Case Report

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Imaging Findings of Metaplastic Breast Carcinoma with Chondroid Differentiation: A Case Reports

연골성 분화를 보이는 화생성 유방암의 영상의학적 소견: 증례 보고

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Metaplastic carcinoma of the breast is a heterogeneous group of neoplasms with mixed epithelial and mesenchymal differentiation. Metaplastic carcinoma of the breast is a rare and aggressive malignancy, with high recurrence and metastasis. Metaplastic carcinoma with chondroid differentiation is an uncommon subtype that tends to have a relatively good prognosis than that of other subtypes. We report the imaging features of three cases of pathologically proven metaplastic carcinoma with chondroid differentiation as follows: a high-density mass with amorphous or coarse heterogeneous calcifications on mammography; a microlobulated or partially indistinct, complex cystic, and solid mass on sonography; and a relatively circumscribed or partially indistinct, irregular mass with heterogeneous T2 high-signal intensity and heterogeneous or rim enhancement with initial fast enhancement and delayed washout on MRI.

Index terms Breast Cancer; Metaplasia; Mammography; Ultrasound; Magnetic Resonance Imaging

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INTRODUCTION

Metaplastic carcinomas are a heterogeneous group of neoplasms with mixed epithelial and mesenchymal differentiation. Metaplastic carcinoma is a rare breast cancer that accounts for less than 1% of all cases. Metaplastic carcinoma is an aggressive form of malignancy that presents with high local recurrence and metastasis, is generally hormone receptor-negative, and has suboptimal response to systemic therapy. Metaplastic carcinoma with chondroid differentiation (MCCD) is an uncommon subtype of metaplastic carcinoma that tends to have a relatively good prognosis compared to other subtypes. Differential diagnosis of MCCD from other subtypes and other breast cancer is important with regard to treatment and prognosis. Radiological and pathological findings of metaplastic breast carcinoma have been described in a few reports. However, there are only a few reports on the imaging findings of MCCD. We report the imaging features of mammography, sonography, and MRI, and the pathological features of three cases of MCCD.

CASE REPORT

CASE 1

A 36-year-old female presented to our hospital with a palpable lump in her left breast, which was discovered two years earlier and slowly increased in size. Mammography revealed an oval, partially circumscribed, isodense mass with obscured portions in the lower inner quadrant of the left breast (Fig. 1A). Calcification in mass was not seen. Ultrasonography showed a 3.2-cm oval, partially circumscribed, partially microlobulated, heterogeneous echoic mass with small marked hypoechoic portions and posterior acoustic enhancement (Fig. 1B). Increased vascularity of the mass was noted on color Doppler examination (Fig. 1C). Axillary lymphadenopathy was not observed. Fine-needle aspiration indicated invasive ductal carcinoma. The patient underwent breast-conserving surgery (BCS). Histopathological examination revealed MCCD (Fig. 1D). Immunohistochemistry of the tumor was negative for estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2) expression and positive for S-100.

CASE 2

A 35-year-old female presented with a palpable right breast mass that was discovered during self-examination and was stable for two months. Mammography revealed an oval, partially obscured isodense mass without calcification in the upper inner quadrant of the right breast (Fig. 2A). Ultrasonography showed a 3-cm oval, indistinct, hypoechoic mass with posterior acoustic enhancement, without increased vascularity or axillary lymphadenopathy (Fig. 2B). MRI showed an oval, relatively circumscribed, heterogeneous T2 high-signal intensity (SI), heterogeneous low SI mass on fat saturated T1-weighted image (T1WI) and heterogeneous enhancement with initial fast enhancement and delayed washout on fat-saturated T1WI with contrast enhancement (Fig. 2C-E). Subsequent diagnostic core biopsy indicated invasive ductal carcinoma. The patient underwent BCS. Histopathological examination revealed MCCD (Fig. 2F). Immunohistochemical analysis of the tumor was negative for ER, PR,

and HER2 expression.

