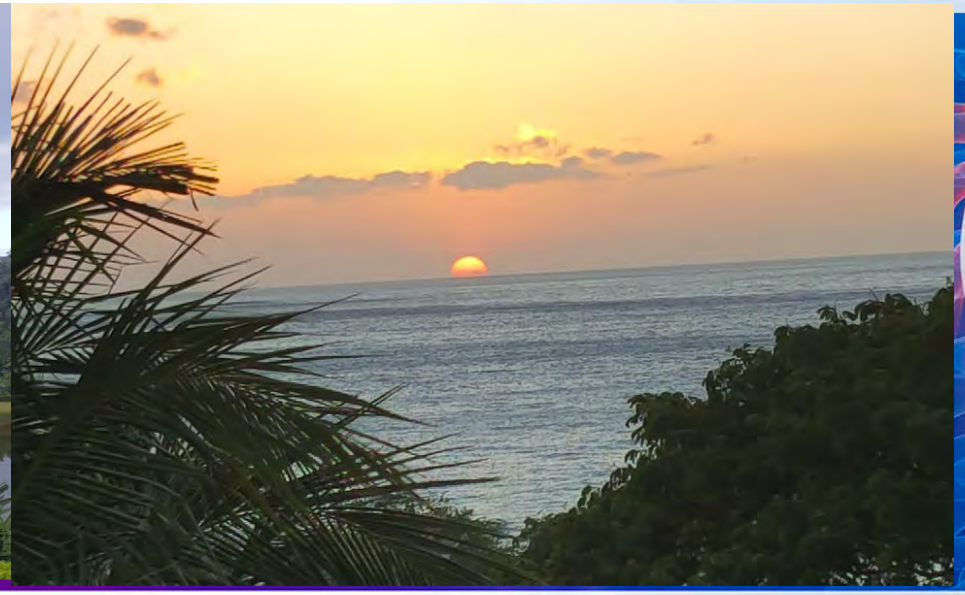
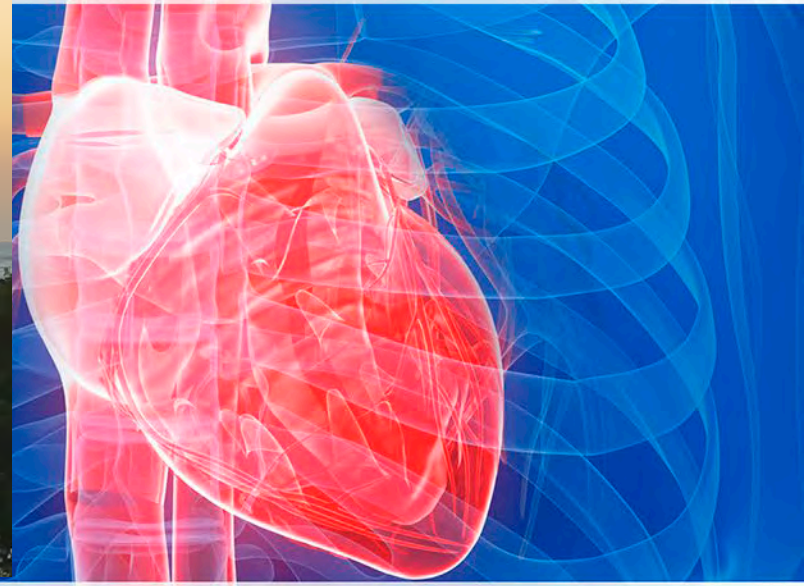
Exercise, Diastolic Function and Strain for VHD

