Efficacy of lesion detection using diffusion-weighted breast imaging: Comparison of a STIR DWI (DWIBS) and a convetional DWI sequence

A. Stadlbauer[1], R. Bernt[2], W. van der Riet[3], S. Gruber[4], J. Haller[2], and E. Salomonowitz[1]

[1]MR Physiks Group, Department of Radiology, Landesklinikum St.Poelten, St. Poelten, Austria, [2]Department of Radiology, Hanusch Krankenhaus, Vienna, Austria, [3]European MRI Consultancy (EMRIC), Strasbourg, France, [4]Department of Radiology, Medical University Vienna, Vienna, Austria

Purpose: To evaluate the efficacy of a diffusion-weighted STIR (DWIBS) and a conventional fat-suppressed diffusion-weighted imaging (cDWI) sequence for detection of breast lesions.

Materials and Methods: 33 patients (age range 22-68; mean age 49.6) with a suspected breast lesion detected by either mammography or ultrasonography underwent DWIBS (TR/TE/TI = 5000/78/180 ms, b_0 = 0s/mm^2, b1 = 500s/mm^2, b_2=1000 s/mm^2, 3 mm axial slices, 3.4 x 3.4 mm resolution), and conventional fat-suppressed DWI (TR/TE = 8700/78 ms, b_0 = 0s/mm^2, b_1 = 1000s/mm^2, b_2=2000 s/mm^2, 3 mm axial slices, 3.4 x 3.4 mm resolution) at 1.5T (Philips Achieva) using a 4-channel breast coil. A T2w STIR sequence and a dynamic contrast-enhanced T1w sequence were performed as part of the routine protocol. ADC and eADC values of the lesions between all b-value combinations were calculated for both sequences, i.e. ADC[b_0,b_1], ADC[b_0,b_2], ADC[b_1,b_2], eADC[b_0,b_1], eADC[b_0,b_2], and eADC[b_1,b_2]. Additionally the background contrast of the signal changes within the lesions on the images obtained with b_1 and b_2 were determined. Qualitative evaluation of lesion detectability and conspicuity (good, acceptable, poor, and not detectable) with DWBIS and cDWI was performed by two experienced radiologists in consensus.

Results: 33 lesions were detected in 30 patients by the routine protocol. The histologic evaluation revealed: nine tumors (invasive ductal carcinoma or ductal carcinoma in situ), twelve fibroadenomas, five cysts, two lymph nodes, 3 post-operative scars, and two abscesses. DWIBS detected 31lesions (94%); the missed lesions were two fibroadenomas. However, cDWI detected only 25 lesions (76%), the missed lesions were one tumor, five fibroadenoma and two scars. Conspicuity of tumors was good in all cases on DWIRBI images, whereas acceptable in 11% and good in 78% of cases on cDWI. Conspicuity of fibroadenoma was good in 50% and acceptable in 25% of cases on DWIBS images, whereas conspicuity was only acceptable in 8% and poor in 50% of cases on cDWI. These findings were confirmed by a significant stronger (P<0.014) background contrast for tumor and fibroadenoma on DWIBS images with obtained with b_2. We found significant differences between tumors and fibroadenomas for ADC[b_0,b_1], ADC[b_0,b_2], eADC[b_0,b_1], eADC[b_0,b_2] of DWIBS (P<0.002) and cDWI (P<0.002), for the ADC[b_1,b_2] and eADC[b_1,b_2] only DWIBS (P=0.001) revealed significant differences, however (Fig 1). For tumor versus lymph node no significant differences were found. DWIBS showed significant differences (P=0.036) between tumor and scar for eADC[b_0,b_1] and eADC[b_0,b_2], and cDWI for ADC[b_0,b_1] and eADC[b_0,b_1] (P=0.036).

Conclusion: DWIBS is superior to cDWI in visualization of both malign and benign lesions. ADC[b_0,b_1], ADC[b_0,b_2], eADC[b_0,b_1], and eADC[b_0,b_2] are best suited for quantification of changes in diffusivity due to the lesions.

Figure1: Boxplots ADC and eADC values measured using DWIBS and cDWI in fibroadenomas (FA) and tumors (TU).

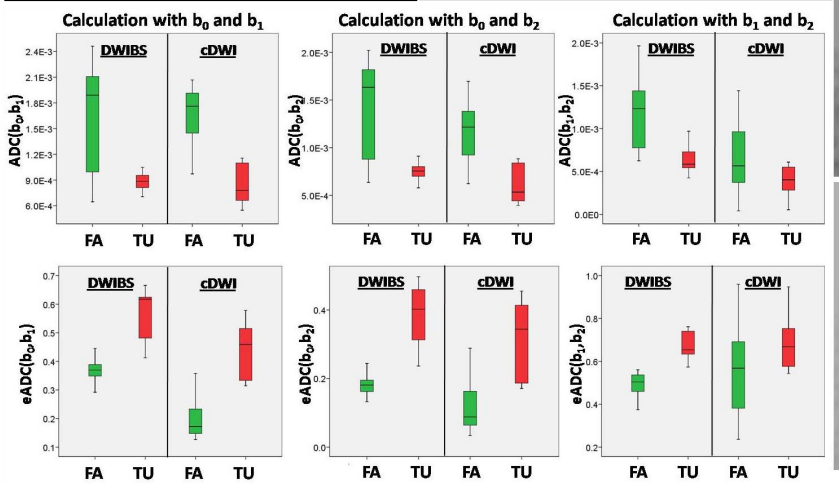

Figure2: DWIBS and cDWI images of a patients suffering from A) a fibroadenoma and B) a multicentric tumor.