Aortic Valvular Stenosis

How to Assess the Four Variables for Management

Low Flow / Low Gradient / Normal EF / Low EF

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Harvard Medical School

No Disclosures

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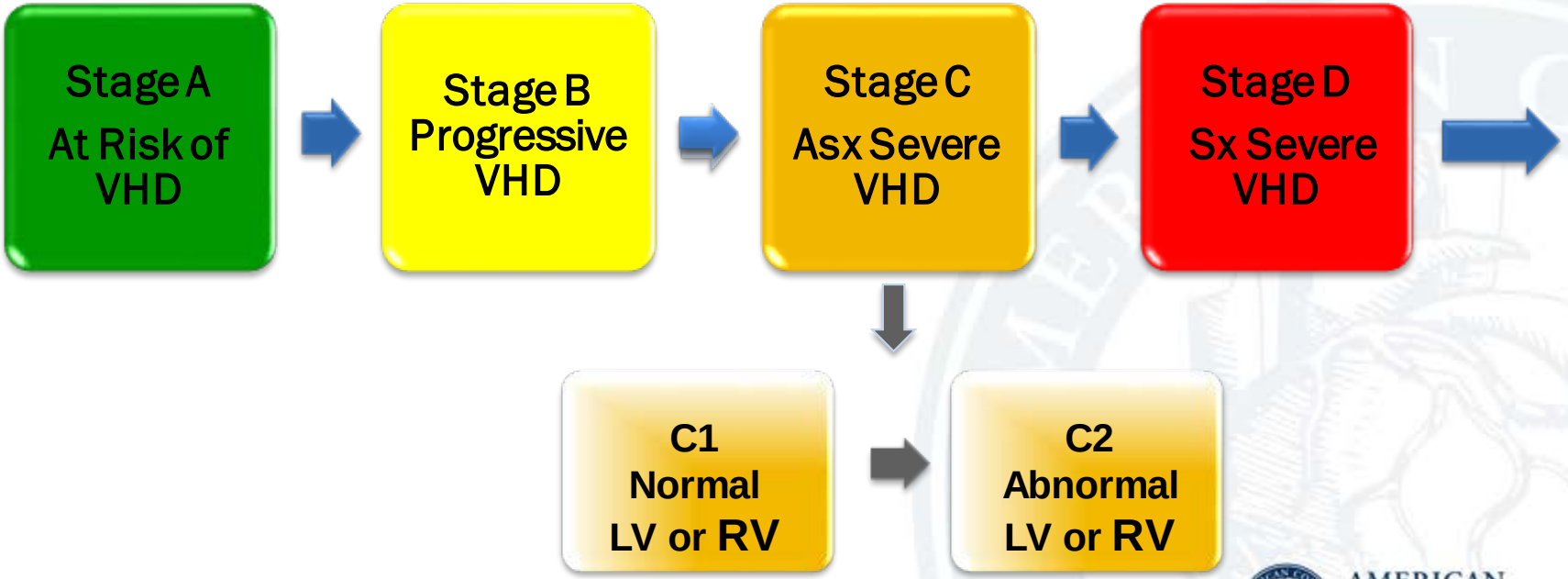
Stages of Valvular Heart Disease



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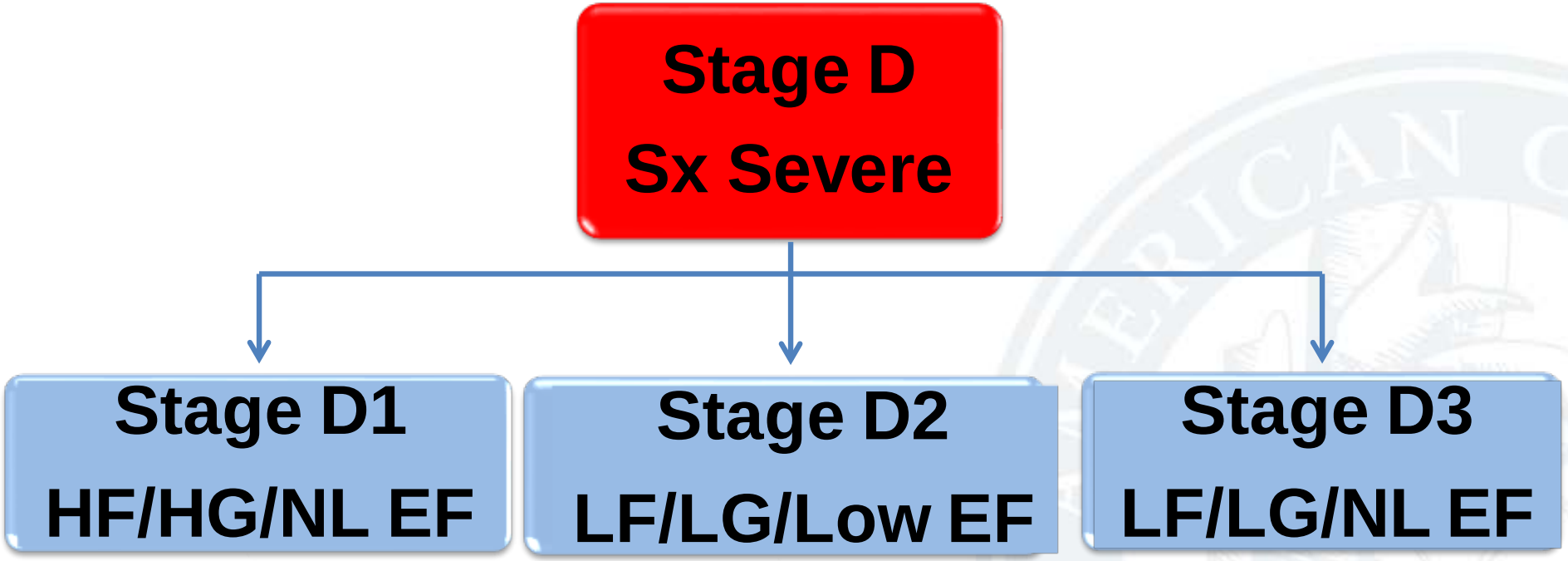
Stages of Chronic AS



Mean ΔP ≠ AVA

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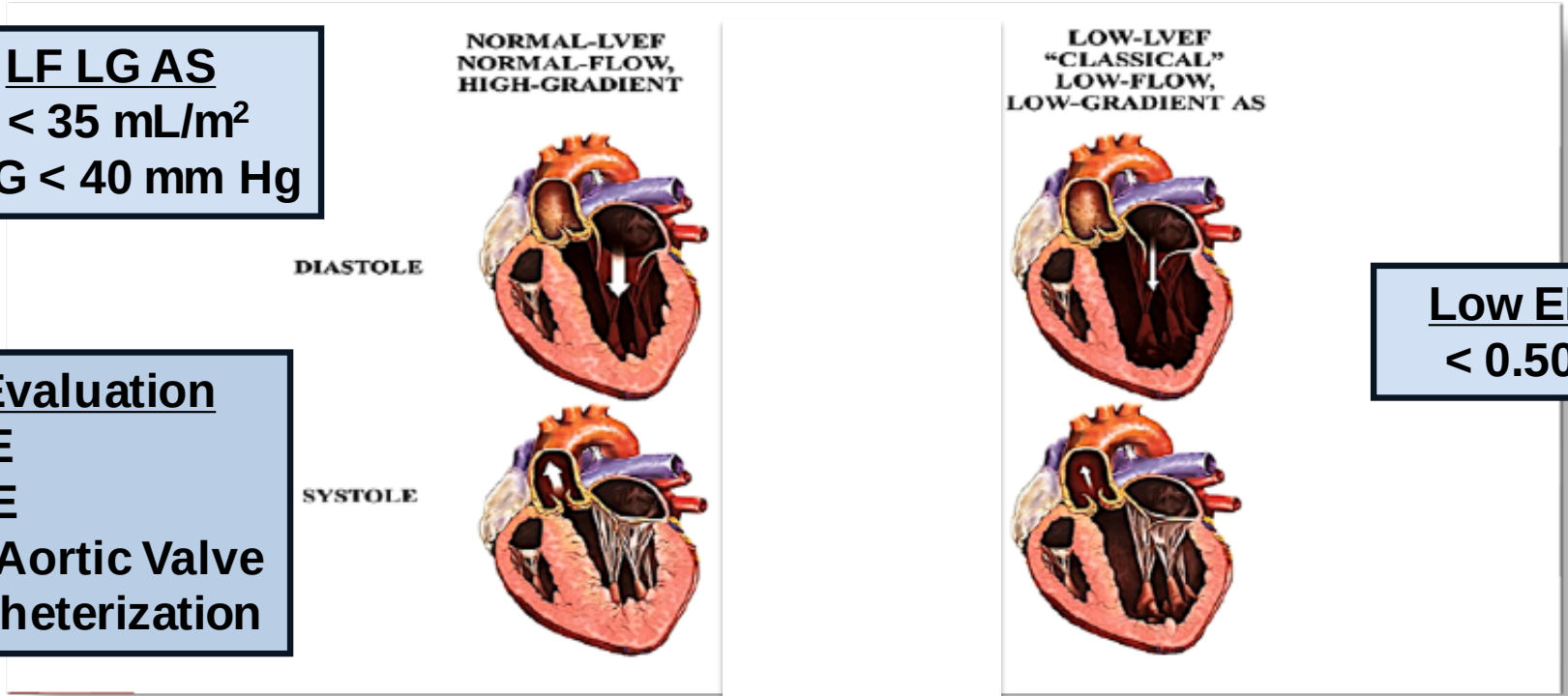
Low Flow Low Gradient Severe AS

