

# Radiologic and Pathologic Correlation of Non-mass like Breast Lesions on US and MRI

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Non-mass like lesions on breast ultrasound (US) and magnetic resonance imaging (MRI) have various pathologic diagnoses from benign to malignant lesions. Non-mass like lesions are usually described as ductal changes with or without intraductal nodules on US and non-mass like enhancement on MRI based on the BI-RADS (Breast Imaging Reporting and Data System) lexicon. Non-mass like lesions can be related with ductal pathology including high risk lesions or malignancies. However, image interpretations of non-mass like lesions are not familiar to radiologists and needs more experiences. In this article, we described image interpretation and clinical significance of non-mass-like lesions on breast MRI and US. And we correlated the radiologic features with pathologic diagnoses in benign, high-risk, and malignant non-mass-like lesions, respectively.

**Index words:** Breast; Non-mass like lesions; Pathologic correlation

## Introduction

The high sensitivity of dynamic contrast enhanced magnetic resonance imaging (MRI) for the detection of breast cancer has expanded its clinical role to include high risk screening, pre-operative staging, and post-treatment follow-up (1, 2). For analyzing a lesion on MRI, the radiologists assesses the morphology as well as kinetics of the lesion following the Breast Imaging Reporting and Data System (BI-RADS) lexicon (3). According to BI-RADS-MRI lexicon (4), the morphology of enhancement was categorized as focus, mass or non-mass-like enhancement. Non-mass like enhancement is the predominant morphology of ductal carcinoma

in situ (DCIS) which exhibits a variety of kinetic curve shapes (3, 5). Similar to non-mass-like enhancement on breast MRI, non-mass-like lesions were usually seen in breast ultrasonography (US) and have been described in some studies (6, 7) while non-mass-like lesions does not exist in standardized terminology of BI-RADS-US lexicon. Identification of non-mass-like lesions on US is very important in enabling accurate interpretation of DCIS and invasive lobular carcinoma that usually manifest as a non-mass-like lesion on US (7). In addition, common benign pathologic disease such as fibrocystic change and fibroadenoma occasionally manifest as non-mass like lesions on breast US and MRI (3). Therefore, non-mass like lesions on breast US and MRI have various pathologic diagnoses from benign to malignant lesions. However, image interpretations of non-mass like lesions are not familiar to radiologists and need more experiences.

In this article, we described image interpretation and

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clinical significance of non-mass-like lesions on MRI and US. And we correlated the radiologic features with pathologic diagnoses in benign, high-risk, and malignant non-mass-like lesions.

## I. Image interpretation and clinical significance

### *Non-mass-like enhancement on MRI*

Non-mass-like enhancement on MRI can be defined as enhancement that has no space-occupying effect and can occur in an area of the fibroglandular tissue that otherwise appears normal on pre-contrast images. The description of a non-mass-like lesion should include a characterization of its distribution (focal or multifocal, linear, ductal, segmental, regional, multiregional, diffuse), internal enhancement (homogeneous, heterogeneous, stippled, clumped, reticular), and symmetry.

The positive predictive value (PPV) for malignancy varied according to distribution and internal enhancement pattern of non-mass-like lesions. In terms of distribution, the reported PPV for linear or branching ductal distribution has varied from 24% to 85% (8). The most frequently observed ductal pattern in the benign lesions was a linear-ductal pattern, whereas a branching-ductal pattern was an indicator of malignancy (9). The differential diagnosis of ductal enhancement on MRI should include atypical ductal hyperplasia, lobular carcinoma in situ and DCIS in addition to benign findings such as fibrocystic change, ductal epithelial hyperplasia, and fibrosis (10). The reported PPV for regional distribution was 21%, while a moderate to marked degree of regional enhancement has a PPV of 59% (11). A segmental distribution of enhancement was associated with a 78% likelihood of cancer (11). In terms of internal enhancement, stippled enhancement is most frequently associated with benign lesions and has a 25% incidence of malignancy (12). Regional enhancement with stippled pattern can be found in both benign (e.g., fibrocystic change) and malignant (e.g., DCIS) abnormalities (11). However, heterogeneous, clumped and homogeneous enhancement are associated with a 53%, 60% and 67% likelihood of cancer, respectively (12).

