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THE ROLE OF STRAIN ELASTOGRAPHY IN REFINING THE DIAGNOSIS OF FOCAL LESIONS IN THE BREAST

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Introduction. Currently, the diversity of clinical presentations and the complexity of the differential diagnosis of focal lesions in the breast necessitate the use of modern and highly informative diagnostic methods. Consequently, the identification of breast pathology, both malignant and benign, is extremely relevant. Although numerous diagnostic methods exist to assess the condition of the breast, they do not always provide accurate conclusions, influencing the choice of treatment strategies. Alongside the widespread use of mammography, ultrasound examination is gaining increasing popularity [1]. Modern ultrasound machines, equipped with high-frequency probes, enable the precise diagnosis of various pathological processes in the mammary glands [2]. The ongoing search for technical methods to enhance diagnostic accuracy in breast diseases continues.

Recently, a new direction in ultrasound visualization, known as elastography, has been actively developed [3]. Various pathological conditions induce significant changes in tissue structure, modifying its properties and leading to local increases in stiffness and reduced deformability under compression.

The non-invasive method of sonoelastography allows for the determination of stiffness in the area of interest. This technique can significantly improve the capabilities of differential diagnosis between benign and malignant breast tumors, thereby avoiding unjustified biopsies [4].

Sonoelastography can also be applied to differentiate between solid and cystic formations. Additionally, it may serve as an auxiliary method in evaluating atypical cysts, especially in the presence of wall components, and allows for the differentiation of intraductal papillomas from intraductal carcinoma [5].

The aim. To evaluate the capabilities of compression elastography as a complementary method in refining ultrasound diagnosis of focal lesions in the breast.

Materials and Methods. A prospective comprehensive ultrasound examination of the breast was conducted on 64 women aged 26 to 67 years (mean age 46.5ё1.2 years) who complained of painful sensations, feelings of fullness, and palpable formations in the breast.

In both mammary glands of the 64 patients, ultrasound revealed 107 focal lesions of various morphological origins. Of these, 72 (67.3%) were palpable formations, and 35 (32.7%) were non-palpable. Women of reproductive age constituted 41 (64.1%), while 23 (35.9%) were in menopause.

The diagnostic ultrasound complex included B-mode sonography and compression elastography. The studies were conducted using the Logiq S8 HD Clear expert-class ultrasound scanner (GE Healthcare, Milwaukee, WI, USA) with a linear 9L-D probe and a frequency range of 8-10 MHz.

All B-mode ultrasound results were recorded according to the BI-RADS system. The compression elastography method allows real-time assessment of tissue stiffness based on tissue displacement in response to compression. Both qualitative and quantitative characteristics were evaluated in compression elastography. Qualitative stiffness was

assessed based on the color pattern of the formation, according to the classification by A. Itoh and E. Ueno, distinguishing five elastotypes:

1.Type 1 - solid formation colored identically to surrounding tissues with occasional color signal variations.

2.Type 2 - characterized by mosaic coloring of the formation with alternating blue and green shades.

3.Type 3 - blue color mainly observed in the central part of the formation, with a green pattern in the peripheral part.

4.Type 4 - solid formation completely mapped with a uniform blue color.

5.Type 5 - observation of formation coloring with blue, transitioning to the color of the surrounding tissue.

The diagnostic value of the isolated B-mode was: accuracy 87.7%, sensitivity 82.9%, specificity 94.1%. There were 7 false-negative and 3 false-positive results.

Elastographically, 55 (80.9%) tumor formations out of the identified 68 had a color pattern associated with malignant origin (1st group). In 53 (77.9%) of these cases, two or more suspicious ultrasound signs were present in the B-mode. The strain ratio (SR) in this group was represented by values of 8.91±4.36 (with $p<0.0001$) (Fig. 1).

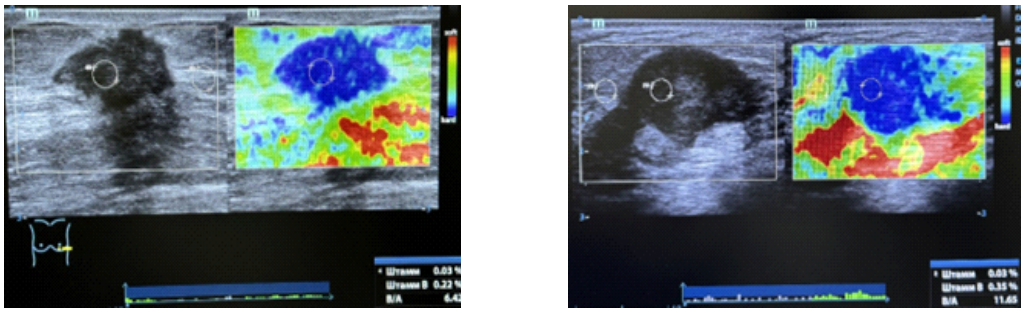

Fig. 1. Breast cancer. Elastograms according to Ueno 4-5 types

39 tumor formations (Group 2) had a color pattern corresponding to a benign origin (Fig. 2). However, in 4 cases, the elastogram of the 4th type was combined with two or more sonographic features. The SR indicator for this group was 2.76±1.34 at a significantly significant level of $p<0.0001$.

