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Comparison of scar signal quantification using phase corrected and conventional magnitude inversion recovery delayed enhancement imaging in patients with ischemic and non-ischemic cardiomyopathy

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Background

Myocardial scar volume quantification has been shown to predict response to medical, surgical, and device therapy. Phase sensitive inversion recovery (PSIR)-based Late Gadolinium Enhancement (LGE) image reconstruction is clinically attractive for its reduced dependence on accurate prescription of the Time from Inversion (TI time), and is becoming a preferred approach for many centers. However, while an efficient approach for the visual interpretation of myocardial injury, the influence of this approach on signal-threshold based scar volume quantification has been poorly explored.

Methods

A total of 80 patients with obvious myocardial scar by LGE imaging (40 ischemic, 40 non-ischemic) underwent blinded evaluations of total scar volume (%LV mass) using matched MIR and PSIR short axis images. Analysis was performed using the Signal Threshold Versus Reference Myocardium (STRM) technique at ≥2, ≥3, and ≥5 SD thresholds. In those with ischemic scar the Full Width at Half Maximum (FWHM) approach was incrementally evaluated. Linear regression and Bland-Altman analyses comparing MIR verses PSIR-based scar quantification was performed.

Results

Linear regression analysis demonstrated an excellent correlation between PSIR and MIR-based STRM scar volumes at all 3 STRM-based thresholds for both ischemic scar (r=0.96, 0.95, and 0.88, respectively) and non-ischemic scar (r=0.86, 0.89, 0.90, respectively). FWHM analysis showed good correlation in ischemic scar (r=0.83). Bland-Altman analysis of STRM analysis showed a systematic bias with lower scar volumes produced by PSIR reconstruction images for both ischemic and non-ischemic scar. These differences were modest using STRM for ischemic scar (-3.3, -4.0 and -4.9%,

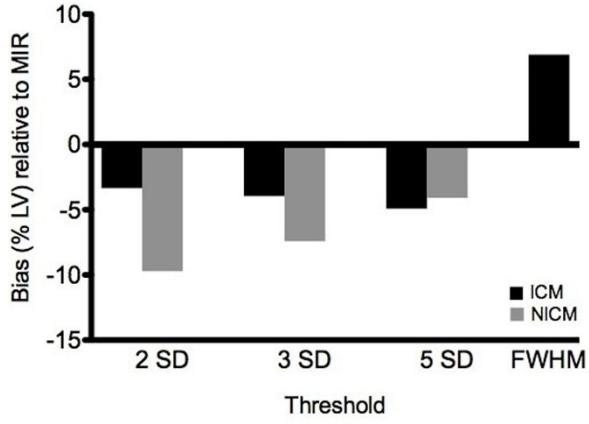

Figure 1 Average bias (&LV) when the PSIR technique is employed (relative to MIR) for patients with ICM (black), and NICM (gray).

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respectively), but greater for non-ischemic scar (-9.7%, -7.4% and -4.1%, respectively). Conversely, ischemic scar analyzed using the FWHM approach on PSIR images produced higher scar volumes than MIR (+6.89%).

Conclusions

Scar volume measures obtained from PSIR-based LGE images correlate well with MIR-based images. However, a systematic bias exists resulting in reduced volumes being reported for PSIR-based images for STRM analysis, and increased volumes using FWHM analysis. This has important implications for the performance of multi-center clinical trials adopting both PSIR and MIR-based LGE techniques, and raises a potential need to define technique-based scar volume thresholds for prediction of cardiovascular events.

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