

CHARACTERISTICS OF THYROID ANATOMY IMAGES ON SONOGRAPHY IN PATIENTS VISITING THE CAN THO UNIVERSITY OF MEDICINE AND PHARMACY HOSPITAL IN 2022

*Doan Duong My Trang, Nguyen Thi Hong Tham, Tran Nhu Quynh, Do Thi Hong Dieu, Nguyen Cao Tien Dong, Nguyen Thi Giao Ha**

Can Tho University Of Medicine And Pharmacy

**Corresponding author: ntgha@ctump.edu.vn*

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ABSTRACT

Background: Currently, there are no studies providing data on normal thyroid anatomy images on ultrasound to document thyroid imaging for doctors in the country in general and in the Mekong River Delta in particular. Therefore, it is necessary to determine the size of a normal adult human thyroid gland by ultrasound and contribute to providing reference data for the training of clinicians, especially determining the dose of drugs to treat some thyroid diseases related to the size of the gland. **Objectives:** To determine the thyroid anatomical imaging features in people without thyroid disease on ultrasound. **Materials and method:** A cross-sectional descriptive study was conducted on 172 patients who visited the Can Tho University of Medicine and Pharmacy Hospital from May 2021 to October 2022. Subjects are selected by the convenient sampling method met the selection and exclusion criteria. **Results:** The average size of the right lobe (height x width x thickness) was 45.59 x 16.67 x 14.03mm and the left lobe was 43.04 x 16.08 x 12.08mm. The mean thyroid isthmus thickness was 2.62 mm. The mean thyroid volume of the right and left lobes in the study subjects was 5.24ml and 4.31ml, respectively. **Conclusions:** In general, the size of the right lobe of the thyroid gland is larger than that of the left lobe ($p < 0.001$), and the thickness of the right lobe of the thyroid gland is larger in men than in women ($p = 0.04$). No statistically significant differences were found between thyroid size and factors such as age, sex, ethnicity, and BMI.

Keywords: The thyroid gland; anatomy; ultrasound.

I. INTRODUCTION

The thyroid is a gland located under the larynx, on either side and in front of the trachea, the thyroid is the largest endocrine gland in the body and at the same time plays an important role in regulating the function of the entire body, especially the metabolic function [1]. The thyroid gland is enlarged in benign and malignant goiters. In size-based diagnosis through neck examination combined with imaging such as CT scan, ultrasound,... However, clinically, detecting thyroid nodules <1cm in size is very difficult, ultrasound plays an important role in diagnosis, increasing the detection rate of thyroid nodules about 10 times compared to clinical examination [2]. Many studies show the frequency of thyroid nodules detected through ultrasound negative in the general population ranged from 21.3% to 68% [3], [4], [5]. One study concluded that patients with Basedow's disease should have regular thyroid ultrasounds to detect thyroid cancer early [6]. For those reasons, today thyroid ultrasound is a popular, non-invasive imaging method with high accuracy that helps survey thyroid imaging characteristics to support diagnosis. To determine pathology on ultrasound, it is necessary to know the anatomical features of the thyroid gland in the neck and to know the size of the normal thyroid gland. Anatomy textbooks also do not have data

on the thyroid gland of Vietnamese, although there are studies on the thyroid gland by ultrasound, most only refer to the description of images in subjects with thyroid diseases. Therefore, studying the characteristics of normal thyroid anatomical images on ultrasound is necessary, contributing to providing more data for radiologists, this work tries to answer the above issues.

Objective: To determine the thyroid anatomical imaging features in people without thyroid disease on ultrasound.

II. MATERIALS AND METHOD

2.1. Materials

Patients who came to the Can Tho University of Medicine and Pharmacy Hospital from May 2021 to October 2022 met the inclusion and exclusion criteria.

Selection criteria: Patients with normal thyroid anatomy on ultrasound aged 18 years or older at Can Tho University of Medicine and Pharmacy Hospital.

Exclusion criteria: Patients who have undergone thyroidectomy, have thyroid disease, patients with a history of radiation therapy for head-face-neck cancer, patients with a history of surgery for head-face-neck cancer, pregnant women, and persons with systemic disorders.

2.2. Method

Study design: Cross-sectional study.

Sample size and Sampling methods: Using the convenient sampling method, 172 patients were selected meeting the selection and exclusion criteria on all patients who performed thyroid ultrasound at Can Tho University of Medicine and Pharmacy Hospital.

Study content: thyroid size indices including width, height, thickness of left and right lobes, isthmus thickness, and thyroid volume.

Statistical analysis: analyze and process using SPSS 22.0 software to calculate frequency, percentage, qualitative variables, calculate the average value and standard deviation of quantitative variables. Use a T-test, Chi-square test, or Fisher's exact test to find the relationship between variables, then comment and discuss based on the results.