LF LG AS
SVi < 35 mL/m²
MPG < 40 mm Hg



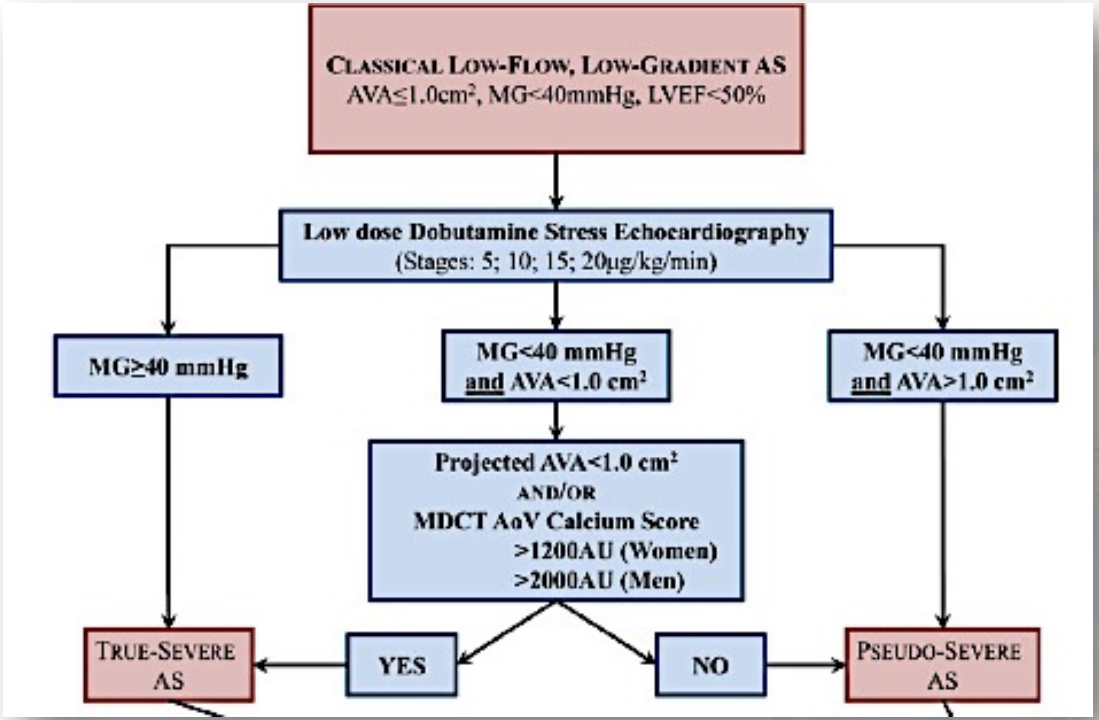
Low EF
< 0.50

Evaluation
TTE
DSE
CT Aortic Valve
Catheterization

Pibarot P, Dumesnil JG. *JACC* 2012; 60:145-53

LF/LG AS with Reduced EF

Flow Reserve
> 20%↑SVi



Clavel M-A et al EHJ 2016; 37:2645-57

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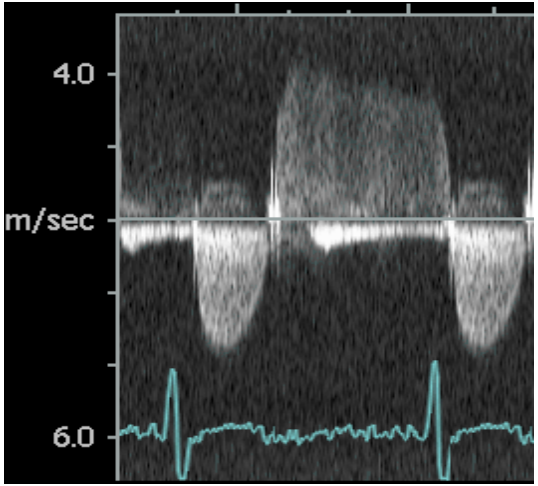
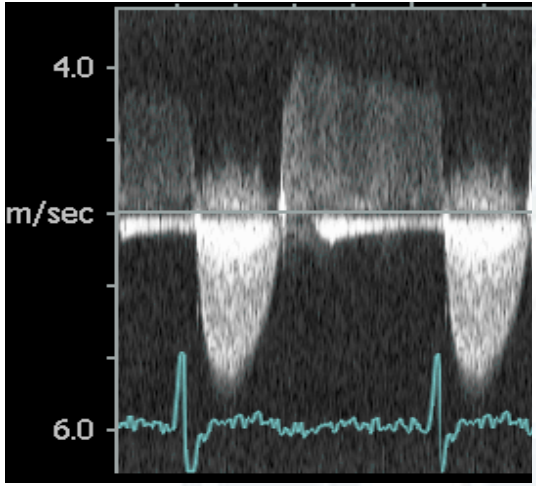
DSE

Baseline



Vmax 3.5 m/s
Mean ΔP 32 mm Hg

Dobutamine



Vmax 4.9 m/s
Mean ΔP 56 mm Hg

Picano E et al. JACC 2009;54:2251-60

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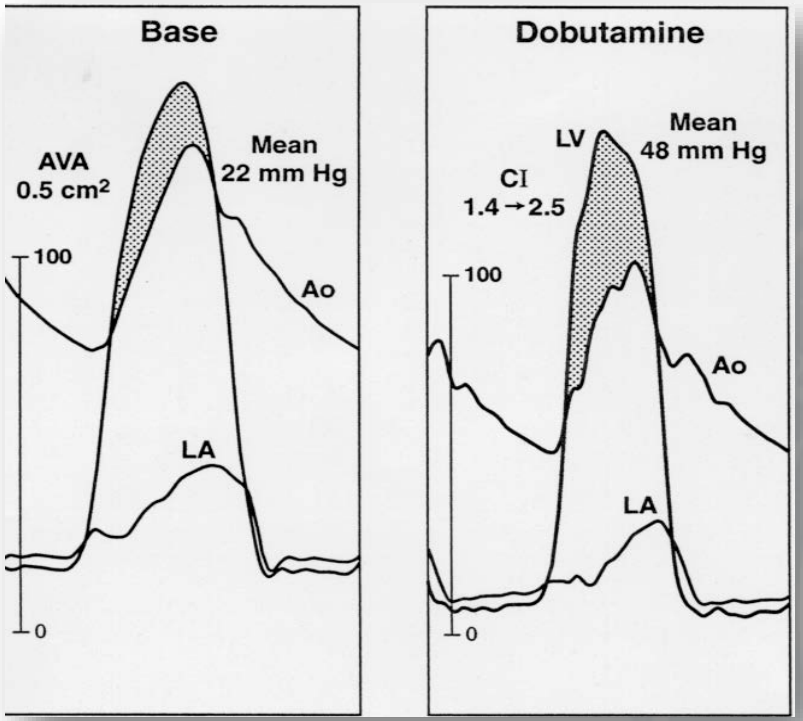
Hemodynamics

Mean Gradient 22



Mean Gradient 48

Courtesy of Rick Nishimura, MD

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AHA/ACC 2014 Guideline
Aortic Stenosis (D2): Timing of Intervention

Recommendation	COR	LOE
AVR is reasonable in patients with LF/LG severe AS with reduced EF (stage D2) with a dobutamine stress study that shows an aortic velocity ≥ 4 m/s (or mean ΔP ≥ 40 mm Hg) with an AVA ≤1.0 cm^2 at any dobutamine dose	IIa	B

ESC/EACT 2017 Guideline
Aortic Stenosis: Timing of Intervention

Recommendations	COR	LOE
AVR is indicated in symptomatic patients with severe LF/LG AS and reduced EF with flow reserve excluding pseudo-severe stenosis	I	C
AVR should be considered in symptomatic patients with LF/LG AS and reduced EF without flow reserve if CT calcium scoring confirms severe AS	IIa	C

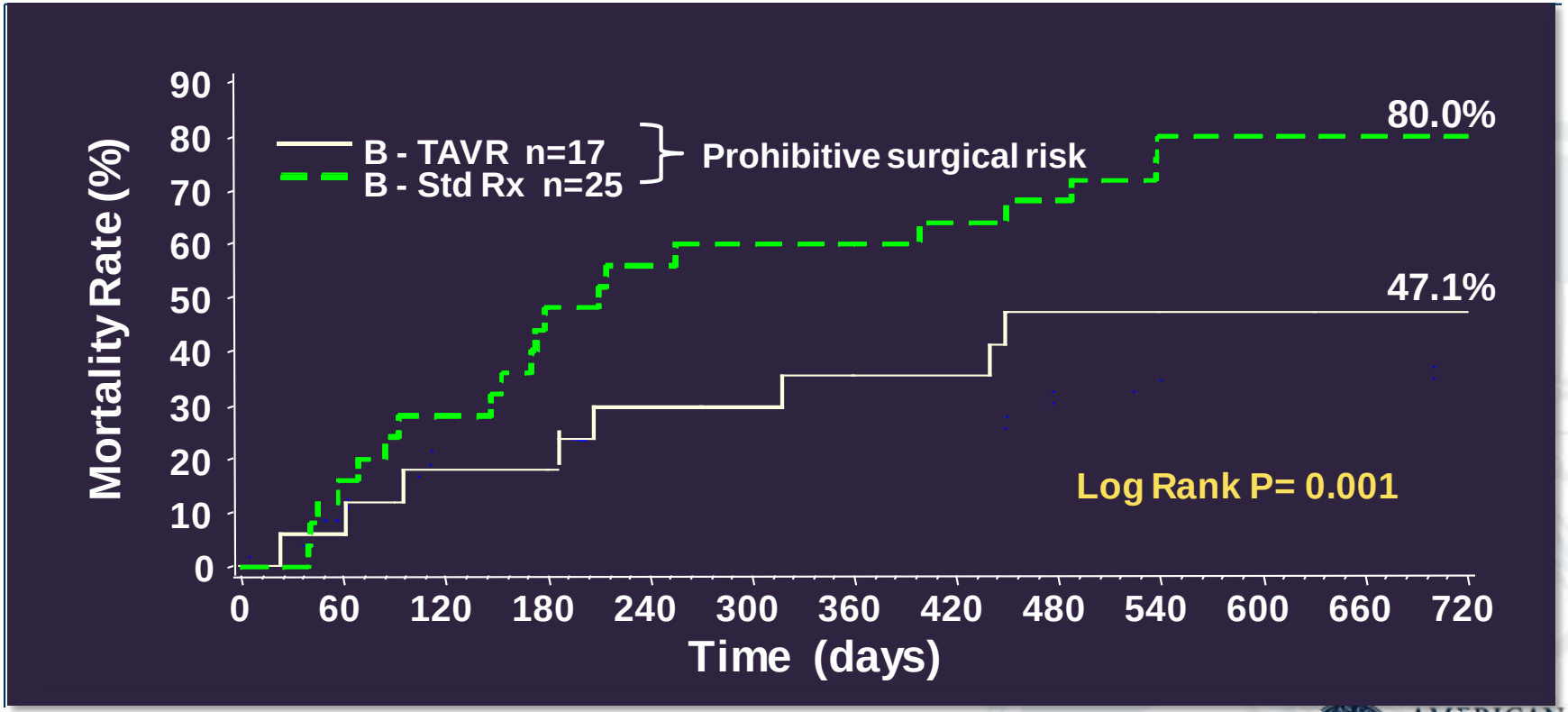
Poor Outcomes After AVR

Classical LF/LG AS

- **NYHA 3+, ↓6MWT, high STS score**
- **EF < 0.35; reduced GLS; lack of flow reserve; low gradient (< 20 mm Hg)**
- **Multi-vessel CAD**
- **Markedly elevated NT-BNP**
- **LGE**

