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ORIGINAL ARTICLE **CME**

Stereotactic-guided Vacuum-assisted Breast Biopsy: Safety and Efficacy in the Asian Population

AYH Wan, AYT Lai, SSW Lo, WWC Wong, JLS Khoo

Department of Radiology, Pamela Youde Nethersole Eastern Hospital, Hong Kong

ABSTRACT

Objectives: *Stereotactic-guided vacuum-assisted breast biopsy (VAB) has gained popularity as a minimally invasive technique for the evaluation of non-palpable breast lesions with microcalcifications. Percutaneous VAB device has been shown to have many advantages over conventional percutaneous biopsy methods and is also a recognised method for complete excision of benign breast lesions. However, analytical studies on the utility of VAB in Asian women are relatively rare, who often have smaller or thinner breasts than the western women. Therefore, the aim of this study was to evaluate the safety and efficacy of a 9-gauge VAB system performed in Asian patients in a conventional mammography unit of a regional hospital in Hong Kong.*

Methods: *A retrospective review of 41 consecutive patients who received stereotactic-guided VAB of microcalcifications between September 2008 and April 2013 in a regional hospital was conducted. Data on patients' demographics, pre-procedural mammographic studies graded with reference to the Royal College of Radiologists Breast Group breast imaging classification, biopsy-related technical factors (including the type of needle applied, approach used, and marker deployment), technical success rate, associated complications, and pathological outcomes were evaluated.*

Results: *A total of 41 consecutive patients with 43 lesions were included in the study; two patients had bilateral lesions. The grading of the microcalcifications was as follows: 90.7% (n=39) as indeterminate, 7.0% (n=3) as suspicious of malignancy, and 2.3% (n=1) as highly suspicious of malignancy. The most common location (48.8%) of the microcalcifications was in the upper outer quadrant of the right breast. A needle aperture of 12 mm was used in 25.6% (n=11) of patients, and a needle aperture of 20 mm was employed in the remaining 74.4% (n=32). A lateral-medial approach was used in all but one case (97.7%, n=42); cranial-caudal approach was used in one patient (2.3%). Technical success rate was 100% with microcalcifications present in all post-biopsy specimen radiographs. None of the cases required a repeated biopsy. Most reported complications were minor and included vasovagal syncope (n=1), mild bleeding (n=5), clinically non-significant haematomas (n=3), mild bruising (n=4), and breast induration (n=1). All these were resolved spontaneously without any additional intervention. The VAB histology was benign in 62.8% (n=27) of the lesions; 37.2% (n=16) were malignant or malignancy-associated lesions. The benign microcalcifications were predominantly due to fibrocystic change (n=13) whereas the malignant or malignancy-associated lesions included invasive ductal carcinoma (n=1), ductal carcinoma in situ (n=7), atypical ductal hyperplasia (n=6), atypical lobular hyperplasia (n=1), and atypical columnar cell hyperplasia (n=1). In the majority of the VAB-diagnosed malignant or malignancy-associated lesions that were surgically excised (71.4%, n=5/7), there was concordance between VAB and postoperative histology. The overall underestimation rate was 5.9% (2/34). The underestimation rate for ductal carcinoma in-situ was 14.3% (1/7). Overall, there were seven true-positive cases, no false-positive case, 26 true-negative cases, and one false-negative case. The sensitivity for VAB was calculated to be 87.5%, while the specificity was 100%. The true-positive predictive value was 100% while the negative predictive value was 96.3%. There were 10 patients with previously treated malignant breast disease. Of these, a relatively high proportion (70%, n=7) showed recurrence*

Correspondence: *Dr Alvin YH Wan, Department of Radiology, Pamela Youde Nethersole Eastern Hospital, 3 Lok Man Road, Chai Wan, Hong Kong.*
Tel: (852) 6460 0394; Email: wyh138@ha.org.hk

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of malignant or malignancy-associated pathology — one patient had recurrence at the same site while the remaining patients had recurrent disease in the contralateral breast.

Conclusion: *Stereotactic-guided vacuum-assisted breast biopsy with a 9-gauge biopsy system is a safe and effective method for evaluation of non-palpable breast lesions with microcalcifications on mammography, and is the most reliable alternative to surgical breast biopsy. In particular, a lower threshold to utilise VAB for microcalcification in patients with prior breast disease should be used.*

Key Words: *Biopsy, needle; Breast neoplasms; Calcinosis; Stereotaxic techniques; Vacuum*

中文摘要

立體定位引導真空輔助乳腺活檢：在亞洲人口中的安全性和有效性

尹宇瀚、黎爾德、盧成瑋、黃慧中、邱麗珊

目的：作為一種評估臨床不能觸及並含微小鈣化灶的乳腺病變的微創技術，立體定位引導下真空輔助乳房活檢（VAB）已漸漸普及。與傳統的經皮活檢比較，經皮VAB技術有更多優點；其作為完全切除乳腺良性病變的技術也獲認可。亞洲女性的乳房一般比西方婦女較小、腺體亦較薄。VAB在亞洲女性中的效用分析研究相對較少。本研究旨在評估香港一所分區醫院中常規乳腺鉬靶攝影部利用9G VAB系統對亞洲患者進行活檢的安全性和有效性。

方法：回顧分析2008年9月至2013年4月期間在一所分區醫院因發現乳腺微小鈣化灶而接受立體定位引導下VAB的共41名患者。評估指標包括：患者的人口統計學資料、術前乳腺鉬靶影像分級（依照英國皇家醫學院放射科醫師乳腺組制定的分級標準）、與活檢相關的技術因素（包括應用針的類型、使用方法和標記放置）、技術成功率、併發症和病理結果。