Jae K. Oh, MD

MAYO CLINIC

Exercise, Diastole and Strain for VHD





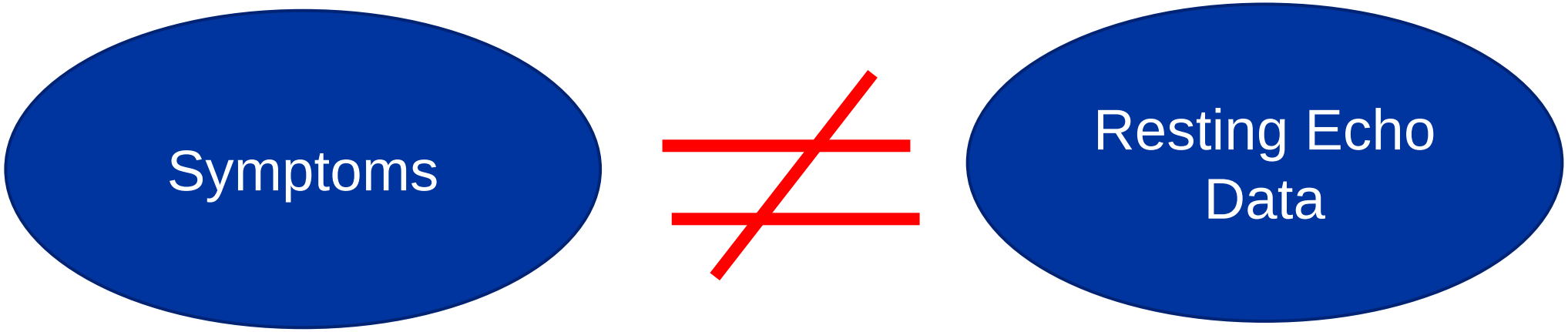
Jae K. Oh, MD
Samsung Professor of CV Diseases

Disclosure

- Consulting for Medtronic's Valve Project
- Echo Core Lab for TMVR (Medtronic Inc)
- Echo Core Lab for Valve in MAC (Edward Science)
- Echo Core Lab for TAVR

Exercise Echo in Valvular Heart Diseases

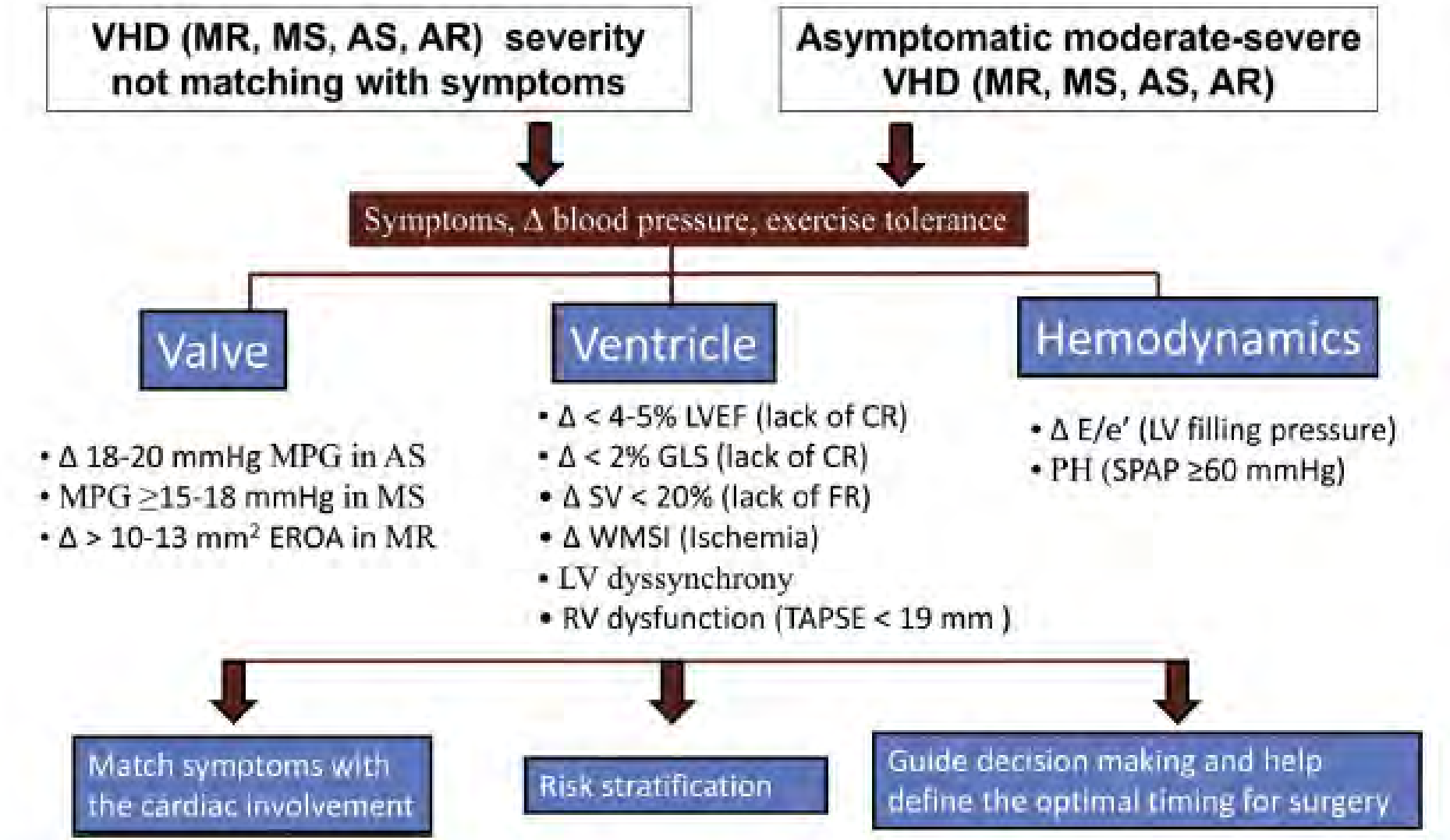
When to do it ?