PARTNER Trial

LG/LG Severe AS with Low EF

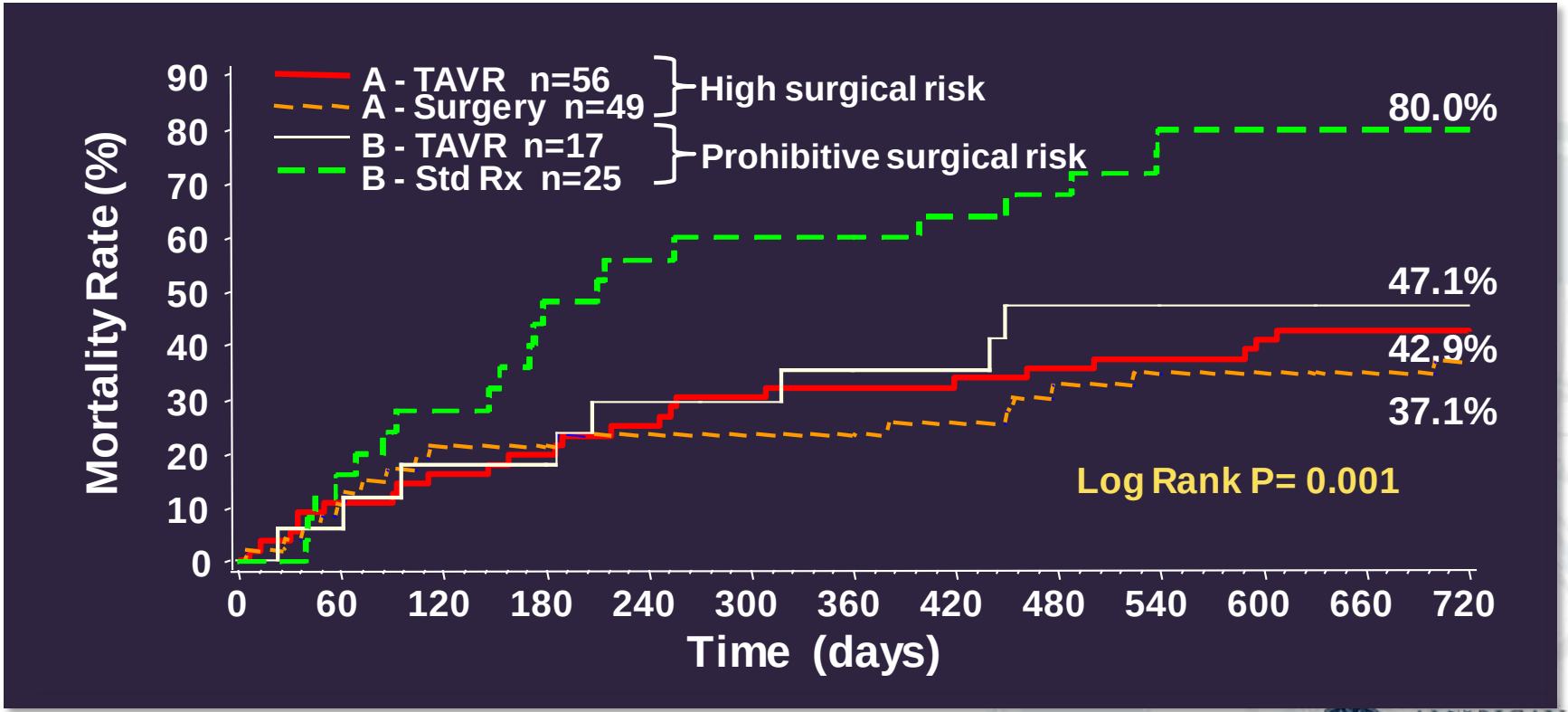


Herrmann H et al, *Circulation* 2013;127:2316-2326

Courtesy of RO Bonow

PARTNER Trial

LF/LG Severe AS with low EF



Herrmann et al, *Circulation* 2013;127:2316-2326

Courtesy of RO Bonow

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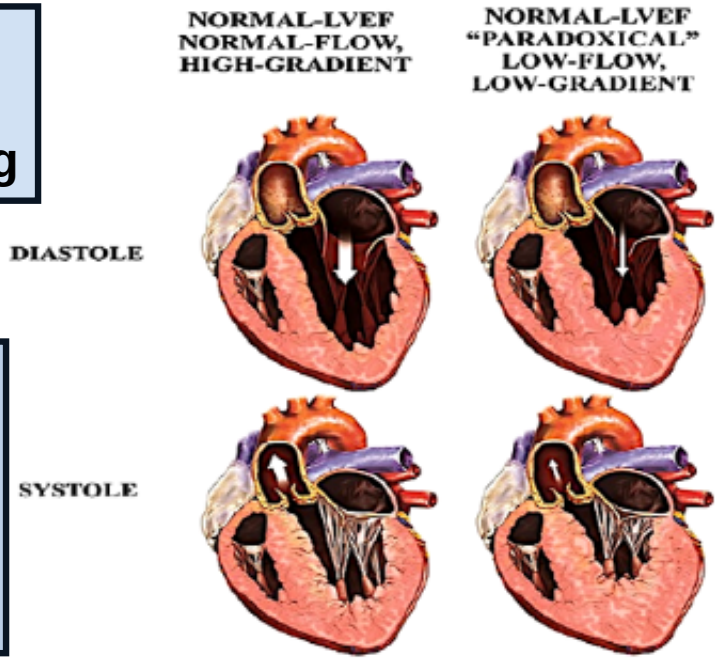
Low Flow Low Gradient Severe AS

LF LG AS
SVi < 35 mL/m²
MPG < 40 mm Hg



Evaluation
TTE
DSE
CT Aortic Valve
Catheterization

NL EF
≥ 0.50

Pibarot P, Dumesnil JG. *JACC* 2012; 60:145-53

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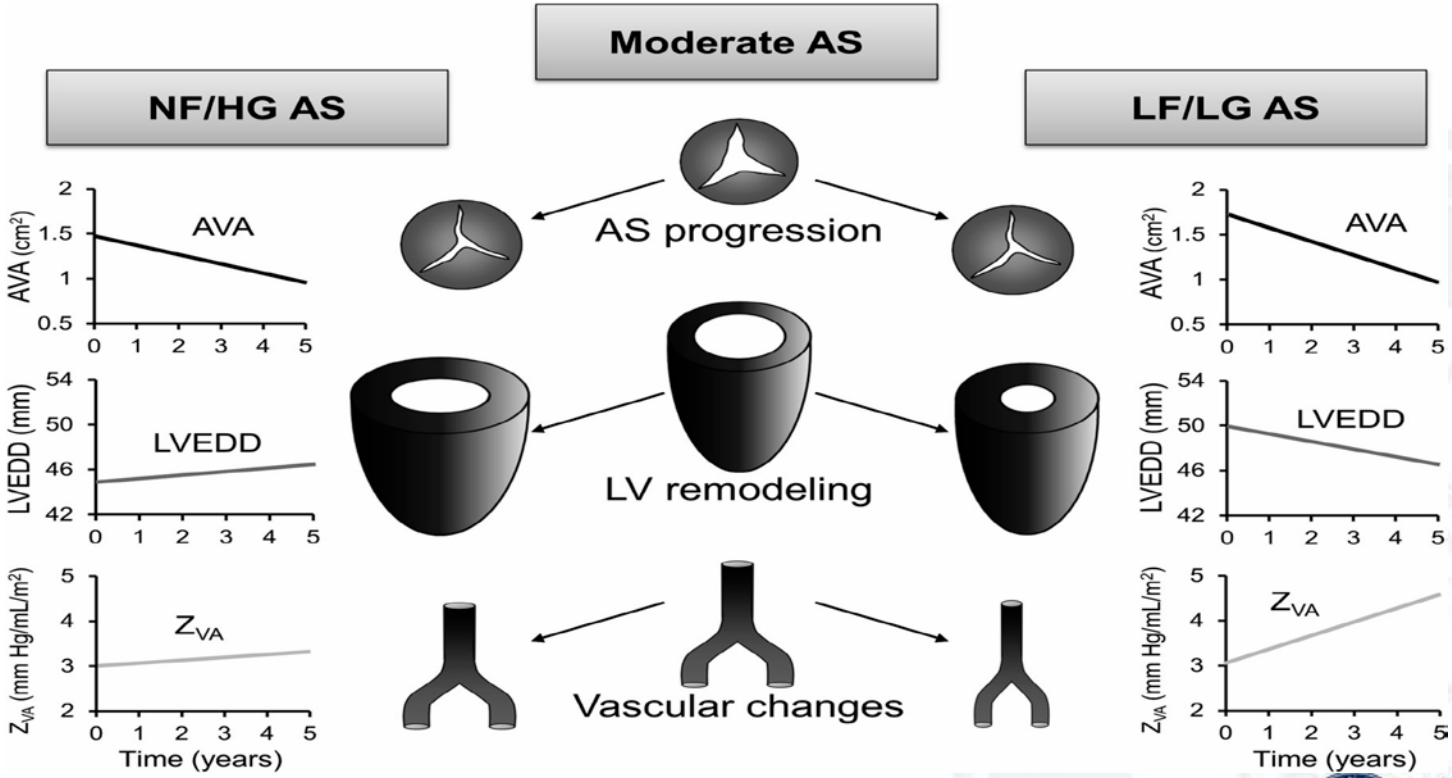
Development of Severe AS



Sorin V Pislaru, and Patricia A Pellikka Heart doi:10.1136/heartjnl-2015-307893

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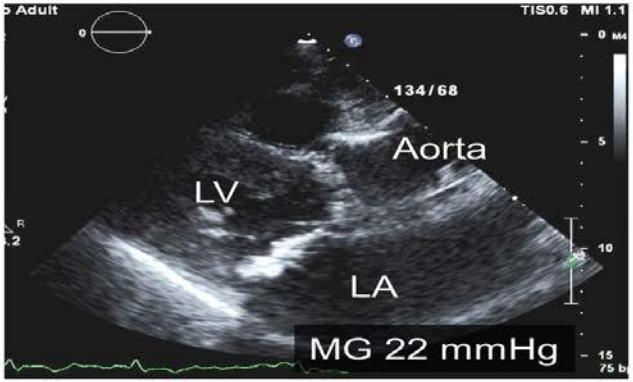
Assessment of Total LV Afterload

