Atrial Fibrillation and Sports

University of Birmingham,
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Dr Andreas Wolff
Conflict of interest

Advisory board, grants and speaker fees

- Boehringer Ingelheim
- Pfizer
- Sanofi
- Servier
- Medtronic
- Spacelabs
Rise of the Mamils (middle-aged men in lycra)

By Dominic Casciani
BBC News

Dominic Casciani (middle) with fellow Mamils

Flashy sports cars are out, now no mid-life crisis is complete without a souped-up road bike. Why?
Common questions:

• I am really fit but now I have developed AF. Have I done myself damage by exercising?
• How much exercise is damaging?
• Is the treatment of AF any different for athletes?
• Do I have to stop exercising?
• What’s my outlook?
“What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?”
BMJ 1998;316:1784 (Published 13 June 1998)

**Paper**

**Lone atrial fibrillation in vigorously exercising middle aged men: case-control study**

Jouko Karjalainen (jouko.karjalainen@pp.inet.fi), internist\(^a\), Urho M Kujala, chief physician\(^b\), Jaakko Kaprio, senior researcher\(^c\), Seppo Sarna, associate professor\(^c\), Matti Viitasalo, cardiologist\(^d\)
Lone atrial fibrillation in vigorously exercising middle aged men: case-control study

- 300 top Finnish orienteers vs 495 controls
- Mean age 47 vs 49 years
- Subjects with risk factors for AF were excluded
- 10 year follow up
- Lone AF developed 5.8 times more frequent in athletes than in the control group
- Mean age at 1st episode of AF was 52 years with an average of 36 years of training

1Karjalainen J et al. BMJ 1998; 310: 1784-85
Annual incidence rate:
Marathon runners: 0.43/100
Control subjects: 0.11/100

Figure 2  The Kaplan–Meier survival curves for cumulated survival free of lone atrial fibrillation in sedentary men and marathon runners.
Meta-analysis of the risk to develop atrial fibrillation comparing athletes with the general population

Figure 2 Meta-analysis of AF risk in athletes compared with controls.
Who are we looking at?

• Master athletes with a long history of sports participation
• Young athletes in their prime
• Former elite athletes
• Difference between sport disciplines
• What constitutes being an athlete?
  – Competition achievements
  – Target times
  – Average daily energy expenditure
Prevalence and clinical significance of left atrial remodelling in elite athletes

Figure 3. Prevalence of supraventricular tachyarrhythmias (i.e., paroxysmal atrial fibrillation or supraventricular tachycardia) before or at initial evaluation in our institute with respect to left atrial (LA) dimension, as assessed by echocardiography in 1,777 athletes. AF = paroxysmal atrial fibrillation; CV = cardiovascular; SVT = supraventricular tachycardia.

Mean age: 24 years
At the average age of 66 years 10% of former Swiss professional cyclists had developed atrial fibrillation.
Who is affected?

- Master athletes with a long history of sports participation
- Former elite athletes
- Endurance sports
- Men
How much is too much?
Figure 3. RR of AF according to jogging frequency at 3 years.

Figure 1. Distribution of total exercise time per week (minutes).
Association of cumulative lifetime physical activity and development of lone atrial fibrillation

Table 5  Adjusted odds ratios and 95% confidence intervals of lone atrial fibrillation for cumulated moderate and heavy physical activity, height, and left atrial anteroposterior diameter

<table>
<thead>
<tr>
<th>Cumulated moderate and heavy physical activity</th>
<th>Odds ratio (95% confidence interval)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–2077 h</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2078–9318 h</td>
<td>5.60 (1.59–19.75)</td>
<td>0.0075</td>
</tr>
<tr>
<td>≥9319 h</td>
<td>15.11 (3.75–60.83)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
Do you have to stop exercising?
Why is AF more common in athletes?