CASE 3

A 52-year-old female presented with a large palpable, painful mass in her right breast, which she had discovered one year earlier and had increased in size. Physical examination revealed a hard, fixed, large mass with skin redness in the right breast. Mammography showed an approximately 8-cm irregular, partially circumscribed, partially indistinct high-density mass with amorphous and coarse heterogeneous calcifications in the upper outer quadrant of the right breast (Fig. 3A). Ultrasonography showed a huge, partially circumscribed, partially indistinct, complex cystic and solid mass with calcification and posterior acoustic enhancement. Increased peripheral vascularity was observed on color Doppler examination (Fig. 3B).

Fig. 1. A 36-year-old female presented metaplastic carcinoma with chondroid differentiation.
A. A craniocaudal view of mammography shows an oval, partially circumscribed, isodense mass with obscured portions in the lower inner quadrant of the left breast (arrow).
B. Ultrasonography shows a 3.2-cm oval, partially microlobulated, heterogeneous echoic mass with small marked hypoechoic portions and posterior acoustic enhancement.
C. Doppler scan reveals increased vascularity in the mass.
D. Microscopic findings reveal tumor nests and cord-like arrays interspersed with a chondromyxoid matrix (hematoxylin and eosin stain, × 100). Calcification is absent in the mass.

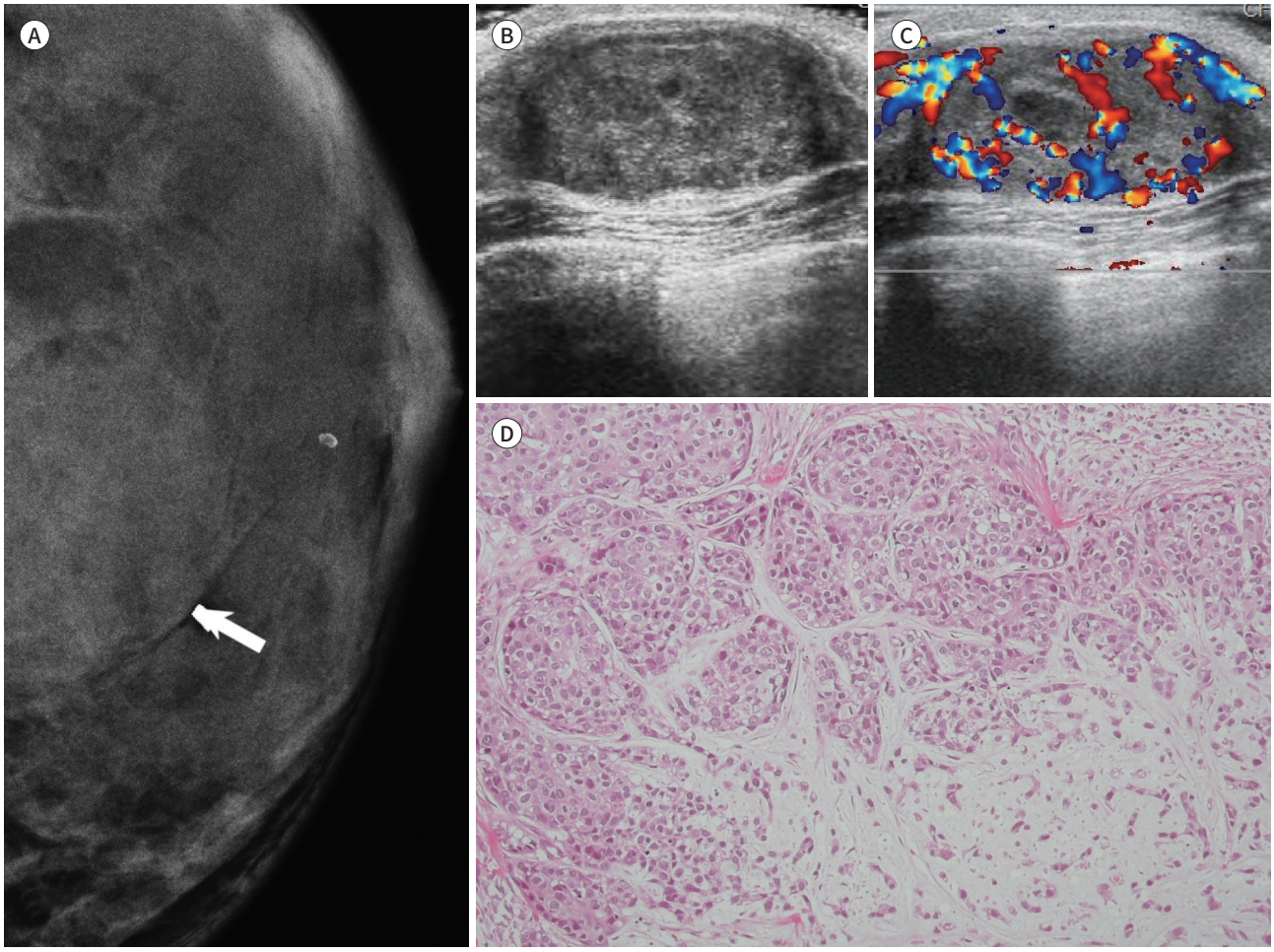

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Fig. 2. A 35-year-old female presented metaplastic carcinoma with chondroid differentiation.
A. A craniocaudal view of mammography shows an oval, partially obscured, isodense mass without calcification in the upper inner quadrant of the right breast (arrow).
B. Ultrasonography shows a 3-cm oval, indistinct, hypoechoic mass with posterior acoustic enhancement.
C-E. The mass has an oval shape, relatively circumscribed margin, and heterogeneous high SI on fat-saturated T2-weighted imaging (C) and low SI on fat-saturated T1-weighted imaging (D). Axial fat-saturated T1WI with contrast enhancement shows a heterogeneous enhancing mass with initial fast enhancement and delayed washout (E).
F. Microscopic findings reveal metaplastic carcinoma with chondroid differentiation showing nests and discohesive cells in a chondromyxoid matrix (hematoxylin and eosin stain, × 100). Calcification is absent in the mass.
SI = signal intensity

