US of Mammographically Detected Clustered Microcalcifications

**Purpose:** To determine whether ultrasonography (US) can depict breast masses associated with mammographically detected clustered microcalcifications and whether the visibility at US is different between benign and malignant lesions.

**Materials and Methods:** Ninety-four patients with 100 mammographically detected microcalcification clusters prospectively underwent US with a 10- or 12-MHz transducer before mammographically guided presurgical hook-wire localization. The visibility of breast masses at US was correlated with histologic and mammographic findings.

**Results:** Surgical biopsy revealed 62 benign lesions, 30 intraductal cancers, and eight invasive cancers. At US, breast masses associated with microcalcifications were seen in 45 (45%) of 100 cases. US depicted more breast masses associated with malignant (31 [82%] of 38) than with benign (14 [23%] of 62) microcalcifications ($P < .001$). In malignant microcalcification clusters larger than 10 mm, US depicted associated breast masses in all 25 cases. There was no statistically significant difference in shape and distribution of calcific particles, as well as in breast composition, at mammography between US visible and invisible groups.

**Conclusion:** Given a known mammographic location, US with a high-frequency transducer can depict breast masses associated with malignant microcalcifications, particularly clusters larger than 10 mm. US can be used to visualize large clusters of microcalcifications that have a very high suspicion of malignancy.

Clustered microcalcifications may be the only detectable manifestation of early breast cancer. Mammography is very sensitive in the detection of microcalcifications, but because benign calcifications cannot always be distinguished from those indicating malignancy, the specificity of mammography remains low. Only 20%-35% of the cases will prove to be cancerous after hook-wire-guided surgical biopsy (1–3). Currently, to our knowledge, no imaging modalities other than mammography have an accepted role in the detection and characterization of microcalcifications (4,5).

The advances in ultrasonographic (US) equipment and the refinement of breast imaging techniques enable radiologists to detect and characterize small lesions better (6–9) and to provide efficient and economical US guidance for percutaneous procedures (10,11). As practitioners gain hands-on experience using US in patients with nonpalpable lesions, both localization procedures and percutaneous biopsies are being performed with increasing frequency by means of US guidance as opposed to mammographic guidance (11–13). However, the low capability of US to depict microcalcifications remains a major limitation (14,15). Microcalcifications cannot be depicted with US when they are located inside echogenic, fibroglandular breast tissue because of the difficulty in differentiating them from the echogenic interfaces among tissues.

After using a high-frequency transducer, some investigators have reported that US depicted clustered microcalcifications in breast cancers (16–18). Calculifications associated with malignant tumors are more likely to be seen sonographically because most malignant calcifications occur within the masses as opposed to within echogenic breast parenchyma. A hypoechoic background of tumor enhances the ability of US to enable identification of the hyperechoic punctate calcifications. In contrast, benign calcifications, especially in fibrocystic diseases, are less likely to be seen at US because most benign calcifications do
not occur within masses. Those studies were, however, retrospective in nature (16,18) and lacked reproducibility of the findings. In nonpalpable lesions, difficulties also arise in ensuring that a lesion that was visible at US was the same as that seen on the mammograms (13, 18). US demonstration of microcalcifications is considered by many to be unreliable if not impossible.

The objectives of this prospective study were to determine whether (a) US performed with a high-frequency transducer can demonstrate breast masses associated with mammographically detected clustered microcalcifications without mass density and (b) the visibility at US is different between benign and malignant lesions.

**MATERIALS AND METHODS**

Between July 1997 and March 1999, 94 consecutive patients, aged 29–70 years (mean age, 52 years), who had been scheduled to undergo surgical breast biopsy on the basis of clustered microcalcifications detected at mammography underwent US just before and after hook-wire localization. All patients gave full informed consent for the study, which was approved by our institutional review board. These patients represented 99% (94 of 106) of the women eligible for the study during that period. Twelve patients were excluded from the study because of vasovagal reactions during the wire localization in one patient, bleeding after the wire localization in another patient, and previously confirmed malignancy or benignity by means of core needle biopsy in four patients. The final six patients, who had microcalcification clusters in diffuse or regional distributions measuring greater than 4 cm in maximal diameter, were excluded because of the difficulty in the correlation of mammographic, US, and histologic findings. Percutaneous needle biopsy is rarely used for the diagnosis of microcalcifications at our institution.

