Aortic Valve Disease

8/17/2021

Aortic Valve Disease

- Aortic Regurgitation
  - Acute or chronic
- Aortic Stenosis
  - Always chronic

Acute Severe Aortic Regurgitation

Sudden large volume imposed on an unprepared left ventricle

No compensatory LV enlargement

Decrease in effective LVSV

Rapid increase in LV diastolic pressure

Acute Aortic Regurgitation

- Endocarditis
- Aortic Dissection
- Rupture of Fenestrated Cusp
- Trauma
- Iatrogenic

Question 1:

- A patient is in cardiogenic shock due to acute severe aortic regurgitation. What is the best immediate treatment option?
  - A. Fluids and pressors
  - B. Intra-aortic balloon pump (IABP)
  - C. Nitroprusside and inotropes
  - D. Emergent surgery (aortic valve replacement)

Severe Acute AR: Treatment

Urgent surgical intervention generally indicated (Type A dissection, acute AR)

IABP strictly contraindicated

Nitroprusside and inotropes can be used

Pressors are relatively contraindicated

Beta blockers relatively contraindicated

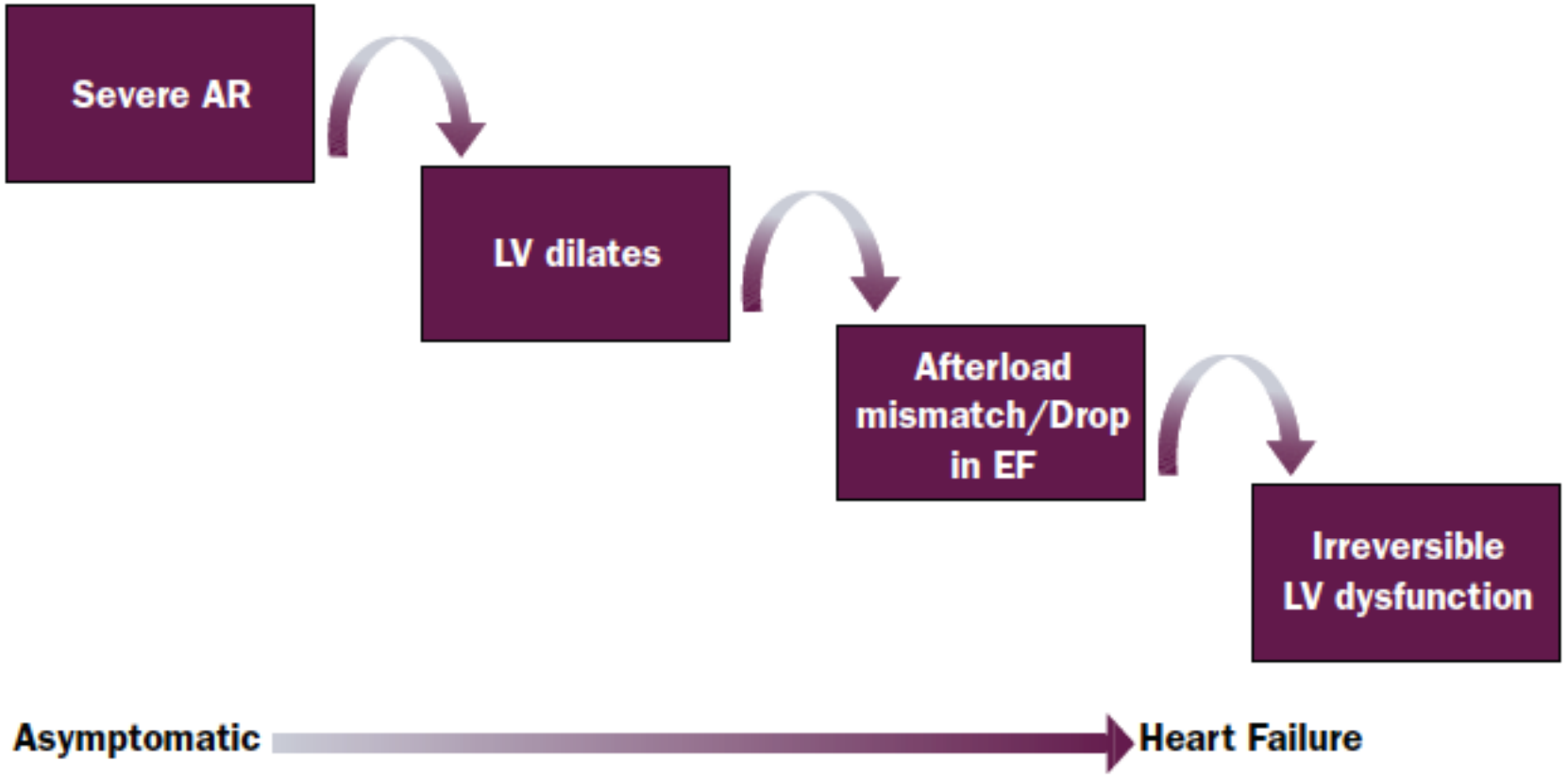
Chronic Aortic Regurgitation

Primary Valve Disorder	Disorder of the Aortic Root
Degenerative calcific stenosis Infective endocarditis (Figure 4) Trauma Congenital defects • Unicuspid, bicuspid, quadricuspid aortic valve • Rheumatic • Ventricular septal defect • Subaortic membrane (Figure 5) Rheumatic heart disease Myxomatous infiltration Systemic disorders that affect the aortic valve • Lupus erythematosus • Giant cell arteritis • Takayasu's arteritis • Ankylosing spondylitis • Jaccoud's arthropathy • Whipple's disease • Crohn's disease Appetite suppressant drugs	Degenerative (age-related) dilatation Degeneration of the extracellular matrix • Associated with Marfan's or Loeys-Dietz syndromes • Associated with bicuspid aortic valves Aortic dissection Systemic hypertension Osteogenesis imperfecta Syphilitic aortitis Ankylosing spondylitis Giant cell arteritis Behcet syndrome Psoriatic arthritis Relapsing polychondritis Reiter syndrome

