MR imaging features of pre-malignant and pre-invasive breast lesions: can they be differentiated?

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Background and Purpose

A commonly proposed theory for developing invasive breast cancer results from a sequence of several steps, starting from normal epithelium to become hyperplasia and progress to atypical hyperplasia. Atypical hyperplasia may lead to a new clone that forms ductal carcinoma in situ (DCIS), which may then progresses to invasive cancer. Despite that this is the common sequence, the tissues may remain unchanged at a certain stage, or for some patients it may progress very rapidly. The risk of developing breast cancer in women with atypical hyperplasia is five times higher than women with normal breast tissue. Women with in-situ lesion have even higher risk of developing breast cancer, approximately 8-10 times, than women without in-situ lesion. Breast MRI is known to have a low specificity (a high false positive rate), which is in part due to many benign lesions (such as hyperplasia or fibrocystic changes) that also show contrast enhancements, and even present the malignant type enhancement kinetics with the wash-out pattern. On the other hand some DCIS may show the continuous enhancing pattern in the enhancement kinetics that is not considered as the malignant type. This study is aimed to compare the MR imaging features of pre-malignant hyperplasia and DCIS lesions.

Material and Methods

A retrospective analysis of all breast MRI studies performed at 1.5T scanner from 2002 to 2005 identified 16 pathological-proven pre-malignant cases (hyperplasia, atypical ductal hyperplasia-ADH, and atypical lobular hyperplasia-ALH) and 34 DCIS. The MR morphological features and enhancement kinetics were compared between them. Feature descriptor was analyzed based on BI-RADS MRI Lexicon. The morphologic criteria included mass type lesion [focus/foci (smaller than 5mm) and mass (greater than 5 mm)] and non-mass lesions of enhancement. The initial enhancement was categorized into fast, medium, and slow. The delayed enhancement was described as persistent, plateau, and washout. Fisher's exact test was used to test the significance of difference of MRI morphological and kinetic features between these two groups of patients.

Results

Table 1 summarizes the morphological imaging features between these two groups. The hyperplasic lesions and DCIS had a similar percentage of mass type (50% vs. 41%) and non-mass type lesions (50% vs. 56%). One DCIS (3%) was not enhanced. The types of non-mass lesions (diffuse, linear, segmental) between these 2 groups were not significantly different. The analysis of internal enhancement patterns showed that DCIS was more likely to present clumped pattern (10/19, 53% vs. 3/8, 38%) and less likely punctate pattern, (2/19, 11% vs. 3/8, 38%), as compared with pre-malignant hyperplasic lesions. Comparison of enhancement kinetics is summarized in Table 2. The malignant type enhancement kinetics (rapid up-slope followed by wash-out or plateau) was only seen in 46% pre-malignant lesions, whereas it was seen more frequently in 75% DCIS.

Ductal Hyperplasia

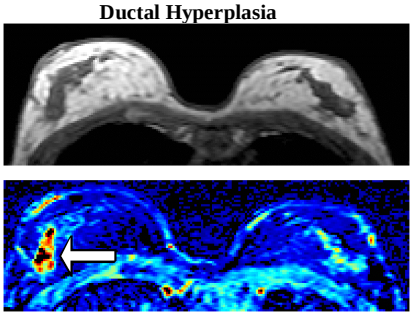

Fig.1. A non-mass type regional enhancement

Atypical Ductal Hyperplasia (ADH)

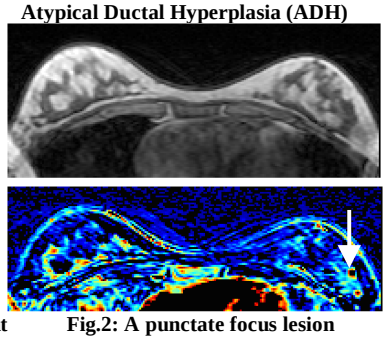

Fig.2: A punctate focus lesion

Atypical Lobular Hyperplasia (ALH)

