

THE CHOICE OF A PERSONALIZED METHOD IN THE DIAGNOSTICS OF BREAST CANCER IN A CYST BY MEANS OF HYBRID TECHNOLOGIES UNDER ULTRASOUND NAVIGATION

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SUMMARY

The article presents the results of the use of a new improved method of cytologic diagnostics of cancer in a breast cyst by applying hybrid technologies. By using our new created method with the application of ozone-oxygen mixture, unlike the traditional method of fine needle aspiration biopsy of breast cysts with a solid parietal component, the probability of obtaining unaltered atypical cells in the punctate in the presence of malignization increases, thereby promoting the informativeness and sensitivity of this diagnostic method.

KEYWORDS: breast cancer, fine needle aspiration biopsy, ozone-oxygen mixture, intracystic cancer, ultrasonic navigation.

CONFLICT of INTEREST. The authors declare no conflict of interest.

Introduction

Breast cancer (BRCA) currently occupies a leading place in the structure of oncological morbidity of the female population, both in Russia and around the world [1, 7]. More than 2 million newly diagnosed cases of this disease are detected annually, which is about 18% of all malignant neoplasms [6, 7]. Lactal cyst cancer (papillary cancer, papillary cystadenocarcinoma) is one of the rarest forms of BRCA, the frequency of which varies from 0.3 to 2.2% [4, 9]. The most common intracystic cancer occurs at the age of 55 to 60 years [5, 7]. It is characterised by a slow rate of tumor growth and a more positive clinical course in comparison with other forms of BRCA. Because of a small number of studies devoted to the diagnosis of intracystic cancer, and despite the rapid progress of computer technology and the constant emergence of new improved diagnostic methods in mammology, timely detection of the pathology continues to be a relevant issue of clinical oncology [1, 2, 3, 8].

Morphological verification is necessary to diagnose intracystic breast cancer. The main method of obtaining material from the cystic cavity is a fine-needle aspiration biopsy (FNAB). The liquid aspirated from the cystic cavity during FNAB is used for cytological examination of a cyst with papillary growths [4, 5]. In the works of N. V. Zabolotskaya, it is indicated that the aspirate is more informative if it is obtained directly from a solid parietal component, since tumor cells in the liquid contents of the cyst may not be enough to diagnose [5, 10]. However, in case of small sizes of intracystic parietal growths, it can be difficult to obtain

material from them even aiming under ultrasound control [5, 8, 11]. Due to the above-stated, we have developed a new improved method of cytological diagnosis of cancer in the breast cyst that allows increasing the informativeness of the FNAB procedure.

The purpose of the study

Creation a new improved method of cytological diagnosis of cancer in a breast cyst.

Materials and methods

We examined 67 women with suspected intracystic breast cancer. All patients underwent a comprehensive examination according to the standard diagnostic algorithm, which included examination and palpation of the mammary glands and areas of regional lymph drainage, ultrasound examination (US) of the mammary glands and axillary areas in B-mode ultrasound, doppler ultrasonography, compression elastography, shear wave elastography, X-ray mammography, FNAB according to traditional and advanced methods under ultrasound control and trepanobiopsy of the a solid parietal component (with a diameter of more than 15 mm). The average age of the patients was 50,19±10,465 years.

A syringe of 20 ml volume and a needle of 22 G diameter were used during FNAB according to the traditional method. Under ultrasound control, after skin preparation with an antiseptic solution has been made, a puncture needle was inserted into the cyst cavity, after which its contents were completely aspirated. The material was sent for cytological examination. In the case of the presence

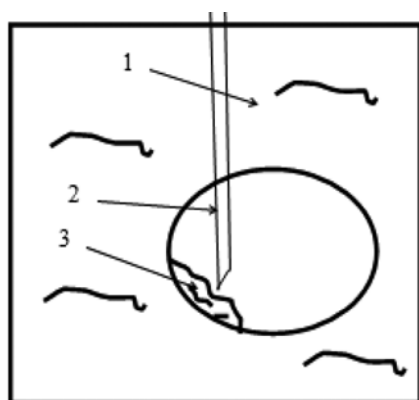


Fig.1. The needle insertion into the cyst cavity with a parietal component, where 1 – mammary gland tissue, 2 – a puncture needle in the cyst cavity, 3 – a parietal solid component.

