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Meeting abstract

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2116 Multislab whole-heart coronary angiography

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Introduction

To simultaneously assess the right and left coronary artery tree, whole-heart imaging techniques covering the entire region between the ostia of the coronary arteries and the diaphragm are required. For the analysis of the resulting angiographic data, sufficient isotropic spatial resolution enabling multi-planar reformats of the data for inspection of the entire course of the arteries is mandatory. Whole-heart imaging, however, is still limited by the required long acquisition times in the order of 15 minutes. During the long acquisitions, the likelihood of patient motion as well as drifts of the expiratory position is high. Furthermore, the optimal cardiac phase with minimal residual cardiac motion may vary depending on oder with respect to the location along the patient axis.

Purpose

In this work an approach to whole heart imaging was investigated, in which the acquisition of the entire volume was divided into subsequent acquisitions of up to three slabs, which in combination ensured coverage of the entire heart at reasonable spatial resolution.

Methods

Seven healthy volunteers (mean age 34 +/- 5) were imaged with the suggested protocol. For whole heart imaging, three slightly overlapping parallel transaxial slabs covering the entire heart from about 1 cm above the ostium of the left coronary artery to about 1 cm inferior to the heart were acquired. Each slab comprised 32 slices with isotropic spatial resolution of $1.4^3 mm^3$. Imaging was performed applying a free-breathing navigator-gated and corrected cardiac triggered steady-state-free-precision (SSFP) sequence with fat suppression and T2 preparation. The navigator gating window was chosen 5 mm wide. Acquisition parameters were as: TE/TR = 1.8/3.6 ms, matrix size = 192 × 192 × 32, field-of-view (AP/FH/RL) = 230/45/230 mm; reconstruction matrix size = 512 × 512 × 64, parallel imaging factor = 1.4 in AP direction. Prior to each volume acquisition, a functional scan aligned with the center of the respective slab was acquired and the resting phase of the heart was individually assessed by visual inspection. Furthermore, the position of the gating window was adapted individually for each slab. For visualization, multi-planar reformatting of the data was performed individually for each slab applying the "soap-bubble" tool.

Results

All scans could be completed successfully. The average navigator efficiency was about 60% and no scan had to be aborted due to navigator drifts. The measurement time per slab was on average 300 s. The manually derived optimal phase points suggested using a longer trigger delay for the most caudally located slab in three volunteers.

All sections of the LCA and RCA could be visualized. An example of the piecewise multi-planar reformatted sections of the left and right coronary artery are provided in Figure 1, showing the proximal and medial LCA (a) and RCA (b), the distal LCA (c), the ramus interventricularis posterior (d), the ramus posteriorlateralis dexter (e), and the crux cordis (f).

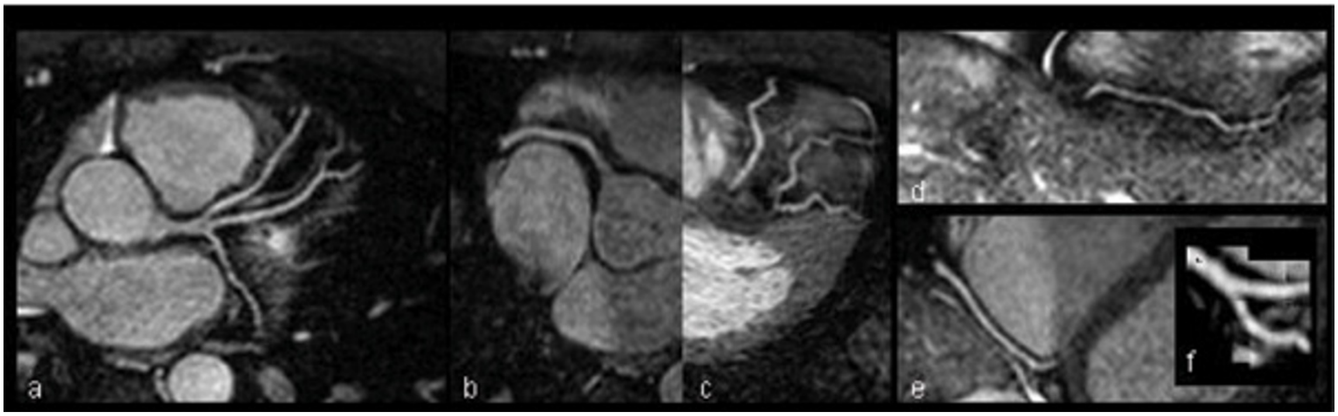

Figure 1
Multi-slab reconstruction of the coronary arteries at isotropic spatial resolution.

Conclusion

The subsequent acquisition of parallel slabs for whole-heart coronary angiography at isotropic spatial resolution appears feasible. The possibility of slab-wise optimization of acquisition parameters, gating windows, and correction factors may provide higher navigator efficiencies, avoid navigator drifts due to the shorter acquisition times per slab and end up with improved image quality due to a slab-specific selection of the optimal cardiac phase. The side-by-side comparison to a single-slab whole-heart technique at the same spatial resolution must reveal the potential benefit of the suggested approach and provide side-by-side comparison of vessel visibility and signal and contrast to noise ratios. Furthermore, combination techniques allowing the visualization of the entire course of the vessel must be investigated for enabling easy reading of the data.