Mammography was performed by using a conventional screen-film technique and dedicated equipment (Senographe, 600T; GE Medical Systems, Milwaukee, Wis). Routine mediolateral oblique and craniocaudal mammograms were obtained in all patients, and additional spot compression magnification and true lateral images were available in all but two patients. Multicentric lesions were seen in four patients, and bilateral lesions were seen in two patients. Of 100 lesions, 48 lesions were in heterogeneously or extremely dense breasts and 52 lesions were in entirely or predominantly fatty breasts. According to the American College of Radiology (ACR) Breast Imaging Reporting and Data System (BI-RADS) (19), the final assessment was probably benign lesions (category 3) in four cases, suspicious lesions (category 4) in 67 cases, and highly suspicious lesions (category 5) in 29 cases. In four cases of probably benign lesions, the patient underwent biopsy because of patient or referring clinician preference based on clinical grounds (Fig 1).

US examinations were performed by one of two radiologists (W.K.M., J.G.I.) who had at least 3 years experience in breast US. A 10-5–MHz linear-array probe (HDI 3000; Advanced Technology Laboratories, Bothell, Wash) was used in 80 patients (83 lesions) and a 12-5–MHz linear-array probe (HDI 5000; Advanced Technology Laboratories) was used in 14 patients (17 lesions). All US examinations were performed with the patient in the supine position with the arms raised. If necessary, the patient was shifted into an appropriate contralateral posterior oblique position to scan the lateral and inferior parts of the breast. US was focused only on the suspicious area in the breast. Scanning was done in radial and antiradial planes, as well as longitudinal and transverse planes (6). The examination took approximately 18 minutes (range, 10–40 minutes). At US performed after hook-wire localization, a sterile gel (Aquasonic 100; Parker Laboratories, Fairfield, NJ) was used to avoid infection of the wound site. The pre- and postlocalization US examinations were performed by the same radiologist.

In all 100 cases, hook-wire localization was performed by using a fenestrated compression plate and a 21-gauge hook-wire needle (Kopans spring hook localization needle; Cook, Bloomington, Ind). All procedures were carefully done to avoid tissue damage or bleeding in the breast. Final wire placement mammograms in craniocaudal, oblique, and true lateral projections were obtained with a radiopaque marker at the wire entry point on the skin. The localizing wire was placed within 2 mm of the lesions in 89 lesions and within 5 mm in 11 lesions. After placement of the hook wire, the patient moved to the US room for the second US examination. Postlocalization US was performed to confirm that the lesion seen at prelocalization US was correct. In nonpalpable lesions, difficulties can arise in ensuring that a lesion that is visible at US is the same as that seen on the mammograms. US scans obtained after hook-wire localization were not used for image analysis. All patients underwent surgery within 24 hours of the US examinations. Mammography of the specimen was performed in all patients, and microcalcifications were confirmed in all 100 lesions.

The 100 clusters of microcalcifications were categorized into two groups accord-
ing to the visibility at US: sonographically visible lesions and invisible lesions. The lesion was considered to be sonographically visible when a mass with or without sonographically visible microcalcification was definitely seen at the suspicious area determined at mammography and confirmed at US after needle localization. We did not attempt to sonographically identify microcalcifications without an associated US mass.

