Endurance Training is Associated with Increased Atrial Fibrosis

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Declaration of interest

- I have nothing to declare
Exercise Exposure and Arrhythmia

- Khan Heart Rhythm 2015
- Andersen Eur Heart J 2013
- Calvo Europace 2016

ESC Congress
Munich 2018
Atrial Tissue Remodeling

Increased Susceptibility to Atrial Fibrillation Secondary to Atrial Fibrosis in Transgenic Goats Expressing Transforming Growth Factor-β1

Original Investigation
Association of Atrial Tissue Fibrosis Identified by Delayed Enhancement MRI and Atrial Fibrillation Catheter Ablation
The DECAAF Study

Nasir F. Marrouche, MD; David Wilber, MD; Gerhard Hindricks, MD; Pierre Jais, MD; Nazem Akoum, MD; Francis Marchinski, MD; Eugene Kholmovski, PhD; Nathan Burgon, BSc; Nan Hu, PhD; Luis Mont, MD; Thomas Dereke, MD; Mattias Duytschaever, MD; Thomas Neumann, MD; Moussa Mansour, MD; Christian Mahnkopf, MD; Bengt Herweg, MD; Emile Daoud, MD; Erik Wissner, MD; Paul Bansmann, MD; Johannes Brachmann, MD
Study Design

- We recruited sixteen endurance athletes
  - >35 yrs old
  - participated in ≥10 yrs of competitive endurance sports
  - actively train in endurance sport for ≥10 hrs/wk.
- Endurance activities included: running, cycling, rowing, and nordic skiing
- Controls were recruited during routine colonoscopy

<table>
<thead>
<tr>
<th>Variable</th>
<th>Athletes (n=11)</th>
<th>Controls (n=15)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>48.2</td>
<td>63.9</td>
<td>0.003</td>
</tr>
<tr>
<td>BMI</td>
<td>21.5</td>
<td>26.6</td>
<td>0.009</td>
</tr>
<tr>
<td>Percentage Male</td>
<td>64%</td>
<td>53%</td>
<td>0.6</td>
</tr>
<tr>
<td>Alcohol Use</td>
<td>55%</td>
<td>47%</td>
<td>0.69</td>
</tr>
<tr>
<td>Diabetes</td>
<td>0%</td>
<td>27%</td>
<td>0.063</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0%</td>
<td>33%</td>
<td>0.03</td>
</tr>
<tr>
<td>Sleep Apnea</td>
<td>0%</td>
<td>20%</td>
<td>0.12</td>
</tr>
</tbody>
</table>

- All subjects underwent cMRI and processed using 3D visualization software
Results

- Mean left atrial (LA) fibrosis score, reported as a percentage, was 13.7% ± 5.4 in EAs compared to 11.8% ± 7.3 in the controls.
- Being an endurance athlete was associated with 6% more LA fibrosis compared to controls (p=0.05).
- Endurance athlete exposure ($R^2 = 0.16$) had a greater impact on degree of fibrosis than any comorbidity including diabetes, hypertension and tobacco use.
Take Home Points

• Highly trained endurance athletes are at an elevated risk of developing atrial arrhythmias
  – This risk is likely dose related
• Fibrotic tissue increases susceptibility to development of AF (animal models)
  – Degree of LA fibrosis predicts maintenance of sinus rhythm after ablation (DECAAF)
• Master athletes show a higher degree of LA fibrosis than would be anticipated based on previously described risk factors
• Presence of LA fibrosis in the athletic heart may help explain the high incidence of arrhythmia
• Future studies should be longitudinal and focus on documentation of LA fibrosis and follow for development of future arrhythmia
  – Can fibrosis change over time (detraining?)