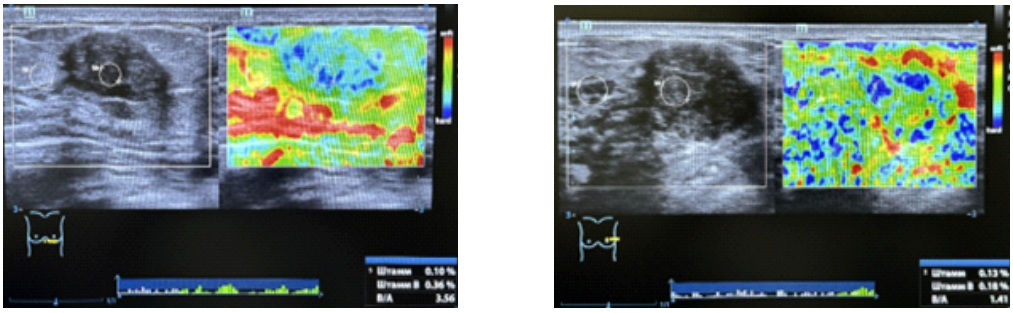

Fig. 2. Fibroadenoma of the breast. Elastograms according to Ueno, types 1-2

As seen in Table 1, during compression elastography in Group 1, 3 (4.4%) formations had a type 2 elastogram, 10 (14.7%) had a type 3 elastogram, 35 (51.2%) had a type 4 elastogram, and 20 (29.4%) had a type 5 elastogram. In compression elastography for Group 2, 8 (20.5%) formations were mapped with a type 1 elastogram, 13 (33.3%)

with a type 2 elastogram, the type 3 was identified in 11 (28.2%) cases, and 7 (18.0%) had a type 4 elastogram.

Table 1. Distribution of elastotypes in focal breast formations

Elastotype	Malignant, n=68		Benign, n=39		p
	absolute	%	absolute	%	
0	-	-	-	-	
1	-	-	8	20,5±6,2	
2	3	4,4±5,8	13	33,3±6,9	<0,01
3	10	14,7±4,9	11	28,2±6,5	>0,05
4	35	51,2±6,2	7	18,0±5,9	<0,01
5	20	29,4±5,1	-	-	
SR	8,91±4,36		2,76±1,34		<0,001

When detecting benign tumor formations, elastotypes 1, 2, and 3 were predominantly observed ($p<0.001$). In contrast, a statistically significant presence of elastotype 5 (62.7%) was identified in the majority of malignant formations, which was not observed in benign focal formations. The occurrence of elastotype 4 was 2.8 times less frequent, bearing significant relevance ($p<0.01$).

Among women with malignant neoplasms, elastotypes 4 and 5 were predominantly found (51.2±6.2 and 29.4±5.1, respectively). Elastotypes 3 and 2 were significantly less frequent, occurring 1.9 and 7.6 times less often compared to the group of women with benign neoplasms ($p<0.05$-0.01).

There is also a threefold increase in SR in malignant formations compared to benign ones ($p<0.001$). It is worth noting that SR exceeds reference values (4.0) by 2.2 times in malignant neoplasms (8.9±4.4) and falls short by 1.4 times in benign formations (2.8±1.3).

The performance indicators of compression elastography in the diagnostic visualization of focal breast formations were as follows: accuracy 83.2%, sensitivity 80.3%, specificity 81.7%, with 8 false negatives and 5 false positives.

Analyzing the results of this study, the application of compression elastography in conjunction with B-mode for diagnosing focal breast formations was accurate in 91.6% of cases. Sensitivity and specificity rates were 88.9% and 93.4%, respectively. In 3 patients, the results were false negatives, and in 4 cases, they were false positives.

Considering that in certain clinical situations, such as the presence of a zone of central necrosis or areas of hemorrhage in a tumor, the presence of large calcifications in benign formations, mucinous, medullary, and papillary carcinomas often having a sonographic appearance similar to benign formations, the capabilities of compression elastography are limited. This limitation leads to false positive and false negative results and, consequently, lower specificity rates.

Conclusion. Thus, the application of compression elastography in comprehensive ultrasound diagnostics of focal lesions in the breast allows for a highly reliable differential visualization of tumors. The obtained data confirm the high informativeness and diagnostic value of a comprehensive ultrasound approach in the diagnosis of breast tumors.

References

1.Гажонова В.Е., Виноградова Н., и Зубарев А.В. Скрининг рака молочной железы: состояние проблемы и пути решения, КМКВ, вып. 3, сс. 6-11, апр. 2018.

2.Бусько Е.А., Семиглазов В.В., Мищенко А.В., Козубова К.В, Шишова А.С., Арабачян М.И., Костромина Е.В., Криворотько П.В. Эффективность мультипараметрического ультразвукового исследования с применением компрессионной эластографии в ранней диагностике образований молочной железы // Лучевая диагностика и терапия. 2019. Т. 10, № 4. С. 6-13

3.Zahran M.H., El-Shafei M.M., Emara D.M., Eshiba S.M. Ultrasound elastography: How can it help in differentiating breast lesions? // Egyptian Journal of Radiology and Nuclear Medicine. 2018. Vol. 49, No. 1. P. 249-258

4.Faruk T., Islam M.K., Arefi n S., Haq M.Z. The journey of elastography: background, current status, and future possibilities in breast cancer diagnosis // Clin. Breast Cancer. 2015 Oct. Vol. 15, N 5. P. 313-324

5.Itoh A., Ueno E., Tohno E. et al. Breast Disease: clinical application of US elast