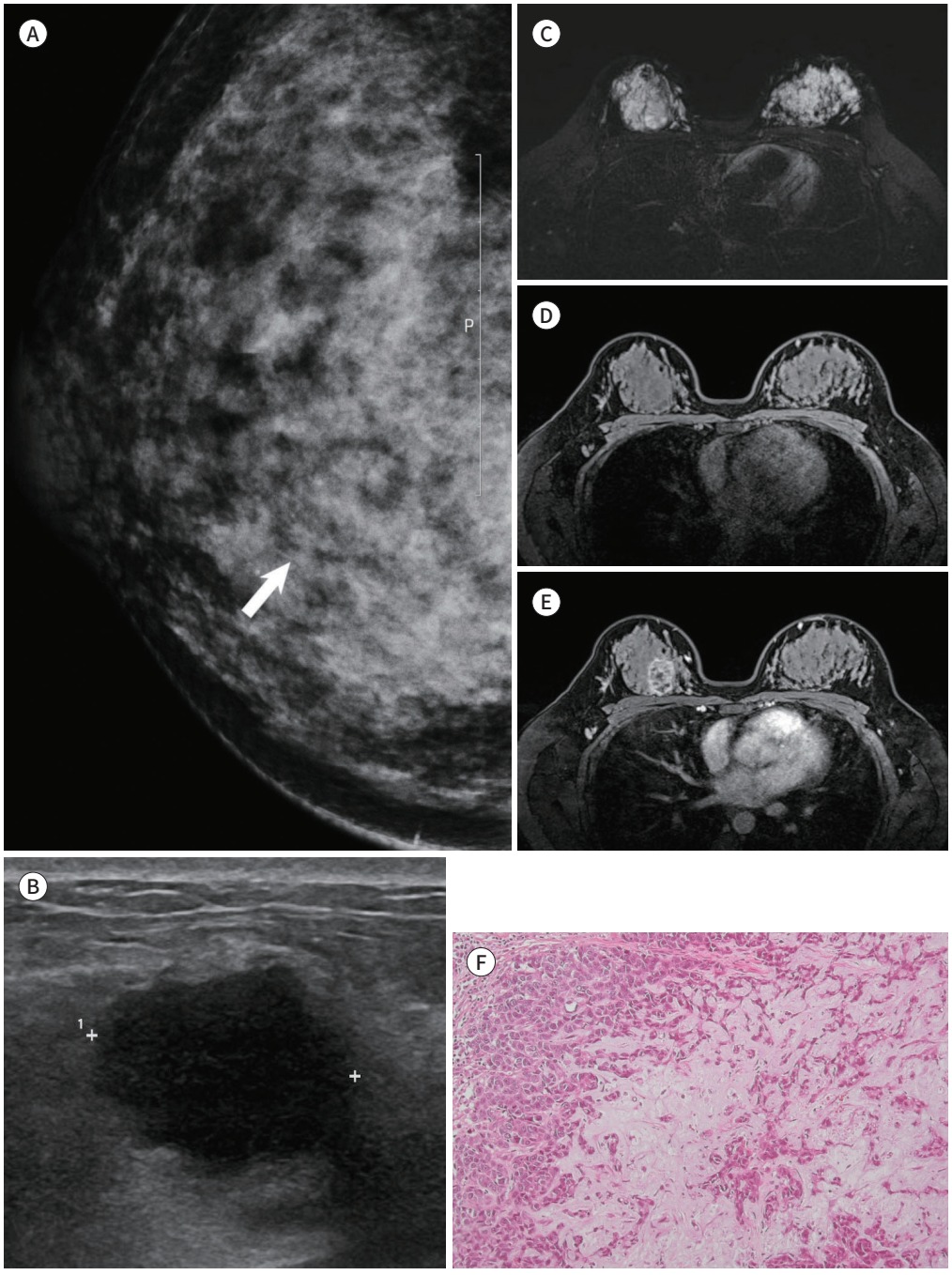