- Asymptomatic patients with severe VHD
- Symptomatic patients with less than severe VHD

- Aortic stenosis
- Mitral regurgitation
- Mitral prosthesis
- Aortic regurgitation
- Mitral stenosis

Exercise Test for Valvular Heart Diseases



ASE/EACVI Guideline 2017

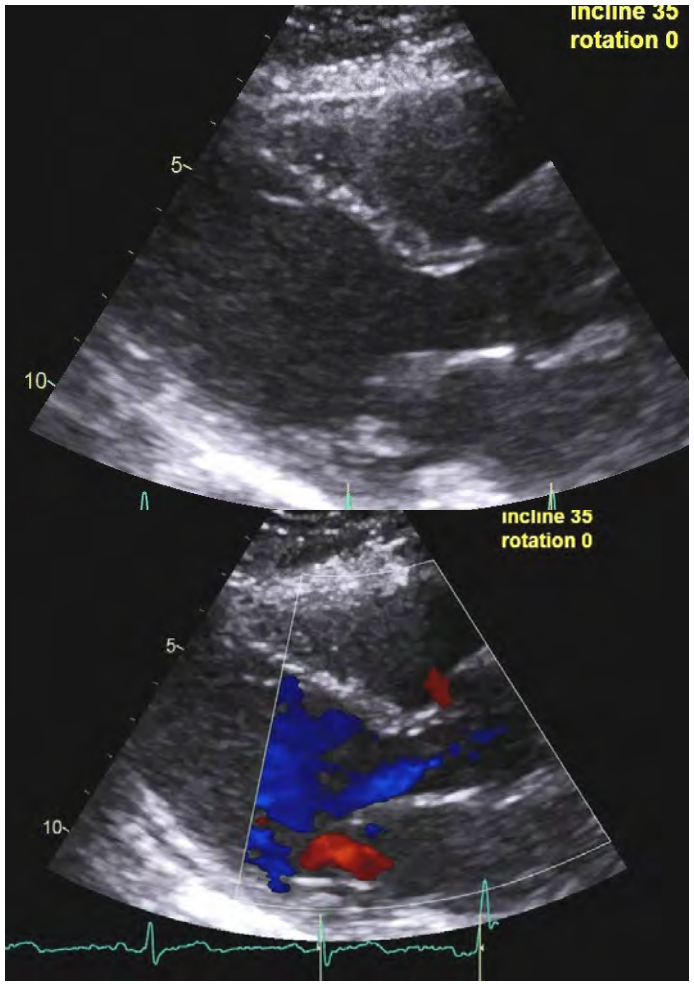
2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: Executive Summary: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Rick A. Nishimura, Catherine M. Otto, Robert O. Bonow, Blase A. Carabello, John P. Erwin III, Robert A. Guyton, Patrick T. O'Gara, Carlos E. Ruiz, Nikolaos J. Skubas, Paul Sorajja, Thoralf M. Sundt III and James D. Thomas