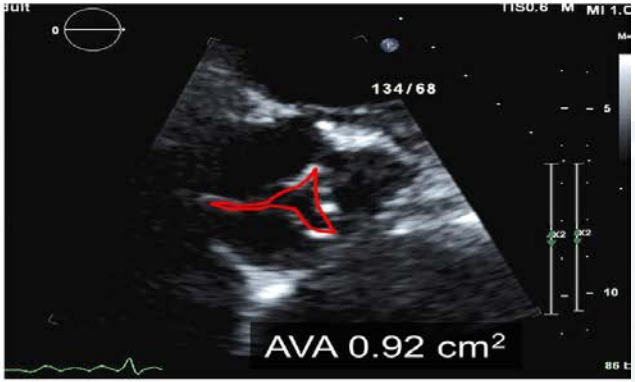
Valvulo-Arterial Impedance: Z_{VA}

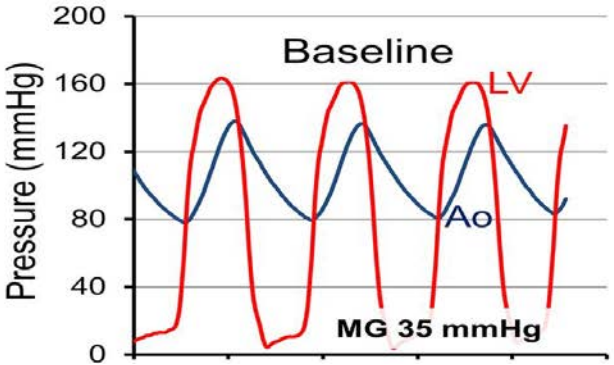
$$Z_{va} = \frac{SBP + Mean\ \Delta P}{SVi}$$

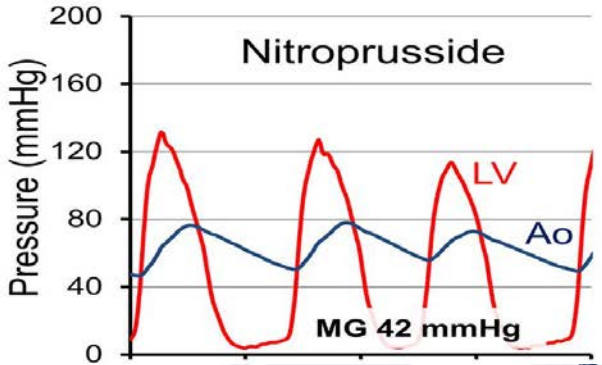
Hachicha Z et al. Circulation 2007;115:2856-64

LFLG Severe AS with NL EF









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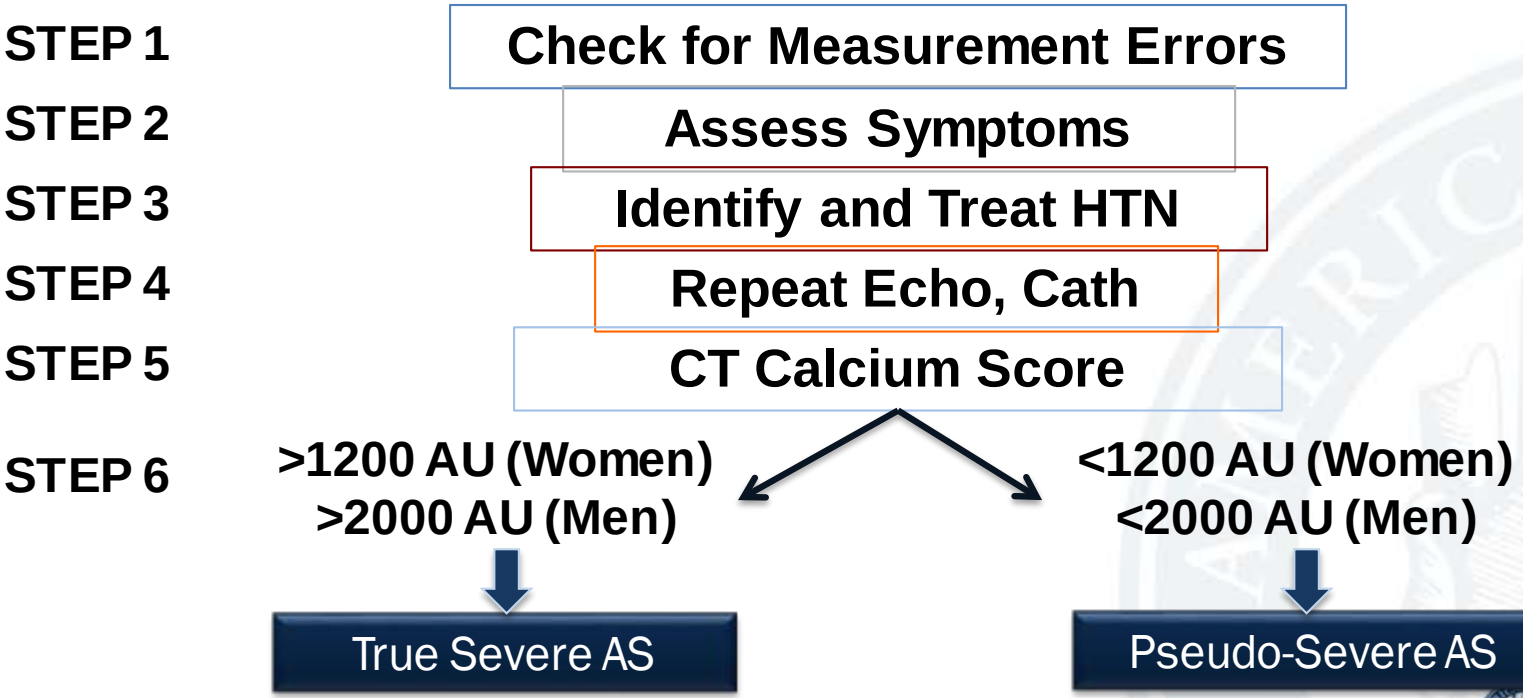
LF/LG AS with Normal EF



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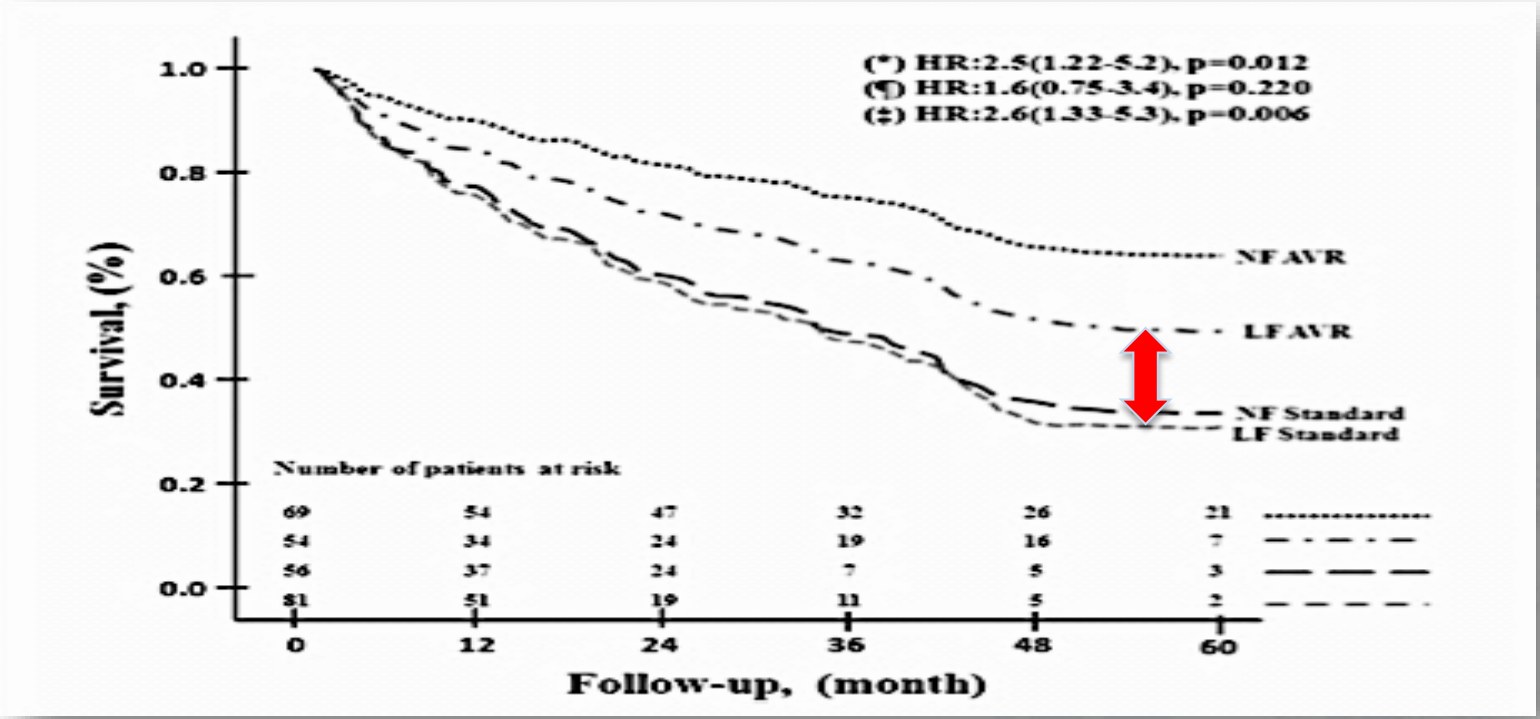
Adapted from Clavel M-A et al EHJ 2016; 37:2645-57

Effect of AVR on Survival

Adjusted, Propensity Analysis



Ozkan A et al. Circulation 2013;128:622-28

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AHA/ACC 2014 Guideline
Aortic Stenosis (D3): Timing of Intervention

Recommendation	COR	LOE
AVR is reasonable in patients with LF/LG severe AS (stage D3) who are normotensive and have an EF ≥50% if clinical, hemodynamic, and anatomic data support valve obstruction as the most likely cause of symptoms	IIa	C

ESC/EACT 2017 Guideline
Aortic Stenosis: Timing of Intervention

Recommendation	COR	LOE
AVR should be considered in symptomatic patients with LF/LG AS and normal EF after careful confirmation of severe AS	IIa	C

