Appropriate Use Criteria for Valvular Heart Disease (VHD) *EACVI 2017*

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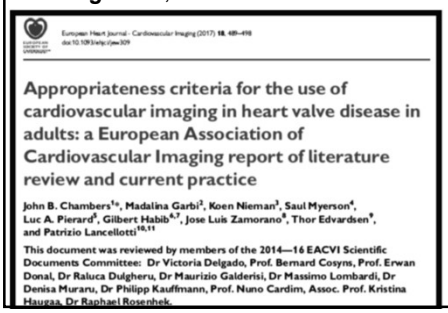
Introduction

Echocardiography remains the **first-line modality** for ***diagnosis***, ***assessment*** and ***serial surveillance***.



European Heart Journal - Cardiovascular Imaging (2017) 18, 489–498
doi:10.1093/ehjci/jew329

Appropriateness criteria for the use of cardiovascular imaging in heart valve disease in adults: a European Association of Cardiovascular Imaging report of literature review and current practice

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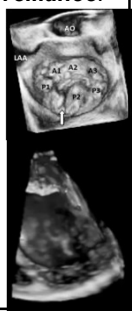
This document was reviewed by members of the 2014—16 EACVI Scientific Documents Committee: Dr Victoria Delgado, Prof. Bernard Cosyns, Prof. Erwan Donal, Dr Raluca Dulgheru, Dr Maurizio Galderisi, Dr Massimo Lombardi, Dr Denisa Muraru, Dr Philipp Kaufmann, Prof. Nuno Cardim, Assoc. Prof. Kristina Haugaa, Dr Raphael Rosenhek.

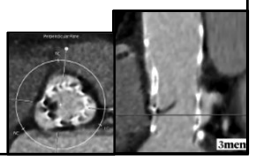


Introduction

However, ***CMR*** and ***CT*** are used when the *echo images are suboptimal* or to *obtain complementary information* in aiding risk assessment of patients.

The review aims to:

Summarize *current evidence* for state-of-the-art clinical practice on the *appropriate use criteria* of CV imaging in heart valve disease in adults



Introduction

Divided into 5 categories:

1. Detection of VHD
2. Assessment of the valve & other cardiac structures
3. Risk assessment
4. Surveillance & screening
5. Intervention – surgery & transcatheter

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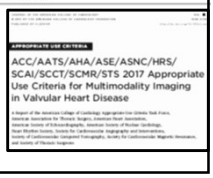
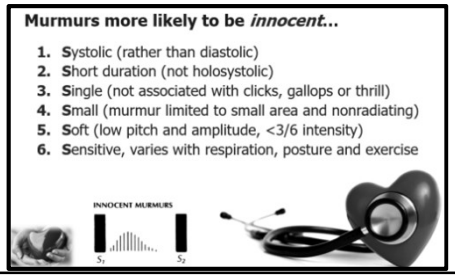


ACC/AATS/AHA/ASE/ASNC/HRS/SCAI/SCCT/SCMR/STS 2017 Appropriate Use Criteria for Multimodality Imaging in Valvular Heart Disease

(I) Detection of VHD

Echocardiography (TTE) is indicated:

1. Likely *pathological murmur* *(not short SEM with normal S_2)*
2. Any murmur associated with cardiac symptom



(I) Detection of VHD

Echocardiography (TTE) is indicated:

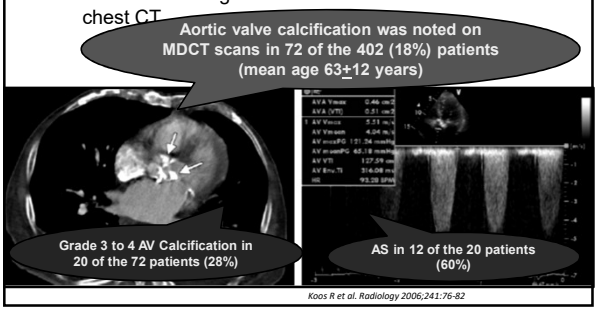
*In the absence of murmur but **<u>in high-risk</u>** groups*

1. Atrial fibrillation (12-21% found with sig. VHD)
2. Breathless or chest pain of potential cardiac origin
3. First-degree relative of bicuspid AV (10% risk)
4. Conditions with known risk of VHD (eg: Marfan, Turners, SLE)
5. Pregnant women from countries with high incidence of rheumatic fever
6. Prior to CABG to detect & quantify mitral regurgitation
7. High-dose radiation exposure (L breast CA, Hodgkin's)
8. High-dose drugs known to cause VHD (5-HT_{2B} receptor)

(I) Detection of VHD

Reasonable indication for Echocardiography (TTE)

1. Incidental finding of aortic valve calcification on chest CT



Koos R et al. Radiology 2006;241:76-82

(I) Detection of VHD

Echocardiography is **NOT indicated**:

1. General population screening
2. Screening based on age alone (or condition specific such as Hip fracture)
3. Low dose dopamine agonists used for treating macroprolactinoma)

CT and CMR are **NOT indicated**:

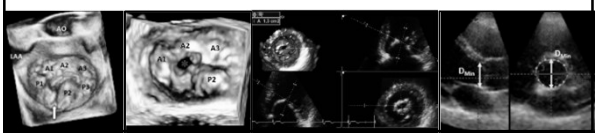
- For routine detection or screening due to cost, availability, lack of portability
- Radiation exposure in CT

(II) Assessment of Valves & Others

Echocardiography (TTE) remains the **mainstay modality** for assessing ***valve morphology & etiology***, and to diagnose ***hemodynamic severity***.