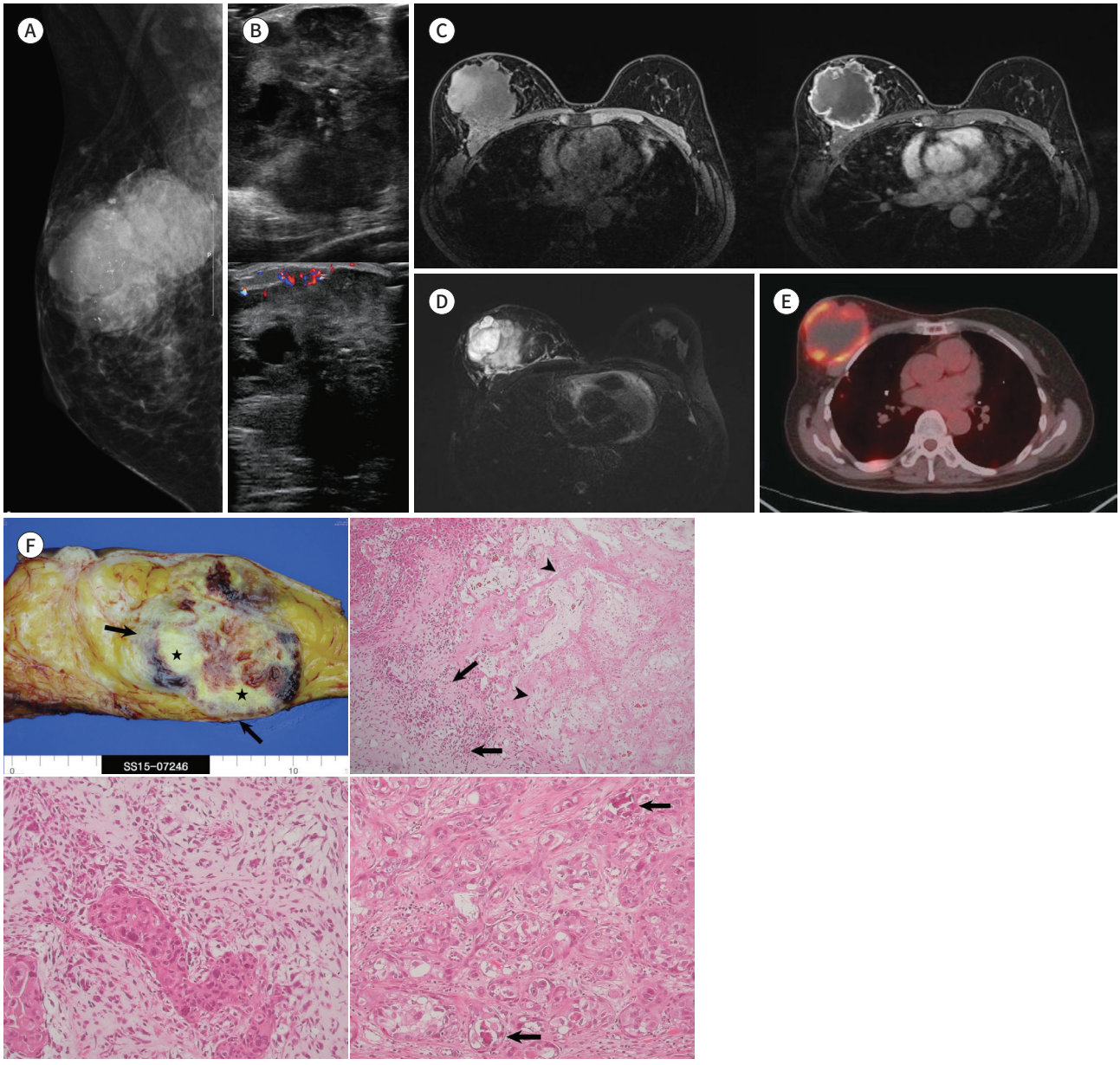