III. RESULTS

3.1. Characteristics of study patients

Table 1. Characteristics of the study patients

Characteristic		Frequency (n=173)	Rate (%)	Characteristic		Frequency (n = 173)	Rate (%)
Sex	Male	56	32.6	Age group	18 - 49	133	77.3
	Female	116	67.4		≥ 50	39	22.7
Ethnic	Kinh	134	77.9	BMI classification	< 18.5	11	6.4
	Hoa	15	8.7		18.5 - < 23	100	58.1
	Khmer	23	13.4		≥ 23	61	35.5

Among the 172 patients studied, male and female patients accounted for 32.6% and 67.4%, respectively, patients aged 18 - 49 accounted for 77.3%, and patients over 50 years old accounted for 22.7%. . The majority of patients are of the Kinh ethnicity, accounting for 77.9%, and other ethnicities account for a smaller percentage. In addition, research shows

that body mass index (BMI) in average people (18.5 - < 23) and overweight and obese (≥ 23) account for 58.1% and 35.5%, respectively.

3.2. Average thyroid size of study subject

Table 2. The average size of the thyroid gland by lobe

Thyroid size (mm)	Left lobe	Right lobe	p	Differential intervals
Height	43.04 ± 9.09	45.59 ± 9.46	< 0.001	1.64 – 3.44
Horizontal	16.08 ± 5.24	16.67 ± 4.16	0.089	-
Thickness	12.80 ± 2.88	14.03 ± 2.97	< 0.001	0.87 – 1.60
Lobe volume	4.32 ± 3.91	5.24 ± 4.91	< 0.001	0.65 – 1.21
Waist thickness	2.62 ± 0.86		-	-

The size of the right lobe is larger than the left lobe of the thyroid gland, the biggest difference is in height: the height of the right lobe is 1.64 to 3.44mm larger than the height of the left lobe.

Table 3. Thyroid size by sex

Thyroid size (mm)		Male	Female	p	Differential intervals
Left lobe	Height	42.54 ± 9.41	42.85 ± 8.99	0.85	
	Horizontal	15.86 ± 6.40	16.20 ± 4.61	0.69	
	Thickness	13.21 ± 2.69	12.59 ± 2.95	0.19	
Right lobe	Height	46.23 ± 10.41	45.28 ± 9.54	0.54	
	Horizontal	16.72 ± 4.51	16.66 ± 4.00	0.93	
	Thickness	14.7 ± 3.19	13.70 ± 2.80	0.04	0.07 – 1.96
Waist thickness		2.75 ± 1.02	2.55 ± 0.76	0.89	

There is a difference in the thickness of the right lobe of the thyroid gland between males and females. The thickness of the right lobe of the thyroid gland is larger in males than in females, from 0.07 to 1.96mm.

Table 4. Thyroid size by age group

Thyroid size (mm)		18 - 49 years old	≥ 50 years old	p
Left lobe	Height	42.98 ± 9.36	41.92 ± 9.95	0.543
	Horizontal	16.01 ± 5.34	16.36 ± 4.95	0.714
	Thickness	12.86 ± 2.69	12.56 ± 3.45	0.567
Right lobe	Height	46.04 ± 8.99	44.05 ± 10.90	0.250
	Horizontal	16.56 ± 3.90	17.05 ± 4.97	0.522
	Thickness	13.84 ± 3.03	14.67 ± 2.68	0.127
Waist thickness		2.62 ± 0.77	2.60 ± 1.12	0.895
The volume of 2 thyroid lobes		9.49 ± 3.77	9.78 ± 5.36	0.701

No difference in thyroid size was detected between the age group under 50 and the age group 50 and older.

Table 5. Thyroid size by ethnicity

Thyroid size (mm)	Ethnic		
	Kinh	Hoa	Khmer
Right lobe height (mm)	45.78 ± 9.56	43.83 ± 9.92	46.60 ± 8.02

Left lobe height (mm)	43.41 ± 9.12	41.13 ± 9.64	42.67 ± 8.01
Right lobe horizontality (mm)	16.55 ± 3.90	17.43 ± 5.89	16.60 ± 3.33
Left lobe horizontality (mm)	15.88 ± 5.33	17.35 ± 5.56	16.00 ± 3.64
Right lobe thickness (mm)	13.93 ± 3.07	14.17 ± 2.16	14.73 ± 3.05
Thyroid size (mm)	Ethnic		
	Kinh	Hoa	Khmer
Left lobe thickness (mm)	12.80 ± 2.89	12.57 ± 2.00	13.13 ± 3.87
Waist thickness (mm)	2.59 ± 0.86	2.71 ± 0.96	2.75 ± 0.63
Right lobe volume (ml)	5.24 ± 2.48	5.08 ± 1.99	5.55 ± 2.17
Left lobe volume (ml)	4.31 ± 2.20	4.13 ± 1.45	4.55 ± 2.76

No differences in thyroid size were detected between different ethnic groups.

