

**Valvular Guideline  
Directed Therapy:  
Where We Have  
Guidance and Where  
We Don't**

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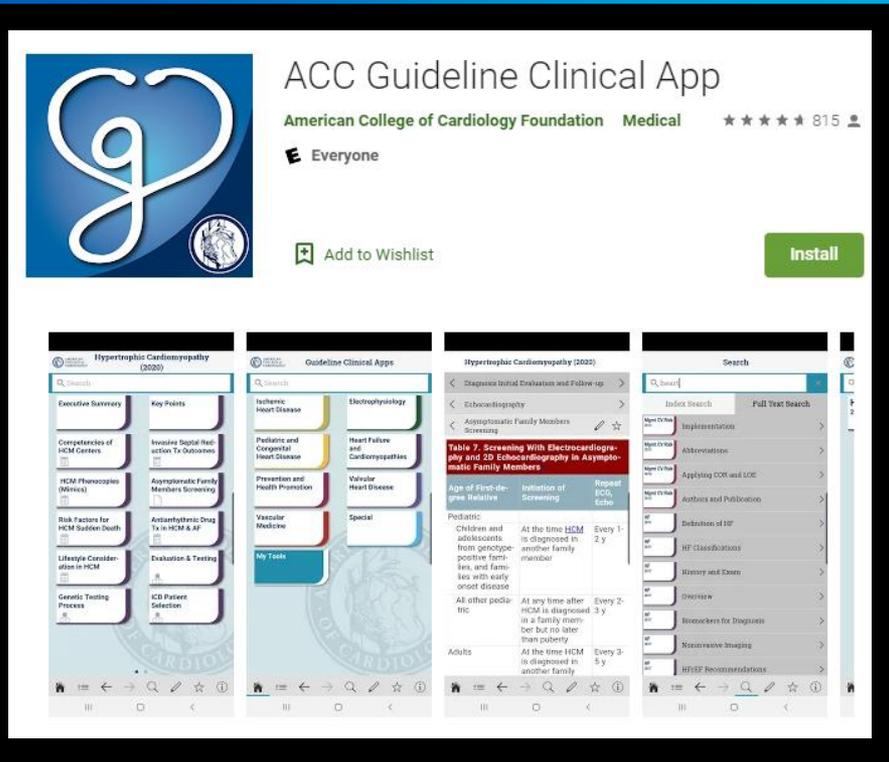


## ACC/AHA CLINICAL PRACTICE GUIDELINE

### **2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines**

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# Objectives



1. Overview of Surgical Risk
2. Describe Guideline Direction in Mgt of IE and Prosthetic Valve Dysfunction
3. Outline current gaps in evidence and management strategies when there are no guidelines to direct us



Table 8. Risk Assessment for Surgical Valve Procedures

Criteria	Low-Risk SAVR (Must Meet ALL Criteria in This Column)	Low-Risk Surgical Mitral Valve Repair for Primary MR (Must Meet ALL Criteria in This Column)	High Surgical Risk (Any 1 Criterion in This Column)	Prohibitive Surgical Risk (Any 1 Criterion in This Column)
STS-predicted risk of death*	<3% AND	<1% AND	>8% OR	Predicted risk of death or major morbidity (all-cause) >50% at 1 y OR
Frailty†	None AND	None AND	≥2 Indices (moderate to severe) OR	≥2 Indices (moderate to severe) OR
Cardiac or other major organ system compromise not to be improved postoperatively‡	None AND	None AND	1 to 2 Organ systems OR	≥3 Organ systems OR
Procedure-specific impediment§	None	None	Possible procedure-specific impediment	Severe procedure-specific impediment

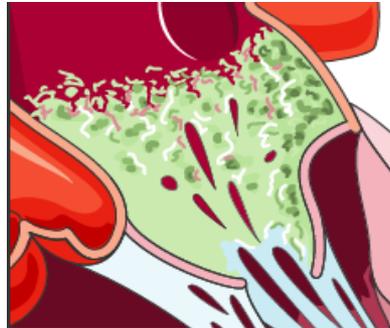


**Table 10. Median Operative Mortality Rates for Specific Surgical Procedures  
(STS Adult Cardiac Surgery Database, 2019)**

<b>Procedure</b>	<b>Mortality Rate (%)</b>
AVR	2.2
AVR and CABG	4
AVR and mitral valve replacement	9
Mitral valve replacement	5
Mitral valve replacement and CABG	9
Mitral valve repair	1
Mitral valve repair and CABG	5



# Infective Endocarditis: Diagnostic Evaluation



## Patients At risk OR with suspected NVE or PVE

### Blood Cultures (1)

### Purpose of TTE (1)

- Identify vegetations
- Hemodynamic severity of valvular lesions
- Assess ventricular function and pulmonary pressures
- Detect complications

### At Risk:

- Congenital or acquired VHD
- Previous IE
- Prosthetic heart valves
- Certain congenital or heritable cardiac malformations
- Immunodeficiency state
- Injection drug use

### Utilize TEE (1)

- If TTE non-diagnostic
- Complication suspected or present
- Intra-cardiac leads present

### Heart Valve Team (1)

- Cardiology
- Cardiac Surgery
- Infectious Disease
- If surgery - cardiac anesthesia
- If neurological event - neurology

**Abbreviations:** IE indicates infective endocarditis; NVE, native valve endocarditis; PVE, prosthetic valve endocarditis; TTE, trans-thoracic echocardiography; and TEE, trans-esophageal echocardiography.

