Successful application of high spatial and spectral resolution MR for imaging of small breast lesions

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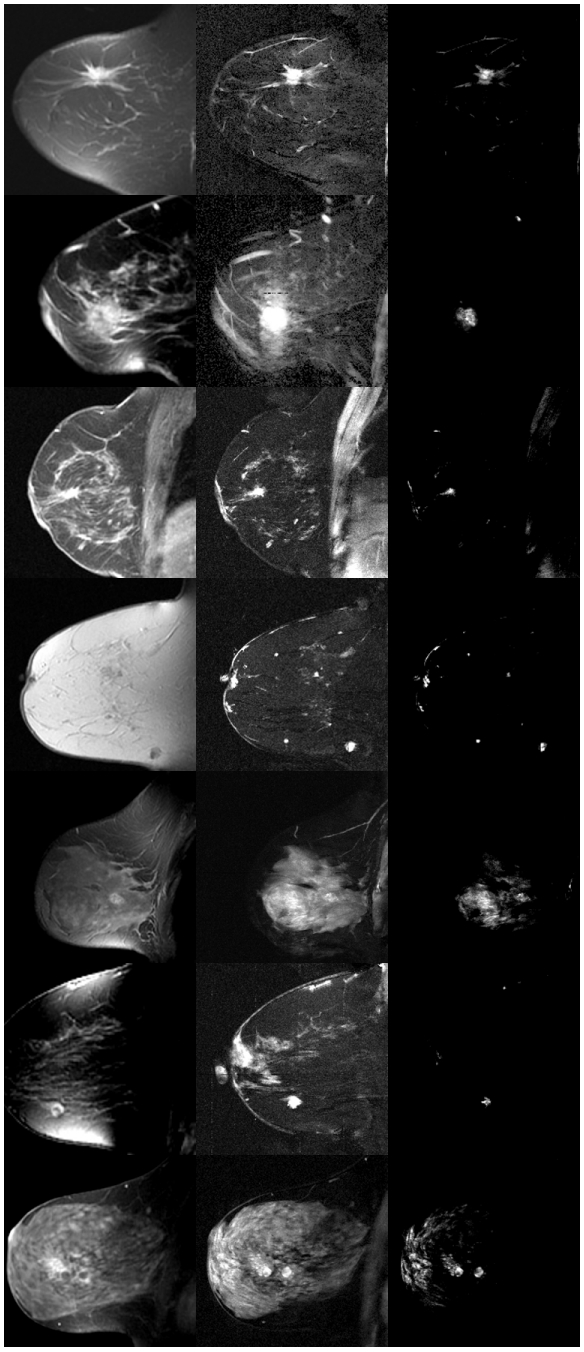
Introduction: Earlier quantitative comparison of high spectral and spatial resolution (HiSS) MRI and conventional images suggested that in the breast, HiSS can provide improved anatomic detail, contrast, and sensitivity to contrast agents. [1] However, tests of the efficacy of HiSS imaging of small breast lesions in a clinical setting are needed. Here, we report on the successful use of HiSS MRI to image 22 women with suspicious mammographic findings.

Methods: Single-slice, sagittal, HiSS images were obtained on a 1.5 T GE SIGNA™ scanner using echo-planar spectroscopic imaging (EPSI), with a resolution of 1 mm by 1 mm by 2.6 Hz in a 4 mm thick slice. [2] The fat resonance in each voxel was fit with a Lorentzian function and removed. Then images proportional to water peak height were constructed.

Results: Twenty two patients with mammographically suspicious lesions were imaged. In 12 cases, the lesions were less than 25 mm in diameter – 7 of these cases are shown in the Figure. In one case only, the lesion was not visualized in HiSS images due to improper slice positioning. More complete and uniform fat suppression was produced through HiSS imaging (center column) than through conventional fat saturation (left column). [1] In addition, HiSS images showed a much larger dynamic range, revealing internal structure within lesions. The center column shows HiSS images windowed to show all structures in the breast, and the right column is windowed to maximize contrast within the lesion, not present in classical clinical images when they were similarly windowed. Conventional fat saturation was not always effective, and sometimes failed completely, in individual slices, due to B_o inhomogeneity (e.g. in the fourth and sixth rows). Thus, lesions were sometimes obscured. In all cases, the lesions are highly conspicuous in HiSS images, with well defined edges. The smallest lesion imaged by HiSS (row 6) is 8 mm in diameter.

Conclusion: HiSS images can be successfully applied in clinical practice for imaging of small (less than 25 mm) breast lesions, even when only a single slice is imaged. Technical improvements currently underway will greatly increase HiSS image acquisition speed and the number of slices that can be imaged. Compared to conventional images, superior fat suppression and larger dynamic range are achieved, due to the high spectral resolution and very strong T_2*-weighting. The resulting improved contrast reveals structure within lesions and clearly delineated edges. These are important elements of clinical assessment elements and have potential to improve the specificity of breast MRI.



Conventional fat-saturated images (left) and HiSS-generated water peak height images (center and right) are compared. The windowing in the right column is adjusted to maximize contrast inside the lesion.

References:

1. Du, W., et al., Radiology, 2002. **224**(2): p. 577-85.
2. Kovar, D.A., et al., Acad Radiol, 1998. **5**(4): p. 269-75.