

# The Clinical Utility of a Adding Lateral Approach to Conventional Vertical Approach for Prone Stereotactic Vacuum-Assisted Breast Biopsy

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**Objective:** The purpose of this study is to evaluate the clinical utility of adding lateral approach to conventional vertical approach for prone stereotactic vacuum-assisted breast biopsies.

**Materials and Methods:** From April 2010 to May 2012, 130 vacuum-assisted stereotactic biopsies were attempted in 127 patients. While a vertical approach was preferred, a lateral approach was used if the vertical approach failed. The success rate of biopsies utilizing only a vertical approach was compared with that using both vertical and lateral approaches and the breast thickness for both procedures was measured and compared with that for vertical approach. In addition, pathology results were evaluated and the causes of the failed biopsies were analyzed.

**Results:** Of the 130 cases, 127 biopsies were performed and 3 biopsies failed. The success rate of the vertical approach was 83.8% (109/130); however, when the lateral approach was also used, the success rate increased to 97.7% (127/130) ( $p = 0.0004$ ). The mean breast thickness was  $2.7 \pm 1$  cm for the lateral approach and  $4 \pm 1.2$  cm for the vertical approach ( $p < 0.0001$ ). The histopathologic results in 76 (59.8%) of the biopsies were benign, 23 (18.1%) were high-risk lesions, and 28 (22.0%) were malignant. The causes of biopsy failure were thin breasts ( $n = 2$ ) and undetected difficult lesion location ( $n = 1$ ).

**Conclusion:** The addition of lateral approach to conventional vertical approach in prone stereotactic vacuum-assisted breast biopsy improved the success rate of stereotactic biopsy, especially in patients with thin breasts.

**Index terms:** Biopsy; Breast neoplasm; Stereotactic technique; Calcification; Success rate

## INTRODUCTION

Stereotactic breast biopsy has been used for the retrieval of suspicious microcalcifications. Recently, the use of a vacuum-assisted approach has allowed more tissue to be obtained, and the success rate of biopsies of

microcalcifications has risen (1-4). To perform the biopsy accurately, the patient must remain still while maintaining a comfortable position. Biopsies that are performed with patients in the prone position in a dedicated stereotactic biopsy unit allow the patients to be more comfortable than those performed in the upright method using an "add-on" stereotactic biopsy unit while the patient is seated. The prone position can better support breast tissues and reduce the frequency of vasovagal syncope. In addition, the prone position allows an approach from all directions, including vertical and lateral approaches. Studies analyzing the utility of stereotactic breast biopsies in Asian women are scarce, and in the few published studies, only cases using the add-on stereotactic method (5) rather than the prone position have been examined, even in procedures involving core needle biopsies (6). We know of no prior articles in which the utility of prone stereotactic vacuum-assisted breast

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biopsies using a lateral approach has been evaluated. In this study, we evaluated the clinical utility of the lateral approach for prone stereotactic vacuum-assisted breast biopsies, especially in Asian women with small or thin breasts.

## MATERIALS AND METHODS

This was a retrospective study of patients who received vacuum-assisted stereotactic breast biopsies of microcalcifications using a prone-type device at our hospital between April 2010 and May 2012. This study received institutional review board approval.

For the prone vacuum-assisted stereotactic biopsies, the Mammo Test (Siemens AG, Munich, Germany) and Mammotome® (Ethicon Endo-Surgery, Johnson & Johnson, Cincinnati, OH, USA) were used.