# Infective Endocarditis: Medical Therapy

## Antibiotics

**Antibiotics should be initiated after blood cultures are obtained**, with guidance from infectious disease plus antibiotic sensitivity data (1)

\*In stable left-sided IE - consider changing to oral antibiotics if:

- No paravalvular infection on TEE
- Follow-up can be assured
- Follow-up TEE can be performed 1-3 days prior to antibiotics completion (2b)

**Patients with known VHD and unexplained fever should NOT receive antibiotics before blood cultures are obtained (3:Harm)**

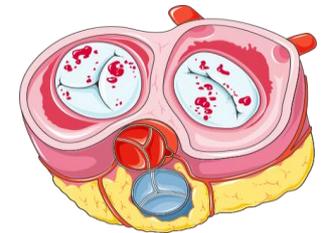
## Anticoagulation

**If there is evidence of cerebral embolism or stroke**, irrespective of other indications for anticoagulation, it is reasonable to temporarily hold anticoagulation (2a)

**In patients on VKA anticoagulation at the time of IE diagnosis**, temporary discontinuation of VKA may be considered (2b)

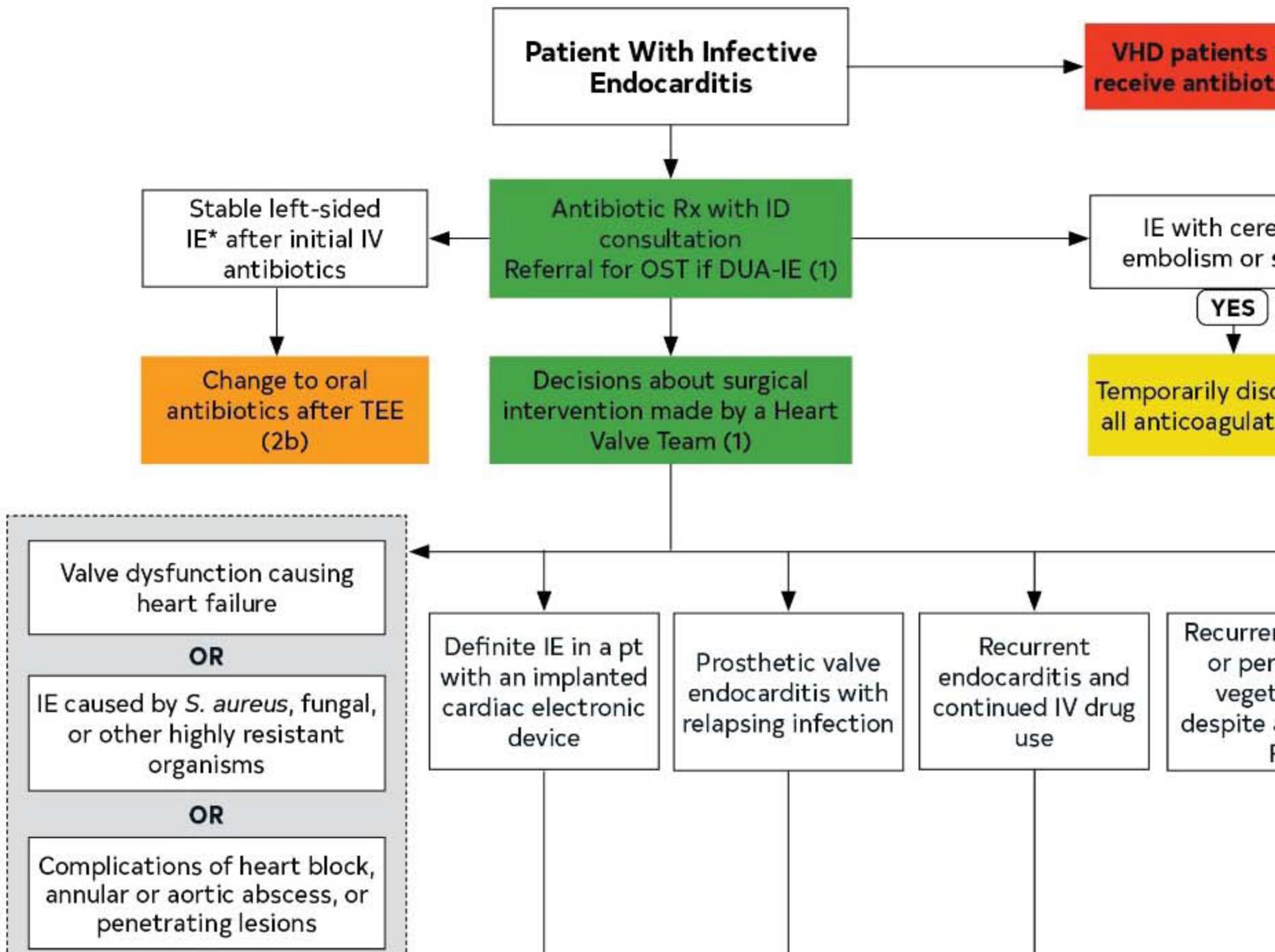
## Addiction Rx

**If IE is a consequence of injection drug use**, the patient should be referred to addiction treatment for opioid substitution therapy (1)

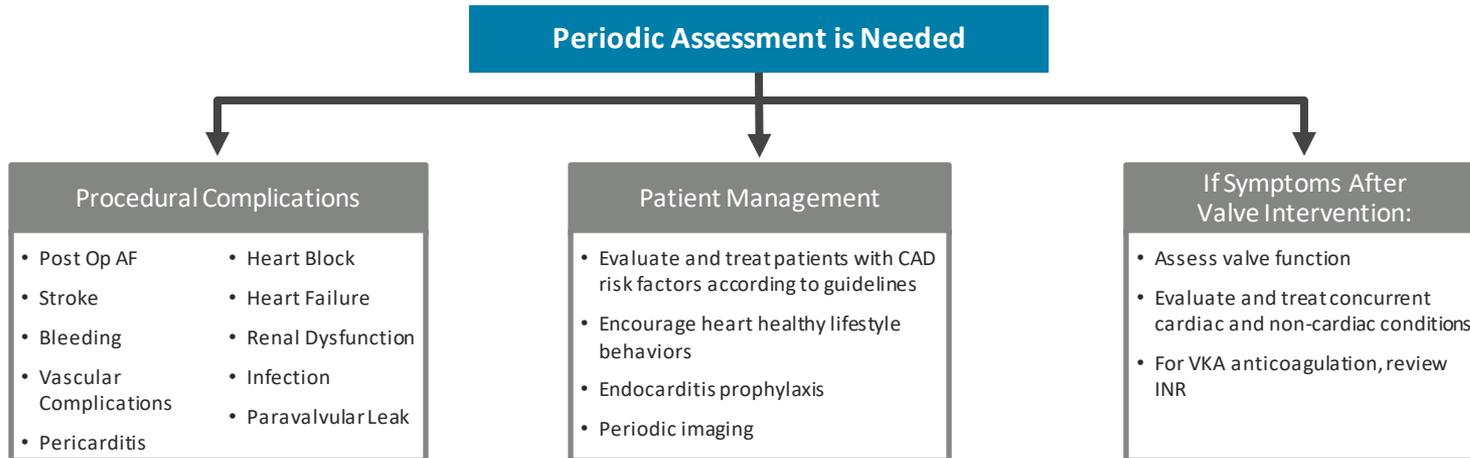


\*IE caused by streptococcus, *E. faecalis*, *S. aureus*, or coagulase-negative staphylococci deemed stable by the Heart Valve Team.

