The American Heart Association Council on Cardiovascular Radiology and Intervention (CVRI) has once again sponsored the North American Society of Cardiovascular Imaging (NASCI)-AHA Young Investigator Awards. These awards are open to all residents, post-doctoral students, medical students and fellows who present at NASCI’s Annual Meeting. This year, at the Annual Meeting in New Orleans, Louisiana from September 20–23, 2014, the following finalists presented their research. The abstracts of this research are below.

Presenter: Akos Varga-Szemes MD, PhD
Abstract Category: MR Cardiac

Comparison of synthetic and conventional inversion recovery images for the evaluation of myocardial late gadolinium enhancement

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Scientific presentations and scientific posters

Inversion recovery (IR) late gadolinium enhancement (LGE) cardiac magnetic resonance (CMR) is generally used for post-contrast evaluation of the myocardium. Novel technological advancements allow for generation of synthetic magnitude and phase contrast IR (MagIR, PSIR) images based on the pixel-by-pixel T1 values. Theoretically, synthetic IR images can be retrospectively generated at any inversion time (TI). In this study we aimed to evaluate the diagnostic value of synthetic IR images for the detection and quantification of myocardial LGE.

Methods

Consecutive patients (n = 24) underwent CMR using a 1.5 T Siemens Avanto scanner. Conventional post-contrast LGE and fast T1-mapping (modified look-locker IR, Molli) of the heart were performed. Synthetic MagIR and PSIR images were generated with 25 ms increments from a TI of 200 to 1,200 ms. In patients with myocardial infarction, localization of the infarct was determined and LGE was quantified using a binary thresholding method. The accuracy of infarct quantification was compared between the conventional and synthetic techniques.

Results

LGE pattern consistent with myocardial infarct was observed in seven (29.1 %) patients. The enhanced myocardial volume measured by conventional MagIR, PSIR, synthetic MagIR, and PSIR were 21.2 ± 7.1, 20.9 ± 8.9, 21.8 ± 6.6, and 21.1 ± 7.6 ml, respectively, and showed excellent agreement. Other than the lung signal, the image quality was visually equivalent between the conventional and synthetic techniques.

Conclusion

In this pilot study we have shown the feasibility of LGE detection and quantification using synthetic IR images. Synthetic images provide the same accuracy as the conventional IR images used in the clinical standard of care. In addition, synthetic methods allow for the retrospective selection of the most appropriate TI to maximize the contrast between the unenhanced and enhanced myocardium. Fast T1-mapping with complete left ventricular coverage provides high resolution TI characterization of the myocardium with corresponding MagIR and PSIR images without additional scanning time.

Presenter: Akos Varga-Szemes MD, PhD
Abstract Category: MR Cardiac

Initial experiences with fast T1-mapping: pulse sequence schemes, reliability, variability, and reproducibility

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Scientific presentations and scientific posters

T1 mapping provides new diagnostic insights into cardiac disease. Even fast T1-mapping performed by modified look-locker inversion recovery (Molli) sequences may require long breath holds that are demanding for the majority of cardiac patients. In this project we aimed to test the reliability, variability, and reproducibility of T1 values acquired by different shortened Molli acquisition schemes.
Methods In consecutive patients (n = 27) referred for cardiac magnetic resonance (CMR) a pre-contrast fast T1-mapping protocol (TE/TR 1.1/2.2 ms, slice thickness 8 mm, flip angle 35°) was performed using a Mollli sequence (Siemens, Erlangen, Germany). Three pulse sequence schemes were set up with an acquisition length of 11 (S1), 10 (S2), or 9 (S3) heartbeats. Non-linear motion correction was performed before curve fitting, and a goodness of fit map was generated for quality assurance. Pixel-by-pixel T1 values were calculated and measured in the myocardium. The reliability of the T1 measurements was compared to the literature. The relative variability was expressed by the coefficient of variation. Reproducibility was compared between repeated measurements.

Results The average T1 values of the normal myocardium obtained by S1, S2, and S3 acquisition schemes were 1.024 ± 48, 1.031 ± 51, and 1.037 ± 58 ms, respectively. The T1 values measured in our study showed good correlation among the protocols, and with the literature reference values. The relative variability of the T1 values was between 4.0 and 5.6 %. Higher image noise was typically observed in subjects with increased heart rate. No significant difference was found between repeated T1 measurements using any of the acquisition schemes, indicating high reproducibility.

Is there incremental value of evaluating left ventricular dyssynchrony by gated SPECT in patients with systolic heart failure and pre-existing abnormal sympathetic function by cardiac MIBG? A pilot study

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Scientific presentations and scientific posters To examine the clinical characteristics and incremental prognostic value for major adverse cardiac events of left ventricular mechanical dyssynchrony(LVMD) in systolic heart failure (SHF) patients with or without abnormal cardiac metaiodobenzylguanidine (MIBG) uptake heart/mediastinum (H/M) ratio <1.6.

Methods Out of 30 SHF patients who participated from our institution in the ADMIRE-HF trial studying MIBG based myocardial cardiac adrenergic nerve activity(MCAN), we included 22 patients with abnormal MIBG H/M ratio of <1.6. We performed gated SPECT LVMD analysis on these patients using the Emory Cardiac Toolbox. The 2 SPECT variables for LVMD assessed were histogram bandwidth and phase standard deviation both of which assess the extent of dispersion of LV activation during contraction as a marker of LVMD. Patients were followed up for a mean period of 6 years. The primary end point was mortality from any cause and secondary end point was heart failure admission or myocardial infarction or ICD shock.

Results 2 Groups were defined: (Group A; n = 17 with H/M MIBG ratio <1.6 and—LVMD and Group B, n = 5 H/M MIBG ratio <1.6 and—LVMD. Baseline characteristics, cardiac risk factors and medications were comparable between both groups. LVEF was lower and RBBB was less common in Group A. There was no statistical difference in achievement of primary or secondary end points in the two groups including death heart failure readmissions, ICD shocks or MI.

Conclusion In our pilot study we did not find definitive value of adding SPECT based LVMD to abnormal cardiac MIBG imaging in SHF patients with regards to predicting outcomes. Although our sample size is too small to make any definitive conclusions it is possible that LVMD works independently through different pathways in the progression of SHF and hence may not necessarily add incremental value to MCAN determination using MIBG.