AORTIC VALVE DISEASES

ACADEMIC HALF-DAY

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Aortic Stenosis

Introduction:

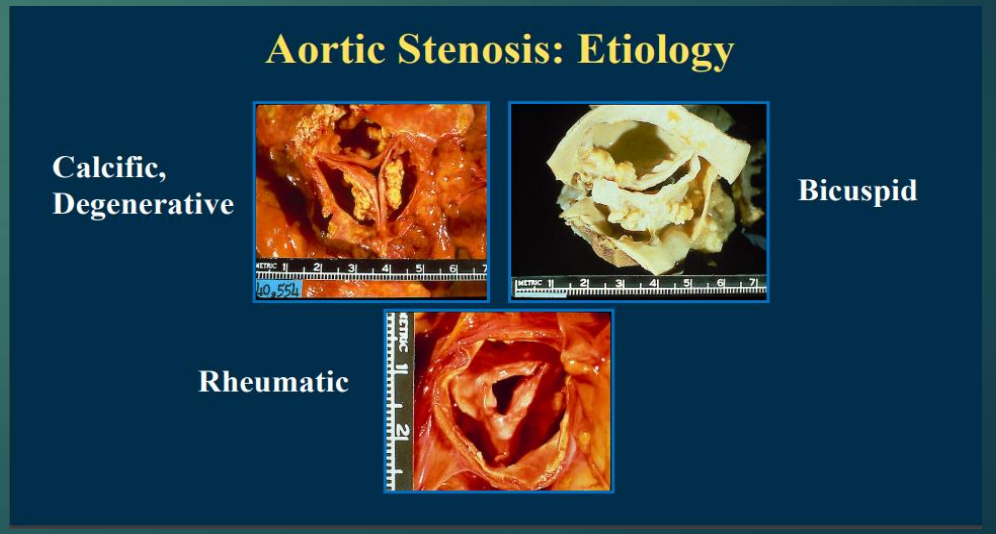
2.8% of patients > 75 years of age

Prolonged latent phase

High mortality rate in severe symptomatic AS

Common causes:

- Calcification normal trileaflet valve
- Calcification of a congenital **bicuspid aortic valve**
- Rheumatic valve disease
- Chest radiation



Which of the following findings would favor a diagnosis of AS over HOCM as the cause of a systolic heart murmur?

- A. Increasing intensity of the murmur in beats following a PVC
- B. Decrease in intensity of the murmur during Valsalva
- C. Radiation of the murmur to the suprasternal notch
- D. Change in configuration of the murmur at the apex

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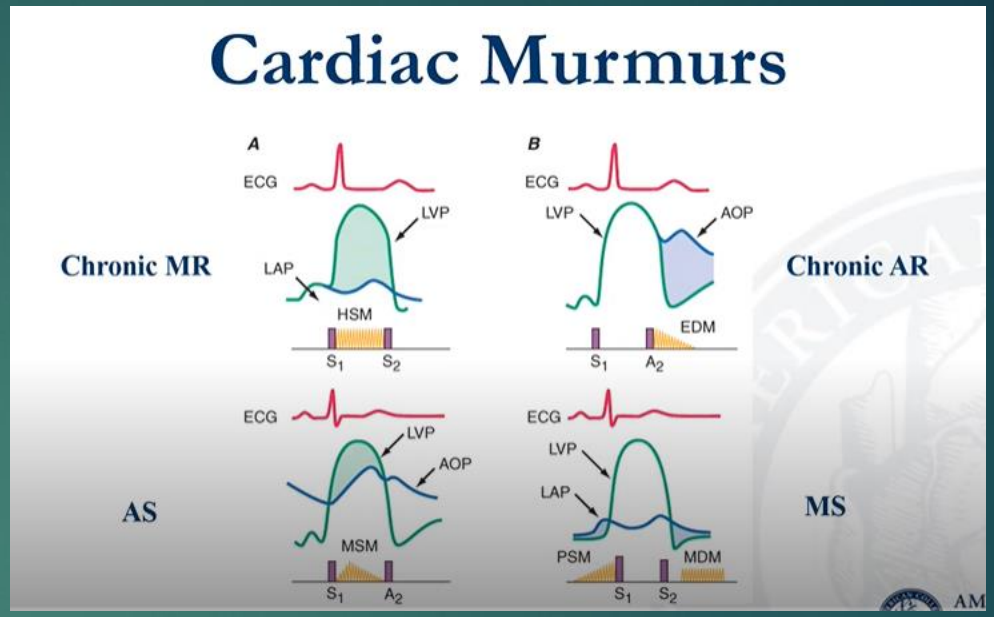
Physical Exam:

- Systolic ejection murmur
- Crescendo-decrescendo,
- Picked like configuration
- Loudest at the cardiac base,
- Radiates to carotids (R>L), LV apex

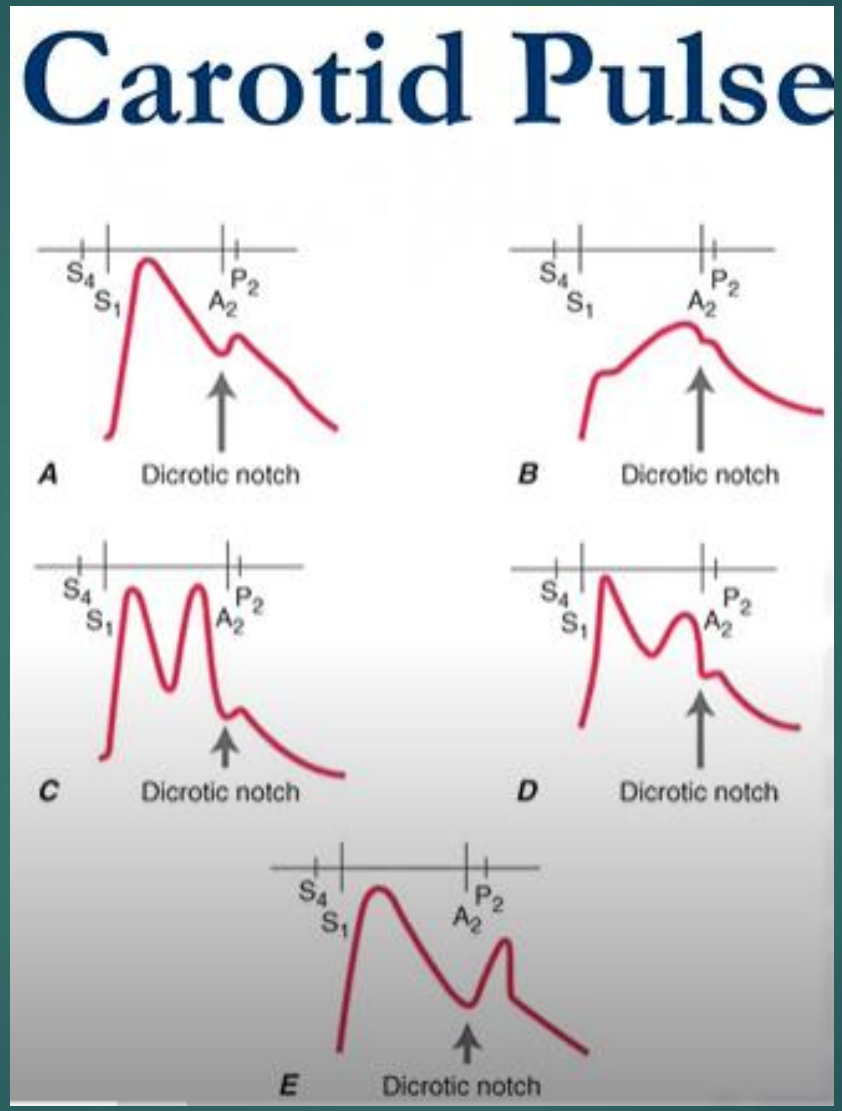


Severe disease:

- Grade III – IV murmur
- 4th heart sound
- Single or paradoxically split 2nd heart sound
- Decreased carotid artery pulse in amplitude and delayed in occurrence *(Parvus and Tardus)*

Caveat: Elderly patients, LFLG, Confusion with MR

Carotid Pulse



A 74 YOF with a h/o HTN and moderate AS presents to your outpatient clinic for follow-up. c/o worsening fatigue and dyspnea, but no chest pain, palpitations, presyncope, or syncope.