**Abbreviations:** IE indicates infective endocarditis; Rx, treatment; TEE, trans-esophageal echocardiography; VHD, valvular heart disease; and VKA, vitamin K antagonists.



# Management of Patients with VHD After Valve Intervention



**Abbreviations:** 1 indicates primary; 2, secondary; AF, atrial fibrillation; CAD, coronary artery disease; INR, international normalized ratio; Op, operative; VHD, valvular heart disease; and VKA, vitamin K antagonist.

# Imaging After Valve Intervention

Valve Intervention	Minimal Imaging Frequency
<b>Bicuspid Aortic Valve Replacement</b>	Continue monitoring if post aortic valve replacement aortic diameter $\geq 4$ cm
<b>SURGICAL</b>	
<i>Mechanical Valve</i>	Baseline
<i>Bioprosthetic Valve</i>	Baseline, 5 & 10 years post surgery, then annually
<i>Mitral Valve Repair</i>	Baseline, 1 year, then every 2 to 3 years
<b>TRANSCATHETER</b>	
<i>Bioprosthetic Valve</i>	Baseline, then annually
<i>Mitral Valve Repair</i>	Baseline, then annually

**Abbreviations:** cm indicates centimeters; LV, left ventricle; and PA, pulmonary artery.

## Recommendations on management of prosthetic valve dysfunction (4)

### Recommendations

#### *Bioprosthetic failure*

Reoperation is recommended in symptomatic patients with a significant increase in transprosthetic gradient (after exclusion of valve thrombosis) or severe regurgitation.

**Class**   **Level**

**I**   **C**

Transcatheter, transfemoral valve-in-valve implantation in the aortic position should be considered by the Heart Team depending on anatomic considerations, features of the prosthesis, and in patients who are at high operative risk or inoperable.

**IIa**   **B**

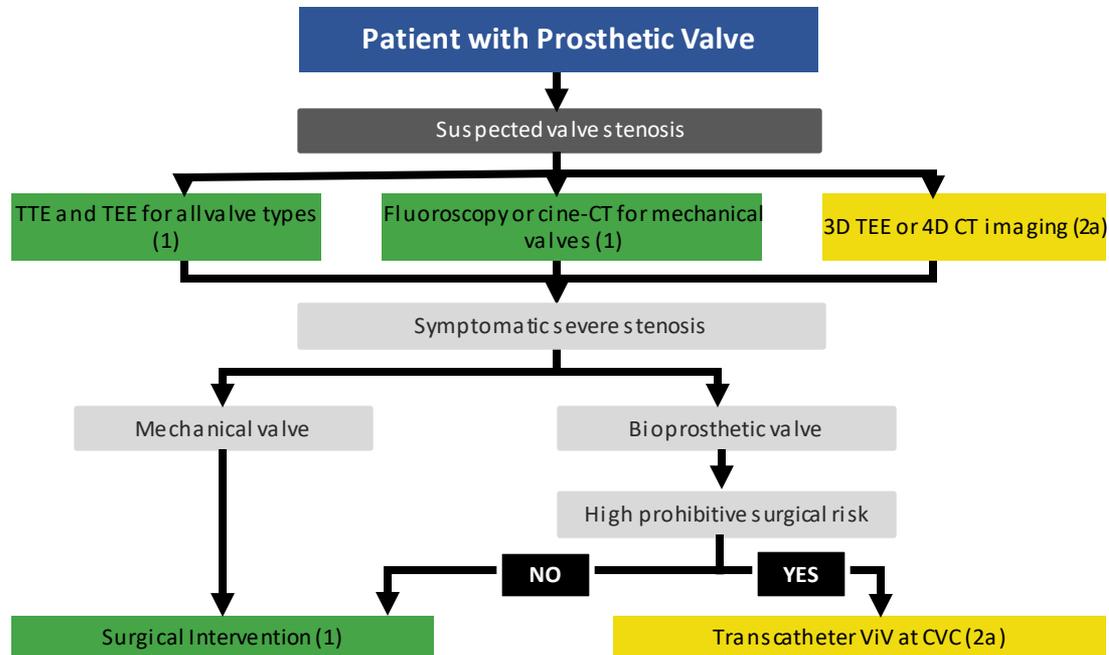
Transcatheter valve-in-valve implantation in the mitral and tricuspid position may be considered in selected patients at high risk for surgical re-intervention.

**IIb**   **B**

Reoperation should be considered in asymptomatic patients with significant prosthetic dysfunction if reoperation is low risk.

**IIa**   **C**

## Figure 14. Management of Prosthetic Valve Stenosis



**Abbreviations:** 3D indicates 3-dimensional; 4D, 4-dimensional; CT, computed tomography; CVC, Comprehensive Valve Center; HF, heart failure; TEE, transesophageal echocardiography; TTE, transthoracic echocardiography/echocardiogram; and ViV, valve-in-valve.

## Requirements for a Heart Valve Centre (1)

### Requirements

Centre performing heart valve procedures with institutional cardiac and cardiac surgery departments with 24 h/7-day services.

**Heart Team:** clinical cardiologist, interventional cardiologist, cardiac surgeon, imaging specialist with expertise in interventional imaging, cardiovascular anaesthesiologist.

**Additional specialists if required:** heart failure specialist, electrophysiologist, geriatrician and other specialists (intensive care, vascular surgery, infectious disease, neurology).

Dedicated nursing personnel is an important asset to the Heart Team.

The Heart Team must meet on a frequent basis and work with standard operating procedures and clinical governance arrangements defined locally.

A hybrid catheterization laboratory is desirable.

The entire spectrum of surgical and transcatheter valve procedures should be available.

High volume for hospital and individual operators.

## Requirements for a Heart Valve Centre (2)

### Requirements

Multimodality imaging including echocardiography, CCT, CMR, and nuclear medicine, as well as expertise on guidance of surgical and interventional procedures.

Heart Valve Clinic for outpatient and follow-up management.

Data review: Continuous evaluation of outcomes with quality review and/or local/external audit.

Education programs targeting patient primary care, operator, diagnostic and interventional imager training and referring cardiologist.

