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# Minimally Invasive Methods of Treatment of Fibroadenomas of the Mammary Glands

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**Abstract** The article provides information on minimally invasive methods of treating fibroadenoma of the mammary glands in women of reproductive age. An analysis of the results of scientific research on this issue is provided. In this article, we focused on the proliferative form of dyshormonal diseases of the mammary glands – fibroadenomas of the mammary glands.

**Keywords** Fibroadenoma of the mammary gland, Minimally invasive ablative treatment methods, Cryoablation, Laser ablation, HIFU

## 1. Introduction

The incidence of benign breast tumors in the population reaches 30–70%. It is generally recognized that breast cancer occurs 3–5 times more often against the background of benign diseases of the mammary glands and 30–40 times more often with nodular forms of mastopathy with proliferation of the epithelium of the mammary glands [1,5]. Benign diseases of the mammary glands include all types of diffuse and local (focal) mastopathy [3].

Fibroadenomas of the breast (FAD) are benign lesions that occur in approximately 10% of all women. Fibroadenomas of the breast are solitary, smooth, mobile, benign lesions of the breast that can occur at any age, but most often in the second and third decades of life. Regression or complete resolution is observed in up to 59% of cases within 5 years [4]. In the etiopathogenesis of dyshormonal diseases of the mammary glands (DDMG), a significant role is given to gynecological diseases [2].

Fibroadenomas are typically diagnosed using a standard triple evaluation that includes physical examination, imaging with ultrasound and/or mammogram, and cytologic or histologic confirmation of the diagnosis [4,6].

Treatment of FAD is conservative if the patient is asymptomatic. In symptomatic patients, tumors can be removed surgically or interventionally using vacuum-assisted mammotomy (VAM) [7]. Ablative techniques such as high-intensity focused ultrasound (HIFU), cryoablation, and laser ablation have also been used to treat FAD, providing minimally invasive treatment without scarring or poor cosmetic results [6].

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Minimally invasive ablative techniques offer the opportunity to treat without scarring and to visualize progress during treatment. Current data on noninvasive or minimally invasive ablative techniques for the treatment of breast fibroadenoma are reviewed. Minimally invasive methods include hyperthermic techniques (radiofrequency, microwave, laser ablation) and the hypothermic method (cryoablation) [5].

Currently, there is only one method of non-invasive extracorporeal thermal ablation of tumors of various localizations - high-intensity focused ultrasound therapy, the effectiveness and safety of which as a method of local destruction of benign and malignant neoplasms of the mammary gland have been demonstrated by many authors. Like all thermal ablation methods, this method has its limitations, complications and disadvantages. This article presents a literature review highlighting the possibilities of performing this method of local destruction in patients with FAD of the mammary gland [8].

Technical capabilities of high-intensity focused ultrasound therapy of breast tumors HIFU therapy is a non-invasive method of thermal ablation of solid tumors, which is based on the transition of energy of focused mechanical waves with a frequency above 20 kHz into thermal energy with the development of coagulation necrosis of tissue at the focal point. In parallel with the phenomena of thermal destruction in this area, processes of acoustic cavitation, direct damage to small vessels, and activation of immune system cells occur [6].

Currently, HIFU therapy for patients with malignant and benign tumors of the mammary gland is performed using ultrasound (US) and magnetic resonance (MR)-guided devices. The former include the JC Focused Ultrasound Therapeutic System (Chongqing HAIFU Technology Company, China) and Echopulse (Theraclion, Malakoff, France) [9].

The effectiveness of HIFU therapy for benign breast tumors was also demonstrated in a multicenter prospective study by R.Kovatcheva et al., which included 42 patients with 51 fibroadenomas in one or both mammary glands with a maximum size of more than 10 mm and localization at a distance of more than 5 mm from the skin in a fixed organ. Eleven patients had previously undergone surgical treatment for this pathology [8].

Cryoablation uses freezing instead of heating to treat breast lesions. Modern cryoablation has been used for over 20 years. It is achieved by inserting a cryoprobe into the target tissue under ultrasound guidance. Liquid nitrogen or Argos gas is then injected into the cryoprobe, allowing it to flow to the target tissue. The freezing process involves two phases: freezing and thawing. Four mechanisms destroy tumor cells: direct injury by the formation of intracellular ice crystals, leading to disruption of cell membranes and osmotic dehydration, and indirect injury by blood clotting, leading to ischemia and an immunological response. The treatment has good precision and control, as ice ball formation can be clearly visualized using ultrasound. Seven studies have tested or published trial results using cryoablation in the treatment of FAD [6].

A multicenter study by Edwards et al used the Visica cryoablation system (Sanarus Medical, Pleasanton, CA). Two freeze-thaw cycles were used, with follow-up at 6 and 12 months. A total of 310 FADs with a mean diameter of 1.8 cm were treated at 53 sites. FADs were palpable at baseline in 77%, at 3 months in 50%, and at 6 months in 33% of patients. Mean residual lesion volume was 49% at 6 months and 3% at 12 months. Complications included infection (2%), ecchymosis (unknown), hematoma (amount comparable to surgical excision), blistering (5%), and depigmentation (1%). Ninety-two percent of patients were satisfied with the procedure, and 91% would recommend the treatment [7]. Numerous studies have been conducted on the results compared to HIFU, which in conclusion can be said that complications after cryoablation treatment were more serious, but less frequent compared to HIFU [9].

In laser ablation, lesions are destroyed by direct heating with low-power laser energy delivered through thin optical fibers that are inserted percutaneously under ultrasound or MRI guidance. When absorbed into the tissue, heat is released, causing death, thermal damage by changing the optical properties of the tissue. The level of necrosis depends on the temperature and time of ablation. Laser ablation can cause very precise necrosis. However, the size and shape of thermal lesions are difficult to predict due to biological variability, charring of the fiber tip, and changes in the optical and thermal properties of the tissue during interstitial laser photocoagulation [8].

Three studies, one of which is currently collecting data, have been conducted to test the use of laser ablation in the treatment of FAD [6]. Overall, data on laser ablative therapy is available in only a few studies, although they included a sufficient number of patients. Complications after treatment were frequent and severe compared to HIFU and cryoablation. Treatment time was fast, approximately 5 minutes [8].

In assessing the treatment efficacy, HIFU showed a 32% reduction in volume at 6 months. Cryoablation showed an average reduction in volume of 40.6% at 6 months and 87.3% at 12 months. Laser ablation showed an average reduction in size of 60% at 6 months and 100% at 12 months [5]. Therefore, laser ablation shows the best potential. However, due to the limited number of results and heterogeneity of the studies, no conclusions can be drawn. The smaller volume reduction observed with HIFU may be explained by the absence of a needle or probe inserted into the FAD that directly heats or cools the surrounding tissue. When using HIFU, due to its absence, increased caution is required to avoid damaging surrounding tissue or skin [8].

Complications such as swelling, pain, tenderness, and bruising are common to all techniques; cryoablation results in tape blisters, hamartoma, and keloids; and tape blisters result in skin depigmentation near the needle insertion site. Skin burns were more common with laser ablation; however, they could also occur with HIFU [9].

## 2. Conclusions

Minimally invasive ablative methods such as HIFU, cryoablation and laser ablation are a new approach in the treatment of breast fibroadenoma. The use of minimally invasive methods such as laser, cryo- and HIFU ablation allows the patient to undergo treatment without surgery and general anesthesia, as well as without the risk of complications associated with currently used methods.

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