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The value of breast MRI for BI-RADS category 4B mammographic microcalcification: based on the 5th edition of BI-RADS

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AIM: To investigate whether magnetic resonance imaging (MRI) can improve the positive predictive value (PPV) for Breast Imaging-Reporting and Data System (BI-RADS) category 4B mammographic microcalcification.

MATERIALS AND METHODS: One hundred and eight consecutive patients with BI-RADS category 4B microcalcification without mass on mammography underwent breast MRI and subsequent histopathological confirmation between January 2009 and December 2015. Mammography and MRI findings were reviewed retrospectively, and imaging features were analysed according to the 5th edition of BI-RADS. The PPV of each descriptor was analysed to identify subgroups in which PPV could be improved by the addition of MRI.

RESULTS: When the criteria of presence of enhancement on MRI was applied to category 4B microcalcification, PPV increased from 0.38 (41 of 108) to 0.82 (37 of 45) and reduced benign biopsy results by 88% (59 of 67). Four ductal carcinoma in situ lesions were missed. For amorphous microcalcification with regional or grouped distribution, MRI images increased PPV without missing malignancy.

CONCLUSION: Breast MRI has the potential to improve PPV for category 4B mammographic microcalcification by reducing false-positive findings. If amorphous microcalcification with regional or grouped distribution on mammography shows no enhancement on MRI, follow-up could be considered rather than immediate biopsy. In addition, breast MRI might have the potential to guide the best site to biopsy in category 4B microcalcification.

Introduction

Microcalcifications constitute approximately 30% of lesions found at screening mammography and present in approximately 50% of non-palpable malignancies.[1,2] The Breast Imaging Reporting and Data System (BI-RADS) has been developed in an effort to standardise the assessment and description of the mammographic findings and the recommendations for management. Previous studies reported that microcalcification descriptors as proposed by the BI-RADS were useful in malignancy risk stratification.[3] Nevertheless, the positive predictive value (PPV) of mammographic microcalcifications is still usually <30%,

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with the PPV of BI-RADS category 4 microcalcifications ranging from 20% to 65.2%.[3–8]

Recently, the 5th edition of BI-RADS was released with several changes concerning suspicious microcalcifications.[9] According to the 5th edition of BI-RADS, three types of microcalcification (amorphous, coarse heterogeneous, and fine pleomorphic) should be assessed as category 4B (moderate suspicion for malignancy); however, a recent study suggested that subcategorisation of morphology descriptors for category 4B microcalcifications by the 5th edition of BI-RADS was needed because of the different PPVs.[10] In their study, the PPV of amorphous microcalcification was only 7.9%. Accordingly, nine of 10 biopsies yield benign results. Although microcalcification with >2% of malignancy risk should undergo biopsy, unnecessary biopsy is still a matter of persistent debate. Indeed, stereotactic vacuum-assisted biopsy (SVAB) involves physical and cost burdens for patients even if, it is much less invasive than conventional surgical biopsy.

Breast magnetic resonance imaging (MRI) has good diagnostic performance for detecting breast cancer in addition to ductal carcinoma in situ (DCIS).[11,12] Previous studies showed that there is potential for increasing the diagnostic performance of breast MRI for microcalcification[13–20]; however, previous published studies performed had only relatively small sample sizes and did not clearly described the results according to morphological descriptors using the BI-RADS lexicon. Moreover, to the authors' knowledge, there have been no data regarding the diagnostic performance of breast MRI for BI-RADS category 4B microcalcification based on the 5th edition of BI-RADS atlas. Therefore, the purpose of the present study was to investigate whether breast MRI improved the PPV for category 4B microcalcification detection at mammography according to the 5th edition of BI-RADS atlas.

Materials and methods

This retrospective study was approved by the institutional review board of Gangnam Severance Hospital. Neither patient approval nor informed consent was required for the review of medical records or images. Informed consent was signed and obtained from all patients for image-guided percutaneous biopsy or surgery prior to the procedures.

Study population

Patients were recruited between January 2009 and December 2015. One hundred and twenty-two consecutive patients, who were clinically asymptomatic, but had suspicious microcalcification at mammography without associated mass, underwent preoperative MRI and subsequent histopathological confirmation. Among them, 14 patients with fine linear/linear branching microcalcification (category 4C) were excluded. Finally, 108 BI-RADS category 4B microcalcifications in 108 patients (median age, 50 years; range, 31–78 years) comprised the study population.

In Gangnam Severance Hospital, histopathological conformation was recommended using SVAB or surgical excisional biopsy for category 4 suspicion of microcalcification on mammography. All 108 enrolled patients underwent surgical excisional biopsy with preoperative mammogram-guided needle localisation. Breast MRI was not routinely recommended for all patients with suspicious microcalcification. It was performed in 79 patients with a concurrent or previous history of breast malignancy and in 29 patients following clinicians or patient's request for evaluation of suspicious microcalcifications.

Mammography evaluation

All mammographic images were obtained on a full-field digital mammography unit (Lorad Selenia, Hologic, Danbury, CT, USA). Standard craniocaudal and mediolateral oblique views were obtained for both breasts along with spot-magnification views over the area of microcalcification. All mammograms were reviewed in consensus of two experienced radiologists using the 5th edition BI-RADS atlas.[9] They were blinded to the MRI findings and histopathological results. Microcalcification was analysed according to the BI-RADS descriptors, including assessment of the morphology and the distribution. The category 4B microcalcifications were defined as amorphous, coarse heterogeneous, and fine pleomorphic microcalcifications in morphology regardless of distribution. In cases of microcalcifications with several descriptors, the most suspicious feature was considered in the analysis.

MRI evaluation

MRI examinations were performed using a 1.5-T MRI system (Magnetom Avanto; Siemens, Erlangen, Germany) in 15 patients and a 3-T system (Achieva; Philips Medical Systems, Best, Netherlands) using a dedicated breast coil (MATRIX Breast coil, Siemens; SENSE Breast coil, Philips Medical Systems) in 93 patients. All images were acquired with bilateral axial views. The routine protocol included turbo spin-echo T1- and T2-weighted sequences and a T2-weighted fat-suppressed spin-echo series. Dynamic contrast-enhanced MRI examination included one pre-contrast and five post-contrast series using a fat-suppressed T1-weighted gradient-echo sequence (3.7 ms repetition time [TR], 1.44 ms echo time [TE], 425×512 matrix, 12° flip angle, 33×33 cm field of view, 1.5 mm section thickness on 1.5 T; 4.9 ms TR, 2.4 ms TE, 340×340 matrix, 12° flip angle, 34×34 cm field of view, 1.5 mm section thickness, on 3 T). Gadopentetate dimeglumine (Bono-I; Central Medical Service, Seoul, South Korea) or gadobutrol (Gadovist, Bayer Healthcare, Berlin, Germany) at a dose of 0.1 mmol/kg was injected using an automated injector (Nemoto; Nemoto Kyorindo, Tokyo, Japan) at a rate of 2 ml/s, followed by a 20-ml saline flush.

All MRI studies were reviewed by two radiologists with 6 and 11 years of breast imaging experience, with consensus according to the 5th edition of BI-RADS.[9] Reviewers were aware of the mammography findings, and carefully

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