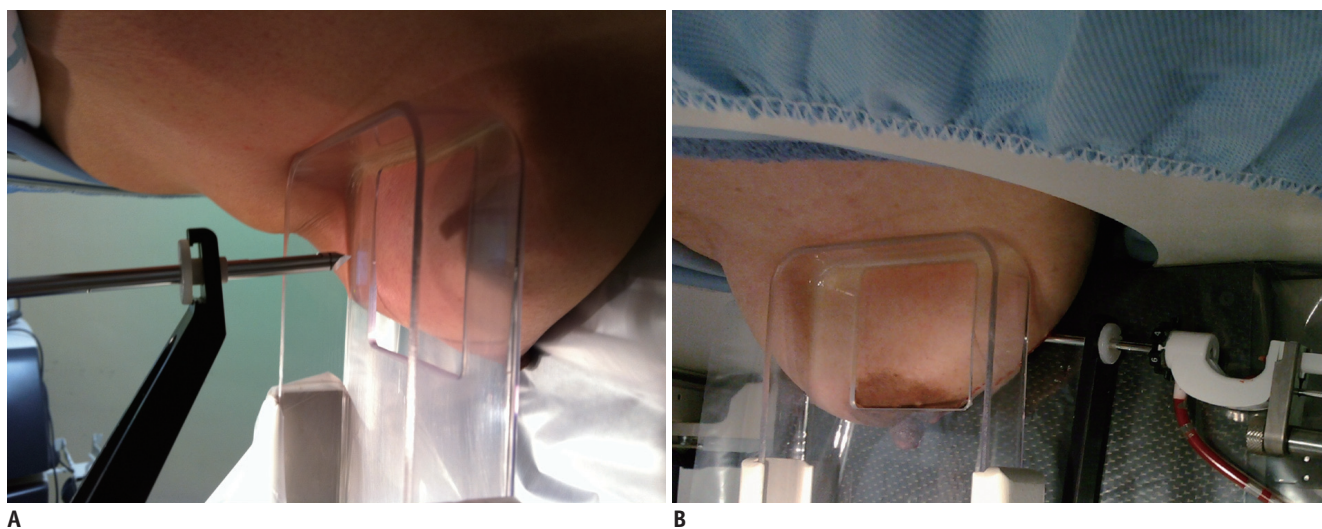
During the procedure, the vertical approach was attempted first. When the vertical approach was not feasible because of thin breasts or the location of the microcalcifications, the lateral approach was used. In the vertical approach for a stereotactic biopsy, the needle is inserted perpendicular to the compression paddle regardless of whether the underlying view is craniocaudal, mediolateral, or lateromedial (Fig. 1A). In the lateral approach, the needle is inserted parallel to the compression paddle, regardless of whether the underlying view is craniocaudal, mediolateral, or lateromedial (Fig. 1B) (5, 7).

In terms of compression pressure, we usually compressed the breasts as hard as the patient could endure and fixed

the breast. It was occasionally necessary to compress the breast harder on the lateral approach than the vertical approach to fix the breast. During efforts to insert the needle, the breast does not move or slip when compression is sufficient to fix the breast.

