Schuster et al. Journal of Cardiovascular Magnetic Resonance 2012, 14(Suppl 1):O50
http://www.jcmr-online.com/content/14/S1/O50

Journal of Cardiovascular Magnetic Resonance

ORAL PRESENTATION Open Access

Cardiac magnetic resonance myocardial feature tracking correlates with natural radial strain and corresponds to inotropic stimulation

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From 15th Annual SCMR Scientific Sessions
Orlando, FL, USA. 2-5 February 2012

Summary

We have demonstrated that cardiac magnetic resonance (CMR) myocardial feature tracking (FT) and natural radial strain correlate and correspond to inotropic stimulation. CMR-FT has the potential for quantitative wall motion assessment at rest and during dobutamine stress magnetic resonance (DSMR) imaging.

Background

CMR-FT is a recently introduced technique for tissue voxel motion tracking on standard steady-state free precession (SSFP) images to derive radial myocardial mechanics. CMR-FT has the potential to facilitate DSMR analysis however has not yet been compared to external reference standards (with stress) such as SSFP derived natural radial strain.

Methods

10 healthy subjects were studied at 1.5 Tesla. LV short-axis radial strain ErrSAX was derived from SSFP cine images using dedicated CMR-FT software (Diogenes MRI prototype, Tomtec, Germany) at rest and during dobutamine stress (10 and 20 μg * kg-1* min-1). Natural radial strain values (loge [End-systolic wall thickness/ end-diastolic wall thickness]) were calculated in identical segments as analysed for ErrSAX using commercially available software (Philips View Forum, The Netherlands). 95% confidence intervals (CI) of the difference and p-values were calculated to compare the 2 techniques.

Results

In all volunteers strain parameters could be derived from the SSFP images at rest and stress. ErrSAX values showed significantly increased contraction with DSMR (rest: 19.6±14.6; 10 μg: 31.8±20.9; 20 μg: 42.4±25.5, $p<0.05$). Natural radial strain values increased with dobutamine (rest: 24±8.9; 10 μg: 36.5±8.9; 20 μg: 44.2 ±8.5, $p<0.05$).

There was reasonable agreement between mean ErrSAX and natural radial strain at rest and with dobutamine stress (figure 1 and table 1) as determined by 95% CI of the difference.

Conclusions

CMR-FT correlates with natural radial strain derived from SSFP cine imaging. Both measures correspond to inotropic stimulation. CMR-FT holds promise of easy and fast quantification of wall mechanics and strain.

Funding

AS receives grant support from the British Heart Foundation (BHF) (RE/08/003 and FS/10/029/28253) and the Biomedical Research Centre (BRC-CTF 196). SK receives grant support from the American College of Cardiology Foundation, the Edna Ittner Pediatric Foundation, and the Children's Hospital and Medical Center Foundation.

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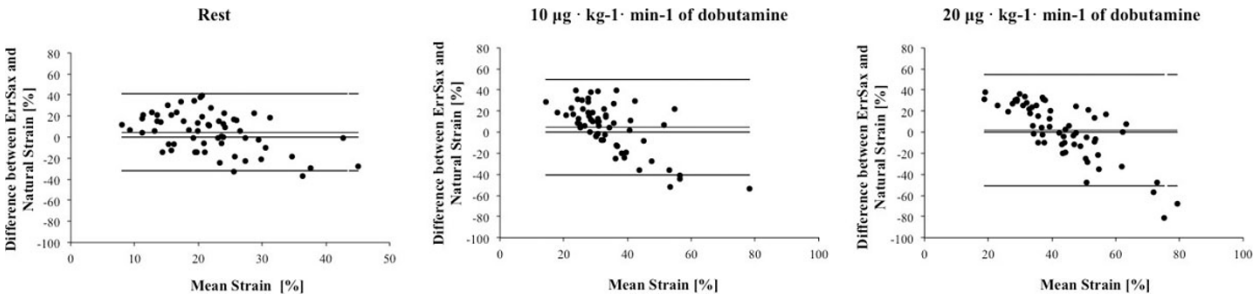

Figure 1 Bland Altman Plots showing the relationship between ErrSAX and natural radial strain. ErrSAX = left ventricular short-axis radial strain.

Table 1

Parameter	Ventricle	Mean	CI (95%)	p-value
Rest	ErrSAX	19.6	15.8-23.4	0.07
	Natural Strain	24	21.7-26.4	
10 µg * kg-1* min-1 of dobutamine	ErrSAX	31.8	26.9-37.9	0.12
	Natural Strain	36.5	34.2-38.8	
20 µg * kg-1* min-1 of dobutamine	ErrSAX	42.4	35.8-48.9	0.59
	Natural Strain	44.2	42-46.4	

The table shows variability between CMR-FT radial strain parameters (Err) and natural radial strain of the LV derived from a short-axis view at rest and with dobutamine stress. 95% Confidence Intervalls of the difference and p-values are given to accurately determine individual variabilities. ErrSAX = left ventricular short-axis radial strain.

Published: 1 February 2012

doi:10.1186/1532-429X-14-S1-O50
Cite this article as: Schuster *et al.*: Cardiac magnetic resonance myocardial feature tracking correlates with natural radial strain and corresponds to inotropic stimulation. *Journal of Cardiovascular Magnetic Resonance* 2012 **14**(Suppl 1):O50.