Optimized CRT stimulation based on high frequency QRS analysis

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Introduction: The high proportion of CRT non-responders leads to the need to search for new ways to better optimize device setup. This work presents the use of ultra-high frequency ECG (UHFECG) to possibly optimize CRT stimulation.

Methods: 34 subjects (24 men and 10 women, age 65.0±10.1) undergoing CRT implantation with a device made from Boston Scientific with the possibility to automatically optimize atrioventricular (AVD) and intraventricular (VVD) delay (SMART algorithm). The patients were evaluated over 48 visits (33 visits were the next day after implantation and 15 visits were at the six-month follow up). The intraventricular delay (IVD) from echocardiography, electrical dyssynchrony (DYS) and a subjective assessment of a potential map using a 1-5 schooling scale (SUBscore) from UHFECG were analyzed for three different CRT configurations - OFF (off stimulation), SMART (SMART algorithm) and OPT (optimal assessment subjectively determined by the potential map from UHFECG).

Results: Mean±STD values over visits for IVD [ms] were 50.32±29.00,29.09±29.33 and 25.17±24.54 for OFF, SMART and OPT respectively. For DYS [ms], it was 69.18±30.85, 31.18±24.42 and 13.42±18.67 for OFF, SMART and OPT respectively. Significant statistical differences ($p<0.01$) exist between OFF and SMART or OPT for both IVD and DYS parameters. Between SMART and OPT, significant differences ($p<0.01$) exist for DYS only. The IVD is smaller for OPT (-4.12±20.61), but not statistically significant. The difference between IVD values in groups subdivided by SUBscore and DYS was statistically significant (except for 1 versus 2 and 3 versus 4 for SUBscore and except for 1 versus 2 for DYS).

Conclusion: The UHFECG analysis may be used to optimize CRT stimulation and to minimize electrical dyssynchrony. In addition, there is a trend to improve mechanical dyssynchrony against optimization implemented by the device's algorithm.