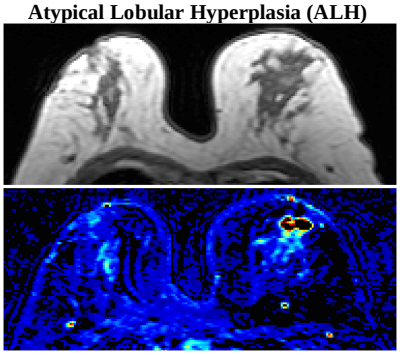

Fig.3. An irregular mass

DCIS- High Grade

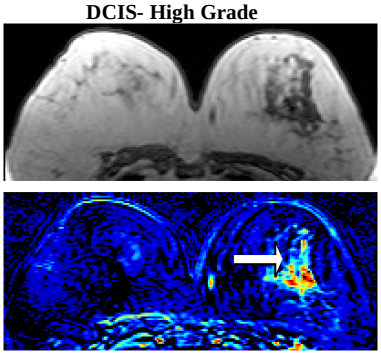

Fig.4. A non-mass type segmental enhancement

Table 1. Morphology Features of Hyperplasic Lesion and DCIS

Lesion Morphology \ Lesion Type	**Hyperplasic (N = 16)**	**DCIS (N= 34)**
Mass Type Lesion	**8/16 (50%)**	**14/34 (41%)**
Focus lesion	1/16 (6%)	3/34 (9%)
Mass lesion	**7/16 (44%)**	**11/34 (32%)**
Non Mass Type Lesion - Morphology	**8/16 (50%)**	**19/34 (56%)**
Multiple	0/8 (0%)	0/19 (0%)
Diffuse	**2/8 (25%)**	2/19 (10.5%)
Regional	**2/8 (25%)**	**6/19 (32%)**
Segmental	1/8 (12.25%)	1/19 (5%)
Focal	1/8 (12.25%)	**4/19 (21%)**
Ductal	0/8 (0%)	2/19 (10.5%)
Linear	**2/8 (25%)**	**4/19 (21%)**
Non Mass Type Lesion - Enhancement	**8/16 (50%)**	**19/34 (56%)**
Punctate	**3/8 (37.5%)**	2/19 (10.5%)
Clumped	**3/8 (37.5%)**	**10/19 (53%)**
Dendritic	0/8 (0%)	0/19 (0%)
Heterogeneous	**2/8 (25%)**	**5/19 (26%)**
Homogenous	0/8 (0%)	2/19 (10.5%)
None Enhancing Lesion	**0/16 (0%)**	**1/34 (3%)**

No significant group difference in all morphology features

Table 2. Enhancement Features of Hyperplasic Lesion and DCIS

Enhancement Kinetics\ Lesion Type	**Hyperplasic (N = 13)**	**DCIS (N= 28)**
Malignant pattern*	**6/13 (46%)**	**21/28 (75 %)**
Benign pattern**	**7/13 (54%)**	**7/28 (25%)**
Not Measured	**3**	**6**
No lesion	0	1
Mild enhancement	**2/3 (67%)**	**4/5 (80%)**
Moderate to Strong enhancement	1/3 (33%)	1/5 (20%)

* kinetics with rapid wash-in followed by wash-out or plateau.
** kinetics showing continuous enhancement.
No significant group difference was found in all kinetic features.

Conclusion

There are no MRI features that can clearly distinguish between the benign hyperplasic lesions (with malignant transformation potential) and DCIS. However, more than half of pre-malignant lesions showed a benign kinetic curve. Although not reaching a significant level, DCIS was more likely to present clumped pattern; whereas the pre-malignant lesions were more likely to show punctuate pattern. The current management protocol for core biopsy-proven hyperplasic lesions with atypia recommends surgical excision to confirm no presence of in-situ or micro invasive disease. A better understanding of MRI features may be used to help further selecting which patient should go for immediate surgical biopsy, and which patient can be put on watchful waiting.

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