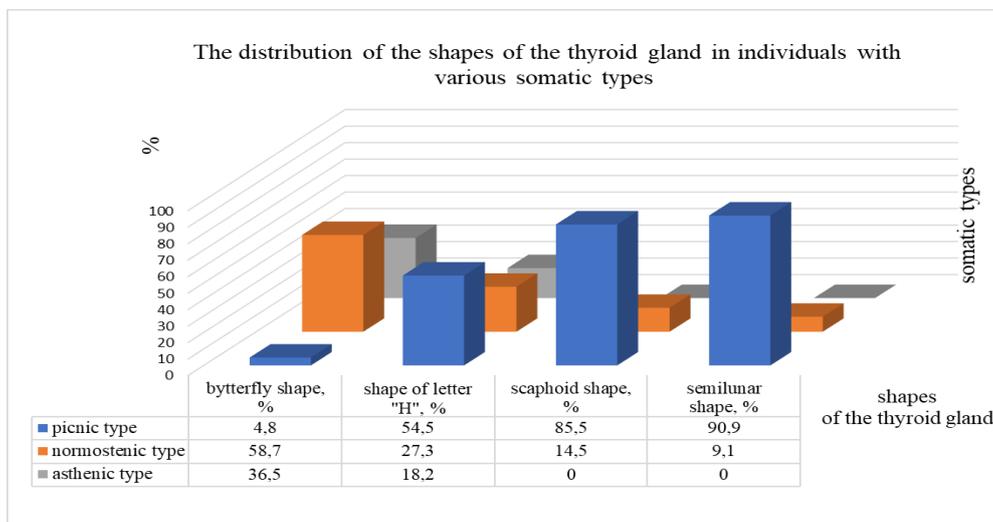
In persons with a wide neck shape, the thyroid gland is represented mainly in the shape of the letter "H", scaphoid and semilunar shape (45.5%, 69.6% and 72.7%, respectively). In persons with normal and thin neck shapes, the thyroid gland is more often butterfly-shaped (35.5% and 53.2%, respectively) (pic. 1).



**Pic. 1. The distribution of the shapes of thyroid gland in individuals with different neck shapes according to the autopsy.**

The butterfly-shaped thyroid gland is predominantly found in people with a normal (68.6%) and thin (80.8%) neck. Thyroid gland in the form of the letter "H", scaphoid and semilunar forms are characteristic of persons with a wide neck shape.

The thyroid gland in the shape of the letter "H", the scaphoid and semilunar is typical for individuals picnic type (54.5%, 85.5% and 90.9%, respectively). The butterfly-shaped thyroid gland is characteristic of the normosthenic (58.7%) and asthenic (36.5%) types (pic. 3).



**Pic. 3. Distribution of forms of the thyroid gland in subjects of different somatic types according to the autopsy.**

The study assessed the size of the lobes, the distance between the poles of the lobes, the angle between the lobes and the size of the isthmus of the thyroid gland.

### DISCUSSION

When comparing the data with the results of the study Y.V. Maleev. Regional differences in the distribution of thyroid forms in the populations of Voronezh and Rostov residents are obvious [9].

The data obtained are comparable with the results of the study of Y.V. Maleev, characterizing the size of the thyroid gland of various shapes in the residents of the Voronezh region. According to Y.V. Maleev, the values of the length of the axes of the lobes and the angle between the axes of the lobes are maximum in the semilunar form, minimum – in the gland in the form of the letter "H". The distance between the lower poles of the lobes is the maximum in the thyroid gland in the shape of the letter "H". The data on the linear dimensions of the lobes and isthmus, taking into account the regional specifics of the Rostov region, obtained in the course of this work, significantly complement the criteria for identifying the shape of the thyroid gland proposed by Y.V. Maleev [7].

**For the first time:** the anatomical criteria for the identification of constitutional and regional norms of various forms of the thyroid gland in residents of the Rostov region are established.

### CONCLUSION

During the work, significant differences in the morphometric parameters of thyroid shapes were established. Data on the linear dimensions of the lobes and the isthmus have helped to clarify the regional characteristics of the size and shape of the thyroid gland among residents of the Rostov region. During the work revealed the following distribution of forms in the thyroid gland: butterfly (52.5%), the letter "H" (18.3%), scaphoid (20.1%) and lunate (9.1%) shapes. The presence of average correlations between the shape of the thyroid gland and the shape of the neck ( $r=0.51$ ), as well as between the shape of the thyroid gland and the somatic type of a person ( $r=0.63$ ) determined the constitutional conditionality of the shape of the organ. The thyroid gland in the shape of a butterfly is typical for persons of normosthenic (58.7%) and asthenic (36.5%) types with normal (35.5%) and thin (53.2%) neck shapes; the thyroid gland in the shape of the letter "H" - for persons picnic (54.5%) and asthenic (27.3%) types with a wide neck shape of (45.5%), thyroid scaphoid and lunate shapes - picnic type (85.5%, for 90.9%, respectively) with the wide shape of the neck (69.6%, 72.7% respectively).

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