3T Breast MRI using Dixon technique

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Introduction: Breast MRI is a highly sensitive imaging tool for the diagnosis and staging of breast cancers. High spatial resolution is a requirement to ensure accurate lesion evaluation, along with fat suppression for assessment of lesion morphology and margins. Active fat suppression such as by chemical shift selective saturation requires homogeneous magnetic field across the entire field-of-view (FOV), which is difficult to achieve with bilateral breast imaging. Image subtraction is an alternative method for fat suppression, but may suffer from patient motion. Dixon technique acquires two separate images with a modified pulse sequence and provides an effective means of water and fat separation. Single-pass Dixon sequences acquire both echoes necessary for fat-water separation within a single TR, resulting in decreased scan time compared to multi-pass Dixon sequence. The goal of this study is to qualitatively evaluate a single pass gradient echo two-point Dixon sequence and a gradient echo sequence with spectral fat suppression in their performance at 3 Tesla for fat suppressed T1-weighted bilateral breast imaging with contrast injection.

Methods: Eight patients underwent dynamic contrast-enhanced breast MRI imaging as part of patient care on a 3 Tesla Signa Excite HDx (General Electric Healthcare, Waukesha, WI) MRI scanner. In addition to the standard sagittal dynamic imaging protocol, axial bilateral imaging with a T1-weighted 3D gradient echo sequence with spectral fat suppression (VIBRANT) and a single pass gradient echo two-point Dixon technique were also performed both before and after administration of intravenous gadolinium contrast agent injection. The indications for breast MRI were high-risk annual screening and breast cancer local staging. Two breast imaging radiologists retrospectively evaluated the axial bilateral images by the two different techniques for spatial resolution, signal in the axilla and anterior chest wall regions, image clarity at fat/water tissue interface. When an enhancing lesion was identified, internal signal intensity, lesion border and conspicuity were also compared.

Results: Performance of two techniques was retrospectively evaluated in seven patients with a total of 14 breast lesions varying between 0.5-5cm in size. One patient study was diagnostically limited due to excessive patient motion. Scan time for the Dixon sequence was consistently less than or equal to the fat suppressed VIBRANT sequence. One patient had invasive ductal cancer, two patients had 12 benign lesions, and one patient had a suspicious non-mass enhancing lesion. Three patient studies were negative for an enhancing abnormality. In all studies, improved fat suppression was consistently achieved with the Dixon fat-suppression technique. Dixon technique was also less sensitive to cardiac motion artifacts and improved the visualization of posterior structures. Lesion margins and internal enhancement characteristics were better assessed in 4(28%) of the 14 lesions including the invasive malignant mass.

Conclusion: Our preliminary findings suggest that the single pass gradient echo two-point Dixon technique is an effective fat suppression method for contrast-enhanced breast MRI. Although it needs to be validated on a larger number of patients, the Dixon technique also seemed to provide improved depiction of posterior structures and better anatomical definition of small lesions.

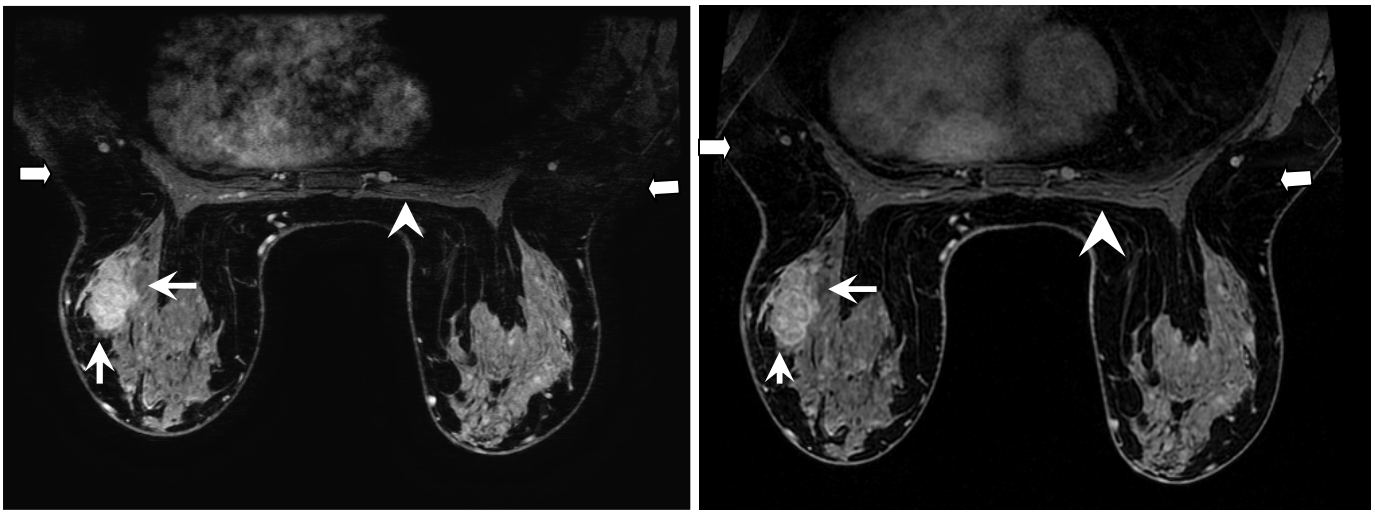

Figure 1: 38 year-old woman with left breast cancer. Contrast-enhanced VIBRANT (left) and water-only two-point Dixon image (right) obtained in the same scan location. Note the improved depiction of axillary structures (block arrows), pectoral muscle and anterior chest wall (arrowhead). Sharper enhancement/breast tissue interface is observed on the water-only Dixon image (arrows, right).