

# The significance of high-frequency ultrasound-guided breast mass biopsy in the diagnosis of breast cancer

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## Summary

**Objective:** The aim of this study was to explore the clinical application value of high-frequency ultrasound-guided breast mass biopsy in the diagnosis of breast diseases. **Materials and Methods:** Two hundred patients with breast mass diagnosed clinically and by ultrasound underwent regular color Doppler ultrasound examination on the breast mass and bilateral axillary parts. Then needle biopsy was performed under the guidance of ultrasound and the biopsy tissues were sent to the Department of Pathology for pathological examination. **Results:** Each patient received biopsy smoothly with a successful puncture rate of 100% under the guidance of ultrasound. No complications occurred, 95% (190/200) of the patients were clearly diagnosed, and 5% (10/200) were orientedly diagnosed. The biopsy examination results were completely consistent with the surgical pathological results in 170 patients, accounted for 85%. Among them, invasive carcinoma in malignant lesions achieved the highest diagnosis coincidence rate (90.1%, 118/131). **Conclusion:** High frequency ultrasound-guided breast mass biopsy is safe and practical. Its successful rate is high and its pathological results are in high coincidence with the surgical pathological results. Thus, it can provide strong evidence for the diagnosis and identification of benign and malignant breast tumors and for choosing the correct operation scheme.

**Key words:** High frequency ultrasound; Breast mass; Biopsy; Breast cancer.

## Introduction

People in China and Western countries are in different ethnic population and have different medical models. The mammary glands of Asians are thin and dense. Thus, if breast cancer occurs, it is always in highly malignant degree and large tumor size (the tumor diameter of two to five cm accounts for 51.3%). The average age of onset is 40 to 50 years, ten years earlier than the patients in Western countries [1]. Breast cancer is the most common malignant tumor in Chinese women and its incidence is still rising. Currently, the treatment effect of breast cancer mainly depends on the clinical staging of the tumor. Therefore, early diagnosis and early treatment is the key to improve the patients' survival rate and prolong their lifespan [2].

The two-dimensional and color Doppler blood flow and hemodynamic parameters have different characteristics between the benign and malignant breast mass, but there is still a certain overlap. For instance, the malignant features of the untouchable mass are not quite obvious, leading to difficulties in differential diagnosis. Ultrasonography-guided core needle biopsy (US-CNB) possesses the characteristics such as accuracy, slight trauma, simpleness, and rapidness. It has become the commonly used method in the diagnosis of breast neoplasm [3-8]. At present, most needle biopsies are still performed using 14G hollow puncture needles based on the biopsy results of mammographic

and stereoscopic researches [9-17]. In this study, the authors retrospectively analyzed the clinical data of 200 patients with breast mass who were hospitalized in the present hospital during April 2010 to April 2014 and underwent needle biopsy with 16G or 18G puncture needles under the guidance of high-frequency ultrasound, in order to explore the clinical value of high-frequency ultrasound-guided breast mass biopsy in the diagnosis of breast cancer.

## Materials and Methods

Two hundred patients with breast mass who were hospitalized in the present hospital during April 2010 to April 2014 and underwent needle biopsy under the guidance of high-frequency ultrasound were enrolled in this study. All patients were women, aged  $42.3 \pm 7.2$  years (from 18 to 72 years). Patients submitted for the hospital because of breast lumps, breast pain or abnormal physical examination. All of them received regular color Doppler ultrasound examination on the breast mass, supraclavicular lymph node area, and upper axillary parts to observe the morphology, size, location, and the surrounding blood flow of the mass. The largest mass was  $15.9 \times 11.8$  cm and the minimum was  $0.8 \times 0.8$  cm. Then the patients underwent breast mass needle biopsy guided by high frequency ultrasound. All cases were surgically treated after the biopsy examination results were obtained. This study was conducted in accordance with the declaration of Helsinki and with approval from the Ethics Committee of Yan'an People's Hospital. Written informed consent was also obtained from all participants.

