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## Prone table stereotactic breast biopsy

### 俯臥式乳房活組織立體定位檢查法

The prone table machine is a mammographic X-ray system specially designed for use in the stereotactic localisation of breast abnormality. In this study, its clinical usefulness was investigated in terms of duration, success rate, complications, and patients' acceptance of the procedure. During a 5-month period, 79 patients attended the Kwong Wah Hospital for stereotactic-guided biopsy on the prone table. Eighty-one lesions were assessed—seven by fine needle aspirations, 67 by large-core needle biopsies, and seven by vacuum-assisted biopsies. Most of the biopsies were done because of clustered microcalcifications (77.8%) and the majority were of mammographically indeterminate nature (58.0%). The mean duration of the procedure was 49 minutes. A high degree of acceptance was experienced by patients. Only one patient had persistent haemorrhage after the biopsy. In conclusion, the prone table machine was considered to be useful and efficient, and had a high degree of acceptance among patients.

俯臥機是一個乳房X射線照相系統，專門利用立體定位的方法找出乳房變異組織的正確位置。我們量度不同的參數，如過程所需的時間、成功率、併發症的出現、以及病人的接受程度，來研究此系統的臨床效用。在5個月內，79名病人在廣華醫院曾接受使用此系統作乳房活組織檢查，發現81個個案有損害的組織：其中7例使用幼針抽吸術，67例使用大芯針活組織檢查，另外7例使用真空輔助活組織檢查。大多數檢查的原因是由於發現病人乳房有成群的鈣化組織(77.8%)，並且這些組織大多數不能用一般乳房X射線辨別(58.0%)。檢查過程平均需時49分鐘。病人均對這種檢查的接受程度很高；只有一名病人在活組織檢查後出現持續出血。我們因此認為利用俯臥機檢查乳房活組織是一種既有效用，又有效率的方法，且被病人高度接受。

#### Key words:

Biopsy;  
 Breast neoplasms;  
 Mammography;  
 Stereotaxic techniques, instrumentation

#### 關鍵詞：

活組織檢查；  
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#### Introduction

Coincident with the introduction of screening mammography, there has been a shift in the presentation of breast cancer towards earlier stage disease. As a result, more patients present with non-palpable lesions. Although mammography is sensitive for the detection of breast abnormalities, benign lesions cannot always be distinguished from malignancy and the specificity of mammography for malignant lesions remains low. Biopsy is required to determine the exact nature of these abnormalities. In the past, this was mainly done by surgical biopsy. In recent years, however, percutaneous image-guided breast biopsy, either using stereotactic or ultrasound guidance, has been increasingly used as an alternative technique for the assessment of non-palpable breast lesions.<sup>1,2</sup> For lesions that cannot be clearly visualised by ultrasound, stereotactic-guided biopsy is used.<sup>3,4</sup> Stereotactic-guided biopsy has two basic formats—traditional add-on units and dedicated prone tables.

The prone table machine is a mammographic X-ray system, specially designed for use in the stereotactic localisation of breast abnormality for both surgical and non-surgical breast biopsies. Patients' anxiety and vasovagal reactions may be minimised as the procedure is performed out of the patient's direct sight. Images may be acquired in a short time using the digital spot mammography system. The prone table system has recently been introduced into Hong Kong, with the Kwong Wah Hospital being one of the first Hospital Authority hospitals to install this system. In this study, the clinical usefulness of this system is investigated in terms of the duration,

success rate, complications, and patients' acceptance of the procedure.

### Subjects and methods

From January 2001 to May 2001, seventy-nine consecutive patients were referred to the Department of Radiology, Kwong Wah Hospital, for stereotactic-guided breast biopsy. All patients had mammographically detected and non-palpable lesions. Informed consent was obtained before the procedure. The patients' mammograms were first reviewed to determine the location of the abnormality. Stereotactic biopsy was performed with a dedicated table with digital imaging capabilities (StereoGuide with Digital Spot Mammography; LoRad, Danbury, US) [Fig 1]. The biopsy was performed with the patient in the prone position with the breast extending through a hole in the table for the procedure (Fig 2). The mammographic unit and needle guidance system are located under the table. The breast was then held in compression against the image acquisition device and the biopsy probe was situated between the device and the X-ray table. Compared with the traditional add-on biopsy unit, the prone table system allows lesions to be approached from all directions. A straight tube digital mammogram was then taken to include the lesion within