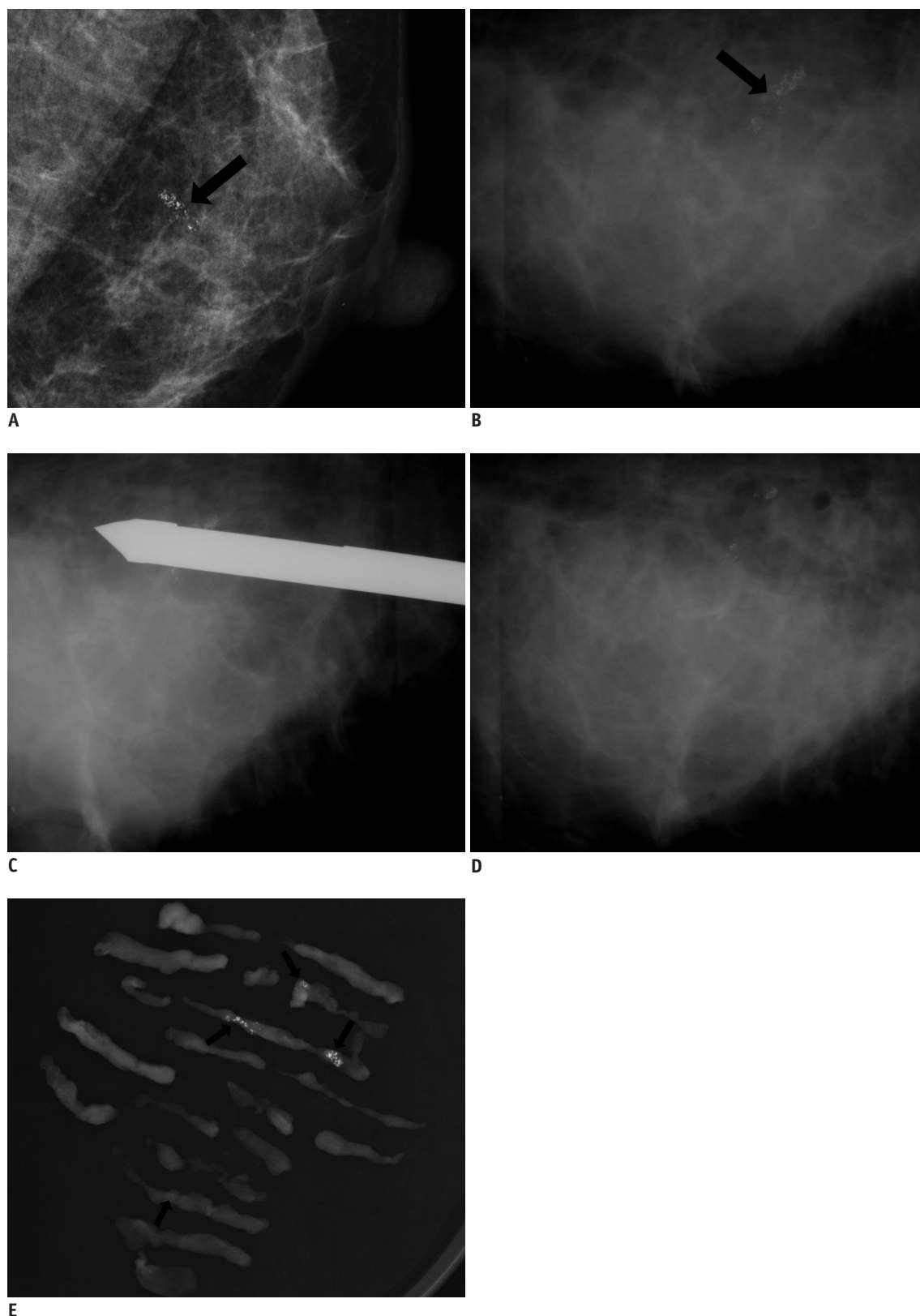
After stereotactic biopsy, the cases were divided into those where the microcalcifications were removed partially or completely (defined as successful cases) and those for which vacuum-assisted prone stereotactic biopsy could not be performed with either the vertical and lateral approaches (defined as failed cases). The success rate of the vertical approach alone was compared with the success rate of procedures in which the lateral approach was also used. The effect of breast thickness on the procedural method used was assessed by measuring the compressed breast thickness. The number of specimens and calcification rates (number of samples containing calcification/total number of samples obtained through stereotactic biopsy) were compared. The pathological results of the tissue biopsies were classified as benign, high-risk, or malignant. For cases in which surgery was performed after histological examination, the results were analyzed. In the cases without surgery, we evaluated the follow-up images. The causes of the failed biopsies were analyzed. Additionally, the characterization and category of microcalcifications confirmed by stereotactic biopsy were evaluated according to BIRADS (8).

Student's *t*-test and chi-square test with Yates' correction (MedCalc, version 10.4.8; MedCalc Software, Mariakerke, Belgium) were used for comparison between vertical and lateral approaches.  $P < 0.05$  was considered statistically



**Fig. 1. Vertical and lateral approaches.**

**A.** Vertical approach for stereotactic biopsy using prone-type device. **B.** Lateral approach for stereotactic biopsy using prone-type device.



