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APPLICATION OF MODERN ULTRASOUND TECHNOLOGIES AT DIAGNOSIS FOCAL FORMATIONS OF GLAND DISEASES

Abstract: *The article presents the results of the diagnosis and treatment of 134 patients with focal thyroid diseases. Based on the modern ultrasound examination of patients, the main specific diagnostic criteria are determined, the use of which allows identifying focal thyroid diseases in the early stages.*

Key words: *thyroid tumors, modern ultrasound diagnostics, elastography.*

Language: *English*

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Introduction

Thyroid pathology occurs in 8-18% of the adult population of the globe, that is, approximately 1.5 billion people [2]. In endocrine pathology, thyroid diseases take the second place in their prevalence. Malignant tumors of the thyroid gland (thyroid gland) account for 1-3% in the structure of oncological pathology [16]. Significant prevalence of thyroid cancer (thyroid cancer), an increase in the incidence due to an increase in risk factors, a high probability of malignant transformation of benign tumors, a tendency to the appearance of latent and latent forms of cancer. Complexity of diagnosis in the early stages when the clinical symptoms of the tumor are weak and non-specific, give particular the severity and significance of the problem. With the advent of expert class of ultrasound equipment, the opportunities for early diagnosis of thyroid cancer have expanded. Ultrasound studies are a promising method for detecting thyroid cancer in the early stages, without clinical manifestations. Despite the work in which attempts were made to systematize echographic semiotics [1, 2, 10, 12], data on the use of the latest ultrasound technologies [2, 9, 10, 13], a complex of beam imaging methods [2, 7], to differentiate ultrasonic morphological features forms of thyroid cancer [2,10,14,15,22], to date, the issue is considered open, and the problem is relevant. The descriptive components of the research protocols, approaches to a comprehensive analysis of the data obtained, the stages of forming conclusions in thyroid cancer are also different [2, 17]. Currently, research in B-mode, color and energy Doppler mapping is of the utmost importance in the ultrasound diagnosis of thyroid diseases. Differential diagnosis of thyroid disease based on an assessment of the size of the gland, its echogenicity, echostructure and information about regional lymph nodes. Nodular formations in the gland are differentiated by localization, size, shape, boundaries, contours, echogenicity, internal echostructure, capsule state and vascularization of the gland [6,10,22]. According to numerous domestic and foreign publications, the sensitivity and specificity of the gray scale technique in the differential diagnosis of malignant and benign processes ranges from 55–70% [18,13,21]. Modern ultrasound diagnostics, consisting of ultrasound imaging and Doppler ultrasound, supplemented by a third technology - elastography. Shear wave elastography is a method that allows a quantitative assessment of tissue elasticity, which eliminates the possibility of subjective interpretation of data [2,12,17]. Physically, a shear wave is an elastic transverse wave (ultrasonic wave - longitudinal), the displacement of the particles of the medium is perpendicular to the direction of the wave. The principle of operation of this technique

based on the generation of a shear wave in tissues caused by an ultrasonic pulse and the subsequent assessment of its progression speed. In this case, the ultrasonic sensor itself also carries out the visualization of the passage of the shear wave. Numerical values of the elasticity index given in m / s or kPa, depending on the type of shear wave elastography, therefore the method called "quantitative ultrasound elastography or elastometry". It is reported in the literature that two methods are used for shear wave elastography: point and two-dimensional shear wave elastography [11,12,17,20,]. Point shear wave elastography as a way to obtain shear waves provides quantitative information about tissue elasticity, but only at a given depth in the focus area. To obtain shear waves at a different depth, it is necessary to shift the focus zone closer or further from the sensor and create the necessary pressure in the new powerful ultrasonic pulse to receive shear waves and measure their characteristics. The stiffness of the fabric depicted in color: blue for softer, and red for stiffer. Following the study of color elastograms, elastometry performed using one or more test volumes that are freely movable and resizable. Digital data can presented either as indicators of shear wave velocity (in m / s) or elasticity (kPa). Thus, this technology allows to quantitatively reflecting the elasticity of the thyroid gland. A significant difference between this technology and the previous one (shear wave spot elastography) is that color mapping greatly facilitates elastometry, giving the doctor the opportunity to choose only high-quality, artifact-free elastograms [3,12,13,16,17]. Most works on the use of elastography are devoted to studies of the pathology of the mammary glands, prostate gland, and liver [5,7,12,17,21,22,23].

