Original Study



# Ultrasound-Guided Vacuum-Assisted Biopsy in Small Breast: A Cost-Saving Solution

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## Abstract

**The study is on ultrasound-guided breast biopsy, which is a cost-saving solution to obtain appropriate samples from suspect lesions, and thereby avoid surgery.**

**Background:** The study aimed to evaluate the feasibility and reliability of ultrasound-guided vacuum-assisted breast biopsy (US-VABB) for sampling of microcalcifications indicative of cancer when stereotactic vacuum-assisted breast biopsy cannot be performed because of reasons such as thin breast tissue, insufficient thickness at compression, and microcalcification situated close to the chest wall or in breast tissue of the axillary tail. **Patients and Methods:** The study population was selected from among 187 patients with microcalcifications detected on mammogram. The findings were classified using the American College of Radiology criteria as Breast Imaging Reporting and Data System 3, 4, or 5. 30 Thirty were not eligible for stereotactic guidance because of reasons such as small breast size, compression thickness <2 cm, or microcalcification located in the axillary tails or close to chest wall. In 23 patients microcalcifications were detected at ultrasound, and US-VABB was performed. The other 7 patients underwent surgical biopsy. In the 23 patients who underwent US-VABB, multiple core samples were taken after a specimen mammography to ensure that microcalcifications were included. **Results:** Biopsy was successful in all cases of US-VABB. The procedure was well tolerated, and there were no complications. **Conclusion:** US-VABB should be preferred over diagnostic surgical biopsy when microcalcifications are sonographically visible and stereotactic guidance is contraindicated. The procedure appears to be reliable and accurate, with added advantages such as low cost and absence of radiation exposure.

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## Introduction

Vacuum-assisted biopsy (VAB) was introduced in the mid-1990s with the aim of eliminating the sampling difficulties associated with core needle biopsy.[1] A major advantage with VAB is that a large specimen can be obtained, reducing the possibility of false negative results.[2] Vacuum-assisted breast biopsy (VABB) is currently recommended for stereotactic and magnetic resonance imaging (MRI)-guided interventions,[3] but such guidance cannot be applied in some circumstances, for example, when the lesion is in a thin breast or when it is situated too close to the chest wall or in the breast tissue of the axillary tails. Stereotactic and MRI guidance are also not feasible in patients who cannot undergo anesthesia or in patients with pacemaker implantation. In addition, stereotactic- and MRI-guided VABB require expensive equipment. Ultrasound (US)-guided biopsy has been proposed as an alternative method for sampling of breast mass lesions.[4,5] US-guided VAB has several advantages: there is no need for compression, no radiation hazard, requires relatively less expensive equipment, and can be performed with the patient in a relatively comfortable position, prone and not supine.[6] In addition, the success rate is reported to be as high as 99.6%.[3] In this study we aimed to determine the usefulness of US-guided VABB in patients in whom stereotactic VABB cannot be performed and microcalcifications are sonographically appreciated.

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## Patients and Methods

Between January 2016 and July 2017, 187 cases of microcalcifications indicative of cancer detected with clinical mammography in the Department of Diagnostic Imaging of Policlinico "Tor Vergata": PTV foundation, University "Tor Vergata" Rome, were classified using the Breast Imaging Reporting and Data System (BI-RADS) classification system and referred for stereotactic VABB using a Mammotome System (Devicor Medical Products, Inc, Cincinnati, OH). Exclusion criteria for VABB were pregnancy, coagulation disorders, and male sex. The age of the patients ranged from 30 years to 55 years (mean age, 42.5 years).

All patients gave their informed consent for this study and its publication before their inclusion in the study. This study was approved by the ethics committee of our University. The study was approved by the institutional review board and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Among the 187 patients, 30 were not eligible for stereotactic VABB because of small breast size, compression thickness <2 cm, lesion location close to chest wall, or presence of heteroplastic breast tissue in the axillary tail. These patients were considered candidates for US-guided VABB. In 7 patients, however, the microcalcifications could not be delineated using US; they were referred for surgical biopsy at the Department of Surgery.

Ultrasonography was performed using a high-resolution US unit (GE LOGIQ E9; LOGIQ E9 XDclear, GE Healthcare GmbH, Solingen) equipped with a 10-13 MHz frequency linear transducer.

In 23 cases microcalcifications without a mass lesion were identified at the US and US-VABB was performed (Figure 1). All examinations and procedures were performed by the same certificated radiologist, with 10 years' experience in breast imaging and interventional procedures.

