Approaches to improvement of the diagnostic values of Sonoelastography in the detection of high-grade thyroid cancer.

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Aims and objectives

Since 2005, the literature is actively discussed the diagnostic value species ultrasound (US) of the thyroid gland, in particular compression elastography or real-time elastography (SEG) in the survey nodules, for thyroid cancer (TC). It should be noted that almost all of the studies were limited to the clinical evaluation of the role of SEG, without affecting the endocrine component of the process [3, 4, 6, 13, 17, 19].

The principle is the ability of SEG tissue compression or compression. It has long been known that the tumor tissue is denser and hence, the tension therein is lower than in the surrounding tissue. All this has given researchers optimism, and some authors have even offered to give up widespread in the diagnosis of thyroid cancer fine needle aspiration biopsy (FNA), especially when soft, ie no thyroid suspicious nodes. At the same time, other authors have not been able to make such an unequivocal conclusion regarding the non-use of FNA, until the negation of using SEG in an independent survey method such patients [2, 18, 26, 27, 30]. previous work, we discussed this issue, but the material was significantly less. Therefore, the results in this study will be evaluated SEG not only clinically but also in comparison with hormonal and metabolic status of the patients tested, in order to improve the diagnostic value of this study in the differential diagnosis of thyroid nodules.
Methods and materials

This prospective study included 81 patients (66 women and 15 men), whose age ranged from 18 to 82 years, mean 48.0 ± 16.4 years. FNA followed cytological evaluation was performed in all patients, sometimes repeatedly, on average for 3-4 weeks prior to surgery. Part cytological studies, especially from other agencies represented, was revised cytologists our Institute. All patients included in the study were subjected to surgery. As a result, histological evaluation of the material identified 20 patients with benign tumors (19 follicular adenomas, 1 Hashimoto’s thyroiditis), and 61 cases of thyroid cancer (13 - follicular carcinomas, 48 - papillary carcinomas). Diabetes mellitus was diagnosed in 6 patients (5 of them had thyroid cancer), mainly patients comply with diet alone. In all patients, we studied the metabolic status of hormone in the range of from 0.5 to 2 months prior to surgery. This included assessment of body weight, height, body mass index (BMI), and hormonal profile and level of glucose in fasting blood. The level of thyroid stimulating hormone (TSH) and free thyroxine (T4 St.) is recruiting firm DRG, Instruments GmbH (Germany) and thyroglobulin (TGB) and anti-TGB recruitment firm Orgentec, Diagnostik GmbH (Germany) and was carried out by ELISA. Blood glucose level was determined by the method set enzimokolorimetricsheskim company "Impact" (Moscow).

Thyroid ultrasound and Sonoelastography (SEG) held ultrasound scanners Hitachi HI Vision 900 and Aloka Prosound A7, for which the possibility of SEG is one of the built-in functions. Ultrasound to assess the size of nodes, thyroid volume, the color of the node that ranged from "red-green" to "mostly blue", as well as the class colors (elastotip) on a scale from 1 to 5 points with increasing sea state as the shift from red to blue color. In addition, indicators are calculated Strain Ratio (SR), characterizes the ratio of node density to the density of the muscle tissue situated near the[4, 14]. Statistical analysis was performed in the program Statistica 7 (StatSoft), and the calculation of sensitivity, accuracy and specificity was carried out on the basis of the standard approach [9]. The critical level of significance when testing statistical hypotheses in this study was taken to be 0.05.
Results

Presentation of the results begin with an assessment of the traditional method of diagnosis of thyroid nodules - TAB [5]. It should be noted that the agreement between the results of cytological and morphological study on "CANCER / no cancer" was held in 67 of 81 (82.7%) cases, which characterizes the index diagnosis of infallibility, that is, the ratio was significantly positive and dostovernootritsateslnyh supervision and in accordance with the previously in our data Institute [7]. The sensitivity of this method was very high 96.7%, while the specificity is not high, at 40.0%. As might be expected, most of the problems encountered with follicular creations of nature, and in our study, they were represented 21.3% of carcinomas and almost all benign nodes. All of this speaks not only about the reliability of this method to detect the true malignant tumors, but also his ability to relate to the class of healthy patients, which makes how to look for additional ways to improve this method and alternative methods of diagnosis.