Therefore, mild stippled enhancement with a regional distribution is indicative of benignity, whereas clumped enhancement with a segmental distribution is more

likely to indicate malignancy (12).

### *Non-mass-like lesions on US*

Non-mass-like lesions on US can be classified according to whether they describe patterns reminiscent of the milk duct system or those reminiscent of glandular tissue (7). The milk duct system patterns on US consist of “single ductal” hypoechoic and “multiple ductal” hypoechoic areas. A ductal hypoechoic area is defined as a duct-like structure with parallel orientation and can represent intraductal lesions growing in the milk duct (7). A ductal hypoechoic area clarified the indications for biopsy (13). In contrast, the glandular tissue patterns on US consist of “non-ductal” hypoechoic areas. A non-ductal hypoechoic area is defined as a lesion that differs from the surrounding glandular tissue or the same area in the contralateral breast (14) and as a confined asymmetry with an indistinct shape on two different projections but that does not fit the criteria of a mass; that is, it lacks convex outer borders and conspicuity (7). A non-ductal hypoechoic areas can be categorized as focal and segmental. A focal non-ductal hypoechoic area is defined as a non-oriented hypoechoic area that occupies a volume of less than one quadrant of the breast, while segmental non-ductal hypoechoic area is defined as a triangular or cone-shaped hypoechoic area with the apex pointing to the nipple and considered highly likely to be malignant (7).

Sotome et al. (6) also categorized non-mass-like lesions on US into duct dilatation, multi-vesicular pattern, or low echo area in the mammary gland. In non-mass-like lesions with duct dilation on US, pathologic diagnoses were DCIS, invasive ductal carcinoma with a predominant intraductal component, intraductal papilloma, or ductal epithelial hyperplasia (6). Multi-vesicular patterns on US were related with DCIS or mastopathy in multi-vesicular pattern and low echo areas were DCIS, invasive ductal or lobular carcinomas, or mastopathy.

## II. Correlation of radiologic features with pathologic diagnoses

Non-mass like lesions on breast US and MRI have various pathologic diagnoses from benign to malignant

lesions. Various pathologic diseases on US and MRI are summarized in Table 1.

### **Benign non-mass-like lesions**

There are fibrocystic change, ductal epithelial hyperplasia, mastitis, mastopathy (focal adenosis), hormonal stimulation and inflammatory changes in benign pathologic diseases presented as non-mass-like lesions on US and MRI (3, 6). Fibrocystic change is a common, non-cancerous condition that affects more than 50% of women. Two types of fibrocystic change were found including more diffuse type and focal type (15). Each type had different morphological features and focal type showed mass type of enhancement whereas more diffuse type showed non-mass type of enhancement (15). Forty three percentage of fibrocystic change presented as non-mass-like enhancement showed regional distribution (16). In terms of internal enhancement, stippled enhancement more likely represents fibrocystic change (Figs. 1, 2).

Ductal epithelial hyperplasia is common form of proliferative breast disease and can be presented as duct dilatation with internal echoes on US (6) (Fig. 3A). On MRI, ductal epithelial hyperplasia can present as non-mass-like enhancement with ductal distribution and homogeneous enhancement pattern (10) (Fig. 3B).

Inflammatory change such as acute mastitis can also be seen as non-mass-like lesions (Fig. 4). According to the study by Renz et al. (17) that reported 42 acute mastitis presented as non-mass-like enhancement, the distributions were 13 segmental (31%), 12 diffuse (28.6%), 9 regional (21.4%) and 8 multiple regions (19%) and the internal enhancement patterns were 15 stippled (35.7%), 11 dendritic (26.2%), 9 clumped (21.4%) and 7 non-specific (16.7%) (17).

