Use of CMR and Echocardiography After CRT to Assess CRT Response by Bundle Branch Morphology

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Background

- Although echocardiography is readily accessible, assessment of functional improvement with echocardiography after cardiac resynchronization therapy (CRT) may be limited by suboptimal windows and endocardial definition.
- As most CRT devices are now MR-conditional, post-CRT cardiac magnetic resonance (CMR) is a safe way to assess right ventricular and left ventricular structure and function after CRT.
- This study sought to compare CMR and echocardiography for assessment of CRT response by bundle branch block morphology.

Methods

- Patients with chronic systolic HF, LVEF ≤ 35% and with a class I or IIA indication underwent CRT implantation
- Patients underwent echocardiography and CMR before CRT and 6 months after CRT with gradient echo or steady-state free precession (SSFP) cine imaging. Example is shown in Figure 1.
- SuiteHeartTM (NeoSoft) and EchoPACTM (GE) software, respectively, were used to analyze volumetric data from CMR and echocardiography.

Results

- In 40 patients, the median LVEF was 24% (IQR 20 to 32%) before CRT and 28% (IQR 19.5 to 33%) post CRT.
- The proportion with at least a 5% LVEF improvement with LBBB or paced rhythm was 50% by MRI and 58.3% by echocardiography, and 33% v. 25% for RBBB (Figure 2).
- After exclusion of 6 patients in whom echocardiographic windows precluded LVEF assessment, moderate correlations were observed for the pre-CRT LVEF between MRI and 2D echocardiography before CRT (r=0.39, p=0.036) and the post-CRT LVEF (r=0.39, p=0.042). The corresponding Bland Altman plots are show in Figure 3.

Table 1. Demographic and Clinical Characteristics, n = 40

Age (years), mean ± SD	68.2 ± 10.0
Gender female, no. (%)	21 (53%)
Ischemic Cardiomyopathy, no. (%)	19 (48%)
Diabetes Mellitus, no. (%)	13 (33%)
Hypertension, no. (%)	16 (40%)
PR Interval (ms), mean ± SD	170 ± 29
QRS Duration (ms), mean ± SD	153 ± 18
Bundle Branch Block Morphology	
LBBB, no. (%)	28 (70%)
RBBB, no. (%)	7 (18%)
Paced, no. (%)	5 (2%)
LVEDVI (mL/m^2), mean ± SD	112.6 ± 37
LVESVI (mL/m^2) , mean ± SD	84.8 ± 35
LVEF (%), median (IQR)	28 (21-32)

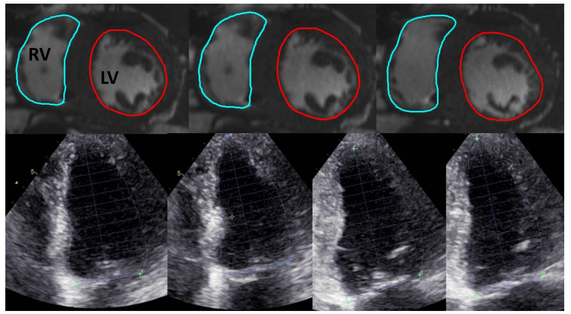

Figure 1. Example images of LV volumetric analysis with CMR (top panel) and echocardiography (bottom panel).

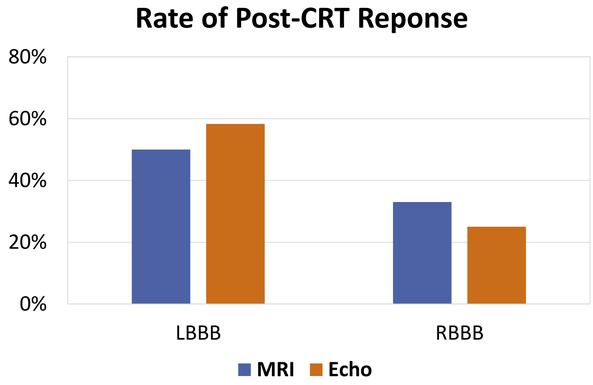

Figure 2. Proportion of patients with at least a 5% improvement in LVEF.

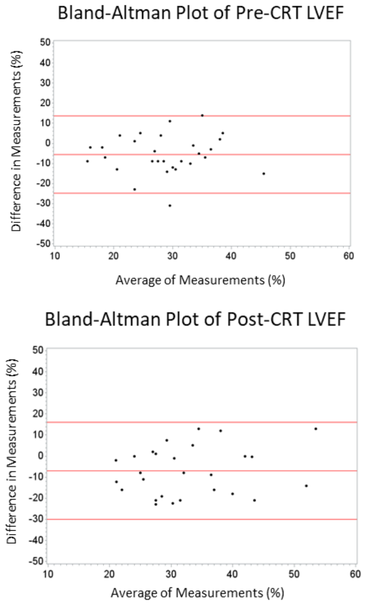

Figure 3. Correlation between CMR and echo assessments of LVEF.

Conclusions

- CMR post-CRT is a feasible alternative to echocardiography and provides better myocardial definition and visualization of additional myocardial characteristics.
- Based on pre and post CMR analysis, more patients with LBBB or paced rhythm had a positive CRT response

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