Clnical value of proton spectroscopy added to high spatially resolved Gd-enhanced MR of the breast

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Introduction

Breast MR demonstrated high sensitivity for invasive cancers while moderate values of specificity and positive predictive values. Proton spectroscopy at 1.5 T (^{1}H-MRS) demonstrated its utility to increase MR imaging specificity and predictive positive values for tumor diagnosis when a total containing compounds (tCho) peak is detected [1-3]. To evaluate feasibility and diagnostic values in clinical setting we added ^{1}H-MRS to dynamic MR imaging (D-MRI) of the breast in a consecutive group of patients.

Patients and Methods

From January 2003 to November 2004, 244 consecutive patients underwent breast MRI using (1.5 T, Sonata, Siemens) T1-weighted 3D gradient-echo sequence (coronal 1-mm partitions; TR/TE=11/4.8 ms; FA=25°; FOV=384 mm; matrix=384x192 mm; 1-mm³ voxel; 0.1 mmol/kg Gd-DOTA; 120-s time resolution; 1 pre- and 4 postcontrast phases), 118 of them being negative or with enhancing foci measuring less than 5 mm in diameter. Two D-MRI were interrupted. In the remaining 124 patients (120 females and 4 males, 56±14 years, range 15-92) single-voxel water- and fat-suppressed spin-echo (TR/TE=1500/136 ms) ^{1}H-MRS was obtained. For D-MRI interpretation a multimodal score system was used. Proton spectra was processed using water reference, filtering, zero-filling, frequency shift, baseline/phase correction, and curve fitting. An intensity choline peak integral equal or higher than 2.0 was considered as a sign of malignancy. Gold standard was pathological examination obtained with core/open biopsy or one year follow-up.

Results

One hundred fifty-one ^{1}H-MRS voxels were obtained, one in 98 patients, two in 25, three in one (voxel size: 2.9±2.2 cm³; range 1-8 cm³; median acquisition time: 13 minutes). No reliable spectrum (low signal-to-noise ratio) resulted in 3 cases (2 IDCs and 1 benign enhancement). In the remaining 148 spectra, pathology demonstrated 68 malignancies and 80 benignancies. ^{1}H-MRS and D-MRI had seven false negative, two of them in the same and five in different patients. Nine benignancies were false positive at ^{1}H-MRS and 15 at D-MRI. Sensitivity was 90% for both for ^{1}H-MRS (62/69) and D-MRI (63/70), specificity was 89% (70/79) and 81% (63/78), PPV 87% (62/71) and 81% (63/78), NPV 91% (70/77) and 90% (63/70), respectively, giving a 8% gain in specificity from ^{1}H-MRS.

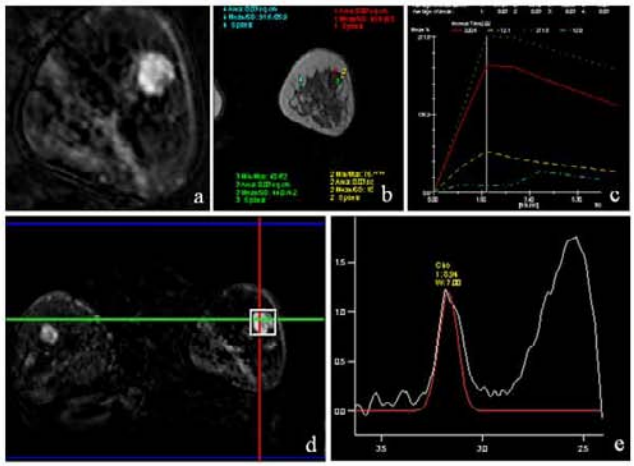

Figure 1: (a) Enhancing mass at the superior external quadrant of the left breast. (b) Regions of interest (ROI) positioned inside and outside the lesion. (c) Percent intensity-to-time curves for each ROI. Morphology and dynamics indicate a suspicious lesion. (d) Voxel of ^{1}H-MRS. (e) Significant tCho peak (I: 8.94) confirming the malignancy of the lesion.

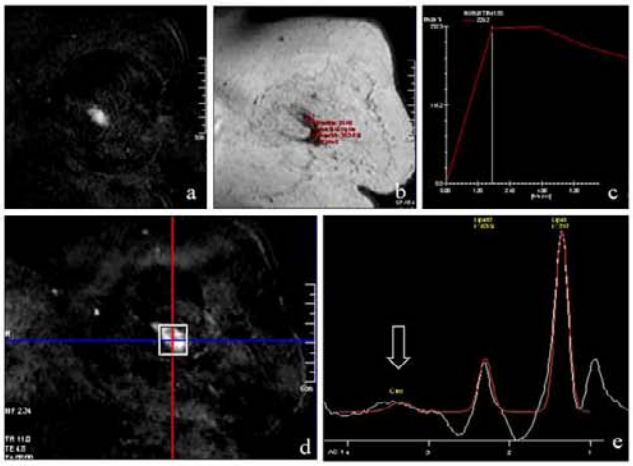

Figure 2: (a) Enhancing area in the nipple quadrant of the left breast near the pectoral muscle. (b) Region of interest (ROI) positioned inside the lesion. (c) Percent intensity-to-time curve for that ROI. Morphology and dynamics indicate a suspicious lesion. (d) Voxel of ^{1}H-MRS. (e) No tCho peak can be detected (arrow) in the range of choline compounds.

Discussion

These data confirmed that ^{1}H-MRS can be routinely performed after breast D-MRI; combining the two techniques even in clinical setting, high values of sensitivity and specificity can be reached.

References

[1] Katz-Brull R et al. J Natl Cancer Inst 94:1197-1203 (2002) [2] Huang W et al. Radiology 232:585-591 (2004) Bartella L et al. Radiology 239:686-692 (2006).