

Enhanced lesion discrimination in breast DWI after contrast administration

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Introduction

Numerous recent publications describe the use of diffusion-weighted imaging (DWI) for the detection, assessment [1-4] or treatment response monitoring [5,6] of breast cancer. While there appears to be good agreement that the additional evaluation of the apparent diffusion coefficient (ADC) can significantly increase the specificity of breast MRI, the applied pulse sequences, b-values and approach (before or after contrast administration, selected slices or complete volumes) differ. In this work, the effect of T1-shortening contrast administration (CA) on the ADC values of fat saturated DW-EPI and its impact on the ability to differentiate benign from malignant breast lesions is investigated.

Methods

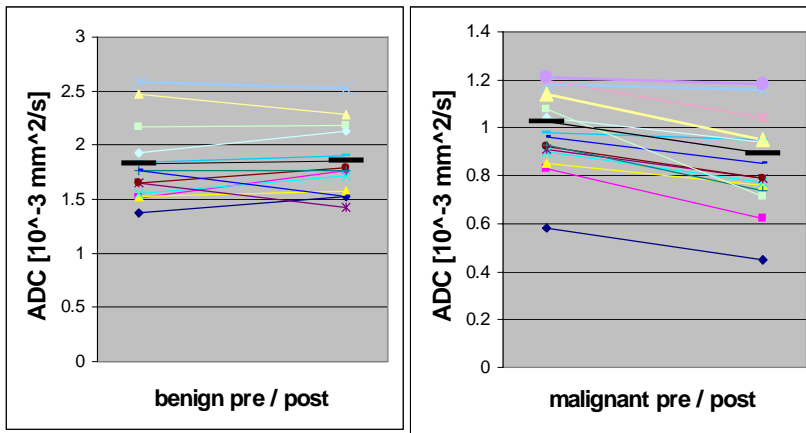
Data were acquired on a 1.5T Siemens Magnetom Avanto using a Siemens breast array coil. The criterium for patient inclusion was a histological proven breast lesion of 6mm or more in size. In total, 23 patients with 28 lesions (13 benign, 15 malignant) were included. The fat saturated DW-EPI sequence using a chemical shift selective fat suppression pulse was applied before and subsequent to the administration of Gadovist following the T1-weighted dynamic scan protocol. DWI measurements were acquired in two averages of 26 slices with 4 mm slice thickness and b-values of 50, 400 and 800 using 3-scan trace calculation resulting in a scan time of only 1:31 minute. ADC maps were calculated automatically using the scanner software. Lesions were first localized in the subtractions of the dynamic protocol and then identified in the diffusion-weighted images, where a region of interest was drawn and copied to the ADC map.

Results and Discussion

The mean lesion size was 1.5±0.7cm. The ADC values of benign lesions were 1.8 (on average, values ranged from 1.4 to 2.6) 10⁻³ mm²/s before and 1.9(1.5; 2.5) 10⁻³ mm²/s after contrast administration. Malignant lesions exhibited a mean ADC of 1.0(0.6; 1.2) 10⁻³ mm²/s prior to and 0.9(0.5; 1.2) 10⁻³ mm²/s after CA. Individual values are displayed in figure 1 for benign and malignant lesions for pre- and post-contrast scans (black bars indicate mean values). While there is no significant change for benign lesions the ADC decrease in post-contrast malignant lesions is significant (p<0.05) which in principle would lead to an improved lesion discrimination. Previous publications have discussed the influence of contrast agent on ADC values for DWI in body imaging [7] resp. DW-EPI with inversion recovery pulses [8] resulting in decreased lesion discrimination presumably because of the altered inversion time after CA. The reason for the ADC change in fat suppressed DW-EPI is still unclear. Furthermore, our data suggest that the selective use of DWI only in case of visible lesions can be useful even after contrast injection. However, higher patient numbers need to be investigated in order to verify this.

References

- [1] Sinha et al, J Magn Reson Imag 2002, 15, 693-704
- [2] Guo et al, J Magn Reson Imag 2002, 16, 172-8
- [3] Rubesova et al, J Magn Reson Imag 2006, 24, 319-24
- [4] Wenkel et al, Acad Radiology 2007, 14, 1077-83
- [5] Pickles et al, Magn Reson Imag. 2006, 24, 843-7
- [6] Yankeelov et al, Magn Reson Imag 2007, 25, 1-13
- [7] Gulani et al, Proc ISMRM 2007, 3833
- [8] Wenkel et al, Proc ISMRM 2007, 2882



Diagrams: ADC values for benign (left) and malignant (right) lesions acquired before and after T1-shortening contrast administration (CA).

Image panel: subtraction of dynamic FLASH (top, left), DWI with b=400 (top, right); calculated ADC maps before (bottom, left) and after CA (bottom, right). ROIs were copied to ADC maps after identification of the lesions on the b=400 images.

