ORAL PRESENTATIONS

Resynchronisation in heart failure

6 December 2003, 8:30 to 10:00
Location: Room 4

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Mechanical synchrony is improved by cardiac resynchronisation therapy in heart failure patients with normal QRS duration.

D. Vinereanu1, M. Turner1, R. Bleasdale1, C. Mumford1, M. Cinteza2, M. Frenneaux1, A.G. Fraser1. 1Wales Heart Research Institute, Cardiff, United Kingdom; 2University Hospital of Bucharest, Cardiology Dept., Bucharest, Romania

In patients with left bundle branch block (LBBB) it has been shown that systolic efficiency is compromised by intra- and inter-ventricular dysynchrony, and biventricular (BiV) pacing can improve haemodynamics. However, many patients with heart failure and a normal QRS duration (QRSd) also have marked mechanical dysynchrony, as demonstrated by tissue Doppler, and they might also benefit from BiV pacing.

Methods: We compared the effects of BiV pacing in 17 patients with class III or IV heart failure and a EF<40%: 9 patients with LBBB (140-218 ms), and 8 with a normal QRSd (79-120 ms). The timing of electrical activation of the LV free-wall was measured by electrograms from the tip of the LV lead. Mechanical timings from the onset of the QRS complex to peak systole were measured by tissue Doppler, in 6 LV basal segments and 1 RV segment (apical views). LV synchrony was defined as the standard deviation of the myocardial timings. Interventricular synchrony was defined as the difference between RV and mean LV timings.

Results: In both groups, pacing was associated with improved long-axis intra-LV synchrony (from 37±15 to 13±7 ms for LBBB patients; and from 24±17 to 11±7 ms, for normal QRSd patients, both p<0.05), and inter-ventricular synchrony, despite the electrographic evidence that the free-wall activation was significantly earlier in the normal QRSd group. In addition (figure), the changes in the timing of regional mechanical activation are similar in both LBBB and normal QRSd patients.

Conclusion: BiV pacing improves mechanical synchrony in patients with normal QRSd, despite the absence of significant delay in LV free-wall electrical activation. Thus, these patients may also derive benefits from BiV pacing, but this should be studied now in long-term studies.

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Determination of reliability of different echocardiographic methods for optimization of atrio-ventricular delay in cardiac resynchronization therapy.

A. Jansen, J.M. Van Dantzig, F.A. Bracke, B. Van Gelder, A. Meijer, K.H. Peels. Catharina Hospital, Cardiology, Eindhoven, Netherlands

Objective: Echocardiographic methods for optimization of the atrio-ventricular delay (AVD) have been studied in conventional pacing and are widely used in biventricular pacing. We compared three echo methods for predicting optimal sensed atrio-ventricular delay (AVD) in biventricular pacing using invasively measured left ventricular dP/dt max. as a reference.

Methods: Left ventricular maximum dP/dt was measured invasively with a 0.014" pressure wire with the pressure transducer mounted at the tip. The sensed AVD with the maximal dP/dt was considered the optimal AVD. Measurements were done in steps of 20 ms decreasing from the maximal sensed AVD with full biventricular capture. Within 24 hours of implant an echodoppler was performed at the same sensed AV intervals as during the invasive procedure. At each AVD Doppler trans-mitral flow and Doppler flow of the left ventricular outflow tract (LVOT) were obtained. Three echo methods were used: First, the optimal AVD predicted by the Ritter’s formula was calculated. Second, the optimal Doppler trans-mitral flow was determined as the maximum of the velocity time integral of mitral flow (EVTI). Third, the maximum of the velocity time integral of the LVOT (VTI) was considered to represent the optimal AVD.

Nineteen patients completed both protocols within 24 hours after implant. The echodoppler data were analysed blinded to the results of the invasive measurements.

Results: The optimal AVD obtained by the EA VTI method was concordant with the optimal AVD measured by invasive dP/dt in 18 of 19 patients. One differed 40 ms. The optimal AVD predicted by the Ritter’s formula was in none concordant and in 8 patients the difference was less than 20 ms in comparison to the invasive results. The optimal AVD obtained by the maximal LVOT VTI was in 4 patients concordant and in 8 patients the difference was less than 20 ms as shown in the table.

Conclusion: Doppler Transmitral flow as measured by EA VTI is the best method in obtaining the optimal AVD in biventricular pacing in comparison to invasive measurements. The Ritter formula and the LVOT VTI method seem less reliable measurements.
829 Baseline left ventricular asynchrony predicts long-term benefit of resynchronisation therapy.

R. Romito, M. Iacoviello, S. Greco, G. Luzzi, P. Guida, E. De Tommasi, B. Rizzon, P. Pitula, M.V. Pitalis. Institute of Cardiology, Bari, Italy

We previously demonstrated the role of left ventricular asynchrony (LVA) assessed by echocardiography in predicting short term reverse remodelling after cardiac resynchronisation therapy (CRT).

To study the predictive role of LVA in long term, we studied 18 patients (64±11 yrs, 9 male) with heart failure (HF), NYHA class III and left bundle branch block (LBBB), in optimal medical therapy. Before biventricular pacemaker (PM) implantation, LVA was evaluated by calculating the shortest interval between the maximum systolic posterior displacement of the septum and the maximum systolic displacement of the left posterior wall (septal to posterior wall motion delay, SPWMD). Before, one month and 1 year after PM implantation, left ventricular end-diastolic (LVEDV, ml/m2) and end-systolic (LVESVI, ml/m2) volume indexed for body surface area and left ventricular ejection fraction (LVEF, %) were evaluated. Baseline median SPWMD value was used to dichotomise patients with (LVA+) and without (LVA-) LVA.