# Patient-centred evaluation for intervention



# Evidence Gaps and Future Directions in VHD

 **STAGE A**

**Prevention of VHD:**

- Disease mechanism and risk factors: Ca<sup>++</sup> in BAV, Lp(a)
- Primary & secondary prevention of risk factors

**STAGE B**

**Medical therapy to prevent VHD progression:**

- Disease mechanism and targets
- Understanding the interplay between severity of VHD and LV modulation and vascular dysfunction

**STAGE C**

**Timing of intervention:**

- Improvement in measures of disease severity and impact on LV
- Patient-centered research and diverse patient groups

 **STAGE D**

**Better management options:**

- Prosthetic valve durability and long-term management
- Optimal anti-thrombotic regimen
- Prevention of complications
- Promoting equity in care of pts with VHD



**Abbreviations:** Ca<sup>++</sup> in BAV indicates calcium in bicuspid aortic valve; Lp(a), lipoprotein (a); LV indicates left ventricle; pts, patients; and VHD, valvular heart disease.

# Three Last Quick Takes:

1. Biosprosthetic valve dysfunction (including TAVI) may occur because of degeneration of the valve leaflets or valve thrombosis
2. Indications for intervention for valvular regurgitation are **relief of symptoms** and **prevention of the irreversible long-term consequences of left ventricular volume overload.**

Thresholds for intervention now are lower than they were previously because of more durable treatment options and lower procedural risks.

3. For patients with **valvular heart disease and atrial fibrillation** (except for patients with rheumatic mitral stenosis or a mechanical prosthesis), the decision to use oral anticoagulation to prevent thromboembolic events, with either a vitamin K antagonist or a non-vitamin K antagonist anticoagulant, should be made in a shared decision-making process based on the CHA2DS2-VASc score. **Patients with rheumatic mitral stenosis or a mechanical prosthesis and atrial fibrillation should have oral anticoagulation with a vitamin K antagonist.**

