

Unusual Breast Malignancy: Correlation of MRI Findings with Pathologic Features

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Invasive ductal carcinoma (IDC) and ductal carcinoma in situ account for about 85% of breast cancers. Unusual breast neoplasms may be broadly divided into invasive lobular carcinoma (ILC), well-differentiated subtypes of invasive ductal carcinoma, cancers of stromal origin, and metastatic neoplasms. We are not familiar to unusual breast malignancies, and hesitate to interpret magnetic resonance imaging (MRI) findings of these tumors and correlate with pathologic features. In this article, we will provide an overview of unusual, as well as a few rare, malignant breast neoplasms and correlate multimodal breast imaging including MRI of these tumors with pathologic features.

Index words: Unusual breast cancer; Magnetic resonance imaging

Introduction

Most breast malignancies arise from epithelial elements and are categorized as carcinomas. IDC not otherwise specified (NOS) and ductal carcinoma in situ are common breast cancers and account for about 85% of breast cancers (1). Unusual breast malignancies may be broadly divided into ILC, well-differentiated subtypes of IDC, cancers of stromal origin, and metastatic neoplasms (2). Well-differentiated subtypes of IDC include mucinous carcinoma, tubular carcinoma, medullary carcinoma, papillary carcinoma, micropapillary carcinoma, apocrine carcinoma and metaplastic carcinoma (Table 1).

However, we are not familiar to these unusual breast malignancies, and hesitate to interpret MRI findings of these tumors and correlate with pathologic features. In this article, we will provide an overview of unusual, as well as a few rare, malignant breast neoplasms and correlate multimodal breast imaging including MRI of these tumors with pathologic features.

Invasive Lobular Carcinoma

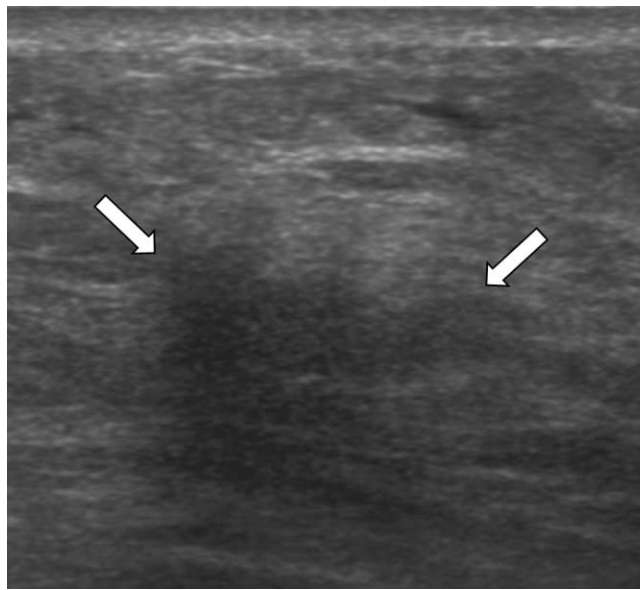
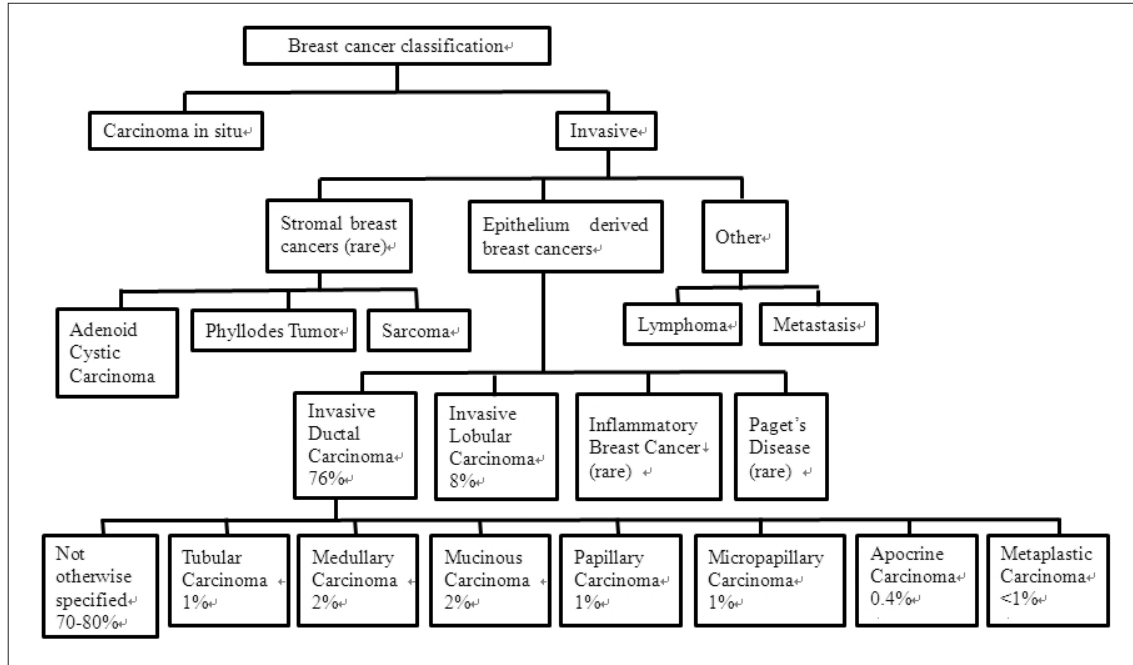
Invasive lobular carcinoma is the second most common histologic type of breast carcinoma, accounting for approximately 8% of all invasive breast cancers. ILC has a characteristic histopathologic appearance consisting of small, uniform tumor cells with round nuclei and scanty cytoplasm arranged in a classic single-file pattern and spread diffusely or between the collagen fibers of the breast and produces little desmoplastic response (3).

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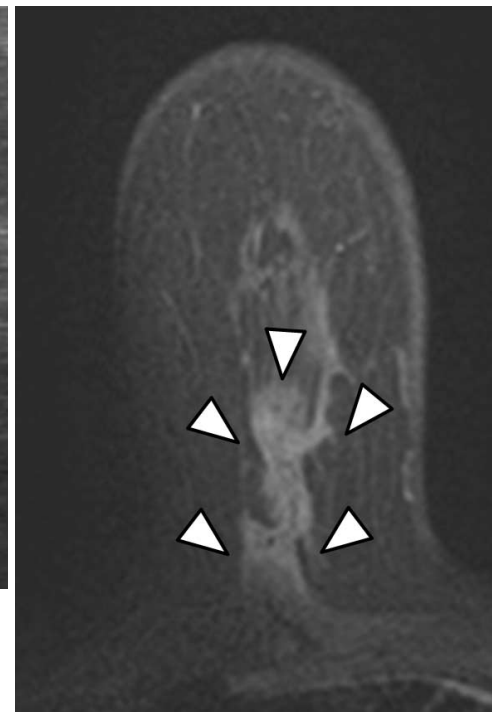
Because of this infiltrative growth pattern, ILC is more difficult to detect at clinical examination and mammography than is IDC (4). The sensitivity of mammography for the detection of ILC reportedly ranges between 57% and 81% (5). On mammography (MG), ILC man-

ifests as a mass, usually with spiculated or ill-defined margins, architectural distortions and asymmetries (5). Calcifications are uncommon in ILC. On ultrasonography (US), ILC manifests as a heterogeneous, hypoechoic mass with angular or ill-defined margins and pos-