Hormone effects caused by hormone replacement therapy can affect proliferative or inflammatory non-mass-like enhancements and ductal carcinomas in situ (18). Non-mass-like enhancements caused by hormone replacement therapy can be seen symmetrically and bi-

**Table 1.** Histopathologic Types of Non-mass-like-lesions

| Benign                        | High risk                   | Malignant                  |
|-------------------------------|-----------------------------|----------------------------|
| Fibrocystic change            | Atypical ductal hyperplasia | Ductal Carcinoma in situ   |
| Ductal epithelial hyperplasia | Intraductal papilloma       | Invasive ductal carcinoma  |
| Mastopathy (Focal adenosis)   | Lobular carcinoma in situ   | Invasive lobular carcinoma |
| Hormonal stimulation          |                             | Invasive tubular carcinoma |
| Inflammatory changes          |                             |                            |

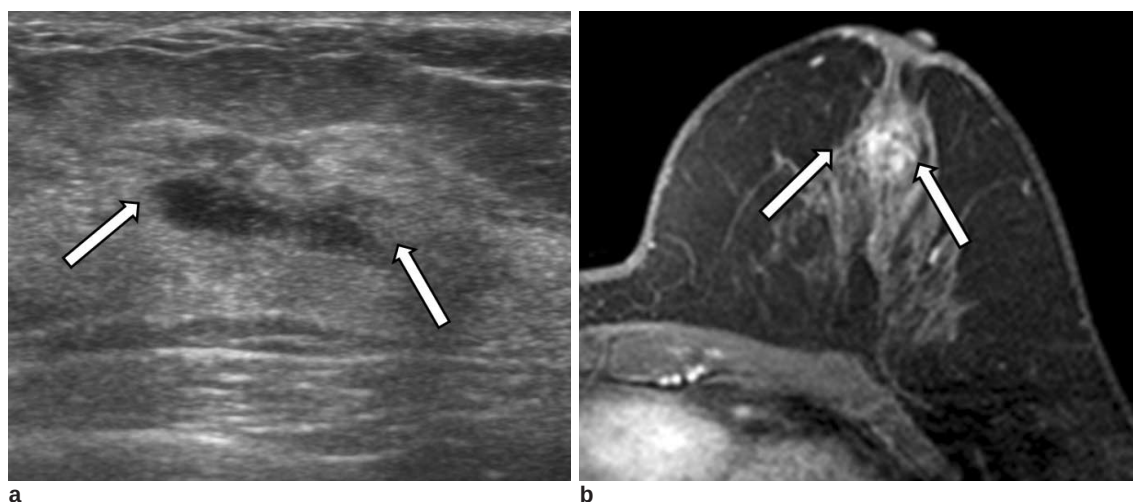


**Fig. 1.** A 54-year-old woman with invasive ductal carcinoma in right breast.

**a.** On US, non-mass-like-lesion is seen in 12 O'clock direction of left breast and the lesion is confirmed as fibrocystic change by core biopsy.

**b.** On axial contrast enhanced T1WI, non-mass-like enhancement with focal distribution and internal stippled enhancement is seen in upper mid portion of left breast.

laterally in outer portion of both breasts (Fig. 5).

### **High risk non-mass-like lesions**

There are atypical ductal hyperplasia, intraductal papilloma and lobular carcinoma in situ in high risk pathologic diseases presented as non-mass-like lesions on US and MRI. Atypical ductal hyperplasia is a lesion that has all of the features of DCIS but involves only one duct, and a lesion that has all of the features of DCIS but measures less than 2 mm in diameter (19). On US, atypical ductal hyperplasia most commonly manifests

suspicious sonographic findings that can also be seen with DCIS: duct extension, branch pattern, or microlobulation (Fig. 6). On MRI, ten cases of atypical ductal hyperplasia (67%) showed non-mass-like enhancement and five cases (33%) showed masses among 15 cases of atypical ductal hyperplasia yielded by MRI-guided vacuum-assisted breast biopsy in the study by Liberman et al. (20).

Intraductal papillomas may appear as well-defined solid nodules or mural-based nodules within a dilated duct on US (Fig. 7) and larger papillomas may appear as