結果：連續41名患者的43個病灶被列入研究範圍；其中兩名患者有雙側病變。針對微小鈣化灶的分級如下：90.7%（39例）屬性質不定、7.0%（3例）屬可疑惡性、2.3%（1例）屬高度可疑惡性。微小鈣化灶的最常見位置是在右乳房上外象限（48.8%）。有25.6%的患者（11例）使用12毫米針芯，其餘74.4%（32例）則使用20毫米針芯。除1例外，所有病例均採用外內位（97.7%，42例）；餘下的1例（2.3%）則採用頭尾位。所有活檢標本X光片呈微小鈣化的徵象，技術成功率達100%。無病例需重複進行活檢。大多數併發症均屬輕微，包括血管迷走性暈厥（1例）、輕微出血（5例）、臨床輕微血腫（3例）、輕度挫傷（4例）和乳房硬結（1例）。所有併發症均自行緩解，無需額外干預治療。VAB組織學發現62.8%（27例）的乳腺病變為良性，另37.2%（16例）為惡性或與惡性腫瘤相關的病變。良性鈣化主要見於纖維囊性改變（13例），而惡性或與惡性相關的病變則包括浸潤性導管癌（1例）、乳腺導管原位癌（7例）、非典型性導管增生（6例）、非典型小葉增生（1例）和非典型柱狀細胞增生（1例）。按VAB診斷為惡性或與惡性相關病變多數經外科手術切除（5/7，71.4%），VAB與術後組織學之間呈一致性。整體低估率為5.9%（2/34）。原位導管癌的低估率為14.3%（1/7）。總體而言，真陽性病例有7個、假陽性病例有0個、真陰性病例有26個、假陰性病例有1個。所以VAB的敏感性為87.5%，特異性為100%。陽性預測值為100%，陰性預測值為96.3%。有10名患者以前曾經接受惡性乳腺疾病的治療，其中有較高的比例（7例，70%）顯示惡性復發或惡性病變相關的病理，1例為原位復發，其餘為對側乳腺復發。

結論：針對臨床不可觸及且鉬靶片上有微小鈣化灶的乳腺病變，利用9G真空探針進行立體定位引導下VAB是安全和有效的，亦是手術乳房活檢一個最可靠的替代法。尤其是對於之前有乳腺病變的患者，因微鈣化灶運用VAB的臨界標準應調低。

INTRODUCTION

Breast tumours rank first in incidence and third as cause of mortality among various malignant diseases in Hong Kong females.[1] Globally, breast carcinoma is the most frequent malignancy among women in terms of incidence and mortality rates in both developed and developing countries.[2] These are detected with increasing frequency by breast screening programmes[3,4] in symptomatic and high-risk patients. Conventional percutaneous biopsy methods such as fine-needle aspiration, core biopsy, or open surgical excision are often used to obtain tissue diagnoses for clinically palpable and imaging-detected lesions. Most are performed by ultrasound guidance, but some mammographic microcalcifications and parenchymal deformities are not detected sonographically. Stereotactic technique is therefore required to biopsy these suspicious lesions.[5]

Stereotactic-guided vacuum-assisted breast biopsy (VAB) has therefore gained popularity as a minimally invasive technique for evaluation of non-palpable breast lesions with microcalcifications. Percutaneous VAB devices have been shown to have many advantages over conventional percutaneous biopsy methods.[6] A larger amount of tissue with multiple contiguous specimens can be obtained with single insertion of a biopsy needle. The higher-quality specimen retrieved reduces rates of false-negative results of cancer detection and rates of histological underestimation.[7-11] VAB is also a recognised method for complete excision of benign breast lesions.[12,13]

However, analytical studies on the utility of VAB in Asian women are relatively rare, who often have smaller or thinner breasts than western women. Therefore, the aim of this study was to evaluate the safety and efficacy of a 9-gauge VAB system performed in Asian patients in a conventional mammography unit of a regional hospital in Hong Kong.

METHODS

A retrospective review of 41 consecutive patients who received stereotactic-guided VAB of microcalcifications between September 2008 and April 2013 in a regional hospital was conducted. Data on patients' demographics, pre-procedural mammographic studies, biopsy-related technical factors (including the type of needle applied, approach used, and marker deployment), technical success rate, associated complications, and pathological outcomes were evaluated.

Patient Demographics

The patient age ranged from 37 to 71 years with a mean age of 52 years. The latent interval between the mammogram examination and VAB ranged from 11 to 213 days, with a mean of 69 days and a median of 57 days. All patients were free from underlying bleeding disorders and were not on antithrombotic therapy.

Pre-procedural Mammographic Data

The pre-procedural mammographic data of all patients with microcalcifications referred for VAB were evaluated. The microcalcifications were graded by using a 5-point scale with reference to the Royal College of Radiologists Breast Group breast imaging classification[14] to indicate the level of suspicion for malignancy and to act as a guide for the need of needle biopsy. Category 1 (normal) or 2 (benign) lesions did not require sampling, while category 3 (indeterminate / probably benign), 4 (suspicious of malignancy), and 5 (highly suspicious of malignancy) lesions required percutaneous needle breast biopsy due to their greater association with malignancy, ranging from 0.5% to 2%, 33% to 50%, and 90%, respectively.[15] Locations of the microcalcifications were also documented.

