Faster Magnetic Resonance Imaging of breast implants using the IDEAL technique.

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Introduction: Regular MRI screening of silicone breast implants, as recently recommended by the FDA (1), creates an imperative for a robust and rapid MR imaging technique to visualize silicone ruptures. In order to accomplish this, silicone must be differentiated from the fat and water that comprise normal breast tissues. Techniques used for water-fat separation (2,3) can be modified to acquire silicone-only images by suppressing fat and separating water and silicone instead. Traditional MRI approaches to breast implant evaluation using Short Tau Inversion Recovery (STIR) with chemically selective pulses are time consuming and cumbersome: these necessitate separate acquisitions for water and silicone selective images; they are also vulnerable to magnetic field inhomogeneities and require manual selection of peaks for chemical separation. This study evaluates breast implant assessment using a STIR sequence modified to allow generation of water-only and silicone-only images with the IDEAL (Iterative-Decomposition of water and fat with Echo Asymmetry and Least-squares estimation) reconstruction technique.
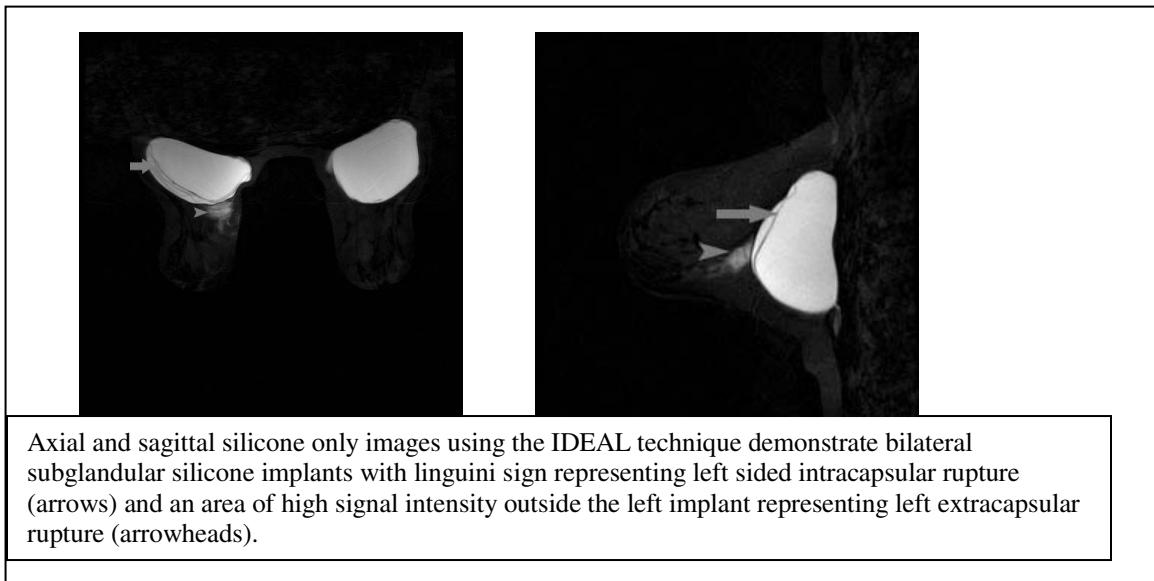
Methods: A retrospective review of all studies using IDEAL-STIR imaging of breast implants at our institution over a 2-year period [April 2005 to April 2007] was performed. The indication for the MRI, findings, follow-up and whether the study was diagnostic were identified. The time taken for each study and how frequently the water-silicone separation failed was determined. A total of 17 females [42-75 years; mean 53.2 years] had MRI of breast implants using the IDEAL-STIR technique on a 1.5T twin-speed GE with a seven element breast coil. Parameters used were (axial parameters in parentheses where different from sagittal/coronal): TR 7,000(8,200); TE 42; ST 6mm; Slice spacing 1mm; FOV 18(24)cm; Matrix 256x192(512x384), Bandwidth 31.25, ETL 9(10). Multiplanar (axial, coronal and sagittal) bilateral imaging was performed.

Results: MRI indications were possible implant rupture (15/17), breast mass (2/17) and cancer screening (3/17) [3 cases had more than 1 indication]. A breast mass was identified in 1 patient (DCIS) and implant rupture in 7 patients. Ruptures were mostly unilateral (6/7) and were intracapsular (5/7) or both intra and extracapsular (2/7). Surgical follow-up was available in 2 cases only and confirmed rupture. All 17 studies were diagnostic. The IDEAL technique took 6 minutes, 11 minutes and 7 minutes for axial, sagittal and coronal planes, respectively, for a total of 24 minutes acquisition time. The standard chemically selective technique took 40 minutes. IDEAL successfully produced fat suppressed water-only and silicone-only images in all 17 cases. No studies needed to be repeated.

Conclusion: MRI of breast implants using the IDEAL-STIR technique is substantially faster and more reliable than traditional assessment techniques.

Clinical Relevance

IDEAL imaging provides faster and more effective MR imaging of breast implants.

Axial and sagittal silicone only images using the IDEAL technique demonstrate bilateral subglandular silicone implants with linguini sign representing left sided intracapsular rupture (arrows) and an area of high signal intensity outside the left implant representing left extracapsular rupture (arrowheads).

References: 1) http://www.fda.gov/bbs/topics/NEWS/2006/NEW01512.html 2) Ma J et. al., MRM 2002; 48: p. 1021. 3) Reeder SB et. al., MRM 2004; 51: p. 35.