One such method is the SEG, which, as already mentioned in the Materials and Methods section, characterized by color evaluation units and / or colors elastotipom. The distribution of the color data of thyroid gland in patients studied, depending on postoperative diagnosis, and illustrative material shown in Fig. 1 and 2, 3. As can be seen from Figure 1, in benign tumors predominate red and green colors of the spectrum, while TC - the color was blue and mostly occurred in 65.6% vs. 20.0%, "chi-square" = 12 61 (the number of degrees of freedom, DF = 1, p = 0.0004). These figures are reflected in the differences in color elastotipa these groups (Table. 1). The greatest difficulty for diagnostic display green and blue (elastotip 3). It takes approximately 26 - 30% of cases in each group, including 5 of the 13 cases of follicular carcinomas. From a clinical point of view the most important indicators of sensitivity, specificity, and the infallibility of the answers that orientation on the color elastotip amounted to 90.2%, 60.0% and 82.7%, respectively. As can be seen, the level of specificity SEG was higher than the FNA. However, the diagnostic accuracy of only 77.8% SEG. All this can talk about some of the advantages of using SEG compared with the TAB, which is consistent with its moderate importance in the literature. At the same time, results as compared with the TAB SEG specificity increased to 65%. In general, the chroma score corresponds to [12] in the literature, but somewhat higher than in other studies [10, 19, 23].

As already mentioned, we conducted a pilot study to less material [5], in which the value added tax, which could increase the specificity of SEG, evaluate the combination provided with TSH levels, glucose and BMI. However, this article and the results of the combination indicators SEG TTG (depending on the above average values for the entire group, i.e.> 1.46 mIU / ml, and blood glucose levels (> March 5 mmol / l) does not alter the specificity of this technique. Only BMI (> 26.9 kg / m2) actually resulted in an increase SEG specificity of 70%. These conclusions are confirmed in the literature and speak about the actual increased risk of thyroid cancer in patients suffering from obesity and insulin resistance, however, these studies have not used the technique SEG, which is a
particular interest from the practical and scientific point of view because it is possible cumulative effect of these factors on the development of thyroid cancer [24, 25]. In addition, it should be added that in previous work TSH levels in patients with thyroid cancer, usually at a higher level than in patients with benign nodes, which was confirmed in this study, however, the trend was weaker (Table 1), which is also consistent with the literature. As before, none of the evaluated characteristics of ultrasound, together with hormonal and metabolic parameters was not significantly different in the groups studied. We could not detect differences in the groups and in terms of SR. Although the level of more than 3,0 SR thyroid cancer was found more frequently (65.8% vs. 40.0%), but statistical significance was not reached as the emergence of "chi-square" = 1.83, (the number of degrees of freedom DF = 1, p = 0.18). Our data are fully consistent with the work of Chong Yu et al. V SRs and color indicator assembly and the work which had doubts about the possibility of providing SEG for the diagnosis of thyroid cancer [2, 19, 20, 26, 27, 28].
Fig. 1: #xamples SEG of the thyroid gland (elastotip 2 - color green) - follicular thyroid adenoma.

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**Fig. 2:** Examples SEG thyroid (elastotip 4 - color blue) - the thyroid papillary carcinoma gland.

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**Fig. 3:** The distribution of the color data and elastotype nodes of the thyroid gland in the examined patients, depending on the postoperative diagnosis. Note: * - significant difference criterion #2 between the two groups (#2 = 17,44, p = 0.00001). ** - Significant criterion #2 difference between the two groups (#2 = 12,61, p = 0.0004)

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<table>
<thead>
<tr>
<th></th>
<th>The whole group (n=86)</th>
<th>Benign nodes (n=20)</th>
<th>Thyroid cancer (n=66)</th>
</tr>
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<tbody>
<tr>
<td>Age, years</td>
<td>46.6±2.7 (47.5)</td>
<td>52.3±6.3</td>
<td>45.1±3.0</td>
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<td>Elastomer, srcv.ed</td>
<td>3.26±0.13 (3.0)</td>
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<tr>
<td>StR, srcv.ed</td>
<td>5.91±1.54 (3.0)</td>
<td>4.87±1.20</td>
<td>9.9±6.0</td>
</tr>
</tbody>
</table>

**Table 1:** Quantitative characteristics of the parameters characterizing the patients and the results of their survey.

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Conclusion

According to our data, SEG has greater diagnostic accuracy in the evaluation of TC in comparison with TAB. Method's specificity can be increased by its association with TAB results and anthropometry. Besides, the preoperative diagnostics of TC can be improved with the use of genetic, hormonal, metabolic and instrumental methods of research, including shear wave elastography.
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