Table 1. Diagram of WHO Classification of Breast Cancer



a



b

Fig. 1. A 70-year-old woman with invasive lobular carcinoma.

a. On US, an indistinct irregular shaped, hypoechoic mass with posterior shadowing (arrows) is seen in right breast, palpable mass site.

b. On contrast-enhanced T1-weighted MR image, enhancing solitary mass (arrowheads) is seen in deep portion of right breast. The extent of mass on MRI is large, as compared with US.

terior acoustic shadowing (69%) (Fig. 1a), focal shadowing without a discrete mass (17%), lobulated, well-circumscribed mass (14%) (6). On MRI, ILC may manifest as an enhancing solitary mass with irregular margins (Fig. 1b) , multiple enhancing lesions, or only enhancing septa (7). Of the three imaging modalities including MG, US and MRI, MRI has the lowest false neg-

ative rate in detecting ILC and has the highest accuracy in measuring the size of the ILC (8). MRI depicts more extensive disease than is suspected with conventional imaging (Fig. 1b) (9). Therefore, MRI could play a key role in the pre-operative work-up for accurate tumor size determination (8).

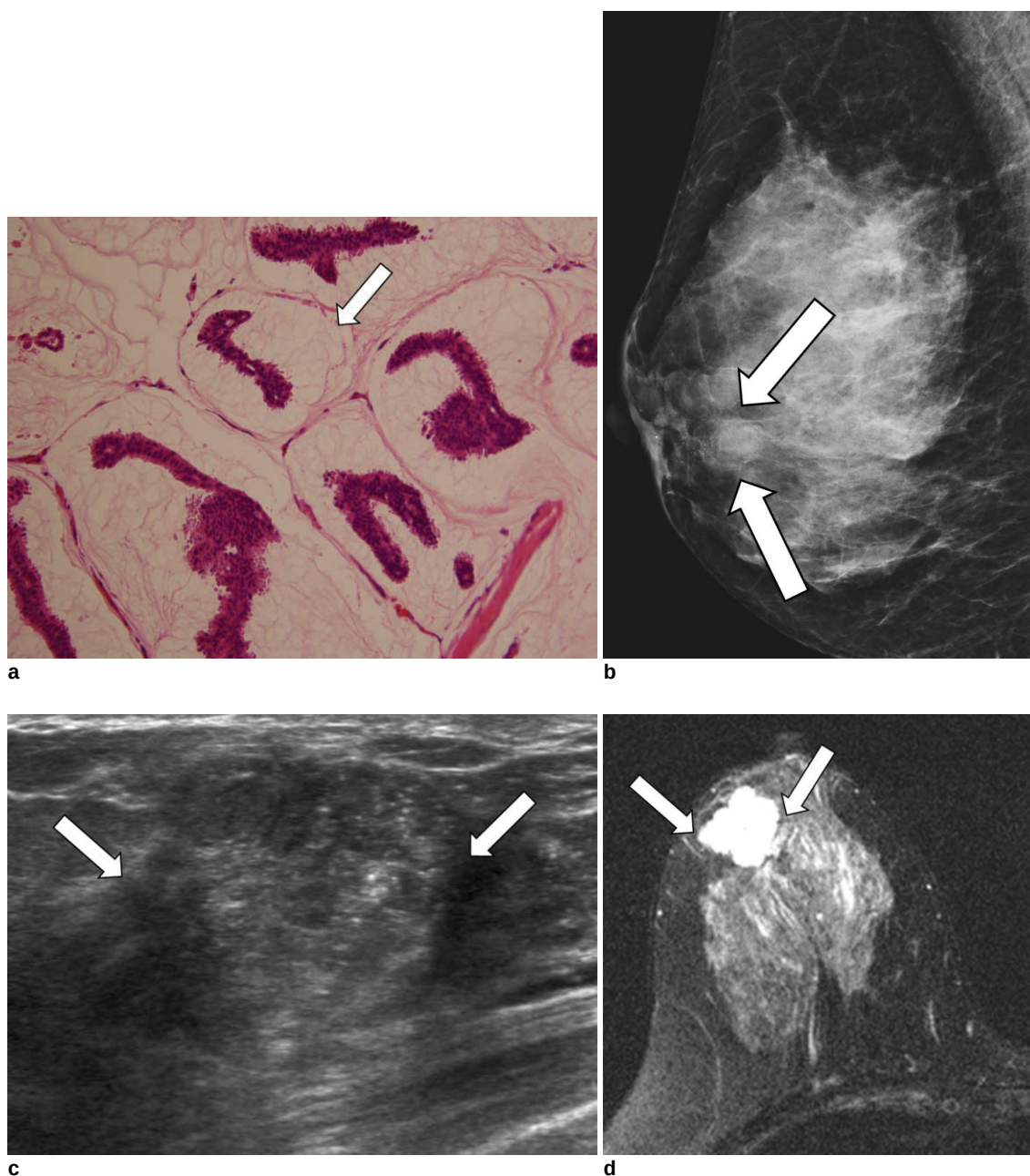


Fig. 2. A 52-year-old woman with mucinous carcinoma.

- a.** Histopathologic examination demonstrates mucinous carcinoma consisting of floating islands of relatively bland tumor cell with collection of lakes of excessive extracellular mucus (arrow) surrounding them (original magnification, X100; hematoxylin-eosin stain).
- b.** On MG (MLO view), an oval shaped, circumscribed isodense mass with internal amorphous microcalcifications (arrows) is seen in subareolar area of right breast.
- c.** On US, the mass (arrows) show heterogeneous in echogenicity and posterior acoustic enhancement.
- d.** On fat-saturated T2-weighted MR image, the mass (arrows) show bright high signal intensity.

Subtypes of Ductal Carcinoma

Mucinous Carcinoma

Mucinous carcinoma accounts for about 2% of breast cancers (1). It is well-differentiated type of invasive adenocarcinoma characterized by abundant accumulation of extracellular epithelial mucus excreted by tumor cells (Fig. 2a) (10). Mucinous carcinoma is classified into two forms, pure and mixed. On MG, mucinous carcinoma typically manifests as a low-density, relatively well-defined or microlobulated oval or lobular mass (Fig. 2b) because of the predominance of mucin (11). Monzawa et al. (10) insisted that pure tumors had a smooth or irregular margin, but all mixed tumors had irregular margins. On US, mucinous carcinomas are often heterogeneous in echogenicity (Fig. 2c) and may have mixed solid and cystic components and posterior acoustic enhancement is common (11). On MRI, the presence of very high signal intensity on fat-saturated T2-weighted images was due to the abundant accumulation of mucus (Fig. 2d) (12) and was a common MRI feature in both forms of pure and mixed type of mucinous carcinoma (10). The presence of an area exhibiting isointensity on fat-saturated T2-weighted images and strong early en-

hancement imply the presence of a mixed mucinous tumor (10).