The patient was placed in a supine position and the location of the microcalcifications was confirmed with US. The site was sterilized with iodine solution. When the location of microcalcifications was confirmed, administration of 5 mL of 1% lidocaine was infiltrated into the skin and subcutaneous tissue to achieve local anesthesia. A small skin incision was made, and a 13-gauge VABB probe (Figure 2; Mammotome System, Devicor Medical Products, Inc) was introduced into the breast. Under direct US visualization, multiple core samples were taken. A specimen mammography was performed to ensure that microcalcifications were totally included and a clip (Mammo MARKTM 11, Devicor Medical Products, Inc) was released at the site (Figures 3 and 4). After the procedure was completed, a unilateral mammogram in orthogonal projection was acquired (cranio-caudal; medio-lateral) to confirm that sampling had been accurately obtained from the site of the microcalcifications identified in the first diagnostic mammography (Figure 5). Biopsy specimens were sent for histological examination at the Department of Pathology of Policlinico "Tor Vergata": PTV Foundation, University "Tor Vergata" Rome. In 7 cases an excisional biopsy was

**Figure 1** Microcalcifications Are Identified With High-Resolution Linear Ultrasound Probe as Tiny Hyperechoic Spots, Surrounded by a Hypoechoic Area, With Borders That Cannot be Defined

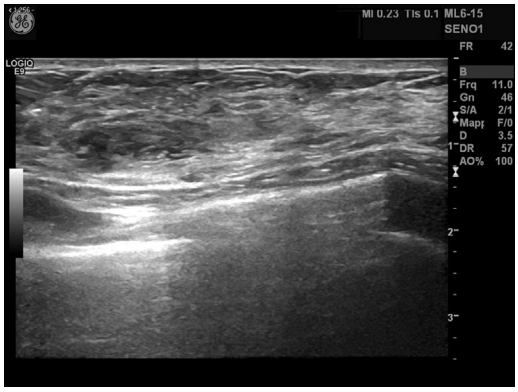



**Figure 2** Under Direct Ultrasound (US) Visualization the 13-Gauge Probe Has Been Inserted. When the Procedure Is Performed With US Guidance a Real-Time Visualization of the Site Lesion Can be Obtained

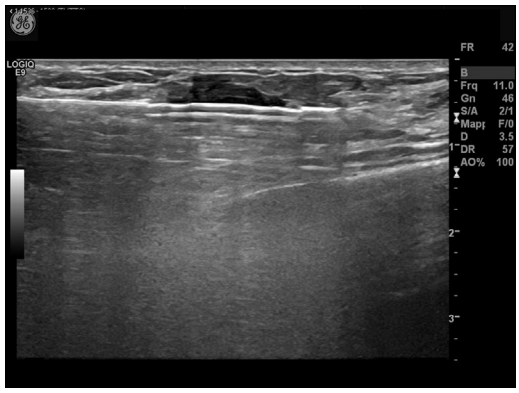



**Figure 3** At the End of the Procedure a Clip (Mammo MARKTM 11, Devicor Medical Products, Inc, Cincinnati, OH) Is Released in the Site of Biopsy

