

ORAL PRESENTATION

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Slice-selective implementation of an adiabatic T₂Prep sequence increases coronary artery conspicuity at 3T

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Background

In non-contrast coronary MRA, the non-selective T₂Prep¹⁻² has been widely used for contrast enhancement between the coronary blood-pool and the myocardium³⁻⁵. This non-selective pre-pulse affects the magnetization both inside and outside the field-of-view, resulting in a reduced steady-state magnetization of the inflowing blood, and consequently a penalty in SNR. We hypothesize that a slice-selective T₂Prep would leave the magnetization of blood outside the imaged volume unaffected, and thereby minimize SNR penalty for inflowing blood. The purpose of this work was to implement a slice-selective T₂Prep coronary MRA sequence and to assess the SNR gain quantitatively.

Methods

Simulations

bloch equations were simulated to test the above hypothesis and to estimate the expected SNR gain.

Implementation

the selective T₂Prep was implemented by replacing the non-selective 90° RF pulses with slice-selective versions plus flow-compensating gradients, and an additional time gap between the T₂Prep and other pre-pulses to allow for inflow of a larger volume of spins with equilibrium magnetization (Figure 1). The T₂Prep volume was graphically selected along the arterial axis and orthogonal to the imaged volume without covering the ventricles (Figure 1c) to avoid saturation of the inflow spins in the ascending aorta.

Experiments

volume-targeted 3D free-breathing navigator-gated and corrected coronary MRA⁵ were acquired on a Philips Achieva 3T a) without T₂Prep, b) with the conventional T₂Prep, and c) with the proposed slice-selective T₂Prep (T_{gap}=150ms) in 10 healthy volunteers. Repeated measures of blood SNR, vessel-neighborhood CNR, and vessel sharpness were statistically compared using ANOVA with Tukey post hoc test.

Results

Consistent with the hypothesis, numerical simulations suggest that the slice-selective T₂Prep leads to an SNR increase in the blood-pool (Figure 1A) when compared to its non-selective counterpart. Figure 1C shows an *in vivo* result obtained with the slice-selective T₂Prep localized along the dark bar (arrows). When compared to the non-selective T₂Prep, vessel sharpness improved significantly using the proposed implementation (54.1 ± 2.4% vs. 48.5 ± 2.4%, p < 0.05, Figure 2A). While both T₂Prep variants led to an SNR penalty when compared to no T₂Prep as previously reported³, the slice-selective T₂Prep still led to a significantly improved SNR compared to conventional T₂Prep (39.9 ± 3.2 vs. 27.7 ± 2.5, p < 0.02, Figure 2B). A similar finding was observed in CNR measurements (16.1 ± 1.6 vs. 11.8 ± 1.5, p < 0.05, Figure 2C).

Conclusions

A slice-selective adiabatic T₂Prep leads to improved coronary artery conspicuity when compared to its conventional non-selective counterpart.

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