Tubular Carcinoma

Tubular carcinoma accounts for about 1% of breast cancers (1). The diagnosis of tubular carcinoma require an excess of 75% tubular elements (13). Tubular carcinoma typically occurs in a young population with more favorable prognosis. On MG, tubular carcinomas are usually identified as very small (< 1 cm) mass with central densities and spiculated margins (Fig. 3a). Long spicules, a feature that might be more typically associated with radial scars were seen in 53% of the tubular carcinomas (13). Microcalcifications on have been described in 8–19% of cases of tubular carcinoma on MG (14, 15). On US, tubular carcinomas are usually seen as hypoechoic masses with ill-defined margins and posterior acoustic shadowing (Fig. 3b) (13). On MRI, solid tubular carcinomas demonstrate as single or multiple tubular like structures showing a “popcorn” appearance with a non-homogenous enhancement pattern on dynamic study (16).

Medullary Carcinomas

Medullary carcinomas account for fewer than 2% of

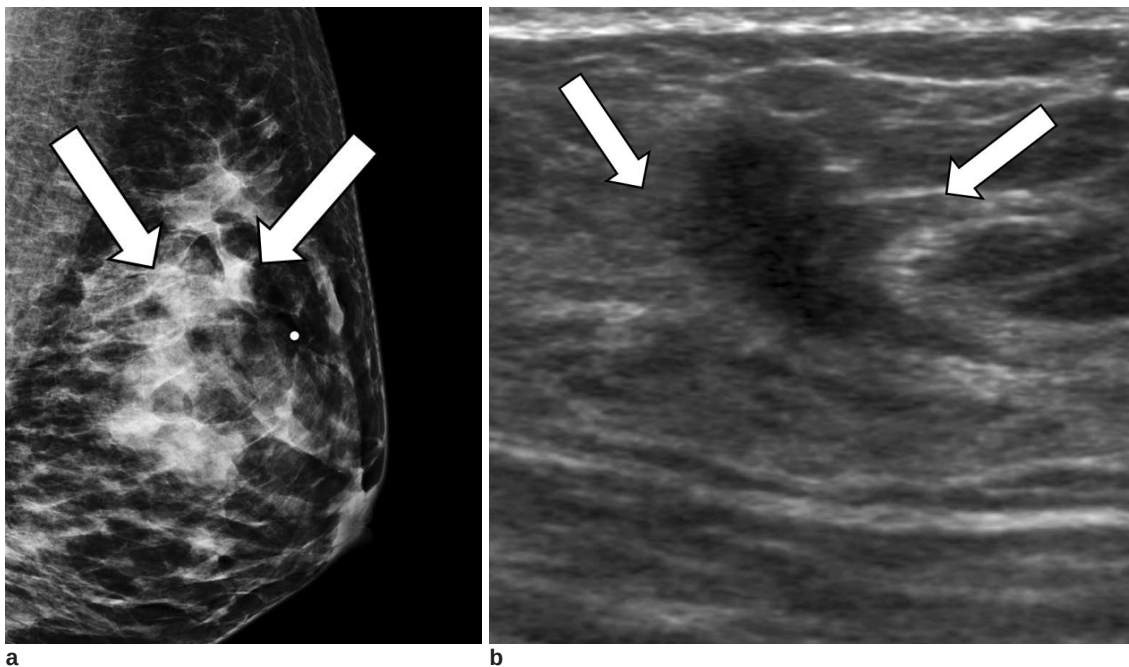


Fig. 3. A 28-year-old woman with tubular carcinoma.

a. On MG (MLO view), a small specculated marginated, irregular shaped, isodense mass (arrows) is seen in left upper breast.

b. On US, a hypoechoic mass with spiculated margin (arrows) and posterior acoustic shadowing is seen.

breast cancers (1). Medullary carcinomas a well circumscribed carcinoma composed of poorly differentiated cells with scant stroma and prominent lymphoid infiltration at pathologic examination (17).

Grossly, medullary carcinoma is usually a large distinct mass with a circumscribed margin and firm consistency and there can be cystic change within large lesions (18). Medullary carcinoma is a noncalcified mass with an indistinct or a circumscribed border on MG and a circumscribed mass with an inhomogeneous hypoechogenicity on US (Fig. 4a) (19). On MRI, most medullary carcinomas have an oval or lobular shape and circumscribed margins, however, intense lymphocytic reactions or secondary nodules around the tumor making a microlobulated contour (18). Jeong et al. (18) reported 86% (thirteen of 15 masses) of medullary carcinoma showed rim enhancement with or without enhancing internal septations on contrast-enhanced MR images. The variable degrees of internal enhancing septations (Fig. 4b) correlate with the nodular structure of medullary carcinoma and the presence of fibroepithelial septa on pathology. Peripheral fibrous capsules of variable degrees seen on histopathology might have been depicted as rim enhancement on contrast enhanced T1-weighted image (Fig. 4b) and a hypointense rim on T2-weighted images. The morphologic features of medullary carcinomas and fibroadenomas overlap

considerably, however, kinetic features in a time-signal intensity curve of dynamic enhancement MR images are useful for differential diagnosis. Fibroadenomas show persistent pattern (20) and all medullary carcinomas showed early enhancement and a plateau or a washout kinetic pattern (18).

Papillary Carcinoma

Papillary carcinoma accounts for about 1% of breast cancers (1). They are most commonly detected in postmenopausal women, arise in the retroareolar region in almost 50% of patients and often manifests as an intraductal or intracystic mass. On MG, shapes of papillary carcinomas are usually round, oval, or lobulated and margins are most commonly well-defined but may be indistinct in areas of invasion (21). Microcalcifications within the tumor are usually pleomorphic but may occasionally be coarse or stippled in appearance (Fig. 5a) (22). On US, papillary carcinomas can present as a hypoechoic solid mass or a complex cyst with septations or mural-based papilliform nodularity (Fig. 5b) (22, 23). On MRI, papillary carcinomas may appear as irregular enhancing nodules or enhancing complex cysts (Fig. 5c and d) (24).

Micropapillary Carcinoma

Invasive micropapillary carcinoma is a rare, clinically

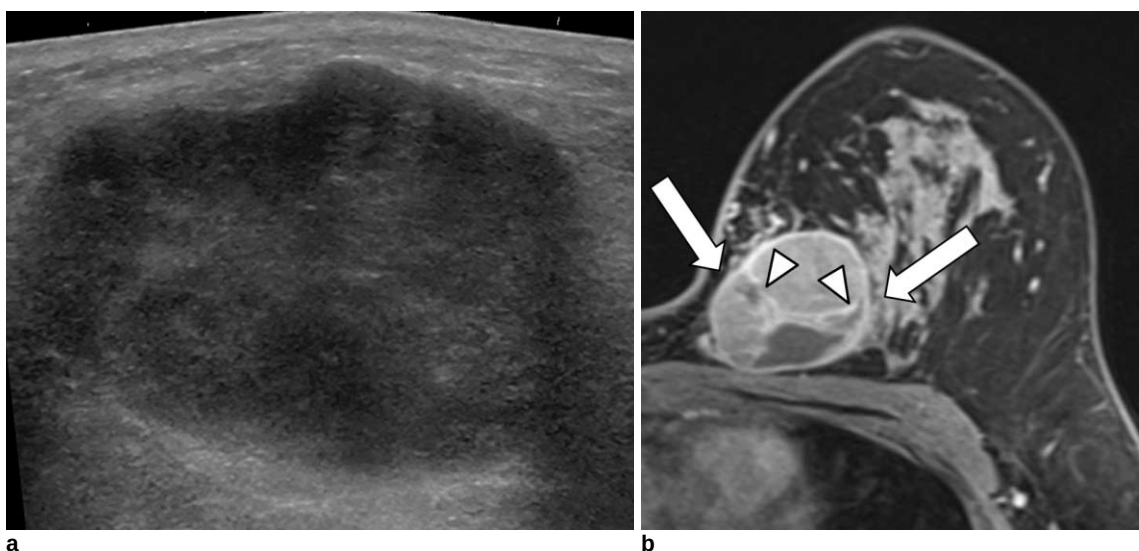


Fig. 4. A 27-year-old woman with medullary carcinoma.