Biopsy Procedures and Post-procedural Assessment

VAB was performed with a 9-gauge ATEC Breast Biopsy System (Suros Surgical Systems Inc., Indianapolis [IN], USA) [Figure 1] in an upright method, using an add-on stereotactic device attached to a digital mammography unit (Figure 2). Biopsy needles with an aperture of either 20 mm or 12 mm (for thinner breasts) were used. Thin breasts with thickness of less than the combined length of the needle biopsy bevel and the needle tip dead space were rendered not feasible for VAB. The procedures were performed with lateral-medial or cranial-caudal approach depending on the position of the microcalcifications (Figure 3). During the procedure, the breasts were compressed in accordance with patients' endurance to maintain sufficient fixation. Efforts were made to ensure the breast did not move or slip during the procedure. After localisation of the microcalcifications (Figure 4), local superficial and deep anaesthesia was administered by injecting a mixture of 5 ml 2% lignocaine plus 5 ml diluted adrenaline (1 ml [1 in 10 000] adrenaline mixed with 9 ml normal saline) at the site marked by stereotactic guidance. A small skin incision was then made for needle insertion. The biopsy needle was inserted perpendicular to the compression paddle and positioned by stereotactic guidance. A pair

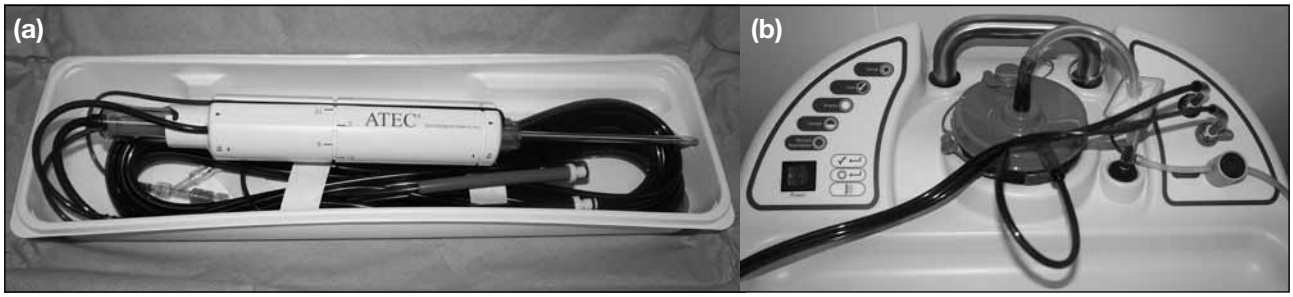

Figure 1. (a) The 9-gauge ATEC Breast Biopsy Needle System. This device is used for stereotactic-guided vacuum-assisted biopsy. (b) The vacuum system. The biopsy needle is connected to a vacuum system to facilitate biopsy of breast tissue. Saline lavage of the breast biopsy cavity is also possible to minimise the risk of haematoma formation.

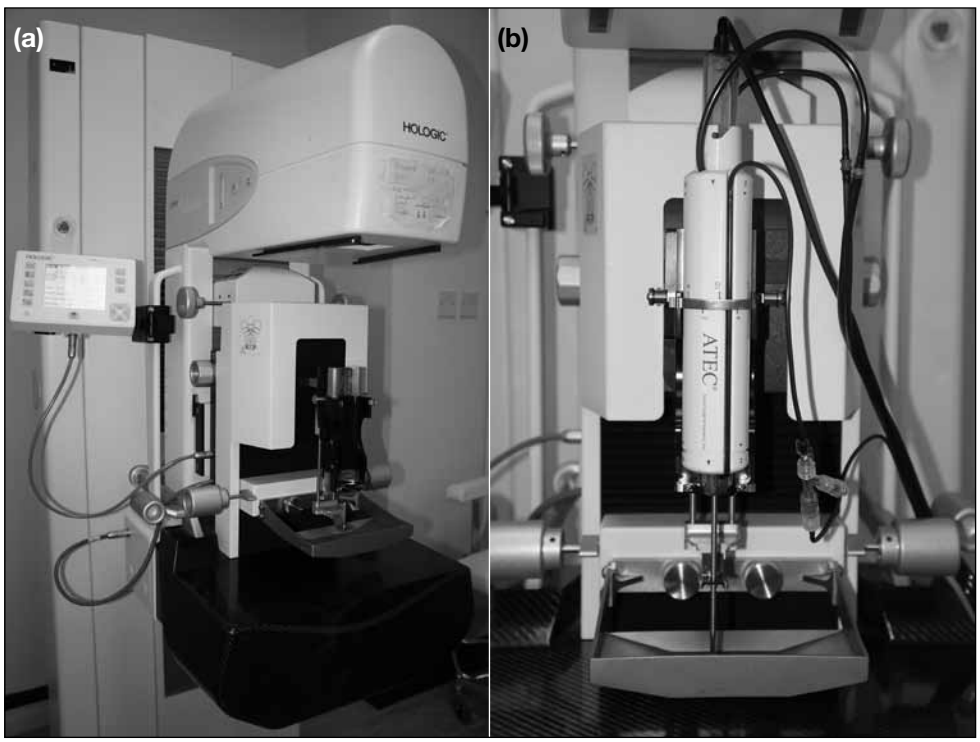

Figure 2. (a) The Hologic digital mammography unit. Vacuum-assisted biopsy is performed with this mammographic unit with an add-on stereotactic device. (b) The Hologic digital mammography unit. The biopsy needle is securely placed within a holder in an upright position for breast biopsy.