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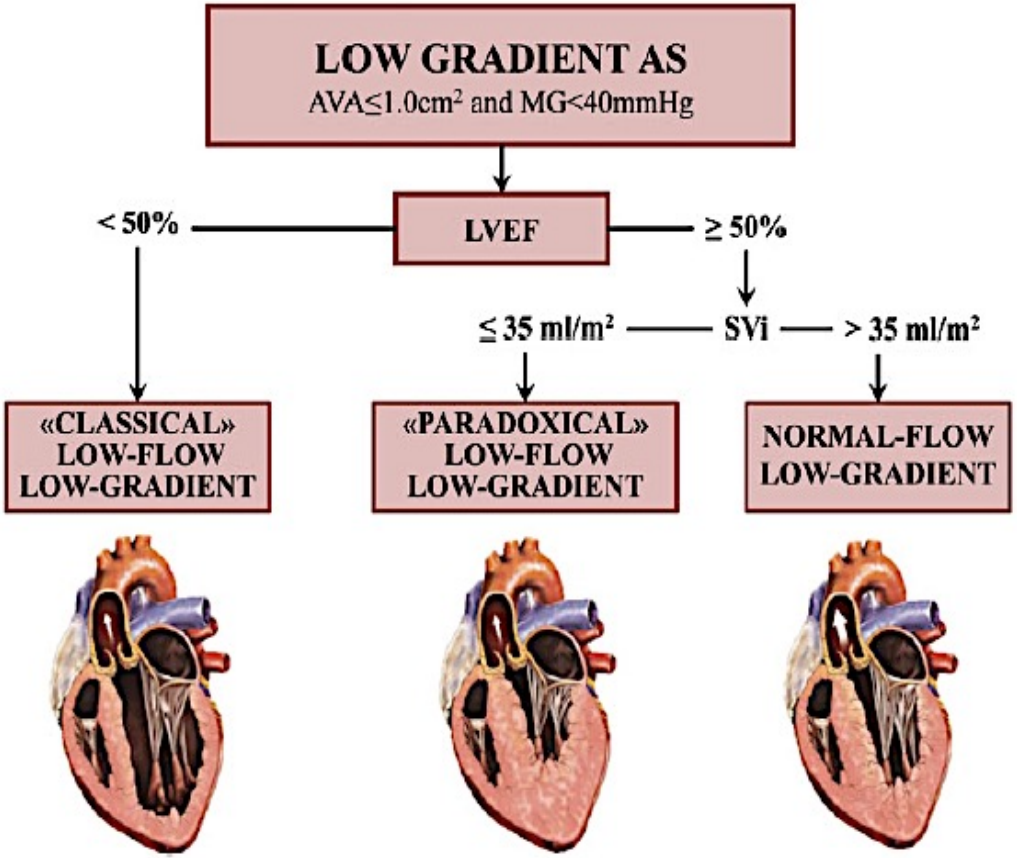
Poor Outcomes After AVR

Paradoxical LF/LG AS

- **LGE**
- **Moderate/severe diastolic dysfunction**
- **Reduced GLS**
- **Very low SVi**



Clavel M-A et al EHJ 2016; 37:2645-57

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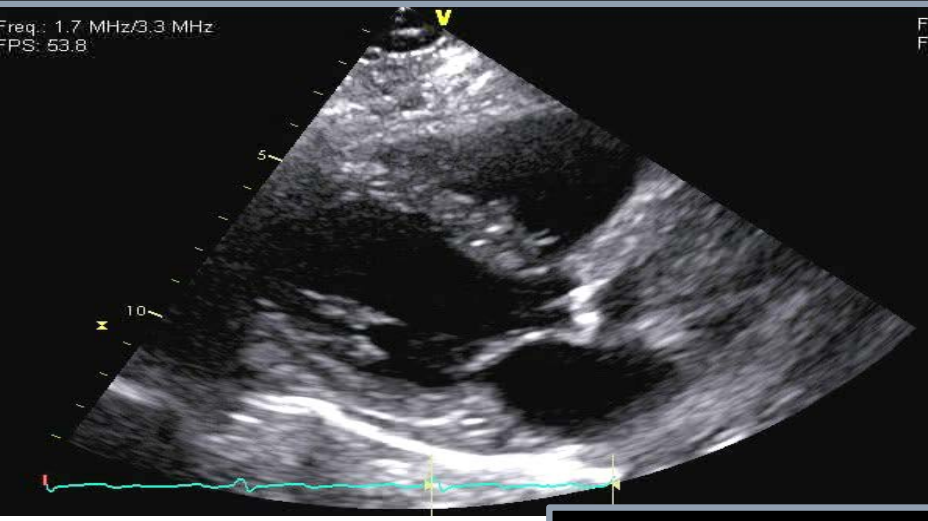

- 82 y/o woman
- PAF, HTN
- Fatigue, dyspnea
- Grade 3 murmur
- No LVH on ECG

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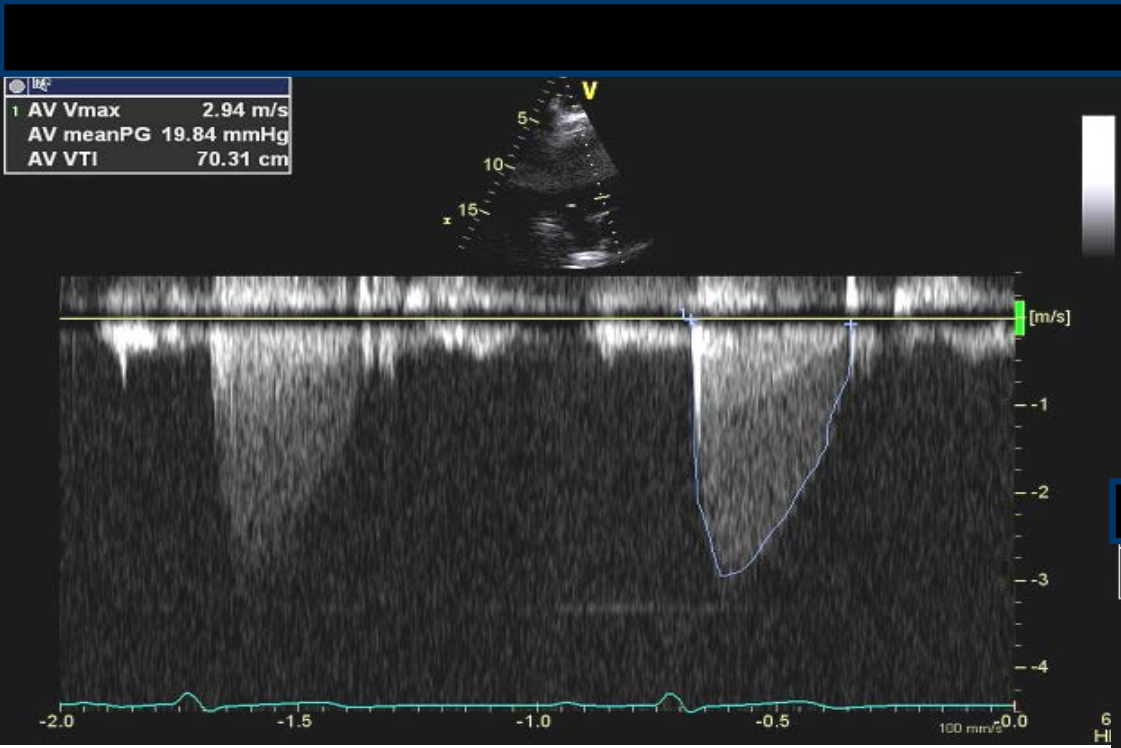

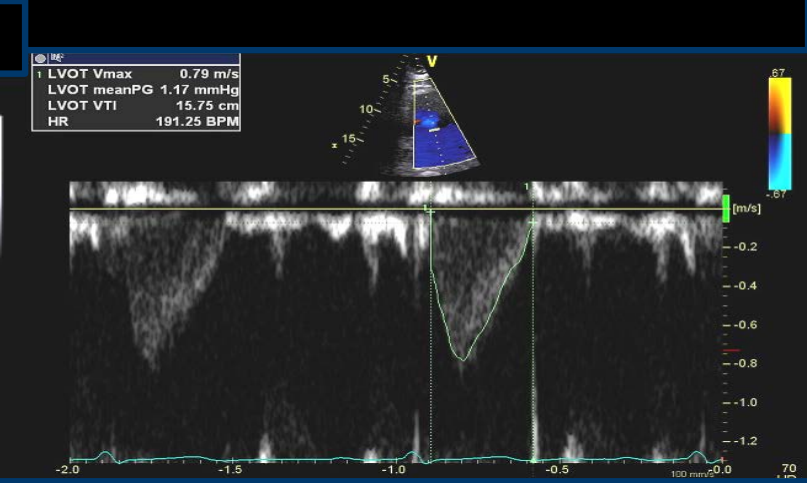

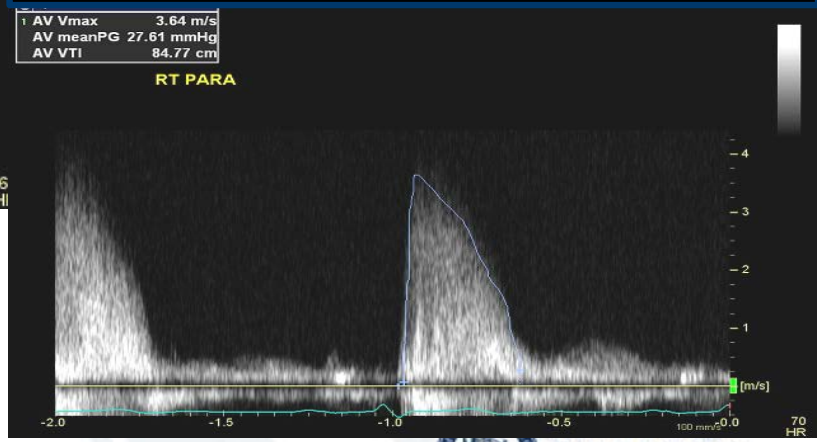

Mean gradient	**28 mmHg**
AVA	**0.8 cm2**
SVI	**35 ml/m2**
DVI	**0.23**

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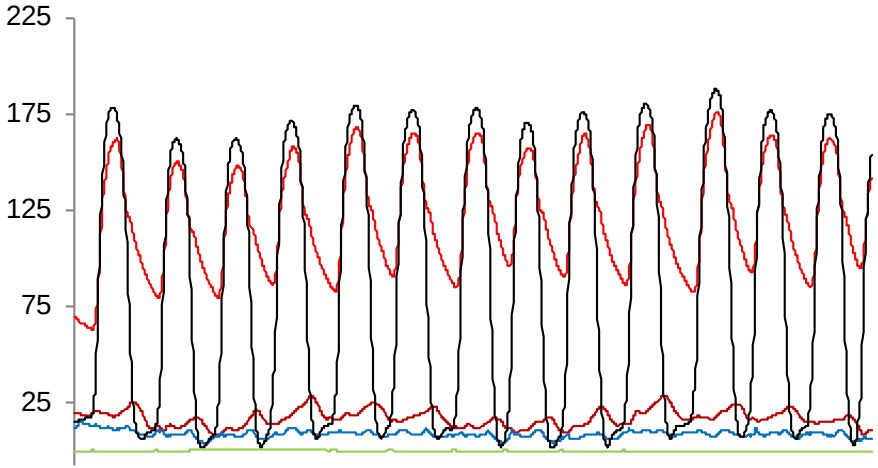
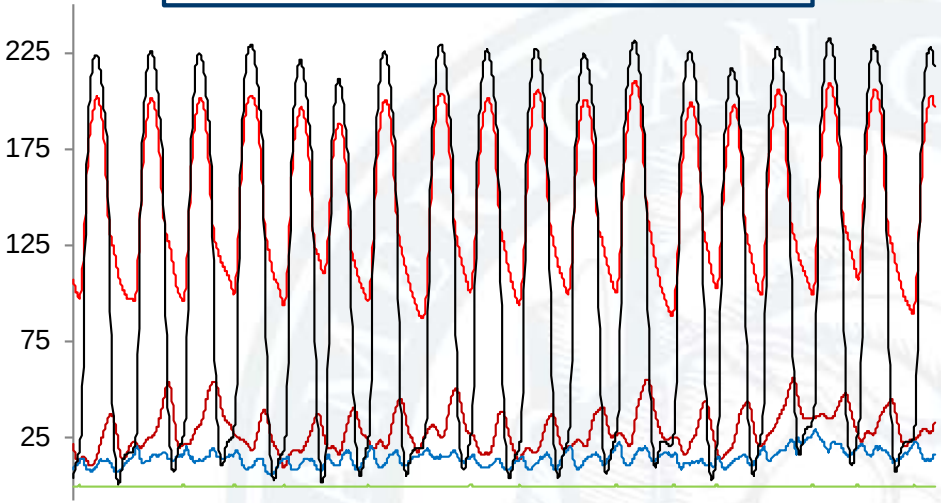
Mean gradient	17
Valve area	0.9cm2
PCWP	14
CO	3.4
Aortic BP	160/63



