



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



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Wg Cdr Nicol & Wg Cdr d'Arcy

- 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)

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

Overview of VHD (2)



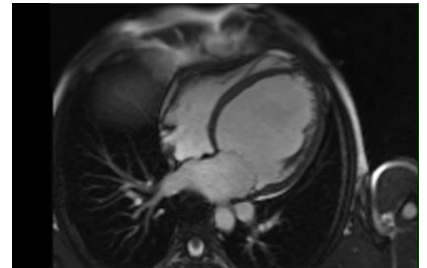
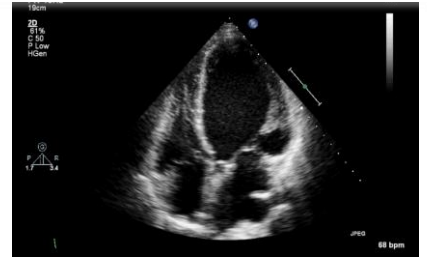
- Asymptomatic till late, and progression extremely difficult to predict
- Mild regurgitation (of any valve) is usually considered normal
- Stenosis (even mild) is abnormal
- Detection is usually opportunistic
- A variety of imaging modalities may be needed for full assessment
 - Aeromedical assessment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



VHD in Aircrew



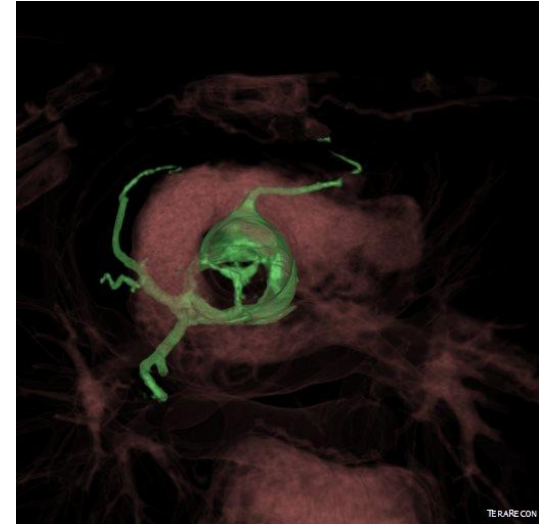
- Main concerns: arrhythmia and effect on cardiac output (CO)
- Arrhythmia most frequently seen with mitral regurgitation (MR)
 - Atrial fibrillation due to dilatation of left atrium
 - distracting, also drops CO further
 - Late presentation in AR (associated with ventricular arrhythmias)
- Aortic stenosis (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



VHD in the Aviator (2)



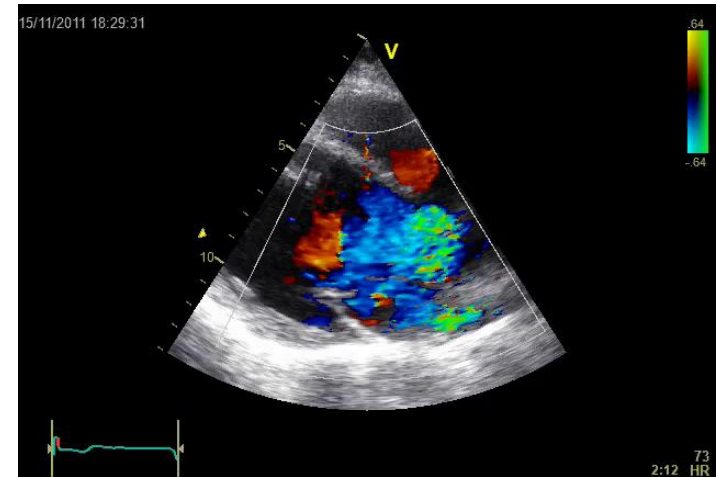
- All VHD may affect ability to increase CO
 - even before impaired systolic function
- Severe VHD may cause LV dilatation/ \downarrow EF%
 - may still be asymptomatic
- AS associated with chest pain and syncope
 - without significant CAD is well-recognised
- Bicuspid aortic valves present additional concerns
 - may progress more rapidly; associated with aortopathy
- In the military, concerns about endocarditis are also a factor in all VHD