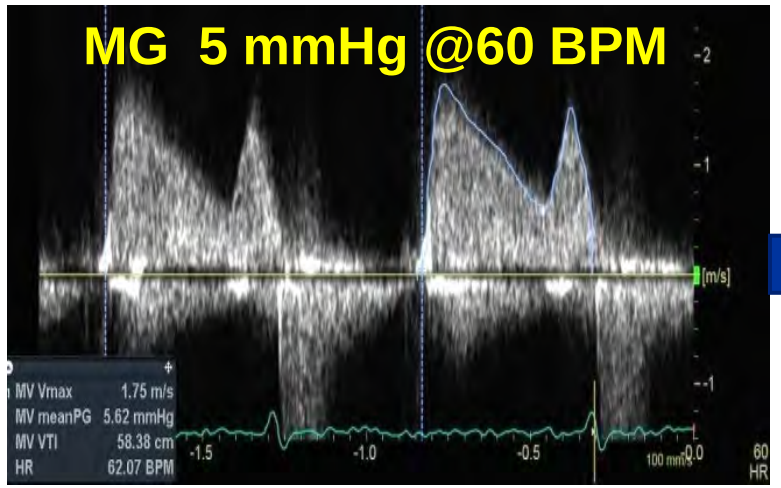
Class I Recommendation for Exercise in Mitral Stenosis

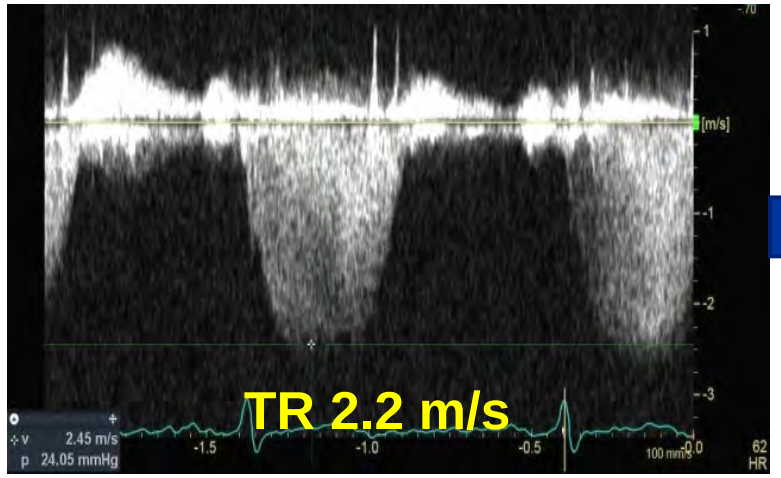
Exercise testing with Doppler or invasive hemodynamic assessment is recommended to evaluate the response of the mean mitral gradient and PASP in patients with MS when there is a discrepancy between resting Doppler echocardiographic findings and clinical symptoms or signs. ***(Level of Evidence: C)***