Fig 1. The LoRad MultiCare Breast Biopsy System



Fig 2. Breast phantom within the compression device and needle in situ

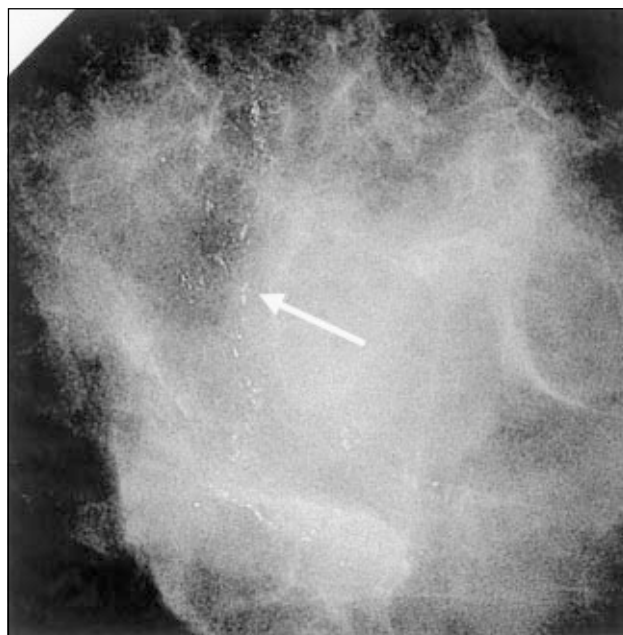


Fig 3. Digital mammogram showing clustered microcalcifications (arrow)

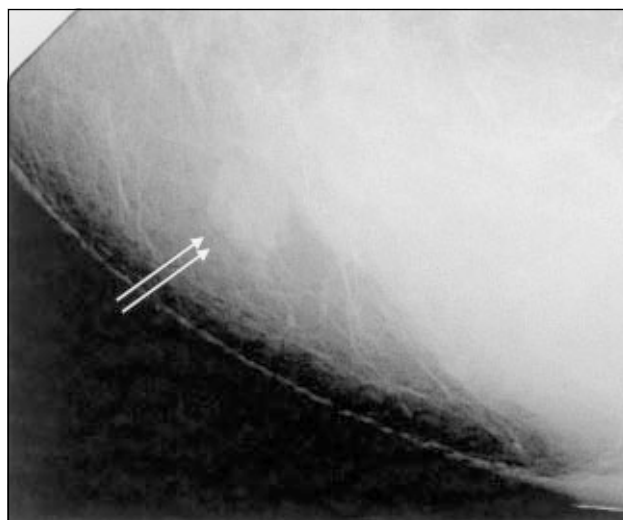


Fig 4. A small lobulated breast mass in digital mammogram (double arrow)

the biopsy window. With the position of the lesion checked, the location of the lesion within the breast was estimated based on the available  $+15^\circ$  and  $-15^\circ$  stereotactic views. Local anaesthesia was given and a small cutaneous incision (5 mm) was made. The stereotactic unit then positioned the biopsy needle within the breast at the calculated coordinates in the horizontal (x) axis, vertical (y) axis, and depth (z) axis from the breast surface. Post-fired stereotactic images were used to ensure that the lesion could be successfully sampled.

A large-core needle (trucut) biopsy was performed for relatively scattered microcalcifications (Fig 3), and multiple microcalcifications were targeted with digital imaging. Specimens were obtained with a 14-gauge long throw needle (22 mm excursion) with a spring-loaded biopsy gun (Manan; Manan Medical Products, Northbrook, US). For lesions less than 2 cm in diameter (Fig 4) and faint, tightly



**Fig 5. Specimen radiograph confirming the presence of calcifications within the breast tissue**

clustered microcalcifications, multidirectional vacuum-assisted (mammotome) biopsy was performed with a 11 G biopsy probe (Mammotone; Biopsys/Ethicon Endo-surgery, Cincinnati, US). Since adequate breast thickness is necessary to accommodate the biopsy probe and its movement if the probe is fired in the breast, for patients with inadequate breast thickness on compression, fine needle aspiration (FNA) biopsy was performed with a 22 G needle (DISP Franseen biopsy needle; Cook, Bloomington, US).

Except for FNA biopsy, specimen radiography was performed for all lesions with calcification since a specific histological diagnosis is more likely to be obtained if calcification is present in the specimen (Fig 5).<sup>5</sup> The duration of the procedure was taken from the positioning of the patient on the prone table to the end of the biopsy.

Suturing was not required to close the wound. Patients were monitored for the development of wound complications. For core biopsy, the biopsy site was manually compressed. A pressure garment was worn for compression after mammotome biopsy. Patients' satisfaction and acceptance of the procedure were assessed on a scale of 1 to 5,<sup>6</sup> with 1 being very dissatisfied and 5 being very satisfied. Pain experienced during the procedure was compared to the pain experienced during previous erect mammogram, needle pricking for blood taking, and freehand- or ultrasound-guided breast biopsy.

