Abstract: P330

Modifications of short-term heart rate variability and intrinsic pacemaker variability in an experimental model of metabolic syndrome

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Introduction: Metabolic syndrome (MetS) describes a cluster of cardiovascular and metabolic alterations such as abdominal obesity, reduced HDL and elevated LDL cholesterol, elevated triglycerides, glucose intolerance and hypertension. Diagnosis requires that any three out of these five criteria are present. MetS has been linked with a higher prevalence of cardiovascular mortality, including sudden cardiac death, but the mechanisms are not well understood. One possible mechanism underlying may be an abnormal modulation of autonomic activity, which can be quantified analyzing heart rate variability (HRV).

Purpose: To investigate the modifications that MetS produces in short-term HRV and the intrinsic modulation of pacemaker variability in isolated heart.

Methods: Male NZW rabbits were randomly assigned to a control (n=12) or a MetS group (n=13), fed during 28 weeks with high-fat (10% hydrogenated coconut oil and 5% lard), high-sucrose (15% dissolved in water) diet. After anesthesia (2% isoflurane), a 15 min ECG recording was performed (lead 1) at week 28. Then, their hearts were isolated and, after 15 min of stabilization, 15 min volume-conducted ECG was recorded. We analyzed short RR time series in vivo and in isolated heart using the following parameters: 1) Time domain: RR, HR, SDNN, triangular index (Ti), RMSSD and TINN; 2) Frequency domain: very low frequency (VLF), low frequency (LF), high frequency (HF), and LF-HF ratio; 3) Non-linear analysis: Poincaré (SD1, SD2) and sample entropy; 4) Time-frequency analysis (wavelet-based). Multivariate analysis of variance (MANOVA) was used for statistical analysis (p<0.05).

Results: Poincaré analysis of HRV showed a decreased SD2 at week 28 in MetS animals, indicative of a reduced parasympathetic activity and non-linear variability. We did not find changes in the rest of time-domain, frequency domain, non-linear and time-frequency parameters of HRV between groups. When comparisons were made within groups, we found a decrease in HR and Ti, and an increase in HF components of HRV (total power and normalized) when comparing week 28 and isolated heart measurements in both control and MetS groups (Table), suggesting a predominance of sympathetic activity in vivo. SD1 and SD2 of Poincaré plot increased in the isolated heart of MetS animals but remained unchanged in controls. No differences were found in the measured HRV parameters in isolated heart between control and MetS groups.

Conclusion: MetS produced changes in non-linear indices of short-term HRV indicative of a decreased parasympathetic activity at week 28. In isolated heart, and thus not submitted to extrinsic nervous or humoral influences, intrinsic pacemaker variability does not seem to be modified by the administration of a high-fat, high-sucrose diet during 28 weeks.
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<table>
<thead>
<tr>
<th>HRV parameter</th>
<th>Control In vivo</th>
<th>Control Ex vivo</th>
<th>MetS In vivo</th>
<th>MetS Ex vivo</th>
</tr>
</thead>
<tbody>
<tr>
<td>RR (ms)</td>
<td>238±29</td>
<td>297±63*</td>
<td>257±27</td>
<td>300±44*</td>
</tr>
<tr>
<td>HR (bpm)</td>
<td>254±32</td>
<td>210±39*</td>
<td>241±26</td>
<td>203±27*</td>
</tr>
<tr>
<td>Ti (ms)</td>
<td>8.9±4.4</td>
<td>2.8±1.5*</td>
<td>7.7±2.9</td>
<td>2.9±1.9*</td>
</tr>
<tr>
<td>HF power (%)</td>
<td>39.5±39.4</td>
<td>86.4±7.4*</td>
<td>21.9±28.3</td>
<td>79.7±23.3*</td>
</tr>
<tr>
<td>HF normalized (%)</td>
<td>41.8±4.1</td>
<td>86.3±7.3*</td>
<td>21.8±3.6</td>
<td>88.1±4.8*</td>
</tr>
<tr>
<td>Time-freq. HF power (%)</td>
<td>44.7±37.4</td>
<td>87.1±7.1*</td>
<td>35.9±25.7</td>
<td>87.2±5.5*</td>
</tr>
<tr>
<td>SD1 (ms)</td>
<td>5.8±5.6</td>
<td>14.2±13.9</td>
<td>4.8±3.8</td>
<td>11.3±17.6*</td>
</tr>
<tr>
<td>SD2 (ms)</td>
<td>20.1±11.5</td>
<td>16.6±14.0</td>
<td>13.4±6.0*</td>
<td>16.2±17.1*</td>
</tr>
</tbody>
</table>

HRV parameters. *p<0.05 vs. control. †p<0.05 vs. in vivo week 28.