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Features of Thyroid Ultrasonal Examination in Patients with Hypothyroidism

D. N. Kambarova

Andijan State Medical Institute, Uzbekistan

Abstract Ultrasonography is an indispensable additional tool in hypothyroidism, which can be observed at almost all ages, from the prenatal period to geriatric age groups. It should be remembered that hypoechogenicity is a key sign of hypothyroidism.

Keywords Hypothyroidism, Ultrasonography, Thyroid gland

1. Introduction

Hypothyroidism, caused by a low level of thyroid hormones, is one of the most common endocrine diseases. It has various etiologies and manifestations; when left untreated, it increases morbidity and mortality. Although the main cause of hypothyroidism worldwide is still a iodine-deficient diet, in regions where food intake of iodine is sufficient, it is an autoimmune thyroid disease. Today, it is successfully treated with exogenous thyroid hormone [3].

Hypothyroidism often constitutes a significant part of the daily workload of endocrinology and radiology. Interdisciplinary communication is very important in approaching and treating this endocrine disorder. In the last 30-40 years, the most specific visualization method in routine thyroid disease examination is ultrasound examination (USI) [1]. Ultrasonography has significantly changed medical practice. Relative ease of use, absence of ionizing radiation, low cost, and accessibility of the patient's bed made it invaluable in many clinical settings where patients with thyroid diseases are examined. The superficial location of the thyroid gland during ultrasound provides the advantage of high resolution for assessing thyroid parenchyma and its lesions. Ultrasound is an indispensable examination for almost all thyroid diseases.

On the other hand, thyroid ultrasound absolutely requires specific recognition of various sonographic manifestations of autoimmune diffuse thyroid disease, especially in the clinical picture of antibody-free hypothyroidism. This is also important for determining whether the focal anomaly represents a true node that may require fine-needle aspiration biopsy or is a part of an inflammatory process often called a pseudo-node [3,4]. Ultrasound examination, like other tests, should be used to confirm a differential diagnosis when it is necessary to answer a specific diagnostic question based on the patient's medical history and physical examination [5].

It must be precisely correlated with other data. The justification for thyroid ultrasound should be made taking into account the patient's medical history and the results of laboratory tests.

Purpose of the research. Prove the advantage of using ultrasound in the diagnosis of thyroid hypothyroidism.

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2. Materials and Methods of Research

The study included 118 patients with chronic migraine (CM). The diagnosis of migraine was made according to the International Classification of Headaches (ICHD-III).

The patients were divided into 3 groups. The 1st group consisted of 38 patients with chronic headache lasting up to 5 years and hypothyroidism. The 2nd group included 41 patients with CM with a headache duration of more than 5 years and hypothyroidism. The 3rd group consisted of 39 patients with CM without hypothyroidism. A control group was also created, which included 20 practically healthy individuals.

The age range of patients in the three groups, as well as in the control group, was >20 years, but <50 years. Thus, the average age of the 1st group was 28.7±4.6 years; 2nd group - 36.3±5.2 years; 3rd group - 31.9±3.8 years; control group - 33.5±5.4 years.

3. Results and Their Discussion

All patients underwent ultrasound of the neck organs before admission to the hospital and outpatient clinic. It was conducted in standard modes (gray scale mode), ED, and SDK. When performing ultrasound in polyclinics, several tasks were solved. Firstly, documentary confirmation of thyroid enlargement was required, determining the structure,

if possible, thyroid size and volume, location, size, and volume of thyroid nodes. Secondly, the task of ultrasound at this stage was to assess thyroid nodal formations using the TIRADS system.

Outpatient examinations were performed in various medical institutions on ultrasound machines of different classes (mainly linear (7-14 MHz) and convex sensors) by ultrasound doctors of different levels of training.

When analyzing the protocols of outpatient ultrasound in patients of the 1st group, it was established that in all cases, the size, location of the thyroid gland, and its relationship with surrounding organs and vessels corresponded to the true size of the thyroid gland (Table 1).