a. On US, a circumscribed mass with inhomogeneous hypoechogenicity is seen.

b. On contrast-enhanced T1-weighted MR image, the mass (arrows) showed rim enhancement with enhancing internal septations (arrow-heads).

aggressive variant of invasive ductal cancer and accounts for 0.7% of breast cancer (25). This tumor is characterized by pseudopapillary structures lacking a fibrovascular core and surrounded by clear, empty spaces resembling lymphovascular channels (Fig. 6a), and a high nuclear grade (25). The aggressiveness of invasive micropapillary carcinoma is presumed to be related to lymphotropism and massive axillary lymph node metastasis is present at diagnosis in most cases (Fig. 6c) (26). On MG, they typically manifestate as a hyper-

dense, irregular mass with spiculated margins that is often associated with microcalcifications (27). On US, they present as an irregularly shaped solid hypoechoic mass with indistinct margins (Fig. 6b). On MRI, invasive micropapillary carcinoma can present as both of mass and non-mass-like enhancement with kinetic feature of rapid initial increase and delayed washout or plateau (27). The most common features of masses were irregular shapes and spiculated margins (Fig. 6d) and the distribution and internal enhancement pattern of non-

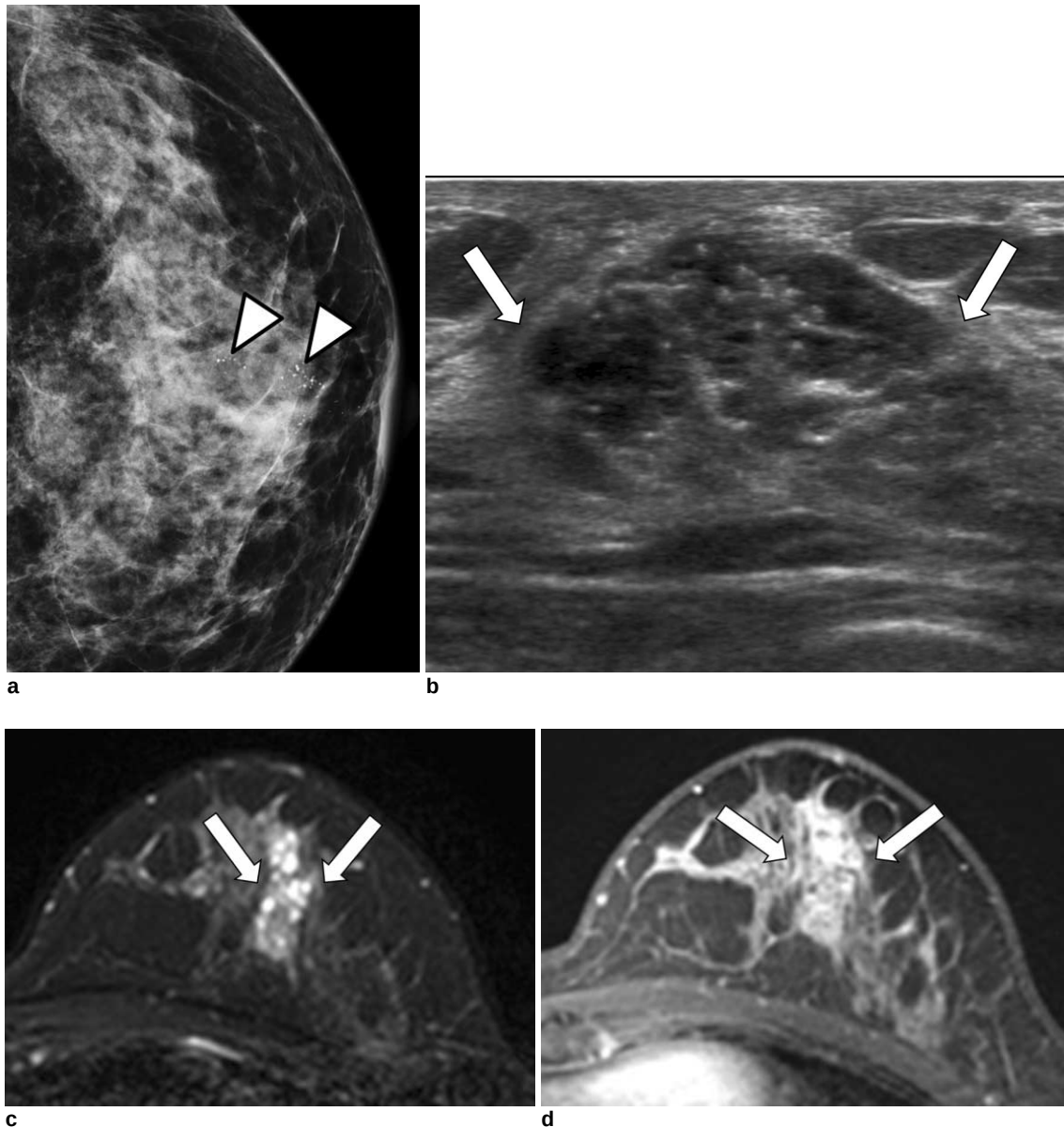


Fig. 5. A 44-year-old woman with papillary carcinoma.

a. On MG (CC view), fine pleomorphic microcalcifications (arrowheads) are segmentally distributed in retroareolar area of left breast.

b. On US, a hypoechoic solid mass with internal cystic portions and microcalcifications (arrows) is seen in retroareolar area of left breast.

c. On fat-saturated T2-weighted MR image, a complex cystic mass containing multiple fluid content with extension along duct to nipple (arrows) is seen.

d. On contrast-enhanced T1-weighted MR image, enhancement of walls of cystic mass and adjacent duct (arrows) is noted.

mass-like enhancement are diffuse clumped or diffuse stippled (27).

