

1111-209 A Novel Method to Assess Ventricular Contraction Dyssynchrony by Tissue Synchrony Index

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Background: Biventricular pacing (CRT) has been shown to improve symptoms and exercise capacity in patients with heart failure and a wide QRS complex. Criteria for patient selection and lead positioning are essential for achieving clinical benefit.

Methods and Results: Twenty-eight patients (20 males, 66±11 years) with ischemic and nonischemic cardiomyopathy and NYHA class III to IV heart failure and QRS duration >140 ms receiving CRT were assessed before and after pacing. Tissue Doppler echocardiography was performed using a 4-basal, 4-mid segmental model (4-and 2-chamber) to assess the time to peak systolic velocity (TS), and the time to peak myocardial displacement (TPMD).

The septal posterior wall delay (SPWD) was measured by M-mode at the base in the parasternal long axis view. Tissue synchrony index (TSI) was used to show the ventricular segmental contraction delay. Patients with LBBB exhibited 3 different patterns of delay by TSI including delay involving the apical septal (n=5), the basal and mid inferior (n=4) and the basal lateral wall (n=16). Patients with RBBB demonstrated delay involving the septum (n=3). The standard deviation of time to TS and TPMD between segments was used as an index of synchronization. There was significant improvement of TSI after pacing.

	TS(msec)	TPMD (msec)	SPWD (msec)
Sinus	44±16	74±25	141±103
Pacing	35±16	47±29	48±50
p	0.03	0.0007	0.001

Conclusions: TSI is a new index, which provides rapid visualization of ventricular contraction dyssynchrony, providing a potentially useful method for selection of patients and for implant pacing lead localization.

1111-210 The Predictive Value of QRS Duration as a Marker of Ventricular Dyssynchrony

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Background: Cardiac resynchronisation therapy (CRT) is becoming widely used in the management of advanced cardiac failure due to systolic dysfunction and ventricular dyssynchrony. QRS prolongation is used as a surrogate marker of dyssynchrony, but not all patients with QRS prolongation benefit from CRT. A reason may be that QRS prolongation and ventricular dyssynchrony are not closely related.

Aim: To correlate QRS prolongation with an echocardiographic indicator of ventricular dyssynchrony –aortic pre-ejection delay (APED).

Methods: 153 patients with symptomatic heart failure and left ventricular systolic dysfunction were retrospectively analysed. Adequate data was collected from 118 patients. QRS duration was measured automatically (MAC 1200 - Marquette). APED, measured as time from the onset of QRS to the onset of aortic forward flow using pulsed wave Doppler above the level of the aortic valve (Echopac 6.2 GE Vingmed), the mean value from 3 beats being recorded. Poor quality ECG recording with the doppler signal accounted for the majority of inadequate data, and excluded patients.

Results: Baseline characteristics: Age 73.1(SD 7.3), NYHA class II(73), III(37), IV (8), mean ejection fraction 29.4% (SD 9.5), 35% of all subjects had a QRS duration > 120ms. The correlation between the QRS duration and the APED was only moderate (Pearson correlation 0.47, p=0.001). The correlation was higher in patients with QRS>120 (R=0.67, p=0.001) and lower in patients with a QRS <=120ms (R=0.08, p=n/s)

Conclusion: QRS duration and APED have only a modest association. The correlation is stronger in those with significant QRS prolongation. There is a poor correlation below a QRS duration of 120ms. This suggests that using QRS prolongation as a sole indicator of dyssynchrony may exclude a number of heart failure patients with a demonstrable marker of echocardiographic dyssynchrony. The data does not however indicate if such patients would respond to CRT

1111-211 Narrowing of the Widest QRS Predicts Improvement in Functional Class and Echocardiographic Parameters in Patients With Cardiac Resynchronization Therapy Devices

