# Post Lumpectomy MRI: using diffusion weighted imaging (DWI) to distinguish benign from malignant tissues

**F. Kelcz[1], and K. S. Hain[1]**
[1]Radiology, University of Wisconsin, Madison, WI, United States

**Purpose**: Although post lumpectomy scars normally do not enhance several months after surgery [1, 2], we and others have noted extended, usually low level enhancement of some scars. Such persistent enhancement may raise concern for local recurrence of breast cancer as irradiated breast cancer may enhance in a similar manner. We added diffusion weighted imaging to our routine breast MRI clinical protocol 3 years ago and have anecdotally noted that post lumpectomy scars displayed unrestricted diffusion characteristics. Since this has not been previously noted or specifically studied, our purpose was to determine how reliable this finding might be.

**Patients and Methods:** With IRB approval, 148 consecutive MRI examinations performed between September 12, 2005 and December 30, 2008 for patients having had lumpectomy were reviewed. Examinations were excluded if no diffusion weighted imaging had been performed (52), or for the following reasons: technical deficiencies preventing measurement of the apparent diffusion coefficient (ADC) (11), no measurable mass (38), only fluid component noted (23) or less than one year of follow-up available (15).

Breast MRI was performed at 1.5T (General Electric Health Care [GEHC]) using the following sagittal sequences: T1-w, T2-w with fat saturation (FS), 3D dynamic contrast enhanced (DCE) with FS. Post DCE T1-w with FS in sagittal and axial planes. Bilateral sagittal diffusion weighted imaging was performed using the following parameters: 2d EPI single shot FS, TR 3000 ms, TE min (typically 79.3 msec), FOV 24 x 24 cm, matrix 128 x 128, slice thickness 5 mm (skip 1 mm), NEX 2. b values were 0 and 1000 sec/mm$^2$. Both the DCE and DWI images were reviewed on a work station using dedicated software (GEHC Advantage Window Functool$^©$). ADC values were calculated by manual placement of ROI's at the workstation. At our institution, we have determined that an ADC value > 1.2 x 10$^{-3}$ mm$^2$/sec speaks for benignancy, in accordance with a recent meta-analysis [3].

**Results:** After eliminating the lesions meeting exclusion criteria, nine lesions thus far have been analyzed. The average lumpectomy scar was 2.1 x 1.6 cm. All lumpectomy scars demonstrated a persistent (Type 1) delayed enhancement curve with average enhancement of 17.6% at 2 minutes and 62.2% at 8 minutes. The average ADC was 1.89 (range 1.43 – 2.20). An example is shown below (Figure 1).



Figure 1: 56 yo woman 2 years post lumpectomy. (*left*) nonenhanced imaging with 2 x 1.6 cm lumpectomy scar (arrow). (*middle*) post Gd (8 minutes) displaying 87% enhancement, kinetics were persistent (Type I). (*right*) ADC map shows benign value of 1.54 x 10$^{-3}$ mm$^2$/sec.

**Conclusions:** Although lumpectomy scars present with worrisome morphology and enhancement that can persist causing concern for malignancy, our preliminary results (more data to be presented at the meeting) confirm that diffusion characteristics of benign scars are indeed in the benign range and may help avoid the need for closer followup or biopsy.

References
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3. Tsushima Y et. al. Magnetic resonance (MR) differential diagnosis of breast tumors using apparent diffusion coefficient (ADC) on 1.5 T. JMRI 2009;30:249-255.