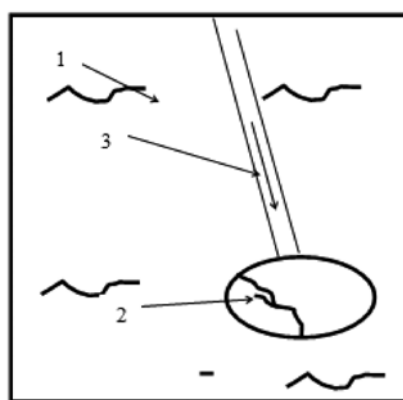


Fig.2. The insertion of an ozone-oxygen mixture into the cyst cavity, where 1 – mammary gland tissue, 2 – a parietal intracystic component, 3 – the insertion of an ozone-oxygen mixture through a puncture needle.

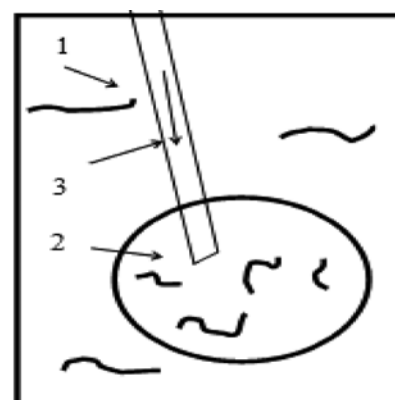


Fig.3. The insertion of an excessive amount of saline solution into the cyst cavity, where 1 – mammary gland tissue, 2 – the contents of the cyst with a fragmented parietal component, 3 – the insertion of saline solution into the cystic cavity.

of parietal growths, the needle was inserted directly into the solid component with subsequent aspiration. Before removing the needle, the plunger of the syringe was released, then it was removed, and the puncture site was pressed with a rolled gauze for 3–5 minutes. Then the contents of the syringe were poured into a test tube and centrifuged, after that a cytological examination was performed.

The traditional technique of FNAB of cysts with a solid parietal component has a number of disadvantages: atypical cells are not always present in the liquid content, puncture of parietal growths is often ineffective, since getting into the area of interest is difficult with its diameter less than 5 mm. As part of the study, false negative results were obtained during cytological examination of a number of patients with intracystic breast cancer (Fig.1). The presence of these disadvantages prompted the creation of a new improved FNAB method (Patent RU № 2712055).

The essence of the new diagnostic method is that before aspiration of the contents, ozone is injected into the cystic cavity, which is a strong oxidizer and quickly necrotizes the outer layer of the parietal formation, thereby increasing its fragility and degree of fragmentation, which increases the possibility of detecting atypical cells in the aspirated liquid. The proposed method is carried out in several stages. At the first stage, an ultrasound examination is performed to detect cysts with parietal growths in the mammary

gland tissue. Then, under ultrasound control, a puncture is performed with aspiration of at least 50 % of the contents of the cystic cavity, followed by the introduction of an ozone-oxygen mixture at a concentration of 5 micrograms / ml, which gives partial necrosis of the outer layer of the parietal component. The contents of the cyst are removed after 1 minute (Fig. 1, 2).

At the second stage, an excessive amount of saline solution in the volume of 150 % of the initial contents of the cystic cavity is injected into the cyst cavity, which leads to the formation of a turbulent fluid flow tearing off the necrotic surface of the parietal component, which increases the probability of detecting unchanged atypical cells in the aspirate (Fig. 3).

At the third stage, the entire volume of cyst contents is aspirated and then centrifuged, followed by cytological examination (Fig. 4).