Chronic Aortic Regurgitation

- Physical Exam (probably the most findings of any disease process)
- Widened pulse pressure
- Inferolaterally displaced PMI
- Early diastolic decrescendo murmur; handgrip can augment
- Hyperdynamic pulses (Corrigans – carotid, Waterhammer – brachial/radial, Quincke's – nail bed

Pathophysiology of Chronic, Severe Aortic Regugitation



Grading of Aortic Regurgitation

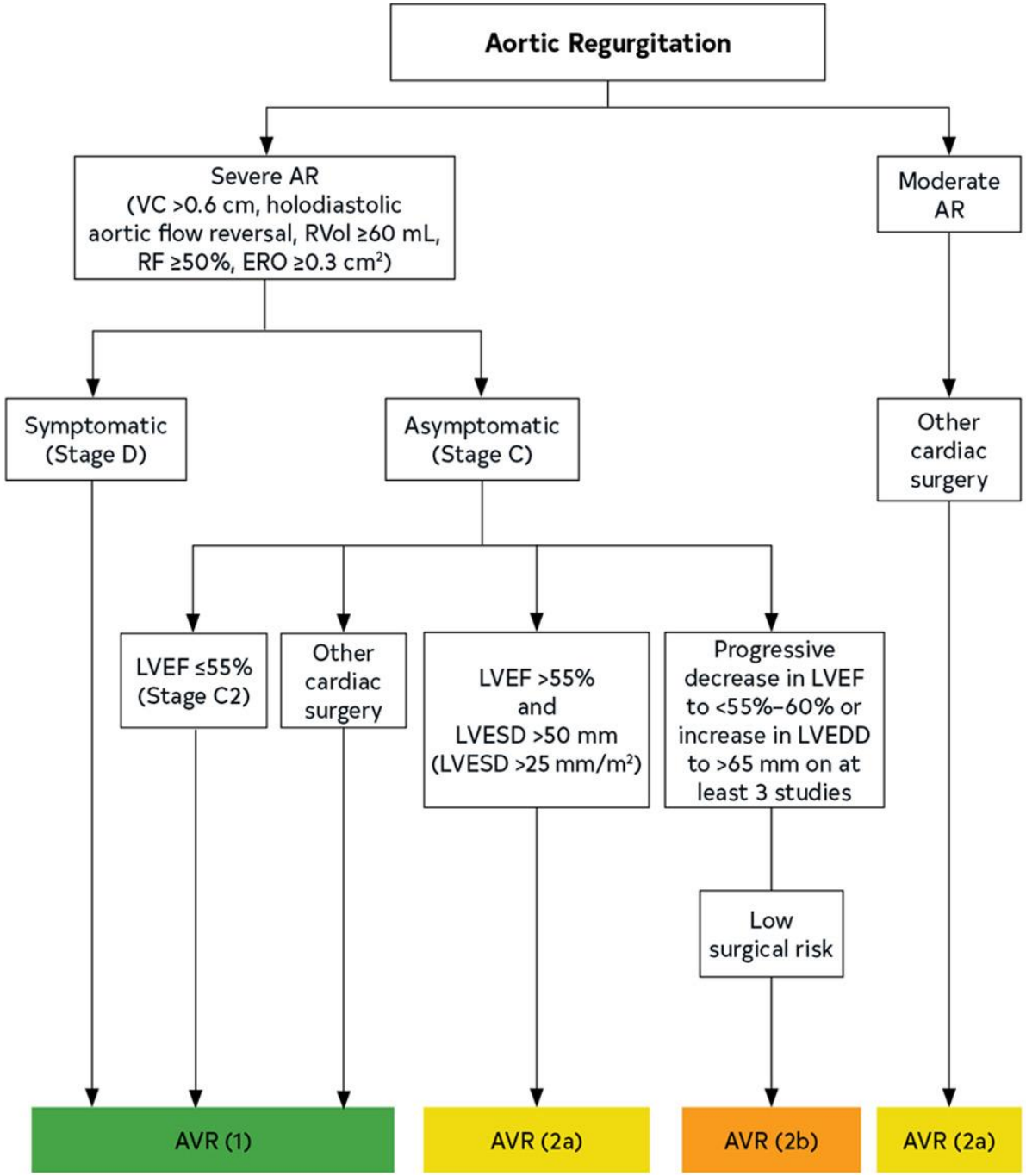
	Mild	Moderate	Severe
Specific signs for AR severity	Central jet width <25% of LVOT	Signs of AR > mild, but no criteria for severe AR are present	Central jet, width ≥65% of LVOT
	Vena contracta <0.3 cm2		Vena contracta >0.6 cm^2
	No diastolic flow reversal in the descending aorta		Holodiastolic flow reversal in the descending aorta
Supportive signs	Pressure half-time >500 ms	Intermediate values	Pressure half-time <200 ms
	Normal LV size		Moderate or greater LV enlargement
Quantitative parameters*			
•Regurgitant Volume (ml/beat)	<30	30-59	≥60
•RF (%)	<30	30-49	≥50
•EROA (cm^2)	<0.10	0.10-0.29	≥0.3

Question 2:

- Your patient has chronic moderate aortic regurgitation. What is your best treatment option?
- A. Emergent surgery (aortic valve replacement)
- B. Elective surgery (can plan and schedule)
- C. Vasodilators (hydralazine/dihydropyridines)
- D. Periodic surveillance (an f/u echo in 3-6m, then annually if stable)
- E. Need more information

Question 3:

- Your patient has chronic, asymptomatic severe aortic regurgitation. What is your best treatment option?
- A. Emergent surgery
- B. Elective surgery
- C. Vasodilators
- D. Periodic surveillance
- E. Need more information


Aortic Regurgitation
Severe AR
(VC >0.6 cm, holodiastolic
aortic flow reversal, RVol ≥60 mL,
RF ≥50%, ERO ≥0.3 cm²)
Moderate
AR
Symptomatic
(Stage D)
Asymptomatic
(Stage C)
Other
cardiac
surgery
LVEF ≤55%
(Stage C2)
Other
cardiac
surgery
LVEF >55%
and
LVESD >50 mm
(LVESD >25 mm/m²)
Progressive
decrease in LVEF
to <55%–60% or
increase in LVEDD
to >65 mm on at
least 3 studies
Low
surgical risk
AVR (1)
AVR (2a)
AVR (2b)
AVR (2a)