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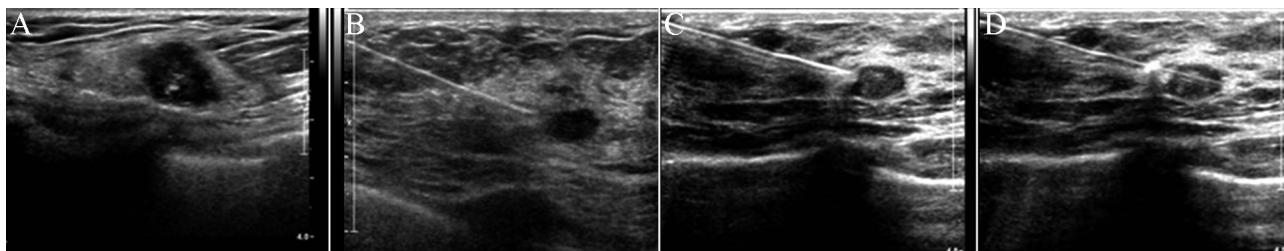


Figure 1. — Ultrasound guided breast biopsy procedures. A: The ultrasonic features of breast mass. B-D: Puncture process under the guidance of color Doppler ultrasonic diagnostic instrument.

Patients received needle biopsy after routine blood examination and the determination of blood coagulation function. According to the results of color Doppler ultrasonic diagnosis, the tumor size, location, and depth were detected with the probe frequency at L12~5MHz (Figure 1A). Patients were positioned on their back or on their side. Before biopsy, patients were carefully sterilized with povidone iodine at the puncture site, which was determined and signed according to the ultrasonic results. After locally anesthetized with 2% lidocaine, needle biopsy was performed using a magnum automatic biopsy device with 16G or 18G puncture needles. Under the guidance of color Doppler ultrasonic diagnostic instrument, the needle was punctured at the direction parallel to the probe and less than 45 degree angle to the skin. Three to four specimens were sampled from each mass, which were obtained by multipoint sampling at different position and different puncture path of the mass. The length of the sampling tissue depended on the size of the mass (Figures 1 B-D). The whole puncture and sampling process were monitored by color Doppler ultrasound to ensure the accuracy. After the biopsy gun was activated, the puncture needle was pulled out quickly and the puncture sites were bandaged immediately with elastic bandage and pressed for 15 minutes. The punctured tissues were fixed in 4% formaldehyde immediately and sent for routine pathological examination. After the biopsy, patients were closely observed to confirm if there were complications such as bleeding and infection. The biopsy pathological results were compared with the surgical pathological results.

## Results

The process of breast mass biopsy was performed very smoothly for each patient under the guidance of high frequency ultrasound and the tissues sampled were appropriate for pathological examination. During the biopsy process and after the biopsy, no complications such as infection, hematoma or pneumothorax happened.

Among the 200 patients receiving high frequency ultrasound-guided breast mass biopsy, there were 124 cases of malignant lesions (including invasive carcinoma and medullary carcinoma), ten cases of suspected malignancy, 12 cases of atypical hyperplasia, two cases of phyllodes tumor, and 52 cases of benign lesions (including fibroadenoma, hyperplasia, and inflammation). 95% of the patients were definitely diagnosed and the remaining 5% were orientedly diagnosed. The needle biopsy examination results were completely consistent with the postoperatively patho-

Table 1. — Comparisons of the pathological results of breast mass obtained by the ultrasound-guided and the resected biopsies.