Table 1. Comparative assessment of thyroid ultrasound parameters in the examined patients

Indicators	1 group	2 group	3 group
Thyroid size			
Length, mm	50,6±0,4	40,9±0,4**	55,8±0,4***
Width, mm	22,4±0,4	18,4±0,4***	24,3±0,4***
Thickness, mm	24,8±0,4	19,2±0,4***	25,2±0,4***
Node dimensions:			
Length, mm	12,2±0,4	35,5±0,4***	-
Width, mm	10,8±0,4	22,3±0,4***	-
Thickness, mm	13,7±0,4	31,9±0,4***	-
Volume of thyroid (cm3)	18,6±0,4	14,6±0,4***	19,3±0,4
TIRADS	T 1	T 2	T 0

Note: Differences relative to the first group data are significant (* - P<0,05, ** - P<0,01, *** - P<0,001)

The thyroid dimensions in patients of the 1st group were as follows: length 50.6±0.4 mm, width 22.4±0.4 mm, thickness 24.8±0.4 mm.

The thyroid dimensions in patients of the 2nd group were equal: length 40.9±0.4 mm, width 18.4±0.4 mm, thickness 19.2±0.4 mm.

In patients of the 3rd group, the thyroid size practically did not differ from the norm, i.e., the length was 55.8±0.4 mm, the width was 24.3±0.4 mm, and the thickness was 25.2±0.4 mm.

Analysis of the presence of nodes revealed that in patients of the 1st group, the size of the node, i.e., its length, was 12.2±1.5 mm, width 10.8±2.4 mm, and thickness 13.7±0.4 mm.

In patients of the 2nd group, these indicators differed and amounted to length - 35.5±0.4 mm, width - 22.3±0.4 mm, thickness - 31.9±0.4 mm.

No nodes were found in patients of the 3rd group.

The thyroid volume in patients of the 1st group was 18.6±0.4 cm3, in the 2nd group - 14.6±0.4 cm3, in the 3rd group - 19.3±0.4 cm3.

In patients of the 1st group, indicators such as: reduction in thyroid volume in 82%, presence of nodular goiter in 16%, presence of a cyst in 12% were found (Figure 1,2).

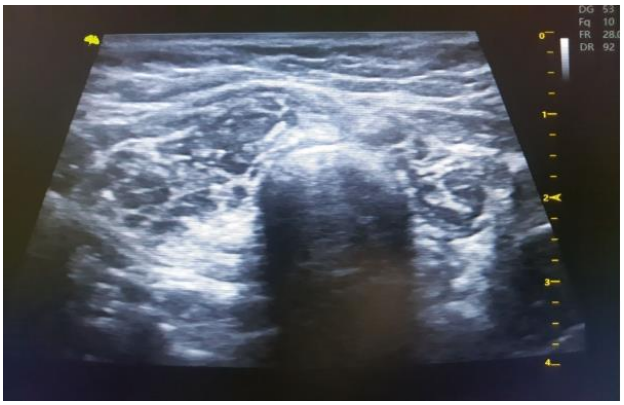

Figure 1. Patient Z.N., 1990. DS: Hypoplasia of the thyroid gland 1st degree

On the echogram, the left lobe of the thyroid gland is reduced in volume compared to the right lobe. The echostructure of the thyroid gland is diffusely heterogeneous on both sides with hyperechogenic bands.

When assessing thyroid nodes using the TIRADS system. In the 1st group (thyroid gland ≈ 100 cm3), TIRADS proved itself to be an effective system for assessing thyroid node ultrasound images. 13 cases (34.2%) were attributed to the TIRADS1 gradation, while TIRADS2 -2 (5.2%), TIRADS3, TIRADS4, and TIRADS5 were absent.

In patients of the 2nd group, a decrease in thyroid volume was observed in 100%, the presence of a colloid node in 28%, and a nodal goiter in 47%. In the 2nd group, 17 cases (41.5%) were attributed to TIRADS1, 4 cases (9.7%) to TIRADS2, while TIRADS3, TIRADS4, and TIRADS5 were absent.

In patients of the 3rd group, no changes were observed in the thyroid ultrasound. When evaluating in groups 1 and 2 using ROC analysis, it was established that TIRADS is a high-quality methodology.

10 qualitative indicators (node shape, echogenicity, structure, presence of the "halo" rim, calcinates, fluid component, contours, boundaries, vascularization of the nodal formation, changes in regional lymph nodes) and 4 quantitative indicators (length, width, thickness, and volume of the node) were considered. ROC analysis revealed that AUC is 0.955 (95% CI = 0.932-0.971), specificity = 89.7%, sensitivity = 93.4% (Figure 1,2,3).

