

Feasibility of High Resolution Diffusion Weighted MRI of the Breast using Readout Segmented EPI or Single Shot EPI

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INTRODUCTION: Diffusion weighted MR imaging (DW-MRI) is expected to increase diagnostic accuracy of detecting breast cancer due to excellent lesion conspicuity. However, compared to dynamic contrast MRI (DC-MRI), image quality of DW-MRI is generally poor because of low spatial resolution and image distortion, particularly around the nipple or breast-air interface. According to Guideline of the European Society of Breast Imaging, special resolution of DC-MRI should be at least 1.0x1.0x2.5mm. If DW-MRI is used to evaluate breast lesion, it would be ideal to achieve high special resolution equivalent to DC-MRI, with minimal image distortion. Readout segmented EPI (RS-EPI) is a recently-developed technique to obtain high resolution DW-MRI with less distortion. The objective of our study is to evaluate the feasibility of high resolution DW-MRI (special resolution of 1.0x1.0x2.5mm) of the breast, using RS-EPI and single shot echo planner imaging (SS-EPI).

MATERIALS and METHODS: With IRB approval, 26 patients with clinically suspected breast cancer were prospectively enrolled between January and November 2011. Breast MRI was performed at 3.0 T scanner (MAGNETOM Trio, A Tim System, Siemens AG) with 16ch breast coil. Sequences were as follows: axial T1WI, T2WI with fat saturation, 3D dynamic DC-MRI series and DW-MRIs. Sagittal unilateral breast DW-MRIs of b values 0 and 850 sec/mm² were obtained using the following parameters: 1) **RS-EPI:** TR/TE=6800/60ms, FOV=200x150mm, matrix=200x150, 2.5mm thickness, 40 slices, resolution of 1.0x1.0x2.5mm NEX=1, iPATx2, 3min 32sec, seven shots. 2) **SS-EPI:** TR/TE=8400/69ms, FOV=200x156mm, matrix=200x156, 2.5mm thickness, 40 slices, resolution of 1.0x1.0x2.5mm, NEX=5, iPATx2, 3min 30sec. To evaluate degree of image distortion, the Antero-posterior (AP) distance of mammary gland and scored distortion artifacts and ghost artifacts on DW-MRIs with RS-EPI and SS-EPI (b=0) was measured and compared to the distance measured on T2WI as a reference. To evaluate the diagnostic performance of each sequence in breast cancer, lesions on RS-EPI/SS-EPI DW-MRIs (b=850) and DC-MRI were categorized based on Breast Imaging Report and Data System (BI-RADS). For quantitative evaluation, apparent diffusion coefficient (ADC) of background mammary gland and lesions were measured.

RESULTS: We could complete all the sequences of each patient. Eighteen patients were pathologically confirmed as breast cancer. The average differences measuring AP distance of mammary gland between T2WI and SS-EPI and that between T2WI and RS-EPI were 12.5±4.7 and 2.3±2.0 mm, respectively (p<0.01). Distortion artifacts were more significant at SS-EPI in all cases (**Figure 1, 2**), but no significant difference of ghost artifacts were observed between two sequences. Sensitivity of DC-MRI, DW-MRIs of RS-EPI and SS-EPI was 94.4, 94.4 and 88.9%, respectively. Average ADCs of the mammary gland by SS-EPI and RS-EPI were 1.47±0.40 and 2.12±0.24 10⁻³ mm²/ sec, respectively (p<0.01) and those of breast cancer were 0.87±0.32 and 1.04±0.36, respectively (p<0.01).

CONCLUSION: High resolution DW-MRI of the breast is feasible both RS-EPI and SS-EPI procedure. DW-MRI using RS-EPI has advantage of less distortion.

Reference: 1) Porter DA, Heidemann RM. *Magn Reson Med.* 2009 62(2):468-75. 2) Morelli JN, Runge VM, Feiweier T et al. *Invest Radiol.* 2010; 45(1):29-35

Figure 1. Sagittal images of normal breast.

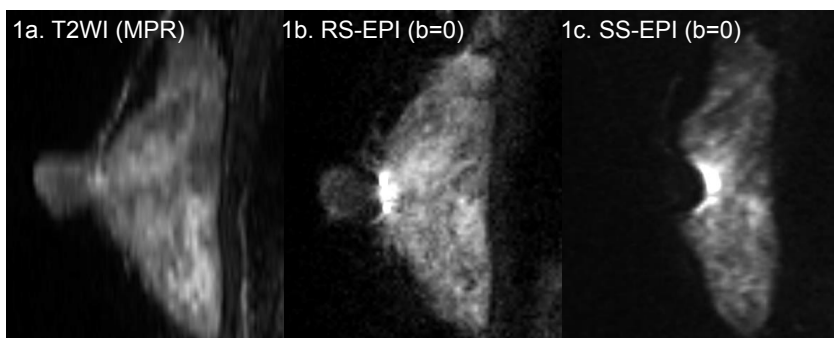


Figure 2. Sagittal images of patient with DCIS.