**Fig. 2. Fibrocystic change in 41-year-old woman was confirmed by lateral approach.**

Mediolateral oblique view of mammography (A) and spot view before lateral approach of stereotactic biopsy (B) showing clustered, amorphous and punctate microcalcifications in left breast (arrows). Breast thickness was measured as 1.9 cm at this time. Spot view after inserting needle (C), spot view after biopsy (D), and spot view of specimen (E) were seen. Because there were several microcalcifications in more than 3 specimens (arrows), this procedure was defined as success, and fibrocystic change was confirmed.

significant.

## RESULTS

From April 2010 to May 2012, stereotactic vacuum-assisted breast biopsy of microcalcifications using a prone-type device was scheduled in 127 patients; 3 patients had lesions in both breasts, for a total of 130 cases.

Of the 130 procedures, the biopsy failed in 3 cases, where failure means that the vacuum-assisted prone stereotactic biopsy could not be performed with either the vertical or the lateral approach. Thus, vacuum-assisted prone stereotactic biopsy was performed in 127 cases in 124 patients. The mean age of the subjects was 49 years (range, 27-74 years).

Of the 127 total successful cases, a vertical approach

was used in 109 cases, and 18 biopsies were performed using a lateral approach (Fig. 2). When only the vertical approach was used, the success rate was 83.8% (109/130); however, when the lateral approach was added, the success rate increased to 97.7% (127/130) ( $p = 0.0004$ ). For the vertical approach, the mean breast thickness was  $4.0 \pm 1.2$  cm, whereas the mean breast thickness for the lateral approach was  $2.7 \pm 1.0$  cm, showing that the biopsy could be performed on thinner breasts ( $p < 0.0001$ ) (Table 1). The number of specimens, calcification rate, and percentage of patients with cancer are shown in Table 1. In terms of these factors, there was no significant difference between the two approaches. We also found that complications such as hematoma due to the long insertion route were not common in the lateral approach. In contrast, hematomas occurred in 5 cases where the vertical approach was used, probably due

**Table 1. Comparison of Lateral and Vertical Approaches from Stereotactic Biopsy and Surgery (127 Cases)**

		Total (127)	Vertical Approach (109)	Lateral Approach (18)	$^{\S}p$
Breast thickness (cm)	Mean $\pm$ SD	$3.8 \pm 1.2$	$4.0 \pm 1.2$	$2.7 \pm 1.0$	$p < 0.0001$
	Range	1-7.2	1.3-7.2	1-4	
Sample number (n)	Mean $\pm$ SD	$19 \pm 7.1$	$19.2 \pm 7.1$	$18.7 \pm 7.2$	$p = 0.78$
	Range	10-38	10-38	10-38	
Calcification rate* (%)	Mean	37.8	42.9	30.2	$p = 0.45$
	Range	3-87.5	10-87.5	3-81	
Percentage of patients with cancer	No	29 <sup>†</sup> /127	27 <sup>†</sup> /109	2/18	$p = 0.33$
	%	22.8	24.8	11.1	

**Note.**— \*Calcification rate: number of samples containing calcifications / total number of samples obtained through stereotactic biopsies, <sup>†</sup>1 ADH was upgraded to IDC after surgery; this was therefore included in malignancy data, <sup>‡</sup>1 ADH was upgraded to IDC after surgery, which was included in vertical approach group, <sup>§</sup> $P$ -values describe when comparing means and proportions between vertical and lateral approaches. ADH = atypical ductal hyperplasia, IDC = invasive ductal carcinoma