Surgery for Chronic Severe AR

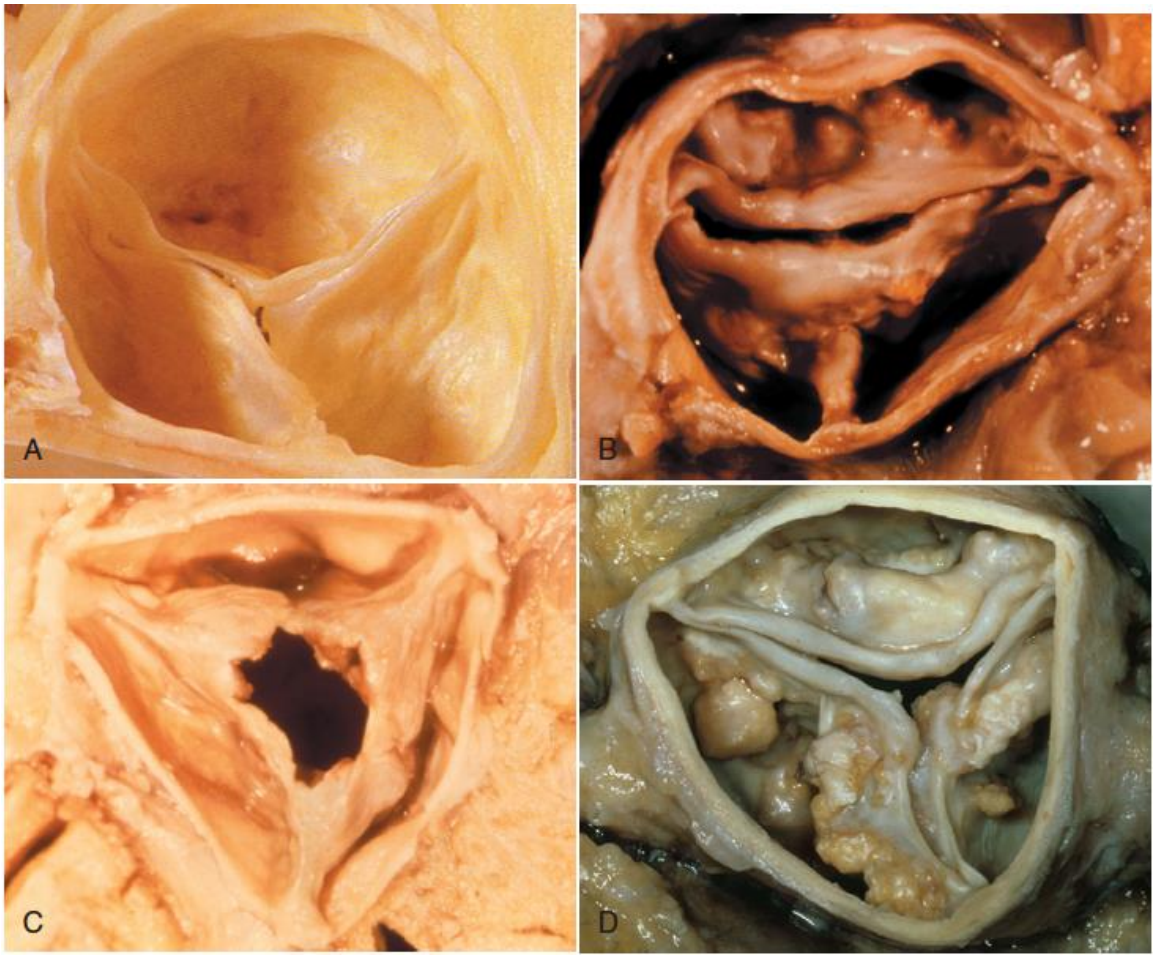
Symptoms (any)

LV dysfunction (EF < 55%)

LV enlargement (ESD > 50mm)

Causes of Aortic Stenosis

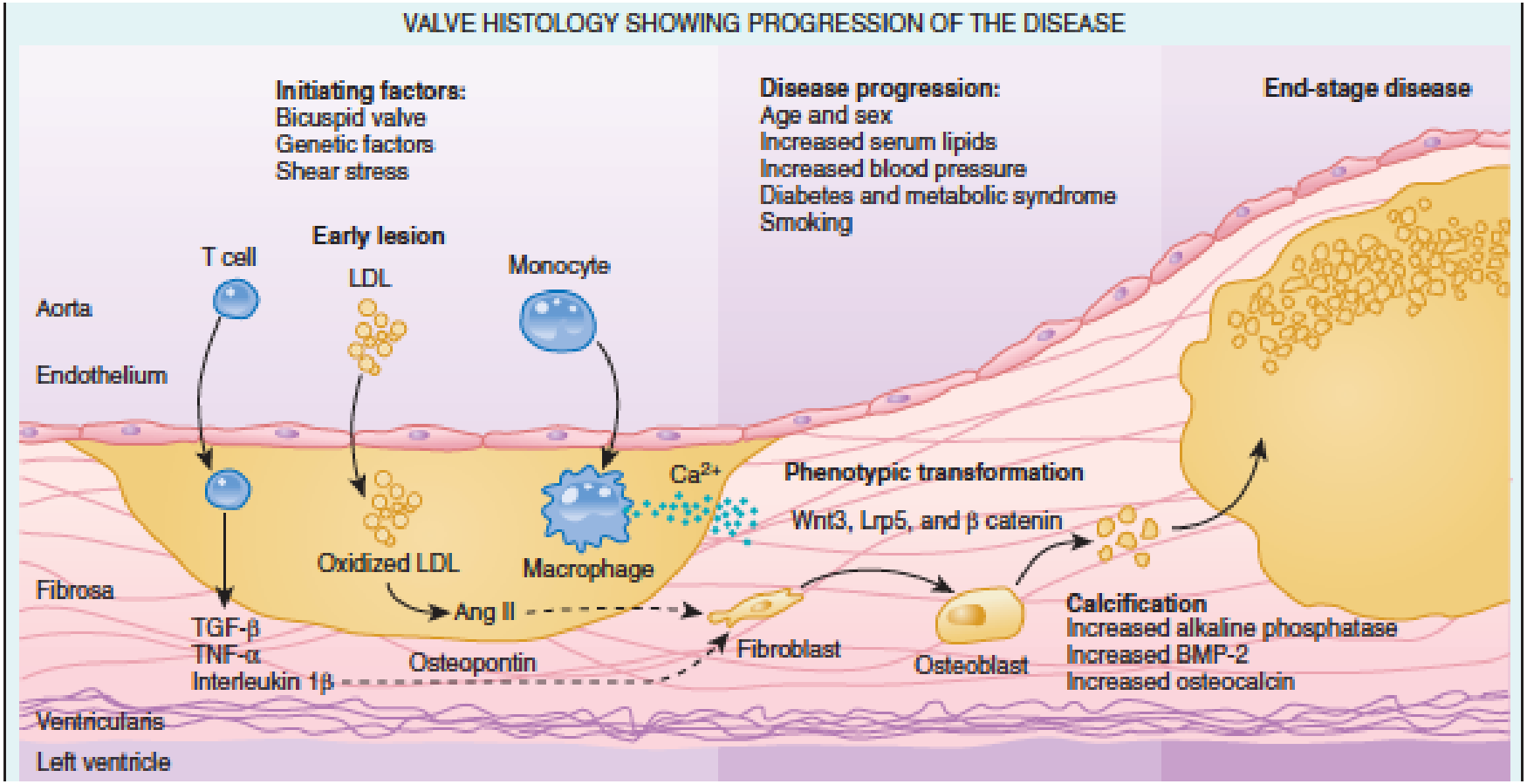
- Supravalvular
- Subvalvular
  - discrete
  - tunnel
- Valvular
  - congenital (0-30yrs old)
  - bicuspid (40-60yrs old)
  - rheumatic (40-60yrs old)
  - senile degenerative (>70yrs old)


