Sport and Aortic valve disease

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Prevalence in athletes?

- **Valvular regurgitation** more frequent in athletes
  
  At least one regurgitant > 90% ; 3-valve regurgitation in 20%

  **Majority = trivial regurgitant volume => no clinical significance**


- **Aortic Stenosis**
  
  2.5 % sudden death in young athletes

  Maron, The Heart of Trained Athletes, Circ 2006

- **Bicuspid Valve**
  
  Same prevalence as in general population = 2.5%

Risks of sport in valvular disease?

- Little is known about the influence of sport on the progression of valvular disease.
  - Increase of cardiac output at exercise
    - \( \Rightarrow \) progression of the valvulopathy?
  - No current scientific data

- Brutal hemodynamic inadaptation at exercise
  - \( \Rightarrow \) Arrhythmia
  - \( \Rightarrow \) Desadaptation of the cardiac pump

*Parker MW, exercise in valvular heart disease: risks and benefits. Prog Cardio Dis 2011*
Severity?
Clinical, ECG, echocardiography

Intensity?
Competitive/leisure-time

Recommendations for sports participation

ACC AHA guidelines for the management of patients with valvular heart disease, JACC 2006
Vahanian, Guidelines on the management of valvular Heart Disease, Eur Heart J 2007

+ Athlete: CPET / exercise echo ± Holter-ECG

Mitchell sport classification

Maron, 36th Bethesda conference, Eligibility Recommendations for competitive athletes with cardiovascular abnormalities, JACC 2005
Pelliccia, Recommendations for competitive sports participation in athletes with cardiovascular disease, EHJ 2005
Mellwig, Recommendations for the management of individuals with acquired valvular heart disease who are involved in leisure-time physical activities or competitive sports, EurCardPrev Rehab 2008
Bicuspid aortic valve

• Prevalence = 2.5%

• Valvular Complications:
  Aortic Stenosis – Aortic Regurgitation

• Aortic dilatation: > 20-21mm/m²
  Disorders of vascular connective tissue

« Recommendations are based on limited data but with the understanding that aortic dissection can occur with aortic root diameters < 50 mm »

Maron, 36th Bethesda conference, JACC 2005
# Bicuspid aortic valve

<table>
<thead>
<tr>
<th>Criteria for eligibility</th>
<th>Recommendations</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>no aortic root dilatation $&lt; 40 \text{ mm}^*$ + no significant AS or AR</td>
<td>all competitive sports</td>
<td>Yearly</td>
</tr>
<tr>
<td>dilated aortic root $40 - 45 \text{ mm}^{**}$</td>
<td>classes IA, IB, IIA, and IIB&lt;br&gt;No sports with potential for body collision or trauma</td>
<td>6 months</td>
</tr>
<tr>
<td>dilated aortic root $&gt; 45 \text{ mm}^{***}$</td>
<td>class IA</td>
<td>6 months</td>
</tr>
</tbody>
</table>

* $< 21 \text{ cm/m}^2$; ** $21 - 23.5\text{mm/m}^2$; *** $> 23.5 \text{ mm/m}^2$

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**Multimodality imaging for the Aorta: CT, MRI**

*Maron, 36th Bethesda conference, Eligibility Recommendations for competitive athletes with cardiovascular abnormalities, JACC 2005*
Aortic regurgitation

Asymptomatic for many years

Sudden death rare among asymptomatic patients (<0.2%/year)

Unclear how competitive exercise training affects prognosis:

Dynamic exercises
• acutely increases heart rate = shortens diastole
  ➥ time available for aortic regurgitation
• ≠ regular endurance training induces bradycardia
  = prolongs AVR and may induce LV dysfunction

Static exertion can worsen regurgitation by increasing afterload acutely

ACC AHA guidelines for the management of patients with valvular heart disease, JACC 2006
## Aortic regurgitation

<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>History, PE, ECG, ET, Echo</td>
<td><strong>Mild-to-moderate regurgitation, normal LV size and function, normal exercise testing, no significant arrhythmia</strong></td>
<td>All sports</td>
<td>Yearly</td>
</tr>
<tr>
<td></td>
<td>Mild-to-moderate regurgitation, proof of <strong>progressive LV dilatation</strong></td>
<td>Class IA</td>
<td>6 months</td>
</tr>
<tr>
<td></td>
<td>Mild-to-moderate regurgitation, significant ventricular arrhythmia at rest or under stress</td>
<td>No competitive sports</td>
<td>Yearly</td>
</tr>
<tr>
<td></td>
<td>AVR and <strong>dilatation of the ascending aorta</strong> (&gt;50mm)</td>
<td>No competitive sports</td>
<td></td>
</tr>
<tr>
<td><strong>Severe</strong> regurgitation</td>
<td></td>
<td>No competitive sports</td>
<td>Yearly</td>
</tr>
</tbody>
</table>

*Mild* = absence of peripheral signs of AVR and normal LV -and atrial size and function; small dimension of the diastolic flow signal on Doppler echocardiography.  
*Moderate* = peripheral signs of AVR, mild-to-moderate enlargement of the LV, normal systolic function, moderate dimension of the diastolic flow signal on Doppler echo.  
*Severe* = peripheral signs of AVR, marked dilatation of the LV and/or evidence of LV dysfunction; enlarged atrial size and large dimension of the diastolic flow signal on Doppler echo.