# A Cheerful Heart is Good Medicine!” -Proverbs17:22

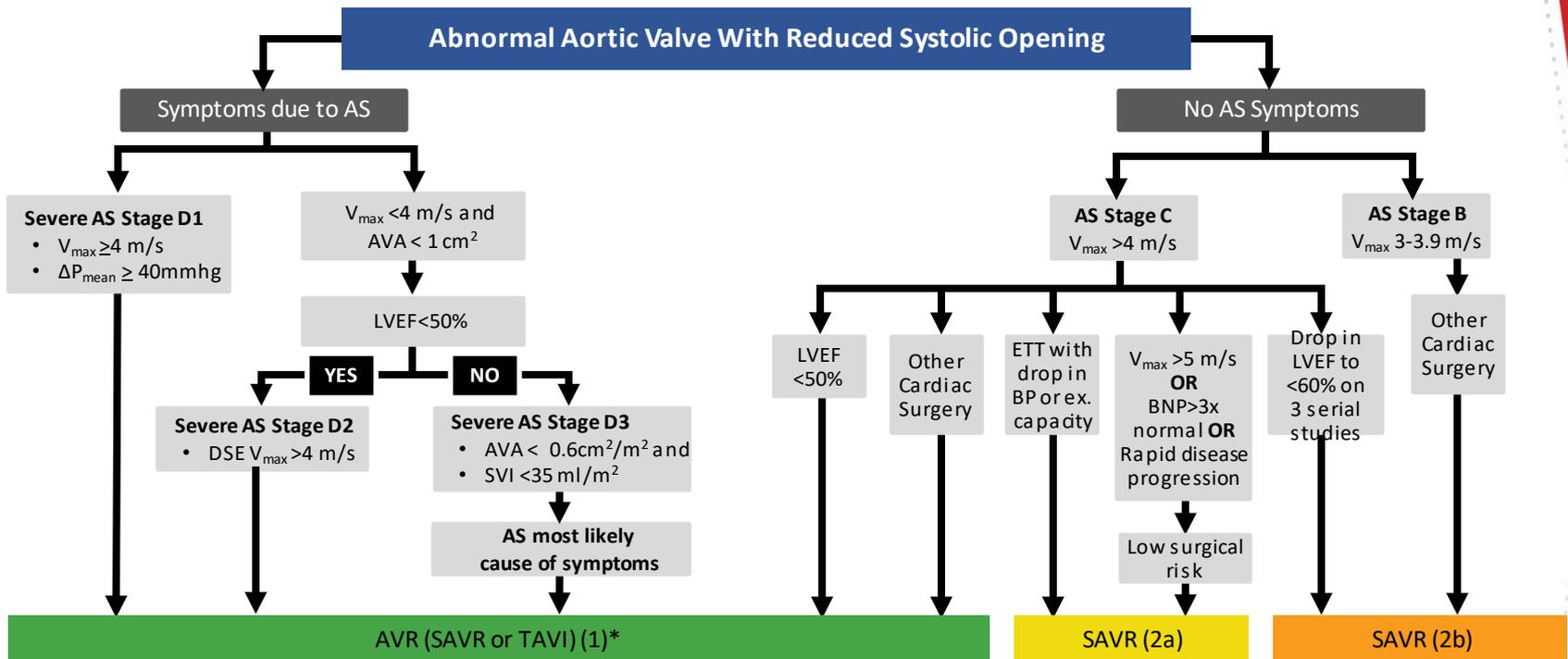


## Table 13. The Evaluation and Management of Aortic Stenosis

STAGE	VALVE ANATOMY	VALVE HEMODYNAMICS	SYMPTOMS
<b>A</b> At risk of AS	<ul style="list-style-type: none"> <li>Bicuspid aortic valve or other congenital valve anomaly</li> <li>Aortic valve sclerosis</li> </ul>	<ul style="list-style-type: none"> <li>Aortic <math>V_{max} &lt; 2</math> m/s with normal leaflet motion</li> </ul>	None
<b>B</b> Progressive AS	<ul style="list-style-type: none"> <li>Mild to moderate leaflet calcification</li> <li>Fibrosis of a bicuspid or trileaflet valve with reduction in systolic motion</li> <li>Rheumatic valve changes with commissural fusion</li> </ul>	<ul style="list-style-type: none"> <li><b>Mild AS:</b> <math>V_{max}</math> 2-2.9 m/s or mean <math>\Delta P &lt; 20</math> mmHg</li> <li><b>Moderate AS:</b> <math>V_{max}</math> 3-3.9 m/s or mean <math>\Delta P</math> 20-39 mmHg</li> </ul>	None
<b>C</b> Asymptomatic Severe AS	<ul style="list-style-type: none"> <li><b>C1:</b> Asymptomatic severe AS</li> <li><b>C2:</b> Asymptomatic severe AS with left ventricular systolic dysfunction (LVEF <math>&lt; 50\%</math>)</li> <li><b>Both C1 and C2 may show:</b> <ul style="list-style-type: none"> <li>Severe leaflet calcification/fibrosis</li> <li>Congenital stenosis with severely reduced leaflet opening</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><b>C1 and C2:</b> <math>V_{max} \geq 4</math> m/s or mean <math>\Delta P \geq 40</math> mmHg, AVA typically <math>\leq 1</math> cm<sup>2</sup> (or AVAi 0.6 cm<sup>2</sup>/m<sup>2</sup>) but not required to define severe AS</li> <li><b>Very severe AS:</b> <math>V_{max} \geq 5</math> m/s or mean <math>\Delta P \geq 60</math> mmHg</li> </ul>	<p><b>C1:</b> None; exercise testing reasonable to confirm symptom status</p> <p><b>C2:</b> None</p>
<b>D</b> Symptomatic Severe AS	<ul style="list-style-type: none"> <li><b>D1:</b> Symptomatic severe high-gradient AS</li> <li><b>D2:</b> Symptomatic severe low-flow low-gradient AS with reduced LVEF (<math>&lt; 50\%</math>)</li> <li><b>D3:</b> Symptomatic severe low-gradient AS with normal LVEF (<math>&gt; 50\%</math>) or paradoxical low-flow severe AS</li> <li><b>D1, D2, and D3 may show:</b> <ul style="list-style-type: none"> <li>Severe leaflet calcification/fibrosis with reduced leaflet motion</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li><b>D1:</b> <math>V_{max} \geq 4</math> m/s or mean <math>\Delta P \geq 40</math> mmHg, AVA typically <math>\leq 1</math> cm<sup>2</sup> (or AVAi 0.6 cm<sup>2</sup>/m<sup>2</sup>) but may be larger with mixed AS/AR</li> <li><b>D2:</b> AVA <math>\leq 1</math> cm<sup>2</sup> with <math>V_{max} &lt; 4</math> m/s or mean <math>\Delta P &lt; 40</math> mmHg; dobutamine stress echocardiography shows AVA <math>\leq 1</math> cm<sup>2</sup> with <math>V_{max} \geq 4</math> m/s at any flow rate</li> <li><b>D3:</b> AVA <math>\leq 1</math> cm<sup>2</sup> with <math>V_{max} &lt; 4</math> m/s or mean <math>\Delta P &lt; 40</math> mmHg AND stroke volume index <math>&lt; 35</math> mL/m<sup>2</sup> measured in a normotensive patient</li> </ul>	Exertional dyspnea, angina, syncope or presyncope, heart failure, exercise intolerance

**Abbreviations:** AR indicates aortic regurgitation; AS aortic stenosis; AVA, aortic valve area circulation; AVAi, aortic valve area indexed to body surface area; LVEF, left ventricular ejection fraction;  $\Delta P$ , pressure gradient between the left ventricle and aorta; and  $V_{max}$ , maximum velocity.

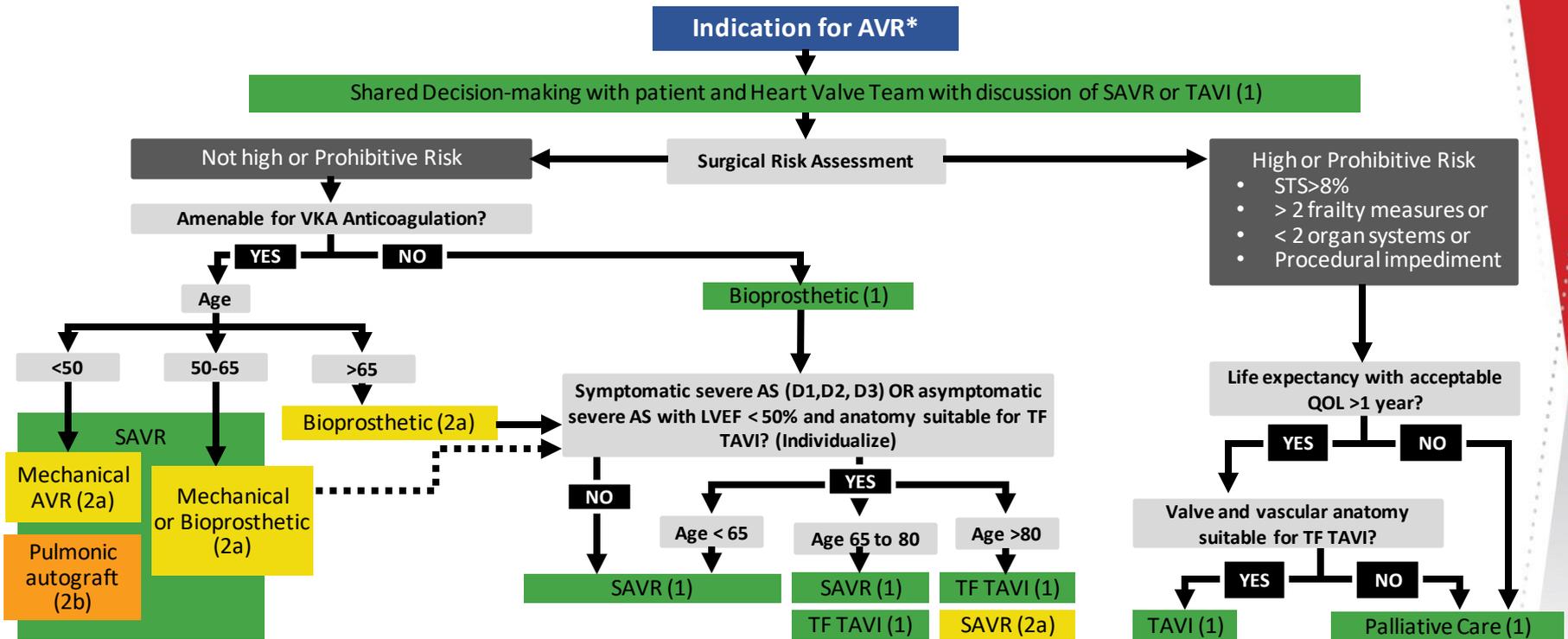
**Figure 2. Timing of Intervention for Aortic Stenosis**



