Ultrasonographic Findings of Metaplastic Squamous Breast Carcinoma and the Pathologic Correlation

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Purpose: We investigated the ultrasonographic (US) appearance of metaplastic squamous breast carcinoma with the pathologic correlation.

Materials and Methods: During an 8-year period, the US appearances of 10 patients with metaplastic squamous breast carcinoma were retrospectively analyzed on the basis of the Breast Imaging and Reporting Data System (BI-RADS) - US lexicon. These 10 patients included 9 patients having invasive adenocarcinomas of the breast with more than 30% squamous metaplasia, and one patient had pure primary squamous cell carcinoma. We correlated the US findings with the pathologic findings.

Results: On US, the majority of the tumors showed oval shapes (70%), indistinct margins (50%), parallel orientation (80%), echogenic halos (60%), complex echogenicity with solid and cystic components (60%), and posterior enhancement (70%). The findings of calcifications (20%) and metastatic axillary lymph nodes (10%) were rare. On pathologic examination, half of the tumors showed infiltrative microscopic margins. All six cases showing complex echogenicity with solid and cystic components on US were pathologically related to the cystic or necrotic portion, and three of these cases had hemorrhage.

Conclusion: On US, metaplastic squamous breast carcinoma mainly manifested as oval, complex, echoic masses with indistinct margins and posterior enhancement that was pathologically related to the cystic or necrotic portions.

Index words: Breast neoplasms
Ultrasound (US)

Metaplastic carcinoma is a rare form of breast carcinoma that comprises less than 5% of all breast malignancies [1, 2]. These tumors are ductal carcinomas that can undergo a variety of metaplastic changes including squamous cell, spindle cell, and heterologous mesenchymal growth [3, 4]. The most common of these metaplastic changes is squamous metaplasia, and its incidence varies from 0.5 to 2.0% [5]. The microscopic criteria for the diagnosis of the squamous component are defined as keratinization, intercellular bridges and cystic areas [3, 4]. Although there have been many reports about the radiologic findings of metaplastic breast carcinoma, to our knowledge, there have been few reports about the ultrasonographic (US) findings of metaplastic squamous breast carcinoma. Therefore, we described here the US appearance of metaplastic squamous breast
carcinoma along with the pathological correlation.

**Materials and Methods**

Of a total of 665 breast cancers that were treated at our hospital between 1994 and 2002, we collected ten cases (1.5%) of metaplastic squamous breast carcinomas by a computer search of the pathology records. We analyzed the clinical, US and pathological findings, and the microscopic slides were reviewed by a pathologist who was an expert on breast cancer. All the patients presented with a palpable mass and their ages ranged from 32 to 62 years, (the mean age was 47).

All the patients underwent preoperative sonography. The sonography was done with linear-array transducers (7 MHz) on XP 10 (Acuson, Mountain View, CA) ultrasound scanners. According to the American College of Radiology Breast Imaging Reporting and Data System (BI-RADS)-US lexicon, the sonographic findings were assessed retrospectively, focusing on the lesion’s size, shape, orientation, margin, boundary and echo pattern, the presence or absence of posterior enhancement and calcification, and the status of the axillary lymph nodes.

The shape of the lesions was classified into 3 types: oval, round and irregular. The orientation of the lesions was assessed as to whether the long axis of the lesion was paralleled or not to the skin line. The margin of the lesions was divided into 3 types: circumscribed, partially circumscribed and not circumscribed. The non-circumscribed margins were subclassified into indistinct, angular, microlobulated and spiculated. The lesion boundary was evaluated for an abrupt interface or an echogenic halo. The echo pattern was divided into anechoic without internal echos, hyperechoic that was defined as having increased echogenicity relative to fat or it was equal to the fibroglandular tissue, complex echoic which contained both anechoic (cystic) and echogenic (solid) components, and hypoechoic that was defined relative to fat.

Tumors were considered to be metaplastic squamous carcinomas if the squamous metaplastic component constituted at least 30% of the tumor and it merged into foci of infiltrative ductal carcinoma not otherwise specified [4]. The tumors in which foci of infiltrative ductal carcinoma were not apparent were considered to be “primary squamous cell carcinomas”. On pathologic examination, the proportion of squamous metaplastic components, the margin and the intratumoral necrotic or cystic portion were assessed. We correlated the US findings with the pathologic findings.

**Results**

**Clinical Findings**

All patients presented with a palpable mass that had noticed by the patients for a week to 6 months. Two patients experienced a recent sudden growth of the mass.