Table 6. Thyroid size by BMI

Thyroid size (mm)	BMI		
	< 18.5	18.5 - < 23.0	≥ 23.0
Right lobe height (mm)	44.91 ± 8.19	44.26 ± 9.87	47.89 ± 8.65
Left lobe height (mm)	43.00 ± 8.92	42.07 ± 8.52	44.64 ± 9.90
Right lobe horizontality (mm)	16.27 ± 3.47	16.21 ± 3.97	17.51 ± 4.50
Left lobe horizontality (mm)	14.73 ± 3.32	15.65 ± 4.79	17.05 ± 6.09
Right lobe thickness (mm)	14.45 ± 2.50	14.09 ± 3.11	13.85 ± 2.83
Left lobe thickness (mm)	12.09 ± 2.34	12.72 ± 2.90	13.05 ± 2.93
Waist thickness (mm)	2.74 ± 0.83	2.61 ± 0.74	2.61 ± 1.03
Right lobe volume (ml)	5.27 ± 2.26	5.01 ± 2.43	5.63 ± 2.39
Left lobe volume (ml)	3.89 ± 1.88	4.17 ± 2.20	4.62 ± 2.16

No differences in thyroid size were detected between different fitness groups.

IV. DISCUSSION

4.1. Characteristics of study object

The research was conducted on 172 patients selected by the convenient sampling method that met the selection criteria and exclusion criteria. The sample size of the research was large enough and using a high-precision measuring instrument (ultrasound with linear transducer) the thyroid size values were reliable. However, there is a large difference in the distribution between the two age groups (18- 49 years old, accounting for 77.3% while the group 50 has only 22.7%), the ethnic groups (Chinese ethnic group) and Khmer account for only 22.1%) and physical condition (BMI <18.5 only 6.4%). This results in decreased sensitivity in detecting statistically significant differences in thyroid size with some of the factors involved in the research.

4.2. Size of the thyroid gland

According to our study, the average size of the right lobe is 45.59 x 16.67 x 12.79mm, and 43.04 x 16.09 x 14.02mm is the average size of the left lobe. Overall we can conclude that the mean size of the right lobe is significantly larger than that of the left, the biggest difference being in height: the height of the right lobe is 1.64 to greater than the height of the left lobe (3.44mm). Next is the thickness of the right lobe greater than the length of the left lobe from 0.87– 1.60mm. The volume of each lobe recorded in our study is: left lobe (4.32 ±3.91ml), right lobe (5.24 ±4.91ml) and right lobe volume is larger than

left lobe with a difference of 0.65– 1.21ml. This thyroid asymmetry is relatively consistent with the results reported by Mohamed Yousef's report in 103 healthy Sudanese subjects with mean volumes of the right and left lobes of the thyroid gland being $3.8 \pm 1.37\text{mL}$, and $3.09 \pm 1.24\text{mL}$ [7]. In the thesis of author Luong Linh Ha "Study on imaging characteristics, thyroid volume of normal and Basedow patients by ultrasound, scintigraphy, computed tomography", there are conclusions, thyroid volume in normal people changes by sex: male ($11.41 \pm 4.22\text{ml}$), female ($10.36 \pm 3.69\text{ml}$), increasing gradually with age, reaching the maximum value at the age of 40 to 50 years, then decreasing at the same time, there is a proportional correlation to height, weight, and body surface area [8]. In our study, it was noted that: male ($9.84 \pm 4.54\text{ml}$) tends to be larger than female ($9.41 \pm 3.99\text{ml}$), thyroid volume in the group ≥ 50 years old ($9.49 \pm 3.77\text{ml}$) decreases more than that in the group of 18- 49 years old ($9.78 \pm 5.36\text{ml}$) and the group of overweight people tend to be larger than the other group. We think that the sample size of each age group, sex, BMI, and ethnicity in this study is relatively small, leading to a decrease in sensitivity in detecting statistically significant differences compared to the study of Author Luong Linh Ha.