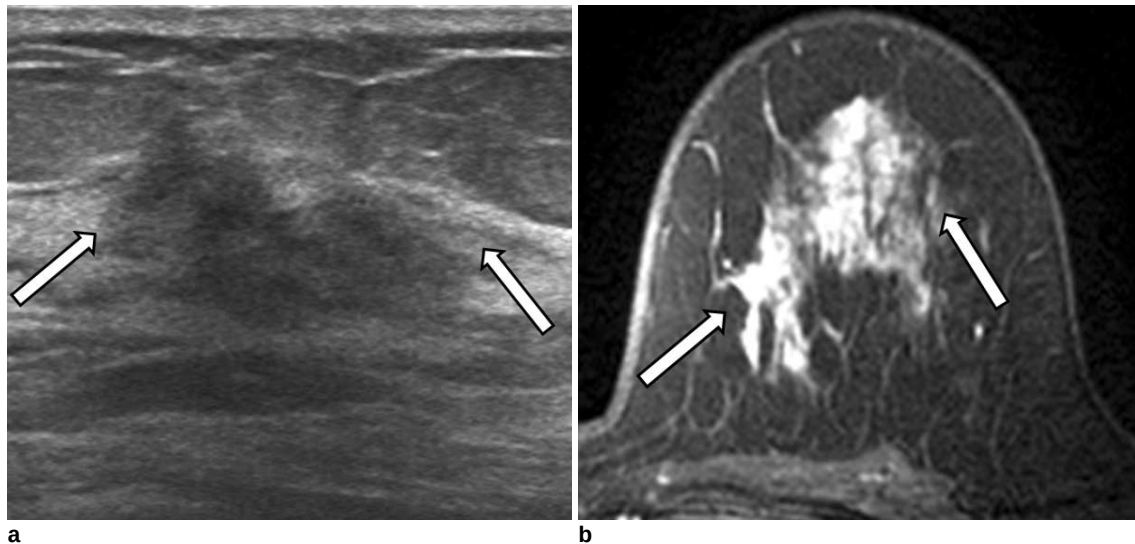


**Fig. 2.** A 48-year-old woman with invasive ductal carcinoma in right breast.

**a.** On US, non-mass-like-lesion is seen in 10 O'clock direction of left breast and the lesion is confirmed as fibrocystic change by core biopsy.

**b.** On sagittal contrast enhanced T1WI, non-mass-like enhancement with segmental distribution and internal clumped enhancement is seen in upper inner portion of left breast.

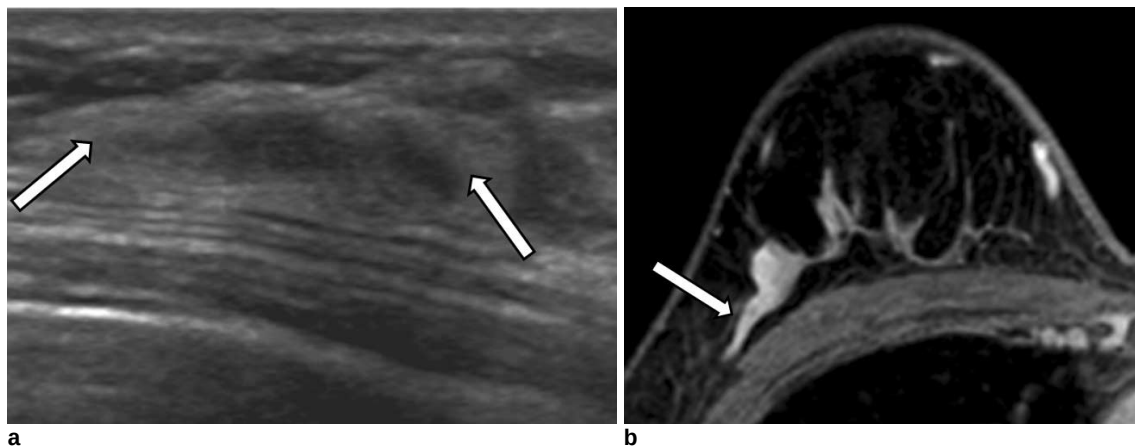


**Fig. 3.** A 52-year-old woman with previous history of paraffin injection in her breasts.

**a.** On US, a single ductal non-mass-like-lesion is seen in 10 O'clock direction of right breast and the lesion is confirmed as moderate ductal epithelial hyperplasia by core biopsy.

**b.** On axial contrast enhanced T1WI, non-mass-like enhancement with ductal distribution and internal homogeneous enhancement is seen in upper outer portion of right breast.

