Quantitative and Qualitative Comparison of 3D T2-prep TFE, Spiral and SSFP Coronary MRA

T. Leiner[1,2], G. Katsimaglis[2], K. V. Kissinger[2], P. Boernert[3], W. J. Manning[2], R. M. Botnar[2]

[1]Dept. of Radiology, Maastricht University Hospital, Maastricht, Netherlands, [2]Cardiac MR Center, RW453, Beth Israel Deaconess Medical Center, Boston, MA, United States, [3]Philips Research Laboratories, Hamburg, Germany

Introduction

Coronary MRA is a promising alternative to X-ray coronary arteriography (1). Recently, several new coronary MRA pulse sequences have become available (e.g. SSFP, spiral), but comparative studies are lacking. The purpose of the current study was to compare 3 different coronary MRA sequences at several different spatial resolutions and to determine the most favourable sequence as defined by objective and subjective image quality.

Materials and Methods

Free breathing, navigator gated coronary MRA with fixed, subject specific trigger delays and acquisition window durations (<100ms) were performed in 20 healthy adult subjects. All imaging was done on a 1.5T clinical MR scanner (Gyroscan NT/ACS R9.1, Philips Medical Systems, Best, The Netherlands). Ten left and 10 right coronary arteries (RCA) were imaged using 3D T2-prep TFE (2,3) (0.7x1.0mm in-plane [IP]), 3D Spiral (4) [high (0.7x0.7mm IP), intermediate (0.84x0.84mm IP), and low (1.0x1.0mm IP) resolution] and 3D SSFP (5) [intermediate (0.84x0.84mm IP), and low (1.0x1.0mm IP) resolution. Measured partition thickness for all sequences was 3.0mm (reconstructed thickness 1.5 mm). Sequences were acquired in random order. Mean vessel length for left main and anterior descending (LAD), circumflex (LCX) and RCA as well as SNR and CNR were determined using custom post-processing software (6). All visible arteries were reviewed for subjective image quality (5-point scale ranging from 0=not visible to 4=very good).

Results

All subjects successfully completed scanning. Individual sequences were all completed within <10 minutes. Intermediate resolution 3D SSFP allowed for longest mean coronary artery visualization (table). Distal coronary arteries (LAD: >4cm; LCX: >3cm; RCA: >5cm) were visualized in 18/20 subjects (90%) versus <80% for all other sequences. For the LAD, this was significantly longer (p<0.02) compared to low- and intermediate resolution spiral. For RCA, this was significantly longer compared to 3D TFE, low-resolution 3D spiral, and low-resolution bTFE (p-values all <0.05) and for the LCX, this was significantly longer compared to all other sequences (p<0.05). Subjective image quality was also highest for intermediate resolution SSFP. SNR and CNR were lowest for this sequence. Below representative examples are shown of T2 prep TFE (a), spiral high resolution (b), spiral intermediate resolution (c), spiral low resolution (d), SSFP intermediate resolution (e), and SSFP low resolution (f) coronary MRA of the RCA (**figure 1**, left) and left coronary arterial system (**figure 2**, right).

	T2-prep TFE	Spiral high res	Spiral interm res	Spiral low res	SSFP interm res	SSFP low res
LAD length	64±7.4	68±12	67±14	70±11	71±14	67±11
LCX length	33±7.7	35±11	38±6.6	36±6.6	42±6.9	35±7.2
RCA length	98±27	99±32	101±29	91±33	118±24	102±32
Mean SNR	29.1±8.8	32.1±6.1	43.0±8.9	50.0±11	29.1±7.5	31.7±11
Mean CNR	19.8±7.5	22.5±7.2	31.0±8.3	36.0±10	19.2±6.8	20.5±7.6
Image Quality	2.5±0.5	2.7±0.4	2.8±0.2	2.7±0.4	3.0±0.3	2.9±0.3
Scan Duration @70bpm	4:10	3:55	3:55	3:55	4:10	3:45

Discussion and Conclusions

Compared with T2-prep TFE and spiral sequences, intermediate 3D SSFP coronary MRA allows for consistently longer visualization of the major coronary arteries, and the highest image quality. Further studies in patients have to determine if there are differences between sequences in diagnostic accuracy for the detection and grading of coronary stenoses.

References

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Fig 1

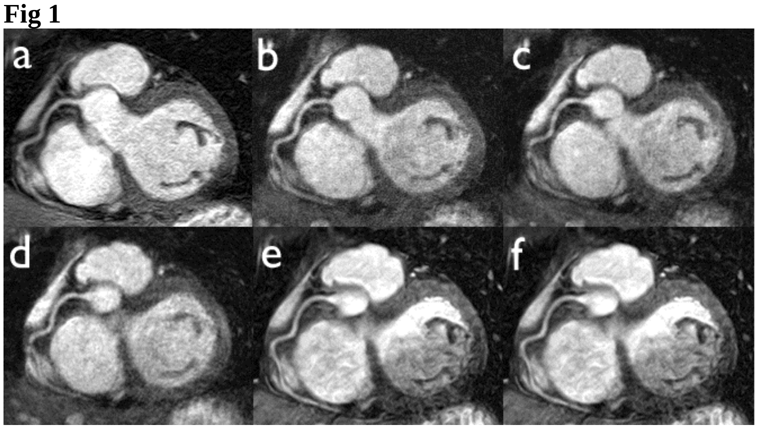

Fig 2