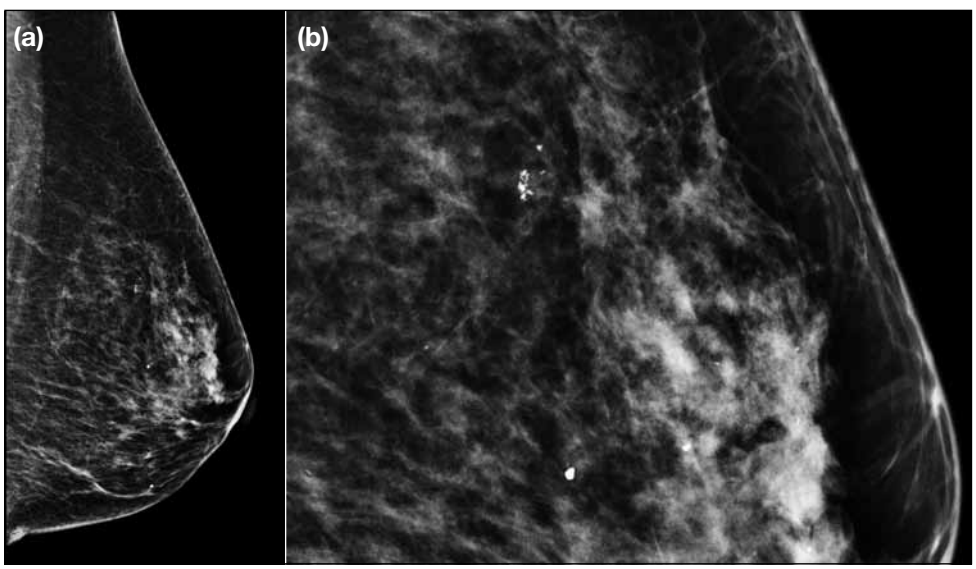

Figure 3. (a) Pre-procedural mammogram. The mammogram is obtained with lateral-medial compression for localisation of the microcalcifications in the breast. (b) Magnification view of the pre-procedural mammogram. It demonstrates the presence of a cluster of indeterminate microcalcifications in the upper portion of left breast in this patient.

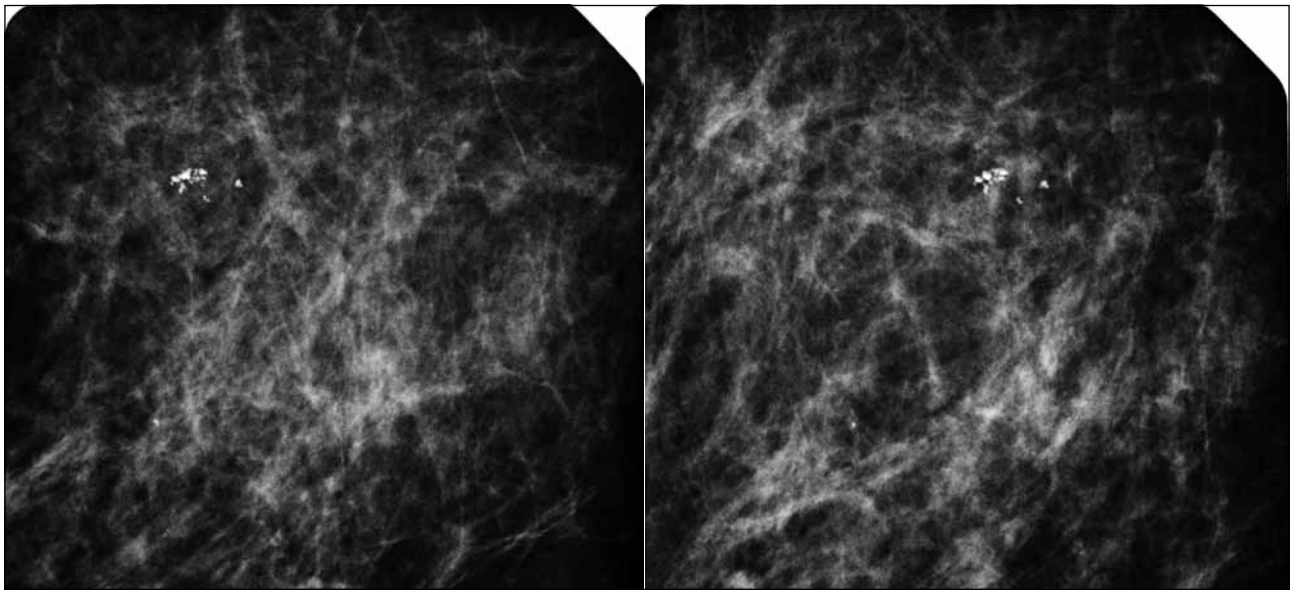

Figure 4. Pair of stereo images. Accurate localisation of the cluster of microcalcifications is performed with the use of stereotactic guidance. The lesion is localised in three dimensions using two angled stereotactic images taken at 15° on either side of the direction of the scout image.