<table>
<thead>
<tr>
<th>Pt</th>
<th>% of S-M</th>
<th>US Tumor location</th>
<th>Tumor Size, cm</th>
<th>US Shape</th>
<th>Margin</th>
<th>US Pathology</th>
<th>US Echo pattern</th>
<th>Cystic necrosis, hemorrhage</th>
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<tbody>
<tr>
<td>1*</td>
<td>100</td>
<td>LOQ</td>
<td>4.0</td>
<td>Oval</td>
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<td>Infiltrative</td>
<td>Complex</td>
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<td>UOQ</td>
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<td>Complex</td>
<td>Cystic necrosis</td>
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<td>3</td>
<td>30</td>
<td>UC</td>
<td>2.9</td>
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<td>Cystic necrosis</td>
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<td>4</td>
<td>60</td>
<td>UOQ</td>
<td>2.4</td>
<td>Irregular</td>
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<td>Complex</td>
<td>Cystic necrosis</td>
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<td>5</td>
<td>&gt; 70</td>
<td>UOQ</td>
<td>6.8</td>
<td>Oval</td>
<td>Partially circumscribed</td>
<td>Partially infiltrative</td>
<td>Complex</td>
<td>Cystic necrosis, hemorrhage</td>
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<td>6</td>
<td>&gt; 70</td>
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<td>3.9</td>
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<td>Partially infiltrative</td>
<td>Complex</td>
<td>Cystic necrosis, hemorrhage</td>
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<td>UOQ</td>
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<td>Infiltrative</td>
<td>Complex</td>
<td>Macro necrosis</td>
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<td>70</td>
<td>OC</td>
<td>5.6</td>
<td>Oval</td>
<td>Microlobulated</td>
<td>Pushing</td>
<td>Hypoechoic</td>
<td>Microcystic necrosis Hemorrhage</td>
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<td>1.7</td>
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<td>Pushing</td>
<td>Hypoechoic</td>
<td>Micro necrosis</td>
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<td>10</td>
<td>70</td>
<td>UOQ</td>
<td>3.7</td>
<td>Oval</td>
<td>Partially circumscribed</td>
<td>Partially infiltrative</td>
<td>Hypoechoic Inhomogeneous hypoechoic</td>
<td>Micro necrosis</td>
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Abbreviations: Pt, patient; S-M, squamous metaplasia; UC, upper center; UOQ, upper outer quadrant; LIQ, lower inner quadrant; OC, outer center; LOQ, lower outer quadrant. *, Primary SCC
One patient had pain at the palpable mass on physical examination, and five tumors were found in each breast, respectively. The tumors were located in the upper outer quadrant in six cases, and in the upper center, outer center, lower inner quadrant and lower outer quadrant in one case each.

**Ultrasonographic Findings**

The US findings about the shape, margin and echo pattern of the tumors are summarized in Table 1. On US, the range of the longest diameter of the masses was from 1.7 cm to 6.8 cm, (the mean diameter was 3.7 cm). The shape of the tumor was oval in seven cases, round in two cases and irregular in one case. The orientation of the mass was parallel in eight cases and nonparallel in two cases. The tumor margins were circumscribed in one case, partially circumscribed in three cases and not circumscribed in six cases. The non-circumscribed margins were subclassified as indistinct margins in 5 cases, and microlobulated in 1 case. The lesion boundaries included six cases with echogenic halos and four cases with abrupt interfaces. Six cases showed complex echogeneity with solid and cystic components (Fig. 1), three cases showed homogeneous hypoechogeticity, and the remaining one case showed inhomogeneous hypoechogeticity. The primary squamous cell carcinoma particularly showed as a cavitary mass due to extensive cystic or necrotic change (Fig. 2). Posterior enhancement was present for seven cases and this was absent for three cases. Calcifications within the masses were seen in two cases, and these findings corresponded to mammographic calcifications. In one case, the US appearance of enlarged axillary lymph nodes showed as uneven cortical thickenings and the compression of the nodal hilums, which was considered as metastasis.

**Histologic Correlation**

The US-pathologic correlation is also included in Table 1. On pathologic examination, the proportion of the metaplastic squamous components of breast carcino-

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**Fig. 1.** Patient 5. A 62-year-old woman with metaplastic squamous breast carcinoma.
A. Craniocaudal mammograms show a partially circumscribed oval mass in the outer portion of the right breast (arrows).
B. Sonogram shows a complex echoic mass with posterior enhancement. Note the presence of small intratumoral cystic areas (arrows).
C. Photomicrograph shows the tumor consisted of cystic areas (arrow), necrosis, and hemorrhage (arrowheads) [Hematoxylin-eosin stain; original magnification × 40].
mas, including primary squamous cell carcinoma, was more than 70% in six cases, and this proportion was between 30% and 60% in the four other cases. One case with a circumscribed margin on US revealed a microscopically pushing margin. Of the three cases with partially circumscribed margins on US, one case showed a microscopically pushing margin and two showed pushing margins with an infiltrative portion. Among the six cases with non-circumscribed margins on US, five cases with the indistinct types showed infiltrative margins and one case with the microlobulated type showed pushing margins on microscopic examination. All six cases having complex echogenicity with solid and cystic components on US contained macroscopic cystic or necrotic portions on the pathologic specimens (Figs. 1 and 2), and three of these six cases were combined with hemorrhage (Fig. 1). Among the remaining four cases, three showed macro or micro necrosis, and one showed microcystic necrosis with hemorrhage on the pathologic specimens. In only one case, the positive axillary nodes seen on US were pathologically proven to be metastasis.