Preference of Echo modalities in scenarios:

1. 3D Echo is better to assess extent of ***MVP*** and MVA in ***MS***
2. 3D derived ***LVOT cross-sectional area*** to calculate AVA (continuity equation) if there is a discrepancy between gradient and orifice size

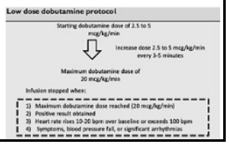


(III) Assessment of Valves & Others

Echocardiography (TTE) remains the **mainstay modality** for assessing ***valve morphology & etiology***, and to diagnose ***hemodynamic severity***.

Preference of Echo modalities in scenarios:

3. DSE for ***low flow low gradient AS*** with ↓ EF to detect flow reserve and differentiate pseudo- from true severe AS
4. Stress (exercise) Echo for symptomatic VHD disproportionate to the severity at rest

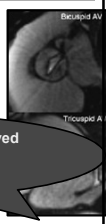


(III) Assessment of Valves & Others

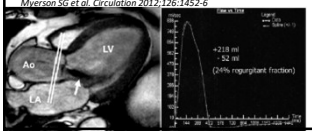
Cardiac Magnetic Resonance is indicated:

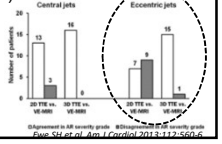
1. For valve morphology *when Echo is suboptimal*
2. Better than Echo for pulmonary valve, subpulm, branch pulmonary artery stenoses
3. Better than Ech… & RV volume…
4. For transvalvular flow …
5. For grading of MR or AR *if uncertain on Echo* or for *additional quantification* (eccentric AR)

Agreement with CMR is improved when 3D Echo is used (Esp. for eccentric AR)



Myerson SG et al. Circulation 2012;126:1452-6



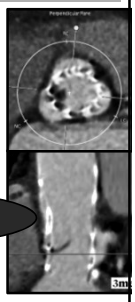


Ewe SH et al. Am J Cardiol 2013;112:560-6

(III) Assessment of Valves & Others

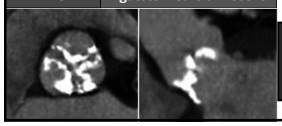
Cardiac MDCT is indicated:

1. For valve morphology & valve opening when *Echo is suboptimal* and *CMR not possible* (due to pacemaker or claustrophobia)
2. Valve **calcification** that will give additional information especially when results are discrepant on echocardiography



In those with no flow reserve with DSE or PLFLG AS

MDCT	Agatston Calcium score



Severe AS likely
Women ≥ 1200
Men ≥ 2000

ESC Valvular Guidelines 2017

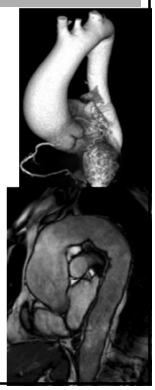
(II) Assessment of Aorta

Echocardiography is indicated:

1. Assessing aortic root & proximal aorta if ***feasible*** *(not distal asc. and desc. aorta)*
2. Detect coarctation
3. Serial assessment of a dilated aorta *(not TEE even if is more sensitive due to invasiveness)*

CT or **CMR** are indicated:

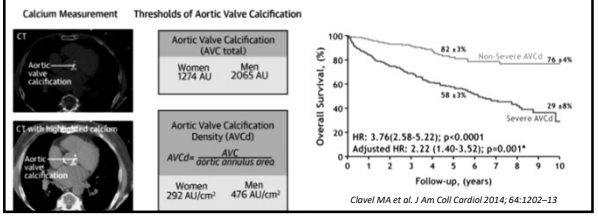
1. At baseline, to confirm Echo measurements
2. After confirmation, can do serial Echo if window is optimal & adequate
3. Repeat as threshold for surgery approaches



(III) Risk assessment

Echocardiography is indicated:

1. Assess risk of events in AS based on: Vmax > 5m/s or Vmax increases by > 0.3 m/s per year
2. Exercise **stress Echo** in asymptomatic AS
3. Aortic **Valve Calcification (by CT)** ***may*** **be** incorporated

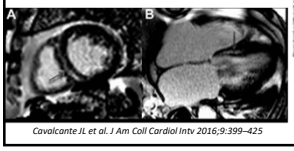


Clavel MA et al. J Am Coll Cardiol 2014; 64:1202–13

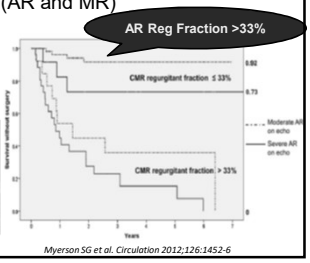
(III) Risk assessment

CMR is indicated:

- No clear clinical role currently but
- ***Likely to develop*** based on emerging evidence
  1. Regurgitant volume (AR and MR)
  2. LV volumes
  3. Myocardial fibrosis



Cavalcante JL et al. J Am Coll Cardiol Intv 2016;9:399–425



Myerson SG et al. Circulation 2012;126:1452-6

(IV) Surveillance of VHD

Echocardiography is indicated:

1. Moderate or severe native valve disease
2. Dilated aorta or high risk of dilatation (eg: Marfan)
3. Normal f…

ACC/AHA/ASE recommends every 3-5 years for AV sclerosis (to exclude development to Stage B)

Echocardi…

- Aortic valve thickening without stenosis
- Normal valve appearance & no more than mild regurg
- Mild MVP & mild MR and ***no risk f…*** *dilatation, age > 50)*

Same modality used for serial studies

CT or **CMR** are indicated for *aortic dilatation*:

- If Echo suboptimal or dilatation is beyond echo window

(IV) Surveillance of VHD

Why need frequent TTE surveillance ?

1. Determine the *optimum* time for intervention
2. Detect *rate of progression*, *symptom onset*, sign of *cardiac decompensation*

Aortic Valve Disease	Frequency
Bicuspid + no AS + mild AR (also rheumatic)	3-5 years
Bicuspid + mild AS	2 years
Tricuspid + mild AS + little Calcium	3-5 years
Moderate AS	1-2 years
Moderate AS (heavy calcium)	½ -1 year
Severe AS	½ -1 year
Mild to moderate AR	3-5 years
Moderate AR	1-2 years
Severe AR	½ -1 year

(IV) Surveillance of VHD

No surveillance if deemed no intervention desired

Mitral Valve Disease	
Mild prolapse + mild MR + risk factors	5 years
Moderate MR	2 years
Severe MR + normal LV	½ -1 year
Severe MR + no previous study	½ year

Right sided Valve Disease	Frequency
Mild PS (Vmax < 3m/s)	5 years
Moderate PS	2 years
Severe PS	1 years
Mild or moderate TR + normal RV/TV	No follow-up usually
Severe TR	1 year

ACC/AHA/ASE recommends
Every 3-5 years for mild VHD (Stage B)
Every 1-2 years for moderate VHD

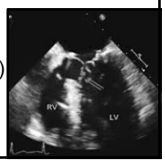
(V) Intervention for VHD

Pre-op Echocardiography is indicated:

1. To confirm VHD, LV and RV adaptations
2. To refine & plan for surgery or intervention
3. TTE and TEE are mainstay (3D for valve anatomy)
4. CT or CMR to assess ***anatomy & size of aorta***
5. CT better for visualization of ***calcification & planning***

Intra-op TEE is essential for:

- All valve surgery (replacements & repairs)
- Confirms good function, no leak
- Exclude complications



(V) Intervention for VHD

Post-op TTE is indicated:

1. Before discharge
   - Confirm valve integrity, LV and RV function
   - Any pericardial effusion
2. At 4-6 weeks *(stable rhythm and ventricular rate)*
   - Hemodynamic 'blue print' when image is better
   - Any improvement of ventricular function
   - Resolution of pericardial effusion

ACC/AHA/ASE recommends 6 weeks to 3 months to establish *baseline post-op*

3. Thereafter, do Echo when there are *symptoms or signs* of *dysfunction* or clinical suspicion of *IE*

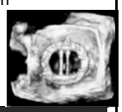
(V) Intervention for VHD

Frequency of TTE surveillance following a normal baseline post-op study

Biological Tissue Prostheses	Frequency
TAVI valve or new designs, Ross	Yearly
Mitral or Tricuspid *	Annually after 5 years
Aortic *	Annually after 10 years

* Consider ***earlier*** with high-risk of structural valve deterioration

1. Age <50 at implantation
2. Renal dysfunction
3. Hypertension, diabetes
4. Patient-Prosthesis mismatch



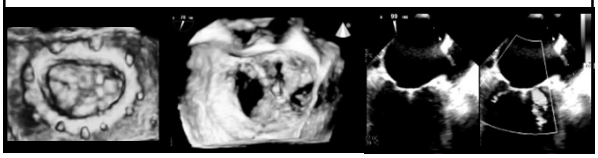
Mechanical prostheses that are normal functioning at baseline DO NOT need routine TTE follow up unless clinical suspicion or other indications (dilated aorta, concomitant LV or valve dysfunction)

(V) Intervention for VHD

Frequency of TTE surveillance following a normal baseline post-op study

Valve Repair	Frequency
Degenerative mitral repair	At 1-year, then as per native MR
Functional MR or Rheumatic MV *	Annually
Repair for Aortic or complex degenerative *	Annually

* Depends on likelihood of failure



Conclusion

Mainstay Imaging

Transthoracic Echocardiography

3D Echo
TEE
Stress Echo

+ Valve Morphology

+ Hemodynamics

CMR
CT

+ Aortic Assessment

+ Chamber Quantification

Multimodality Approach in VHD