\*See section 3.2.4.2

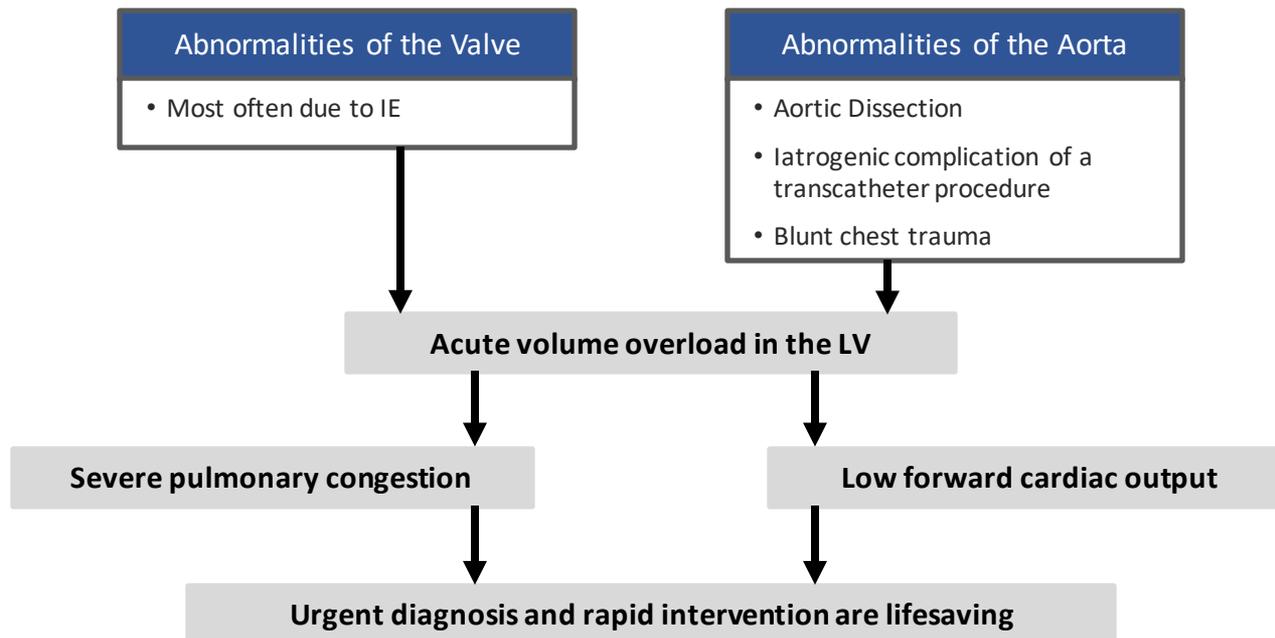
**Abbreviations:** AS indicates aortic stenosis; AVA, aortic valve area; cm, centimeter; AVR, aortic valve replacement; BNP, B-type natriuretic peptide; DSE, dobutamine stress echocardiography; ETT, exercise treadmill test; LVEF, left ventricular ejection fraction; mmHg, millimeters of mercury;  $\Delta P_{mean}$ , average change in pressure; SAVR, surgical aortic valve replacement; SVI, stroke volume index; TAVI, transcatheter aortic valve implantation; and  $V_{max}$ , maximum transvalvular velocity.

**Figure 3.** Choice of SAVR versus TAVI for AVR in Valvular AS



\*See section 3.2.3 Abbreviations: AS indicates aortic stenosis; AVR, aortic valve replacement; LVEF, left ventricular ejection fraction; QOL, quality of life; SAVR, surgical aortic valve replacement; STS, Society of Thoracic Surgeons; TAVI, transcatheter aortic valve implantation; TF, transfemoral; and VKA, vitamin K antagonist.

# Acute Aortic Regurgitation



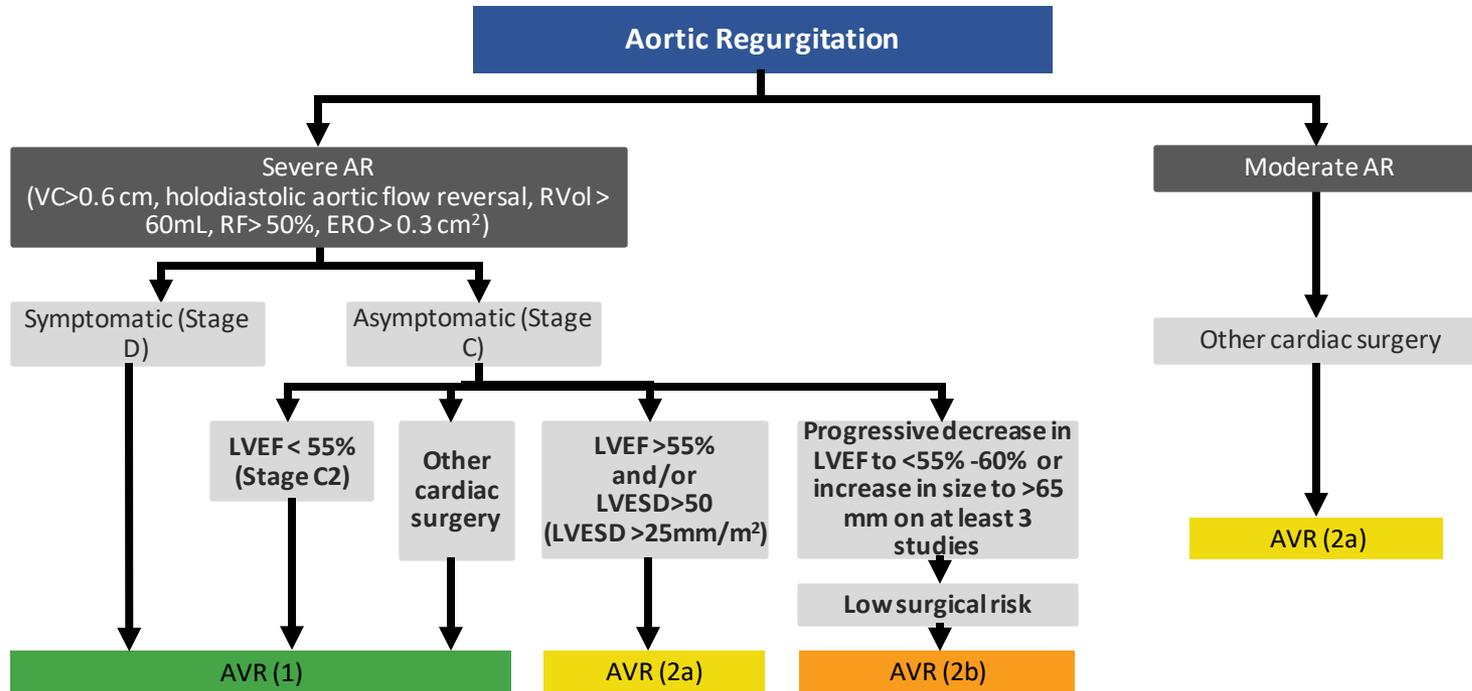
**Abbreviations:** AR indicates aortic regurgitation; IE, infective endocarditis, and TAVR, transcatheter aortic valve replacement.

