Athlete’s heart

Saturday, 10 December 2005, 10:00–11:00
Location: Poster Area

1167
Long-term follow-up 38 years after professional cycling: are there signs of systolic and diastolic dysfunction?
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Background: In professional cyclists (PC), typical cardiac changes include reversible left ventricular (LV) and atrial remodelling, but no change in diastolic function. Data on long-term outcome are limited.

Methods: Of all 134 former Swiss PC who participated at least 1x in a professional race 1955-1975, 62 were recruited for a study. The men were screened with a complete echocardiographic exam, measurement of BNP and creatinine levels. The controls were 52 males matched for age.

Results: The time since the last bicycle race as a PC was 38±6 years. The average age at exam was 67±6 years in controls and 66±7 years in PC (p>0.05). There was no difference in presence of hypertension or creatinine level. Current hours of endurance training per week was 3.2±1.6 in controls and 4.6±4.3 in PC (p=0.03). There was no significant difference in cardiac medication. Former PC tended to have a lower ejection fraction with 62±8% versus 64±7% (p=0.06).

Conclusions: Among former PC, reversibility of all exercise induced cardiac changes is questionable. Subtle differences in systolic and diastolic function are found between former PC and controls in the long-term follow-up paralleling changes is questionable. Subtle differences in systolic and diastolic function are found between former PC and controls in the long-term follow-up paralleling.

1168
Echocardiographic assessment of cardiac morphology and function in elite male basketball players

As adaptive response to vigorous physical activity, the heart undergoes profound morphologic, functional and electrophysiological alterations, which have been identified as the "athletes heart syndromes". If we consider numerous sudden cardiac deaths connected with physical activity, it is very important to distinguish physiologic changes of the heart due to physical activity and pathologic changes due to some cardiac diseases. The clear border has to be established for every kind of physical training, every sports discipline and level. There is a very few information about adaptive changes in basketball players.

In this study, we compared cardiac parameters in 35 elite male basketball players of the national level and 34 sedentary controls of similar age, sex and body surface area. Mono- and 2D-echocardiography and Doppler method was used to assess resting cardiac parameters.

We obtained following parameters: left atria dimension (LAD), aorta diameter (AoD), LAD/AoD index, interventricular septum diastolic wall thickness (IVSd), end-diastolic diameter (LVDd), left ventricular end-diastolic diameter (LVDdL), posterior wall thickness (PWV), relative wall thickness (RWT), left ventricular mass (LVm), fractional shortening (FS), ejection fraction (EF), transaortic flow velocity (TAFV), transpulmonary flow velocity (TPFV), tricuspidal flow velocity (ET), early (E) and late (A) diastolic filling velocity of the left ventricle, and E/A index. We also compared between two groups LVM, IVSD and LVD indexed for body surface area (BSA), body mass index (BMI) and lean body mass (LBM).

Analyzing these parameters we concluded that there are significant morphologic and homodynamic changes of the heart responsible for better work efficiency in basketball players comparing with nonathletes, and these are: dilatation of the heart and left ventricular hypertrophy. Diastolic function of the heart, with unchanged E, E/A index and increased ET and systolic function changed by in- creased FS and EF demonstrates the dynamic of blood movements in the heart that kind of athlete. According to relation LVDd/LVM that is less than 1.3, not decreased E/A index and relative wall thickness (PWTd/LVDd) less than 0.45 we can conclude that there is no criteria for hypertrophic cardiomyopathy. Statistical difference between two groups LVM, IVSD and LVD indexed for body surface area (BSA), body mass index (BMI) and lean body mass (LBM).

In order to properly compare the results body surface area (BSA) was considered.

Results: Of all 134 former Swiss PC who participated at least 1x in a professional race 1955-1975, 62 were recruited for a study. The men were screened with a complete echocardiographic exam, measurement of BNP and creatinine levels. The controls were 52 males matched for age.