To obtain an ozone-oxygen mixture of the desired concentration, the medical ozone therapy machine YOTA-60-01-Medozon was used, which has been recommended for use in medical practice in the Russian Federation since 1996 (registration certificate 29/06050796/1561-01) and is included in the Russian Register of Medical Equipment. YOTA-61-01 is the only medical device recommended by Ministry of Health of the Russian Federation as a material and technical support for ozone therapy (registration certificates of medical technologies FC – 2005/058, FC – 2007/014).

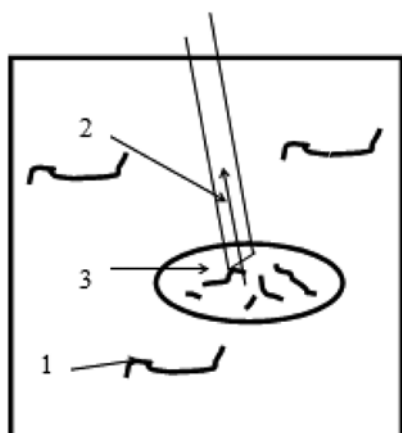


Fig.4. Evacuation of the contents of the cystic cavity with saline solution, where 1 – mammary gland tissue, 2 – the evacuated contents of the cyst, 3 – a reduced cystic cavity with atypical cells detached from the parietal component.

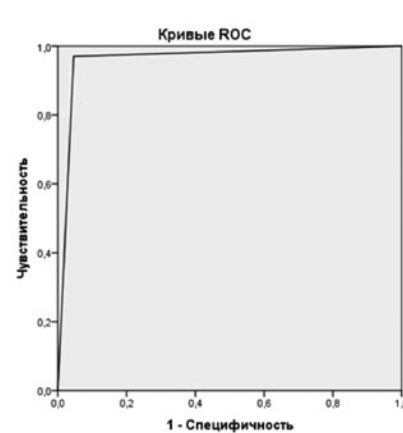


Fig.5. The ROC-analysis in order to study the diagnostic and prognostic value of a new method of diagnosing cancer in a breast cyst.

Results and discussion

The patients were divided into two groups depending on the method of performing FNAB.

FNAB was performed on 33 patients with intracystic breast cancer according to the traditional method under ultrasound control. FNAB was performed on 34 patients according to a new improved technique using the preliminary introduction of an ozone oxygen mixture.

Atypical cells were not detected during cytological examination in 18.2% (n=6) of patients with intracystic breast cancer who underwent FNAB according to the standard technique, so the study turned out to be false negative, atypical cells were detected in the remaining 81.8% (n=27) of patients.

During cytological examination of the contents of the cystic cavity, atypical cells were found in 97.06% (n=33) of patients with intracystic breast cancer who underwent FNAB using a new technique.

Thus, the sensitivity of FNAB according to the traditional method of the diagnosis of intracystic breast cancer was 81.8%, and the sensitivity of the new improved method was 97.06%, which indicates the reasonability of using the latter in order to improve the diagnosis of intracystic cancer at the pre-operative stage.

In order to study the diagnostic and prognostic value of a new method of diagnosing cancer in a breast cyst, we carried out the ROC-analysis. A statistically significant correlation was revealed between the detection of atypical cells in the contents of the cystic cavity and the diagnosis of «cancer in the cyst».

The area under the curve was 0.984 (95% CI – 0.961–0.995), which corresponds to the excellent quality of the classifying ability (Fig. 5).

Conclusions

1. The presence of a number of disadvantages of the existing traditional FNAB method limits its use in the diagnosis of intracystic breast cancer, because there is a high probability of obtaining false negative results.

2. A new improved method of diagnosing cancer in a breast cyst using an ozone oxygen mixture has turned out to be more effective than the existing one, which proves the reasonability of using FNAB with an ozone oxygen mixture in order to improve the diagnosis of intracystic cancer at the pre-operative stage (AUROC – 0,984, CI 0,961–0,995).

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