Evaluation of Severity of Mitral Stenosis

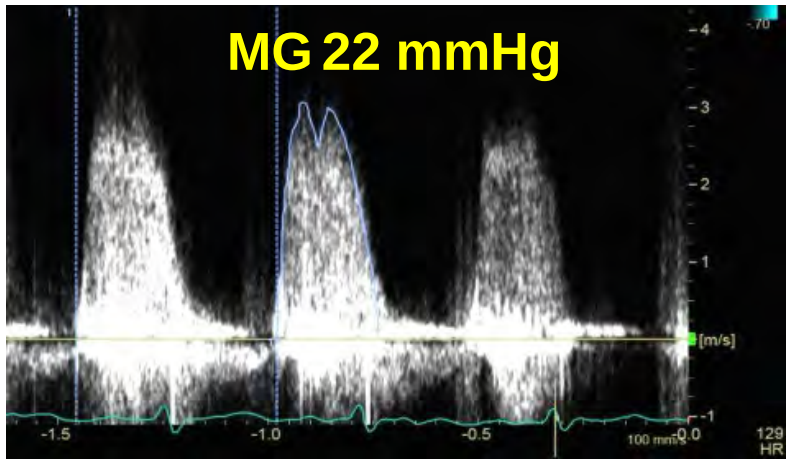


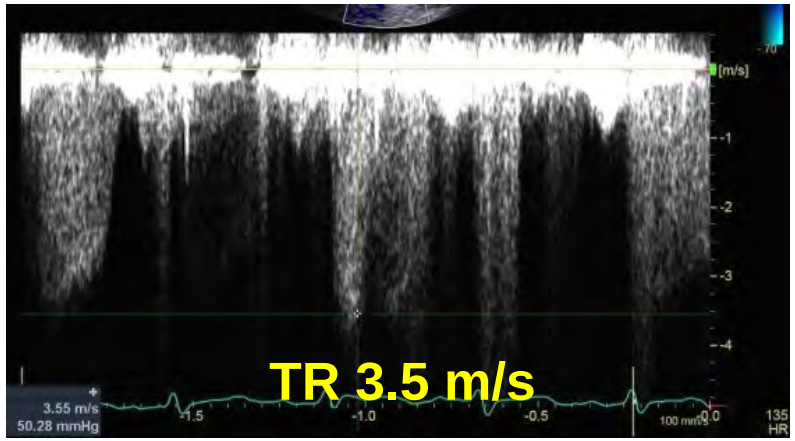
Rest





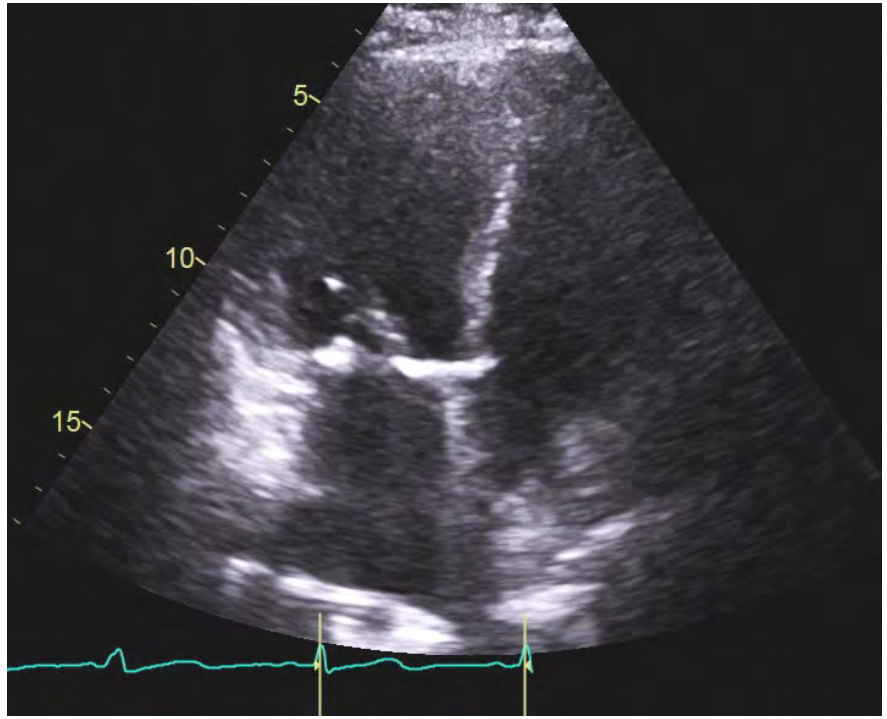
Exercise

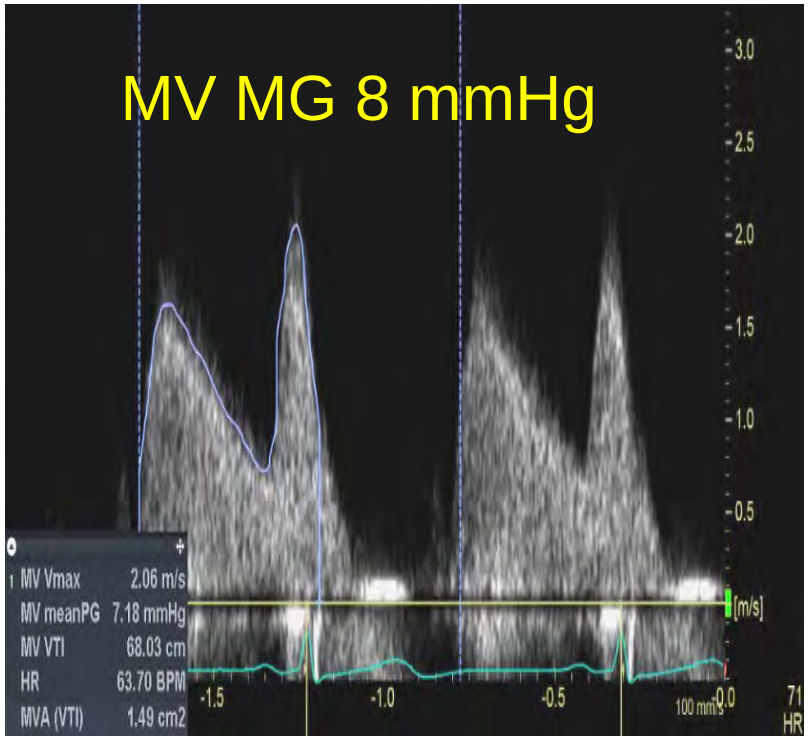