4.3. Thyroid size and its related factors

Age group

Our study showed that the average size of the right lobe of the thyroid gland in the group of subjects 18- 49 years old was $46.03 \times 16.56 \times 13.84\text{mm}$, the group of subjects aged 50 years and older was $44.05 \times 17.05 \times 14.66\text{mm}$. At the same time, the average size of the left lobe in the group under 50 years old was $43.37 \times 16.01 \times 12.86\text{mm}$ and in the group of 50 years old and older it was $41.92 \times 16.36 \times 12.56\text{mm}$, the thickness of the thyroid isthmus in the subjects group 18- 49 years old and 50 years old and older are 2.62mm and 2.60mm, respectively. In addition, the data showed that the thyroid volume in the group ≥ 50 years old ($9.49 \pm 3.7\text{ml}$) increased more than the group 18– 49 years old ($9.49 \pm 3.77\text{ml}$). In the thesis of author Luong Linh Ha "Research on imaging characteristics, thyroid volume of normal and Basedow patients by ultrasound, scintigraphy, computed tomography", it was concluded that thyroid 5 volume increased gradually with age and reached the maximum value at age of 40 to 50 years and then decreases with old age [6]. In addition, in a study by Barret, it was found that thyroid volume increased with age until 65 years old [7]. However, the number of study subjects in our study in the age group of 50 and older is much less than that of the group of subjects under 50 years old, the sensitivity is reduced to detect a significant difference in gland size between these two groups.

Sex

Through the research results, we show that the average size of the right lobe of the thyroid gland in males is $46.23 \times 16.72 \times 14.71\text{mm}$ and in females is $45.28 \times 16.66 \times 13.70\text{mm}$. Also in the table above, we see that the average size of the left lobe in males is $42.54 \times 15.86 \times 13.21\text{mm}$ and in the female group is $42.85 \times 16.20 \times 12.59\text{mm}$. In addition, the data shows that the thickness of the thyroid isthmus in the male and female groups is 2.75mm and 2.55mm, respectively. Because the number of male subjects in our study is much less than in the female group, in general, we can not detect a significant difference in thyroid size between the two groups. Similar to us, in the study of Marchie, in thyroid volume between men and women they also did not find a significant difference [10].

However, we found that in males, there was a difference between 14.71mm and 13.70mm in thickness of the right lobe, about 0.07 to 1.96mm larger. The studies of Yousef M (2011) and Nguyen Thi Binh (2020) reported that thyroid size is significantly higher in males than in females and many explanations have been proposed for the difference in thyroid size between the sexes [11], [12].

Ethnic

The average size of the right lobe of the thyroid gland in the Kinh ethnic group is 45.78 x 16.55 x 13.93mm with a volume of 5.24ml and in the Hoa ethnic group is 43.83 x 17.43 x 14.17mm with a volume of 5.08ml and in the Khmer ethnic group is 46.60 x 16.60 x 14.73mm with 5,55ml volume. The average size of the left lobe in the Kinh ethnic group is 43.41 x 15.88 x 12.80mm with a volume of 4.31ml and in the Hoa ethnic group is 41.13 x 17.35 x 12,57mm with a volume of 4.13ml and Khmer ethnic group is 42.67 x 16.00 x 13.13mm with a volume of 4.55ml. In addition, the data show that the thickness of the isthmus in the Kinh, Hoa, and Khmer ethnic groups is 2.59mm, 2.71mm, and 2.75mm, respectively. However, the limitation of the difference in the sample size of subjects belonging to these 3 ethnic groups has led to the inability to detect a statistically significant difference in thyroid size between ethnic groups.

BMI

The average size of the right lobe of the thyroid gland in the low-weight group was 44.91 x 16.27 x 14.45mm with a volume of 5.27ml and in the moderate-weight group it was 44.26 x 16.21 x 14.09mm with a volume of 5.01ml and the overweight group - obesity is 47.89 x 17.51 x 13.85mm with a volume of 5.63ml. The mean size of the left lobe in the underweight group was 43.00 x 14.73 x 12.09mm with a volume of 3.89ml, while in the moderate weight group was 42.07 x 15.65 x 12.72mm with a volume of 4.17ml and the overweight group is 44.64 x 17.05 x 13.05mm with a volume of 4.62ml. Besides, the height and thickness of the thyroid isthmus in the underweight, moderate, and overweight groups were 22.18 x 2.74mm, 21.53 x 2.61mm, and 20.69 x 2.61mm, respectively.

Thereby, we found that the size and volume of the thyroid gland in the overweight/obese group were somewhat larger than in the underweight group. However, the number of subjects in the study in the thin group was too small compared with the group of average body, it was not possible to see the significance of the difference in thyroid size between the two groups.

V. CONCLUSION

Through the study of 172 thyroids, we have the following results: The average size of the right lobe is 45.59 x 16.67 x 14.02 mm and 43.04 x 16.09 x 12.79mm is the average size of the left lobe. It can be concluded that the mean size of the right lobe is significantly larger than that of the left lobe ($p < 0.001$). The thickness of the right lobe of the thyroid gland is larger in men than it is in women ($p = 0.04$): the thickness of the right lobe of the thyroid gland in men is 14.71mm and in women, it is 13.70mm. No statistically significant differences were found between thyroid size and factors such as age, sex, ethnicity, and BMI.

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