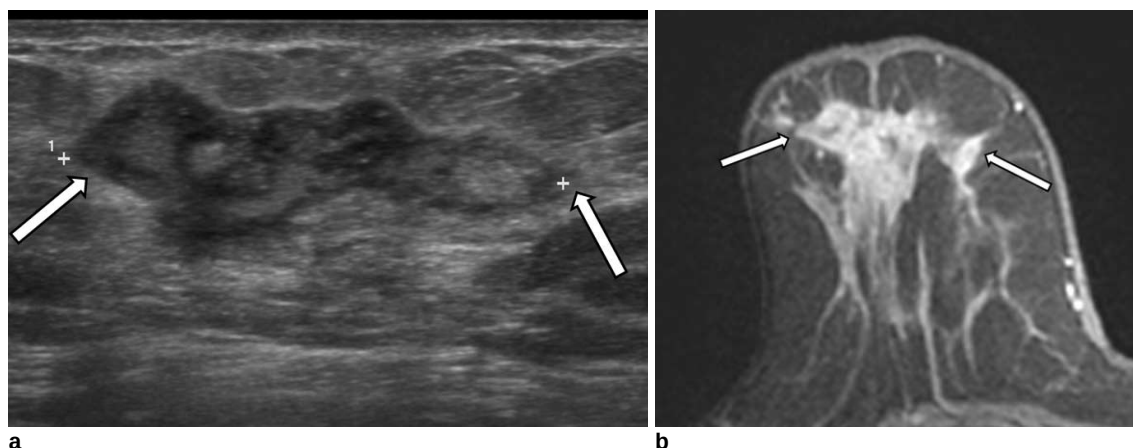


**Fig. 4.** A 60-year-old woman with invasive ductal carcinoma in left breast.

**a.** On US, non-mass-like-lesion is seen in 6 O'clock direction of right breast and the lesion is confirmed as chronic granulomatous inflammation with necrosis by core biopsy.

**b.** On axial contrast enhanced T1WI, non-mass-like enhancement with regional distribution and internal heterogeneous enhancement is seen in upper outer portion of right breast.

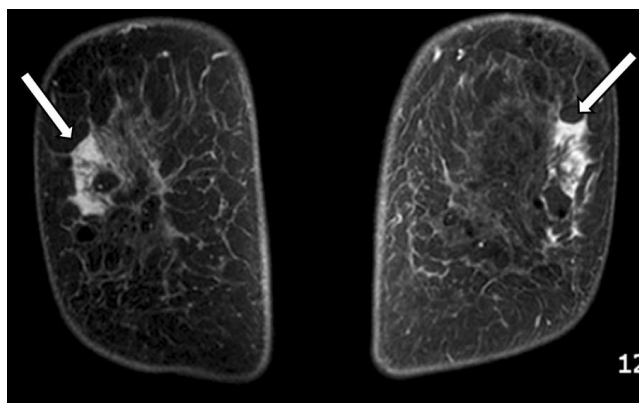


**Fig. 5.** A 55-year-old woman with hormone replacement therapy. On axial contrast enhanced T1WI, bilateral, symmetric non-mass-like enhancements with regional distribution and internal stippled enhancement are seen in upper outer portion of both breasts.

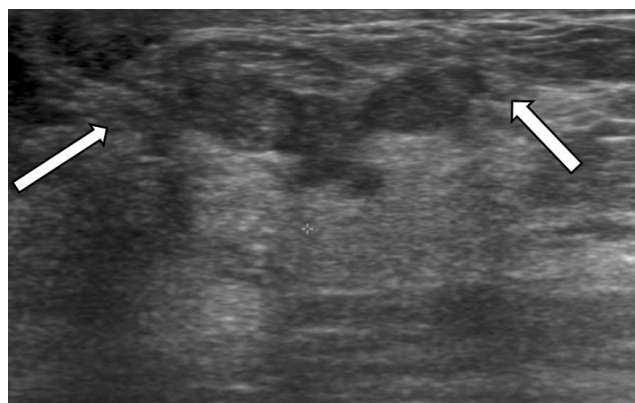


**Fig. 7.** A 44-year-old woman with no clinical symptom. On US, lobulated contoured, dilated duct with intraductal echogenic material is seen in subareolar area of right breast. The lesion is confirmed as intraductal papilloma with fibrocystic change by surgical excision with US-guided needed localization.