A
B
C
D

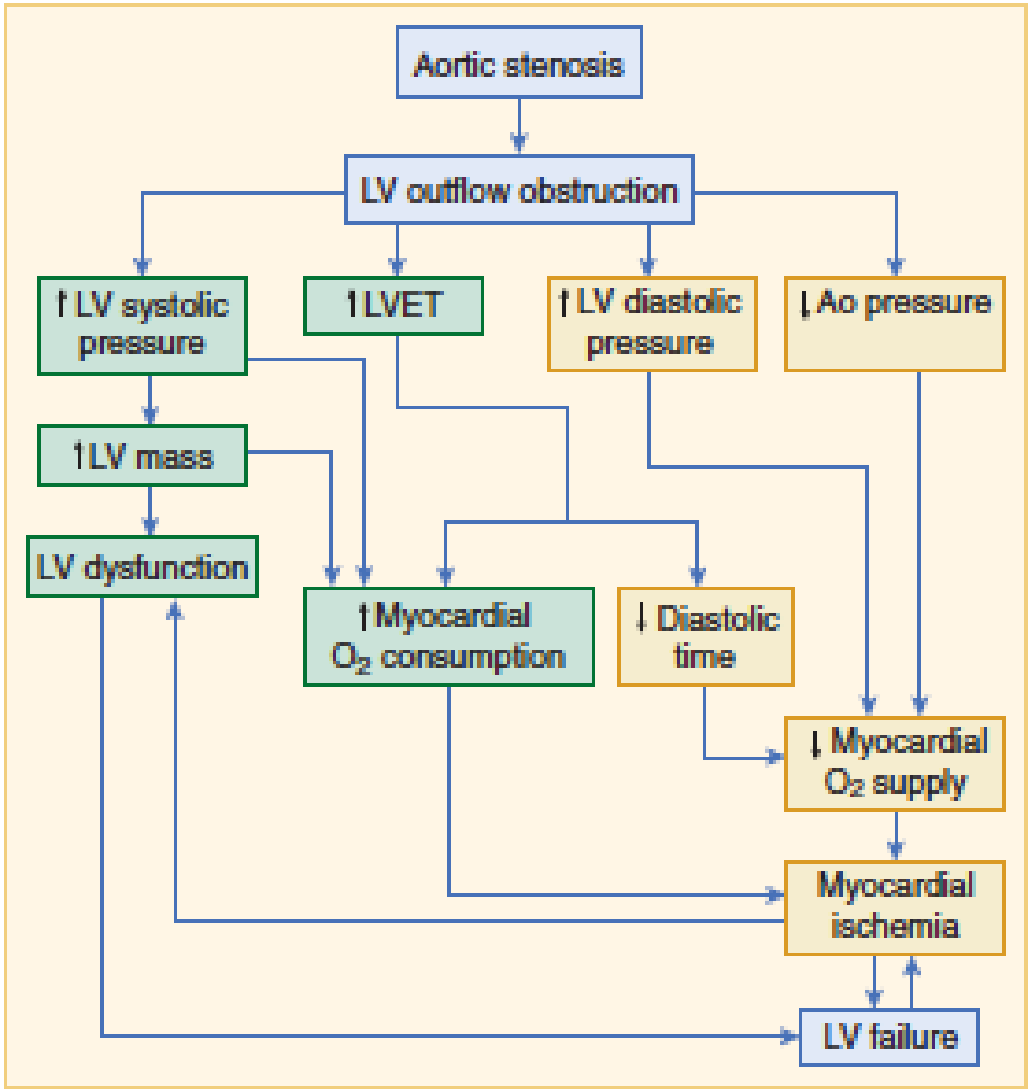
Bicuspid Aortic Valve

- The most common congenital cardiac abnormality is bicuspid aortic valve affecting 1-2% of the U.S. population.
- Over time, one-third to one-half of such valves become stenotic, with significant narrowing of the aortic orifice typically developing in the 5th and 6th decades of life.
- Sometimes with associated aortopathy.