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Few parameters have been shown to predict improvement in patients treated for congestive heart failure (CHF) with cardiac resynchronization therapy (CRT). To assess whether narrowing of the QRS duration after CRT device implantation predicts improvement in clinical and echocardiographic parameters we collected these data for 145 consecutive patients treated with CRT at the Cleveland Clinic Foundation between 09/01/1998 and 02/01/2002 (age 66±13 years, 68% male, 63% ischemic cardiomyopathy). All patients had pre and post implantation 12-lead ECG and 2D-echocardiograms. Widest QRS in any lead before and after CRT was documented. Functional status was assessed during follow-up at the CHF clinic. QRS narrowed significantly with CRT from 187.2±/ 30.7 msec to 179.4 ±/ 24.8 msec (p < 0.007). In patients who experienced QRS narrowing with CRT, NYHA functional class, left ventricular end diastolic dimension (LVEDD), and mitral regurgitation (MR) improved significantly versus patients in whom the widest QRS did not narrow. There was a strong trend towards improvement in the left ventricular end

systolic dimension (LVEDD) and ejection fraction (EF) in those with narrowed QRS. **Conclusion:** Narrowing of the widest QRS complex after CRT device implantation predicts improvement in NYHA functional class, left ventricular end diastolic dimension and mitral regurgitation.

Parameter	Patients with narrowed QRS	Patients without narrowed QRS	P value
NYHA improvement, %	51%	33%	0.04
LVEDD decreased, %	78%	55%	0.004
LVEDS decreased, %	72%	56%	0.06
MR Decreased, %	60%	42%	0.04
EF Improved, %	28%	16%	0.11

1111-212 Left Ventricular Asynchrony Predicts Heart Failure Progression After Cardiac Resynchronization Therapy

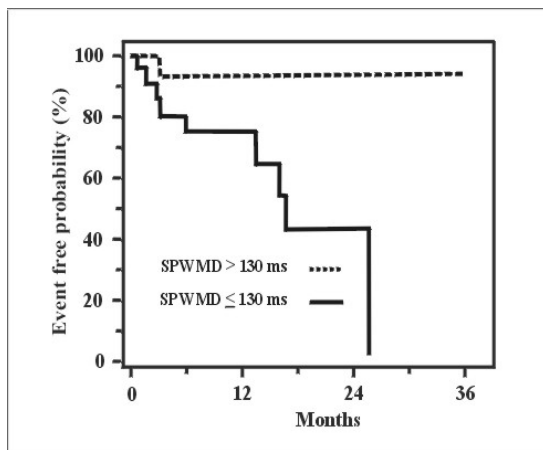
Maria V. Pitzalis, Massimo Iacoviello, Roberta Romito, Pietro Guida, Giovanni Luzzi, Stefania Greco, Cinzia Forleo, Brian Rizzon, Elisabetta De Tommasi, Luigi Di Biase, Paolo Rizzon, Bari, Italy

Echocardiographic evaluation of left ventricular asynchrony (LVA) has been shown to predict hemodynamic improvement after cardiac resynchronization therapy (CRT).

To test the role of LVA in predicting heart failure (HF) progression after CRT, we studied 44 patients (63±11 years, 23 male) with HF (9 with ischemic cardiomyopathy), NYHA class III, left bundle branch block (LBBB), in optimal medical therapy who underwent CRT. Before pacemaker implantation, LVA was evaluated by calculating QRS duration (168±18 ms) at ECG and septal to posterior wall motion delay, SPWMD (157±96 ms), at echocardiography; left ventricular end-diastolic diameter (LVEDD, 67±6 mm), left ventricular ejection fraction (LVEF, 25±6%) and mitral regurgitation (MR, 2.6±0.9 a.u.) were also evaluated.

During follow-up (13±9 months) 9 patients experienced HF progression (1 needed a stable increase of diuretic therapy, 6 were hospitalized and 3 died after worsening of HF). Among studied variables only SPWMD (p=0.02) and ischemic cardiomyopathy (p=0.02) were significantly related to events at univariate analysis. The Figure shows the Kaplan-Meier curves of patients with SPWMD above and below the median value.

In conclusion, in patients with severe HF and LBBB, the absence of a marked LVA at echocardiography is associated to the occurrence of HF progression after CRT, thus strengthening its role in predicting patients who will benefit from biventricular pacing.



1111-223 Left Ventricular Reverse Remodeling Predicted Rehospitalization for Heart Failure After Cardiac Resynchronization Therapy

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Background: Cardiac resynchronization therapy (CRT) has been shown recently to improve heart failure (HF) rehospitalization. It is also benefit the heart by inducing left ventricular (LV) reverse remodeling. This study investigated if responders of reverse remodeling were able to predict a lower rehospitalization event rate.

