Comparison of MRI Features of Infiltrating Lobular Carcinoma with Invasive Ductal Carcinoma Based on ACR BI-RADS MRI Lexicon

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Purpose

Invasive lobular carcinoma (ILC) comprises approximately 10% of breast cancers and has a different biology from that of invasive ductal carcinoma (IDC). ILC are more often hormone receptor-positive than IDC [Arpino et al. Breast Cancer Res. 2004; 6:R149-56]. Clinical data have found that the frequency of multiple metastases was higher in ILC than IDC. The incidence of multiple lesions in ILC compared to IDC was also reported to be higher. It was demonstrated that ILC achieved a lower response to chemotherapy than IDC [Mathieu et al. Eur J Cancer 2004; 40:342-51]. Patients with ILC are less likely to have a complete response rate and have a larger number of involved axillary lymph nodes. However, ILC is showing a good response to adjuvant endocrine therapy, and patients tend to have longer recurrence-free survival and overall survival compared to IDC [Cristofanilli et al. J Clin Oncol. 2005; 23:41-8]. Due to the infiltrating growth pattern of ILC which causes minimal architecture distortion, it is difficult to detect ILC by ultrasonography or conventional mammography. MRI, however, has been proved very useful in detection of ILC as well as assessment of disease extent. A superior correlation between tumor size measured on MRI and pathology has been established. More understanding of different MRI features in ILC may further improve the accuracy in early diagnosis. The aim of this study was to analyze and compare the different morphological appearances and kinetic features between ILC and IDC, using the features defined in ACR BI-RADS MRI lexicon.

Methods

Histologically proven cases of 29 ILC and 30 IDC were included in this study. Breast MRI was performed on a Philips Eclipse 1.5T MR scanner, using a dedicated bilateral breast coil. The spin echo T1W sagittal unilateral pre-contrast images, and axial bilateral dynamic contrast-enhanced (DCE) images were acquired. For DCE sequence, a 3D SPGR (RF-FAST) (TR=10 msec, TE=3.6 msec, slice thickness= 4mm, flip angle= 20 degrees, matrix size= 256x128, field of view= 32-38 cm) was employed, including 4 pre-contrast and 12 post-contrast scans. The post-enhanced images acquired at the sixth acquisition at 1-min post injection was used to subtract the average of 4 pre-contrast images to generate enhancement maps, shown both in gray level and in color (Fig.1). The maximum intensity projections (MIPs) were also generated from the subtraction images (Fig.1). Morphological appearances and kinetic features of breast lesions in MRI were analyzed according to the ACR BI-RADS MRI lexicon. Different types of lesions included focus/foci (smaller than 5mm), mass (greater than 5 mm) and non-mass-like enhancement pattern. Further, lesions characteristics such as shape, margin, and internal enhancement patterns were assessed. The evaluation of enhancement kinetic curve was based on initial (within the first 2 minutes or when the curve starts to change), and late phases (after 2 minutes or after the change). The initial enhancement phase is categorized into fast, medium, and slow. The delayed enhancement phase is described as persistent, plateau, and washout. All cases were retrospectively reviewed by an experienced radiologist.

Results

Regarding lesion morphological appearances, ILC patients had more diverse findings than IDC. Twenty-two ILC patients (22/29) showed irregularly enhanced lesions (2 multiple foci and 20 masses). The size ranged from 4mm to 4cm. Seven ILC (7/29) revealed non-mass-like enhancement including four with diffuse reticular or dendritic enhancements in whole breast or multi-quadrants, one linear enhancement, and two small regional enhancements. For IDC, 29 patients (29/30) either had single focus, multiple foci, or irregular masses (size range 3mm to 3.5cm). One advanced case showed segmental clumped enhancement. Kinetic features between these two groups were also different. In cases where separate lesions were identified, the kinetics from each lesion was measured. Of the 35 enhancement kinetics measured from the ILC lesions, 26/35 showed fast early enhancement phase, 8/35 showed moderate early phase, and one with slow early phase. While in 35 IDC lesions, most of them (34/35) showed fast early enhancement phase, and only one with slow early phase. Delayed enhancement phase also showed different features in these tumor types. All except two IDC (32/34) with fast early phase demonstrated washout; and the other two showed plateau. While in 26 ILC showing fast early phase, 18 lesions (18/26) showed washout, seven (7/26) reached plateau, and one showed persistent enhancement. Figure 1 demonstrates 4 different ILC morphological patterns, and Table 1 summarizes the findings of kinetic features between ILC and IDC.

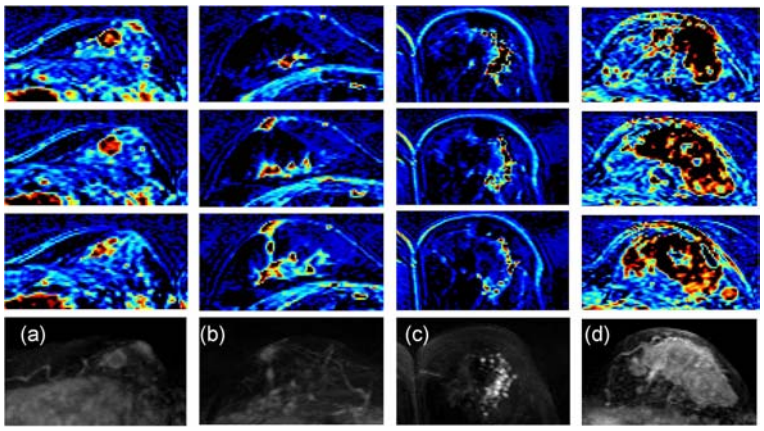

Table 1: Kinetics features of IDC and ILC

Kinetic feature	IDC (35)	ILC (35)
fast-washout	32	18
fast-plateau	2	7
fast-persistent	0	1
medium	0	8
slow	1	1

Fig. 1: Four different morphological patterns for ILC, (a) solitary mass, (b) mass with multiple enhancing foci, (c) regional clumped enhancements and (d) diffuse reticular pattern. The color-coded enhancement maps from 3 different slices and the MIPs are shown.

Discussion

ILC displayed more diverse morphological appearances than IDC. The frequency of non-mass-like enhancement patterns was higher in ILC than in IDC (7/29 vs. 1/30). In cases where there was a main mass, ILC was also more likely to have multiple enhanced foci, such as the case shown in Fig.1 (b). Regarding kinetic features, ILC had a higher possibility showing moderate or slow early enhancement phase than IDC (9/35 versus 1/35). While 91% IDC (32/35) demonstrated the typical malignant kinetic pattern with fast early enhancement and wash-out in the delayed phase, this pattern was only seen in 51% ILC (18/35). IDC and ILC were two pathologically distinct entities, and ILC also demonstrated different morphological and kinetic features compared to IDC. More understanding of these MRI features for ILC may aid in early diagnosis of this disease. For example, while the fast early enhancement with wash-out is a good criterion for diagnosis of IDC, it can not be reliably applied to diagnose ILC. If the morphology belongs to one of those patterns shown here, it is suspicious of malignancy and biopsy should be performed. Since other conventional imaging modalities cannot reliably detect ILC, MRI may play an ever increasing important role, not only in diagnosis but also in treatment planning and monitoring.

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