Calcific Degenerative Aortic Stenosis



Pathophysiology



Pathophysiology:

"Normalize" wall stress

- Stress = $\frac{\text{pressure x radius}}{\text{thickness}}$
- LV cavity size remains normal
- LVEF remains normal

END stage - LV dilation and poor EF

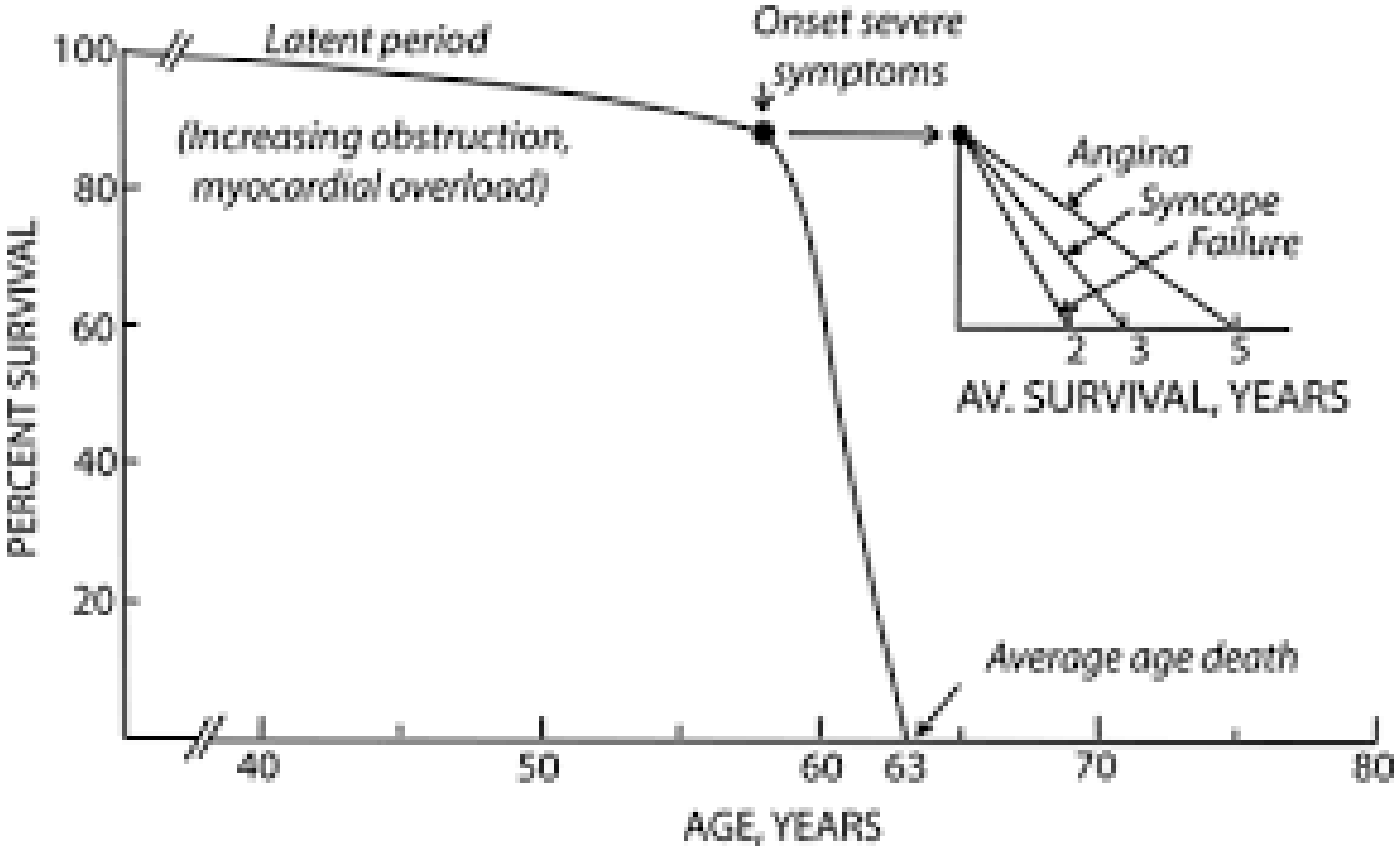
Classic Symptom Triad

- Angina
- Syncope
- Dyspnea

Question 4

- What symptom of severe aortic stenosis carries the worst prognosis?
- A. Angina
- B. Syncope
- C. Dyspnea
- D. Any symptom / all equivalent