Rest

Mean gradient	19
Valve area	1.2cm2
PCWP	28
CO	6.7
Aortic BP	201/98



Peak

Courtesy Mayo Clinic Fellows

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APPROPRIATE USE CRITERIA

ACC/AATS/AHA/ASE/EACTS/HVS/SCA/SCAI/SCCT/SCMR/STS 2017 Appropriate Use Criteria for the Treatment of Patients With Severe Aortic Stenosis

A Report of the American College of Cardiology Appropriate Use Criteria Task Force, American Association for Thoracic Surgery, American Heart Association, American Society of Echocardiography, European Association for Cardio-Thoracic Surgery, Heart Valve Society, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, Society for Cardiovascular Magnetic Resonance, and Society of Thoracic Surgeons

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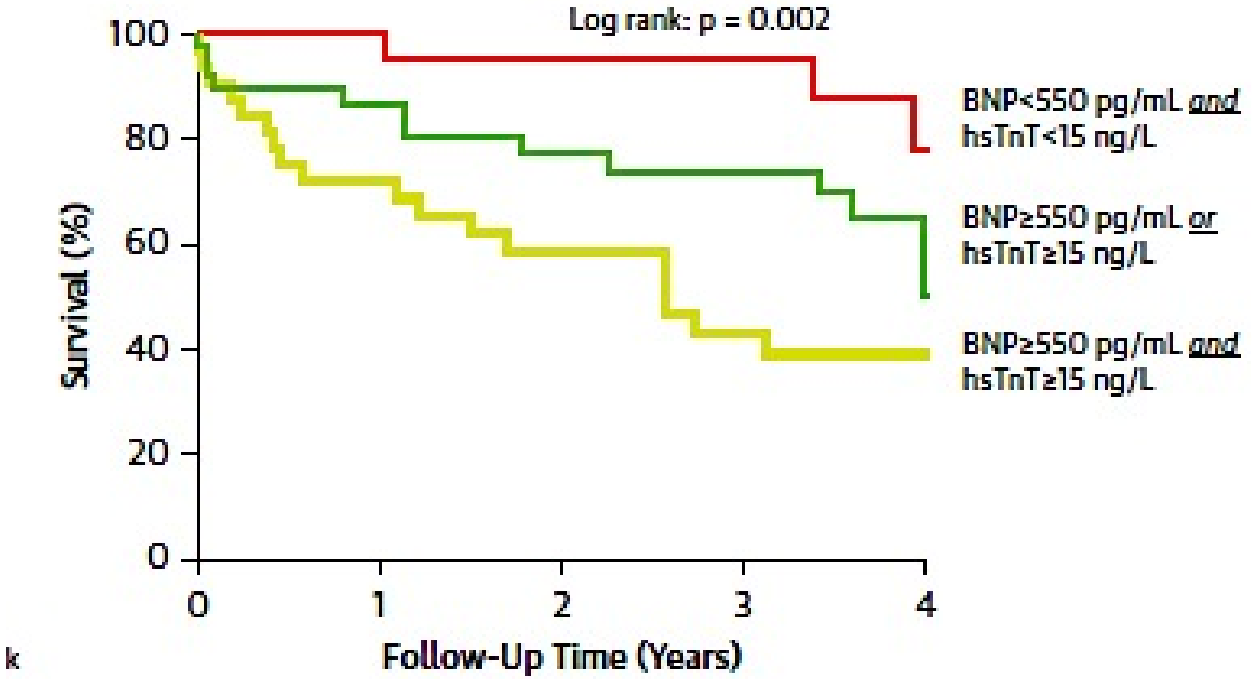
Biomarkers in LF/LG AS



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TOPAS Study JACC Imag 2017

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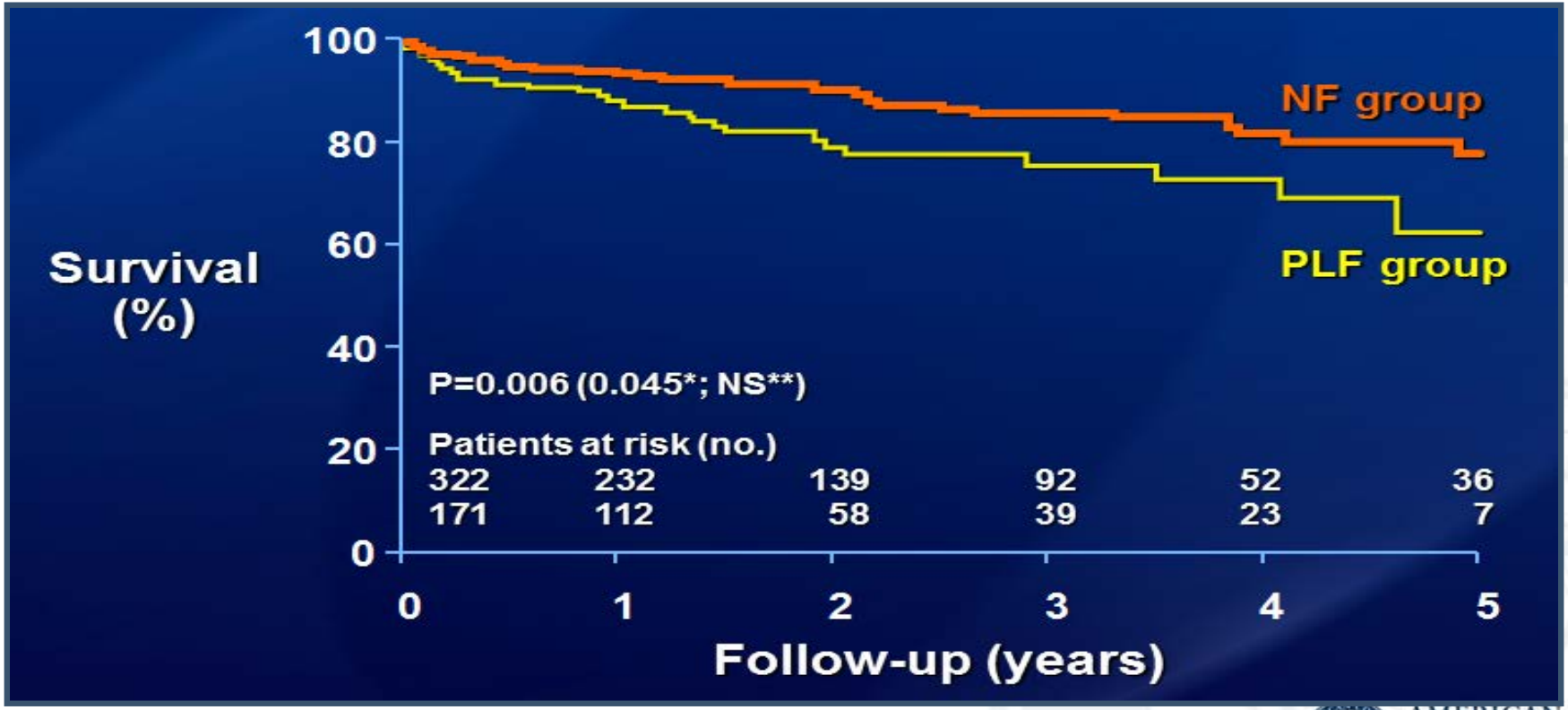
Survival



Hachicha Z et al. Circulation 2007;115:2856-64

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History

- 82 yo F
  - Progressive fatigue and dyspnea for the last year
  - Can now walk only a block before limited
  - No edema, chest pain, syncope
  - No orthopnea, PND