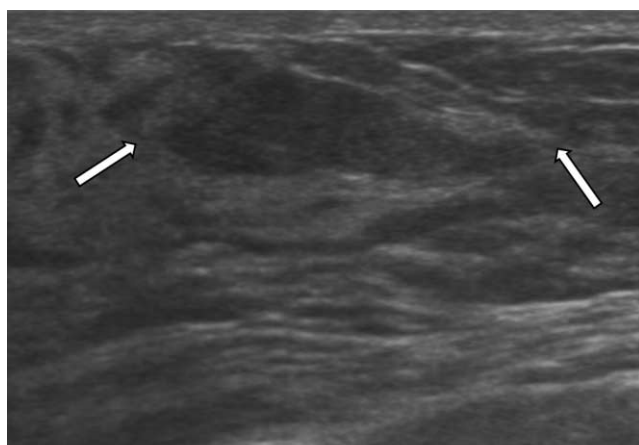


**Fig. 6.** A 33-year-old woman with no clinical symptom. On US, dilated duct with intraductal echogenic material is seen in subareolar area of right breast. The lesion is confirmed as atypical ductal hyperplasia with fibrocystic change by surgical excision with US-guided needed localization.

enhancing nodules with or without intraductal components on MRI (21). Among 34 cases of intraductal papillomas on MRI, 24 cases presented as masses, 9 non-mass-like enhancements and one focus in the study of Jansen et al. (3).

### ***Malignant non-mass-like lesions***

There are DCIS, invasive ductal carcinoma, invasive lobular carcinoma, and invasive tubular carcinoma presented as non-mass-like lesions on US and MRI (7). Pathological examination revealed that breast cancers presented as non-mass-like enhancements comprised 17% DCIS, 39% invasive lobular carcinomas, and 23% invasive ductal carcinomas (6). It has been reported

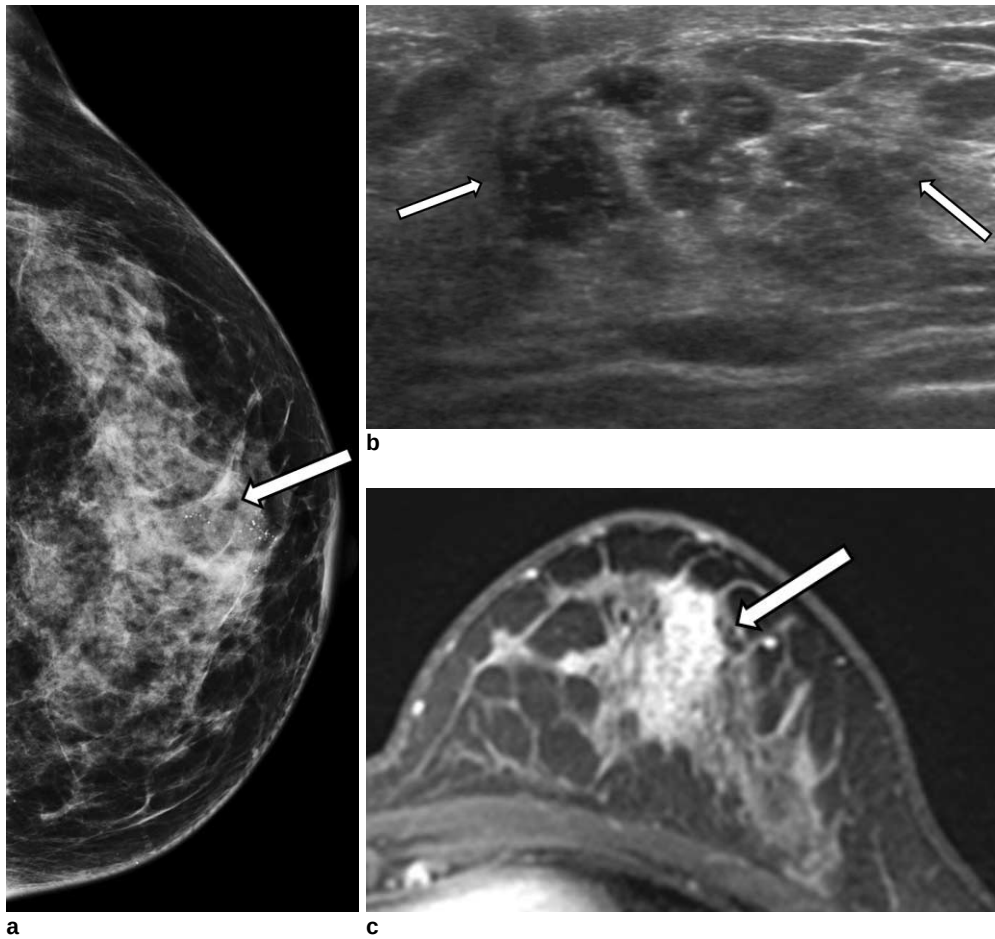


**Fig. 8.** A 44-year-old woman with no clinical symptom.

**a.** On left mammography, indistinct and round microcalcifications are regionally distributed in subareolar area of left breast.

