



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

Citation

Mekkaoui, Choukri, Timothy G Reese, Himanshu Bhat, Marcel P Jackowski, and David E Sosnovik. 2016. "Characterization of the myocardium in the 4-chamber view using accelerated free-breathing diffusion tensor MRI." Journal of Cardiovascular Magnetic Resonance 18 (Suppl 1): P13. doi:10.1186/1532-429X-18-S1-P13. http://dx.doi.org/10.1186/1532-429X-18-S1-P13.

Published Version

doi:10.1186/1532-429X-18-S1-P13

Permanent link http://nrs.harvard.edu/urn-3:HUL.InstRepos:29407646

Terms of Use

This article was downloaded from Harvard University's DASH repository, and is made available under the terms and conditions applicable to Other Posted Material, as set forth at http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#LAA

Share Your Story

The Harvard community has made this article openly available. Please share how this access benefits you. <u>Submit a story</u>.

Accessibility



POSTER PRESENTATION



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

Choukri Mekkaoui^{1*}, Timothy G Reese¹, Himanshu Bhat³, Marcel P Jackowski², David E Sosnovik¹

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 mm², resolution 2.5×2.5 mm², thickness = 8 mm, inplane GRAPPA rate 2, TE = 34 ms, b-values = 0 and 500 s/mm², 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 across all directions evenly distributes the rejections across all 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

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

Published: 27 January 2016

References

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

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



© 2016 Mekkaoui et al. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http:// creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/ zero/1.0/) applies to the data made available in this article, unless otherwise stated.

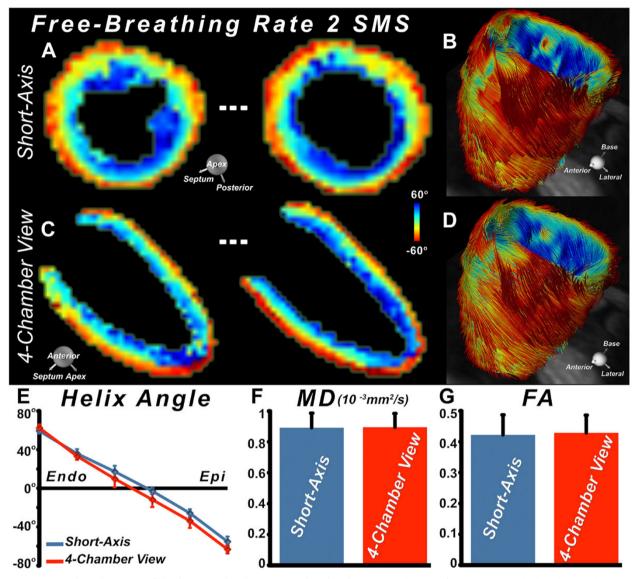


Figure 1 Free-breathing DTI of the heart in the short axis and 4-chamber views. The use of rate 2 SMS resulted in the simultaneous acquisition of two slices, and was equally effective in the short-axis (**A**) and 4-chamber (**B**) views. Consistent tractograms of the entire LV were obtained in either 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.

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

BioMed Central

Submit your manuscript at www.biomedcentral.com/submit