The purpose of this study is to report ultrasonographic findings and ultrasonographically guided core needle biopsy in the clinical setting of palpable breast cancers without visible mass on mammograms. Lymph node status and cancer size are discussed.

Twenty-eight surgically proved cases of palpable breast cancers without any mammographically visible mass were enrolled. All the patients underwent preoperative sonography and ultrasonographically guided core needle biopsy. Mammograms and sonograms were reviewed. The efficacy of ultrasonographically guided core needle biopsy and the correlation of ultrasonographic features with surgical histopathological diagnoses, lymph node status and cancer size were analyzed.

On sonograms of our 28 cases, the outline of the lesion was circumscribed in 16 cases, irregular in 6, and indistinct in the other 6. All our two cases of atypical ductal hyperplasia and 6 of the 14 cases of ductal carcinoma in situ (28%) were histologically undergraded with ultrasonographically guided core needle biopsy and subsequently turned out to be ductal carcinoma in situ and invasive ductal carcinoma, respectively, after surgery. No clinical management was delayed. The sonographic features were not a significant predictor of the pathological subtypes of ductal cancer and lymph node status. The cancer sizes on sonogram were moderately correlated ($r = 0.555$, p-value = 0.002) by Pearson correlation.

In the clinical setting of palpable cancers, ultrasonography enabled us to detect mammographically occult masses and effectively obtain core tissue for pre-operative diagnosis. US measurement of cancer size was moderately reliable as correlating with surgical specimens.

Key words: Breast neoplasms, biopsy; Breast neoplasms, diagnosis; Breast neoplasms, Localization Ultrasound, guidance

Palpable breast cancers with false negative results on mammograms have been reported, occurring in 16.5% of diagnosed breast cancers [1]. Usefulness of adjuvant ultrasonography (US) to evaluate the palpable breast masses in patients without corresponding mammographic abnormality has been documented, with cancer detection rate of approximately 84% [2]. This implies that breast cancers may escape detection with the mammographic findings of normal or seemingly benign abnormalities. Evaluation with US is thus essential to avoid the overlook of lesion in cases of palpable breast cancer without obvious mass on mammograms. Moss et al. also reported that US increased cancer detection by 14% in symptomatic patients who were evaluated with both mammography and US [3]. However, about 4% of palpable breast cancers appeared normal, benign or nonspecific on both mammography and US [4]. We believe that familiarity of the US features of such breast cancers and subsequently with US-guided core needle biopsy can benefit further management. We also postulate that understanding the correlation of US features to lymph node status and cancer size will help the treatment planning.
For these purposes, retrospective ultrasonographic study of palpable breast cancers with mammographically occult mass was undertaken and discussed.

**METHODS AND MATERIALS**

Reviewing the records of US examinations from January 2001 to December 2002 in our department, 590 US-guided core needle biopsies were performed and 212 breast cancers were finally proved by surgery. Among them, palpable breast cancers that had been reported as normal or having no visible mass on mammograms were enrolled in this study. All the patients were referred from the outpatient department for imaging evaluation. Conventional examinations consisted of mammography (Lorad, Danbury, CT) with film-screening technique including craniocaudal and mediolateral oblique projections and US (Elegra, Siemens, Issaquah, WA) with a 5–9-MHz broadband linear-array transducer on bilateral whole breasts. The corresponding areas of the palpable masses were carefully evaluated. For cases with US-detectable masses, US-guided core needle biopsy was subsequently done with an automatic powerful spring-loaded biopsy gun (magnum; C. R. Bard, Covington, GA), and an 18- or 16-gauge cutting biopsy needle (C. R. Bard) with a 22-mm ‘throw’. The entire procedure of US-guided core needle biopsy was confirmed with the biopsy needle passing through the targets on the longitudinal and axial cross views. The procedure was terminated after obtaining at least two confirmed biopsies with adequate specimens. The specimens were then stored in formalin solution and were sent for histopathological analysis. The US examination and US-guided core needle biopsy were carried out in the same session. All the subjects in this study finally received surgery.

**RESULTS**

Twenty-eight women, ages ranged from 30 to 60 years (mean 46.75 years) with palpable breast masses, with 14 cases in the right side and 14 cases in the left side were evaluated. After getting the informed consents, US-guided core needle biopsy using the 18-gauge needles in 11 patients and the 16-gauge needles in the other 17 patients was performed. The number of fires ranged from 2 to 5 (mean= 2.75 per case). Such biopsy procedure yielded atypical ductal hyperplasia (ADH) in 2 patients, ductal carcinoma in situ (DCIS) in 14 and invasive ductal carcinoma (IDC) in 12. Seventeen patients finally received modified radical mastectomy, while 11 had partial mastectomy. Surgical lymph node staging was also performed in all our patients. The final diagnoses based on surgery were DCIS in 10 patients and IDC in the other 18. Seven of the 28 patients had axillary lymph node metastasis.