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Table 1. Diameters with significant difference in examined groups. BSA is considered

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Static group</th>
<th>Non static group</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>LA (cm)</td>
<td>2.0</td>
<td>1.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>LVd (cm)</td>
<td>2.8</td>
<td>2.7</td>
<td>NS</td>
</tr>
<tr>
<td>RWT</td>
<td>0.424</td>
<td>0.403</td>
<td>0.02</td>
</tr>
<tr>
<td>PA (cm)</td>
<td>1.4</td>
<td>1.3</td>
<td>0.006</td>
</tr>
<tr>
<td>RV (cm³)</td>
<td>1.6</td>
<td>1.5</td>
<td>0.01</td>
</tr>
<tr>
<td>LVM mass (g/m²)</td>
<td>127.3</td>
<td>116</td>
<td>0.01</td>
</tr>
</tbody>
</table>
group (35% vs 40.6% p<0.001 and 67.6% vs 70.5% p=0.02, respectively). E/A was 2.7 in the intervention period and 2.1 in non-static period (p<0.001). 3. Waves function (atrio vs non-atrio); Tricuspid regurgitation 23.9 mmHg vs 19.9 mmHg (p<0.001). Trace atrio occlusion occurrence 9.76% vs 6.3%.

Conclusions: 1. The higher component of atrio in given discipline without considering dynamic atrio load is an important factor associated with concentric type of heart remodeling in elite athletes. 2. Higher isometric component is connected with more frequent occurrence of atrio regurgitation. 3. The load of isometric training has influence on echocardiographic diastolic and systolic parameters. 4. In sport disciplines with higher level of static atrio right ventricle seems to be more loaded.

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Depressed left ventricular ejection fraction measured by Teicholz method is not related to a worse functional capacity in elite athletes


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Usually, left ventricular ejection fraction (LVEF) is measured in elite athletes (EA) using the Teicholz's method (TM). Nevertheless, we have noticed that some EA have a depressed LVEF when using this method. Our aim was to assess if those patients with depressed LVEF measured by TM also have depressed LVEF when Simpson's method (SM) is used. A second aim was to evaluate if there is any relationship between the LVEF measured by TM and the functional capacity.

Methods: 707 EA underwent a conventional echocardiographic during the last year. 108 (15%) had depressed LVEF (<55%) as assessed by TM. Out of them, 58 were re-evaluated (34 with normal -group 1- and 24 with depressed -group 2- LVEF by TM). They comprised our study group. LVEF was evaluated in all of them by means of SM. In all of them a maximal incremental exercise test with oxygen uptake analyzed breath by breath was measured to determine the functional capacity.

Results: LVEF by TM and SM was 69±6.6 and 58±8.1 in group 1 and 46±3.8 and 55.8±5.2 in group 2. Echocardiographic variables were similar in both groups (see table). Intraobserver correlation coefficient (ICC) between the measurements of LVEF using TM and SM was poor (ICC=0.32). Nevertheless maximum oxygen consumption was similar in both groups (Group 1:54.7±5.2 ml/kg min; P=0.99).

Conclusions: The measurement of LVEF by TM may not be accurate in EA. A depressed LVEF when evaluated by means of TM is not related to worse maximal oxygen consumption.

1171
Is the improved work capacity obtained by high intensity training mediated by improved myocardial function?


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Background: Physical exercise is used in rehabilitation programs to improve work capacity. Conflicting results have been reported regarding the mechanisms implied in this improvement. The effects of high intensity deep water training on myocardial function were studied by means of exercise stress Tissue Velocity Echocardiography (TVE).

Methods: 26 healthy women 64±5 (SD) years old participated. They were randomly assigned to a control/training group. The training group performed deep water running/walking wearing a vest two times a week for eight weeks. At baseline and after the program a symptom-limited dynamic stress echo and cardiopulmonary exercise test with oxygen uptake analyzed breath by breath was measured to determine the functional capacity.

Results: LV function (mainly as LVEF and LV mass index) and body surface area (BSA) were divided in ten subgroups according to BSA (1.60 m 2, p<0.02). The load of isometric training had influence on echocardiographic diastolic and systolic parameters.

Conclusions: Exercise induces morphological cardiac modifications also in young athletes. These become significant when BSA was greater than 1.60 m 2 (1.60 m 2, p<0.02).

1172
Morphologic ventricular adaptations to training in young soccer players and swimmers: an echocardiographic study

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Background: Top-level training induces morphologic cardiac adaptations; the most significant change is cardiac hypertrophy. There are many data about so called "athlete's heart" in adults, but there are not yet clear the effects of the training in young subjects' heart. The aim of this study was to assess physiological cardiac adaptations in professional soccer players and swimmers, in childhood and adolescence.