- Athlete’s Heart:
  - Increased vagal tone
    - Bradycardia
    - Reduction in the atrial refractory period
  - Increased heart muscle mass
  - Left atrial dilatation
  - Fibrosis

The athlete's heart: is big beautiful?
R J Shephard

*Br. J. Sports Med.* 1996;30;5-10
doi:10.1136/bjsm.30.1.5
Vagal AF appears considerably more common in athletes with AF compared with the general AF population.
Figure 3  Distribution of vagally, adrenergically and mixed triggers of atrial fibrillation.
Left atrial remodelling in competitive athletes

Figure 1. Distribution of transverse left atrium dimensions in 1,777 highly trained athletes. Data are shown separately for female (grey bars) and male (black bars) athletes. Twenty percent of athletes had an enlarged left atrium (range, 40 to 50 mm), including 2% with an atrial dimension ≥45 mm.

Table 5. Adjusted odds ratios and 95% confidence intervals of lone atrial fibrillation for cumulated moderate and heavy physical activity, height, and left atrial anteroposterior diameter.

<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>Odds Ratio (95% Confidence Interval)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulated moderate and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>heavy physical activity</td>
<td>0-2077 h</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2078-9318 h</td>
<td>5.60 (1.59-19.75)</td>
</tr>
<tr>
<td></td>
<td>≥9319 h</td>
<td>15.11 (3.75-60.83)</td>
</tr>
<tr>
<td>Height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>155-164.9 cm</td>
<td>1</td>
<td>13.54 (2.47-74.30)</td>
</tr>
<tr>
<td>165-176.9 cm</td>
<td>23.23 (2.48-247.56)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Left atrial anteroposterior diameter (mm)</td>
<td>14.00 (1.17-1.67)</td>
<td>0.0003</td>
</tr>
</tbody>
</table>

Data are expressed as mean ± SD, unless otherwise specified. LVEF, left ventricular ejection fraction; LVD, left ventricular diameter; LVEF, left ventricular ejection fraction; LVFW, left ventricular wall thickness; NS, not significant. *Data of eight participants.
12-lead ECG in the athlete: physiological versus pathological abnormalities

D Corrado, A Biffi, C Basso, A Pelliccia and G Thiene

Br. J. Sports Med. 2009;43;669-676
doi:10.1136/bjsm.2008.054759

Updated information and services can be found at:
http://bjsm.bmj.com/cgi/content/full/43/9/669
Treatment of atrial fibrillation does not differ greatly in athletes

- Antiarrhythmic medication as 1\textsuperscript{st} line:
  - Pill-in-pocket treatment
  - Be aware of coexisting atrial flutter
- Permanent AF – check rate control at peak exercise
- Ablation therapy
- Stroke prevention
AADs cont.

• (Beta-blockers)
• Flecaïnide, Propafenone
• Dronedarone
• Sotalol
• Disopyramide
• Amiodarone
SAFE-T study

Singh B et al. NEJM 2005; 352: 1861-72
Effect of AADs on all-cause mortality

Figure 3: Mixed treatment comparison analysis: effect of anti-arrhythmic drugs on all-cause mortality in studies involving >100 patients in either arm. Odds ratios and 95% confidence intervals. Note—odds ratio smaller than 1 indicates a benefit (lower mortality) for the active agent.
Category I-II run
AF at 34min
No medication
Category IV run on Flecainide 200mg/d
Symptoms and course of paroxysmal atrial fibrillation in athletes: a 9-year follow up

97% symptomatic
60% moderate to severe symptoms

63% symptomatic
41% moderate to severe symptoms

Hoogsteen J et al. Europace 2004; 6 222-228
Kaplan–Meier curves for long-term freedom from recurrent arrhythmias after a single ablation procedure in the lone AF sport group (dashed line) and patients with lone AF and no history of exercise activity (solid line).
Fig. 2. Kaplan-Meier curves showing development of AF in 19 patients who continued endurance sports after ablation, vs. 118 patients who did not.
Stroke prevention and sports

- Stroke risk assessment
- Many will be at low risk of stroke
- True low risk = no stroke prevention required
- Anticoagulation and sports:
  - Many sports can be pursued on anticoagulants
  - Use common sense
Anticoagulation and sports

- No contact sports!
- Vast majority of master athletes will be endurance athletes
- Endurance sports = safe in terms of OAC use
- Pitfalls: travelling, supplements, seasonal variation
- Special consideration:
  - Mountaineering
  - (Cycle-)Road racing
Long-term outlook?