Fig. 3. A 52-year-old female presented metaplastic carcinoma with chondroid differentiation.
A. Mammography shows an 8-cm, partially circumscribed, partially indistinct, irregular shape, hyperdense mass in the upper outer quadrant of the right breast. Amorphous and coarse heterogeneous calcifications are present in the mass.
B. Ultrasonography shows a partially circumscribed, partially indistinct, huge, complex cystic and solid mass, with calcification and posterior enhancement. Peripheral increased vascularity is noted using color Doppler examination.
C. Fat-saturated T1WI with contrast enhancement (right) shows rim enhancement with initial fast enhancement and delayed washout. High SI area on the anterior portion of the mass on fat-saturated T1WI (left) is not enhanced and corresponds to hemorrhagic foci in the pathologic specimen.
D. Fat-saturated T2WI shows an irregular shape and margin and heterogeneous high SI mass.
E. PET-CT shows peripheral fluorodeoxyglucose uptake in the right breast mass (maximum standardized uptake value, 8.1) and right pleura.
F. Left upper: the cross-section of the gross specimen shows a large, partially ill-defined, heterogeneously yellowish tan-to-gray, solid mass with a peripheral myxoid portion (arrows), multifocal hemorrhage, and infarction necrosis (stars). Right upper: hemorrhagic necrosis is observed in the mass (arrowheads) and chondroid matrix (arrows) (H&E stain, × 40). Left lower: microscopic findings reveal infiltration of malignant epithelial cells with metaplastic chondromyxoid differentiation (H&E stain, × 100). Right lower: calcification is noted in the carcinoma and mesenchymal portions (H&E stain, × 100) (arrows).
H&E = hematoxylin and eosin, SI = signal intensity, T1WI = T1-weighted image, T2WI = T2-weighted image