## Results

Of the 79 patients referred to the unit during the 5-month period, three (3.8%) procedures were not completed due to a lesion located in the axilla (one patient) and asymmetrical densities (two patients), which cannot be localised by the digital mammographic system. Seventy-six patients with 81 lesions were evaluated. Multicentric lesions were seen in five (6.6%) patients. The patients' ages ranged from 34 to 66 years (median, 49 years).

Lesions identified on mammograms were categorised into five groups according to the mammographic pattern that led to the recommendation for biopsy. These included nine (11.1%) masses, three (3.7%) masses with calcifications, 63 (77.8%) clustered microcalcifications, two (2.5%) focal asymmetries, and four (4.9%) architectural distortions. The radiological grading of the lesions were probable benign lesion for 32 (39.5%), indeterminate lesions for 47 (58.0%), and probable malignant lesions for two (2.5%). For probable benign lesions, patients underwent biopsy because of anxiety or the referring clinician's preference based on clinical grounds. Lesions with suspicious mammographic findings were recommended for surgical excision regardless of the core biopsy result. With the help of a preoperative diagnosis, a two-step surgical procedure for diagnosis and treatment can be avoided. Methods of biopsy were FNA for seven (8.6%) lesions, trucut biopsy for 67 (82.7%), and mammotome for seven (8.6%). The mean duration of the procedure was 49 minutes (range, 30-90 minutes). Specimen radiographs confirmed the presence of calcifications in 77.3% (51/66) of lesions.

There were no major complications such as wound infection or significant haematoma requiring surgical evacuation. One patient had persistent bleeding after the procedure as a blood vessel had been traversed, which was stopped by manual compression. No patient had a vasovagal reaction during the study period.

For the FNA biopsy, there was a relatively high inadequate sampling rate of 42.9% (3/7) and four of the seven lesions were benign. A definitive pathological diagnosis was achieved for 97% of trucut and 100% of mammotome biopsies. For the overall pathological outcome of trucut and mammotome biopsies, a benign diagnosis was obtained for 75.7% (56) and 9.5% (7) of the lesions were malignant (Table). Nine (12.2%) lesions were benign but belonged to certain pathological entities with a high correlation with malignancy, for example, atypical ductal hyperplasia. Therefore, a larger tissue sample, taken by excision, was required for a definitive diagnosis to be made. Inadequate

**Table. Histological diagnoses in trucut and mammotome biopsies**

Histological diagnosis	Cases, n=74 No. (%)
<i>Benign lesions</i>	56 (75.7)
Histologically normal breast tissue with calcifications	11 (14.9)
Fibrocystic changes	41 (55.4)
Foreign body type granuloma	1 (1.4)
Fibroadenoma	3 (4.1)
<i>Benign lesions with a high correlation with malignancy</i>	9 (12.2)
Atypical ductal hyperplasia	6 (8.1)
Papillary lesion	3 (4.1)
<i>Malignant lesions</i>	7 (9.5)
Ductal carcinoma in situ	4 (5.4)
Invasive ductal carcinoma	1 (1.4)
Invasive lobular carcinoma	1 (1.4)
Papillary carcinoma	1 (1.4)
<i>Inadequate material</i>	2 (2.7)

sampling occurred in two (2.7%) lesions. Therefore, the total number of failures including those lesions not localised on mammography was 9.9% (8/81). Surgical excision was performed for 11 patients after trucut and mammotome biopsies at subsequent follow-up in the hospital. A high correlation between the pathological results was observed.

Results of the questionnaire for the procedure are as follows: 0 (0%), 3 (3.9%), 22 (28.9%), 27 (35.5%), and 24 (31.6%) patients graded their satisfaction of the procedure as grades 1, 2, 3, 4, or 5, respectively. Patients who felt that the pain of the procedure was worse than, similar to, or less severe than erect mammography numbered 7 (9.2%), 13 (17.1%), and 56 (73.7%), respectively. Four patients in the study did not have previous experience of needle pricking for blood taking since a significant proportion of the patients were referred from the Well Women Clinic and were previously healthy. Patients who felt that the pain of the procedure was worse than, similar to, or less severe than needle pricking numbered 15 (19.7%), 31 (40.8%), and 26 (34.2%), respectively. Only 19 (25%) patients gave a history of prior freehand- or ultrasound-guided breast biopsy. Patients who felt that the pain of the procedure was worse than, similar to, or less severe than previous freehand- or ultrasound-guided breast biopsy numbered 4 (5.3%), 4 (5.3%), and 11 (14.5%), respectively.

