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Highly accelerated high spatial resolution myocardial perfusion imaging

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Introduction

Assessment of myocardial perfusion is of crucial importance in the evaluation of patients with suspected or known coronary artery disease (CAD). Recently, a method that exploits spatial and temporal data correlations (k-space and time; *k-t* SENSE) to permit higher acceleration factors for data sampling has been used successfully for CMR perfusion imaging [1]. However, increasing acceleration factors compromises the temporal fidelity of the reconstructed images [2]. This problem can be reduced by increasing the number of training data profiles which, therefore diminishes the net acceleration factor [3]. As an alternative, SENSE can be used to increase the training data resolution without reducing the net acceleration [4].

Purpose

To assess the clinical feasibility and diagnostic performance of a novel scan acceleration technique for rapid high spatial resolution Cardiac Magnetic Resonance (CMR) perfusion imaging.

Methods

Twenty patients (mean age 60 ± 7 years, 4 female) with suspected or known coronary artery disease scheduled for invasive coronary angiography underwent highly accelerated perfusion imaging using a 3.0 Tesla whole-body scanner. Perfusion images were obtained under pharmacological stress (adenosine: 140 μg/kg/min over 6 min) using an extension of the k-t SENSE method employing parallel imaging methods to double the spatial resolution of the k-t SENSE training images. This extension permitted 8-fold nominal scan acceleration (k-t factor = 8, training profiles = 11). Typical imaging parameters were: TR = 2.6 ms, TE = 0.92 ms, flip angle = 20°, saturation prepulse delay = 150 ms, acquisition window = 90 ms, typical FOV = 380 × 380 mm^2, slice thickness = 10 mm, dynamics = 24. In-plane spatial resolution was 1.13 × 1.13 mm^2. Perfusion scores were derived using the 16-segment AHA model for LV assessment. Quantitative coronary angiography served as standard of reference.

Results

High diagnostic accuracy was achieved using CMR as reflected by an area under the curve of the receiver operating characteristic of 0.94 for detecting stenoses >50% overall. Values for the LAD, LCX and RCA territories were 0.75, 0.92 and 0.79, respectively. Highly accelerated CMR perfusion imaging offered excellent to good image quality under stress.

Conclusion

Highly accelerated CMR perfusion imaging is clinically feasible and offers excellent diagnostic performance in detecting coronary artery disease.

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