Hemodynamic Consequences of A V Delay Programming in Cardiac Resynchronization Therapy

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Mechanical left heart AV normalization is an important aspect for the success of cardiac resynchronization therapy (CRT). A normal right heart AV may cause a non-physiological left heart AV interval due to P wave sense offset (PSO) and interatrial electromechanical delay (IAEMD), leading to pacemaker syndrome. A short left heart AV, for example, may affect left atrial transport due to truncation of atrial flow, and thus diminish or abolish the clinical benefits of CRT. It was previously shown that the normal mechanical left AV is 85 +/- 15 ms, that the IAEMD (the interval between the right heart P wave and the onset of the A wave of mitral flow) can be predicted from the P wave duration. In addition, and PSO can be easily calculated as the difference between the measured AV (from surface ECG) and programmed AV. Therefore, a computer simulation software was developed to demonstrate the hemodynamic consequences of AV programming in CRT devices based on the following equation: AV = 85 + IAEMD – PSO – VV delay, which normalizes left AV by compensating for above delays. The computer model was designed using actual Doppler findings from a total of 110 patients with and without pacemakers, and demonstrates the interaction between left atrial and left ventricular Doppler flows and pressures as the AV delay is changed. Inputs for the software are the value of IAEMD (predicted from P width), pacing mode (atrial sensing or atrial pacing), the measured value of PSO, and the programmed value of VV delay. The software simulates the time relationship between left atrial and left ventricular pressures and between atrial flow and the onset of mitral regurgitation, thus revealing AV delay conditions that may lead to pacemaker syndrome.

Conclusion: Computer simulation demonstrates that the use of above equation preserves a mechanical left AV within a normal range for pacing mode changes and different values of IAEMD and rate. A normalized left AV may reduce the risk of pacemaker syndrome.

Automatic Border Detection Pattern of Left Ventricle for Biventricular Pacing

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Aim: to assess if the pattern of left ventricle (LV) volume curves variation using automatic border detection (ABD) can help in differentiation of desynchronized contraction.

Methods: patients (pts) with dilated cardiomyopathy were included (n=41; 58±16.2 years). Currently accepted TDI and TM parameters were used to identify LV desynchronization. On-line continuous LV volumes changing were recorded using ABD. Ejiction time (ET) was measured from LV wave amplitude (ET ABD=ET/RR interval). The time relationship between LV and RV systolic contraction was also assessed using ABD. LV desynchronization was found in 31 pts (23 pts QRSd>120ms, 8 pts QRSd<120ms). In these pts ET ABD was 232±42ms significantly smaller vs without asynchrony (323±27 ms, p<0.001); difference in ET ABD was: 27.8% vs 39.5±4%, p=0.001; 12 pts undergone biventricular pacing and presented significant improvement in LV ABD (26±4% vs 31±5%, p=0.001) and LV volume contraction pattern.

Conclusion: ABD can help in differentiation of ventricular asynchrony and may be used in the follow-up of multisite pacing.

Cardiac Resynchronization: Feasibility of a Simplified Procedure

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Multisite pacing procedures are X-ray and time consuming and difficult. Our aim was to determine whether a simple procedure is effective, safe and faster. A coronary sinus (CS) angiography is performed prior to implantation. Even with thin or twisted target vein, we tried to catheterize directly CS and target veins using different styles and curves. The lead choice (OTW or standard) was discussed before each procedure. In case of failure, the standard procedure (sheath ± angioplasty guide wire) was tried.

Results: 27 pts were evaluated from 05-04 to 12-04. The target vein size was the right 7 pts, medium with 11 pts and large with 9 pts. An OTW lead was chosen for 8 pts. 2 pts failed to be implanted with both techniques and 2 pts were implanted using the standard procedure. The direct SC lead positioning was successful in 25/27. LV threshold: 1.23±0.8V, LV wave amplitude: 15.2±7mV, LV impedance: 820±330Ohms, and procedure time: 70±30min. 3 early lead dislodgments had required a repositioning.

Conclusion: In a majority of cases (85%), this simplified procedure is safe and faster than standard procedures even when the target vein seems to be small.

Left Ventricular Functional Deterioration and Worsening in NYHA Class After Right Ventricular Pacing Is Improved by Upgrading to Biventricular Stimulation in Patients with Different Degrees of Baseline Dysfunction

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Worsening in NYHA Class and left ventricular (LV) systolic function is reported in right ventricular (RV) paced patients (pts); improvement in LV function can be expected after LV lead placement. Aim of this study was to assess in pts with LV dysfunction whether RV pacing affects clinical/functional parameters and the role of LV lead placement. 18/100 pts referred for CRT underwent upgradiong to biventricular stimulation: 14 DDD, 4 VVI, 2-180 months before upgrading. Before conventional PM pts were in NYHA Class 2.5 ± 0.8; LV ejection fraction (EF) was 30.5 ± 10.4 (19 - 46%). CRT was performed for worsening heart failure. Before CRT pts were in NYHA Class 3.2 ± 0.5, LVEF 24±5.2% (p=0.05 vs before RV implantation). At 3-18 months follow-up, NYHA class increased to 2.1 ± 0.3 with an increase in LVEF to 29 ± 4% (p<0.05 vs pre-upgrading).

In pts with baseline LV dysfunction, RV pacing worsens NYHA Class and LVEF. Upgrading to CRT improves clinical and function. CRT should be a first choice treatment in pts with LV dysfunction who need RV pacing for clinical reasons.

Polysomnography and Heart Failure: Central Sleep Apnoea and Biventricular Pacing

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Background: There are 2 types of nocturnal respiratory disorders: the obstructive sleep apnoea (OSA) and the central sleep apnoea (CSA). Correlation of CSA with severity of cardiac dysfunction and arrhythmias has been hypothesized. Aim: Evaluate the prevalence of OSA/CSA in heart failure patients, the effect of cardiac resynchronization therapy (CRT) on OSA/CSA and the predictive value of positive response to CRT.

Methods: We submitted 10 pts, mean age 70y±6.1; EF 42±7% with heart failure (NYHA class III IV, EF<40%, QRS duration >130 ms) for polysomnography before CRT. After CRT we repeated the exam in 5.

Results: We documented a prevalence of light sleep and a moderate or severe fragmentation of sleep. 6 showed an abnormal index of apnoea-hypopnoea (AHI) and number of AHI per sleep/hour: 4 had light AHI, 1 moderate AHI and 1 severe AHI. Most frequent event recorded was CSA; 2 of the 4 pts with normal AHI had OSA/CSA. In the 5 pts controlled after CTR we found improvement in sleep quality.

Conclusions: Polysomnography found high prevalence of sleep disorders in our patients with heart failure. Our data suggest that CRT can improve sleep quality.