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Selection of candidates for cardiac resynchronization therapy (SCART): study design and preliminary results.

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Background: Cardiac resynchronization therapy (CRT) has been demonstrated to be effective in patients (pts) with advanced congestive heart failure (HF) and ventricular dysynchrony (VD). The observation of variable efficacy of CRT has resulted in efforts to predict the response to this approach.

Purpose: Identification of new parameters for the selection of candidates to CRT.

Methods: 42 pts (76% male, age 71 ± 8.4) with advanced HF (NYHA class 3.1 ± 0.6), low EF (EF 26.2 ± 7.7%) and VT were enrolled in the SCART study, a prospective multicenter study.

Three different method were used to assess VT.
1) electrocardiography (QRS > 150ms).
2) echocardiography (QRS > 150ms): Inter-V delay (IVD) > 40ms and intra-V delay expressed as posterioralateral LV wall activation delay (Q-L = 290ms) and/or Q-L > Q to wave-begning of LV filling interval (Q-E).
3) Tissue Doppler Imaging (TDI) (QRS > 150ms): inter-intra delay expressed as time between LV lateral wall systole (S) and RV free wall systole (L) > 70 ms and VT septum S (LV-VS) > 50 ms, respectively.

Results: 25 pts were enrolled according to QRS (group 1) and 15 pts according to echo-criteria (group 2). At 1 mo FU, group 1 decreased NYHA class (from 3.2 ± 0.8 to 2.2 ± 0.7, p < 0.001) and IVD (from 59.5 ± 25.7 to 12.4 ± 25.5, p < 0.001) improved EF (from 23.2 ± 7.8 to 31.1 ± 11, p < 0.001) and diastolic filling time from 442.9 ± 8 to 442.9 ± 49.8, P = NS). Similarly, group 2 decreased NYHA class (from 3.1 ± 0.3 to 2.2 ± 0.6, p < 0.005) and IVD (from 47.6 ± 19.5 to 17.1 ± 15.1, p < 0.001) improved EF (from 32.9 ± 19.0 to 33.1 ± 0.05) and diastolic filling time (from 435.1 ± 165 to 458 ± 179, p = NS). No statistical differences were observed in term of clinical and hemodynamic improvement between two groups.

Conclusion: From these preliminary data appears that echo-parameters despite QRS duration are good indicators to CRT. Further analyses in a larger population are needed in order to identify responders.

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Asynchrony of cardiac contraction and filling in patients with congestive heart failure of different QRS duration.

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The objectives of our study were to analyze the difference in filling and contraction patterns in groups with normal or wide QRS (wider than 130 ms).The group of 55 pts with CHF was divided into subgroups with normal - 31 pts and wide QRS - 24 pts. Mean EF was 29.7%,Mean QRS width in narrow QRS group was 112.5 ms vs. 180.67 in wide QRS group.

The parameters of interventricular, and intraventricular asynchrony were estimated and compared between two groups.Interventricular asynchrony was presented as a difference in onset and duration of pulmonary and aortic flows (QAO-QPA, LVEF-RVET).Intraventricular asynchrony was measured as differences between movement of wall segments or mitral ring segments.The distances from Q to maximal systolic movement of the segments were measured.Differences between septal and posterior wall segments (QIVSS-QPWS); lateral and septal ring segments (QLS-QS); posterior and septal ring segments (QP-QS) and posterior and lateral ring segments (QP-QL) were estimated.The measurement of time from Q wave to the beginning of E wave (QE), the pressure of one wave filling (F fillers, A fillers) described left ventricular filling, and in our opinion should reflect atrioventricular asynchrony.

Selected measurements for NQRS and WQRS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NQRS</th>
<th>WQRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>QAO - QPA (ms)</td>
<td>16.71</td>
<td>37.41*</td>
</tr>
<tr>
<td>QE (ms)</td>
<td>470.56</td>
<td>540.9*</td>
</tr>
<tr>
<td>number of E fillers</td>
<td>2</td>
<td>9*</td>
</tr>
<tr>
<td>number of A fillers</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>statistically significant</td>
<td>p &lt; 0.05</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions: 1. wider QRS duration is connected with delayed left ventricular ejection - significant interventricular asynchrony.

2. QRS duration of 130 ms as a borderline value does not allow to define the group with significant difference in the movement of left ventricular segments (interventricular asynchrony-delay)

3. The onset of left ventricular filling is significantly delayed in the group with wide QRS, whereas filling pressure waveforms do not differ between the group with QRS duration less than 150 ms and indicates atrioventricular asynchrony.

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Asynchrony indices in patients with heart failure- a tissue Doppler echocardiography study.

