

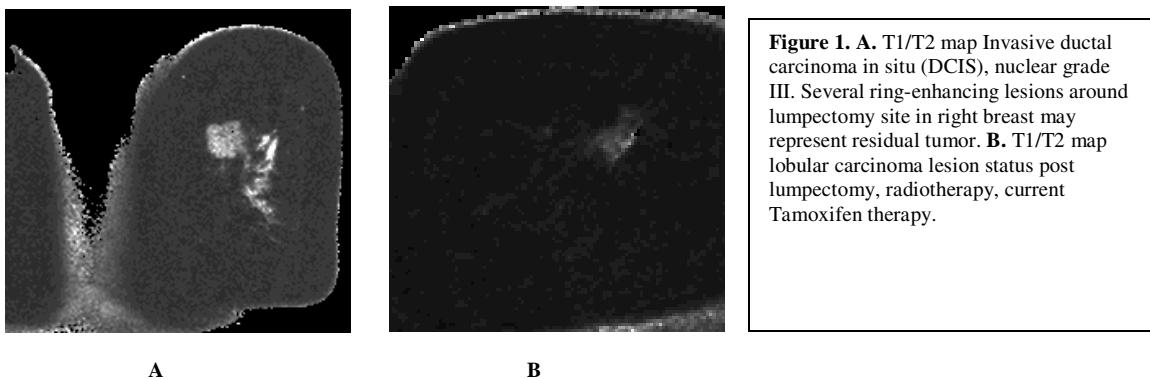
Quantitative MRI Technique for Mapping the T1/T2 Ratios of Benign and Malignant Breast Lesions

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Purpose: Early breast NMR work by Medina et al. (J Natl Cancer Inst. 1975 54(4):813-8.) showed that T2 exhibited relatively greater elevations in cancerous tissue than T1, and found that calculated values of the ratio T1/T2 provided improved discrimination of fibroadenomas from adenocarcinomas at $p < 0.05$. The purpose of the present work was to develop a quantitative MRI technique for mapping the longitudinal-to-transverse relaxation times ratio (T1/T2) of various benign and malignant breast lesions.

Methods: This is a cross sectional study of subjects scheduled to undergo conventional MRI at Boston University Medical Center (BUMC). Women of all races with known or suspected breast mass or lesion who were scheduled to have standard of care breast MRI were invited to participate in this study. This research study is approved by BUMC Institutional Review Board. Informed consent was obtained prior to any study procedures were performed. Participants were asked to undergo additional 2-10 minutes Q-MRI sequence after conventional MRI is performed. The risk and benefits were explained to the subjects, as well as voluntary nature of this study by trained study personnel. Women who are having their menstrual cycles were asked to undergo urine pregnancy test prior to MRI. Post menopausal status, age, hormone replacement therapy and contraceptives use were recorded. All images were obtained between days 5-10 of menstrual cycle for women who are still menstruating in order to have consistency in MRI data. Mixed turbo spin echo (mixed-TSE) multislice 2D pulse sequence was applied in the coronal plane providing full breast coverage with null interslice gap: $0.78 \times 0.78 \times 4 \text{ mm}^3$ voxel size. Mixed-TSE combines the principles of T1-weighting by inversion recovery and T2-weighting by dual-turbo spin echo sampling into a single mixed MRI acquisition. Self-coregistered T1 and T2 maps were generated and used as input for a T1/T2 ratio algorithm that avoids singularities with a pixel-wise Boolean conditional statement. Images were acquired with a 1.5 T superconducting MR imaging system (NT- Intera Philips Medical Systems, N.A.) Twenty two female subjects (N=22) with suspected or known breast lesions were included in the study. All lesions were proven to be benign or malignant based on biopsy and pathologic correlation. For all subjects, the lesions were identified by a Radiologist (JNT) and, using a Q-MRI based morphologic algorithm as illustrated in Fig. 1, segmental T1, T2, and T1/T2 histograms were generated.



A

B

Statistical analysis: The non-parametric Kruskal-Wallis test was utilized to perform statistical analysis of the data. This test yielded statistically significant results for this data set with significant exact p-value of 0.0096, indicating that there are statistically significant differences found between three analyzed groups.