Our results showed that 26 of 28 cancers (93%) were correctly diagnosed by US-guided core needle biopsy. All the two cases of ADH diagnosed with US-guided core needle biopsy were finally upgraded to DCIS after surgery. The discordant percentage for cancer was 7%. In addition, 6 of 14 DCIS (43%) diagnosed with core needle biopsy were upgraded to IDC after surgery. The overall undergrade rate of core needle biopsy for cancer was 28% (8 of 28 cancers). However, none of our cases was delayed in treatment decision on clinical practice. The diagnoses are summarized in Table 1.

**Mammographic and US findings**

Regarding the Breast Imaging Reporting and Data System (BI-RADS), dense breasts (breast density categories 3 and 4) were noted in our 16 patients and fibroglandular breasts (breast density category 2) were noted in the other 12. Based on our classification of mammographically occult mass, negative finding was found in 8 patients, suspicious increased density in 7, and isolated microcalcification in the other 13. No tumor mass was reported on the mammograms. In those cases with isolated microcalcifications, core needle biopsy was performed under the guidance of US instead of stereotaxis, because the involved breasts were too small or the targeted microcalcifications were too superficially located.
US revealed circumscribed mass (Fig. 1) in 16 patients, irregular mass (Fig. 2) in 6, and mass with indistinct outline (Fig. 3) in 6. Comparing to the adjacent breast tissues, 25 lesions were hypoechoic and the other 3 were inhomogeneous mixed hyper- and hypoechoic lesions with poorly defined borders.

Of the 10 cases of surgical proved DCIS, the outline of the lesions was circumscribed in 6 and

**Figure 1.** A 48-year-old woman. a. Mammogram of right breast (mediolateral oblique view) shows homogenous dense breast. No obvious mass was observed. b. US over the palpable breast mass shows a circumscribed mass with homogenous internal echo. Finally, US-guided core needle biopsy and surgery concordantly proved the mass to be DCIS.

**Figure 2.** A 40-year-old woman. a. Mammogram of right breast (mediolateral projection) shows regionally distributed granular and pleomorphic microcalcifications. b. US over the area of breast microcalcification displayed a small hypoechoic mass (0.6 cm in greatest diameter) with an irregular outline. The mass was diagnosed as ADH by US-guided core needle biopsy and finally as DCIS by surgery. The cancer size was underestimated compared to histology.
irregular in 4. Of the 18 cases of surgical proved IDC, the outline of the lesions was circumscribed in 10, irregular in 2, and indistinct in 6. Posterior acoustic phenomena were shown in 7 cases, in which 2 cases (1 DCIS, 1 IDC) exhibited enhancement and the other 5 (3 DCIS, 2 IDC) exhibited shadowing. Dilated duct with obliteration (Fig. 4) was observed in 2 cases. US displayed microcalcifications in six (46%) of the 13 cancers presenting with isolated mammographic microcalcifications on mammograms. The outline of the lesion on sonogram was not a significant discriminator for DCIS and IDC, even though the p-value was close to the threshold (Table 2).

**US findings correlating with lymph node status and gross cancer size**

Statistically, the US outline feature of cancers was not a significant predictor for lymph node metastasis (Table 2). However, the cancer sizes measured by US and on surgical specimens were moderately correlated by Pearson correlation coefficient ($r = 0.555$ and p-value $= 0.002$) (Fig. 5).

In our series, the size of the lesions measured at their greatest diameters ranged from 0.6 cm to 4 cm (average size: 1.48 cm) on US, but from 0.6 cm to 8 cm (average size: 1.93 cm) on surgical specimens. The average underestimated size was 0.45 cm in greatest diameter. From the correlation graph (Fig. 5), the cancer size was underestimated in 6 cases (2 with circumscribed outline; 4, indistinct) and was overestimated in 2 (2, indistinct). Correlating with the mammographic findings, the 6 cancers with underestimated size exhibited suspicious increased density (2 cases) or isolated microcalcifications (4 cases) while the 2 cancers with overestimated size exhibited suspicious increased density.
US evaluation of clinically palpable breast abnormalities has been published with excellent demonstration of the ultrasonographical characteristics [5,6,7]. Not only for tissue differentiation, US is also complementary to mammography in many clinical aspects, including the detection of mammographically occult cancer, detailed evaluation of suspicious breast abnormalities, better demonstration of palpable breast masses, and guidance of percutaneous core needle biopsy.