All mammographic and US images were assessed preoperatively by means of consensus between the two radiologists. At mammography, the size of the calcific cluster was measured at the greatest dimension. The shape and distribution of microcalcifications were described according to the ACR BI-RADS (19). At US, the lesions were described according to size, shape, orientation, echogenicity, echotexture, margin, boundary echo, acoustic transmission, and US evidence of calcifications (6). The US maximum diameter of the mass was defined as the size of the lesion. The shape of masses was classified as round, lobular, or irregular. The orientation of masses was classified as wider than tall or taller than wide according to the anteroposterior to transverse dimension ratio. The echogenicity of masses was compared with that of the subcutaneous fat and classified as hyperechoic, isoechoic, mildly hyperechoic, markedly hypoechoic, or anechoic. The echotexture of masses was classified as homogeneous or heterogeneous. Mass margins were classified as well defined, microlobulated, ill defined, or spiculated. If an echogenic boundary was seen, it was defined as a thin capsule or thick halo. Posterior shadowing or enhancement was considered to be present when an area had relatively less or more through transmission of sound than was present in the surrounding tissue at the same depth. If punctate echogenic dots suggestive of calcifications were seen within the mass, they were reported. The two radiologists who performed the US examinations also correlated US findings with histologic and mammographic findings.

To determine whether the visibility at US is affected by the pathologic condition (benign or malignant disease), breast composition (fatty or dense breast), and/or mammographic findings (size, shape, and distribution of microcalcifications), statistical analysis was performed with a statistical software system (SAS for Windows, version 6.12; SAS Institute, Cary, NC). The Fisher exact test and $\chi^2$ test were used for independent samples, and the Mann-Whitney $U$ test was used for the variables with non-normal distributions. Findings with a $P$ value of less than .05 were considered as statistically significant. By using the presence of the mass at US as the diagnostic criterion for malignancy in ACR BI-RADS category 4 or 5 microcalcifications, a diagnostic accuracy, including sensitivity, specificity, and positive and negative predictive values, was calculated. Because the number of cases in which we used the 12.5-MHz transducer was small, the results of US performed with 10-5–MHz and with 12-5–MHz transducers were reported together.

**RESULTS**

Surgical biopsy revealed 62 benign lesions in 56 patients and 30 intraductal and eight invasive carcinomas in 38 patients (Table 1). All invasive carcinomas were histologically ductal carcinomas and not otherwise specified.

At US, breast masses associated with mammographically detected microcalcifications were seen in 45 (45%) of 100 cases: 23% (14 of 62) in benign and 82% (31 of 38) in malignant microcalcifications, both before and after hook-wire localization. In malignant microcalcification clusters larger than 10 mm, US depicted associated breast masses in all 25 cases (Table 2). The correlations of visibility at US with histologic findings and with mammographic findings are summarized in Tables 1 and 2, respectively. The US findings of 45 masses associated with microcalcifications are summarized in Table 3.

Of 14 benign lesions found at US, 10 lesions were seen as a solid mass and four as a cystic mass. In all four cases of fibroadenoma, US depicted an oval or round, well-defined hypoechoic mass with echogenic dots within the mass that was suggestive of calcifications (Fig 1). In three cases of ductal hyperplasia without atypia and in one case of microcysts, US depicted multiple well-defined cysts, 3–6 mm in size, in the area that corresponded to microcalcifications at mammography. In two cases of atypical ductal hyperplasia, US showed irregular hypoechoic masses without posterior shadowing.

Of 31 malignancies found at US, 23 cases were DCIS and eight cases were infiltrating ductal carcinomas (Table 1). All of the malignant lesions were seen as solid masses with heterogeneous echotexture but with variable findings. At US, a lobular shape ($n = 14$), mild hypoechogenicity ($n = 16$), ill-defined margin ($n = 13$), normal acoustic transmission ($n = 18$), and lack of associated calcifications ($n = 13$) were more commonly seen in DCIS (Fig 2), whereas an irregular shape ($n = 6$) and calcifications within the mass ($n = 7$) were more frequently seen in invasive cancers (Table 3).