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The assessment of left ventricular (LV) asynchrony has important clinical implication in patients (pts) with chronic heart failure (CHF) and can help in the selection and monitoring of resynchronization therapy. However, echocardiographic estimation of segmental LV contractility is routinely accomplished through visual and subjective assessment.

The aim of the study was to quantify the LV asynchrony in pts with CHF using pulse-wave tissue Doppler echocardiography (TDE).

The study group comprised of 60 pts with LV dysfunction- 30 pts after myocardial infarction (MI group, aged 58:10 yrs; LVEF 28:17%) and 30 pts with dilated cardiomyopathy – DCM group; aged 43:12 yrs, LVEF 25:8%). Echocardiography was detected by coronary angiography. Control group consisted of 60 healthy volunteers (aged 43:12yrs, LVEF 65:2%). We measured peak TDE myocardial velocities: systolic, early and late diastolic and time intervals: preejection period (PEPm), ejection, isometric contraction (IRVT), rapid filling, diastasis and atrial contraction time in six basal segments in standard apical views. Following indices of heterogeneity were calculated: dispersion of velocities and time intervals (a ratio of standard deviation to the mean value of TDE parameter of 6 sampled basal segments) and asynchrony of systole and diastole (the delay of PEPm or IRVT). Dispersion of systolic velocities in MI group was significantly higher than in DCM and control groups (33.1 ± 6.0 vs. 12.6 ± 3.7 vs 15.3 ± 5.6; p < 0.001) similar, dispersion of diastolic velocities was higher in MI group. Dispersion of all time intervals was significantly higher in pts with CHF than in controls with no differences between MI and DCM groups. Asynchrony of diastole was higher in pts with CHF than in controls, and in MI group than in DCM group (124.1 ± 8 vs 58.8 ± 28.8 ms; p = 0.023). Asynchrony of systole was also higher in pts with CHF than in controls, but does not differ between MI and DCM groups (50.2 ± 25.1 vs 46.3 ± 19.5 ms; p = NS).

Conclusion: TDE allows the quantification of systolic and diastolic asynchrony in pts with CHF. Best index of heterogeneity is dispersion of systolic velocities, which differs among pts with ischemic and idiopathic cause of CHF.

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Interventricular and intraventricular delay assessment by pulsed wave tissue Doppler imaging in heart failure disease.

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Background:

Current criteria of interventricular (Interv) electro-mechanical (EM) asynchrony include a QRS duration more than 150 ms.

The aim of our study is to evaluate the Interv and intraventricular (IntraV) dysynchrony by Pulsed Wave Tissue Doppler Imaging (PW-TDI) in patients (pts) with heart failure (HF) and left bundle branch block (LBBB), and to correlate it with QRS duration.

Methods: We studied 59 pts (age 68:9 yrs, M 49) with HF, NYHA class III-IV (35/24) and LBBB at ECG. Standard 12-lead ECG, echocardiogram and PW-TDI were performed in all pts. We defined EM delay of ventricular lateral wall (LV), Interv septum (IS), and right ventricular free wall (RW) as the time interval between the onset of QRS at ECG and the onset of S wave at PW TDI on the respective segment (S-QWS interval). The difference between LW and IS QWS intervals, and between LW and RW QWS intervals, were defined respectively Interv and IntraV dysynchrony. Pts were divided in a univentricular (UNIV) and biventricular (BV) group if the underlying disease involved only left or both left and right ventricle (RV) (with at least moderate pulmonary hypertension and/or tricuspid regurgitation and/or RV dilation) respectively.

Results: We assessed mean QRS duration (182:26 ms, EF (24:6%), Interv dysynchrony (53 msc) and IntraV dysynchrony (54:63 msc) in all pts. We found a greater Interv and IntraV time interval in UNIV group than BIV group (respectively: 93:48 msc vs 47:48 msc; p=0.002), 73:61 msc vs 33:58 msc, p=0.007), with no differences as regards QRS duration, EF and NYHA class. In all pts and in both groups we found a correlation between Interv and IntraV dysynchrony (r=0.67, p<0.0001), while there were not significant correlations between each of these two parameters and QRS duration, EF, and NYHA class.

Conclusions: EM dysynchrony isn’t only related to a prolongation of electrical activation, but also to a mechanical activation delay of a damaged myocardial wall due to a volume or pressure overload. So PW-TDI is better than QRS duration to assess the interV and intraV asynchrony, because it can perform serial and quantitative assessment of regional cardiac function and synchronicity. This study suggests that PW-TDI may play a role in the selection of pts who might be suitable for resynchronization therapy.