**b.** On US, duct ectasia with internal microcalcifications and intraductal echogenic material is seen in left subareolar area.

**c.** On axial contrast enhanced T1WI, non-mass-like enhancement with segmental distribution and internal heterogeneous enhancement is seen in upper outer portion of right breast. The lesion is confirmed as ductal carcinoma in situ, low grade by breast conserving therapy.

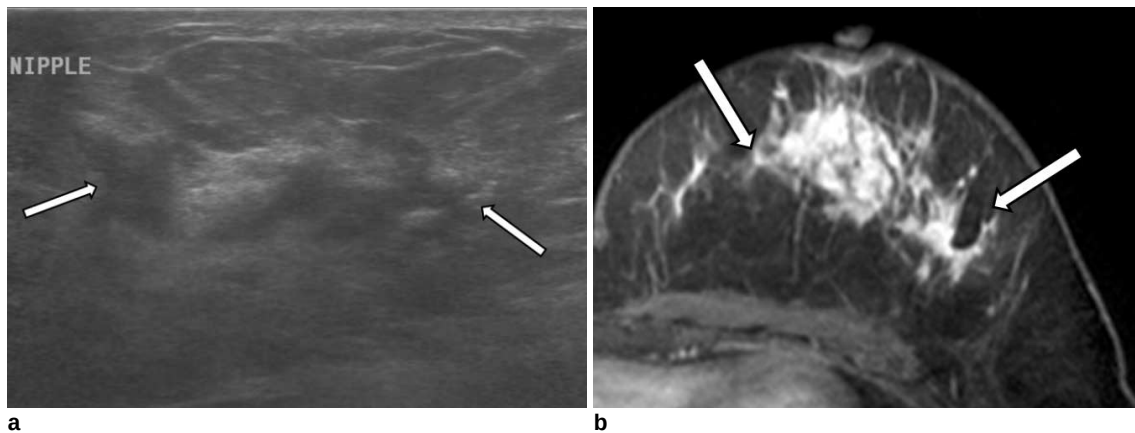


**Fig. 9.** A 47-year-old woman with palpable mass in her left breast.

**a.** On US, multiple hypoechoic ductectasia are seen in palpable area of left breast.

**b.** On axial contrast enhanced T1WI, non-mass-like enhancement with segmental distribution and internal clumped enhancement is seen in her left breast. The lesion is confirmed as invasive ductal carcinoma with concurrent ductal carcinoma in situ by breast conserving therapy.