US depicted more breast masses associated with malignant microcalcifications than masses associated with benign microcalcifications: 82% (31 of 38) in malignancies and 23% (14 of 62) in benign lesions ($P < .001$). Breast masses associated with microcalcifications were more frequently seen in invasive cancers than in DCIS: 100% (eight of eight) in invasive cancers and 77% (23 of 30) in DCIS ($P < .01$). According to subtypes of DCIS, breast masses associated with microcalcifications were more frequently seen in the comedo type than in the noncomedo type: 81% (13 of 16) in comedo and 71% (10 of 14) in noncomedo DCIS ($P < .05$). According to the breast composition, more masses were visible in the dense

**TABLE 1**

<table>
<thead>
<tr>
<th>Histologic Diagnosis</th>
<th>Visibility at US</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visible ($n = 45$)</td>
<td>Nonvisible ($n = 55$)</td>
<td></td>
</tr>
<tr>
<td>Benign lesions ($n = 62$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microcysts</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Sclerosing adenosis</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Intraductal papilloma</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Ductal hyperplasia without atypia</td>
<td>4</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>Atypical ductal hyperplasia</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fibroadenoma</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Ductal carcinoma in situ ($n = 30$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comedo type</td>
<td>13</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Noncomedo type</td>
<td>10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Infiltrating ductal carcinoma ($n = 8$)</td>
<td>8</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
breast than in the fatty breast—48% (23 of 48) in dense breast and 42% (22 of 52) in fatty breast—but the difference was not statistically significant \( (P > .05) \). According to the mammographic findings, breast masses were more frequently seen in calcific clusters larger than 10 mm than in calcific clusters smaller than 10 mm: 52% (34 of 65) in calcific clusters larger than 10 mm and 31% (11 of 35) in calcific clusters smaller than 10 mm \( (P < .05) \). There was no significant difference in the shape and distribution of calcific particles at mammography between the sonographically visible and invisible groups \( (P > .05) \).

By using the presence of a US mass as the diagnostic criterion for malignancy in ACR BI-RADS category 4 \( (n = 67) \) or 5 \( (n = 29) \) microcalcifications, the sensitivity, specificity, and positive and negative predictive values of US were 82% (31 of 38), 83% (48 of 58), 76% (31 of 41), and 87% (48 of 55). For ACR BI-RADS category 4 \( (n = 40) \) or 5 \( (n = 22) \) lesions larger than 10 mm, the sensitivity, specificity, and positive and negative predictive values of US were 100% (31 of 31), 84% (31 of 37), 81% (25 of 31), and 100% (31 of 31).

### DISCUSSION

Our study results showed that, even with high-frequency transducers, US depicted breast abnormalities associated with microcalcifications in only 45% (45 of 100) of the cases. However, US depicted breast masses associated with malignant microcalcifications in the majority of the cases; breast masses were seen in 82% (31 of 38) of malignant microcalcifications compared with 23% (14 of 62) of benign microcalcifications. In malignant microcalcification clusters larger than 10 mm, US depicted associated breast masses in all 25 cases. In this study, postlocalization US was used to confirm that the lesion seen on the prelocalization US scan was correct.

US is less sensitive for demonstration of microcalcifications than is mammography (20,21). The smaller the calcifications, the lower the sensitivity of US for depicting them. The low capability to visualize microcalcifications remains a major limitation for using US as a screening or diagnostic tool for breast cancers. However, the currently used high-frequency transducers can yield a higher percentage of mammographically visible calcifications than could the previously used lower-frequency transducers (22,23). With use of high-frequency, correctly fo-

### TABLE 2

**Correlation of US Visibility and Mammographic Findings of Mammographically Detected Microcalcifications**

<table>
<thead>
<tr>
<th>Mammmographic Findings</th>
<th>Benign</th>
<th>DCIS*</th>
<th>Invasive Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visible ((n = 14))</td>
<td>Nonvisible ((n = 48))</td>
<td>Visible ((n = 23))</td>
</tr>
<tr>
<td>Overall breast composition</td>
<td>fatty</td>
<td>7</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>dense</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td>Size of calcific cluster (mm)</td>
<td>&lt;10</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>10–19</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>$\geq$20</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>8.9 ± 3.5</td>
<td>10.2 ± 4.6</td>
<td>15.3 ± 4.2</td>
</tr>
<tr>
<td>Shape of microcalcification</td>
<td>round</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>punctate</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>amorphous</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>heterogeneous</td>
<td>8</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>linear branching</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Distribution of microcalcification</td>
<td>clustered</td>
<td>11</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>linear</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>segmental</td>
<td>2</td>
<td>5</td>
</tr>
</tbody>
</table>

* DCIS = ductal carcinoma in situ.
† The size of the calcific cluster was measured at the greatest dimension.