Methods of research

Ultrasound examinations performed for 134 patients with suspected focal thyroid formation using a standard technique using modern ultrasound technology. The age of patients in the study ranged from 18 to 74 years. Among the examined patients, men and women were 48 (36%) and 86 (64%), respectively. Modern ultrasound examination of the thyroid gland was performed on modern ultrasound devices Logiq S8 XD clear GE Healthcare (USA), Samsung-Medison WS80 AC ELITE (South Korea), \ "MINDRAY DS-70" (China) and HI VISION Preirus (Hitachi Medical Corporation, Japan using linear multi-frequency sensors (frequency range-5-13.0 MHz). Modern sonography was performed using the following modes: gray scale, tissue harmonic, pulse wave Doppler, color and energy Doppler mapping, and elastography (compression and shift wave), with the help of which the stiffness of focal thyroid gland formations was evaluated.

Results.

The malignant nature of focal thyroid changes indicated by following characteristics:

- irregular shape (Fig. 1) (75.9%);
- uneven borders (84.3%);
- fuzzy contours (Fig. 2) (73.4%);
- hypoechoicity (74.7%);
- heterogeneity of the echostructure (Fig. 2.3) (88.9%);
- presence of hyperechoic inclusions (Fig. 2) (34.4%), rare in benign thyroid formations (in 18.9%), the inclusions were distributed in the form of microcalcifications (up to 2-3 mm in size, without an acoustic shadow and with an acoustic shadow) ;
- hypervascularity of focal changes (87.3%), uneven distribution of vessels in the structure of the node (87.9%), randomness, asymmetry, disorganization of the vascular pattern, pathological transformation of vessels (86.5%) (Fig. 3-4-5) .
- increase in tissue density during compression elastography - tissues are dyed blue (Fig. 6).

The gray scale mode was the main technique for visualization of nodular malignant thyroid formations. The tissue harmonic method in 29.6% of cases (often with large (more than 2 cm) sizes of education) made it possible to improve the visualization of the node, to assess the presence and localization of calcifications, but its value in the differential diagnosis of thyroid cancer is small.

