



Relationship of Temporal Resolution to Diagnostic Performance for Dynamic Contrast Enhanced MRI of the Breast

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Abstract

Purpose: To investigate the relationship between temporal resolution of dynamic contrast-enhanced (DCE) magnetic resonance imaging (MRI) and classification of breast lesions as benign versus malignant.

Materials and Methods: Patients underwent T1-weighted DCE MRI with 15 s/acquisition temporal resolution using 1.5 Tesla (n = 48) and 3.0T (n = 33) MRI scanners. Seventy-nine patients had pathologically proven diagnosis and 2 had 2 years follow-up showing no change in lesion size. The temporal resolution of DCE MRI was systematically reduced as a postprocessing step from 15 to 30, 45, and 60 s/acquisition by eliminating intermediate time points. Average wash-in and wash-out slopes, wash-out percentage changes, and kinetic curve shape (persistently enhancing, plateau, or wash-out) were compared for each temporal resolution. Logistic regression and receiver operating characteristic (ROC) curve analysis were used to compare kinetic parameters and diagnostic accuracy.

Results: Sixty patients (74%) had malignant lesions and 21 patients (26%) had benign lesions. All temporal-resolution parameters significantly predicted benign versus malignant diagnosis ($P < 0.05$). However, 45 s/acquisition and higher temporal-resolution datasets showed higher accuracy than the 60 s/acquisition dataset by ROC curve analysis (0.72 versus 0.69 for average wash-in slope; 0.85 versus 0.82, for average wash-out slope; and 0.88 versus 0.80 for kinetic curve shape assessment, for 45 s/acquisition versus 60 s/acquisition temporal-resolution datasets, respectively ($P = 0.027$).

Conclusion: DCE MRI data with at least 45-s temporal resolution maximized the agreement between the kinetic parameters and correct classification of benign versus malignant diagnosis.

Key Words: dynamic contrast enhanced (DCE); magnetic resonance imaging (MRI); breast; kinetic curve; temporal resolution; wash-out; wash-in



MRI-Guided Vacuum-Assisted Breast Biopsy: A Phantom and Patient Evaluation of Targeting Accuracy

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Abstract

Purpose: To determine the spatial localization errors of magnetic resonance imaging (MRI) guided core biopsy for breast lesions using the handheld vacuum-assisted core biopsy device in phantoms and patients.

Materials and Methods: Biopsies were done using a 10- gauge handheld vacuum-assisted core biopsy system (Vacora, Bard, AZ, USA) on a 1.5T MRI scanner (Philips Achieva, Best, The Netherlands). A standardized biopsy localization protocol was followed by trained operators for multiplanar planning of the biopsy on a separate workstation. Biopsy localization errors were determined as the distance from needle tip to center of the target in three dimensions.

Results: Twenty MRI-guided biopsies of phantoms were performed by three different operators. The biopsy target mean size was 6.8 \pm 0.6 mm. The overall mean three dimensional (3D) biopsy targeting error was 4.4 \pm 2.9 mm. Thirty-two MRI breast biopsies performed in 22 patients were reviewed. The lesion mean size was 10.5 \pm 9.4 mm. The overall mean 3D localization error was 5.7 \pm 3.0 mm. No significant differences between phantom and patients biopsy errors were found ($P > 0.5$).

Conclusion: MRI-guided handheld vacuum-assisted core biopsy device shows good targeting accuracy and should allow localization of lesions to within \pm 5 to 6 mm.

Key Words: breast cancer; MRI; biopsy; phantom study; gadolinium



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Diffusion-weighted Imaging Improves the Diagnostic Accuracy of Conventional 3.0-T Breast MR Imaging 1

Abstract

Purpose: To evaluate the incremental value of diffusion-weighted (DW) imaging and apparent diffusion coefficient (ADC) mapping in relation to conventional breast magnetic resonance (MR) imaging in the characterization of benign versus malignant breast lesions at 3.0 T.

Materials and Methods: This retrospective HIPAA-compliant study was approved by the institutional review board, with the requirement for informed patient consent waived. Of 550 consecutive patients who underwent bilateral breast MR imaging over a 10-month period, 93 women with 101 lesions met the following study inclusion criteria: They had undergone three-dimensional (3D) high -spatial-resolution T1-weighted contrast material-enhanced MR imaging, dynamic contrast enhanced MR imaging, and DW imaging examinations at 3.0 T and either had received a pathologic analysis-proven diagnosis (96 lesions) or had lesion stability confirmed at more than 2 years of follow-up (five lesions). DW images were acquired with b values of 0 and 600 sec/mm². Regions of interest were drawn on ADC maps of breast lesions and normal glandular tissue. Morphologic features (margin, enhancement pattern), dynamic contrast-enhanced MR results (semiquantitative kinetic curve data), absolute ADCs, and glandular tissue-normalized ADCs were included in multivariate models to predict a diagnosis of benign versus malignant lesion.

Results: Forty-one (44%) of the 93 patients were premenopausal, and 52 (56%) were postmenopausal. Thirty-three (32.7%) of the 101 lesions were benign, and 68 (67.3%) were malignant. Normalized ADCs were significantly different between the benign (mean ADC, 1.13 $\times 10^{-3}$ mm²/sec \pm 0.4 [standard deviation]) and malignant (mean ADC, 0.55 $\times 10^{-3}$ mm²/sec \pm 0.16) lesions (P , .001). Adding normalized ADCs to the 3D T1-weighted and dynamic contrast-enhanced MR data improved the diagnostic performance of MR imaging: The area under the receiver operating characteristic curve improved from 0.89 to 0.98, and the false-positive rate decreased from 36% (nine of 25 lesions) to 24% (six of 25 lesions).

Conclusion: DW imaging with glandular tissue-normalized ADC assessment improves the characterization of breast lesions beyond the characterization achieved with conventional 3D T1-weighted and dynamic contrast-enhanced MR imaging at 3.0 T.