### TABLE 3

**US Findings of Breast Masses Associated with Mammographically Detected Microcalcifications**

<table>
<thead>
<tr>
<th>US Findings</th>
<th>Benign ((n = 14))</th>
<th>DCIS* ((n = 23))</th>
<th>Invasive Cancer ((n = 8))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of mass (mm)</td>
<td>&lt;10</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>10–19</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>$\geq$20</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>11.1 ± 5.0</td>
<td>18.3 ± 5.9</td>
<td>13.6 ± 4.1</td>
</tr>
<tr>
<td>Shape</td>
<td>round</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>lobular</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>irregular</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Orientation</td>
<td>wider than tall</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>taller than wide</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Echogenicity</td>
<td>hyperechoic</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>isoechoic</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>mildly hyperechoic</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>markedly hyperechoic</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>anechoic</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Echotexture</td>
<td>homogeneous</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>heterogeneous</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Margin</td>
<td>well defined</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>microlobulated</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>ill defined</td>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>spiculated</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Boundary echo</td>
<td>thin echogenic capsule</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>thick echogenic halo</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>absent</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>Acoustic transmission</td>
<td>shadowing</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>enhancement</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>normal</td>
<td>11</td>
<td>18</td>
</tr>
<tr>
<td>Calculations</td>
<td>present</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>absent</td>
<td>8</td>
<td>13</td>
</tr>
</tbody>
</table>
and invisible in some malignancies. Malignant disease; calcifications are sono-
used to distinguish between benign and 
of calcifications within a mass cannot be 
the current study. However, the visibility 
than benign calcification was proved in 
malignant cases. The assumption that US 
the mass that were suggestive of calcifi-
mention and a higher frequency transducer 
increase with state-of-the-art US equip-

crisoned 10–12-MHz probes, tiny echogenic 
spots without acoustic shadowing that 
correspond to the mammographic image 
findings can be seen.

According to the results of a phantom 
experiment with a 7.5-MHz transducer, 
US can depict and enable identification 
of minute glass beads even 100 mm in 
diameter, provided they are scattered in 
an ideal hypoechoic area (24). The visu-
alization of typical malignant microcalci-
fications as small as 100–500 \( \mu m \) should 
increase with state-of-the-art US equip-
ment and a higher frequency transducer 
(25). In our study, echogenic dots within 
the mass that were suggestive of calcifi-
cations were seen in 55% (17 of 31) of 
malignant cases. The assumption that US 
will more likely depict malignant rather 
than benign calcification was proved in 
the current study. However, the visibility 
of calcifications within a mass cannot be 
used to distinguish between benign and 
malignant disease; calcifications are sono-
graphically visible in some benign lesions 
and invisible in some malignancies.

The main benefit of identifying a US 
abnormality in women with mammogra-
graphically detected microcalcifications 
is to allow the use of US to guide inter-
ventional procedures, such as needle bi-
opsy and needle localization (18,22). 
However, US cannot be routinely used 
to guide biopsy or needle localization of 
suspicious calcifications because it fails to 
depict the calcifications or an associated 
mass in many cases. Our study results 
showed that the majority of large mali-
gnant clusters of microcalcifications were 
visible at US, whereas small malignant 
clusters or benign clusters of any size 
were frequently invisible at US. There-
fore, it would be reasonable to use US to 
try to visualize large (>10-mm) clusters 
of microcalcifications with a high suspi-
cion of malignancy (estimated likelihood 
of malignancy 75% or higher, using mam-
mographic assessment criteria). US-guided 
procedures are less expensive and faster 
than stereotactically guided procedures 
(11). In addition, for those institutions that 
do not have stereotactic equipment, the 
use of US in selected cases (large-area high-
suspicion microcalcifications) would 
extend the role of percutaneous biopsy at 
these sites.