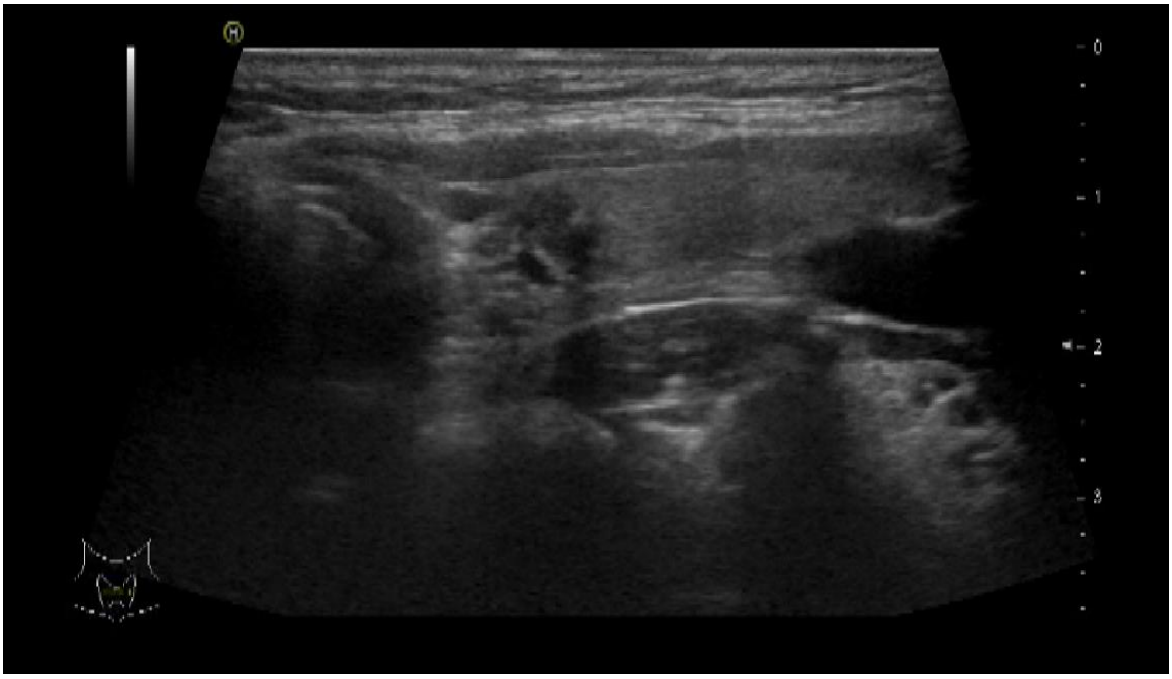

Fig. 1. Thyroid cancer. Irregular shape, irregular knot borders. Two-dimensional study in seroscale mode

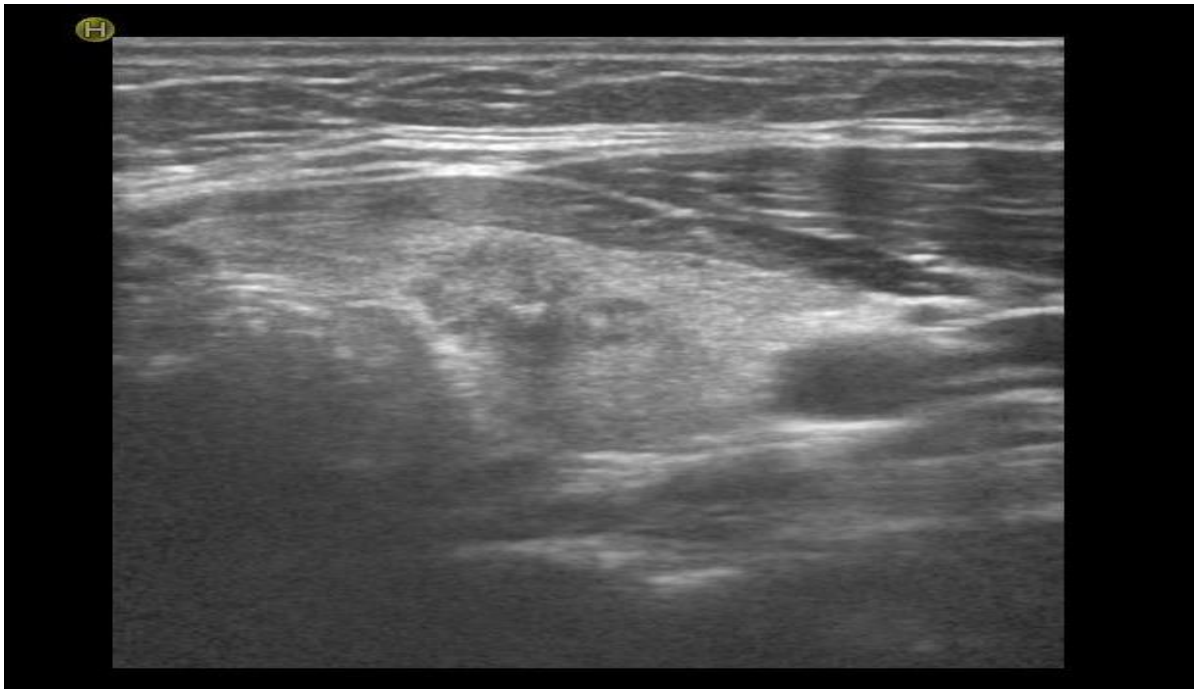

Fig. 2. Thyroid cancer. Fuzzy contours of education.
Two-dimensional study in seroscale mode