**Table 2. Pathology Results from Stereotactic Biopsy and Surgery Following Stereotactic Biopsy (127 Cases)**

Pathology Results from Stereotactic Biopsy (n)		Pathology Results from Surgery Following the Stereotactic Biopsy (n)
Benign (76)	Fibrocystic changes (FCD) (57)	
	Columnar cell hyperplasia (16)	
	Florid ductal hyperplasia (1)	
	Fibroadenoma (1)	
	Foreign body reaction (1)	
High-risk lesion (23)	Atypical ductal hyperplasia (ADH) (13)*	
	Flat cell atypia (4)	IDC (1)
	Mucocele-like lesion (4)	ADH (10)
	Intraductal papilloma (2)	
Malignancy (28)	Ductal carcinoma <i>in situ</i> (DCIS) (26) <sup>†</sup>	DCIS (18)
	IDC (2)	IDC (7)
		Micro-invasive ductal carcinoma (3)

**Note.**— \*1 ADH was upgraded to IDC from surgery, <sup>†</sup>5 DCISs were upgraded to IDCs and 3 DCISs were upgraded to micro-invasive ductal carcinomas after surgery. ADH = atypical ductal hyperplasia, IDC = invasive ductal carcinoma



to the larger number of vertical approach cases.

Of the 127 stereotactic biopsies performed, 76 cases were benign, 23 cases had high-risk lesions, and malignancies were found in 28 cases. Table 2 describes the results of the comprehensive pathology and the postsurgical pathology analyses.

In 2 of the 3 failed cases, we could not perform stereotactic biopsies because the breasts were too thin (0.8 cm, 0.7 cm). One case was diagnosed as benign after an ultrasound-guided vacuum-assisted biopsy with specimen mammography. The other case was stable by follow-up study for 2 years.

In 1 of the 3 failed cases, microcalcifications were located in the right posterior breast. The lesion was visualized only on the mediolateral oblique view of screening mammography but was not seen on the prone-type device, preventing stereotactic biopsy. After surgery, the case was diagnosed as ductal carcinoma *in situ* (DCIS).

According to our study results, linear branching (1/1; 100%) was the most common malignant characteristic of microcalcifications, and a linear distribution (2/3; 66.7%) was the most common malignant distribution pattern (Table 3). No cases were found (0/2) of malignancy in lesions with an amorphous character and diffuse distribution. Additionally, 0% of category 3 biopsies, 23.3% of category 4 category 4 biopsies, and 100% of category 5 malignancies were confirmed by stereotactic biopsy (Table 4).

In our study, mammograms of 127 cases undergoing stereotactic biopsy showed the following distribution of BI-RADS categories: 6 cases were category 3, 120 cases were category 4, and 1 case was category 5. Biopsies were performed on the category 3 cases because the patients strongly desired biopsy rather than follow-up, and none of the category 3 cases were found to be malignant. Surgery was performed on the 28 patients whose stereotactic biopsy results indicated malignancies. After surgery, 5 cases were upgraded from DCISs to IDCs, and 3 cases were upgraded from DCISs to micro-invasive ductal carcinomas. Surgery was performed on 11 of the 23 patients with high-risk lesions and 12 of the 23 patients were followed by mammography and ultrasonography for 12 to 24 months. Surgery was performed in 11 of 13 ADH cases. Clinicians and patients made the decision to follow 2 cases of ADHs, 4 cases of flat cell atypia, 4 cases of mucocoele-like lesions, and 2 cases of intraductal papillomas. One of the 11 surgically confirmed high-risk lesions was upgraded from ADH to IDC. For the benign lesions, surgery was not performed, and follow-up consisted of mammography for 12 to 24 months (Table 2).

Of the 130 total cases intended for stereotactic biopsy in our study, malignancies were found in 30 of these cases (23.0%). Of the 127 cases in which stereotactic biopsy could be performed, malignancies were found in 29 cases (22.8%).

