Optimizing Clinical Breast MRI: How to identify common artifacts and correct them

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Purpose:

Our objective is to provide technical pearls for both non-enhanced breast MR Imaging (MRI) and dynamic contrast enhanced breast MRI for optimizing breast MR imaging protocols in clinical practice. In this educational poster, we will review requirements for breast MRI including magnet and coils, fast spoiled gradient echo (FSPGR) sequences developed for dynamic contrast-enhanced imaging on different magnet systems and breast MRI on 3T within the context of technical recommendations for breast MRI made by American College of Radiology.

Outline of content:

Breast MR Imaging is technically demanding, as it requires excellent fat saturation, high spatial resolution, and rapid performance of postcontrast sequences.

A 1.5T or higher magnet provides optimal signal for breast imaging. A breast MR imaging examination performed for potential cancer diagnosis requires the use of a dedicated breast coil, typically with 4, 7, or 8 channels. Bilateral imaging has the advantage of allowing for assessment of symmetry and preventing aliasing artifacts more commonly encountered on unilateral breast imaging. Spatial resolution -a function of matrix size, field of view (FOV), and section thickness-has gained more importance in the diagnosis of cancer than fast dynamic imaging over the past years and must be kept <1 mm for breast MRI. Slice thickness sets the limit on the smallest visible lesion and should be kept at <3 mm. Imaging at higher magnetic fields (3T) provides high signal to noise ratio without compromising temporal resolution. However, 3T imaging presents additional challenges in the form of difficulty in fat suppression and magnetic field inhomogeneity, and therefore may increase visualized artifacts.

Common artifacts seen at breast MR imaging include motion, suboptimal fat suppression, metallic susceptibility, phase wrap, radiofrequency noise, and chemical shift. Fat suppression may be performed by chemical shift selective pulse (CHESS), subtraction, or fat-water separation techniques such as Dixon or IDEAL imaging, examples of which are illustrated in our poster. Problems related to breast positioning, selection of imaging volume, and phase-encoding direction can be overcome by training and providing feedback to MR imaging technologists.

Summary:

Technical factors that lead to suboptimal breast MRI studies may not be recognized due to lack of experience with MR imaging. It is essential to be able to provide imaging-based feedback to technologists in order to ensure high image quality and reduce artifacts.