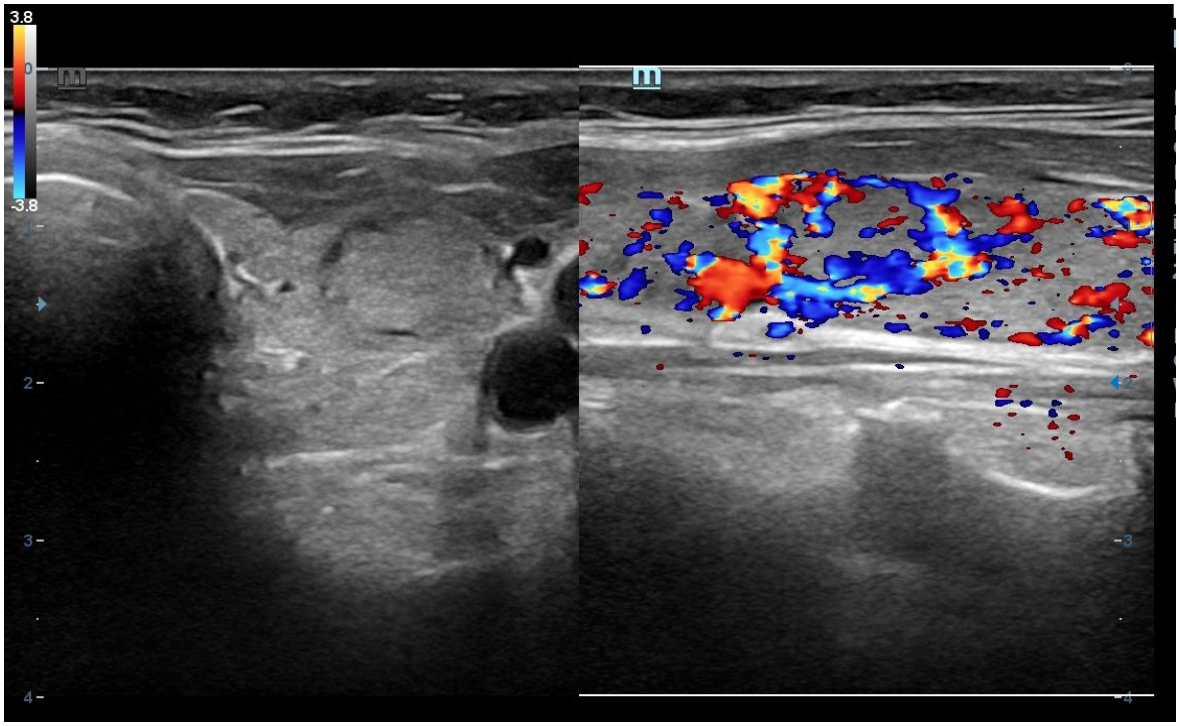

Fig. 3. Nodular thyroid gland formation with enhanced peri and intranodular vascularization in color Doppler mapping