Figure 1. Incidence and relative risk (RR) of sudden death (SD) among athletes (solid columns) and non-athletes (open columns) from cardiovascular and non-cardiovascular causes. Athletes had a 2.8 RR of cardiovascular SD (confidence interval [CI] 1.9 to 3.7; p < 0.001), as compared with a 1.7 RR of non-cardiovascular SD (CI 0.3 to 5.7; p = 0.39).
Figure. Annual Incidence Rates of Sudden Cardiovascular Death in Screened Competitive Athletes and Unscrened Nonathletes Aged 12 to 35 Years in the Veneto Region of Italy (1979-2004)

During the study period, the annual incidence of sudden cardiovascular death decreased by 89% in screened athletes ($P$ for trend <.001). In contrast, the incidence rate of sudden cardiovascular death did not demonstrate consistent changes over time in unscreened nonathletes.

Corrado D et al. JAMA 2006; 296: 1593-601
### Table 1
Demographic, clinical, and echocardiographic data from 175 elite athletes with ambulatory Holter electrocardiograms

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total (n = 175)</th>
<th>PVCs</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Group A 0 (n = 40)</td>
<td>Group B 1–100 (n = 71)</td>
</tr>
<tr>
<td>Age (yrs)</td>
<td>23.6 ± 6</td>
<td>23.4 ± 5.4</td>
<td>24.1 ± 6.1</td>
</tr>
<tr>
<td>Men/women</td>
<td>108/67</td>
<td>23/17</td>
<td>42/29</td>
</tr>
<tr>
<td>Heart rate at rest (beats/min)</td>
<td>48.8 ± 6</td>
<td>49.3 ± 5.5</td>
<td>47.4 ± 5.4</td>
</tr>
<tr>
<td>PVCs</td>
<td>802 ± 2,308</td>
<td>0</td>
<td>21 ± 27</td>
</tr>
<tr>
<td>Couplets</td>
<td>23 (13%)</td>
<td>0</td>
<td>5 (7%)</td>
</tr>
<tr>
<td>NSVT</td>
<td>8 (5%)</td>
<td>0</td>
<td>4 (5%)</td>
</tr>
<tr>
<td>Ventricular septum (mm)</td>
<td>9.4 ± 1.3</td>
<td>9.4 ± 1.4</td>
<td>9.4 ± 1.7</td>
</tr>
<tr>
<td>Posterior wall thickness (mm)</td>
<td>9.2 ± 1.2</td>
<td>9.3 ± 1.3</td>
<td>9.4 ± 1.3</td>
</tr>
<tr>
<td>LV end diastolic diameter (mm)</td>
<td>53.6 ± 5</td>
<td>52.9 ± 4.1</td>
<td>53.7 ± 5.7</td>
</tr>
<tr>
<td>LV mass (g)</td>
<td>92 ± 57</td>
<td>188 ± 56</td>
<td>195 ± 66</td>
</tr>
<tr>
<td>LV mass index (g/m²)</td>
<td>99 ± 21</td>
<td>98.5 ± 21</td>
<td>100 ± 24</td>
</tr>
</tbody>
</table>

Data are expressed as mean ± SD or as number (percentage).

* Groups A and B versus group D.
† Groups C and D versus groups A and B.
Effects of deconditioning on ventricular dysrhythmias

Figure 1. Number of premature ventricular depolarizations (PVD), ventricular couplets, and bursts of non-sustained ventricular tachycardia (NSVT) during 24-h Holter electrocardiogram recording at peak training and after the period of deconditioning in 70 trained athletes.
Longterm follow-up of former professional cyclists

Figure 1 Survival curve of former athletes participating in the Tour de Suisse compared to a reference population. The dotted lines represent a 95% pointwise confidence interval.
Lone atrial fibrillation in vigorously exercising middle aged men: case-control study

• 300 top Finnish orienteers vs 495 controls
• Lone AF developed in 5.3% of orienteers vs 0.9% in control group
• Lower mortality rate in orienteers: 1.7% vs 8.5% in control group

1Karjalainen J et al. BMJ 1998; 310: 1784-85
Thank you.

Questions: AndreasWolff@nhs.net