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Metastatic lymphadenopathy in the right axilla was also observed. MRI showed an irregular shape and margin, heterogeneous T2 high-SI mass, and rim enhancement with initial fast enhancement and delayed washout on fat-saturated T1WI with contrast enhancement. In addition, the high SI portion of the mass on fat-saturated T1WI was not enhanced (Fig. 3C, D). In addition, the high SI portion of the mass on fat-saturated T1WI was not enhanced in the dynamic-enhanced image (Fig. 3C). PET-CT showed remarkable fluorodeoxyglucose (FDG) uptake in the peripheral portion of the right breast mass (maximum standardized uptake value [maxSUV], 8.1), right axilla, and right pleura (Fig. 3E). Chest CT showed several enhancing nodules in the right lung and thickened, enhancing the right pleura, and suspicious metastasis. Subsequent diagnostic core biopsy indicated MCCD. The patient underwent a modified radical mastectomy. On gross examination, multifocal hemorrhage and infarction necrosis in the mass were observed. Histopathological examination revealed MCCD (Fig. 3F). Immunohistochemistry of the tumor was negative for ER, PR, and HER2 expression and positive for cytokeratin and S-100. The patient underwent palliative radiotherapy and chemotherapy.

This study was approved by the Institutional Review Board of our hospital and the requirement for informed consent was waived (IRB No. SGPAIK 2022-02-005).

DISCUSSION

Metaplastic carcinoma, a heterogeneous group of neoplasms with mixed epithelial and mesenchymal differentiation, is a rare breast cancer, comprising less than 1% of invasive breast carcinomas (1). The Wargotz and Norris (2) classification includes five variants of metaplastic carcinoma: matrix-producing carcinoma, carcinosarcoma, squamous cell carcinoma, spindle cell carcinoma, and metaplastic carcinoma with osteoclastic giant cells. The most common clinical history of metaplastic carcinoma is a growing palpable mass that usually presents in females older than 50 years. Two patients in our study were younger than those in previous studies. The most common subtype of metaplastic carcinoma is squamous cell carcinoma, while MCCD is relatively rare. In metaplastic carcinoma, hematogenous spread is more frequently observed than lymphatic spread, and distant metastasis to the lungs and bones is common. MCCD tends to have a relatively good prognosis compared with other subtypes of metaplastic carcinomas (3). Wargotz and Norris (2) reported that patients with MCCD had a 68% survival rate at five years. Downs-Kelly et al. (4) reported that MCCD is more aggressive than invasive ductal carcinoma, even after adjusting for patient age, stage, and tumor grade. Axillary node involvement in metaplastic carcinoma is less frequent than in other breast cancers (25%–40% range in a previous study) (5). In our study, one patient had axillary lymph node metastasis and distant metastasis to the lungs, pleura, and brain.

To our knowledge, radiologic findings (5-10) and pathologic features (2, 4) of MCCD have been described in only a few reports. Shin et al. (8) described the characteristic mammographic appearance of MCCD as an irregular, high-density mass with indistinct or partially indistinct margins, with or without calcification. A total of 50% of cases contained microcalcifications, and the pattern was amorphous and coarse heterogeneous, amorphous, coarse heterogeneous, or round. Joo et al. (9) described a highly dense, obscured mass with grouped amorphous calcification. In previous reports (5, 6, 10), 25%–44% of metaplastic carcinoma cases had masses

with calcification and highly suspicious morphology. Coarse heterogeneous calcifications were noted more frequently in the MCCD group. In our series, two patients had oval-shaped, partially circumscribed or indistinct isodense masses without calcification on mammography. One patient had an irregularly shaped and partially indistinct high-density mass with amorphous, coarse heterogeneous calcification.

On sonographic examination, two masses were oval-shaped, microlobulated heterogeneous and indistinct hypoechoic. One patient had a large irregular shape, partially indistinct, complex cystic and solid mass with calcification. All masses had posterior acoustic enhancement, and two showed increased vascularity on color Doppler examination. Shin et al. (8) reported that all masses had irregular shapes and posterior acoustic enhancement, with 70% of all masses having complex internal echogenicity with solid and cystic components and 30% having hypoechogenicity. In previous reports (5, 6, 10), 50%–81% of metaplastic carcinoma cases had a round- or oval-shaped, complex cystic and solid mass with posterior acoustic enhancement. However, these sonographic features are not specific to MCCD, which can be considered in the differential diagnosis of a complex cystic and solid mass with calcification on US.

