Non Invasive Hemodynamic Optimization Of Cardiac Resynchronization Therapy With Multipoint Left Ventricular Pacing. A Multi-Center Pilot Experience


Dipartimento di Scienze Cardiovascolari, Università Campus Bio-Medico, Rome, Italy. Università Tor Vergata, Rome, Italy. Ospedale Fatebenefratelli, San Giovanni Calibita, Italy.

Abstract

Introduction: multipoint left ventricular pacing (MPP) using a quadrupolar catheter in a single coronary vein allows delivery of two sequential stimuli from different dipoles. This new technology has shown to improve cardiac contractility in the acute setting and increase the response if compared with conventional cardiac resynchronization therapy (CRT). The varied number of configurations of MPP can lead to doubts in choosing the best sequence and intervals between stimuli according to different patient’s characteristics. The QRS width and morphology are the most used parameters for CRT optimization. QRS reduction is correlated with CRT clinical outcome, but is not proved to be a good tool to optimize the different MPP configurations. This study evaluates the optimization of MPP inter and intra ventricular (RV-LV and LV1-LV2) delays using a non-invasive measure of hemodynamic parameters (Indexed Stroke Volume - SVI, Cardiac Output - CO and Cardiac Index - CI) and compare it with the ECG.

Methods: 48 patients were included. If multisite pacing was feasible, measurement of CO, CI and SVI were performed at first follow-up in different configurations: spontaneous rhythm, conventional biventricular pacing (BiV) and 12 different MSP configuration using both the most and the least delayed LV dipole automatically calculated (varying intervals and sequence of stimulation, RV-LV1-LV2 and vice versa). A 12-lead ECG for QRS width analysis was collected for any configuration.

Results: Among 48 patients (pts) implanted with MPP, 44 were eligible for the study (age 71.1 ± 8.5 years, 72.9% male, EF 28.4 ± 7.1%, QRS 163 ± 23 ms). Three were not eligible because of no MPP configuration available (high LV thresholds or phrenic nerve stimulation) and one not analyzed for incomplete data. In the study group LBBB was present in 34/44 pts. Hemodynamic parameters in spontaneous rhythm were: CI 2.6 ± 0.6 L/min/Kg/m2, CO 4.7 ± 1.3 L/min and SVI 40.4 ± 22.0 ml/Kg/m2. The best MPP configuration was chosen according to CI values. The best MPP, the mean of 12 configuration MPP (Mean MPP), biventricular pacing (BiV) and the configuration with shortest QRS (Best QRS) all determined a significative increase of CI with respect to spontaneous rhythm (p<0.0001; p=0.004; p=0.004; p=0.021 respectively). No differences between BiV and Best QRS were found (p=0.53). In 18/44 patients (40.1%) all the 12 MPP configurations were superior to BiV in terms of CI. In only one patient (2.2%) Best MPP was also Best QRS. There were neither differences in terms of CI, CO and SVI between patients with ischemic vs non ischemic cardiomyopathy (CI p=0.337; CO p=0.410; SVI p=0.475), nor between patients with LBBB vs non-LBBB (CI p=0.249; CO p=0.387; SVI p=0.695). Best configuration in terms of CI by pacing first from right ventricle or from one of the LV was not associated with presence of LBBB or non-LBBB (p=0.472).

Conclusions: Different MPP configurations carry variations in non-invasive hemodynamic parameters, seemingly not correlated with QRS reduction. Measurement of hemodynamic with a non-invasive tool is a valuable method to optimize MPP devices. Larger randomized trials and long-term follow-up will help to clarify the clinical impact of hemodynamic guided MPP optimization.