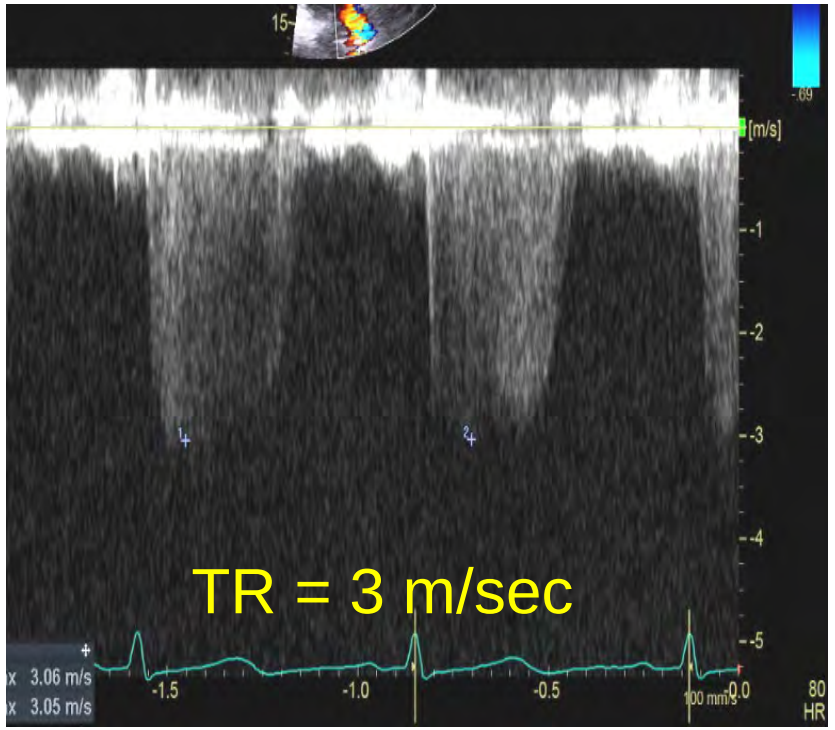


Severe MS MG > 15 with exercise, > 18 mmHg with Dobutamine

70 year old woman with hypertension and NYHA III
Mitral annulus calcification and increased gradient