*Mellwig, Recommendations for the management of individuals with acquired valvular heart disease who are involved in leisure-time physical activities or competitive sports, Eur Card Prev Rehab 2008*
Aortic regurgitation

Evaluation: Pitfalls in athletes
LV end-diastolic size is increased in the healthy athlete
=> should be considered when assessing LV size in AR

Professional Rugby Player
H = 1.95m - W = 123kg
BSA = 2.54m²

LVEDd: 60mm - LVESd 42mm
Aortic Stenosis

**Sudden death** is more frequent in symptomatic patients with severe AS
May occur in completely asymptomatic patients
Is rare with mild AS
Present in 2.5% of young athletes with SCD

In patients with AS exercise induces
  a markedly elevated cardiac output
  or peripheral vascular resistance

=> exaggerated valvular gradient and a marked increase in LV systolic pressure

Maron, The Heart of Trained Athletes : Cardiac Remodeling and the Risks of Sports, Including Sudden Death Circ 2006
# Aortic Stenosis

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</table>
| History, PE, ECG, ET, Echo | **Mild** stenosis  
normal LV size and function at rest and under stress  
no symptoms, no significant arrhythmia | Low-moderate dynamic, low-moderate static (I A,B + II A, B) | Yearly    |
|                  | **Moderate** stenosis  
normal LV function at rest and under stress | Low dynamic and low static (IA)                       | Yearly    |
|                  | **Moderate** stenosis  
**LV dysfunction** at rest or under stress, or marked LV hypertrophy (>15 mm) | No competitive sports                                | Yearly    |
|                  | **Severe** stenosis | No competitive sports                                | Yearly    |
|                  | **Symptomatic** patients with significant AVS | Surgery                                              |           |

Mild = AVA > 1.5 cm\(^2\), mean gradient ≤ 20mmHg  
Moderate = AVA of 1.0 –1.5 cm\(^2\), mean gradient 21–49 mmHg  
Severe = AVA <1.0 cm\(^2\), mean gradient ≥ 50mmHg.

*Mellwig, Recommendations for the management of individuals with acquired valvular heart disease who are involved in leisurse-time physical activities or competitive sports, Eur Card Prev Rehab 2008*
Aortic Prosthesis

• **Insufficient data** to determine whether sport has any **long-lasting effect** on ventricular or prosthetic valve function

• Reduced effective valve areas
  Exercise: elevated valve gradients
  and reduced cardiac outputs / normally expected

⇒ Evaluate at rest and during exercise **using stress echo**
  to the level of exercise the athlete wishes to pursue

*Maron, 36th Bethesda conference, Eligibility Recommendations for competitive athletes with cardiovascular abnormalities, JACC 2005*

*Mellwig, Recommendations for the management of individuals with acquired valvular heart disease who are involved in leisuré-time physical activities or competitive sports, Eur Card Prev Rehab 2008*
# Aortic Prosthesis

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<tr>
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</thead>
<tbody>
<tr>
<td>Bioprosthetic</td>
<td>History, PE, ECG, ET, Echo</td>
<td>Normal valve function + normal LV function + stable sinus rhythm</td>
<td>I A,B + II A, B</td>
<td>Yearly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AF and anticoagulation</td>
<td>+ No contact sports</td>
<td>Yearly</td>
</tr>
<tr>
<td>Prosthetic (artificial)</td>
<td></td>
<td>Normal valve function + normal LV function + anticoagulation</td>
<td>I A,B + II A, B</td>
<td>Yearly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No contact types of sport</td>
<td></td>
</tr>
</tbody>
</table>

Mellwig, *Recommendations for the management of individuals with acquired valvular heart disease who are involved in leisure-time physical activities or competitive sports*, *Eur Card Prev Rehab* 2008
Conclusion

« Physicians with knowledge of an individual athlete severity of the lesion + physiological + psychological response to competition may liberalize these recommendations in selected instances »

« The recommendations are for athletes who are asymptomatic »

« Exercise testing is useful in confirming normal effort tolerance and suitability for the proposed athletic activity »