The Most Famous Graph in Cardiology

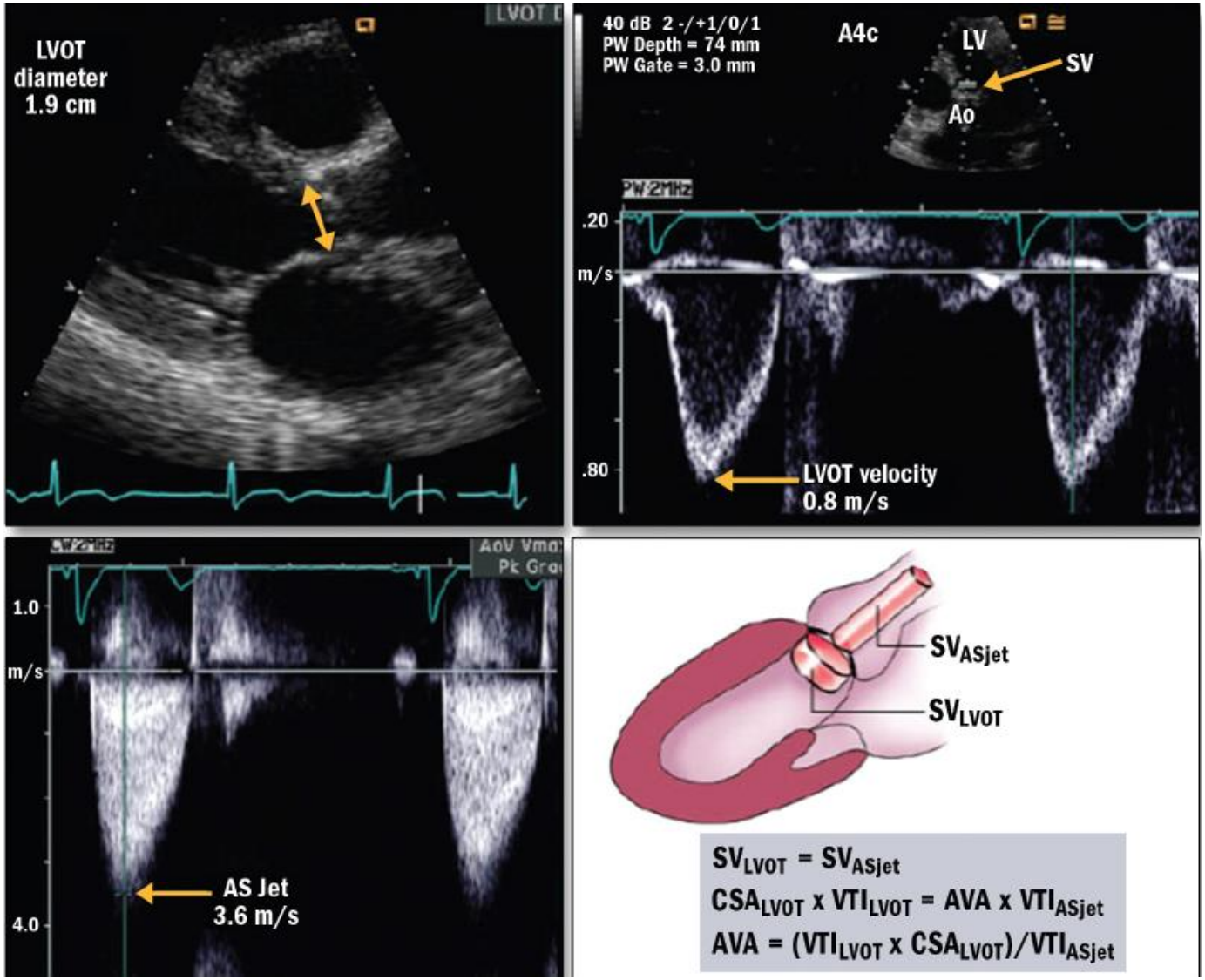


Ross J Jr, Braunwald E: Aortic stenosis. Circulation 38[Suppl V]:61, 1968

Aortic Stenosis – Physical examination

- Systolic ejection murmur; RUSB to carotid
- Intensity can be deceptive; more related to stroke volume than stenosis severity
- Diminished S2; murmur will stop earlier with increasing severity
- Pulsus parvus et tardus
- S4 gallop

Measurement of AV Stenosis



Echocardiography

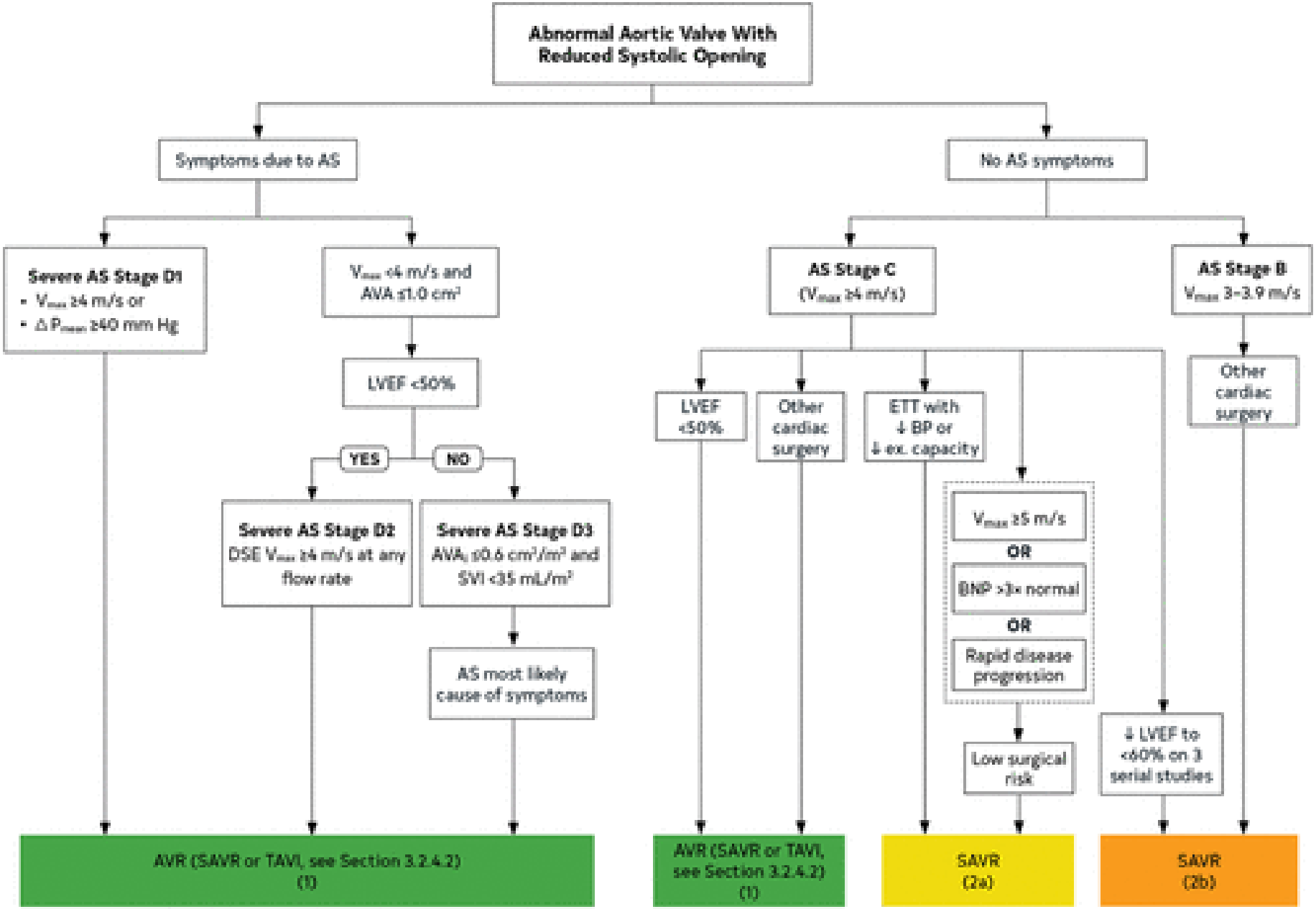
- A maximal instantaneous and mean AV gradient is derived from the continuous-wave Doppler velocity across the aortic valve.
- AVA can be estimated by **continuity equation:**
- $AVA = \frac{LVOT_{area}\ LVOT_{TVI}}{AV_{TVI}}$

