Valvular Heart Disease in Aircrew: Assessment & Impact

NATO Aviation Cardiology Working Group (RTG HFM-251)
Wing Commander Joanna d’Arcy, MD MRCP DAvMed
Royal Air Force

Wing Commander Ed Nicol FRCP DAvMed FRAeS
We have no financial relationships to disclose

We will not discuss off-label use and/or investigational use in my presentation
Scope

• Overview of Valvular Heart Disease (VHD)
• VHD and Aircrew
• Assessment of VHD
• Aeromedical Disposal
Overview of VHD

• Mostly degenerative - rarely rheumatic, congenital, endocarditis
• Left-sided much more common than right
• Age-related
  • some identified risk factors for AS
  • may present earlier if have a bicuspid aortic valve (BAV)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Aortic stenosis n=1197</th>
<th>Aortic regurgitation n=369</th>
<th>Mitral stenosis n=336</th>
<th>Mitral regurgitation n=877</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degenerative (%)</td>
<td>81.9</td>
<td>50.3</td>
<td>12.5</td>
<td>61.3</td>
</tr>
<tr>
<td>Rheumatic (%)</td>
<td>11.2</td>
<td>15.2</td>
<td>85.4</td>
<td>14.2</td>
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<tr>
<td>Endocarditis (%)</td>
<td>0.8</td>
<td>7.5</td>
<td>0.6</td>
<td>3.5</td>
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<tr>
<td>Inflammatory (%)</td>
<td>0.1</td>
<td>4.1</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Congenital (%)</td>
<td>5.4</td>
<td>15.2</td>
<td>0.6</td>
<td>4.8</td>
</tr>
<tr>
<td>Ischaemic (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>7.3</td>
</tr>
<tr>
<td>Other (%)</td>
<td>0.6</td>
<td>7.7</td>
<td>0.9</td>
<td>8.1</td>
</tr>
</tbody>
</table>

Overview of VHD (2)

- Asymptomatic till late, and progression extremely difficult to predict
- Mild regurgitation (of any valve) is usually considered normal
- Stenosis (even mild) is abnormal
- Detection is usually opportunistic
- A variety of imaging modalities may be needed for full assessment
  - Aeromedical assessment needs additional considerations
VHD in Aircrew

- Main concerns: arrhythmia and effect on cardiac output (CO)
- Arrhythmia most frequently seen with mitral regurgitation (MR)
  - Atrial fibrillation due to dilatation of left atrium
  - Distracting, also drops CO further
  - Late presentation in AR (associated with ventricular arrhythmias)
- Aortic stenosis (AS) is a fixed stenosis and associated with AV conduction defects
  - May cause dizziness, pre-syncope, and even loss of consciousness
  - Poorly tolerated in a high $G_z$ environment
  - Risk of ventricular arrhythmias
• All VHD may affect ability to increase CO
  • even before impaired systolic function

• Severe VHD may cause LV dilatation/↓EF%
  • may still be asymptomatic

• AS associated with chest pain and syncope
  • without significant CAD is well-recognised

• Bicuspid aortic valves present additional concerns
  • may progress more rapidly; associated with aortopathy

• In the military, concerns about endocarditis are also a factor in all VHD
Assessment of VHD

- Need to ensure accurate assessment for appropriate aeromedical disposition
- Trans-thoracic echo (TTE) most widely used for diagnosis and follow up
- Grading of mild/moderate/severe/ is artificial
- Assessment of arrhythmia and also exercise capacity useful (24T/ExECG)
- May follow up aircrew more frequently than standard clinical practice
Trans-thoracic echocardiography (TTE)

- Basis of all VHD diagnosis, assessment and follow up
- Accessible, cheap, non-invasive
- Can assess severity of VHD, and effect on the left ventricle (LV)
- Assessment of morphology of valve often possible
- May also highlight other abnormalities
Limitations of TTE

• Imaging may be inadequate for a number of reasons
• May not be possible to determine morphology of aortic valve, especially when calcified
• Technical aspects may affect quantification of severity of VHD
• Symptoms may not correlate with severity on TTE assessment
Cardiac Magnetic Resonance (CMR)

- CMR is increasing in availability; gives lots of information
- Gold standard for assessment of LV function; No radiation exposure
- Better at assessing some aspects of anatomy than TTE
- Can look for associated pathology
- Flow measures avoid geometric assumptions
  - possible correlation with outcomes
- Can image entire thoracic aorta at the same time
Limitations of CMR

- Expensive
- May not be easily accessible
- Time consuming
- Technical factors may affect interpretation
- Some aircrew may not be able to undergo MRI due to contra-indications
Cardiovascular CT

- Most frequently used for assessing aorta and coronaries in those who have VHD
- Can be used to assess entire aorta in bicuspid aortic valve disease
- Can assess aortic valve morphology, calcification, annulus size
- Involves ionising radiation
Trans-oesophageal echocardiography (TOE)

- More detailed anatomical assessment
- Also useful when symptoms are out of proportion to VHD on TTE
- But:
  - invasive, and requires sedation
  - sedation may affect assessment of severity of VHD
  - still affected by same geometric assumptions as TTE
Aeromedical disposal in VHD

• Arrhythmia risk and potential decrease in G tolerance in significant VHD affect AE disposal
• Valvular stenosis of any severity is likely to result in limitations
• Moderate regurgitation
  - usually associated with restrictions
• Severe stenosis and regurgitation
  - highest risk of complications
  - Will usually carry greatest restrictions
  - may be disqualifying
Conclusion (1)

- Comprehensive and accurate evaluation in aircrew with VHD is vital to ensure appropriate aeromedical disposition
- All imaging modalities have limitations, which must be recognized
- Definitive decisions made on a single measurement from a single modality should be avoided
Conclusion (2)

• Assessment for possible arrhythmia and overall exercise capacity should also be included in the work-up in aircrew
• Limitations to flying privileges should be considered when:
  • any degree of stenosis is found
  • moderate (or greater) regurgitation is present
• In military aircrew, endocarditis risk may also need to be considered
Any questions?