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Meeting abstract

1125 Spiral first-pass myocardial perfusion imaging at 3 Tesla: feasibility study

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Introduction

Achieving high spatial resolution and complete coverage of the left ventricle is desirable in first-pass myocardial perfusion imaging (MPI) for robust detection of regional perfusion deficits associated with significant CAD. 2DFT combined with parallel imaging [1,2] is currently most commonly used for clinical applications since it is relatively robust to inherent errors such as off-resonance and gradient delay. Echo planar imaging also has been used for fast acquisition in MPI [3], but additional correction for ghosting artifacts is typically required. Another well-known fast acquisition scheme uses spiral trajectories. While spiral MPI has not been reported presumably due to its high sensitivity to off-resonance effects, the approach allows high readout duty cycles and efficient coverage of k-space [4] providing the rationale for the present study. We applied short spiral readouts with spectral spatial RF pulse to single slice MPI, and obtained high quality images from a healthy subject.

Purpose

The purpose of the present study was to investigate the feasibility of spiral first-pass MPI at 3 Tesla.

Materials and methods

The pulse sequence consists of a BIR4 RF pulse for B1 and B0 insensitive global saturation, and an interleaved spiral gradient echo acquisition. A spectral spatial readout RF pulse is used for fat suppression. The blurring effect caused by off-resonance is a well-known problem in spiral imaging and increases with increasing magnetic field strength (e.g. 3 T). Hence, a short readout time of 4.2 ms was used, and a total of 14 interleaves were combined in a bit reversed order for a target in-plane resolution of 2 × 2 mm^2 and FOV of 26 × 26 cm^2. Other imaging parameters included: TR = 9.8 ms, flip angle = 30°, and slice thickness = 8 mm. Imaging used ECG-gating such that a single diastolic cardiac phase could be acquired with each cardiac cycle.

The spiral perfusion sequence was tested on a healthy volunteer using a GE Signa Excite whole body 3 T scanner with an 8 channel cardiac coil. Gd-DTPA (Magnevist, 0.1 mmol/kg) was injected at 3 ml/sec followed by 20 ml of saline, and the subject was instructed to hold his breath as long as possible.

Results and discussion

Representative images at four time points are depicted in Fig. 1: (a) pre-contrast, (b) RV enhancement, (c) LV enhancement, and (d) myocardial enhancement. Signal enhancement in the blood pool and in the myocardium is demonstrated without noticeable blurring effects. A major concern with spiral MPI is "whirling" artifacts caused by data inconsistency in k-space, which can hinder accurate quantitative analysis of contrast agent kinetics. In the present study we observed only a small degree of "whirling" artifacts at the moment of blood pool enhancement, which did not interfere with the ability to use this approach to generate high quality myocardial perfusion imaging.

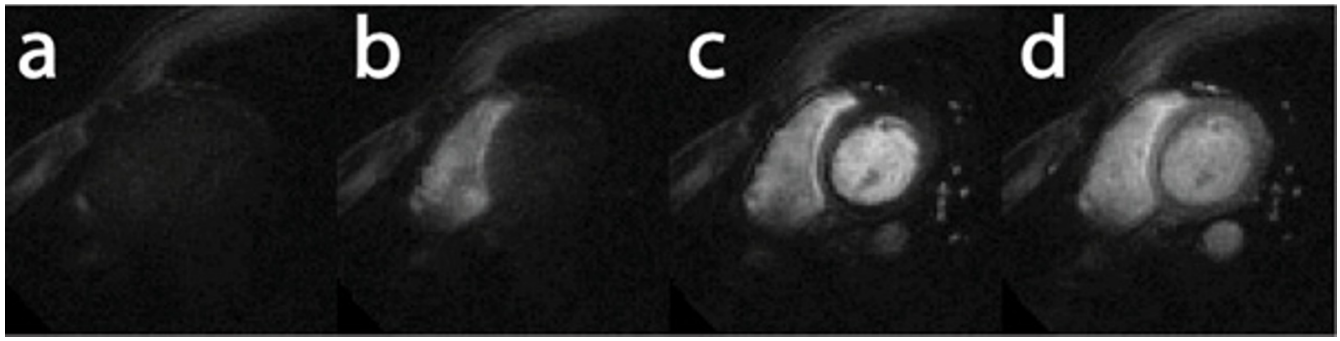

Figure 1
Representative perfusion images at (a) pre-contrast, (b) RV enhancement, (c) LV enhancement, and (d) myocardium enhancement.

Conclusion

We have demonstrated the feasibility of spiral MPI at 3 Tesla that can provide high spatial resolution with minimal blurring effects.

References

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