Apocrine Carcinoma

Apocrine carcinoma is a rare breast tumor and accounts for 0.4% of breast carcinoma (28). It begins in the milk duct of the breast and the cells of an apocrine carcinoma resemble cells normally found in the sweat glands in the underarm and groin area. It is suggested that the normal ductal breast cells have undergone metaplasia, to become more like apocrine cells. Apocrine carcinomas are often “triple negative” and are almost always positive for androgen receptor. Clinical and mammographic features of apocrine carcinoma

do not differ from those of IDC (29). On MG, widespread, scattered, mixed type atypical calcifications of circular shape and benign appearance can be seen in apocrine carcinomas (30). Sonographic characteristics have not been detailed but they might be seen as solid mass with spiculated or angular margin and complex cyst containing solid components or thick septa (31, 32). In our case, apocrine carcinoma presents as a lobular margined, oval shaped, isodense mass on mammography (Fig. 7a) and hypoechoic mass with circumscribed and partially indistinct margin on US (Fig. 7b). Hirose et al. (33) reported three cases of apocrine carcinoma and insisted that the margins of apocrine carcinomas are not clear and the shapes of tumors are vari-

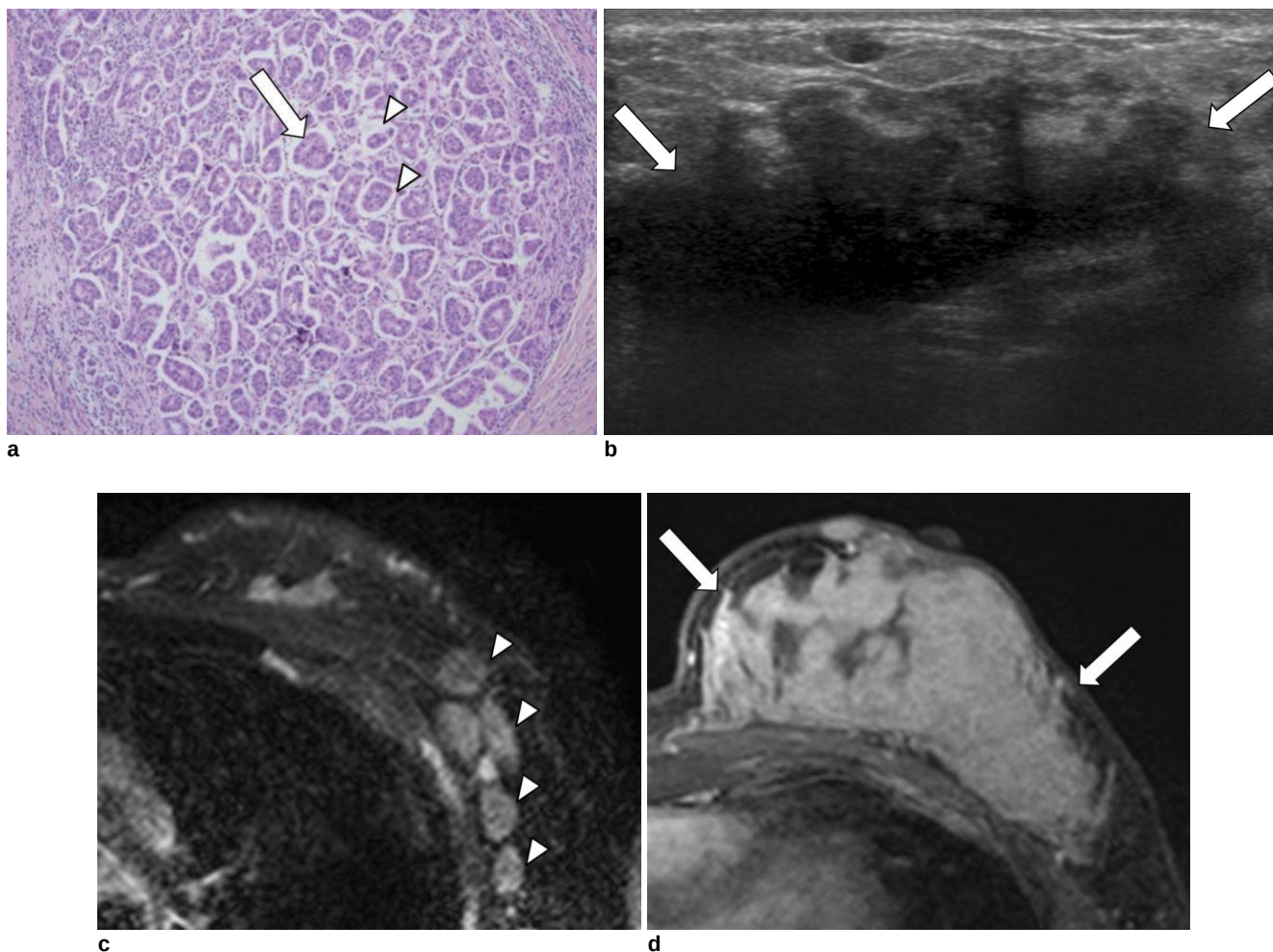


Fig. 6. A 51-year-old woman with micropapillary carcinoma.

- a. Histopathologic examination demonstrates the formation of pseudopapillary structures lacking a fibrovascular core (arrow) by spaces represent retraction artifact (arrowheads) (original magnification, X100; hematoxylin-eosin stain).
- b. On US, an irregularly shaped solid hypoechoic mass with indistinct margin (arrows) is seen in left breast.
- c. On fat-saturated T2-weighted MR image, multiple axillary lymph node metastases (arrowheads) are seen.
- d. On contrast-enhanced T1-weighted MR image, huge irregular shaped, spiculated, heterogeneous enhancing mass (arrows) is seen in left breast.

able, the signal intensities of three apocrine carcinomas are low on the T2-weighted images (Fig. 7c) and they show enhancement on post-enhanced studies. In our case, mass show hypointense rim on T2-weighted image (Fig. 7c) and rim enhancement with internal enhancing septa on contrast enhanced T1-weighted image (Fig. 7d), similar to medullary carcinoma.

Metaplastic Carcinomas

Metaplastic carcinomas account for fewer than 1% (1). Metaplastic carcinomas are regarded as ductal carcinomas that undergo metaplasia into a nonglandular growth. The Wargotz and Norris classification differentiates metaplastic carcinomas into 5 subtypes: spindle cell, squamous cell (Fig. 8a and b), carcinosarcoma, matrix-producing, and metaplastic carcinoma with osteoclastic giant cells (34). They present as irregular or cir-