Assessment of VHD



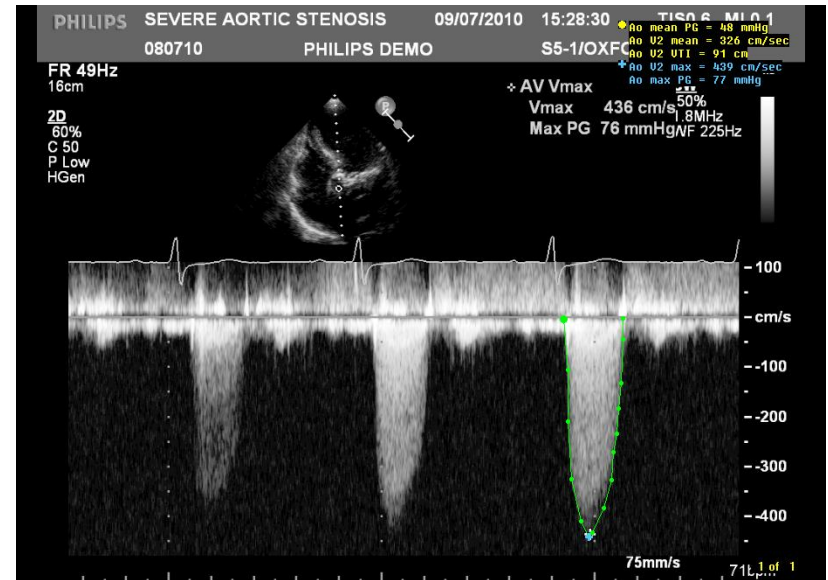
- Need to ensure accurate assessment for appropriate aeromedical disposition
- Trans-thoracic echo (TTE) most widely used for diagnosis and follow up
- Grading of mild/moderate/severe/ is artificial
- Assessment of arrhythmia and also exercise capacity useful (24T/ExECG)
- May follow up aircrew more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

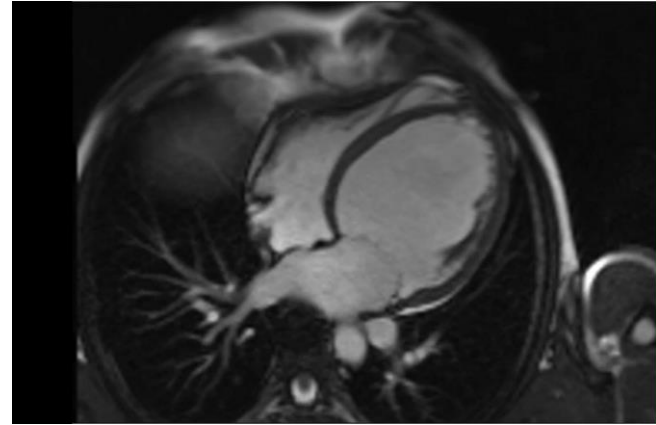


- Imaging may be inadequate for a number of reasons
- May not be possible to determine morphology of aortic valve, especially when calcified
- Technical aspects may affect quantification of severity of VHD
- Symptoms may not correlate with severity on TTE assessment

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

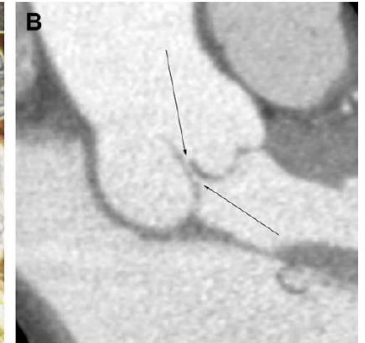
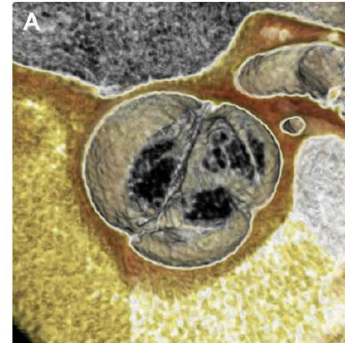
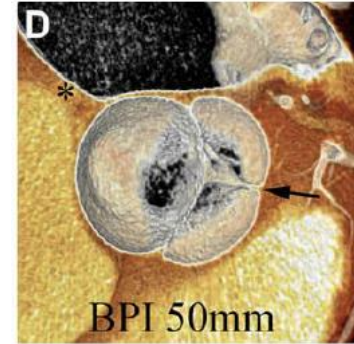


- Expensive
- May not be easily accessible
- Time consuming
- Technical factors may affect interpretation
- Some aircrew may not be able to undergo MRI due to contra-indications

Cardiovascular CT



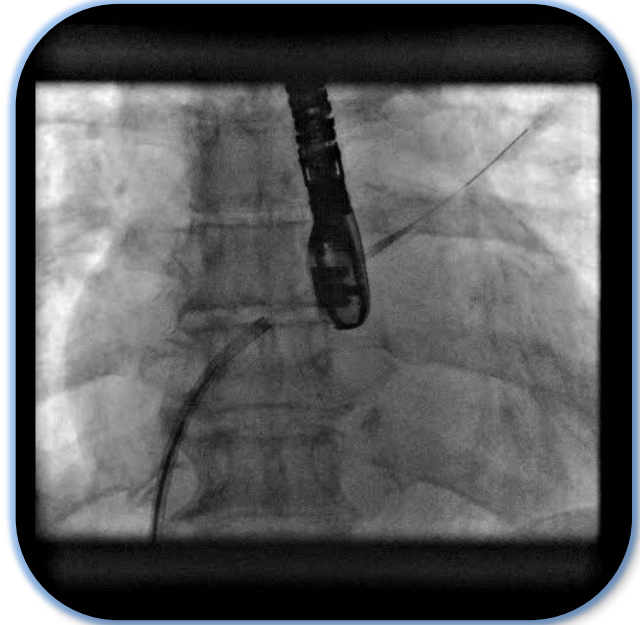
- Most frequently used for assessing aorta and coronaries in those who have VHD
- Can be used to assess entire aorta in bicuspid aortic valve disease
- Can assess aortic valve morphology, calcification, annulus size
- Involves ionising radiation