Methods: 53 patients (aged 65±11 years, 66% male, 58% non-ischemic etiology) received CRT were prospectively studied. Echocardiography and clinical assessment were performed at baseline and 3-month follow up to assess LV reverse remodeling response. Responders were define as a reduction of LV end-systolic volume >15%.

Results: The mean duration of follow up was 753±386 days. Responders of reverse remodeling were observed in 57% of patients, whereas the rest were classified as non-responders (43%). Mortality occurred in 17% of patients, while HF developed in 13% of patients. The responders had a significantly lower rate of developing HF than non-responders (3% Vs 12%, Log Rank Chi²=4.16, p<0.05). There was also a trend towards lower mortality rate for responders than non-responders, though it was not significant (13% Vs 22%). The responders also had a greater improvement of New York Heart Association class (-1.04±0.5 Vs -0.5±0.6, p=0.01) and peak exercise capacity (1.1±1.6 Vs -

0.2±1.2 METs, p<0.05).

Conclusions: Responders of LV reverse remodeling predicts a lower heart failure event rate than non-responders. They were also associated with more symptomatic improvement and a better gain in peak exercise capacity.

1111-224 Improvement of Brain Natriuretic Peptide Levels 48 Hours Following Cardiac Resynchronization Therapy

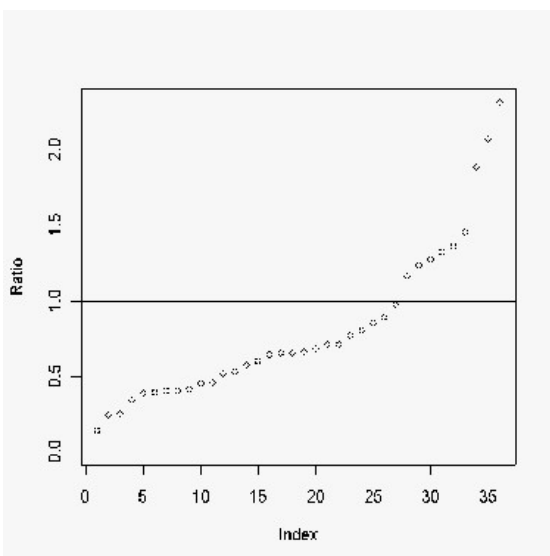
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Background: Brain natriuretic peptide (BNP) levels are a marker of left ventricular dysfunction in heart failure. High BNP levels after optimal medical management of heart failure are an independent predictor of prognosis. Cardiac resynchronization therapy (CRT) or dual ventricular chamber pacing improves quality of life, exercise capacity and cardiac function. A small previous study showed improvement in BNP levels with chronic CRT (15±8 weeks). We investigated the short term effects of CRT on BNP levels.

Methods: 36 patients with a mean EF 23±7% and LBBB (mean QRS 170±25ms) were investigated. BNP levels were checked immediately prior to and 48 hours after CRT. BNP levels were measured using the Triage BNP test/ Biosite Diagnostics, USA.

Results: The paired t-test on the log transformed data indicates that the difference between baseline BNP and 48 hours BNP is statistically significant (p=0.0006). The average change on the log scale is -0.3956 which is 0.673 when converted to a proportion. The 95% confidence interval for the average change is 0.545-0.832. The figure shows the ratios of 48 hours/baseline BNP levels plotted in increasing order of the ratio, for the 36 patients. 75% of the patients had a reduction in BNP.

Conclusions: There is a statistically significant reduction in BNP levels 48 hours following CRT.



1111-225 In the Rapid Pacing Canine Model of Heart Failure, Left Ventricular Stimulation Resynchronizes Better the Left Ventricle Compared to Biventricular or Right Ventricular Stimulation: An Echocardiographic-Hemodynamic Correlation of Systolic and Diastolic Function

