

10.5 CNR Optimization of High Resolution Peripheral MRA Using Sensitivity Encoding for the Vasovist Blood Pool Agent

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Introduction

MR sequence parameters used in conventional CE-MRA with extracellular fluid agents are not optimized for equilibrium phase (EP) imaging as they are based on short scan times. Using blood pool agents (BPA), lengthier protocols can be used to exploit the long window of vascular enhancement in the EP and thereby obtain ultra-high spatial resolution images of the peripheral vasculature. In this work, optimal sequence parameters for EP imaging were determined using the BPA Vasovist (gadofosveset, EPIX Pharmaceuticals).

Methods

A model for optimizing vascular contrast-to-noise (CNR) is presented based on using the reduction in scan time gained from sensitivity encoding (SENSE) to enhance CNR performance by increasing TR and minimizing bandwidth. Tissue relaxation times, g-factors for two imaging coils, and clinical imaging requirements in terms of voxel size and scan time were determined from human studies. Using these known parameters, optimal sequence parameters for TR, TE, bandwidth, flip angle and SENSE factor can be derived from the model.

Results

The optimization model closely predicts the experimental CNR data measured in two clinical studies ($r^2 = 0.84$). Improvements in CNR were demonstrated in subjects imaged using optimal sequence parameters. In an optimized study of 10 patients, clinical EP CE-MRA data of the lower extremity thigh and calf were acquired at ultra-high spatial resolution on the order of 0.125 mm^3 using a SENSE factor of 4. Optimal sequence parameters will be presented for a 12-channel and 18-channel phased-array peripheral vascular coil at two different doses of Vasovist (0.03 mmol/kg and 0.05 mmol/kg).

Discussion

The use of parallel acquisition for enhancing CNR was demonstrated for ultra-high resolution EP imaging. Diseased arteries were well-depicted and vessel wall enhancement seen at the site of atherosclerotic disease. In the calf, sufficient resolution and contrast allows distinction between small caliber arteries and adjacent larger veins (fig).