Classification of Aortic Stenosis Severity

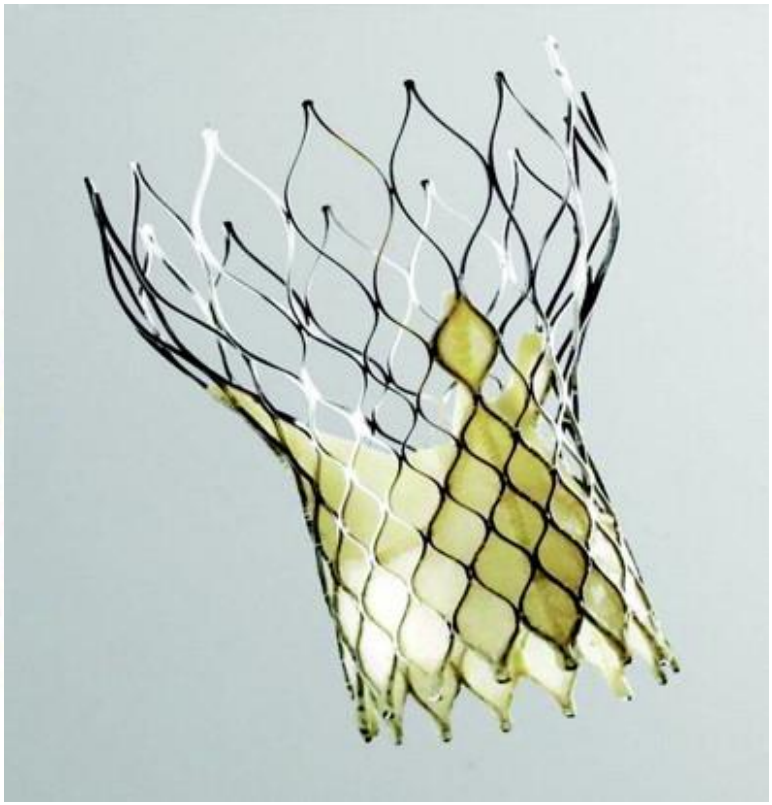
	Aortic Velocity (m/s)	Mean Transaortic Gradient (mm Hg)	Aortic Valve Area (cm^2)
Mild	<3.0	<20	>1.5
Moderate	3.0 - 4.0	20 - 40	1.0 - 1.5
Severe	>4.0	>40	<1.0
Very severe	>5.0	>60	<0.7

Question 5:

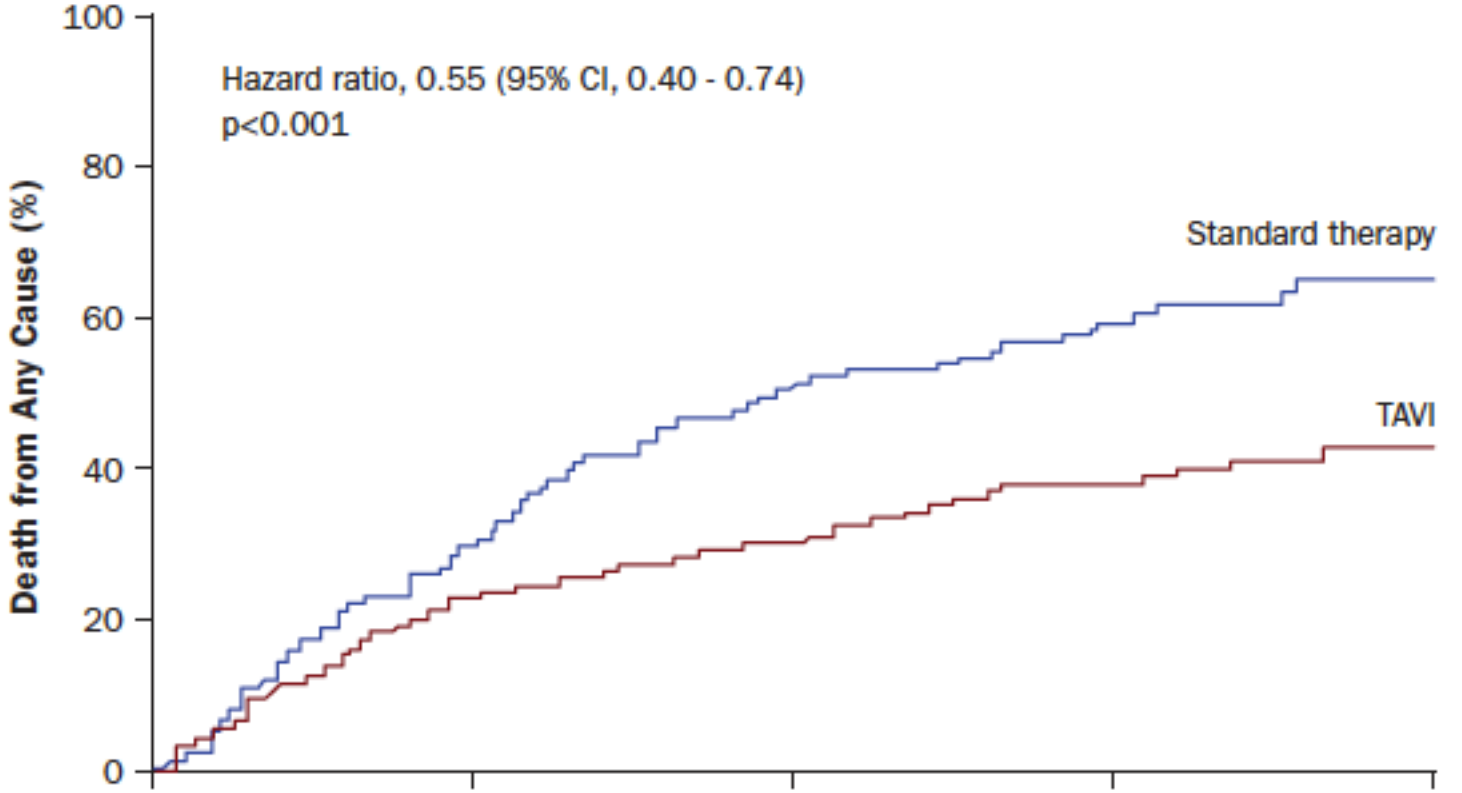
- Your patient has symptomatic severe aortic stenosis. What is your best treatment option?
- A. Emergent surgery
- B. Elective surgery
- C. Vasodilators
- D. Periodic surveillance
- E. Need more information