**Table 3. Frequency of Carcinoma Based on Morphology and Distribution of Microcalcifications (127 Cases)**

	Punctate	Amorphous	Coarse Heterogenous	Fine Pleomorphic	Linear Branching	Total
Diffuse		2 (0/2)				2 (0/2, 0%)
Regional	3 (0/3)	18 (5/18)	1 (0/1)	4 (2/4)		26 (7/26, 26.9%)
Clustered	16 (5/16)	36 (4/36)	2 (0/2)	19* (6/19)		73 (15/73, 20.5%)
Linear				2 (1/2)	1 (1/1)	3 (2/3, 66.7%)
Segmental	5 (0/5)	9 (2/9)		9 (3/9)		23 (5/23, 21.7%)
Total	24 (5/24, 20.8%)	65 (11/65, 16.9%)	3 (0/3, 0%)	34 (12/34, 35.3%)	1 (1/1, 100%)	127 (29/127, 22.8%)

**Note.**— \*1 ADH was upgraded to IDC after surgery, which was included in clustered, fine pleomorphic group. ADH = atypical ductal hyperplasia, IDC = invasive ductal carcinoma

**Table 4. Frequency of Malignant Diagnoses by BIRADS Category (127 Cases)**

BIRADS Category	No. of VAB (%)	No. of Malignant (%)
3	6 (4.7%)	0/6 (0%)
4	120 (94.5 %)	13/94 (14.0%)
4A	94 (73.2%)	13*/24 (54.2%)
4B	24 (18.9%)	2/3 (66.7%)
4C	3 (2.4%)	
5	1 (0.8%)	1/1 (100%)

**Note.**— \*1 ADH was upgraded to IDC after surgery, which was included in the BIRADS category C4B group. BIRADS = breast imaging reporting and data system, VAB = vacuum assisted biopsy, ADH = atypical ductal hyperplasia, IDC = invasive ductal carcinoma

## DISCUSSION

It is known that microcalcifications are important for detecting DCIS (9). However, it is difficult during a mammography to distinguish whether microcalcifications belong to benign or malignant lesions, resulting in diagnostic difficulties (10). Suspicious clustered microcalcifications detected by mammography can be diagnosed by stereotactic biopsy or surgery following mammography-guided needle localization (11). However, stereotactic biopsy cannot be performed for 2-13% of cases because the lesions are not well-visualized; the location of the lesion is either too close to the thoracic wall, or the patient cannot lie in the prone position (12). Stereotactic biopsy could not be performed in 2.3% (3 cases) of the total cases in our study because the breast was too thin (2/3; 66.7%), or the microcalcifications were located in the far posterior aspect (1/3; 33.3%). In previous studies examining the feasibility of stereotactic biopsy in Caucasian women, the major cause of biopsy failure was reported to be the location of the lesion or inadequate visualization of the microcalcification. In contrast, small or thin breasts are the most common cause of biopsy failure in Asian women, as shown in our study (12, 13).

In the past, core needles have been used for stereotactic biopsies for microcalcifications of the breast. However, the rate of calcification extraction by an 11-gauge vacuum-assisted biopsy is higher than for a core biopsy, histologic underestimation is reduced, and the cost of re-biopsy is lower; thus, vacuum-assisted biopsy is now more widely used (4, 13-16).

In America, prone devices are commonly used, but these devices have not been extensively used in Asia because of their high cost (3). Another shortcoming is that prone devices require sufficient space to position the prone table and perform the procedure. Considering the small number of patients requiring stereotactic biopsy, it is often not feasible to use prone devices, and upright devices are therefore more common (17). However, it has been reported that when a prone device is used, the breast is better supported, and the patient feels more comfortable than when she is sitting on a chair during the procedure (3). Additionally, patient movement during the procedure can be reduced, which is important for performing the procedure accurately. Complications that can develop during the upright procedure, such as vasovagal syncope, are reduced in the prone position. In our study, a prone-type

device was used, and microcalcifications were confirmed by specimen mammography for all of the 127 successful cases; furthermore, none of the cases developed vasovagal syncope during or after the procedure.

