Can MRS Improve Our Ability to Distinguish Between Benign and Malignant Lesions?

R. Do[1], L. Moy[1], N. Salibi[2], C. L. Mercado[1], K. McGorty[3], M. Kitazono[4], E. Hecht[1]

[1]Radiology, New York University, New York, NY, United States, [2]Siemens Medical Solutions, St. Louis, Missouri, United States, [3]New York University, New York, NY, United States, [4]Keck School of Medicine of USC, Los Angeles, CA, United States

PURPOSE: Dynamic contrast-enhancement pattern (DCE) is used in breast magnetic resonance (MR) imaging in the detection of cancer. Both the morphologic and kinetic features of the lesions are used to differentiate between benign and malignant masses. More recently, studies have shown that magnetic resonance spectroscopy (MRS) can detect choline found predominantly in breast cancers, in contrast to normal breast tissue. The purpose of this study is to determine if MRS correlates with DCE and can affect management of breast lesions on MRI.

MATERIALS AND METHODS: Dynamic contrast enhanced fat suppressed T1 weighted images were acquired at 1.5T for 21 patients and 3.0T for 12 patients. All lesions found at MRI were examined with MRS using a single voxel. Spectra were obtained using a 1H SVS protocol with a PRESS sequence which includes spectral lipid and water suppression. MRS scan parameters at 1.5T were (numbers in parentheses are for 3.0T) TR/TE = 1500/135 ms (2000/135ms), 128 (64) averages with lipid and water suppression, and 16 (8) averages without suppression. The acquisition times ranged from 3 min12s (2min08s) with suppression to 24s (16s), without suppression technique. A spectroscopy voxel was placed on one or more enhancing breast lesion(s) for each patient. Voxel sizes were variable and adjusted to the size of the enhancing breast tissue, to minimize intravoxel fat. Automated shim was used, and when need, manual optimization was performed.
Two radiologists first analyzed all lesions based on the morphologic and kinetic features. Kinetic curves were characterized as persistent (type I), plateau (II), or early washout (III). The MRS data was included in a second readout session, along with the morphologic and kinetic analysis, to determine if the spectra changed our assessment of the lesion. Correlation was made with the radiology and pathology database.

RESULTS: Among 33 patients, 36 lesions (mean 1.8 cm, range 0.6 – 5 cm) were found at MR. Seventeen of 36 lesions were classified as BIRADS 1 or 2, based on morphology and kinetics. Eleven of 17 lesions had pathologic correlation: 2 invasive carcinomas, 3 DCIS, 6 benign. A choline peak was detected in 4/5 cancers, all 4 lesions were upstaged to a BIRADS 4. One of these cancers is illustrated in figure 1. No choline was detected in the 12 benign lesions.
Thirteen of 17 lesions classified as BIRADS 4, 5, and 6 are biopsy proven cancers. Only 1/13 cancer demonstrated the type III washout curve. Choline was detected in 5/13 cancers, all 5 lesions were upstaged from BIRADS 4 to 5. In 4/17 lesions where choline was not detected, the patients' management did not change. Also, the MRS data did not change our assessment of two lesions categorized as BIRADS 3 because no choline was detected.

CONCLUSION: Four pathologically proven cancers were initially categorized as BIRADS 2. Using MRS data, these cancers were correctly changed to a BIRADS 4. No choline was detected in the benign lesions. Thus, MRS data adds predictive information not available using morphologic and DCE criteria alone.

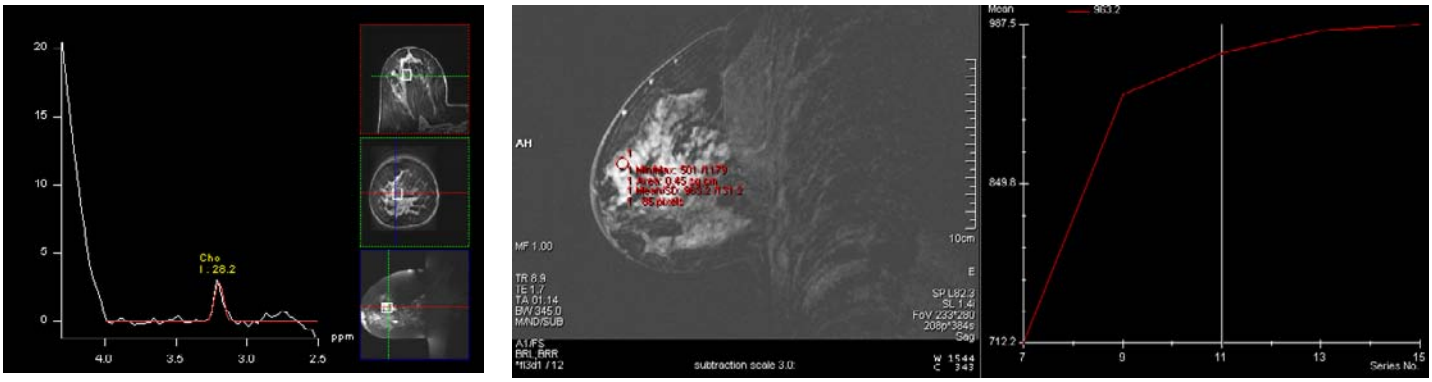

Figure 1. Choline peak from single voxel spectroscopy and ROI curve from enhancing breast lesion.