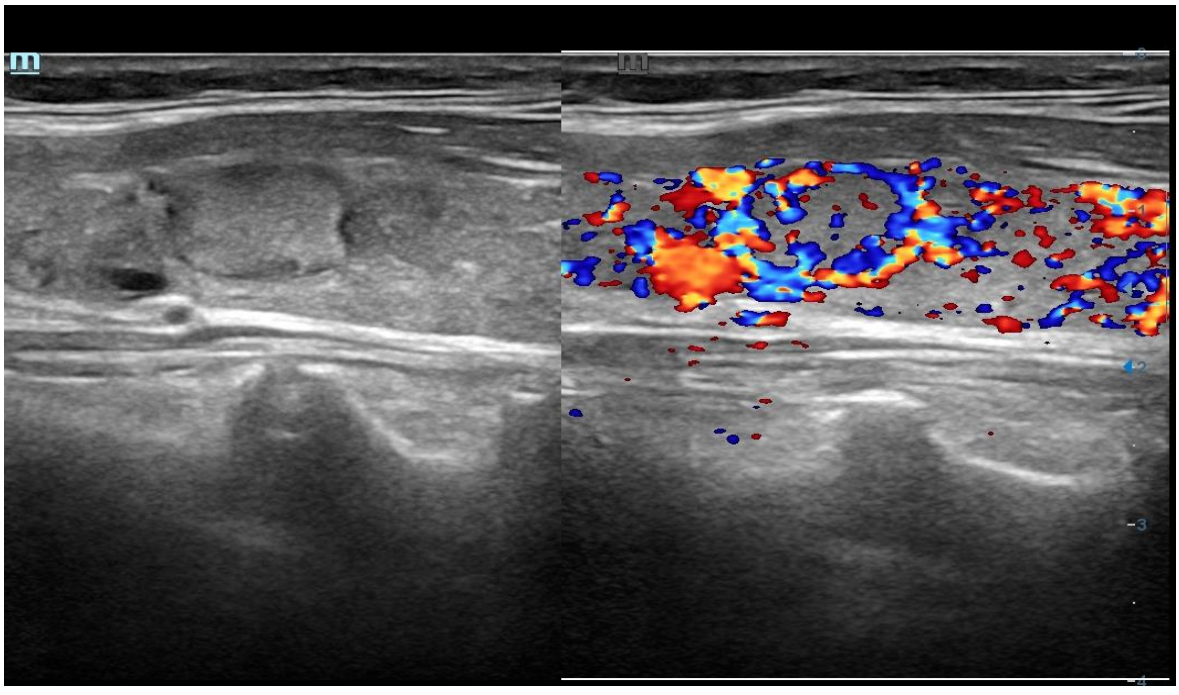

Fig. 4. Multiple thyroid glands with enhanced peri and intranodular vascularization in color Doppler mapping mode