PMH

- Paroxysmal AF
- Borderline HTN

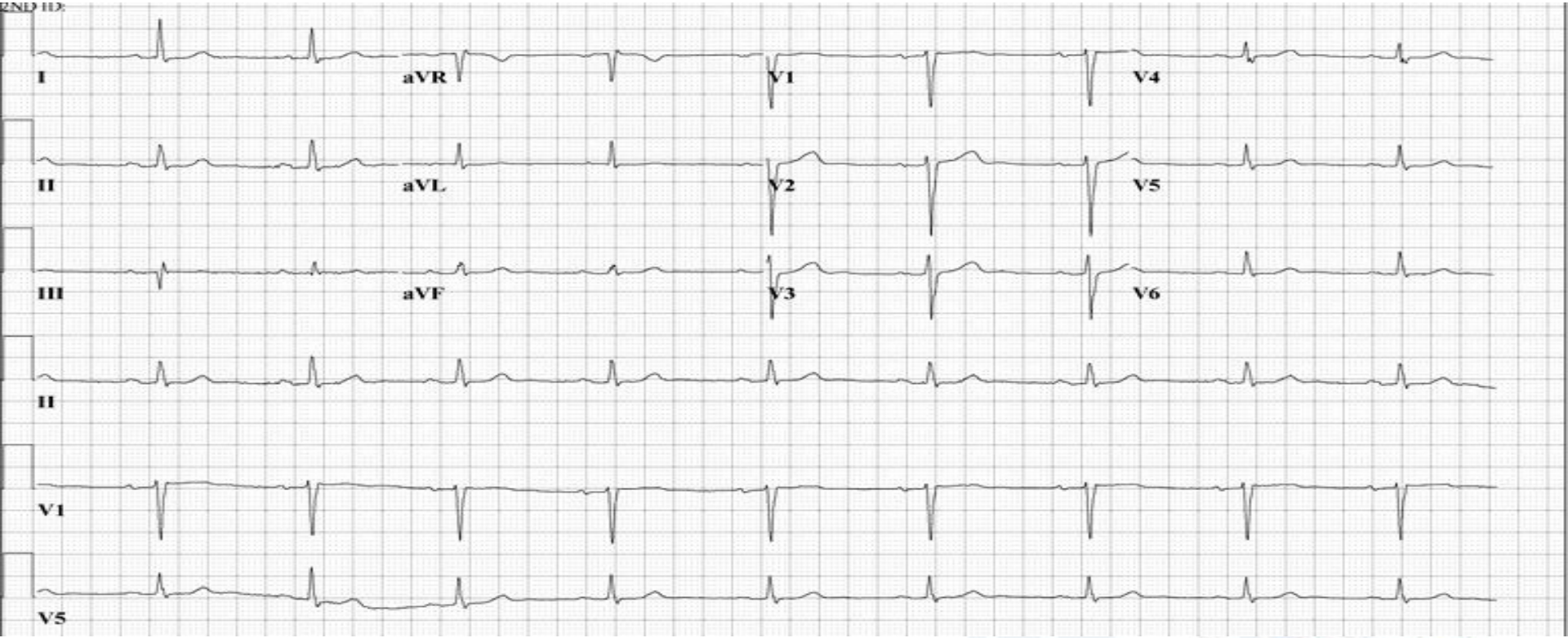
Home Meds

- Aspirin

Exam

- BP 119/55, HR 70, BMI 25.38
- JVP normal
- Carotid upstroke 1+ parvus and tardus
- Heart: LV impulse slightly sustained and localized
- Normal S1, single S2.

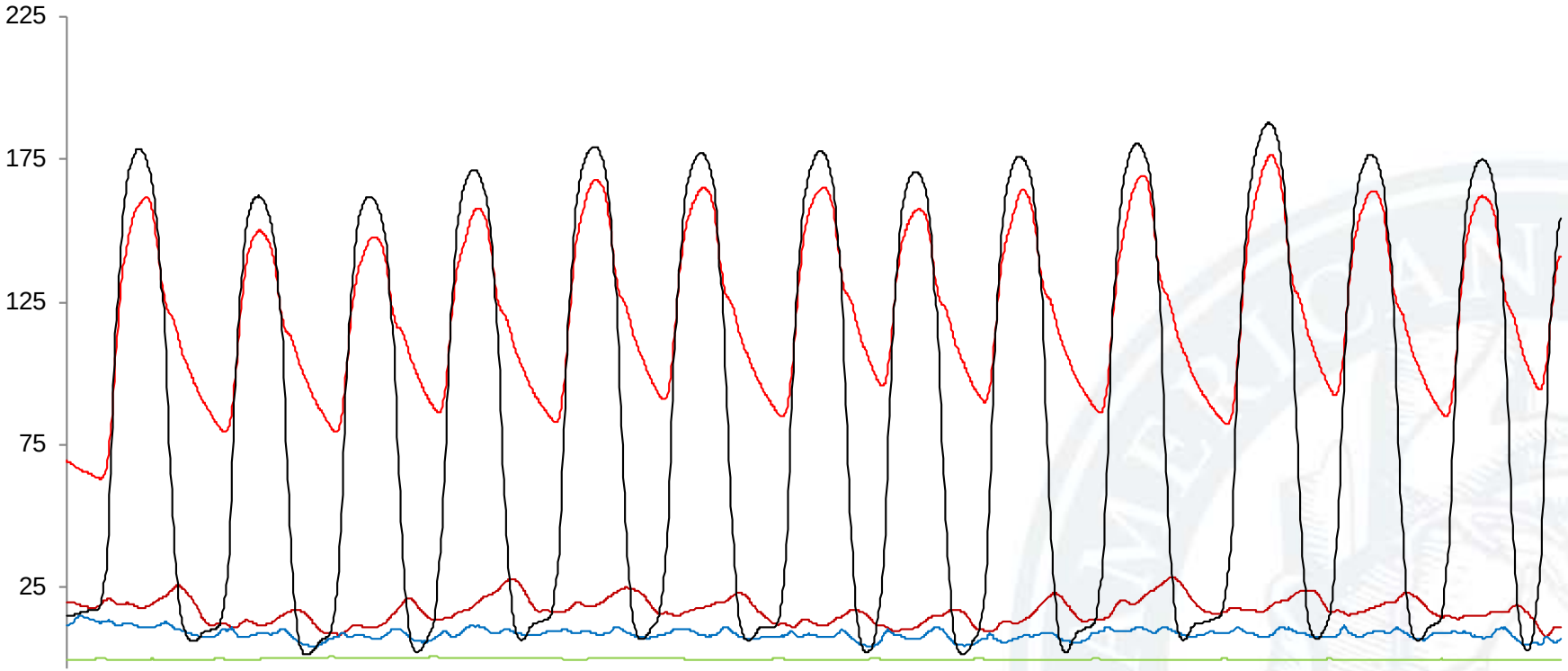
  2/6 SEM RUSB with early to mid peak
- Lungs: Clear
- No edema



Paradoxical Low flow, low gradient severe AS

TAVR? SAVR? Observe?

Rest



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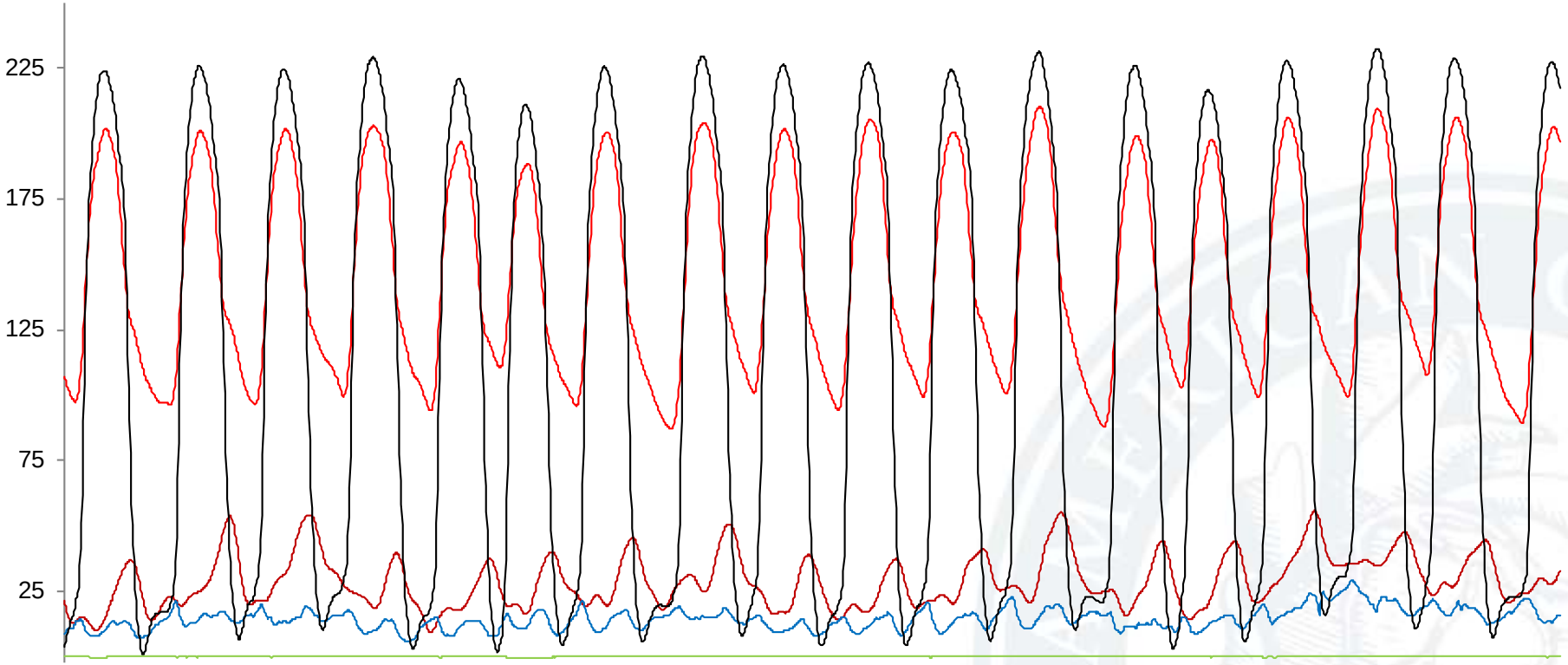
Exercise



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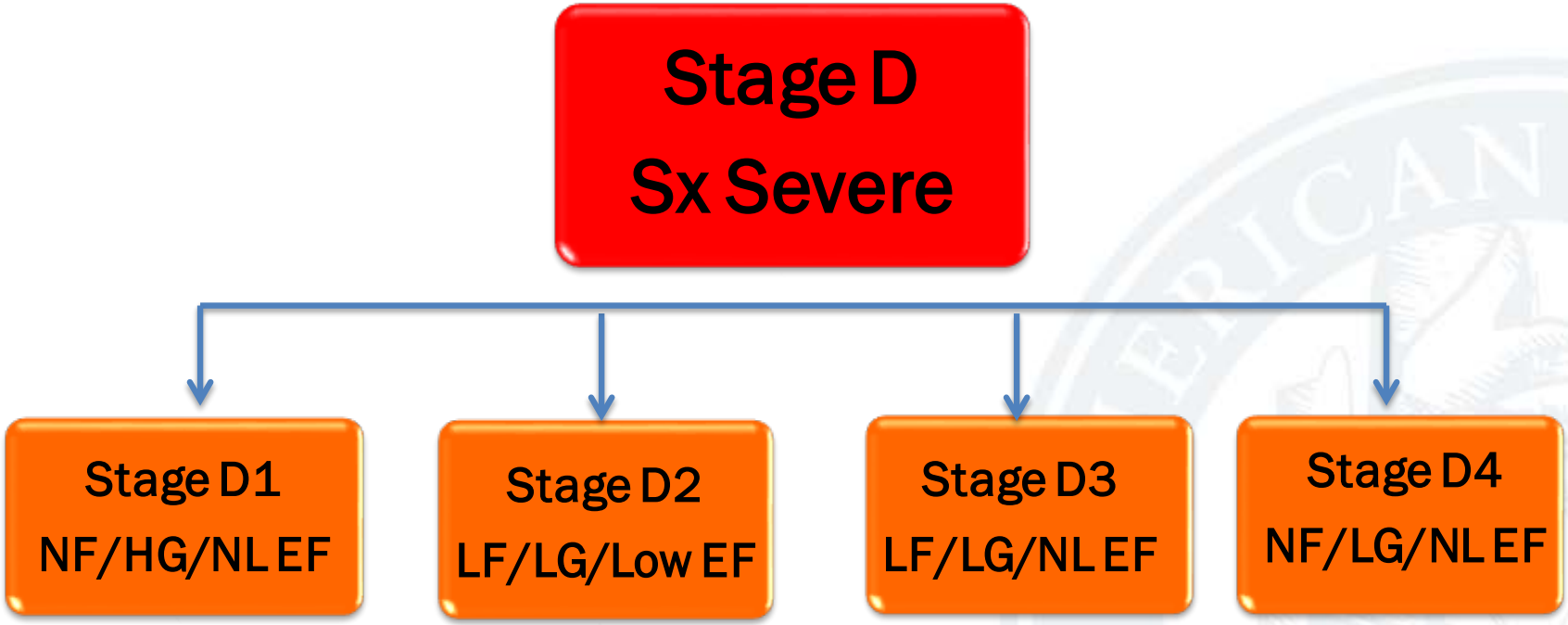
DIAGNOSIS