BP112/80 mm Hg HR: 66 bpm.

ECHO last year: Normal biventricular function, mild MR, and aortic peak velocity 3.1 m/sec with a calculated aortic valve area 1.3 cm2.

What physical examination finding would suggest progression of this patient's aortic stenosis?

A. Increased opening snap-S2 interval.

B. Ejection click.

C. Widened splitting of S2.

D. Enhanced A2.

E. Late-peaking murmur.

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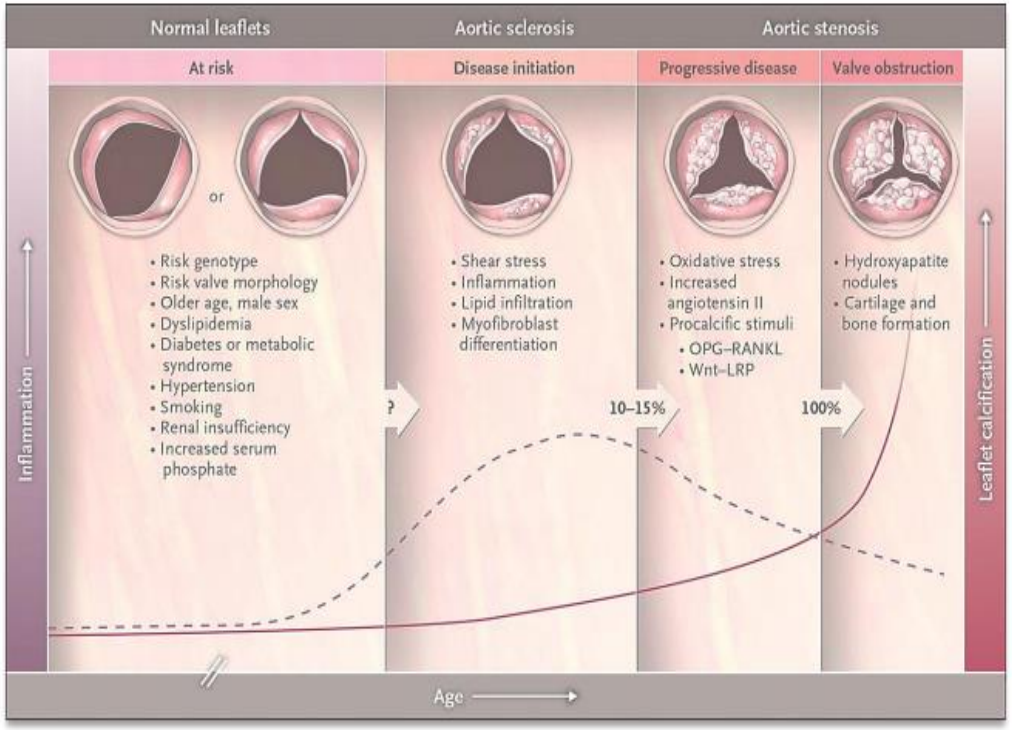
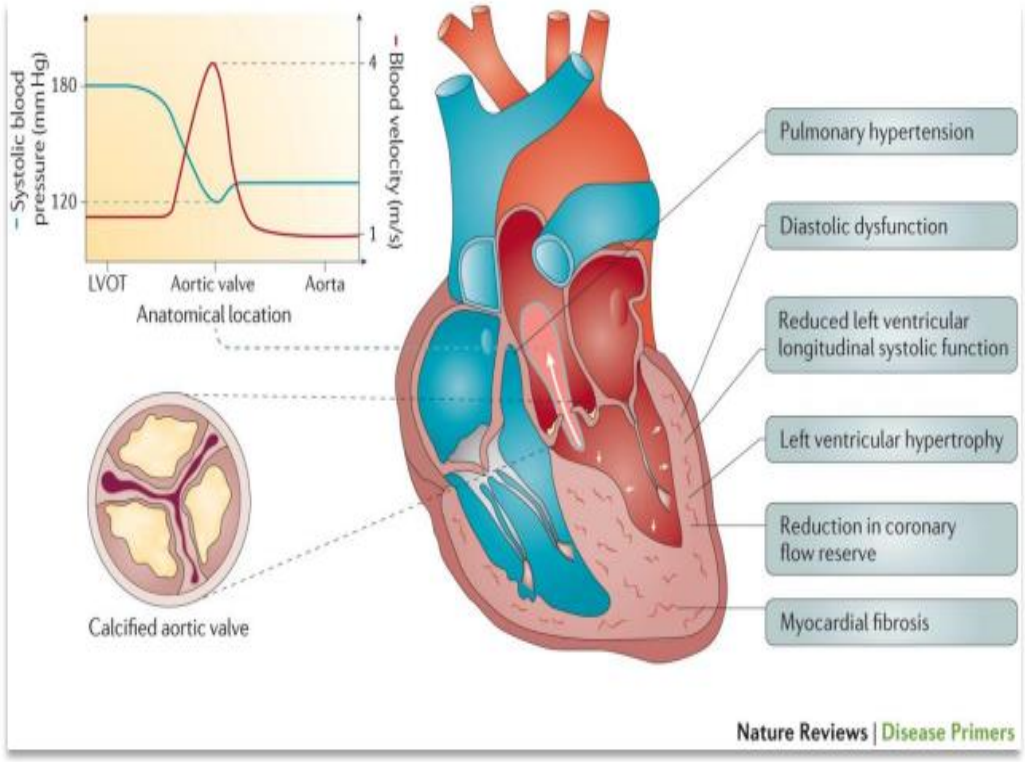
Natural history of aortic stenosis

Pathogenesis and Disease Progression



Otto CM, Prendergast B. NEJM 2014; 371:744

LV Response to AS



Nature Reviews | Disease Primers

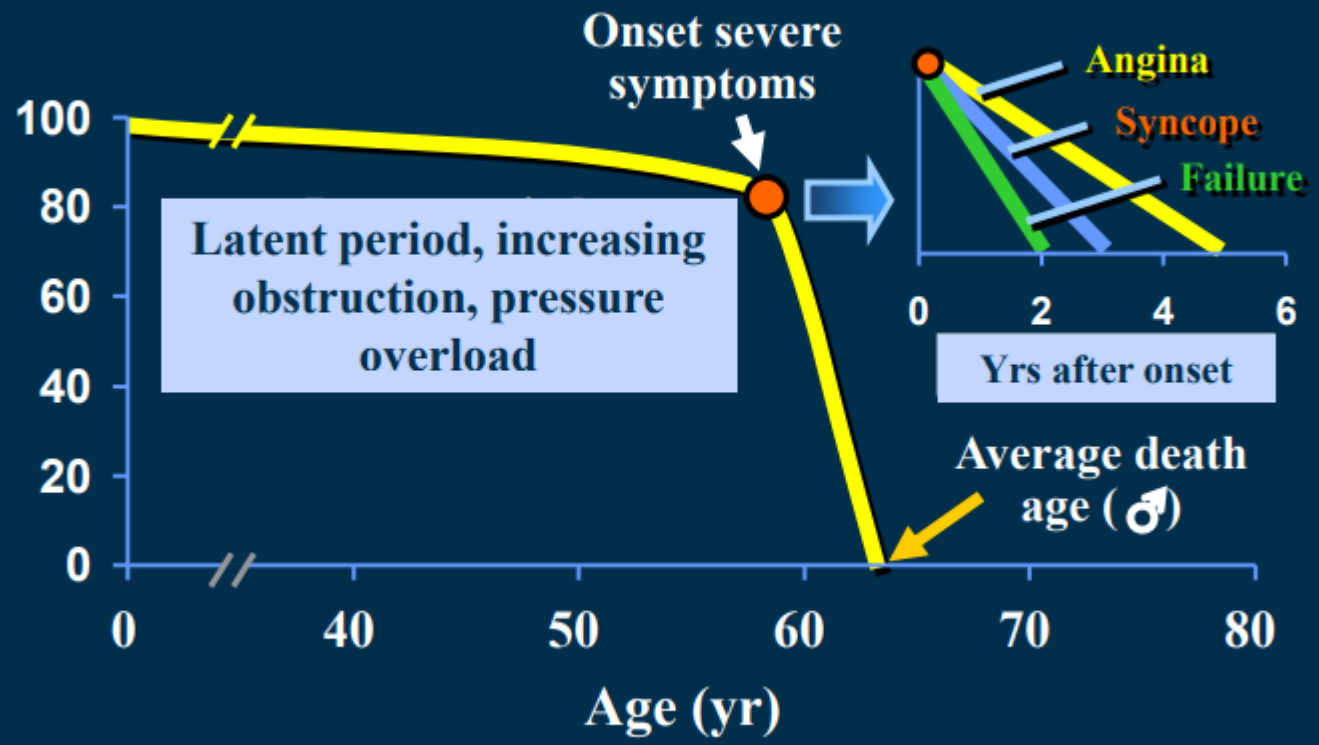
Symptoms:

- The most common symptoms is a decrease in baseline exercise capacity or exertional dyspnea
- Classic Triad: Angina, heart failure, presyncope late manifestations
- The process of worsening symptoms is very gradual therefore patients may compensate by adjusting with her activity level to avoid symptoms. (Question should be comparing physical capacity to 6 to 12 months prior)
- Rate of death in symptomatic aortic stenosis is excessively high unless aortic valve replacement is performed

50% of patients with severe AS will die within one year

- Very important to educate patients about timely medical attention once symptoms occur.