Trans-oesophageal echocardiography (TOE)



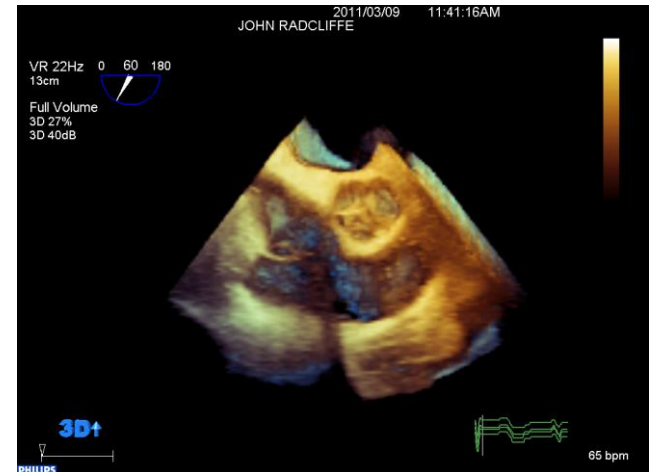
- More detailed anatomical assessment
- Also useful when symptoms are out of proportion to VHD on TTE
- But:
 - invasive, and requires sedation
 - sedation may affect assessment of severity of VHD
 - still affected by same geometric assumptions as TTE



Aeromedical disposal in VHD



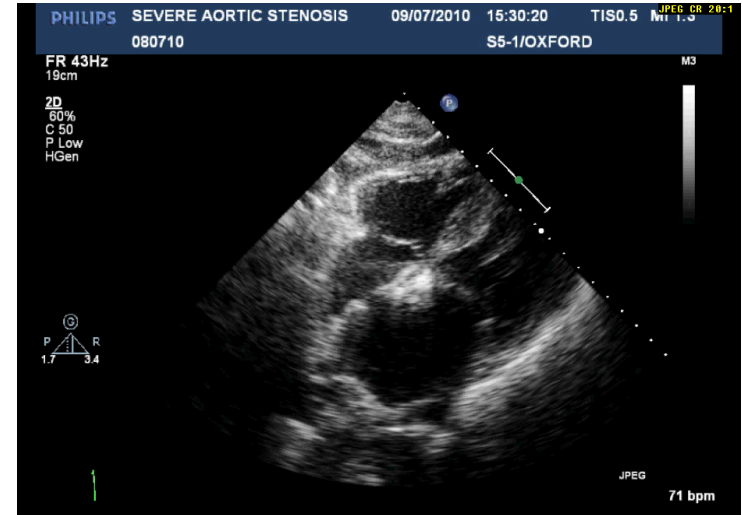
- Arrhythmia risk and potential decrease in G tolerance in significant VHD affect AE disposal
- Valvular stenosis of any severity is likely to result in limitations
- Moderate regurgitation
 - usually associated with restrictions
- Severe stenosis and regurgitation
 - highest risk of complications
 -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



Conclusion (1)



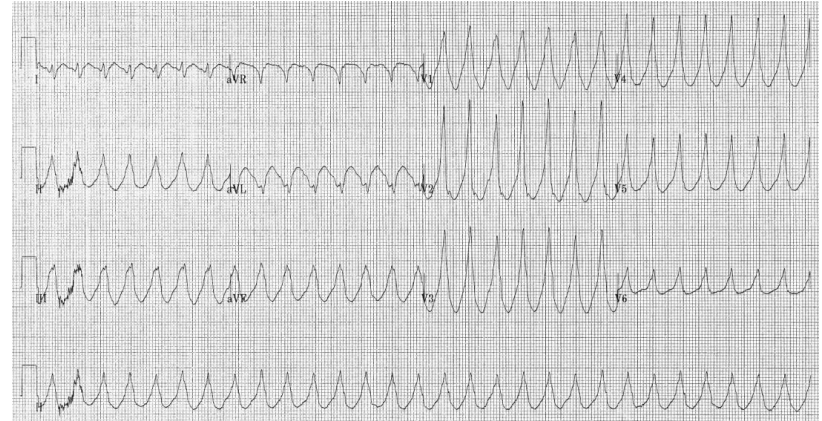
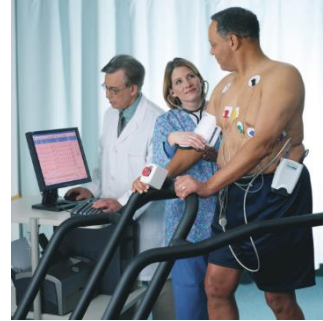
- Comprehensive and accurate evaluation in aircrew with VHD is vital to ensure appropriate aeromedical disposition
- All imaging modalities have limitations, which must be recognized
- Definitive decisions made on a single measurement from a single modality should be avoided



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?