The sensitivity of mammography in detecting breast cancer varies among ages, with 70% in women of 31 to 40 year-old and up to 91% in those over 60 years old [1]. It seems that the rate of mammographically occult breast cancers would be higher in the younger population, relating to their denser breasts or abundant fibroglandular tissues. With the superiority of US over mammography for identifying those obscured lesions amidst dense breast tissues, the combined use of both mammography and US to evaluate a palpable breast mass led to a high negative predictive value (99.8%) [8]. However, negative findings in both mammogram and US in patients with a palpable mass cannot completely exclude the presence of breast cancer, even though the likelihood was low (approximately 2.7%) [9]. In certain cases for whom mammograms only manifest with isolated microcalcification, US may discover small occult cancers [10,11]. The smallest size of occult cancer displayed in our series was 0.6 cm in its greatest diameter. In those patients with breast microcalcifications who did not receive stereotactic core needle biopsy, US evaluation with US-guided core needle biopsy is an alternative way to get the tissue diagnosis [11,12].

When a breast mass is identified, US features can help differentiate benignity from malignancy in most cases [13]. However, a breast cancer and a benign breast mass sometimes have overlapped US features. The development of percutaneous needle biopsy and a real-time US-guiding technique, in such condition, help in the preoperative tissue diagnosis of a breast mass. US-guided core needle biopsy can be effectively achieved with high concordance to those by surgical biopsy[14], thus, certain unnecessary surgical biopsies can be obviated [15,16,17]. Although 2 cases of DCIS were histological undergraded as ADH by core needle biopsy, clinical management was not confused due to the well recognition of the wide pathological borderline between ADH and DCIS. US-guided core needle biopsy is still helpful in the clinical management of breast cancers. With the agreements from patients, US-guided core needle biopsy can be carried out in the same session of US examination.

Conservative mastectomy, a feasible operative method to preserve large part of normal breast tissue, is widely used in clinical practice. Accurate preoperative measurement of cancer size and extension is thus essential for treatment planning and cancer staging. It has been documented that the size of breast cancer measured by US was closely correlated to that on the surgical specimen [18,19], especially for those solitary cancers less than 20 mm without an extensive intraductal component [17]. In our series, the correlation of cancer sizes on US with surgical specimens were statistically significant. However, in some of our cases, US could not map the exact cancer extension, either in infiltrative form or intraductal spreading.

### DISCUSSION

US evaluation of clinically palpable breast abnormalities has been published with excellent demonstration of the ultrasonographical characteristics [5,6,7]. Not only for tissue differentiation, US is also complementary to mammography in many clinical aspects, including the detection of mammographically occult cancer, detailed evaluation of suspicious breast abnormalities, better demonstration of palpable breast masses, and guidance of percutaneous core needle biopsy.

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leading to underestimation or overestimation of the cancer size. On the other hand, the mass lesion demonstrated on sonography may represent the higher-grade component of the tumor (e.g. invasive component in a large area of DCIS) [20]. Thus, the study of breast cancer extension by various imaging modalities should be prospectively carried out with larger number of cases from multiple centers. Nevertheless, pre-operative assessment of cancer size by US is reliable in most cases.

**CONCLUSION**

In the clinical setting of palpable breast cancers, US can detect mammographically occult masses, and US-guided core needle biopsy can effectively obtain the histologic diagnosis. US assessment of cancer size is statistically reliable in this clinical setting.

**REFERENCES**

臨床上可觸診但乳房攝影未見腫瘤之乳癌：
其超音波表現及超音波引導粗針生検之結果

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本研究之目的，在研究臨床上可觸診但乳房攝影未見之乳癌，其超音波表現及超音波引導
粗針生検之結果。同時討論其超音波特徵與淋巴結狀態與腫瘤大小之相關。

本研究針對28位經手術證實，臨床上可觸診但乳房攝影未見腫瘤之乳癌病例，施行超音波
檢查及超音波引導粗針生検。我們回顧其乳房攝影及超音波影像，並分析超音波引導粗針生検
成效，比較超音波特徵與組織學證實之淋巴結狀態與腫瘤大小之相關。

在本研究的28名病例中，病灶邊緣完整有16例，邊緣不規則有6例，邊緣模糊有6例。有
2例術前粗針生検結果為異常變化，有6例術前粗針生検結果為原位癌的病灶，術後診斷分別
為原位癌及侵犯性癌。但是沒有任何臨床治療上的延誤發生。超音波表徵尚無法預測淋巴結狀
態。以皮爾森檢查相關檢定，超音波及病理下的乳癌大小具中度相關。

臨床上可觸診但乳房攝影未見之乳癌，超音波可以用來偵測病灶，引導施行粗針生検，以
作為術前診斷之依據。以超音波測量術前乳癌病灶大小具有中度可信度。

關鍵詞：診斷；乳癌；針生検；超音波