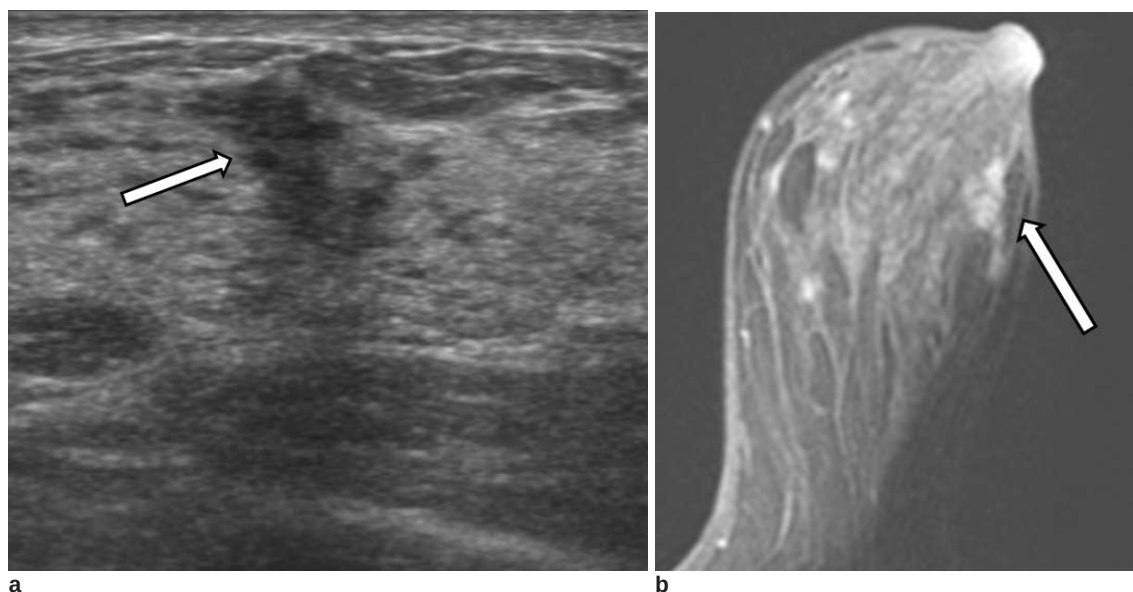


**Fig. 10.** A 44-year-old woman with no clinical symptom.

**a.** On US, a non-ductal hypoechoic area is seen in subareolar area of left breast.

**b.** On axial contrast enhanced T1WI, non-mass-like enhancement with regional distribution and internal clumped enhancement is seen in her left breast. The lesion is confirmed as invasive lobular carcinoma by breast conserving therapy.

that 95% of breast cancers with non-mass-like appearance on breast US also show non-mass-like enhancements on breast MRI (6). DCIS usually manifests as calcifications on mammography, which are caused by necrosis and subsequent calcification of the debris (Fig. 8A) and DCIS can usually manifest as a non-mass-like lesion on US (7) (Fig. 8B). On MRI, a finding of segmental or ductal non-mass-like enhancement is the most common finding of DCIS (22) (Fig. 8C). In invasive ductal carcinomas, cases with extensive intraductal component or DCIS can be seen as non-mass-like lesions on US and MRI (Fig. 9). Invasive lobular carcinomas are composed of non-cohesive cells individually dispersed or arranged in a single-file linear pattern within a fibrous stroma (7). This histopathological characteristics can be reflected in the non-mass-like lesions on US and MRI (Fig. 10).

## Conclusion

Non-mass like lesions on breast US and MRI have various pathologic diagnoses from benign to malignant lesions. On US, non-mass like lesions associated with segmental or linear distributed suspicious microcalcifications or intraductal nodules prefer malignancy. On dynamic MRI, non-mass like lesions with ductal or seg-

mental distribution and heterogeneous or clumped enhancements prefer malignancy. On the other hand, kinetic assessment on MRI may not be helpful to distinguish benign from malignant non-mass like lesions.

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## 유방 초음파와 자기 공명 영상에서 보이는 비종괴양 병변의 영상과 병리학적 연관성

송성은<sup>1</sup> · 서보경<sup>1</sup> · 조규란<sup>2</sup> · 우옥희<sup>3</sup> · 김백현<sup>1</sup> · 차상훈<sup>1</sup>

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유방 초음파와 자기 공명 영상에서의 비종괴양 병변에는 양성에서부터 악성까지 다양한 병리학적인 진단이 있다. 비종괴양 병변은 초음파에서는 유관내 결절을 동반하거나 동반하지 않은 유관 변화로 보이며, 자기 공명 영상에서는 BI-RADS 용어집에 근거하여 비종괴양 조영증강으로 기술된다. 비종괴양 병변은 보통 고위험군을 포함한 유관 변화나 관상피내암과 관련이 있다. 그러나, 비종괴양 병변의 영상을 판독하는 것은 영상의학과 의사에게 익숙하지 않으며, 더 많은 경험이 필요하다. 따라서 이 논문에서는 유방 초음파와 자기 공명 영상에서 보이는 비종괴양 병변의 영상 해석과 임상적 중요성을 논의하겠다. 또한 비종괴양 병변을 양성, 고위험군, 악성으로 분류하여 영상의학적 소견과 병리학적 소견을 각각 비교하겠다.

**Index words:** Breast; Non-mass like lesions; Pathologic correlation