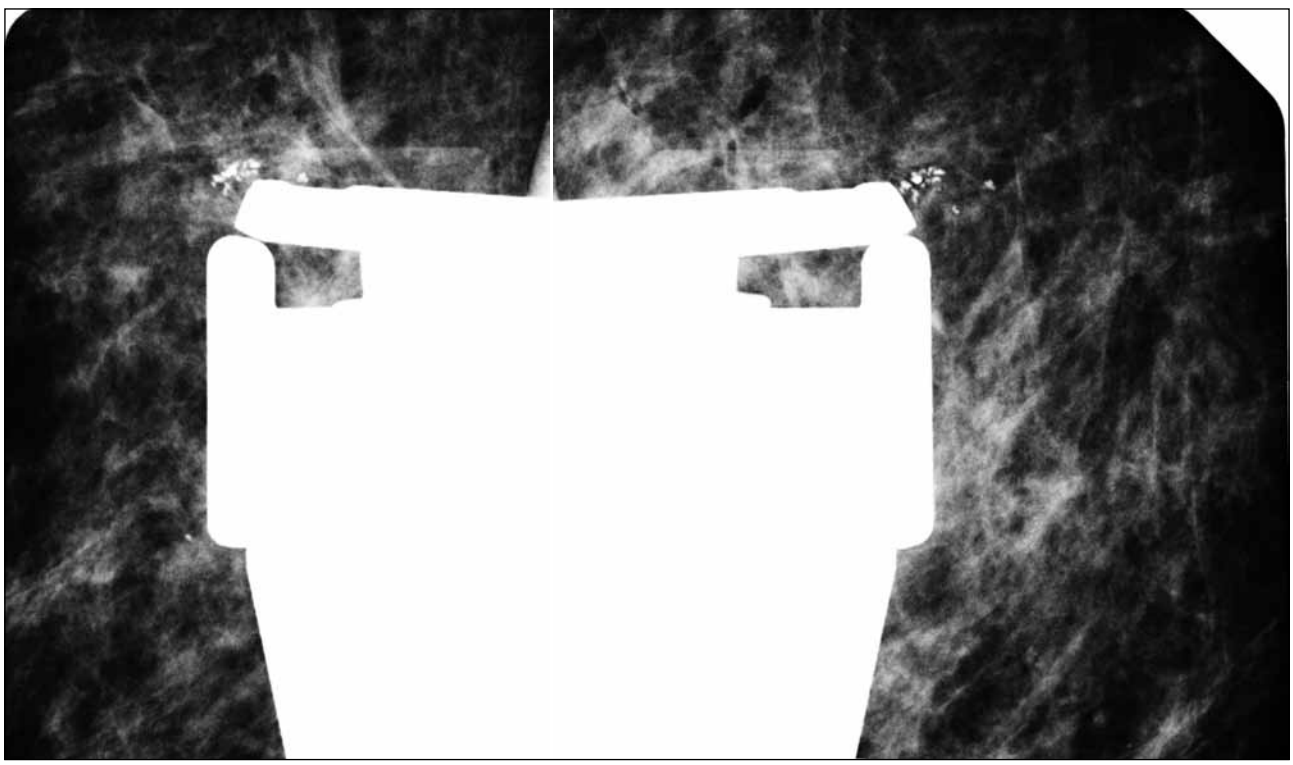

Figure 5. Pair of stereo images. The biopsy needle is inserted perpendicular to the compression paddle and positioned by stereotactic guidance. A pair of stereo images is obtained to ensure satisfactory needle placement.

of stereo images was obtained to ensure satisfactory needle placement (Figure 5). Breast tissue was pulled into the sampling side aperture by vacuum suction and specimens obtained with the application of an inner cutter. Multiple contagious samples could be retrieved with rotation of the biopsy needle in different directions without the need of needle reinsertion. The specimens were subsequently transferred to a collection chamber by vacuum technique. Specimen radiographs were obtained to ascertain the presence of microcalcifications

in the biopsied breast tissues (Figure 6). An inert titanium metallic marker was then deployed into the breast for biopsy-site identification for small lesions and microcalcification clusters that were completely removed (Figure 7). Assessments for removal of microcalcifications, possible haematoma formation, and accurate metallic marker deployment were made in post-procedural mammography. After removal of the biopsy system, localised compression of the breast for 15 to 30 minutes by a dedicated nursing colleague was performed for every patient until the bleeding stopped.

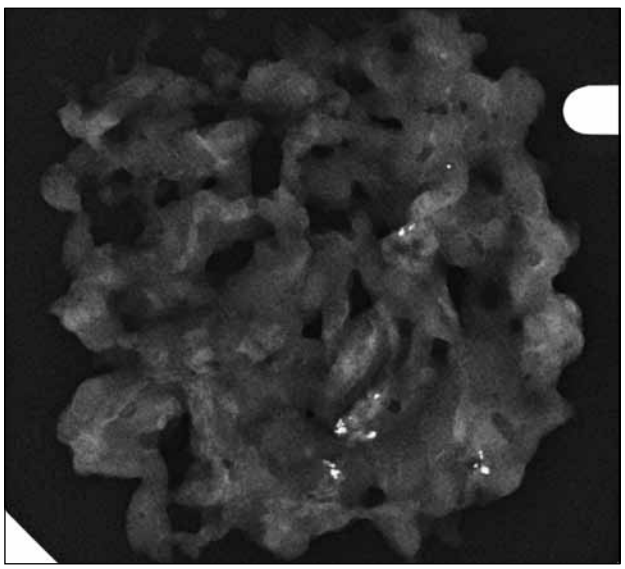

Figure 6. Specimen radiograph. The presence of microcalcifications in the biopsied breast tissue confirms the technical success of the procedure.