Natural History of Aortic Stenosis



Ross J Jr. and Braunwald E: *Circ* 38(Suppl 5):61, 1968

Stages of Aortic Stenosis

Stage	Definition	Valve Anatomy	Hemodynamics	Symptoms
A	At Risk for AS	Bicuspid Aortic Valve Aortic Sclerosis	Aortic V_{max} <2.0 m/sec	None
B	Progressive AS	Mild-moderate leaflet calcification with reduced systolic motion Rheumatic valve changes with commissural fusion	Mild AS - Aortic V_{max} 2.0 - 2.9 m/sec or mean ΔP <20 mm Hg Moderate AS - Aortic V_{max} 3.0 - 3.9 m/sec or mean ΔP 20 - 39 mm Hg	None
C Asymptomatic Severe AS				
C1	Asymptomatic Severe AS	Severe leaflet calcification with reduced opening	Aortic V_{max} ≥4.0 m/sec or mean ΔP ≥40 mm Hg AVA typically ≤1.0 cm^2, LVEF normal	None
C2	Asymptomatic Severe AS with reduced EF	Severe leaflet calcification with reduced opening	Aortic V_{max} ≥4.0 m/sec or mean ΔP ≥40 mm Hg AVA typically ≤1.0 cm^2, LVEF <50%	None
D Symptomatic Severe AS				
D1	Symptomatic severe high gradient AS	Severe leaflet calcification with reduced opening	Aortic V_{max} ≥4.0 m/sec or mean ΔP ≥40 mm Hg AVA typically ≤1.0 cm^2, LVEF normal	Decreased exercise tolerance Dyspnea on exertion Heart failure Angina Exertional presyncope Syncope
D2	Symptomatic severe low-flow, low-gradient AS with reduced LVEF	Severe leaflet calcification with reduced opening	Aortic V_{max} <4.0 m/sec or mean ΔP <40 mm Hg AVA ≤1.0 cm^2, LVEF <50%, DSE = Aortic V_{max} >4.0 m/sec, AVA <1.0 cm^2 at any flow rate	
D3	Symptomatic severe low-flow, low-gradient AS with normal LVEF	Severe leaflet calcification with reduced opening	Aortic V_{max} <4.0 m/sec or mean ΔP <40 mm Hg AVA ≤1.0 cm^2, Indexed AVA <0.6 cm^2/m^2, Stroke volume index <35 ml/m^2, LVEF ≥50%	

A 58 YOF presents to your office with a 6-month h/o palpitations and DOE. She has no medical problems and takes no medications.

PE reveals a body mass index of 30 kg/m2, HR 68 bpm, BP 160/80 mm Hg. JVP is 6 cm H20. Her cardiac exam reveals a systolic murmur with a single component S2.

What test is most likely to elucidate the diagnosis?

A. Injection of agitated saline contrast.

B. Chest X-ray.

C. Electrocardiogram.

D. Doppler tricuspid regurgitation velocity.

E. Doppler aortic velocity across the aortic valve.

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Diagnostic testing:

TTE:

Transvalvular velocity/gradient, valve area, valve anatomy, stroke-volume index, LV morphology and function

LV hypertrophy, LV volume, LV diastolic function, LV global longitudinal strain, presence of coexisting valvular disease

Hemodynamic Assessment of Aortic Stenosis Severity by Echocardiogram

	Aortic Sclerosis	Mild	Moderate	Severe	Very Severe
Peak AV velocity (m/s)	<2.0 m/s	2.0-2.9	3.0-3.9	≥4.0	≥5.0
Mean Gradient (mm Hg)	—	<20	20-39	≥40	≥60
AVA (cm^2)	—	>1.5	>1.0-1.5	≤1.0	≤0.60
Indexed AVA (cm^2/m^2)	—	>0.85	>0.60-0.85	≤0.60	
Velocity Ratio	—	>0.50	>0.25-0.50	≤0.25	

Exercise testing:

- Asymptomatic Severe AS can be assessed by exercise testing to evaluate functional capacity and confirm asymptomatic status
- Symptomatic patients with severe aortic stenosis should not undergo exercise testing

Dobutamine stress echocardiography:

- Decreased aortic valve area < 1 cm2 but low pressure gradient with LVEF <50% low-dose dobutamine stress echocardiogram is recommended.
- Determine contractile reserve

CT imaging:

- Discordant echocardiographic data patients with low output/low gradient aortic stenosis with normal or reduced EF, CT aortic valve calcium score is helpful.
- If calcium score is above 1200 AU in women (mostly fibrotic) or more than 2000 and then (mostly calcific) severe stenosis is diagnosed

Cardiac catheterization:

- Can be done in the setting of inconclusive results or discrepancy between echo and clinical evaluation.
- Crossing stenotic aortic valve carries a risk of stroke

An 88 YOF presents to clinic for progressive DOE and lower extremity edema. PMH: osteoarthritis and HTN. Meds: ASA 81, metoprolol suc. 25 mg, amlodipine 5 mg, and naproxen as needed.

PE, BP: 130/60 , HR: 70, RR: 16 bpr. JVP is 10 cm H20. There are bibasilar crackles. She has a late-peaking, harsh systolic murmur along the right upper sternal border with a single S2. There is 2+ bilateral lower extremity edema.

ECHO: Severely calcified aortic valve with reduced leaflet excursion.

Peak velocity across the valve is 3.3 m/sec, mean gradient of 28 mm Hg. Valve area was 0.8 cm2 and dimensionless index is 0.22. LV is mildly dilated with a LVEF of 25-30% and global hypokinesis.

Which of the following is the most appropriate next step in the management of this patient?

- A. Exercise myocardial perfusion scan.
- B. Right and left heart catheterization.
- C. Cardiac magnetic resonance imaging.
- D. Transesophageal echocardiography.
- E. Dobutamine stress echocardiography.

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Dobutamine Stress Echocardiography to Determine Low-Flow, Low-Gradient Severe Aortic Stenosis With Reduced Ejection Fraction

*Low-dose dobutamine stress echo protocol**

- Obtain baseline echographic images
- Start dobutamine infusion dose 2.5-5.0 mcg/kg/min to maximum dose of 20 mcg/kg/min

Infusion stopped when:

1. Maximum dose of dobutamine reached
2. Positive result obtained
3. Heart rate rises 10-20 bpm over baseline or exceeds 110 bpm
4. Symptoms, blood pressure fall, or concerning arrhythmias