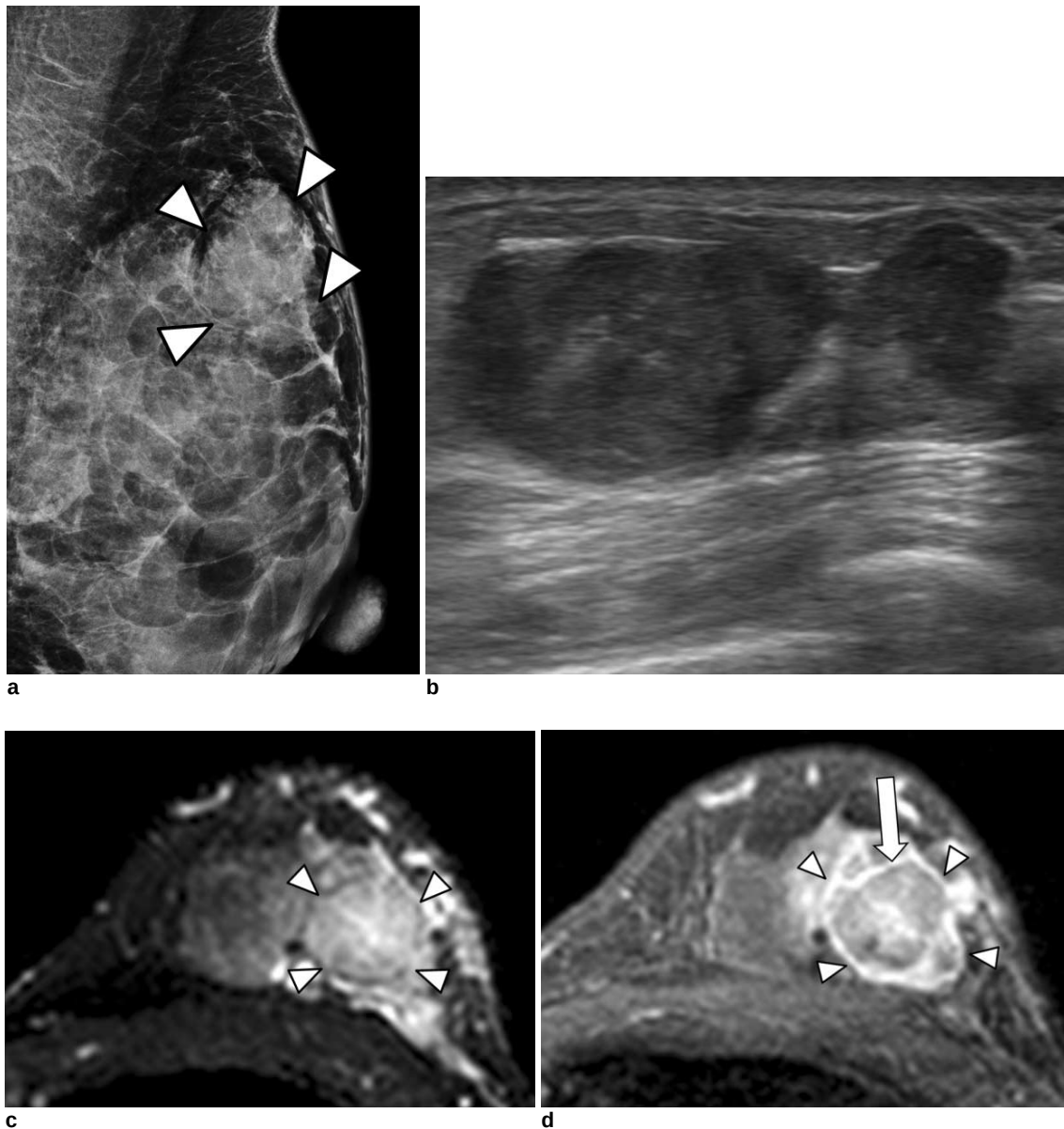


Fig. 7. A 42-year-old woman with apocrine carcinoma.

a. On MG (MLO view), a lobular margined, oval shaped, isodense mass (arrowheads) is seen in left upper breast.

b. On US, a hypoechoic mass with circumscribed and partially indistinct margin is seen.

c. On fat-saturated T2-weighted MR image, the mass show isointense to normal breast tissue and has hypoechoic rim (arrowheads).

d. On contrast-enhanced T1-weighted MR image, the mass show rim enhancement (arrowheads) and internal enhancing septa (arrow) are seen.

cumscribed palpable masses with spiculated margin on MG, solid irregular vs. mixed cystic and solid masses on US (Fig. 8c), intermediate to increased T2 signal intensity and isointense or hypointense on T1-weighted image (35). Solid and cystic components correlated with metastatic carcinoma containing necrosis, hemorrhage, cystic degeneration and matrix formation on pathology (34) and the lesions with more cystic components were associated with squamous component such as our case.

Malignant Neoplasms of Stromal Origin

Breast tumors may originate from the supporting tissue of the breast, including fibromuscular tissue, blood vessels, and lymph system. Malignant neoplasms of stromal origin include phyllodes tumor, angiosarcoma, osteosarcoma and adenoid cystic carcinoma.

Adenoid Cystic Carcinoma

Adenoid cystic carcinoma is a rare variant of adenocarcinoma that usually occurs in the major and minor salivary glands but also has been observed in the breast. It accounts for 0.1% of breast carcinoma (33) and is diagnosed predominantly in postmenopausal women. They consist of a mixture of proliferative glandular tissue and stromal or basement membrane elements (36). Microcystic areas formed by coalescent spaces in the dilated glands are found in about 25% of tumors and these spaces are large enough to be seen at gross examination (36). On MG, they present as benign-appearing smooth or lobulated masses (37), irregular shaped indistinct margined masses (37, 38) or subtle architectural distortion (39). On US, they can be seen as irregularly shaped masses with angular, indistinct or microlobulated margins. They are either hypoechoic or heterogeneous in echotexture (Fig. 9a) (39). On MRI, they can

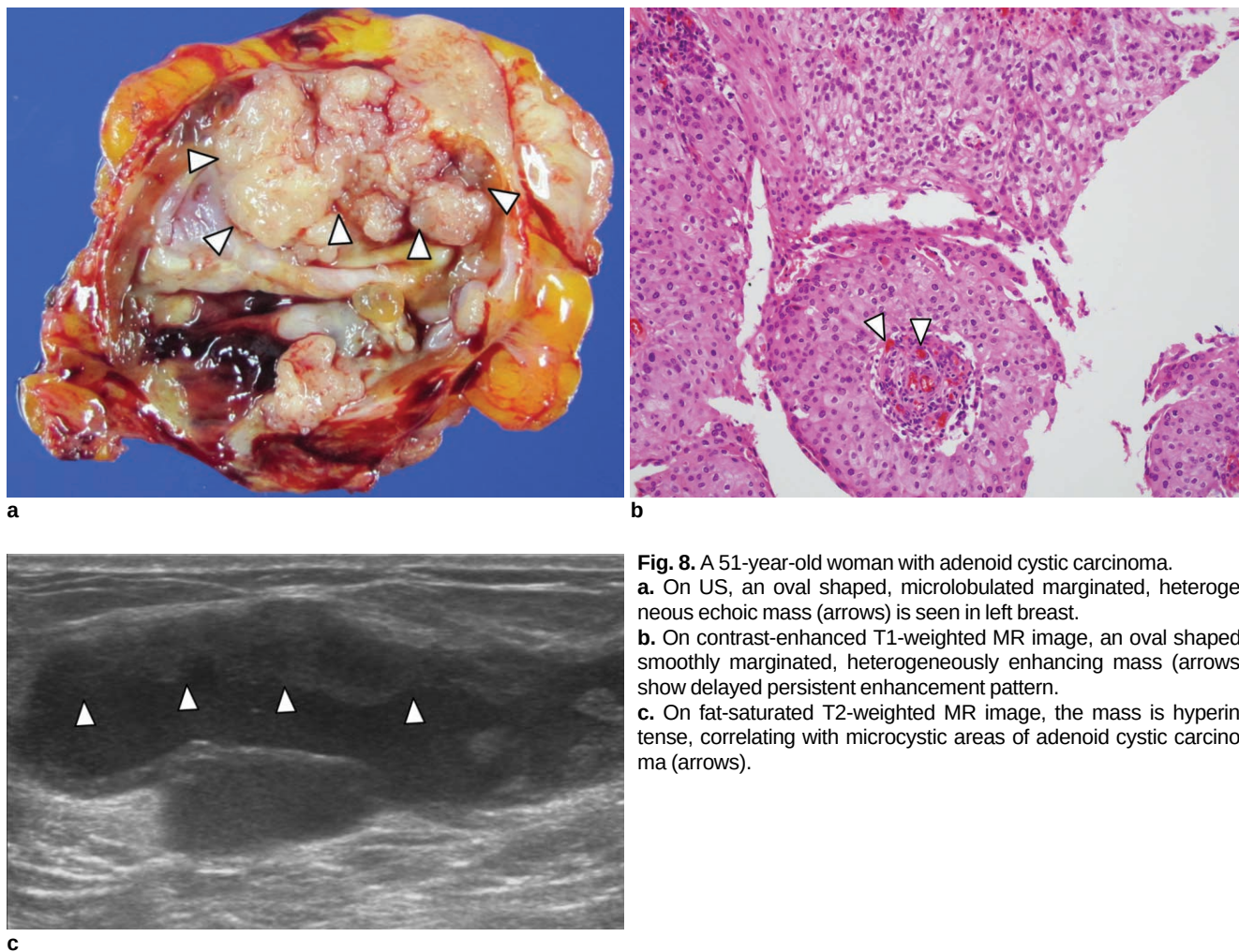
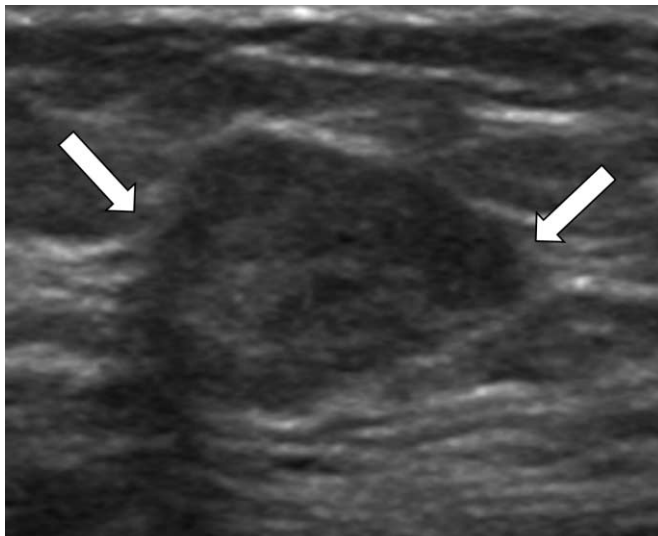