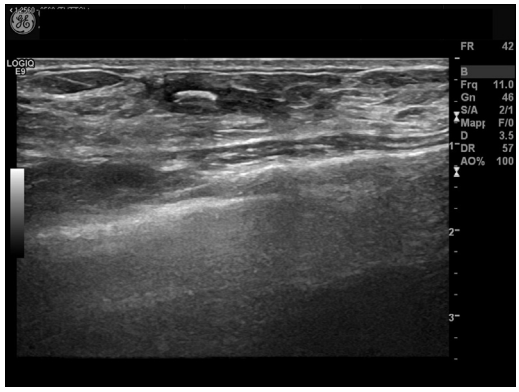
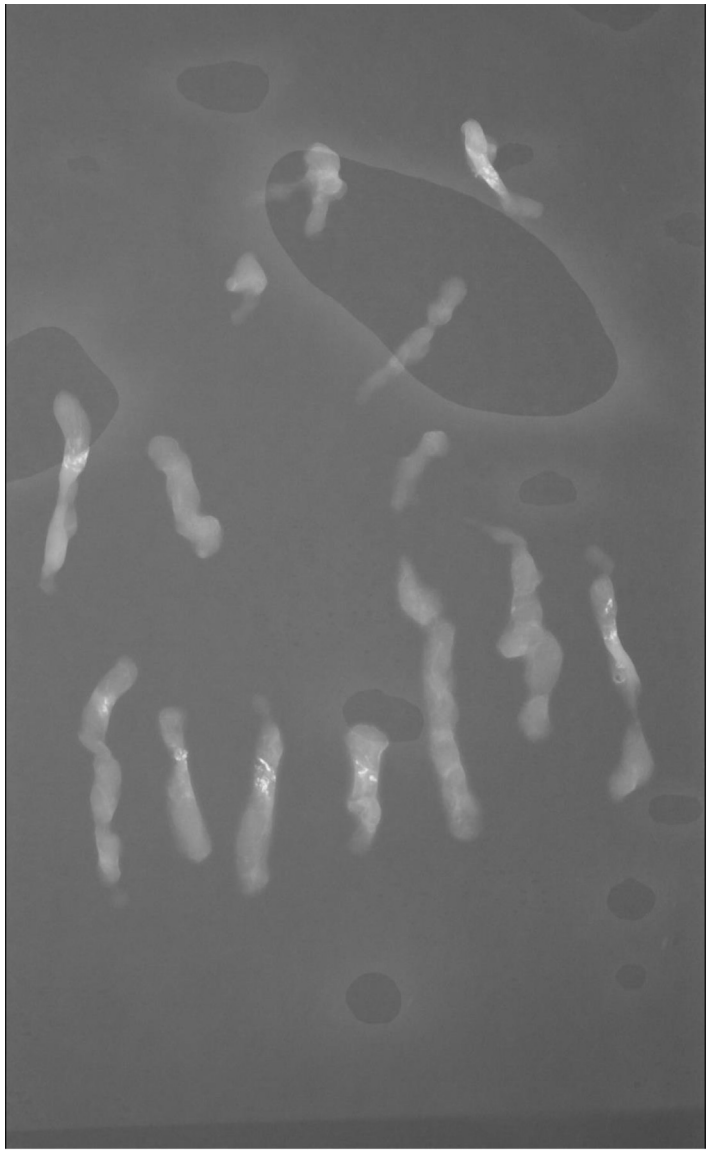


**Figure 4** Mammographic Control of the Specimen Is Obtained to Ensure That Microcalcification Is Properly Included

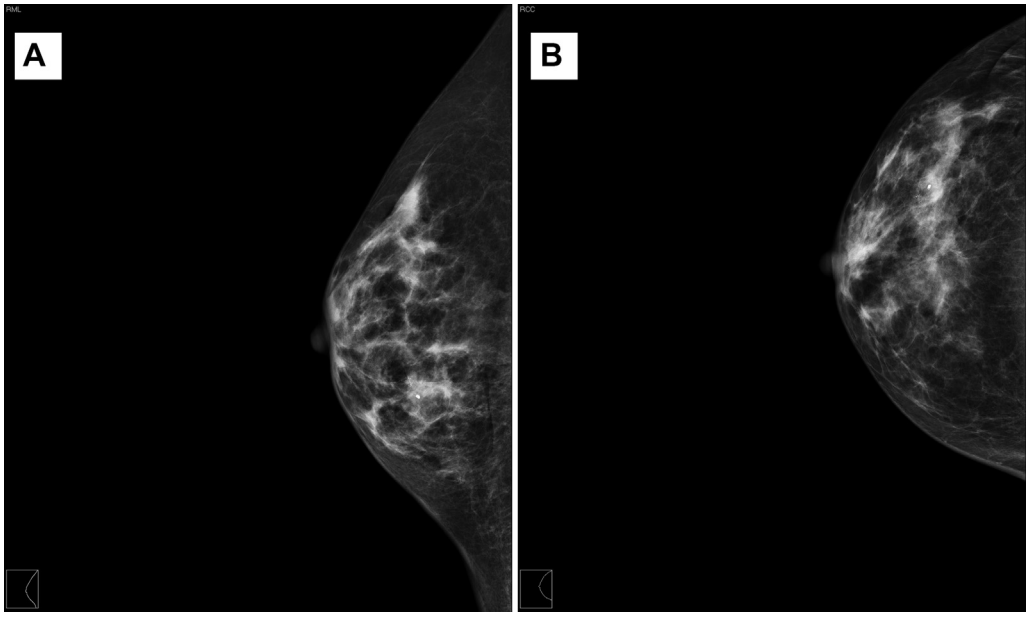


used after mammography needle-guided localization for microcalcifications that could not be delineated using US. These lesions were excluded from US-VABB because of a lack of evidence and sent to the Department of Surgery of our institution to perform a surgical biopsy.