Methods: We studied 423 elite athletes (group A: 119 swimmers, group B: 304 soccer players) and 131 non-trained controls (group C). The study included 53 soccer players and 26 swimmers who had a depressed LVEF when using the Teichholz's method (TM). Nevertheless, we have noticed that some EA have a depressed LVEF when using this method. Our aim was to assess if those patients with depressed LVEF measured by TM also have depressed LVEF when Simpson's method (SM) is used. A second aim was to evaluate if there is any relationship between the LVEF measured by TM and the functional capacity.

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1173
The effect of combined resistance and aerobic training on the left ventricular remodeling in patients after acute myocardial infarction

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Aim of study: To determine, whether the combined aerobic and resistance training can influence the process of left (LV) ventricular remodeling in patients after first myocardial infarction (MI).

Methods: The patients with first acute myocardial infarction were entered in 8-week aerobic (60-80% VO2max) and resistance exercise program. Before and after the program a symptom-limited dynamic stress echo and cardiopulmonary exercise tests were performed. The rest and exercise ejection fraction (EF), LV volumes, WMSI and pVO2 analysis were calculated.

Results: 184 patients (163 male/21 female) of age 58±9 years were enrolled into study. The patients were divided in two subgroups in accordance to the diagnosis: group 1; 63 pts with anterior MI (AMI), and group II; 121 pts with posterior MI (PM). The aerobic exercise program increased significantly exercise tolerance.
and pVO2 (p<0.0001) in both subgroups. This finding persists at one-year control. The AMI pts revealed lower values of baseline EF (p<0.05), higher WMSI (p<0.001), and no significant difference in enddiastolic volume of LV (EDV) compared to the PMI pts. The EF and WMSI were improved significantly after training in both subgroups (p<0.0001). This finding also persists at one-year control (p<0.0001). The EDV decreased after training in both AMI (p<0.0001) and PMI (p<0.0001) significantly. After one year, some tendency of EDV to return to its baseline values in AMI group was apparent. The difference in EDV between subgroups becomes significant (p<0.05).

Conclusions: The combined exercise rehabilitation program has positively influenced the parameters of LV function as well as parameters of gas exchange analysis. Early aerobic and resistance exercise did not negatively influence the process of LV remodeling after the training, and during one-year of follow-up, respectively.

1174 Improvement in cardiac performance after continuous physical training in patients with left ventricular dysfunction

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Aim: To assess the effects of continuous physical training on exercise capacity (EC), left ventricular ejection fraction (EF) and regional systolic and diastolic myocardial function in patients (pts) with left ventricular (LV) dysfunction.

Method: Forty-eight male pts (mean age 60.3±8.8 years) with ejection fraction (EF) < 40% were trained for two weeks at a residential rehabilitation center. At the end of this rehabilitation program pts were randomly assigned either to continue training (3 x weekly) during 24 weeks (T group, n = 27) or not to train (C group, n = 21). In all pts bicycle ergometric test and echocardiography studies after rehabilitation and 24 weeks later were performed. Regional myocardial function, was obtained from apical approach, with pulsed wave Doppler myocardial imaging (PW-DMI) sample volume within any LV segment at basal level. In each adequately visualized segment we measured peak myocardial velocity of systolic (Vs), early (Ve) and late (Va) diastolic waves and calculated their ratio Ve/Va - index of regional diastolic function.

Results: After 24 weeks EC improved in both groups but more in the T than in the C group, in the T group, EC and duration of test increased by 30.4% (P<0.001) and by 43% (P<0.001) while in the C group by 18.7% (P<0.025) and by 35.1% (P<0.005). Regional systolic and diastolic myocardial velocities of basal LV segments were measured in 119 (88.1%) segments in the T group and in 91 (66.0%) segments in the C group. After 24 weeks in the T group systolic and diastolic myocardial function of basal LV segments increased significantly: Vs from 6.6±3.1 to 7.7±3.3 cm/s (P<0.01) and Ve/Va from 0.74±0.35 to 0.81±0.31, P<0.05. In the C group systolic function of basal LV segments also increased after 24 weeks, but it did not reach statistical significance (Vs from 6.5±3.1 to 7.1±3.0 cm/s, NS) while regional diastolic function increased significantly (Ve/Va from 0.72±0.30 to 0.81±0.31, P<0.05). EF increased significantly in the T group (P<0.05) and slightly in the C group.

Conclusion: In pts with LV dysfunction continuous physical training increased the favorable modification of EC, EF and regional systolic and diastolic myocardial function which are induced by standard therapy alone.