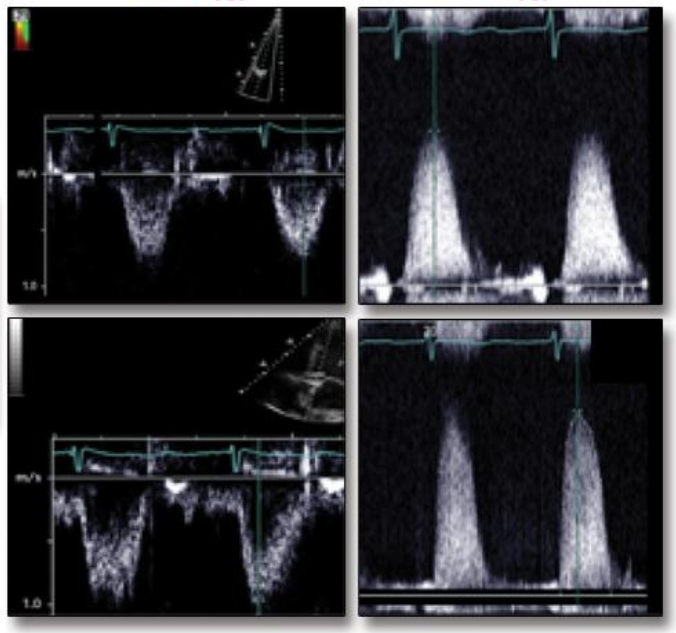
Positive Results:

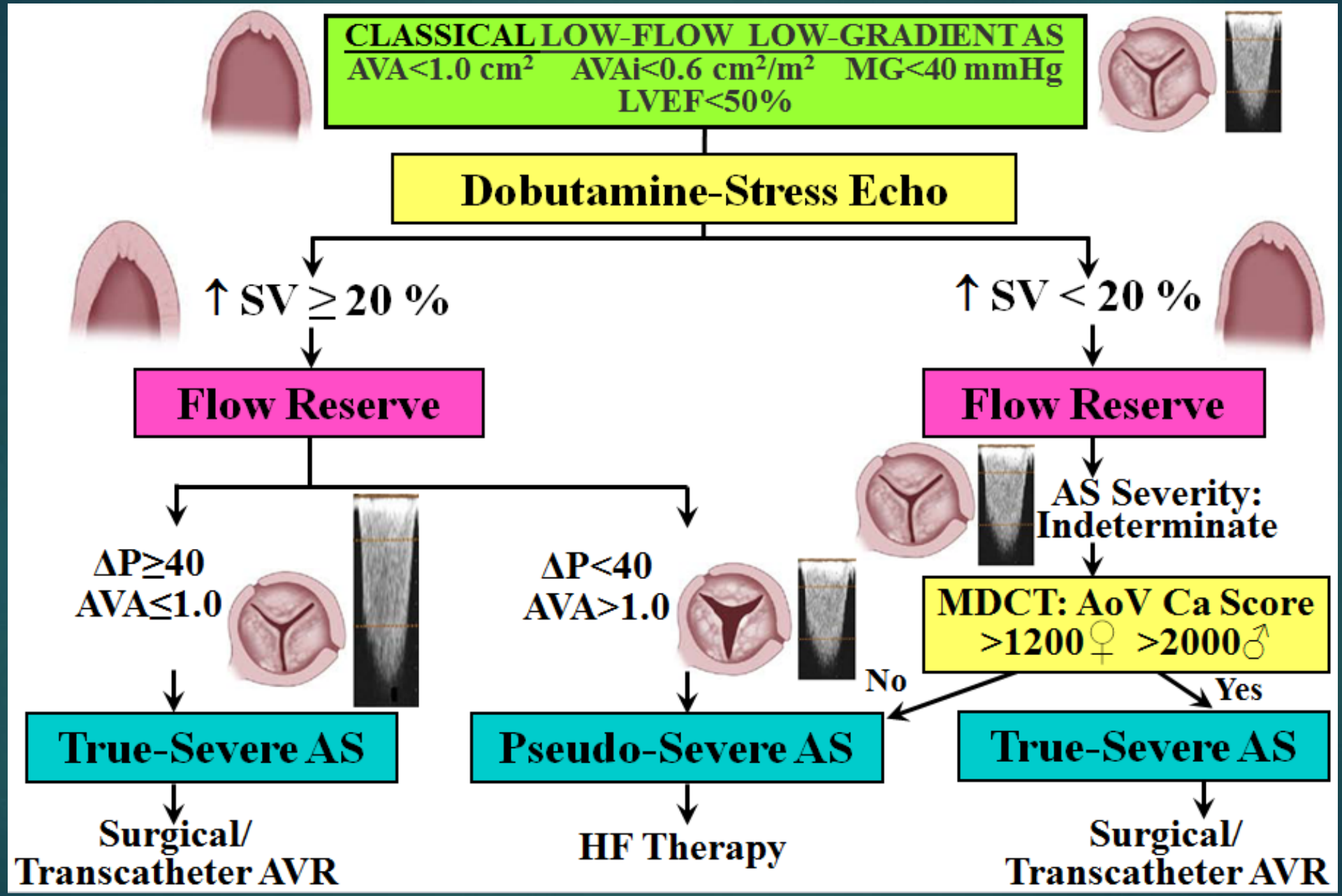
- Increase in effective AVA >1.0 cm^2 (pseudostenosis)
- Peak AV velocity >4.0 m/s or a mean gradient >40 mm Hg with an AVA <1.0 cm^2 at any flow rate (true severe stenosis)
- Absence of contractile reserve – failure to exceed stroke volume by >20% (predicts poor surgical outcomes)

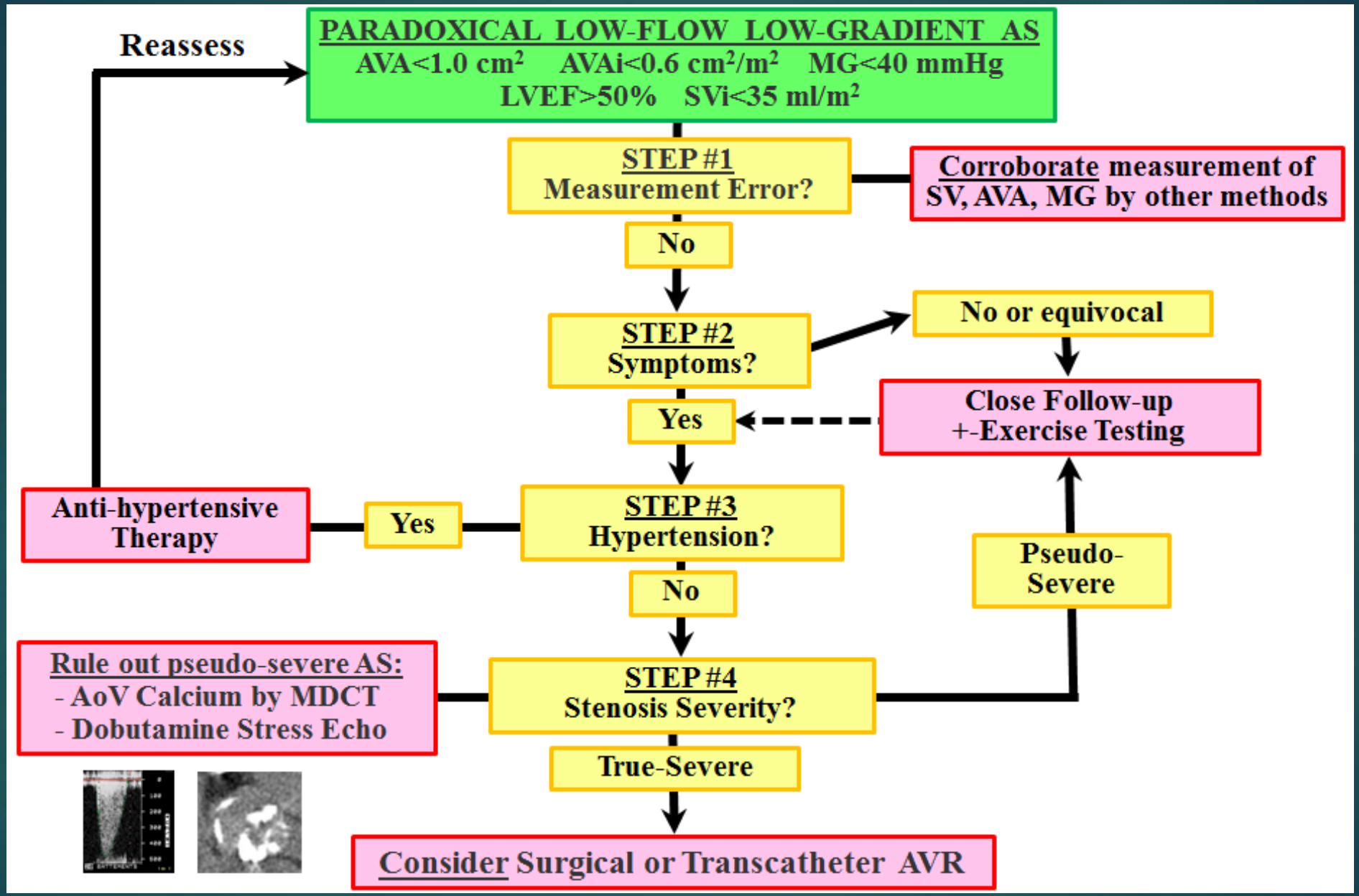
Patients with LVEF 35% with low-flow, low-gradient severe AS confirmed by low dose dobutamine stress protocol

