Mekkaoui et al. Journal of Cardiovascular Magnetic Resonance 2016, 18(Suppl 1):P13
http://www.jcmr-online.com/content/18/S1/P13

Journal of Cardiovascular Magnetic Resonance

POSTER PRESENTATION Open Access

Characterization of the myocardium in the 4-chamber view using accelerated free-breathing diffusion tensor MRI

Choukri Mekkaoui[1*], Timothy G Reese[1], Himanshu Bhat[3], Marcel P Jackowski[2], David E Sosnovik[1]

From 19th Annual SCMR Scientific Sessions
Los Angeles, CA, USA. 27-30 January 2016

Background

Diffusion Tensor MRI (DTI) of the heart *in vivo* has conventionally been performed in the short-axis of the left ventricle (LV) [1]. While this allows all three coronary territories to be seen, the short-axis acquisition orientation has some limitations. Full coverage of the LV in the short-axis requires roughly 12 to 15 slices, and accurate evaluation of the apex of the heart is often compromised. In addition, a nominal slice thickness of 8 mm is routinely used. An accelerated free-breathing DTI acquisition of the heart in its horizontal long-axis (4-chamber view) would require fewer slices (6), reduce acquisition time, and improve the characterization of the anterior and apical walls. A 4-chamber view, previously not performed, may be particularly useful when studying the remodeling of these regions.

Methods

DTI was performed in healthy volunteers (n = 7) on a clinical 3T scanner (Siemens Skyra), with an ECG-gated STE sequence. Acquisition parameters were: FOV = 360 × 200 mm^2, resolution 2.5 × 2.5 mm^2, thickness = 8 mm, in-plane GRAPPA rate 2, TE = 34 ms, b-values = 0 and 500 s/mm^2, 10 diffusion-encoding directions, 8 averages, and 12 contiguous short-axis and 6 contiguous 4-chamber slices. Rate 2 SMS excitation was followed by a blipped-CAIPI readout. A sequential acquisition of diffusion-encoding directions evenly distributes the rejections across all directions ensuring that we can select enough samples of each direction. STR was applied to reduce the misregistration resulting from respiratory motion [2]. Following STR, we utilize a novel entropy-based retrospective image selection method to reject corrupted images and maximize SNR. Mean diffusivity (MD), fractional anisotropy (FA) and helix angle (HA) values were compared between breath-hold and free-breathing.

Results

Accelerated free-breathing DTI acquisition of the heart could be successfully performed in the 4-chamber view. Similar HA maps and tractograms were produced from the short-axis and 4-chamber acquisitions of the LV (Figures 1A-D). There was no statistical difference in HA, MD, or FA values between short-axis and 4-chamber acquisitions of the LV (Figures 1E-G). The 4-chamber view enabled the antero-apex and true apex to be better characterized, and suggested a reduction in the number of circumferential fibers at the true apex, in addition to the two-fold reduction in total scan time.

Conclusions

Accelerated free-breathing DTI of the human heart can be accurately performed in the 4-chamber view. This capability may be valuable in characterizing remodeling in the anterior and apical walls. Imaging the myocardium in the 4-chamber view significantly reduces scan time compared to the conventional short-axis view, which could facilitate the clinical translation of cardiac DTI.

Authors' details
[1]Harvard Medical School - Massachusetts General Hospital, Charlestown, MA, USA. [2]University of São Paulo, São Paulo, Brazil. [3]Siemens, Boston, MA, USA.

Published: 27 January 2016

References

1. Wu, *et al*: *Circulation* 2006.
2. Mekkaoui C, *et al*: *J Cardiovasc Magn Reson* 2012.

[1]Harvard Medical School - Massachusetts General Hospital, Charlestown, MA, USA
Full list of author information is available at the end of the article