HFpEF

Moderate AS

Stages of Chronic AS



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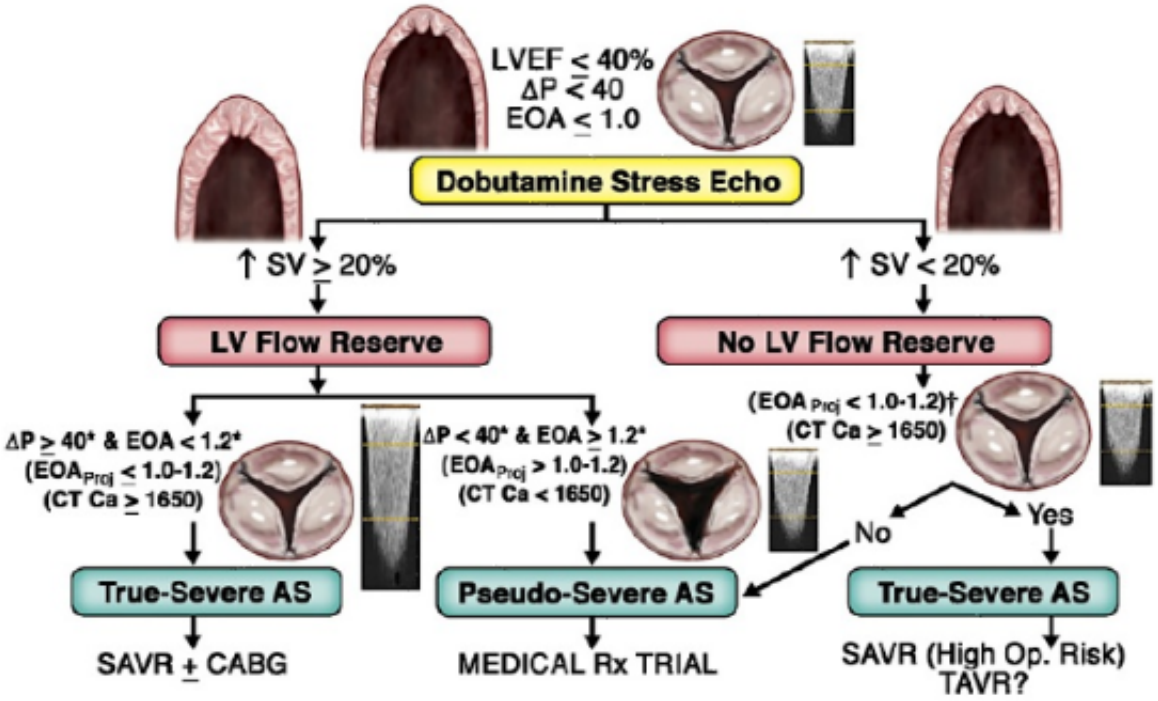
LF/LG Severe AS with Low EF



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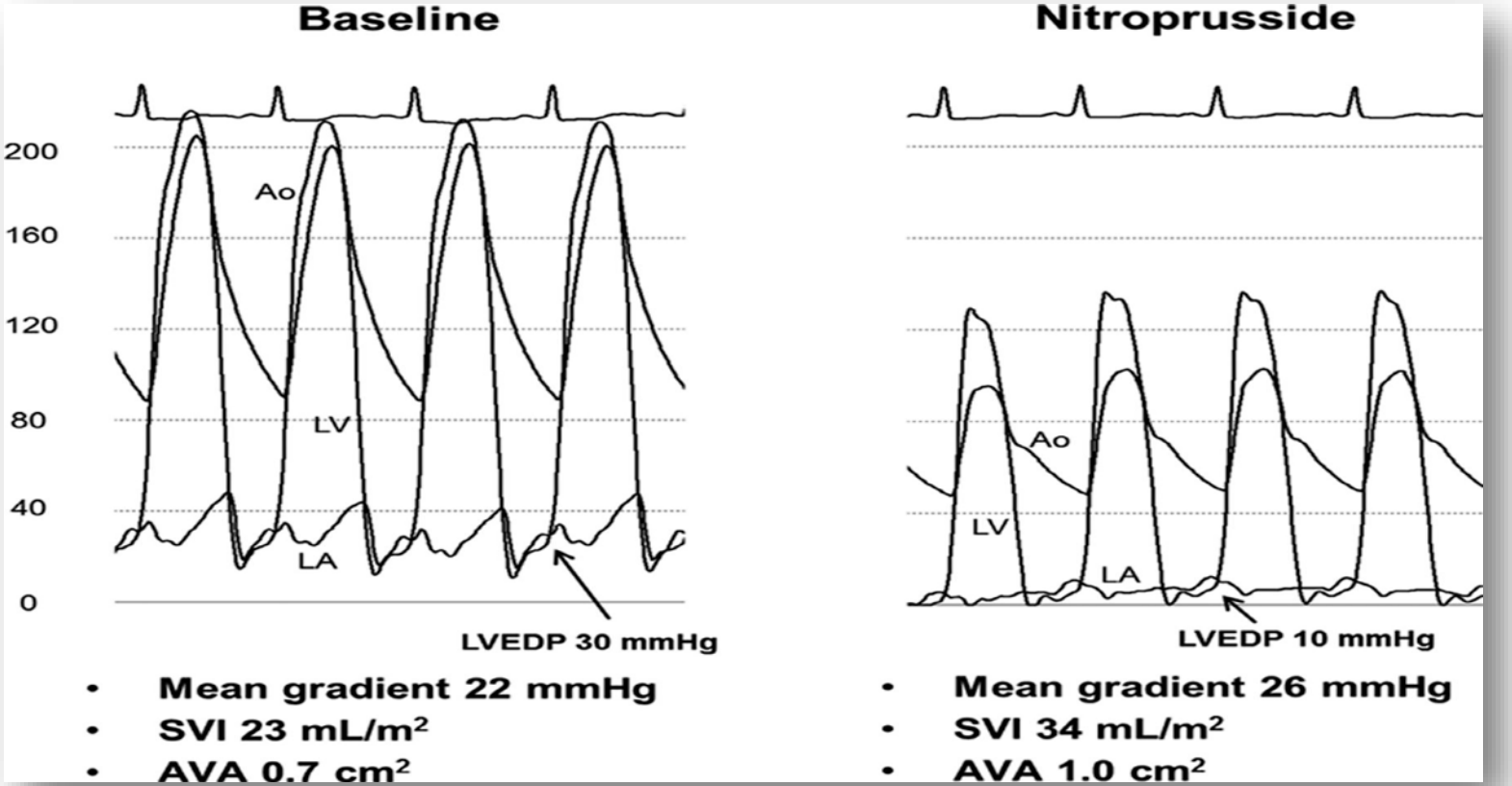
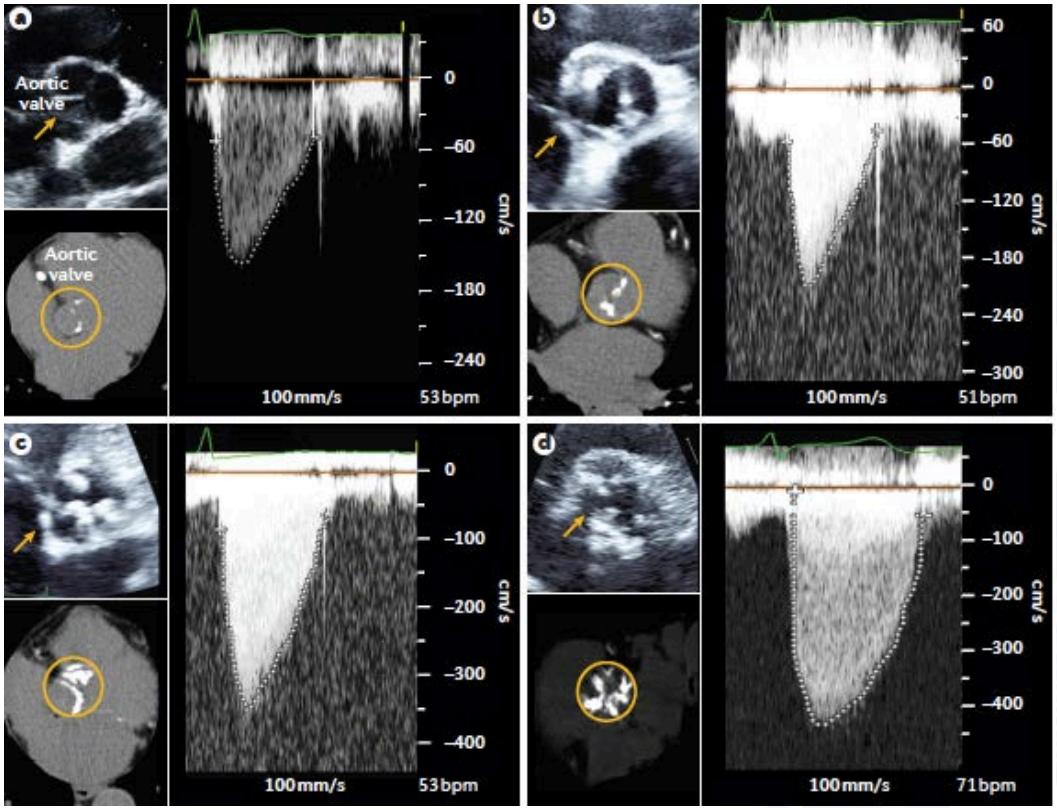


Eleid M F et al. *Circulation* 2013;128:1349-1353

Anatomic/Doppler Assessment of AS



Lindman BR et al. Nat Rev Dis Prim 2016

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