A few reports have been published regarding the MRI findings of MCCD (5, 7-10). A relatively circumscribed mass with heterogeneous high SI on T2-weighted image (T2WI) and rim enhancement or heterogeneous enhancement with initial fast enhancement and delayed washout and plateau pattern on dynamic contrast-enhanced images was noted, similar to our study. In our study, high SI focus in the mass on fat-saturated T1WIs with no enhancement corresponded to hemorrhagic necrosis in the mass.

A high SI focus on T2WI is observed in masses with cysts, necrosis, and chondroid matrix. These findings are nonspecific, similar to other invasive breast carcinomas such as invasive ductal carcinoma with necrosis, mucinous carcinoma, and other subtypes of metaplastic carcinoma.

Joo et al. (9) reported remarkable FDG uptake in the mass on PET-CT, corresponding to a focal lesion of the mass with initial fast enhancement and delayed washout on dynamic-enhanced T1WIs and diffusion restriction on diffusion-weighted images and apparent diffusion coefficient maps. In our study, peripheral FDG uptake in the mass corresponded with rim enhancement with initial fast enhancement and delayed washout on dynamic-enhanced MR images.

MCCD can be diagnosed by aspiration cytology or core biopsy; however, excisional biopsy is recommended because of the foci of transition between invasive ductal carcinoma and metaplastic components or inadequate samples with extensive necrosis or hemorrhage. Immunohistochemical studies are important for differentiating metaplastic carcinoma from other breast tumors, such as sarcomas. MCCD is generally hormone receptor, ER, and PR negative. In our study, all three patients were negative for ER, PR, and HER2 expression. Two patients tested positive for vimentin.

In conclusion, MCCD is a rare subtype of breast malignancy with nonspecific imaging features. However, a rapidly growing high-density mass with amorphous or coarse heterogeneous calcifications on mammography; microlobulated or partially indistinct complex cystic and solid mass with calcification and posterior acoustic enhancement on sonography; and a relatively circumscribed or partially indistinct, irregular mass with heterogeneous high SI on T2WI and rim enhancement or heterogeneous enhancement with initial fast enhancement

and delayed washout on MRI may be useful imaging findings suggesting a diagnosis of MCCD.

Author Contributions

Conceptualization, K.J., K.S.H., J.M.J.; formal analysis, K.J., L.J.H., K.M.; investigation, K.J., G.G.; and resources, K.J., Y.S.H.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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연골성 분화를 보이는 화생성 유방암의 영상의학적 소견: 증례 보고

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화생성 유방암은 상피성 암과 다양한 화생성 변화가 혼합된 형태의 암으로, 드물게 발생하나, 높은 재발률과 전이율을 보이는 공격적 성향을 가진 암이다. 연골성 분화를 보이는 화생성 암은 화생성 유방암의 아형 중에서도 상대적으로 드물게 발생하며, 다른 아형에 비해 비교적 좋은 예후를 보인다. 저자들은 연골성 분화를 보이는 화생성 유방암으로 진단된 3명의 환자의 영상의학적 소견을 다음과 같이 보고한다. 유방촬영상 무정형 또는 거친 불균질한 석회화를 동반한 고밀도 종괴를 보이고 초음파상 미세소엽형 또는 불분명한 경계를 가진 복합성 낭성 및 고형성 종괴(complex cystic and solid mass)로 보인다. 자기공명영상에서 비교적 경계가 분명한 또는 부분적으로 경계가 불분명한 종괴로, T2 강조영상에서 비균질한 고신호강도를 보이고, 빠른 초기 조영증강 및 말기 세척형의 신호강도 감소를 동반한 비균질한 조영증강이나 가장자리 조영증강을 보인다.

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