Journal of Cardiovascular Magnetic Resonance

BioMed Central

Meeting abstract

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48 TPAT accelerated myocardial tagging with a 32-channel coil

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from 11[th] Annual SCMR Scientific Sessions
Los Angeles, CA, USA. 1–3 February 2008

Published: 22 October 2008

Journal of Cardiovascular Magnetic Resonance 2008, **10**(Suppl 1):A49 doi:10.1186/1532-429X-10-S1-A49

This abstract is available from: http://jcmr-online.com/content/10/S1/A49

Introduction

Myocardial tagging is an established method for evaluating regional function, however current tagging sequences suffer from poor temporal resolution, and sparse distribution of tags across the myocardium. This is a particular problem for analysis of RV function as the normal wall thickness is much less than the typical distance between tags. Parallel imaging techniques can be used to accelerate tagged acquisitions, however high acceleration factors may result in significant artifacts. Temporal parallel acquisition techniques (TPAT) derive coil reference data by using adjacent time frames of an interleaved k-space acquisition scheme, thereby reducing acquisition times. Images are reconstructed using a TSENSE or TGRAPPA algorithm. Additionally, using a coil with multiple independent receiver channels may allow higher acceleration factors with fewer artifacts compared.

Purpose

To evaluate the performance of various levels of TPAT accelerated tagged imaging using a 32-channel coil with respect to achievable spatial resolution and tag spacing, in comparison to usual clinical imaging parameters and coils.

Methods

Cine imaging with myocardial grid tagging was performed on seven volunteers using a 32-receiver channel 1.5 T system (Avanto, Siemens Medical Solutions). A TPAT accelerated TurboFLASH sequence with an average TR = 40 ms and TE = 4 ms was used. Images obtained using a standard body matrix phased array coil with 4 independent channels placed anteriorly, and 4 channels from a spine array placed posteriorly were compared with those obtained using an experimental 32-channel phased array coil (In-Vivo) with 16 anterior and 16 posterior elements. Subjects were imaged with tag spacing ranging from 8 to 4 mm using the standard and 32-channel coils, with a TPAT factor of 2 for the standard coils, and TPAT2 and 4 for the 32-channel coil, all with acquisition matrix 256*134. For 3 of the subjects, the acquisition matrix was increased during 32-channel TPAT factor 4 imaging while maintaining a fixed TR and breathhold <15 secs.

Images were analyzed by two independent reviewers using a semi-quantitative visual assessment of myocardial tag quality on a four-point scale (4 – preserved tags, excellent resolution of adjacent tags 1 – tags lost, poor resolution of adjacent tags). Images were evaluated at both end diastole (ED) and end systole (ES).

Results

Images obtained using both the standard and 32-channel coils at TPAT2 had fair to good quality and tag resolution at larger tag spacing (Average score at 8 mm: ED = 3.5 ES = 2.6 standard vs. ED = 3.5 ES = 2.8 32-channel) but there was a perceived improvement in tag clarity using the 32-channel coil and TPAT2 at 4 mm tag spacing (Average score: ED = 2.3 ES = 1.6 standard vs. ED = 2.9 ES = 1.9 32-channel). Tags were poorly resolved using the 32-channel coil with an acceleration factor of 4 at 256*134 matrix secondary to significant parallel imaging artifact (Average score ED = 2.5 ES = 1.7 at 8 mm, and ED = 2 ES = 1.2 at 4 mm). A 320*168 matrix with the same TR and TPAT4 resulted in markedly improved visualization at smaller tag spacing, while maintaining a breathhold < 15 secs (Average score of ED = 3.1 ES = 2.4 32 channel high-resolution vs. ED = 2.3 ES = 1.6 standard coil and matrix TPAT2).

Conclusion

Use of a 32-channel coil results in improved tagged image quality compared to standard coils for smaller tag spacing, when using typical spatial resolution and parallel imaging acceleration factors. Images acquired with a TPAT acceleration factor of 4, when acquired using the 32-channel coil, allowed increased spatial resolution, while maintaining acceptable breath hold length. This resulted in a further improvement in tag resolution at a decreased tag spacing of 4 mm. This four-fold improvement in tag density over standard techniques may prove useful for analysis of RV regional function evaluation of non-transmural abnormalities in the LV myocardium.