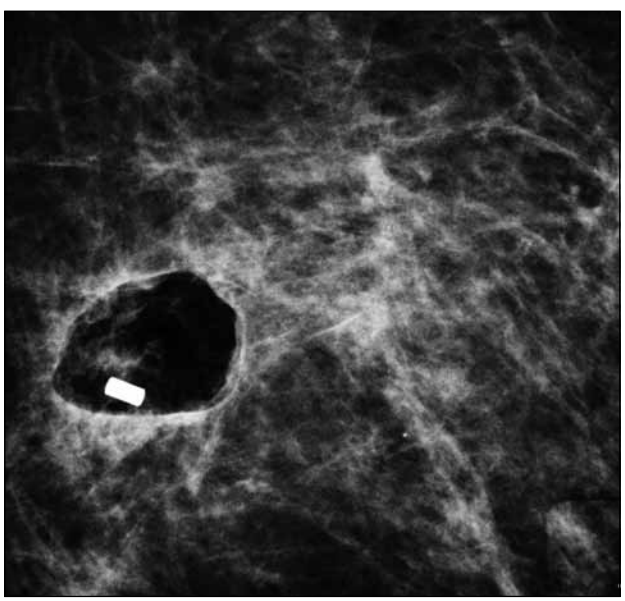

Figure 7. Post-procedural radiograph. An inert titanium metallic marker is deployed into the breast for biopsy-site identification, and the position of the marker was counterchecked in the post-procedural radiograph.

Technical Success

Technical success was defined as the presence of microcalcifications in the specimen radiograph without the need of a repeated biopsy.

Associated Complications

Procedure-related complications were assessed with a systematic checklist by a designated radiologist and nursing colleague. All patients underwent reassessment immediately, after 4 hours, and 1 day after the VAB procedure. Evidence of bleeding, bruising, haematoma formation, induration of breast tissue and systemic symptoms such as vasovagal syncope was documented. Haematomas were classified as non-clinically significant or clinically significant.[16] A non-clinically significant haematoma was defined as an asymptomatic haematoma visible only on mammograms, a mildly tender haematoma with pain well controlled by analgesics (such as paracetamol), and a haematoma that required no additional surgical intervention. A clinically significant haematoma was defined as that which required additional surgical intervention or percutaneous drainage, and which caused severe post-biopsy pain with no response to analgesics.

Pathological Outcomes

All histological results of the VAB were traced and correlated with the mammographic findings. For patients who underwent subsequent surgery, the final surgical histological findings were assessed and compared with the VAB results. Histological underestimate was defined as an upgrade of a malignant pathological VAB finding in subsequent surgical excision. For example, a VAB specimen that yielded ductal carcinoma in-situ (DCIS) but showed the presence of an invasive component in excisional surgical biopsy would be a histological underestimate.

RESULTS

Preprocedural Mammographic Data

A total of 41 consecutive patients with 43 lesions were included in the study, with two patients having bilateral lesions. The grading of the microcalcifications is shown in Table 1, with the majority being graded as indeterminate (90.7%).

The locations of the microcalcifications are shown in

Table 2. Overall, there were two patients with bilateral disease and hence bilateral biopsies: one had bilateral upper outer quadrant lesions, and the other had a right upper outer quadrant lesion and a left subareolar lesion.

Biopsy Procedures

A needle aperture of 12 mm was used in 25.6% (n=11) of the cases, and a needle aperture of 20 mm was employed in the remaining 74.4% (n=32) of patients. The lateral-medial approach was used in all but one case (97.7%, n=42); the cranial-caudal approach was used in one case (2.3%). A metallic marker was deployed in 34 (79.1%) cases.

As microcalcifications were found in all the post-biopsy specimen radiographs and none of the cases required repeated biopsy, the technical success rate rendered was 100%.

Associated Complications

Except for one patient who had vasovagal syncope, none of the patients complained of systemic symptoms during the procedure. Most reported complications were minor and included mild bleeding (n=5), clinically non-significant haematomas (n=3), mild bruising (n=4), and breast induration (n=1); all symptoms were resolved spontaneously. No clinically significant haematoma was noted and no surgical intervention was required for any of the cases.

Histology Results

The VAB histology was benign in 62.8% (n=27) of the cases; 37.2% (n=16) were malignant or malignancy-associated lesions. The benign microcalcifications were predominantly due to fibrocystic change (n=13) and there were various histopathological findings in the malignant or malignancy-associated lesions. Findings are summarised in Table 3.

Correlation of pre-procedural mammographic findings with VAB histology was made and is summarised in Table 4. The histology of the mammographically graded category 5 (highly suspicious of malignancy) lesions showed high-grade DCIS. One of the three lesions mammographically graded as suspicious of malignancy (category 4) showed malignant pathology, which was low-to-intermediate–grade invasive ductal carcinoma. The other two had no malignant features on histopathological examination. Of the 39 lesions mammographically graded as indeterminate (category 3), 14 (35.9%) demonstrated malignant or malignancy-associated pathology, including DCIS (n=6), atypical ductal hyperplasia (n=6), atypical columnar cell

Table 1. Pre-procedural mammographic grading of microcalcifications.

Mammographic grading	No. (%) of lesions
Benign	0
Indeterminate	39 (90.7)
Suspicious	3 (7.0)
Highly suspicious	1 (2.3)

Table 2. Location of the microcalcifications detected on mammography.

Location of lesions	No. (%) of lesions
RUOQ	21 (48.8)*†
RUIQ	2 (4.7)
RLOQ	1 (2.3)
RLIQ	1 (2.3)
Right subareolar	0
LUOQ	10 (23.3)*
LUIQ	2 (4.7)
LLOQ	0
LLIQ	4 (9.3)
Left subareolar	2 (4.7)†

Abbreviations: RUOQ = right upper outer quadrant; RUIQ = right upper inner quadrant; RLOQ = right lower outer quadrant; RLIQ = right lower inner quadrant; LUOQ = left upper outer quadrant; LUIQ = left upper inner quadrant; LLOQ = left lower outer quadrant; LLIQ = left lower inner quadrant.
* One of the patients had bilateral upper outer quadrant lesions.
† One of the patients had right upper outer quadrant lesion and a left subareolar lesion.