Baseline
Peak AV_{vel} = 3.4 m/s
Mean Grad = 27 mm Hg
AVA = 0.80 cm^2

Peak Dobutamine
Peak AV_{vel} = 4.1 m/s
Mean Grad = 40 mm Hg
AVA = 0.90 cm^2




CLASSICAL LOW-FLOW LOW-GRADIENT AS
AVA<1.0 cm² AVAi<0.6 cm²/m² MG<40 mmHg
LVEF<50%
Dobutamine-Stress Echo
↑ SV ≥ 20 %
↑ SV < 20 %
Flow Reserve
Flow Reserve
ΔP≥40
AVA≤1.0
ΔP<40
AVA>1.0
AS Severity:
Indeterminate
MDCT: AoV Ca Score
>1200♀ >2000♂
No
Yes
True-Severe AS
Pseudo-Severe AS
True-Severe AS
Surgical/
Transcatheter AVR
HF Therapy
Surgical/
Transcatheter AVR


Reassess
PARADOXICAL LOW-FLOW LOW-GRADIENT AS
AVA<1.0 cm² AVAi<0.6 cm²/m² MG<40 mmHg
LVEF>50% SVi<35 ml/m²
STEP #1
Measurement Error?
Corroborate measurement of SV, AVA, MG by other methods
No
STEP #2
Symptoms?
No or equivocal
Close Follow-up
+-Exercise Testing
Yes
Anti-hypertensive Therapy
Yes
STEP #3
Hypertension?
Pseudo-Severe
No
Rule out pseudo-severe AS:
- AoV Calcium by MDCT
- Dobutamine Stress Echo
STEP #4
Stenosis Severity?
True-Severe
Consider Surgical or Transcatheter AVR

A 52 YOM, h/o Hodgkin lymphoma in childhood treated with chest irradiation, HTN, and recent occult GI bleeding presumed to be secondary to AVM malformation is referred to your clinic for evaluation of a new murmur and mild DOE.

PE : BP: 126/74 mm Hg, HR: 72 bpm, and a late peaking systolic murmur.

ECHO: Bicuspid aortic valve (BAV) with mean gradient of 42 mm Hg. Ascending aorta is 3 cm in diameter.

He is referred for surgical evaluation.

What is the best next step in the management of this patient?

A. Bioprosthetic aortic valve replacement.

B. Transcatheter aortic valve implantation.

C. Mechanical aortic valve replacement.

D. Ascending aorta repair.

E. Medical management.

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Management:

No guideline directed medications are recommended to slow the progression of AS

Patients should be evaluated for conventional cardiovascular risk factor modifications. Lifestyle changes, blood pressure control, lipid management smoking cessation etc.

Moderate exercises in adults with less than severe aortic stenosis

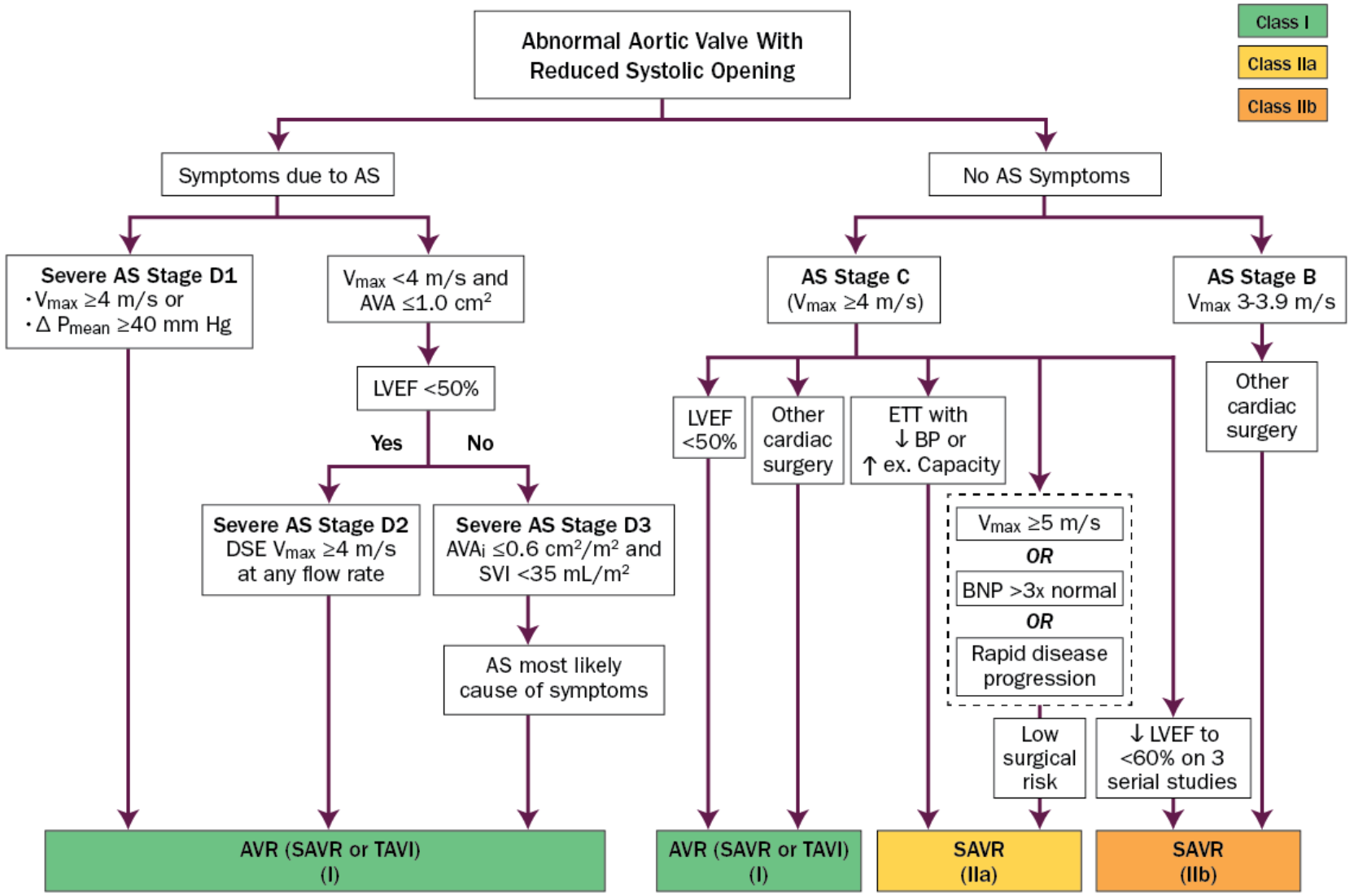
Strenuous activity and competitive sports should be avoided in severe AS

Decompensated HF benefit from afterload reduction while waiting for intervention

Class I indication

- Symptomatic severe aortic stenosis
- Asymptomatic patients with a reduced ejection fraction less than 50%
- Patient requiring cardiac surgery

Indications and Timing for AVR



A 48 YOM presents for evaluation of bicuspid AS because of worsening SOB over the past few months. He is an avid motorcyclist and despite a recent accident, would never consider not riding.

ECHO 6 months ago: Normal biventricular function, a peak transaortic velocity of 4.2 m/sec, peak transaortic gradient of 72 mm Hg, mean gradient of 48 mm Hg, and calculated aortic valve area of 0.8 cm2.

PMH: Hypothyroidism. BP: 128/66 mm Hg, HR: 72 bpm, and he has a normal S1 and a late peaking harsh systolic murmur. His lungs are clear to auscultation bilaterally and he has no peripheral edema.

In a shared decision-making approach, which of the following is the most likely approach to be aligned with the patient's preferences?