# Table 15. Stages of Chronic AR

STAGE	VALVE ANATOMY	VALVE HEMODYNAMICS	SYMPTOMS	
<b>A</b> At risk of AS	<ul style="list-style-type: none"> <li>Bicuspid aortic valve</li> <li>Aortic valve sclerosis</li> <li>Diseases of the Aortic sinuses or ascending aorta</li> <li>Rheumatic Heart disease</li> <li>Infective Endocarditis</li> </ul>	<ul style="list-style-type: none"> <li>Echocardiography: None or trace AR.</li> <li>Angiography: Grade 0</li> </ul>	None	
<b>B</b> Progressive AS	<ul style="list-style-type: none"> <li>Mild to Moderate Calcification</li> <li>Bicuspid aortic valve</li> <li>Dilated Aortic Sinuses</li> <li>Rheumatic Valve Changes</li> <li>Previous Infective Endocarditis</li> </ul>	<p><b>Mild AR by Echocardiography</b></p> <ul style="list-style-type: none"> <li>Jet width &lt;25% of LVOT</li> <li>Vena contracta &lt;0.3 cm</li> <li>Regurgitant volume &lt;30 mL/beat</li> <li>Regurgitant fraction &lt;30%</li> <li>ERO &lt;0.10 cm<sup>2</sup></li> <li>Angiography: grade 1</li> </ul> <p><b>Moderate AR by Echocardiography</b></p> <ul style="list-style-type: none"> <li>Jet width 25%–64% of LVOT</li> <li>Vena contracta 0.3–0.6 cm</li> <li>Regurgitant volume 30–59 mL/beat</li> <li>Regurgitant fraction 30% to 49%</li> <li>ERO 0.10–0.29 cm<sup>2</sup></li> <li>Angiography: Grade 2</li> </ul>	None	
<b>C</b> Asymptomatic Severe AS	<ul style="list-style-type: none"> <li>Calcific valve disease</li> <li>Bicuspid aortic valve</li> <li>Dilated Aortic Sinuses or ascending aorta.</li> <li>Rheumatic Valve Changes</li> </ul>	<p><b>Severe AR by Echocardiography</b></p> <ul style="list-style-type: none"> <li>Jet width ≥65% of LVOT</li> <li>Vena contracta &gt;0.6 cm</li> <li>Holodiastolic flow reversal in proximal abdominal aorta</li> <li>Regurgitant volume ≥60 mL/beat</li> <li>Regurgitant fraction ≥50%</li> <li>ERO ≥0.3 cm<sup>2</sup></li> <li>Angiography: grade 3 to 4</li> </ul>	<p><b>C1:</b> Normal LVEF (&gt;55%) and mild to moderate LV dilation (LVESD &lt;50 mm)</p> <p><b>C2:</b> Abnormal LV systolic function with depressed LVEF (≤55%) or severe LV dilation (LVESD &gt;50 mm or indexed LVESD &gt;25 mm/m<sup>2</sup>)</p>	None: Exercise testing is reasonable to confirm symptom status
<b>D</b> Symptomatic Severe AS	<ul style="list-style-type: none"> <li>Previous infective endocarditis with abnormal leaflet closure or perforation</li> </ul>	<p>In addition, diagnosis of chronic severe AR requires evidence of moderate to severe LV dilation. May occur with normal LVEF or mild/moderate or severe LV dysfunction.</p>	Exertional dyspnea or angina or more severe HF symptoms	

**Abbreviations:** AR indicates aortic regurgitation; cm, centimeter; ERO, effective regurgitant orifice; HF, heart failure; IE, infective endocarditis; LV, left ventricle; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; LVOT, left ventricular outflow track; mm, millimeter; and TAVR, transcatheter aortic valve replacement.

**Figure 4.** Timing of intervention for AR



**Abbreviations:** AR indicates aortic regurgitation; AVR, aortic valve replacement; EDD, end-diastolic dimension; ERO, effective regurgitant orifice; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic dimension; RF, regurgitant fraction; RVol, regurgitant volume; and VC, vena contracta.

# Timing of Intervention in Chronic Aortic Regurgitation

COR	RECOMMENDATIONS
1	<ol style="list-style-type: none"> <li>1. In symptomatic patients with severe AR (Stage D), aortic valve surgery is indicated regardless of LV systolic function.</li> <li>2. In asymptomatic patients with chronic severe AR and LV systolic dysfunction (LVEF <math>\leq</math>55%) (Stage C2), aortic valve surgery is indicated if no other cause for systolic dysfunction is identified.</li> <li>3. In patients with severe AR (Stage C or D) who are undergoing cardiac surgery for other indications, aortic valve surgery is indicated.</li> </ol>
2a	<ol style="list-style-type: none"> <li>4. In asymptomatic patients with severe AR and normal LV systolic function (LVEF <math>&gt;</math>55%), aortic valve surgery is reasonable when the LV is severely enlarged (LVESD <math>&gt;</math>50 mm or indexed LVESD <math>&gt;</math>25 mm/m<sup>2</sup>) (Stage C2).</li> <li>5. In patients with moderate AR (Stage B) who are undergoing cardiac or aortic surgery for other indications, aortic valve surgery is reasonable.</li> </ol>
2b	<ol style="list-style-type: none"> <li>6. In asymptomatic patients with severe AR and normal LV systolic function at rest (LVEF <math>&gt;</math>55%; Stage C1) and low surgical risk, aortic valve surgery may be considered when there is a progressive decline in LVEF on at least 3 serial studies to the low-normal range (LVEF 55% to 60%) or a progressive increase in LV dilation into the severe range (LV end-diastolic dimension [LVEDD] <math>&gt;</math>65 mm).</li> </ol>
3 HARM	<ol style="list-style-type: none"> <li>7. In patients with isolated severe AR who have indications for SAVR and are candidates for surgery, TAVI should not be performed.</li> </ol>

**Abbreviations:** AR indicates aortic regurgitation; COR classification of recommendation; LVEF, left ventricular ejection fraction; LVESD, left ventricular end-systolic diameter; mm, millimeter; SAVR, surgical aortic valve replacement; TAVI, transcatheter aortic valve implantation.