In stereotactic biopsy, a vertical approach involves inserting the needle perpendicular to the compression paddle (Fig. 1A), and the lateral approach involves inserting the needle parallel to the compression paddle (Fig. 1B) (5, 7). In our study, the mean breast thickness for which stereotactic biopsy with a vertical approach could be performed was  $4.0 \pm 1.2$  cm, whereas the lateral approach could be performed in breasts with a mean thickness of  $2.7 \pm 1.0$  cm. This difference was statistically significant ( $p < 0.0001$ ); thus, we found that the lateral approach could be performed on thinner breast tissues. Recent studies have also reported that the lateral approach could be performed on thinner breasts than the vertical approach (5, 7, 17). In one such study, the minimal breast thickness for which the lateral approach could be performed was 1 cm (5). In a study by Nakamura et al., the biopsy was performed by placing polyethylene foam on the plate to facilitate the insertion of the needle into the deep breast tissues, and we assumed that the subjects of that study were Asian women. However, the minimum breast thickness in this study was also 1 cm. In our study, the biopsy was performed without special manipulation, and the minimal breast thickness for which the lateral approach could be performed was 1 cm, similarly to the study by Nakamura et al. (5). In patients for whom the vertical approach can be performed, breast compression is easily achieved, and the route of needle insertion is shorter than for the lateral approach. In the lateral approach, the needle enters the space between the compression paddle and the plate, and the breast may be displaced, causing the route of the needle to be longer than in the vertical approach. Therefore, the vertical approach is generally favored. However, small or thin breasts are prevalent in Asian women; thus, if the compressed breast is very thin, stereotactic biopsy can fail. The length of the notch of the Mammotome is 1.94 cm, and the length from blade to notch is 0.79 cm. A stroke margin (the distance from plate to edge of blade) of at least 0.4 cm (enough for  $> 0.7$  cm) is needed to perform the stereotactic biopsy. Therefore, sufficient breast thickness is an important factor in performing the examination. When breast thickness is not sufficient for the vertical approach, the lateral approach can be applied, allowing the biopsy to be performed. However, it is impossible to perform the stereotactic biopsy,

even using the lateral approach, on women with less than 1 cm of breast thickness. Therefore, at our hospital, the easier vertical approach method was performed first, and the lateral approach was then attempted for cases in which the vertical approach failed. It takes less than 5 minutes to change the position from vertical to lateral after attempting the vertical approach.

Notably, our study had several limitations. The number of patients was small. Pathology diagnoses were confirmed by follow-up studies after stereotactic biopsy in some patients. Previous studies have reported that in cases where lesions were classified as benign by stereotactic biopsy, malignant lesions were found during the follow-up period. In this study, of the 23 high-risk lesions, only 12 were examined by stereotactic biopsy, though they were not confirmed by surgery for sufficient follow-up. Any benign lesion from stereotactic biopsy was not confirmed by surgery. Therefore, for confident conclusions, continuous follow-ups are required (6, 18, 19).

In conclusion, stereotactic biopsy could not be performed in all of the patients with breast microcalcifications. Nonetheless, the 11-G Mammotome stereotactic biopsy has been widely used to detect microcalcifications and is a useful diagnostic tool. The prone method has several shortcomings, such as a higher cost than the upright method and a requirement for a sufficient space to place the prone table and perform the procedure. However, the prone position can offer better support of the breast, reduce the movement of patients during the procedure, allow the patients to feel more comfortable, and reduce complications such as vasovagal syncope. In addition, this position allows the biopsy to be performed using a vertical approach and also from a different direction, such as a lateral approach, thus reducing any limitations due to breast size. We conclude that the lateral approach in prone stereotactic vacuum-assisted breast biopsy improved the success rate of stereotactic biopsy, especially in patients with thin breasts.

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## Lateral Approach for Prone Stereotactic Vacuum-Assisted Breast Biopsy

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