- A. Transesophageal echocardiogram.
- B. Repeat transthoracic echocardiogram in 1 year.
- C. Bioprosthetic aortic valve replacement.
- D. Exercise stress testing.
- E. Mechanical aortic valve replacement.

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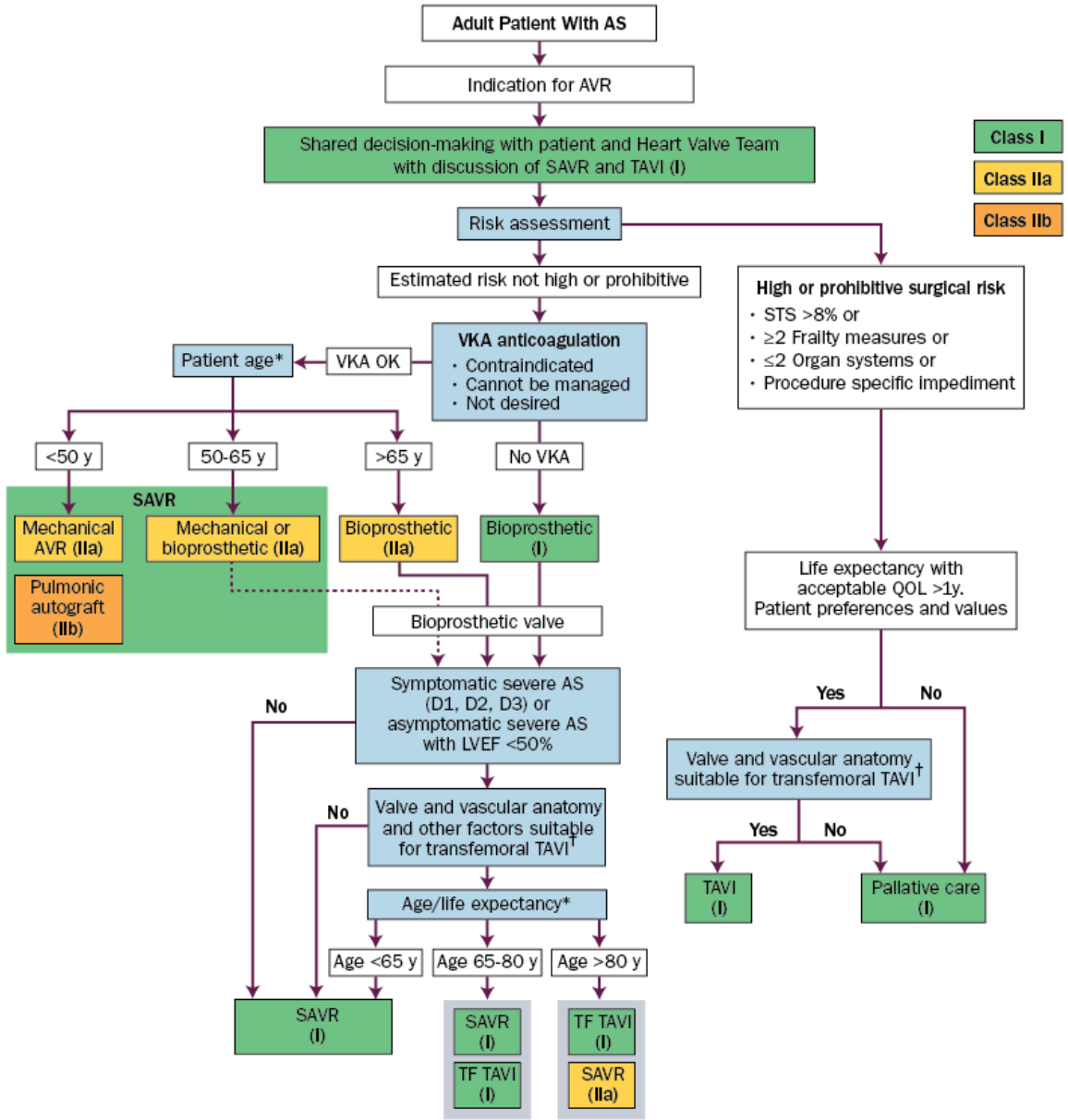
Choice of TAVI Versus SAVR in Patients With AS



A 60 yom presents for evaluation of a murmur. He exercises by walking his dog two miles daily without limitations. h/o HTN, HLP. Meds: amlodipine 5 mg, atorvastatin 20 mg daily.

PE: HR: 70, BP:128/80, JVP is 4 cm H20. His lungs are clear. His cardiac exam shows a soft systolic ejection murmur radiating to the carotid arteries. His extremities have no edema.

His echocardiogram shows an ejection fraction of 60% and aortic stenosis (AS) with a peak velocity of 2.3 m/sec, mean gradient of 13 mm Hg, and a valve area of 1.8 cm2.

In the absence of new symptoms, what is the appropriate interval for a repeat echocardiogram in this patient?

A. 2 years

B. 6 months

C. 3 years

D. 6 years

E. 1 year

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D. 6 years

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Surveillance:

- Repeat echocardiogram every 6 months to 1 year for severe AS
- 1 to 2 years for moderate AS
- 3 to 5 years for mild AS

More frequent monitoring if rapid progression (increase in AV maxV > 0.3 m/sec/yr or decrease in valve area > 0.1 cm2 per year

Stage	Type of Valve Lesion			
	Aortic Stenosis*	**Aortic Regurgitation**	**Mitral Stenosis**	**Mitral Regurgitation**
Progressive (Stage B)	Every 3–5 y (mild severity; V_{max} 2.0–2.9 m/s) Every 1–2 y moderate severity; V_{max} 3.0–3.9 m/s)	Every 3–5 y (mild severity) Every 1–2 y (moderate severity)	Every 3–5 y (MV area >1.5 cm^2)	Every 3–5 y (mild severity) Every 1–2 y (moderate severity)
Severe asymptomatic(Stage C1)	Every 6–12 mo (V_{max} ≥4 m/s)	Every 6–12 mo Dilating LV: More frequently	Every 1–2 y (MV area 1.0–1.5 cm^2) Every year (MV area <1.0 cm^2)	Every 6–12 mo Dilating LV: More frequently

A 30 YOM is referred for evaluation of a murmur. No symptoms and has no significant medical history. PE: height is 69 inches and weight is 185 lbs. BP is 135/70 mm Hg with a regular HR 78 bpm. His lungs are clear.

Prominent carotid pulsations are present. JVP is at the level of the sternal notch. The apical impulse is slightly enlarged and laterally displaced to the anterior axillary line. The S1 and S2 are normal, and an S3 is present. There is an early systolic click that does not change with inspiration. Both a soft (grade 2/6) crescendo-decrescendo systolic murmur and a soft (grade 2/6) decrescendo diastolic murmur are present along the left sternal border.

Which of the following is the most likely valvular abnormality in this patient?

A. Bicuspid aortic valve with regurgitation.

B. Patent ductus arteriosus.

C. Pulmonic valve stenosis with regurgitation.

D. Rheumatic mitral stenosis and regurgitation.

E. Degenerative aortic valve stenosis with regurgitation.

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E. Degenerative aortic valve stenosis with regurgitation.