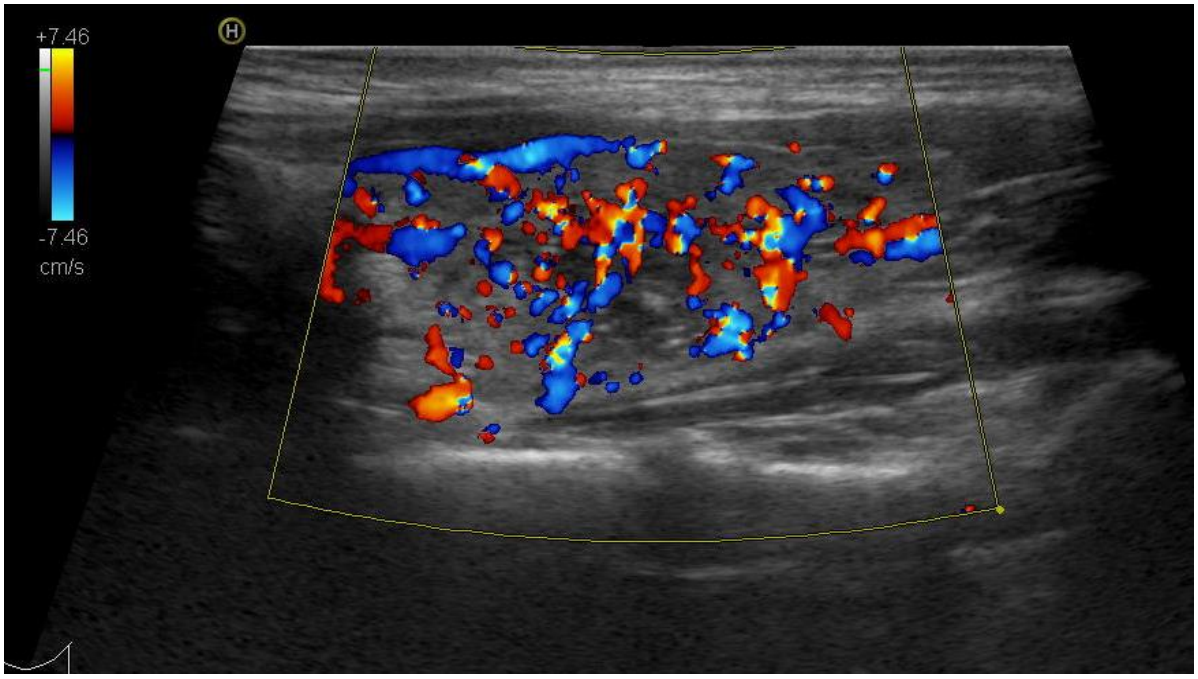

Fig. 5. Thyroid cancer with enhanced intranodular vascularization in color Doppler mapping

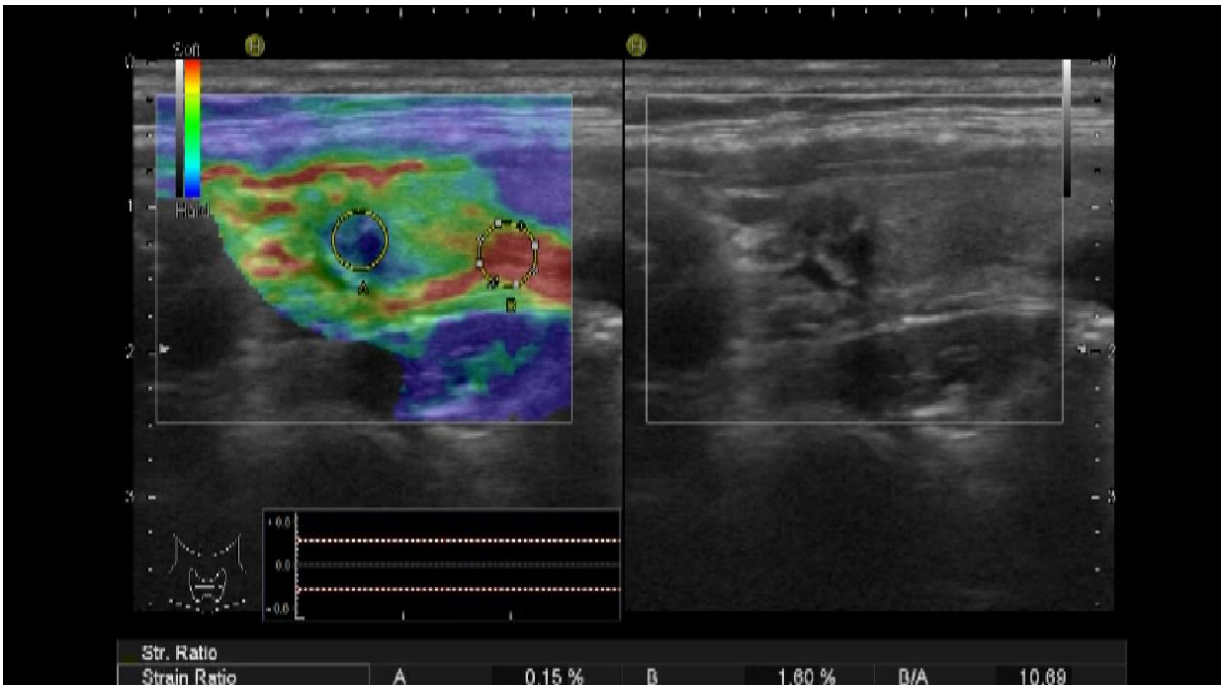

Fig. 6. Thyroid cancer. With compression elastography

Conclusion

Consequently, modern ultrasound examination is an affordable, highly informative method for early and precise diagnosis of focal thyroid formation and damage to the lymph nodes of the neck in the presence of regional metastasis. The sensitivity of modern ultrasound imaging using a complex of techniques and technologies in the diagnosis of focal thyroid formation was 91.9%, specificity 78.6%, diagnostic accuracy 92.7%. The sensitivity of modern ultrasound in determining metastasis to the lymph nodes of the neck is 84.2%, specificity is 86.7%, and diagnostic accuracy is 83.9%.

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