## Results

Ultrasound-guided VABB was performed in 23 patients in whom microcalcifications, without mass lesions, were identified on US. Biopsy was successful in all cases; sampling was accurate, with the microcalcifications included in all samples, and the tissues were sufficient for pathological evaluation (Table 1). The procedure was well tolerated by the patients, and no major complications were encountered. After histological examination the lesions were classified into 5 categories: B1, B2, B3, B4, and B5. Lesions classified as B3, B4, and B5 were sent to surgical resection after multidisciplinary review. Histological examination of the resected specimens showed a 100% concordance with VABB results. There were 14 patients with B2 lesions; these patients were advised to follow-up after 6 months. Thus, US-guided VABB helped avoid a more invasive surgical biopsy in these 14 patients. Three lesions were classified as B3. There were 2 B4 lesions and 4 B5 lesions; as mentioned previously, these patients were sent for surgical resection after a multidisciplinary review. In this case, US-guided VABB enabled early diagnosis of the malignancy and helped improve outcome (Table 2).

**Figure 5** After the Procedure a Double-Projection Mammogram Is Acquired, to Ensure a Proper Clip Placement. (A) Lateral projection. (B) Craniocaudal projection




## Discussion

Our study was aimed to show the feasibility of US-VABB in select cases, to obtain a cost- saving solution when stereotactic or MRI VABB cannot be performed. Among our 23 cases, with strict criteria of selection, when surgical resection became mandatory we found complete concordance at the histological examination between the specimens and the resected tissue.

The VABB procedure, introduced by Steve Parker in 1990, is the reference standard for minimally invasive histological characterization of breast lesions.[1] It is considered a valid alternative to diagnostic surgical biopsy, which is more invasive, more expensive, poorly tolerated by patients, requires hospitalization, and leaves evident scars.[7-10] Several studies have shown that histopathological diagnosis obtained with VABB is nearly equivalent to that with open biopsy.[11]

Currently, the US-VABB system, which uses a large-lumen cannula (8- to 13 gauge), is considered very effective and is universally accepted as the standard of care in the management of breast lesions.[12] One of the greatest advantages with the US-VABB is that a relatively large amount of tissue can be sampled; in fact, complete removal of a benign lesion is also sometimes possible, with excellent aesthetic results and considerable cost savings.[13-15]

All lesions classified as BI-RADS category 4 or higher require sampling for histological characterization. Information on histological grade and hormone receptor expression is essential for prognostication and for selection of the most appropriate diagnostic and therapeutic plan. For BI-RADS category 3 lesions additional follow-up with biopsy is recommended.[16]

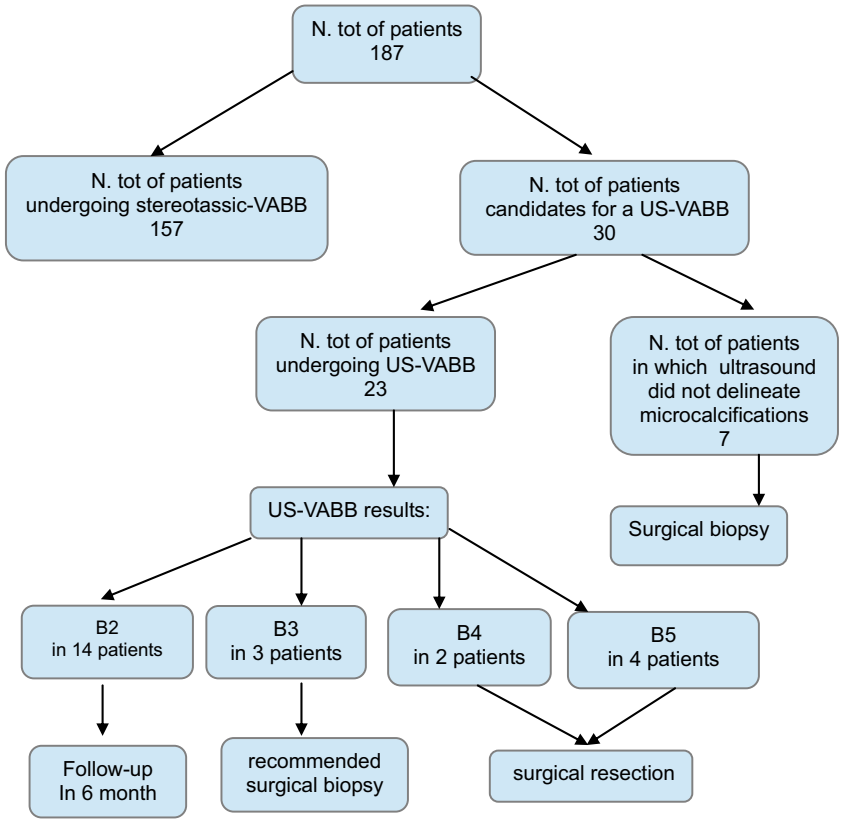
Pleomorphic or fine linear microcalcifications, especially when clustered together, are highly indicative of malignancy and should be considered an early sign of breast cancer.[17] In this scenario US-VABB represents a very useful tool for diagnostic and therapeutic purposes.[18]