Aortic Regurgitation:

Prevalence: Between 4.9% and 10% in the US

Male > Female

More commonly in male

Etiology:

Primary valve vs. disorder of aortic root

- Bicuspid aortic valve
- Calcific aortic disease
- Aortic dilation
- Acute case: Infective endocarditis or Aortic dissection
- Rheumatic heart disease (developing countries)

There is significant association between bicuspid aortic valve and aortopathy

ACUTE:

Regurgitation to a normal size LV with no time to adaptation

↓

Increased LVEDP when large volume of blood is delivered to a noncompliant LV

↓

Reduction of SV, pulmonary congestion and low cardiac output

CHRONIC:

Changes happen over time

↓

Excessive preload and afterload

↓

Compensated phase: LV adapts to volume by developing LVH to maintain normal wall stress

↓

Concentric hypertrophy

Systolic function is preserved due to combination of LV chamber dilatation and hypertrophy

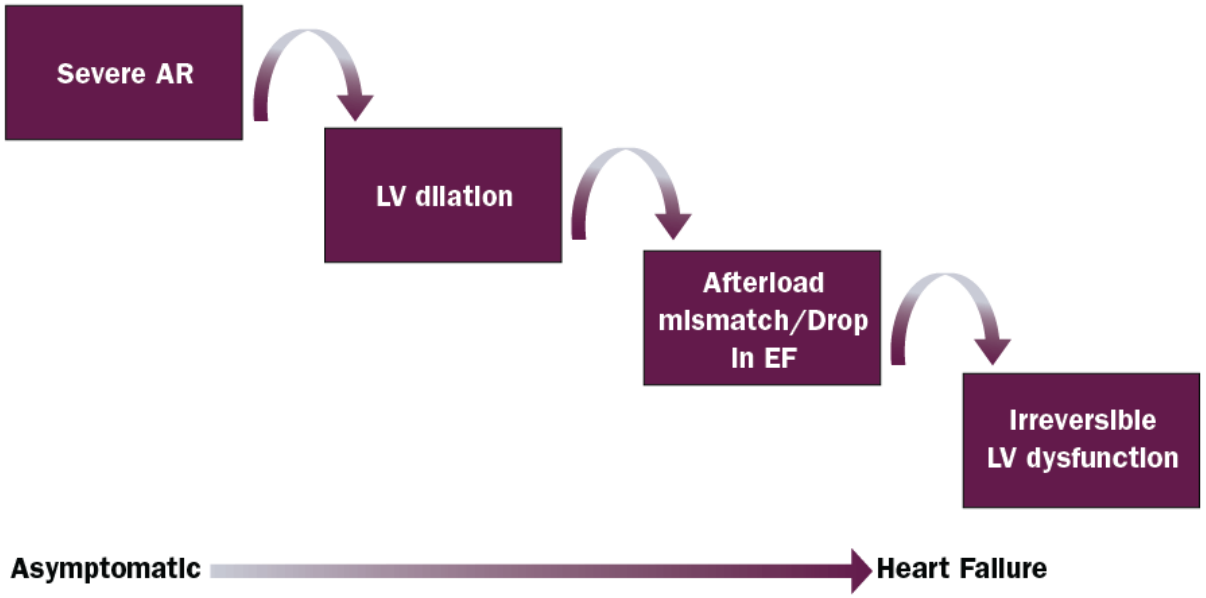
↓

Eventually LA pressure increases and symptoms occur left compensatory hypertrophy fails (afterload mismatch)

↓

systolic dysfunction

Pathophysiology of Chronic, Severe Aortic Regurgitation



Natural History:

- Chronic AR asymptomatic for many years
- Morbidity and mortality is related to severity, etiology, presence of symptoms, size and function of the LV
- Mild to moderate AR have an excellent prognosis
- Severe AR rate of progression to symptoms or LV dysfunction is 4.3 %/year

- High risk markers:

Increased LV end-systolic dimension

Increased LV end-diastolic dimension

Reduced exercise ejection fraction

- Since LV systolic dysfunction that is short-lived is reversible with surgical correction of AR, noninvasive monitoring is recommended
- Acute AR is catastrophic unless treated surgically in a timely manner
- Medically treated patient's having mortality of 75% whereas surgically treated patients have mortality and 25% range

Clinical presentation:

- HF symptoms
- Increase in both EDP and volume
- Increased right sided pressures
- SOB with exertion and with rest
- Palpitations
- Syncope (diminished diastolic blood pressure)
- Angina (because of decreased coronary blood flow especially during exercise)

Physical exam:

- Hyperdynamic apical impulse, displaced laterally and inferiorly
- Peripheral signs of severe chronic aortic regurgitation results from a widened pulse pressure
- **Classic murmur**: Diastolic murmur, LSB (if related to aortic valve) RSB (if related to aortic root)

- Sometimes a systolic aortic murmur related to increase the stroke-volume is also heard
- Second low-pitched diastolic murmur (Austin Flint murmur). Similar to MS (aortic regurgitation hits the mitral valve causing it to close prematurely)

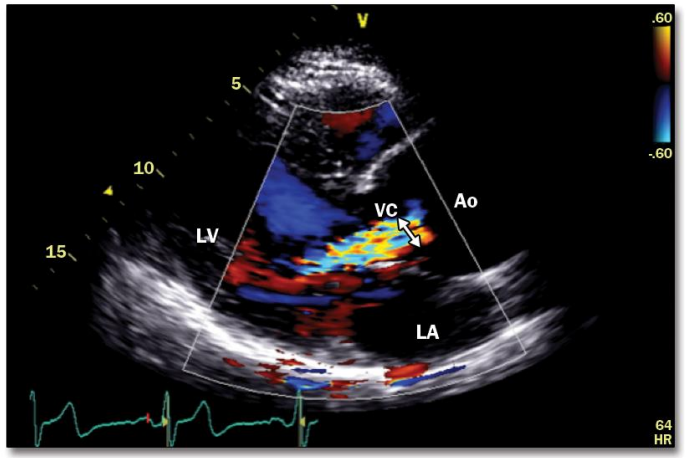
Peripheral Signs of Chronic Severe Aortic Regurgitation

de Musset sign	Head bobbing in sync with the arterial pulse
Duroziez's sign	Systolic and diastolic bruit heard over the femoral artery with compression by the stethoscope
Traube's sign	Loud systolic and diastolic sounds heard over the femoral artery
Quincke's pulse	Pulsation of the nail beds
Müller's sign	Systolic pulsation of the uvula
Hill's sign	Lower extremity blood pressure >40 mm Hg higher than the brachial artery pressure
Corrigan's (water hammer) pulse	Rapid and forceful distension of the arterial pulse with quick collapse

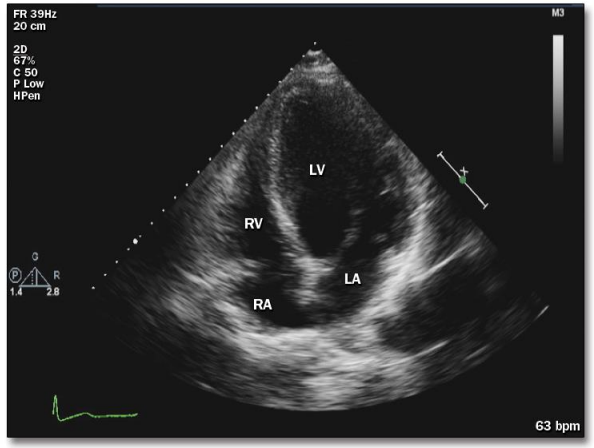
ACC/AHA Recommendations for Diagnostic Testing in AR

Class I
• In patients with signs or symptoms of AR, TTE is indicated for assessment of the cause and severity of regurgitation, LV size and systolic function, prognosis, and timing of valve intervention. • In patients with a BAV or with known dilation of the aortic sinuses or ascending aorta, TTE is indicated to evaluate the presence and severity of AR. • In patients with moderate or severe AR and suboptimal TTE images or a discrepancy between clinical and TTE findings, TEE, CMR, or cardiac catheterization is indicated for the assessment of LV systolic function, systolic and diastolic volumes, aortic size, and AR severity.
Other
• In patients with known AR and changes in clinical status (e.g., development of dyspnea or angina), repeat imaging, typically with echocardiography, is recommended. • Serial echocardiography to monitor LVEDV, LVESV, and reduction in systolic function is recommended in patients with asymptomatic severe AR and normal LV systolic function. • Exercise testing can be used to assess symptom status and functional capacity in patients with severe AR.

Severe Aortic Regurgitation in the Parasternal Long-Axis View



Apical Four-Chamber View



American College of Cardiology/American Heart Association Guidelines for Monitoring with Noninvasive Imaging in Patients with Aortic Regurgitation

Stage	Frequency of Monitoring With Echocardiography
Progressive (stage B)	Every 3-5 years (mild severity) Every 1-2 years (moderate severity)
Severe (stage C)	Every 6-12 months Dilating LV: more frequently

A 55 YOW is referred to you for evaluation and treatment of AR. h/o BAV.

She exercises four to five times per week on an upright stationary bicycle and reports no symptoms. PMH: HLD. Atorvastatin 40 mg.

PE: BP: 126/54 mm Hg, HR: 84 bpm. Her lungs are clear to auscultation. LV apical impulse is normal and nondisplaced. A soft, grade 2/4 diastolic decrescendo murmur is present at the left sternal border. A systolic ejection click is noted. There is no S3 or S4, and no peripheral edema.