## Discussion

Percutaneous image-guided breast biopsy is less invasive than surgical biopsy and has been shown to have accuracy similar to needle-guided excisional biopsy.<sup>3,4,7,8</sup> Due to sampling error, it is unlikely that the accuracy of needle biopsy will achieve that of excisional biopsy after needle localisation. Excisional biopsy, however, is physically and psychologically traumatic as well as expensive. Since a substantial majority of questionable lesions detected by mammogram are benign, excisional biopsy performed for all lesions would result in much potential deformity and psychological trauma for patients. Percutaneous breast biopsy may spare many of these patients having to undergo a more invasive procedure, with the resultant scarring. Moreover, due to the reduced invasiveness and the potential to decrease costs, percutaneous breast biopsy is likely to become increasingly popular as an alternative to surgical excision biopsy. The procedure may be performed with minimal patient preparation and finished within a short time. Only a small incision is needed and minimal tissue is removed resulting in no breast deformity and minimal scarring. The biopsy can be done without general anaesthesia or systemic sedation. Patients may return to work immediately afterwards or resume routine activity other than exertional exercise. This procedure can obviate the need for surgery for women with benign lesions and reduces the number of operations for females with breast cancer, all of which results in a less traumatic experience for patients.

Successful lesion targeting is the key to performing stereotactic breast biopsy. Accurate needle placement within

the breast is needed, especially for small lesions as minimal patient motion can compromise the accuracy of needle positioning. The prone table machine with digital imaging capabilities is a dedicated piece of equipment used to improve the accuracy of stereotactic biopsy.<sup>9</sup> This can be achieved in two ways.

Firstly, the biopsy is done under the table on which the patient is lying—she does not witness the procedure as it is being performed. Unlike the traditional add-on biopsy unit, in which the whole biopsy procedure can be visualised by the patient, the prone table serves as a 'barrier' between the patient and the procedure. This can decrease the patient's anxiety and motion during the procedure. Patients are better immobilised during the biopsy than when positioned in an upright unit and vasovagal reactions are rare. Secondly, the image in the prone table stereotactic unit is available as a small field of view (spot) digital image. Although conventional screen film systems are considerably less expensive, a longer procedural time is required. The time for image acquisition may be 3 to 5 minutes with the film cassette system but is less than 20 seconds for digital imaging. Therefore, compared with the conventional screen-film technique, digital mammography is fast and patients' movements can be minimised. This further increases the likelihood of success.

The use of the prone table is feasible for the majority of patients. With breast biopsy, there is a risk of hitting the breast platform with the tip of the needle in a breast of less than 3 cm in thickness if a long throw needle with a spring-loaded biopsy gun is used. This is a major concern for the local population because the sizes of breasts of oriental women are, in general, smaller than those of Caucasians. This study shows that there is no difficulty in applying this technique to our patients. Stereotactic biopsy on the prone table is relatively contraindicated for lesions located near the axilla as the positioning of the lesion within the biopsy window would be difficult. With the use of the arm-through-the-hole technique, biopsy of these lesions is now feasible. Visualisation of the lesion can also affect the success of lesion targeting and asymmetrical density seen in conventional mammogram may be difficult to visualise with the digital mammographic system with 8-bit grey-scale. Lesions detected by conventional mammogram may be distorted using the digital system and will be difficult to localise due to the intrinsic inferior image quality. Difficulty may also be encountered when trying to identify the same microcalcifications in two stereotactic views. This is especially true if the microcalcifications are small and only faintly calcified.

The preliminary data from this study demonstrate that the procedure is well accepted by patients and is not painful when compared with erect table mammogram, needle pricking for blood taking, and freehand- or ultrasound-guided breast biopsy. Complications are unusual. Only one patient had persistent bleeding after the biopsy, which was stopped

by manual compression. There were no major complications such as wound infection or significant haematoma requiring surgical evacuation. The most common complaints after the procedure were transient neck pain and numbness over the body. Because of the relative lack of pain complications, patients are more comfortable in accepting this management plan and are more compliant with the follow-up protocol.

The management decision after needle biopsy should not be based on the biopsy results alone but rather on the biopsy results in conjunction with clinical and mammographic findings. A repeat biopsy is warranted if histological findings and imaging findings are discordant. If needle biopsy is to substitute for excisional biopsy after localisation, women should be informed of the lower accuracy of the needle biopsy. Follow-up can be offered if the needle biopsy yields benign findings concordant with imaging characteristics.

The main disadvantage is the expense of this equipment. The traditional add-on unit is designed to attach onto a mammogram machine to convert it into a biopsy guidance system. This can be removed at the end of the procedure and the room and mammographic unit are again available for non-interventional imaging. Although dedicated prone tables are considerably more expensive than upright units, this study showed that the procedure can be accomplished within a relatively short period of time. More patients can be assessed within the same time, making this a more cost-effective use of manpower and hence has a potential for cost saving.

## Conclusions

The prone table machine is a minimally invasive image-guided breast biopsy system that is well accepted by patients. It can provide specimens that are as reliable as open surgical specimens. Even with its limitations, the procedure is easy to perform and highly accurate in experienced hands. It is expected that open surgical biopsy will be replaced by image-guided breast biopsy.

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