Fig. 8. A 51-year-old woman with adenoid cystic carcinoma.

a. On US, an oval shaped, microlobulated margined, heterogeneous echoic mass (arrows) is seen in left breast.

b. On contrast-enhanced T1-weighted MR image, an oval shaped, smoothly margined, heterogeneously enhancing mass (arrows) show delayed persistent enhancement pattern.

c. On fat-saturated T2-weighted MR image, the mass is hyperintense, correlating with microcystic areas of adenoid cystic carcinoma (arrows).



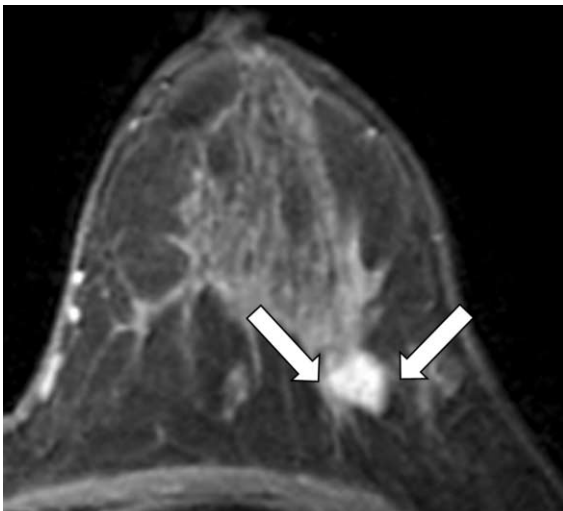
a

Fig. 9. A 81-year-old woman with squamous cell type metaplastic carcinoma.

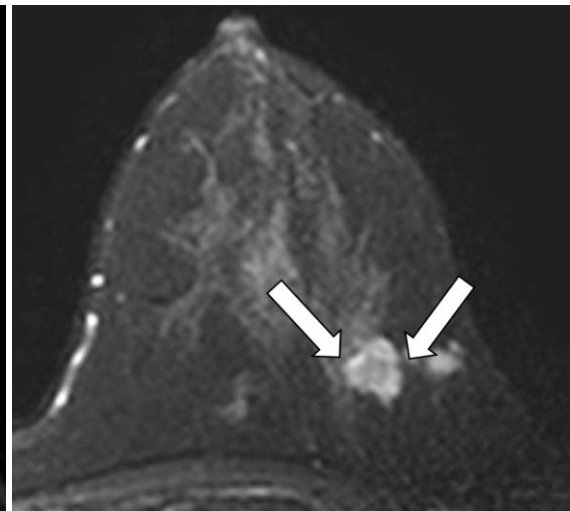
a. On gross specimen, inner surface of cystic mass shows multiple papillary projections (arrowheads).

b. Histopathologic examination demonstrates large pleomorphic cells with squamous differentiation and keratin pearls (arrowheads) (original magnification, $\times 100$; hematoxylin-eosin stain).

c. On US, an oval shaped, circumscribed marginated, cystic mass with surrounding echogenic wall is seen. Echogenic wall (arrowheads) is well correlated with multiple papillary projections of gross specimen.



b



c

be seen as a well-circumscribed, round mass with rapid enhancement mass (Fig. 9b) (40) or irregular or spiculated mass with suspicious enhancement kinetics (39). On T2-weighted image, they present as isointense or hyperintense (Fig. 9c) (39).

Metastatic Disease

Metastatic disease in the breast should be considered when there is axillary adenopathy or multiple masses are present other than benign fibrocystic changes. The most common metastatic diseases in the breast are lymphoma; melanoma; rhabdomyosarcoma; lung, ovarian, renal cell, or cervical carcinoma; and leukemia, in order of frequency.

Conclusion

Unusual breast malignancies are a few, rare breast neoplasms and include ILC, well-differentiated subtypes of IDC, cancers of stromal origin, and metastatic neoplasms. Breast MRI is recommendable imaging technique to understand their characteristics, assess the extent, and show good correlation with pathologic features.

References

1. Berg JW, Hutter RV. Breast cancer. *Cancer* 1995;75(Suppl 1):257-269
2. Harvey JA. Unusual breast cancers: useful clues to expanding the