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Resynchronization therapy is effective for patients with left ventricle (LV) dysfunction, but the underlying mechanisms are not well understood. We studied acute hemodynamic effects of RV, LV and biventricular (BiV) and established the correlation with LV resynchronization assessed with echocardiography and tissue Doppler. **Methods:** A total of 17 dogs were paced at high rate for a minimum of 4 weeks to create LV dysfunction. Transvenous pacing electrodes were implanted in the right atrium, the right ventricle (RV) and in a lateral branch of the coronary sinus (LV). Aortic, LV and pulmonary pressure were continuously monitored and because dogs have short PR intervals, complete AV node ablation was performed to assess the isolated effect of the different modes of stimulation, with no participation of intrinsic conduction. **Results:** All the animals developed severe heart failure (mean LVEF=28,7%), none with a wide QRS. LV stimulation was associated with better LV hemodynamic parameters than BiV (5-10%) which was superior to RV stimulation (10-20%, p<0.05). Echocardiographic evaluation showed that LV pacing was associated with improved LVEF, less mitral regurgitation (MR) and less LV intraventricular dyssynchrony as assessed with tissue Doppler. Improved systolic performance was associated with improved diastolic performance (negative Lvdpt) and diastolic pattern assessed by echo. **Conclusions:** 1- In a canine model of heart failure, LV stimulation was found to result in better LV systolic and diastolic performance compared to BiV and RV

stimulation. 2- The superior LV performance with LV pacing is associated with improved LVEF, less mitral regurgitation and less intraventricular systolic and diastolic LV dyssynchrony.

1111-226 Frequency and Mechanisms of Inappropriate Implantable Cardioverter Defibrillator Therapy in MADIT II

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Background: Inappropriate implantable defibrillator (ICD) shocks have been reported to be a common adverse event in ICD patients, with serious consequences including impaired quality of life. **Methods:** We classified the rhythm triggering ICD therapy by review of stored electrograms for each episode. Inappropriate therapy was defined as antitachycardia pacing or ICD shock for anything other than ventricular arrhythmia. Inappropriate shocks were further classified as atrial fibrillation (AF), other supraventricular tachycardia (SVT) (including sinus), or abnormal sensing. We examined the baseline clinical characteristics and medications of patients with and without inappropriate shocks. **Results:** Inappropriate shocks occurred in 88 (12.2 %) of the 720 patients who received an ICD in MADIT II. A total of 806 therapies were delivered from the ICD of which 513 (63.6%) were appropriate and 293 (36.4%) were inappropriate. The clinical characteristics of patients receiving inappropriate therapy were not different from those patients not receiving such therapy. **Conclusions:** Despite awareness of the frequency of inappropriate therapy in prior ICD trials, and despite frequent use of detection algorithms, inappropriate ICD therapy was common in the MADIT II trial. The most common mechanism for inappropriate shocks in the MADIT II trial was AF. Clinical characteristics and medications prescribed do not predict which patients experience inappropriate ICD therapy.

Inappropriate Therapy

Type	Frequency
AF	131 (48%)
Other SVT	96 (34 %)
Abnormal Sensing	48 (17 %)

ORAL CONTRIBUTIONS

828

Pulmonary Vein Isolation for Treating Atrial Fibrillation

Monday, March 08, 2004, 4:00 p.m.-5:30 p.m.
Morial Convention Center, Room 254

4:00 p.m.

828-1 Pulmonary Vein Isolation to Prevent Atrial Fibrillation: Long-Term Safety, Efficacy, and Predictors of Outcome

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Background: The long-term safety and efficacy of segmental ostial ablation to isolate the pulmonary veins in patients with atrial fibrillation (AF) have not been well-defined. **Methods and Results:** Pulmonary vein isolation by ostial applications of radiofrequency energy guided by pulmonary vein potentials was performed in 187 consecutive patients (mean age = 52 ± 11 years) with paroxysmal (167) or persistent AF (20). The left superior, left inferior, and right superior pulmonary veins were targeted in all patients, and the right inferior pulmonary vein also was targeted in 73 patients (39%). Successful isolation was achieved in 96% of targeted pulmonary veins. A repeat ablation procedure was performed in 11% of the patients. At 2 years of follow up, 70% of patients with paroxysmal AF and 25% of patients with persistent AF were free of recurrent episodes of AF, in the absence of antiarrhythmic drug therapy (p<0.001). Among patients with paroxysmal AF, vagotonic AF was the only independent predictor of recurrent AF. Complications consisted of pericardial tamponade (0.5%), left atrial flutter (0.5%), transient ischemic attack (0.5%), and unilateral quadrantanopsia (0.5%). No patient had symptomatic pulmonary vein stenosis. **Conclusions:** The long-term efficacy of pulmonary vein isolation is 70% in patients with paroxysmal AF, and the risk of complications is low. Alternative ablation strategies should be considered to improve long-term efficacy, particularly in patients with persistent or vagotonic AF.