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# Real time cardiac MRI and its clinical usefulness in arrhythmias and wall motion abnormalities

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New Orleans, LA, USA. 16-19 January 2014**Background**

Analysis of cardiac function in patients with arrhythmias is very limited or nearly impossible in ECG synchronized cine acquisitions with balanced SSFP. A real-time method at 1.5 T with SSFP contrast was used to show that this method is superior for image quality and analysis of ventricular function in a subset of patients with atrial fibrillation and AV-Block.

**Methods**

Radial gradient-echo sequences with fully balanced SSFP gradients and at least 15-fold undersampling (real-time SSFP, RT) and conventional ECG-synchronized cine SSFP CMR (Cine) was used on a 1.5 T scanner system. Patients who had permanent arrhythmias (most often atrial fibrillation, AA; n = 8) or wall motion abnormalities (WMA; n = 3) were scanned in the standard views

and compared to patients in sinus rhythm (SR; n = 21) without wall motion abnormalities. Image reconstruction of RT was performed offline by regularized non-linear inversion. Quality (IQ) of scan was detected using an image quality score (ranging from 0 = no diagnostic quality to 1 = reduced diagnostic quality, 2 = many artifacts, 3 = some artifacts, and 4 = optimal diagnostic quality). Cardiac function was analyzed using a semiautomatic contour detection (Q mass, Medis, NL) applied to 5 consecutive beats in RT and Cine averaging data of 10-12 beats. All analysis was done by two blinded observers (3 and 8 years experience of CMR evaluation).

**Results**

IQ was comparable for Cine and RT SSFP in patients with WMA or patients in sinus rhythm without WMA given in Table 1. However, IQ was significantly better

**Table 1**

Views for IQ and quantitative parameters	Patient groups	Number of views	RT	Cine
Short axis base (IQ)	AA	16	3.94 ± 0.25 *	2.75 ± 0.68
	WMA	6	4.00 ± 0.00	4.00 ± 0.00
	SR	42	3.62 ± 0.54	3.95 ± 0.22
Short axis mid (IQ)	AA	16	3.81 ± 0.40 *	2.69 ± 0.60
	WMA	6	3.67 ± 0.5	4.00 ± 0.00
	SR	42	3.48 ± 0.67	3.93 ± 0.26
Short axis apex (IQ)	AA	16	3.81 ± 0.40 *	2.19 ± 0.91
	WMA	6	3.00 ± 1.26	3.50 ± 0.55
	SR	42	3.07 ± 0.97	3.70 ± 0.55
Enddiastolic volume [ml]	AA	16	55.15 ± 10.17	36.80 ± 20.13
	WMA	3	52.39 ± 3.91	43.10 ± 6.73
	SR	16	47.50 ± 12.70	51.32 ± 18.4
Endsystolic volume [ml]	AA	16	32.30 ± 13.11	21.60 ± 16.50
	WMA	3	30.50 ± 9.80	24.10 ± 6.86
	SR	16	25.10 ± 13.0	22.40 ± 10.70

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**Table 1** (Continued)

Beat volume [ml]	AA	16	22.83 ± 6.30	15.20 ± 6.20
	WMA	3	21.90 ± 8.50	19.00 ± 1.27
	SR	16	22.37 ± 5.30	29.84 ± 16.7
Ejection fraction [%]	AA	16	43.50 ± 15.10	46.30 ± 16.10
	WMA	3	41.70 ± 16.70	45.00 ± 6.90
	SR	16	50.00 ± 12.20	57.90 ± 12.50

\*  $p < 0.001$  RT vs Cine

for RT compared to Cine in all three short axis in patients with arrhythmias. Functional parameters showed no significant differences, however there was a trend to lower values for enddiastolic, endsystolic and beat volumes for Cine (10-12 beats) compared to RT (5 consecutive beats) in RT.

### Conclusions

RT cardiac MRI is a robust method with high image quality that has the potential to allow functional analysis of sequences in patients with arrhythmias that are often difficult or impossible to analyze by cine SSFP.

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