Simultaneous Bilateral 3D DCE-MR Breast Imaging with Radial Acquisition

L. Dougherty[1], G. Isaac[1], H. Song[1]
[1]Radiology, University of Pennsylvania, Philadelphia, PA, United States

Introduction

Investigators have previously developed a dynamic contrast-enhanced imaging method for breast MRI using an interleaved back-projection acquisition that was shown to reconstruct high spatial resolution images as well as high temporal resolution images using the same data [1]. Using a multi-resolution reconstruction they were able to reconstruct images with 0.47 mm isotropic resolution suitable for feature extraction as well as images with temporal resolution of 15 seconds for 32 slices. However, many cases require the imaging of both breasts, which would normally require the temporal interleaving of both volumes, reducing the resolution and precision of extracting kinetic parameters. We have modified a 3D radial sequence to excite both breasts simultaneously and to extract the slices from each breast using a SENSE reconstruction [2].

Methods

IRB approval was obtained prior to the start of this study. Patients with palpable or mammographically-visible, suspicious findings were entered into this study. After informed consent, patients were placed in the scanner (Sonata, Siemens Medical) in the prone position, with the breasts gently compressed within the manufacturer's breast coil. For the calculation of coil sensitivities used for SENSE processing, a coarse matrix reference scan was performed. The contrast-enhanced images were acquired using a fast 3D spoiled gradient-recalled back-projection sequence using 512 data samples/projection with 384 projections, and 32 phase encoding steps in the slice direction (TR/TE, 10/4; flip angle=20°; ±74 kHz sampling bandwidth). The projection angle was advanced so that π radians were uniformly covered every 48 views. Images were acquired using 24 cm FOV and ~3 mm thick slices. The fat signal was suppressed using a spectral inversion pulse played-out twice per slice group. The frequency of the RF selection pulse was set to excite the center point between both breast as determined via graphic prescription and was modulated by a cosine function at a frequency that moved the excitation slabs over each breast (Figure 1). A high-resolution baseline volume was acquired followed by dynamic imaging started simultaneously with the intravenous injection of 0.1-mmol/kg gadopentetate dimeglumine (Magnevist, Berlex Laboratories, Wayne, NJ). Contrast was administered over a 10-second interval and followed by a saline flush. Data were acquired over the following 6-minute period. Data from each breast coil were saved separately. Each data set were reconstructed using a re-gridding approach and slice aliasing between breasts was removed using SENSE.

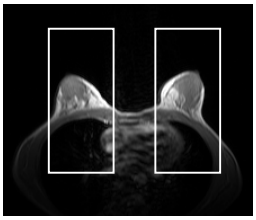

Figure 1. Bilateral prescription

Results

Fourteen exams were performed, all with excellent image quality. Thirty-two 512 x 512 slices were reconstructed for each breast. Figure 2 shows a representative case with a slice from each breast, an enhancing lesion and corresponding enhancement curve. Due to the interleaving of the radial acquisitions and the parallel acquisition of both breasts, the contrast kinetics were sampled every 15 seconds, which is a 16X acceleration factor over a conventional approach.

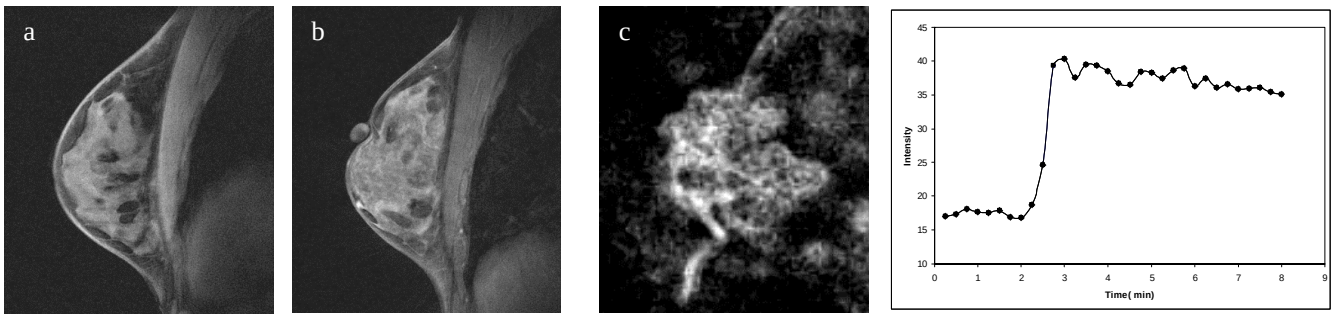

Figure 2. Simultaneous bilateral breast imaging: a) slice from left breast; b) right breast; c) enhancing lesion; d) enhancement curve

Conclusions

Dynamic contrast enhanced images of the both breasts can be acquired simultaneously providing high-resolution images as well as rapid sampling of the contrast kinetics.

1. Song HK, Doughetry L, Schnall MD. *Mag. Res. Med*., 46(3):503-509, 2001.
2. Pruessmann KP, *et al*. Magn Reson Med 1999; **42**: 952-962.

Supported by NIH 1RO1-CA90699