Common US features of invasive breast 
cancers include irregular shape, taller 
than wide orientation, marked hypo-
echogenicity, heterogeneous echotex-
ture, spiculated margins, and posterior 
aoustic shadowing (6–9,26). Little is 
known about the US features of DCIS be-
cause this entity usually manifests as pure 
mammographic calcifications, which, to 
our knowledge, rarely have been evalu-
ated with US. In our study, a lobular 
shape, mild hypoechogenicity, and nor-
mal acoustic transmission were the most 
common findings of DCIS, and these 
findings are consistent with those of pre-
vious reports about DCIS at US (27,28). 
Similar US findings were also seen in 
some benign lesions, such as sclerosing 
adeno and atypical ductal hyperplasia, 
and were reported in a radial scar (29). 
Therefore, the US findings of DCIS seen 
in our study seem to be nonspecific. Ab-
normal distention of central ducts with-
out an associated mass or intracyctic pap-
illary nodule, which is usually seen in 
patients with a nipple discharge or a pal-
pable mass, was not observed in our se-
ries.

Benign US features were typically seen 
in some fibrocystic lesions and fibroade-
nomas. Multiple small cysts were seen in 
the area that corresponded to microcalci-
fications at mammography in three cases 
of ductal hyperplasia without atypia and 
in one case of microcysts, and a well-
deined ellipsoid mass was seen in all fi-
broadenomas. On mammograms, the mi-
crocalcifications in these cases were of 
low to intermediate suspicion in all cases 
(Fig 1). Whether US can increase the 
specificity of mammography and helps 
to reduce the number of surgical or core 
biopsies performed in women with mi-
crocalcifications needs further investiga-
tion.

Our study seemed to include a smaller 
proportion of small DCIS lesions than 
expected; 37% (11 of 30) of DCIS lesions 
in our series were smaller than 10 mm 
compared with 72% (47 of 65) in the 
Sickles series (30). Thus, our overall 
results showed a larger percentage of DCIS 
lesions to be visible at US than would be 
oberved in a practice that routinely de-
tects DCIS at a smaller size. In our study, 
US visibility of mammographic calcifica-
tions in dense breasts (48% [23 of 48]) 
was higher than that in fatty breasts 
(42% [22 of 52]), but the difference was 
not statistically significant. We speculate 
that mammographic calcifications with 
subtle or small associated masses might 
be obscured by the dense parenchyma 
and misinterpreted as pure calcifications.

In summary, given a known mammo-
graphic location, US performed with a 
high-frequency transducer can depict 
breast masses associated with microcalci-
fications in a minority (45%) of cases. 
However, the visibility at US is much 
higher in malignant microcalcifications, 
particularly clusters larger than 10 mm, 
than in benign microcalcifications. 
Therefore, US can be used to visualize 
large clusters of microcalcifications that 
have a very high suspicion of malignancy. 
The potential benefit of US examination 
for suspicious breast microcalcifications is 
to identify a mass lesion associated with the 
calcifications and to guide the needle bi-
opsy or hook-wire localization in cases 
for which stereotactic biopsy or localiza-
tion cannot be performed or is unavail-

Figure 2. DCIS, cribriform type, in the left breast of a 43-year-old woman. (a) Craniocaudal spot 
compression and magnification mammogram shows a 5-mm cluster of microcalcifications (arrow) 
in the deep portion of the breast. The calcifications are fine, irregular, and variable in size 
and shape. (b) US scan shows an 11-mm, ill-defined, hypoechoic mass (arrows) in the area 
corresponding to microcalcifications at mammography. Punctate echogenic dots (arrowheads) 
within the mass are probably due to the calcifications.

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References