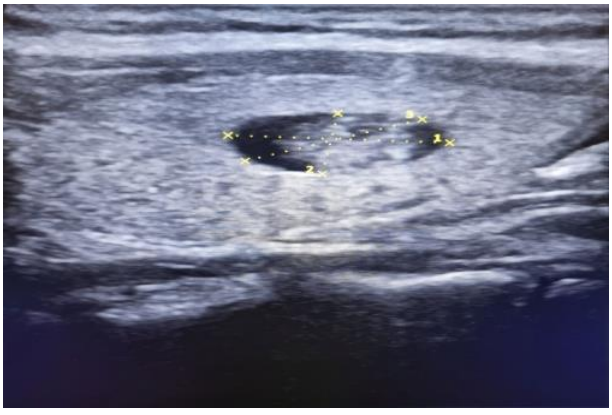

Figure 2. Patient A.M., 1980 DS: Right thyroid gland cyst

On the echogram of the right lobe of the thyroid gland, an oval-shaped cystic anechogenic formation with smooth and clear contours and a heterogeneous contents in the form of a hyperechogenic structure inside, measuring 21x11 mm, is observed, which resembles a colloidal cyst.

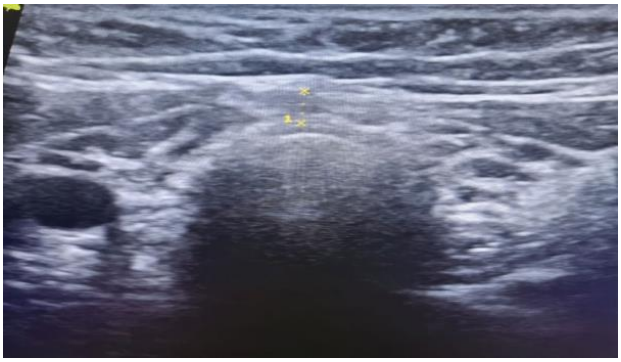

Figure 3. Patient M.B., 1996 DS: 2-3-degree thyroid hypoplasia

On the echogram of the thyroid gland, a sharp decrease in the volume of both lobes and diffuse heterogeneity of the echostructure in the form of hyper- and hypo- echogenic areas are noted.

The image shows the measurement of the neck thickness.

Figure 4. Patient F.D., 1992. D-d: Diffuse thyroid gland 2st degree. The image shows the measurement of the neck thickness

The echogram of the thyroid gland shows a diffuse increase in thyroid volume on both sides and thickening of the neck. The echostructure of the thyroid gland is diffusely heterogeneous, medium to large-grained, the contours are smooth, clear, and of normal shape.

The image shows the measurement of the neck thickness with its thickening up to 8 mm.

On the echogram of the right lobe of the thyroid gland, a round hypoechogenic formation of a heterogeneous nature with areas of hyperechogenic inclusions in the form of calcifications, with uneven clear contours measuring 31x28 mm, is noted

Thyroid ultrasound is a modern and effective diagnostic method, distinguished by its high safety and accuracy. It allows for the detection of even small neoplasms, such as cysts and tumors, as well as any structural changes that occur in thyroid diseases.

During the procedure, specialists determine the shape, boundaries, and size of the thyroid gland, calculate its volume, assess the structure and homogeneity of the tissues, and visualize small pathological formations measuring only 1-2 millimeters. If the lesions reach 3 millimeters or more, then with high probability, it is possible to determine whether they are benign or malignant. Also, during the study, the condition of the nearby lymph nodes is assessed.

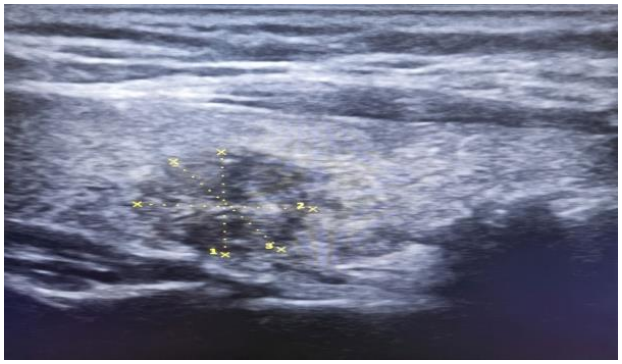

Figure 5. Patient L.R., 1985 y. D-d: right lobe node of the thyroid gland

4. Conclusions

Ultrasonography is an irreplaceable additional tool for hypothyroidism, which can be observed in almost all age groups, from the intrauterine period to geriatric age groups.

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