Table 3. Histopathological findings of vacuum-assisted breast biopsy.

Histopathological finding	No. (%) of lesions
Malignant or malignancy-associated conditions	16 (37.2)
IDC	1 (2.3)
DCIS	7 (16.3)
ADH	6 (14.0)
ALH	1 (2.3)
ACCH	1 (2.3)
Benign*	27 (62.8)
Fibrocystic change	13 (30.2)
Fibroadenoma	2 (4.7)
Sclerosing adenosis	2 (4.7)
Adenosis	2 (4.7)
Ductal epithelial hyperplasia	2 (4.7)
Epithelial hyperplasia	2 (4.7)
Columnar cell hyperplasia	3 (7.0)
Columnar cell metaplasia	2 (4.7)
Periductal lymphoplasmacytic infiltrate	1 (2.3)

Abbreviations: IDC = invasive ductal carcinoma; DCIS = ductal carcinoma in situ; ADH = atypical ductal hyperplasia; ALH = atypical lobular hyperplasia; ACCH = atypical columnar cell hyperplasia.
* Multiple benign diagnoses are present in seven patients.

hyperplasia (n=1) and atypical lobular cell hyperplasia (n=1). The remaining 25 (64.1%) cases had no malignant pathology.

Seven of the VAB-diagnosed malignant or malignancy-associated lesions were surgically excised. The rest of these patients either defaulted follow-up or refused further surgical intervention and were excluded. Correlation of histology results in excisional biopsies and VAB was conducted (Table 5). In the majority of cases (71.4%), the excisional biopsy results were concordant with VAB histology. A single case was overestimated as invasive ductal carcinoma, with excisional biopsy showing atypical ductal hyperplasia. This could be attributed to the possible complete removal of the components for invasive ductal carcinoma by VAB. One case was underestimated as DCIS, with excisional biopsy showing invasive ductal carcinoma. One patient with VAB pathology of sclerosing adenosis underwent excisional biopsy, with subsequent histopathology showing a phyllodes tumour. Overall, the underestimation rate was 5.9% (n=2/34). The underestimation rate for DCIS was 14.3% (n=1/7).

In summary, there were 7 true positive cases, no false positive case, 26 true negative cases, and 1 false negative case. The sensitivity for VAB was calculated to be 87.5%, while the specificity was 100%. The positive predictive value was 100%, while the negative predictive value was 96.3% (Table 6).

There were 10 patients with previously treated malignant breast disease. A relatively high proportion of these patients (70%, n=7) had recurrence of malignant or malignancy-associated pathology: one patient had recurrence at the same site while the remaining patients had recurrent disease in the contralateral breast (Table 7).

Table 4. Correlation of pre-procedural mammographic findings with vacuum-assisted breast biopsy histopathology.

Mammographic findings	No. (%) of malignant or malignancy-associated lesions
Indeterminate (n = 39)	14 (35.9)
Suspicious (n = 3)	1 (33.3)
Highly suspicious (n = 1)	1 (100)

Table 5. Correlation of histopathology results between excisional biopsies and vacuum-assisted breast biopsy.

Histology finding in surgical specimen	Histology finding in VAB specimen	No. (%) of cases
Correlating with VAB histology		5 (71.4)
High-grade DCIS		3 (42.9)
Intermediate-grade DCIS		2 (28.6)
Overestimated by VAB		1 (14.3)
ADH	IDC	1 (14.3)
Underestimated by VAB		1 (14.3)
IDC	DCIS	1 (14.3)

Abbreviations: ADH = atypical ductal hyperplasia; DCIS = ductal carcinoma in situ; IDC = invasive ductal carcinoma; VAB = vacuum-assisted breast biopsy.

DISCUSSION

Stereotactic-guided VAB has recently evolved as a minimally invasive technique for evaluation of non-palpable breast lesions with microcalcifications.[8,17,18] Stereotaxis utilises co-ordinates defined from oblique radiographs to determine accurate needle placement, which is the basis for stereotactic-guided breast biopsies.[19] The lesion is localised in three dimensions using two angled stereotactic images taken at 15° on either side of the direction of the scout image. The target for accurate needle placement is then calculated by the computer software.[20] The application of vacuum assistance in breast biopsy allows the use of larger gauge probes than conventional core biopsy needles, thus helping to obtain a larger amount of breast tissue for histopathological examination.[19] It involves the incorporation of a vacuum chamber to draw tissue into the cutting needle where the sample is taken. Multiple contagious samples can be retrieved by rotating the biopsy needle in a different direction with a single needle puncture.

Various types of VAB devices are available, each with different strengths and weaknesses.[19] The first VAB device in the market was the Mammotome (Ethicon

Table 6. Summary of sensitivity, specificity, positive predictive value and negative predictive value of vacuum-assisted breast biopsy (VAB).

	Surgically proven malignant lesion	No surgically proven malignant lesion	
VAB-positive for malignant lesion	7	0	Positive predictive value = 100%
VAB-negative for malignant lesion	1	26	Negative predictive value = 96.3%
	Sensitivity = 87.5%	Specificity = 100%	

Table 7. Correlation of vacuum-assisted breast biopsy–diagnosed malignant or malignancy-associated histopathology in patients with prior malignant breast disease.