LVA+ patients showed a significant improvement of LVEF, LVESVI and LVEF after 1 month and a further improvement after 1 year (Figure). In LVA- patients no hemo-
dynamic changes were found after one month as well as after one year (Figure).

After one year LVA+ showed significantly lower values of LVEF (p<0.0001) and of LVESVI (p<0.0001) and a higher value of LVEF (p<0.0001) in comparison to LVA- patients.

In conclusion, in patients with advanced HF and LBBB, baseline SPWMD is a strong predictor of the occurrence of reverse remodelling and systolic functional improvement after CRT, thus suggesting the usefulness of LVA in identifying patients likely to benefit from biventricular pacing.

830 Quantification of left ventricular asynchrony in patients with systolic dysfunction with transthoracic real-time 3D echocardiography.

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Asynchronous contraction of myocardial segments is a recognised feature of left ventricular dysfunction, even in the absence of bundle branch block. Quantification of mechanical asynchrony may be important for a more accurate functional assessment of LV function. Transthoracic real-time three-dimensional echocardiography (RT3DE) is a new modality which may be able to provide a swift and accurate measure of left ventricular asynchrony.

Methods: Forty six patients with normal QRS duration (~120 ms) referred for assessment of left ventricular function were investigated. Routine 2D echocardiogra-
phy was performed and patients were separated into 4 groups depending on the degree of LV dysfunction: 1. Normal, 2. Mild LV dysfunction, 3. Moderate LV dysfunction and 4. Severe LV dysfunction. RT3DE was performed immediately after 2D echocardiography utilizing the Philips Sonos 7500 with the X4 matrix array transducer. A full volume acquisition (FVA) of the left ventricle was obtained from the apical position. The 3D dataset was analysed offline (4D LV analysis, version 1.1, TomTec) to derive left ventricular time-volume curves utilising semi-automated endocardial border detection. Time-volume curves were also obtained for the regional LV volumes corresponding to all myocardial segments, according the ASE 16-segment model. The time to minimum volume for each regional volume from onset of systole (Ts) was calculated and an asynchrony index derived by evaluating the standard deviation of the Ts for all regional volumes.

Results: 27 patients had normal LV function on 2D echo. Of the 19 patients with abnormal LV systolic function, 2 had mild, 10 had moderate and 7 had severe systolic dysfunction. The average RT3DE acquisition time was 6 sec.

The mean asynchrony index with 95% confidence intervals for each group is illustrated in table 1.

In conclusion, Doppler derived Qp/Dt and left ventricular asynchrony in patients with dilated cardiomyopathy: a study combined using of strain imaging and conventional Doppler echocardiography.

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The aim of this study was to evaluate the echocardiographic determinants of left ventricular asynchrony (LVA) in pts with dilated cardiomyopathy.

Study group was consisted of 35 pts with dilated cardiomyopathy and mital regur-
gitation. After obtaining the conventional echo variables LV Qp/Dt was calculated from the MR Doppler spectrum by known rate-pressure-rise method. Apical 4-2 and long axis strain images were off-line analyzed to assess LVA. The longest time in-
terval between the peaks of negative strain waves from any reciprocal segments was defined as LVA in each pt. The mean Qp/Dt was 83±2.66 mmHg/sec (range 420-1400) and the LVAs was 72±6.5 msec (range 0-200). Linear regression analy-

Table 1

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<th>LV Function</th>
<th>LVEF</th>
<th>Asynchrony Index</th>
<th>p value</th>
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<tbody>
<tr>
<td>Normal</td>
<td>58%</td>
<td>3.6 (3.2 - 4.0)</td>
<td></td>
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<tr>
<td>Mildly impaired</td>
<td>45 - 55%</td>
<td>4.1 (3.3 - 4.9)</td>
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<td>Moderately impaired</td>
<td>25 - 45%</td>
<td>7.5 (6.3 - 8.7)</td>
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<td>Severely impaired</td>
<td>&lt;25%</td>
<td>17.5 (11 - 24)</td>
<td>0.006</td>
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Conclusion: RT3DE and regional volumetric analysis is a sensitive tool for quantifying mechanical LV asynchrony which appears to increase with increasing degrees of systolic dysfunction.

831 Correlation between Doppler derived Qp/Dt and left ventricular asynchrony in patients with coronary artery disease.

R. Romito, M. Iacoviello, S. Greco, G. Luzzi, P. Guida, E. De Tommasi, B. Rizzon, P. Pitula, M.V. Pitalis. Institute of Cardiology, Bari, Italy

LVQp/Dt is an indication for biventricular pacemaker implantation. We previously demonstrated the role of LVQp/Dt in predicting short term reverse remodelling after cardiac resynchronisation therapy (CRT).

To study the correlation between LVQp/Dt and left ventricular asynchrony (LVA), we studied 18 patients with dilated cardiomyopathy and mital regur-
gitation. After obtaining the conventional echo variables LV Qp/Dt was calculated from the MR Doppler spectrum by known rate-pressure-rise method. Apical 4-2 and long axis strain images were off-line analyzed to assess LVA. The longest time in-
terval between the peaks of negative strain waves from any reciprocal segments was defined as LVA in each pt. The mean Qp/Dt was 83±2.66 mmHg/sec (range 420-1400) and the LVAs was 72±6.5 msec (range 0-200). Linear regression analy-

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Conclusion: Revascularisation normalises the QRS response to stress in patients with coronary artery disease. This results in resynchronisation of LV incoordination and an increase in LV filling time at peak stress. Failure to achieve such targets may suggest requirement for additional artificial ventricular resynchronisation device.