# Diagnosis & Treatment: Bicuspid Aortic Valve

Figure 5. Diagnosis

Aortopathy is present in 20-40% of patients with BAV

## Bicuspid Aortic Valve

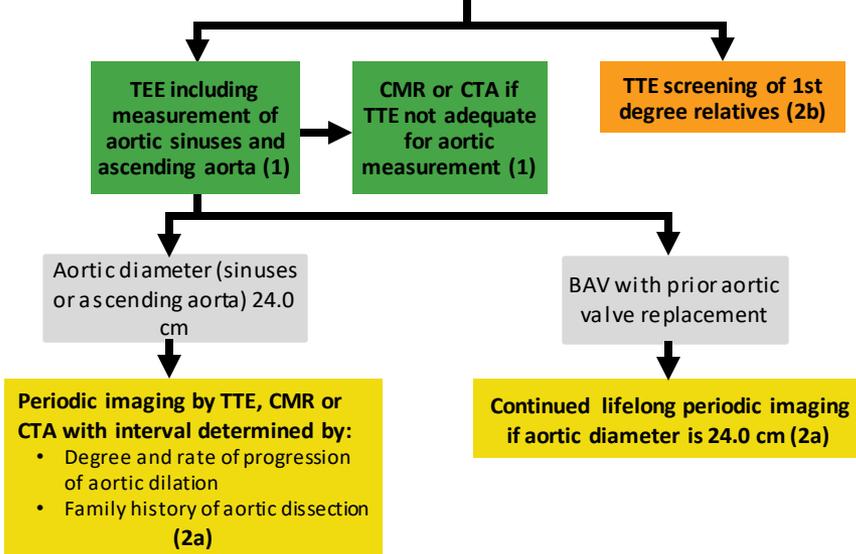
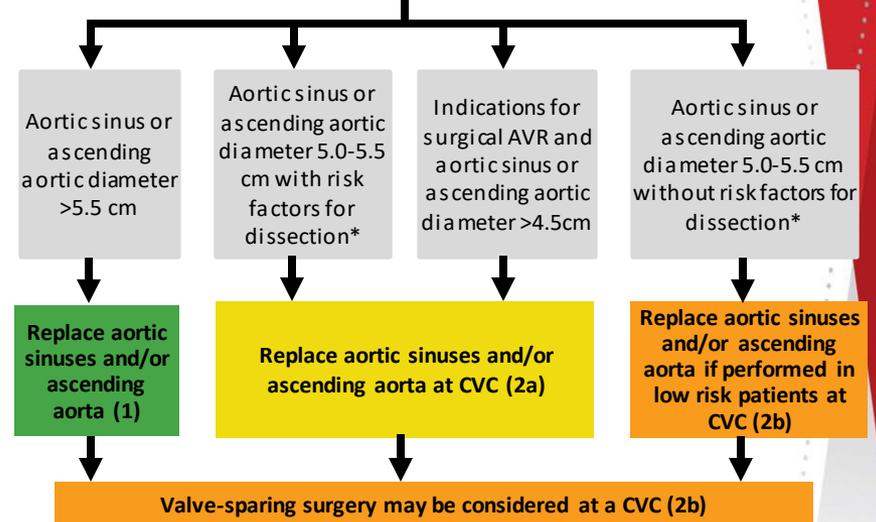


Figure 6. Treatment

## Bicuspid Aortic Valve



\*Family history of aortic dissection, aortic growth rate  $\geq 0.5$  cm/y, and/or presence of aortic coarctation.

Abbreviations: BAV indicates bicuspid aortic valve; CMR, cardiac magnetic resonance imaging; CTA, computed tomography angiography; CVC, comprehensive valve center; and TTE, transthoracic echocardiography.

## Clinical, anatomical and procedural factors that influence the choice of treatment modality for an individual patient (1)

	Favours TAVI	Favours SAVR
<b>Clinical characteristics</b>		
Lower surgical risk	-	+
Higher surgical risk	+	-
Younger age	-	+
Older age	+	-
Previous cardiac surgery (particularly intact coronary artery bypass grafts at risk of injury during repeat sternotomy)	+	-
Severe frailty	+	-
Active or suspected endocarditis	-	+

## Clinical, anatomical and procedural factors that influence the choice of treatment modality for an individual patient (2)

	Favours TAVI	Favours SAVR
<b>Anatomical and procedural factors</b>		
TAVI feasible via transfemoral approach	-	+
Transfemoral access challenging or impossible and SAVR feasible	-	+
Transfemoral access challenging or impossible and SAVR inadvisable	+	-
Sequelae of chest radiation	+	-
Porcelain aorta	+	-
High likelihood of severe patient–prosthesis mismatch (AVA <0.65 cm <sup>2</sup> /m <sup>2</sup> BSA)	+	-

## Clinical, anatomical and procedural factors that influence the choice of treatment modality for an individual patient (3)

	Favours TAVI	Favours SAVR
<b>Anatomical and procedural factors (continued)</b>		
Severe chest deformation or scoliosis	+	-
Aortic annular dimensions unsuitable for available TAVI devices	-	+
Bicuspid aortic valve	-	+
Valve morphology unfavourable for TAVI (e.g. high risk of coronary obstruction due to low coronary ostia or heavy leaflet/LVOT calcification)	-	+
Thrombus in aorta or LV	-	+

## Clinical, anatomical and procedural factors that influence the choice of treatment modality for an individual patient (4)

	Favours TAVI	Favours SAVR
<b>Concomitant cardiac conditions requiring intervention</b>		
Significant multi-vessel CAD requiring surgical revascularization	-	+
Severe primary mitral valve disease	-	+
Severe tricuspid valve disease	-	+
Significant dilatation/aneurysm of the aortic root and/or ascending aorta	-	+
Septal hypertrophy requiring myectomy	-	+