Abnormal Aortic Valve With Reduced Systolic Opening
Symptoms due to AS
No AS symptoms
Severe AS Stage D1
• Vmax ≥4 m/s or
• ΔPmean ≥40 mm Hg
Vmax <4 m/s and AVA ≤1.0 cm²
LVEF <50%
YES
NO
Severe AS Stage D2
DSE Vmax ≥4 m/s at any flow rate
Severe AS Stage D3
AVAi ≤0.6 cm²/m² and SVI <35 mL/m²
AS most likely cause of symptoms
AVR (SAVR or TAVI, see Section 3.2.4.2) (1)
AS Stage C
(Vmax ≥4 m/s)
AS Stage B
Vmax 3–3.9 m/s
LVEF <50%
Other cardiac surgery
ETT with ↓ BP or ↓ ex. capacity
Vmax ≥5 m/s
OR
BNP >3× normal
OR
Rapid disease progression
Low surgical risk
↓ LVEF to <60% on 3 serial studies
Other cardiac surgery
AVR (SAVR or TAVI, see Section 3.2.4.2) (1)
SAVR (2a)
SAVR (2b)

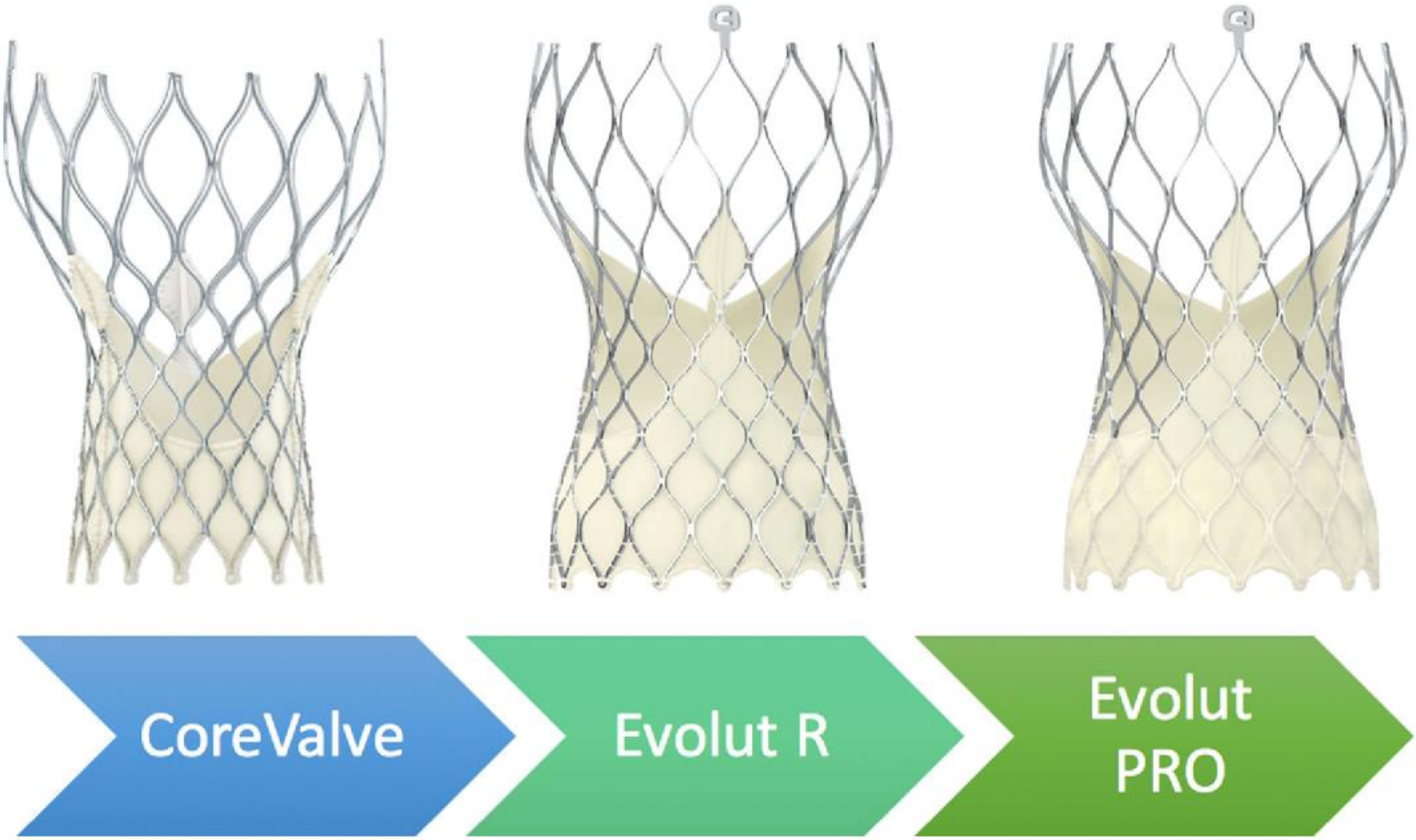
TAVR



Survival with Transcatheter Aortic Valve Implantation Compared to Standard Therapy in Adults with Severe Symptomatic Aortic Stenosis and Prohibitive Surgical Risk.



No. at Risk					
TAVI	179	138	122	67	26
Standard	179	121	83	41	12


CoreValve
Evolut R
Evolut
PRO

Aortic Balloon Valvotomy

- ***Class IIb***
- **Aortic balloon valvotomy might be reasonable as a bridge to surgery in hemodynamically unstable adult patients with AS who are at high risk for AVR. *(Level of Evidence: C)***
- **Aortic balloon valvotomy might be reasonable for palliation in adult patients with AS in whom AVR cannot be performed because of serious comorbid conditions. *(Level of Evidence: C)***