- differential diagnosis. *Radiology* 2007;242:683-694
3. Sickles EA. The subtle and atypical mammographic features of invasive lobular carcinoma. *Radiology* 1991;178:25-26
4. Krecke KN, Gisvold JJ. Invasive lobular carcinoma of the breast: mammographic findings and extent of disease at diagnosis in 184 patients. *AJR Am J Roentgenol* 1993;161:957-960
5. Lopez JK, Bassett LW. Invasive lobular carcinoma of the breast: spectrum of mammographic, US, and MR imaging findings. *Radiographics*: a review publication of the Radiological Society of North America, Inc 2009;29:165-176
6. Butler RS, Venta LA, Wiley EL, Ellis RL, Dempsey PJ, Rubin E. Sonographic evaluation of infiltrating lobular carcinoma. *AJR Am J Roentgenol* 1999;172:325-330
7. Qayyum A, Birdwell RL, Daniel BL, et al. MR imaging features of infiltrating lobular carcinoma of the breast: histopathologic correlation. *AJR Am J Roentgenol* 2002;178:1227-1232
8. Boetes C, Veltman J, van Die L, Bult P, Wobbes T, Barentsz JO. The role of MRI in invasive lobular carcinoma. *Breast Cancer Research and Treatment* 2004;86:31-37
9. Weinstein SP, Orel SG, Heller R, et al. MR imaging of the breast in patients with invasive lobular carcinoma. *AJR Am J Roentgenol* 2001;176:399-406
10. Monzawa S, Yokokawa M, Sakuma T, et al. Mucinous carcinoma of the breast: MRI features of pure and mixed forms with histopathologic correlation. *AJR Am J Roentgenol* 2009;192:W125-131
11. Lam WW, Chu WC, Tse GM, Ma TK. Sonographic appearance of mucinous carcinoma of the breast. *AJR Am J Roentgenol* 2004;182:1069-1074
12. Kawashima M, Tamaki Y, Nonaka T, et al. MR imaging of mucinous carcinoma of the breast. *AJR Am J Roentgenol* 2002;179:179-183
13. Sheppard DG, Whitman GJ, Huynh PT, Sahin AA, Fornage BD, Stelling CB. Tubular carcinoma of the breast: mammographic and sonographic features. *AJR Am J Roentgenol* 2000;174:253-257
14. Leibman AJ, Lewis M, Kruse B. Tubular carcinoma of the breast: mammographic appearance. *AJR Am J Roentgenol* 1993;160:263-265
15. Elson BC, Helvie MA, Frank TS, Wilson TE, Adler DD. Tubular carcinoma of the breast: mode of presentation, mammographic appearance, and frequency of nodal metastases. *AJR Am J Roentgenol* 1993;161:1173-1176
16. Testempassi E, Sakuma T, Fukuda Y, et al. Solid tubular carcinoma of the breast: MR imaging and pathologic correlation. *Breast Cancer* 1995;2:59-63
17. G C. Malignant lesions. In: *Breast imaging*. Philadelphia, Pa: Lippincott Williams & Wilkins; 2004.
18. Jeong SJ, Lim HS, Lee JS, et al. Medullary carcinoma of the breast: MRI findings. *AJR Am J Roentgenol* 2012;198:W482-487
19. Meyer JE, Amin E, Lindfors KK, Lipman JC, Stomper PC, Genest D. Medullary carcinoma of the breast: mammographic and US appearance. *Radiology* 1989;170(1 Pt 1):79-82
20. Brinck U, Fischer U, Korabiowska M, Jutrowski M, Schauer A, Grabbe E. The variability of fibroadenoma in contrast-enhanced dynamic MR mammography. *AJR Am J Roentgenol* 1997;168:1331-1334
21. Schneider JA. Invasive papillary breast carcinoma: mammographic and sonographic appearance. *Radiology* 1989;171:377-379
22. Brookes MJ, Bourke AG. Radiological appearances of papillary breast lesions. *Clinical Radiology* 2008;63:1265-1273
23. Liberman L, Feng TL, Susnik B. Case 35: intracystic papillary carcinoma with invasion. *Radiology* 2001;219:781-784
24. Eiada R, Chong J, Kulkarni S, Goldberg F, Muradali D. Papillary lesions of the breast: MRI, ultrasound, and mammographic appearances. *AJR Am J Roentgenol* 2012;198:264-271
25. Fisher ER PA, Redmond C, et al. Pathology findings from the national surgical adjuvant breast project (protocol no. 4). *Am J Clin Pathol* 1980;73:313-320
26. Kim MJ, Gong G, Joo HJ, Ahn SH, Ro JY. Immunohistochemical and clinicopathologic characteristics of invasive ductal carcinoma of breast with micropapillary carcinoma component. *Archives of Pathology & Laboratory Medicine* 2005;129:1277-1282
27. Adrada B, Arribas E, Gilcrease M, Yang WT. Invasive micropapillary carcinoma of the breast: mammographic, sonographic, and MRI features. *AJR Am J Roentgenol* 2009;193:W58-63
28. Abati AD, Kimmel M, Rosen PP. Apocrine mammary carcinoma. A clinicopathologic study of 72 cases. *Am J Clin Pathol* 1990;94:371-377
29. Gilles R, Lesnik A, Guinebretiere JM, et al. Apocrine carcinoma: clinical and mammographic features. *Radiology* 1994;190:495-497
30. Kopans DB, Nguyen PL, Koerner FC, et al. Mixed form, diffusely scattered calcifications in breast cancer with apocrine features. *Radiology* 1990;177:807-811
31. Onoue S, Katoh T, Chigira H, et al. A case of apocrine carcinoma of the breast presenting as two cysts. *Breast Cancer* 1997;4:193-196
32. Gokalp G, Topal U, Haholu A, E K. Apocrine carcinoma of the breast: mammography and ultrasound findings. *European Journal of Radiology Extra* 60 2006:55-59
33. Hirose M, Hashizume T, Seino N, Kubota H, Nobusawa H, Gokan T. Atlas of breast magnetic resonance imaging. *Current Problems in Diagnostic Radiology* 2007;36:51-65
34. Yang WT, Hennessy B, Broglio K, et al. Imaging differences in metaplastic and invasive ductal carcinomas of the breast. *AJR Am J Roentgenol* 2007;189:1288-1293
35. Leddy R, Irshad A, Rumboldt T, Cluver A, Campbell A, Ackerman S. Review of metaplastic carcinoma of the breast: imaging findings and pathologic features. *Journal of Clinical Imaging Science* 2012; 2:21
36. Rosen P. Adenoid cystic carcinoma. In: *Rosen's breast pathology*, vol. 535-549, 2nd edn. Philadelphia, Pa: Lippincott Williams & Wilkins; 2001
37. Santamaria G, Velasco M, Zanon G, et al. Adenoid cystic carcinoma of the breast: mammographic appearance and pathologic correlation. *AJR Am J Roentgenol* 1998;171:1679-1683
38. Sperber F, Blank A, Metser U. Adenoid cystic carcinoma of the breast: mammographic, sonographic, and pathological correlation. *The Breast Journal* 2002;8:53-54
39. Glazebrook KN, Reynolds C, Smith RL, Gimenez EI, Boughey JC. Adenoid cystic carcinoma of the breast. *AJR Am J Roentgenol* 2010;194:1391-1396
40. Tsuboi N, Ogawa Y, Inomata T, et al. Dynamic MR appearance of adenoid cystic carcinoma of the breast in a 67-year-old female. *Radiation Medicine* 1998;16:225-228

흔하지 않은 유방암: 자기공명영상 소견과 병리 소견의 연관성

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침윤성 관상피암과 관상피내암은 유방암의 대략 85%를 차지한다. 흔하지 않은 유방암에는 대략적으로 침윤성 소엽암과 잘 분화된 침윤성 관상피암, 기질에서 유래한 암, 그리고 전이성 암들이 있다. 흔하지 않은 유방암은 익숙하지 않아서 이러한 종양들의 자기공명영상 소견을 판독하는 것과 병리 소견과 연관시키는 것을 주저하게 된다. 따라서 이 논문에서는 흔하지 않은 유방암들, 또한 매우 드문 유방암들에 대한 개요를 살펴보고, 이러한 암들의 자기공명영상을 포함한 다양한 유방 영상과 병리소견의 상관관계를 연관시켜 제시하고자 한다.

Index words: Unusual breast cancer; Magnetic resonance imaging