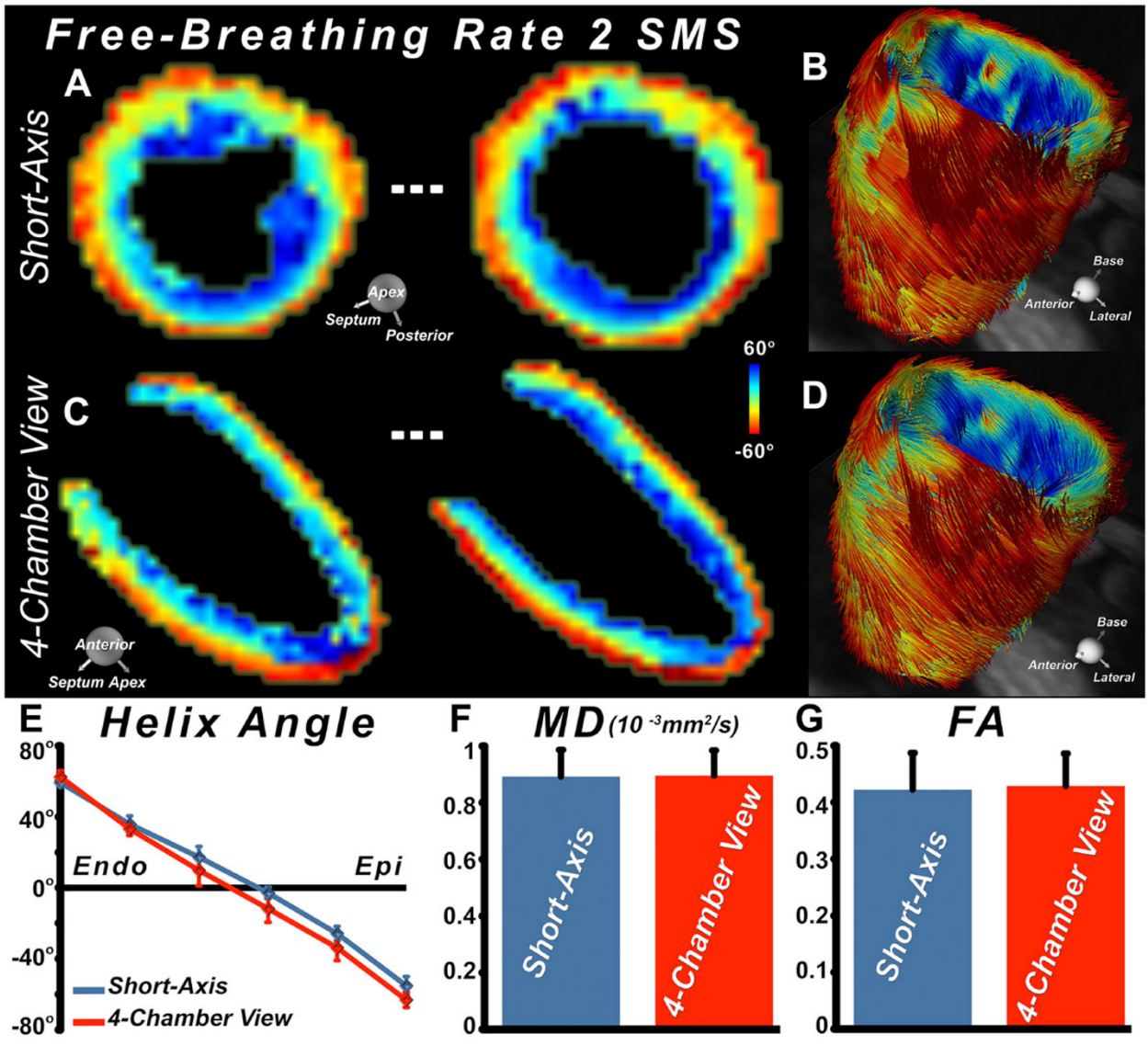

Figure 1 Free-breathing DTI of the heart in the short axis and 4-chamber views. The use of rate 2 SMS resulted in the simultaneous acquisition of two slices, and was equally effective in the short-axis (**A**) and 4-chamber (**B**) views. Consistent tractograms of the entire LV were obtained in either the short-axis (**C**) or 4-chamber views (**D**). (**E-F**) No significant differences were seen in transmural HA, MD, or FA between data acquired in the short-axis or 4-chamber views.

doi:10.1186/1532-429X-18-S1-P13
Cite this article as: Mekkaoui *et al.*: Characterization of the myocardium in the 4-chamber view using accelerated free-breathing diffusion tensor MRI. *Journal of Cardiovascular Magnetic Resonance* 2016 **18**(Suppl 1):P13.