	Prior malignant breast pathology	Current malignant breast pathology (if any)	No. (%) of cases
Ipsilateral			2 (4.7)
With recurrence			1 (2.3)
	DCIS	DCIS	1 (2.3)
Without recurrence			1 (2.3)
	IDC		1 (2.3)
Contralateral			8 (18.6)
With recurrence			6 (14.0)
	DCIS	DCIS	1 (2.3)
	IDC	DCIS	2 (4.7)
	IDC	ADH	1 (2.3)
	Mucinous carcinoma	ADH	1 (2.3)
	Intraductal papilloma	ADH	1 (2.3)
Without recurrence			2 (4.7)
	Invasive ductal and mucinous carcinoma	Adenosis	1 (2.3)
	IDC	Adenosis and epithelial hyperplasia	1 (2.3)

Abbreviations: ADH = atypical ductal hyperplasia; DCIS = ductal carcinoma in situ; IDC = invasive ductal carcinoma.

Endo-Surgery, Inc., Cincinnati [OH], USA) in 1995. ATEC Breast Biopsy System (Suros Surgical Systems Inc.), which was used in our patients, is a second generation of VAB apparatus that automatically and continuously irrigates the biopsy cavity in a closed system. It can also be set to continuously acquire specimens from pre-programmed positions in the breast. Together with a large needle (9-gauge), this VAB technique can retrieve a larger amount of breast tissue for more extensive sampling and possible complete removal of some clusters of microcalcifications. It has been shown that VAB outperforms biopsy with core biopsy needle in terms of larger specimen size and higher calcification retrieval rate; and lower targeting error, false negative rate, underestimation rate, and the need for re-biopsy or further multi-treatment surgery.[19,21]

The VAB procedure can be performed using an upright-type stereotactic mammography unit or a prone-type biopsy table with similar efficacy and calcium retrieval rates.[22] The upright units modify existing mammographic equipment temporarily and may be used with a special chair that enables the patient to lie flat in the horizontal decubitus position to reduce the rate of vasovagal syncope. For dedicated prone-type stereotactic apparatus, the patient lies face down on the biopsy table and the breast falls through a hole in the table. The breast is then compressed against a mammographic plate with a lateral-medial or cranial-caudal projection depending on the location of the target microcalcifications. The breast tissue can be sampled after the target area is localised with stereotactic guidance.[20] Our technical success rate was 100% with microcalcifications present in all specimen radiographs and no patient required repeated biopsy. In a previously published study, a higher calcification retrieval rate was achievable with the use of larger calibre biopsy needle.[23-25] According to Jackman and Rodriguez-Soto,[24] technical failure of calcification retrieval was noted in 4% of lesions using 14-gauge vacuum biopsy needle, and in only 1% of lesions with the use of 11-gauge vacuum biopsy. These data suggest that 9-gauge biopsy needle may be associated with a higher technical success rate than 11- or 14-gauge needle. In line with this principle, our study found that 9-gauge needle was a satisfactory instrument in VAB to ensure adequate sampling of breast tissue for accurate histological diagnosis.

A high level of concordance between preoperative and surgical diagnoses is important to minimise surgical procedures and avoids misdiagnosis.[26] Among the operated cases for VAB-diagnosed malignant or malignancy-associated lesions in our study, the majority (71.4%, n=5/7) demonstrated concordance between postoperative and VAB histology. The sensitivity, specificity, positive and negative predictive values were shown to be satisfactory in this study, and did not deviate significantly from values reported in other published results.[10,20,22,27-29] Underestimation was observed in only one case which was upgraded from DCIS to invasive carcinoma; this finding is not substantially different

from that in other studies.[20] These data suggest that VAB is an effective means to characterise the nature of lesions for planning further surgical management in patients with breast microcalcifications.

In our study, a relatively high percentage of patients (70%) with prior breast tumour had recurrence of malignant or malignancy-associated pathology. This finding suggests that VAB should be performed at a lower threshold for microcalcifications in patients with prior history of malignant breast disease, disregarding the site of the microcalcifications (ipsilateral or contralateral breast).

Complication rates reported in previously published studies were low, and included vasovagal reactions, mild bruising, haematoma, and abscess formation.[19,22] The rate of requirement for surgical drainage of a haematoma or abscess was around 0.1%.[23,30] A large centre review indicated that only 0.17% of patients developed mastitis requiring antibiotics.[31] Our study showed that VAB was a safe procedure with no clinically significant haematoma formation or substantial complication in any patient. This was in concordance with published reports concerning the risk of haematoma formation during core needle biopsy of the breast.[16,32,33] The vacuum applied throughout the procedure was useful for suction of blood out of the biopsy cavity to decrease haematoma formation.[20] For non-clinically significant haematoma, supportive therapeutic measures with pressure bandage, ice packs, simple analgesia with paracetamol, and short-term clinical follow-up are often all that are necessary.[16] Our routine reassessment 4 hours and 1 day after the biopsy procedure served as a satisfactory survey of complications. No patient reported having significant complications after the reassessment.

There were several limitations to this study. As a retrospective study, it had its inherent limitations. The sample size was relatively small and the study was performed at a single institution by a selected group of breast radiologists; thus, the results might not be readily generalised to other practices. A longer follow-up period for benign cases was also desirable to obtain a higher accuracy of false-negative rate. Nevertheless, this study served the purpose of a pilot study in evaluating the safety and efficacy of VAB, and larger-scale studies involving a bigger sample or multicentre evaluation would be useful for further assessment of VAB procedures.

CONCLUSION

Stereotactic-guided VAB with a 9-gauge biopsy system is a safe and effective method for evaluation of non-palpable breast lesions with microcalcifications on mammography. The procedure is the most reliable alternative to surgical breast biopsy. In particular, VAB should be performed at a lower threshold for microcalcifications in patients with prior history of malignant breast disease.

DECLARATION

No conflict of interests were declared by the authors.

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