**Discussion**

Metaplastic breast carcinomas have many different histologic entities, and these include spindle cell carcinoma, carcinoma with osseous metaplasia, carcinoma with pseudosarcomatous metaplasia, squamous cell carcinoma with pseudosarcomatous stroma, fibrosarcoma-like squamous cell carcinoma and carcinosarcoma (4). Metaplastic carcinomas can generally be regarded as ductal carcinomas that have undergone metaplasia into a nonglandular growth pattern. The extent of metaplasia can vary from a few microscopic foci to the complete replacement of glandular growth (1). Squamous metaplasia can arise in various benign and malignant conditions, and most commonly it arises from ductal carcinoma (6). In most metaplastic carcinomas, the foci of transition between invasive ductal carcinoma and the metaplastic element were sometimes detected only after ex-

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**Fig. 2.** Patient 1. A 51-year-old woman with primary squamous cell carcinoma.

A. Craniocaudal mammograms show an oval mass having a partially circumscribed margin in outer portion of left breast.

B. Sonogram shows a complex echogenic mass having an indistinct margin with posterior enhancement.

C. Photomicrograph shows large areas of intratumoral cyst lined with squamous cell carcinoma that contains necrotic debris (arrow) [Hematoxylin-eosin stain; original magnification × 40].
Cystic areas may occur in metaplastic breast carcinoma as a result of necrosis and hemorrhage, and these cystic areas are commonly associated with squamous components [1, 13, 14]. According to Park et al., 6 metaplastic carcinomas (55%) showed complex echogenicity with solid and cystic components on US, and 4 of these 6 lesions also had hemorrhagic or cystic necrosis on the pathologic examination [9]. Three cases of the four metaplastic carcinomas in Park’s report were squamous types. Samuels et al. have reported that the predominantly squamous cell carcinomas and pure squamous cell carcinomas appeared as cystic masses on US, and cystic and necrotic areas that were evident on the gross and histologic examination were characteristic of squamous cell carcinoma [11]. Dash et al. have reported that on magnetic resonance imaging, primary squamous cell carcinoma was of low intensity on T1WI and of high intensity on T2WI; the latter, however, was not sufficiently intense to represent a simple cyst, and this led to a diagnosis of necrotic tumor [7]. In our study, six of ten cases (60%) showed masses containing both anechoic and echogenic components on US, and in particular, the primary squamous cell carcinoma appeared as a cavitary mass due to the extensive cystic or necrotic changes. All of these six cases showed macroscopic cystic or necrotic portions on the pathologic specimens, and three of these six cases were combined with hemorrhage. Although the pathologic descriptions of the remaining four cases did mention areas of cystic or necrotic change, these features could not be found on the US finding. This discrepancy of the US and pathologic findings may have been due to the masses containing very small sized cysts or impacted necrotic debris. In addition, hemorrhage within the lumen may have simulated a solid mass on US. The intratumoral cystic or necrotic portions caused the posterior enhancement behind the mass that was noted on US.

Metaplastic carcinoma and primary squamous cell carcinoma have been related with a low rate of axillary nodal metastasis in relation to the tumor size [11]. Only one patient in this study had positive nodes; this patient had a 3.7 cm palpable primary tumor with 70% squamous metaplastic components.

In the previous reports, malignant microcalcifications were not a typical feature of metaplastic carcinoma and primary squamous cell carcinoma [2, 6, 11]. In our study, 20% of the patients showed calcifications within their masses on US.

Some reports have revealed that the prognosis of metaplastic carcinoma and primary squamous cell carcinoma was worse than that of adenocarcinoma [3, 15]. However, most authors believe that the prognosis was essentially the same as that of ductal carcinoma [16, 17]. Several prognostic factors associated with a poorer outcome for metaplastic carcinoma and primary squamous cell carcinoma include a large tumor size, the presence of infiltrating margins, and the predominance of sarcomatous over the epithelial elements [3, 6, 12]. The overall 5-year survival rate for metaplastic carcinoma and primary squamous cell carcinoma is approximately 40% and 64%, respectively [4, 6].

In conclusion, the metaplastic squamous breast carcinoma manifested at the time of presentation as a rapidly growing, relatively large mass. On US, there was complex echogenicity with solid and cystic components, indistinct margins and posterior enhancement, and this was pathologically related to the presence of cystic necrosis or hemorrhage. Malignant calcifications did not seem to be a usual finding. The axillary lymph nodes were not frequently involved. Although these findings are frequently seen for the other breast malignancies, metaplastic squamous breast carcinoma should be included in the differential diagnosis for breast masses with a cystic component that is observed on US.

References