Acute beneficial hemodynamic effects of a novel 3D-echocardiographic optimization protocol in cardiac resynchronization therapy.

Post-implantation therapies to optimize cardiac resynchronization therapy (CRT) focus on adjustments of the atrio-ventricular (AV) delay and ventricular-to-ventricular (VV) interval. However, there is little consensus on how to achieve best resynchronization with these parameters. The aim of this study was to examine a novel combination of doppler echocardiography (DE) and three-dimensional echocardiography (3DE) for individualized optimization of device based AV delays and VV intervals compared to empiric programming. 25 recipients of CRT (male: 56%, mean age: 67 years) were included in this study. Ejection fraction (EF), the primary outcome parameter, and left ventricular (LV) dimensions were evaluated by 3DE before CRT (baseline), after AV delay optimization while pacing the ventricles simultaneously (empiric VV interval programming) and after individualized VV interval optimization. For AV delay optimization aortic velocity time integral (AoVTI) was examined in eight different AV delays, and the AV delay with the highest AoVTI was programmed. For individualized VV interval optimization 3DE full-volume datasets of the left ventricle were obtained and analyzed to derive a systolic dyssynchrony index (SDI), calculated from the dispersion of time to minimal regional volume for all 16 LV segments.
Consecutively, SDI was evaluated in six different VV intervals (including LV or right ventricular preactivation), and the VV interval with the lowest SDI was programmed (individualized optimization). EF increased from baseline 23±7% to 30±8 (p<0.001) after AV delay optimization and to 32±8% (p<0.05) after individualized optimization with an associated decrease of end-systolic volume from a baseline of 138±60 ml to 115±42 ml (p<0.001). Moreover, individualized optimization significantly reduced SDI from a baseline of 14.3±5.5% to 6.1±2.6% (p<0.001). Compared with empiric programming of biventricular pacemakers, individualized echocardiographic optimization with the integration of 3-dimensional indices into the optimization protocol acutely improved LV systolic function and decreased ESV and can be used to select the optimal AV delay and VV interval in CRT.

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