	Invasive carcinoma	Medullary carcinoma	Mucinous adenocarcinoma	Carcinoma in situ	Atypical hyperplasia
Invasive carcinoma	115	3	0	0	0
Medullary carcinoma	0	6	0	0	0
Suspected malignancy	10	0	0	0	0
Atypical hyperplasia	6	0	0	6	0
Phyllodes tumor	0	0	0	0	0
Fibroadenoma	0	0	0	0	0
Hyperplasia	0	0	0	0	0
Inflammation	0	0	4	0	0
Total	131	9	4	6	0

	Fibro-adenoma	Phyllodes tumor	Hyperplasia	Inflammation	Total
Invasive carcinoma	0	0	0	0	118
Medullary carcinoma	0	0	0	0	6
Suspected malignancy	0	0	0	0	10
Atypical hyperplasia	0	0	0	0	12
Phyllodes tumor	0	2	0	0	2
Fibroadenoma	12	4	0	0	16
Hyperplasia	4	0	12	0	16
Inflammation	0	0	0	16	20
Total	16	6	12	16	200

logical results in 170 patients, accounting for 85%. Invasive carcinoma had the highest diagnosis coincidence rate (90.1%, 118/131) in the malignant lesions (Table 1).

## Discussion

With the gradual improvement of health awareness, more and more women are conscious of the importance of periodic routine checkups. On this basis, the detection rate of breast diseases increases markedly, while the mortality rate of breast cancer declines significantly. The rising survival rate and the reduced mortality of breast cancer do not totally depend on the improvement of the treatment but depend on the early detection. When the lesions are in the

early histological or clinical stage, the cancer cells are still confined to the mammary gland and the lesions are small and without any distant metastasis. In this stage, more than 90% of such patients can obtain long-term survival after radical resection [18].

Ultrasonography is one of the main means for screening and diagnosing breast diseases, which is the necessary means for early detection of breast cancer. The application of color Doppler flow imaging technology has provided more valuable information about blood flow for the differential diagnosis of benign and malignant breast masses [19]. However, there are still quite a number of ultrasonographic characteristics of atypical breast diseases, lacking specific changes, which make it difficult to identify benign from malignant breast masses.

With the continuous development and popularization of ultrasound-guided interventional technology, high frequency ultrasound-guided needle biopsy on tumors has become an important means to obtain pathological results besides surgery. Breast masses are always located superficially, which can be accurately positioned. Thus, ultrasound can be used to monitor the whole process of the biopsy. The inserting direction of the needle can be adjusted in real time, so that the puncture needle can accurately biopsy the tissue from the mass and effectively avoid inserting into the great vessels or penetrating into the pleura. Ultrasound-guided biopsy is safe and simple to operate, which can also avoid the radiation caused by X-ray examination. It has been reported in the literatures that the coincidence rate of the needle biopsy results and the surgical biopsy results is more than 90% [20, 21]. The present findings showed that high frequency ultrasound-guided needle biopsy could make a clear diagnosis of breast mass by up to 95% (190/200), and 85% of the needle biopsy results were completely in accordance with the surgical pathological results. Among the malignant lesions, invasive carcinoma achieved the highest diagnostic accordance rate of up to 90.1% (118/131). Therefore, ultrasound-guided breast mass needle biopsy can play a similar role to the intraoperative frozen section in the diagnosis of small mass of breast cancer. However, ultrasound-guided breast mass needle biopsy has more obvious advantages than intraoperative frozen section in some ways, such as safety and minimal invasion. Breast core needle biopsy causes smaller trauma and recovers more rapidly as compared with surgical biopsy. Thus it is more likely to be accepted by patients and more easily to be generalized [22]. The tissue obtained by needle biopsy can be diagnosed by pathological analysis, so that if the benign or malignant state can be further determined, it provides powerful pathological basis for making a decision regarding both treatment and surgical schema, as well as choosing the radiotherapy and chemotherapy schema.

In conclusion, high frequency ultrasound-guided breast mass biopsy has many advantages, such as simple operation, safety, low cost, less postoperative complications, and

high accuracy of the results. It can effectively and qualitatively diagnose the type of breast masses earlier, and the malignant tumors can be treated. It can be a preferable means for a definite diagnosis of breast cancer. Due to its safety, ultrasound-guided breast mass biopsy may take the place of resection biopsy in the diagnosis of breast cancer [23].

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