

Oral presentation

Coronary magnetic resonance angiography at 7 Tesla: a quantitative comparison with results at 3 Tesla

Saskia GC van Elderen*¹, Maarten J Versluis¹, Jos JM Westenberg¹, Harsh Agarwal², Nadine BS Smith¹, Matthias Stuber², Albert de Roos¹ and Andrew G Webb¹

Address: ¹LUMC, Leiden, Netherlands and ²Johns Hopkins University, Baltimore, MD, USA

* Corresponding author

from 13th Annual SCMR Scientific Sessions
Phoenix, AZ, USA. 21-24 January 2010

Published: 21 January 2010

Journal of Cardiovascular Magnetic Resonance 2010, **12**(Suppl 1):O88 doi:10.1186/1532-429X-12-S1-O88

This abstract is available from: <http://jcmr-online.com/content/12/S1/O88>

© 2010 van Elderen et al; licensee BioMed Central Ltd.

Introduction

Commercial 7 Tesla(T) systems have recently become available for human use. Our initial results have shown feasibility of right coronary artery(RCA) magnetic resonance angiography(MRA) at 7 T[1]. Since then, we have optimized the RF coil design, resulting in significantly improved image quality at 7 T.

Purpose

To quantitatively compare same-subject signal-to-noise(S/N), coronary vessel length, vessel sharpness, acquisition time and navigator efficiency of right coronary MRA at 7 T and 3 T.

Methods

Eight healthy adult subjects (mean age 23 ± 3 years, 5 men) underwent vector ECG-triggered, navigator gated and corrected free-breathing 3D MRA of the RCA at 7 T and 3 T. At 7 T a quadrature loop-pair (two 15 cm elements) was constructed, and the 2D selective respiratory navigator was localized at the lung-heart interface. At 3 T, a commercial 6-element cardiac receive array was used with body-coil transmit. A 3D segmented k-space gradient echo technique was combined with spectrally selective adiabatic inversion-recovery magnetization fat saturation. At 3 T, coronary MRA were obtained with the navigator localized at the lung-heart interface and at the lung-liver interface, respectively. The scan parameters at both field strengths were as similar as possible (Table 1). The S/N in the bloodpool of the aortic root near the RCA offspring,

coronary vessel length, vessel sharpness, acquisition time and navigator efficiency were compared using Wilcoxon matched-pairs test. For visualization, reformatting with the 'Soapbubble'-tool was utilized.

Results

In Figure 1, RCAs obtained in the same subject at 7 T(Figure 1a) and 3 T (Figure 1b) are shown. The corresponding quantitative findings averaged over all subjects are listed in Table 2. The S/N was very similar at both field strengths and visible RCA vessel length was slightly lower at 7 T, but not statistically significant. Vessel sharpness obtained at 7 T was significantly higher compared to that at 3 T ($p < 0.03$). The scanning time for all 3D acquisitions was identical. There was a tendency for reduced navigator efficiency at 7 T which was not statistically significant, however. These findings apply for both the diaphragmatic navigator as well as for that localized at the heart with a trend for a lower S/N at 3 T for the navigator localized at the lung-heart interface.

Conclusion

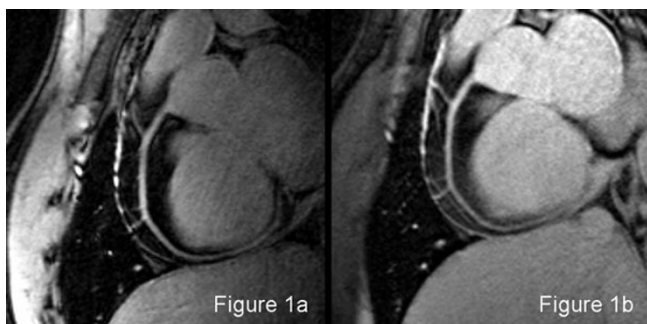
Using a quadrature transmit/receive coil at 7 T, it was shown that 7 T coronary MRA image quality has already begun to approach that at 3 T while vessel sharpness is already significantly improved. With future incorporation of technology such as larger transmit arrays we anticipate that the image quality at 7 T will continue to improve at rapid pace.

Table 1: Scan parameters

Field strength and sequence	7 Tesla, 3D gradient echo	3 Tesla, 3D gradient echo	3 Tesla, 3D gradient echo
Navigator	Heart	Diaphragm	Heart
Coil	Quadrature loop	6 element array	6 element array
TR/TE/TI fat suppress (ms)	4.3/1.38/200	4.3/1.38/150	4.3/1.38/150
Voxel size (mm ³)	0.82 × 0.86 × 2.00	0.82 × 0.86 × 2.00	0.82 × 0.86 × 2.00
No. slices	30	30	30
FOV (mm ²)	420 × 268	420 × 269	420 × 269
Matrix	512 × 312	512 × 312	512 × 312
Tip angle (°)	15	15	15
Acquisition window (ms)	107	108	108

Table 2: Quantitative findings, *significantly different from 7 T (p < 0.05)

	7 T	3 T: navigator on diaphragm	3 T: navigator on heart
S/N blood	49.2 ± 30.9	46.1 ± 13.6	38.2 ± 14.2
RCA vessel length (cm)	7.21 ± 2.50	8.48 ± 3.06	8.46 ± 2.84
RCA vessel sharpness (%)	58.94 ± 9.27	48.35 ± 6.45*	48.92 ± 9.62*
Acquisition time (sec)	414 ± 144	478 ± 214	470 ± 173
Navigator efficiency (%)	57 ± 20	48 ± 15	48 ± 15

**Figure 1**