ECHO: LVEF 59% with an end-systolic dimension of 33 mm and an end-diastolic dimension of 50 mm. The aortic root diameter is 3.9 cm at the sinuses of Valsalva. There is a BAV with severe AR.

Which of the following is the next best step the treatment of this patient?

A. Metoprolol succinate 25 mg.

B. No additional medications.

C. Enteric coated aspirin 81 mg.

D. Extended release nifedipine 30 mg.

E. Enalapril 5 mg.

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ACC/AHA Guidelines for Medical Therapy in AR

Class I
• In asymptomatic patients with chronic AR (stages B and C), treatment of HTN (SBP >140 mm Hg) is recommended. • In patients with severe AR who have symptoms and/or LV systolic dysfunction (stages C2 and D) but a prohibitive surgical risk, GDMT for reduced LVEF with ACEIs, ARBs, and/or sacubitril/valsartan is recommended.
Other
• Medical therapy with ACEIs and BBs is reasonable in patients with severe AR who have symptoms and/or LV dysfunction (stages C2 and D) when surgery is not performed because of comorbidities.

A 67 yom with chronic severe AR and trileaflet aortic valve presents to the cardiology clinic follow-up. He denies any dyspnea with walking at a moderate pace, mowing his lawn, or other usual activities.

PE: II/VI diastolic decrescendo murmur along the left sternal border. JVP NL, Lungs clear, no peripheral edema.

Echocardiogram is obtained.

If present, which of the following echocardiographic findings would support surgical aortic valve replacement (AVR) for this patient?

A. A left ventricular ejection fraction of 56%.

B. An aortic root of 4.8 cm at the sinuses of Valsalva.

C. A left ventricular end systolic dimension of 52 mm.

D. A left ventricular end diastolic dimension of 61 mm.

E. Holodiastolic flow reversal in the abdominal aorta.

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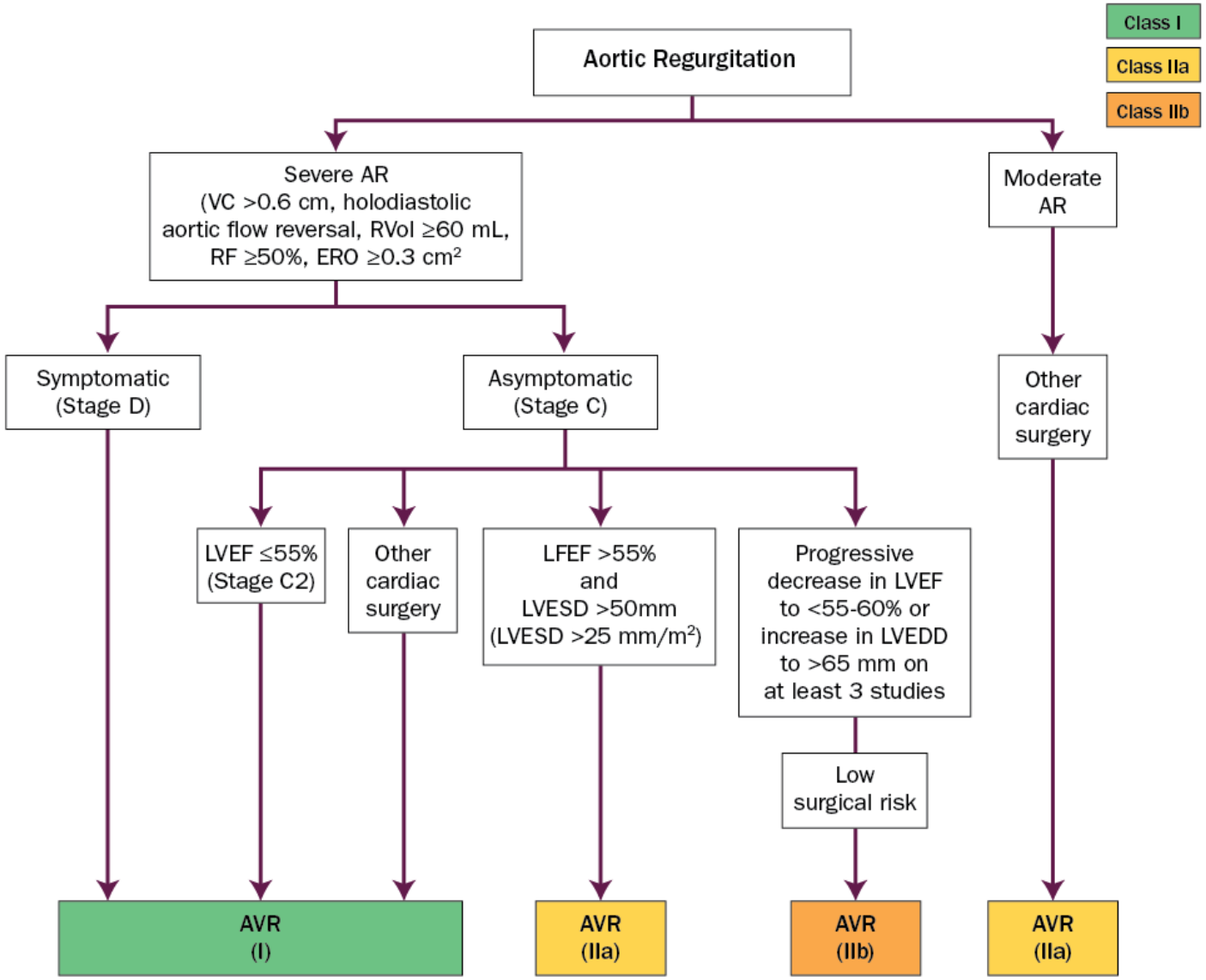
ACC/AHA Recommendations for Surgical Intervention in AR

Class I
• In symptomatic patients with severe AR (stage D), AoV surgery is indicated regardless of LV systolic function. • In asymptomatic patients with chronic severe AR and LV systolic dysfunction (LVEF ≤55%; stage C2), AoV surgery is indicated if no other cause for systolic dysfunction is identified. • In patients with severe AR (stage C or D) who are undergoing cardiac surgery for other indications, AoV surgery is indicated.
Class IIa
• In asymptomatic patients with severe AR and normal LV systolic function (LVEF >55%), AoV surgery is reasonable when the LV is severely enlarged (LVESD >50 mm or indexed LVESD >25 mm/m^2). • In patients with moderate AR (stage B) who are undergoing cardiac or aortic surgery for other indications, AoV surgery is reasonable.
Class IIb
• In asymptomatic patients with severe AR and normal LV systolic function at rest (LVEF >55%; stage C1) and low surgical risk, AoV surgery may be considered when there is a progressive decline in LVEF on ≥3 serial studies to the low–normal range (LVEF 55-60%) or a progressive increase in LV dilation into the severe range (LVEDD >65 mm).
Class III
• In patients with isolated severe AR who have indications for SAVR and are candidates for surgery, TAVI should not be performed.

Timing of Intervention for AR



STRUCTURAL DISEASE

TAVR in Bicuspid Aortic Stenosis: Data and Current Limitations

Reviewing the current state of transcatheter aortic valve replacement in the bicuspid aortic valve and what is needed for further validation.

By Siamac Yazdchi, MD, and Hursh Naik, MD, FSCAI

CONCLUSION

TAVR in comparison with SAVR seems to be a safe and effective therapy in patients with severe bicuspid aortic valve stenosis in the absence of aortopathy and high-risk anatomic features. However, further clinical trials and prospective studies aimed at comparing SAVR with TAVR in low-risk patients are needed to have a better understanding of the long-term results of this growing technology. ■

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- Mathew W. Martinez, MD FACC Sports cardiology medical director HCM Co-director Atlantic Health System/Morristown Med Center (AR 2021 ACC board review)
- Patrick T. O'Gara, MD, MACC Watkins Family Distinguished Chair in Cardiology Brigham and Women's Hospital Professor of Medicine, Harvard Medical School, (AS ACC board review)
- Low-Flow Low Gradient aortic stenosis. When is it severe? Abdellaziz Dahou, MD, MSc; Phillippe Pibarot, DVMPhD, FACC

The End