Prompt clinical management of patients with benign lesions (which can cause considerable anxiety) and malignant lesions is important. In our experience, the US-VABB technique highly fulfills the European Guidelines criteria, in term of accuracy. In the present study, microcalcifications indicative of cancer in 14 patients resulted as benign lesions, and overtreatment was avoided. In 1 patient US-VABB helped in early diagnosis of a lobular carcinoma in situ.

**Table 1** Histological Subtypes of the 23 Lesions Sampled Using Ultrasound-Guided Vacuum-Assisted Breast Biopsy

| Lesion Type |
|---|
| **Benign** |
| Fibroadenoma = 5 |
| Periductal chronic inflammation = 1 |
| Adenosis = 1 |
| Fibrosis = 3 |
| Typical ductal hyperplasia = 4 |
| **High-Risk** |
| Atypical ductal hyperplasia = 2 |
| Radial scar = 1 |
| Papillary lesion = 2 |
| **Malignant** |
| Invasive ductal carcinoma = 2 |
| Ductal carcinoma in situ = 1 |
| Lobular carcinoma in situ = 1 |

**Table 2** Percentages of Patients Who Were Excluded From Stereotactic-VABB and Among These Cases the Percentage of Patients Who Underwent the US-VABB Instead of Surgical Biopsy




| | n | % |
|---|---|---|
| Patients With Microcalcifications Indicative of Cancer | 187 | 100.00 |
| Patients Who Underwent Stereotactic VABB | 157 | 83.9 |
| Patients Who Were Candidates for an US-VABB | 30 | 16.04 |
| Patients Who Were Candidates for US-VABB in Whom Ultrasound Did Not Delineate Microcalcifications and Who Directly Underwent Surgical Biopsy | 7 | 23.3 |
| Patients Who Were Candidates for US-VABB and Effectively Underwent US-VABB | 23 | 76.6 |
| Patients With a B2 Result on US-VABB Who Did Not Need a Surgical Biopsy | 14 | 60.86 |
| Patients With a B3 Result on US-VABB Who Were Recommended for Surgical Biopsy | 3 | 13 |
| Patients With a B4/B5 Result on US-VABB Who Underwent Surgical Biopsy | 6 | 23 |

Abbreviations: US-VABB = ultrasound-guided vacuum-assisted breast biopsy; VABB = vacuum-assisted breast biopsy.

Stereotactic VABB is considered the gold standard for sampling of microcalcifications for histological characterization.[19] However, when there is a thin breast (compression thickness <2 cm) or microcalcifications located too close to the chest wall, or in the breast tissue of the axillary tail, diagnostic surgical biopsy is considered the only option. US-VABB has emerged as a valid alternative to stereotactic VABB.[20] The absence of exposure to radiation is a major advantage that US-VABB has over stereotactic VABB. Stereotactic VABB and US-VABB cause almost no internal scarring, and therefore do not affect subsequent mammograms. Furthermore, these modalities do not cause aesthetic impairment, and are therefore more acceptable to patients. They also are less expensive than surgical biopsy.[21-24] A limit of our study could be that all the procedures were performed by a single radiologist not counting a second opinion from a less experienced operator, but it should be considered that radiologists with specialty training in breast imaging detect more cancers than general radiologists and the aim of our study was detecting all the possible lesions and avoiding surgical biopsy.

Ultrasound cannot detect most microcalcifications, but in the cases of microcalcifications identified using US we have shown the high accuracy of US-VABB if it is performed by an operator expert in such a clinical setting.

## Conclusion

Ultrasound-guided VABB, a minimally invasive procedure with significant advantages in terms of costs and aesthetics and absence of radiation exposure, appears to be a feasible alternative to surgical biopsy in patients with breast microcalcifications indicative of

cancer, especially when stereotactic VABB cannot be performed for some reason.

### *Clinical Practice Points*

- The stereotactic VABB system is widely used in common clinical practice for a high success rate in sampling microcalcification, but as shown in this article it has limitations.
- Ultrasound-guided VABB has a great clinical advantage in the age of cost-saving solutions, and avoiding unnecessary surgeries.
- A skilled operator is fundamental for obtaining the best results and the highest success rate of the procedure.

## Disclosure

The authors have stated that they have no conflicts of interest.

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