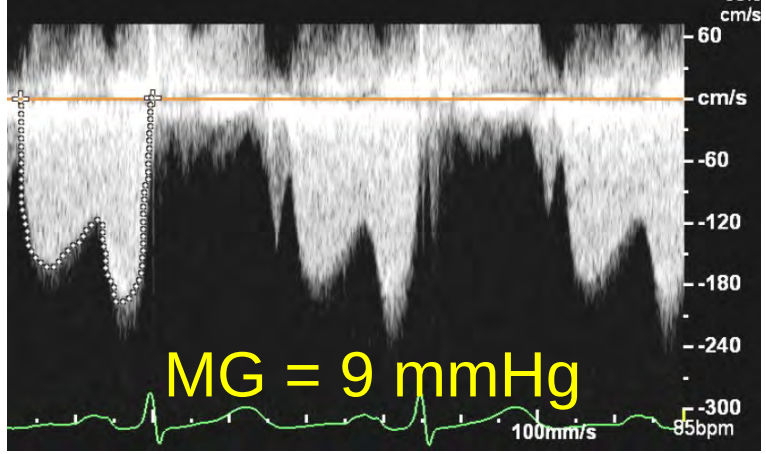




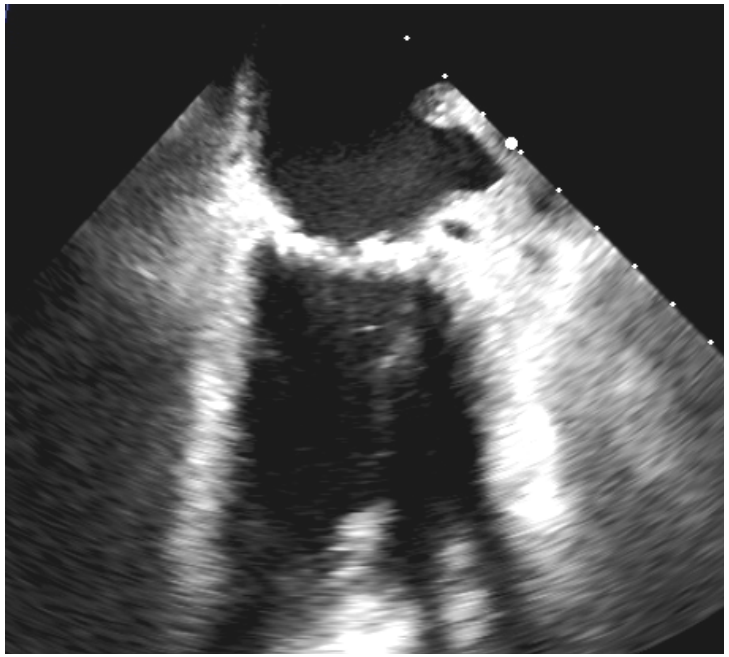


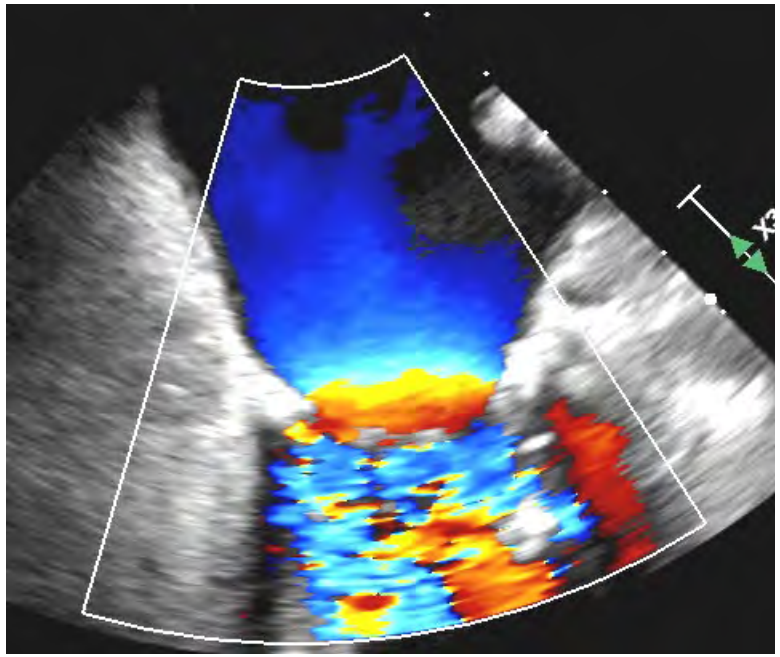
Severe MS at resting Echo

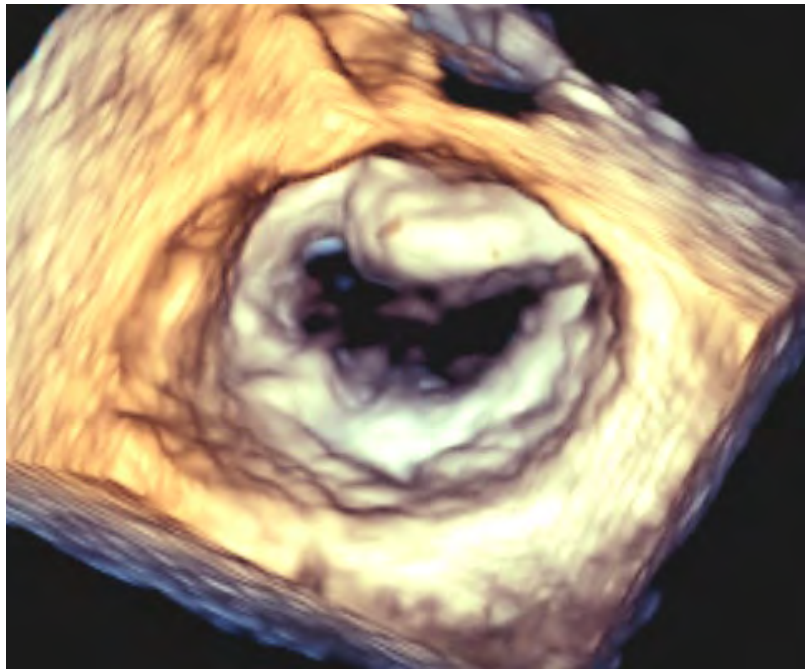
MVA < 1 cm^2 ESC and < 1.5 cm^2 ASE



70 yo woman with hypertension and NYHA III
Mitral annulus calcification and stenosis



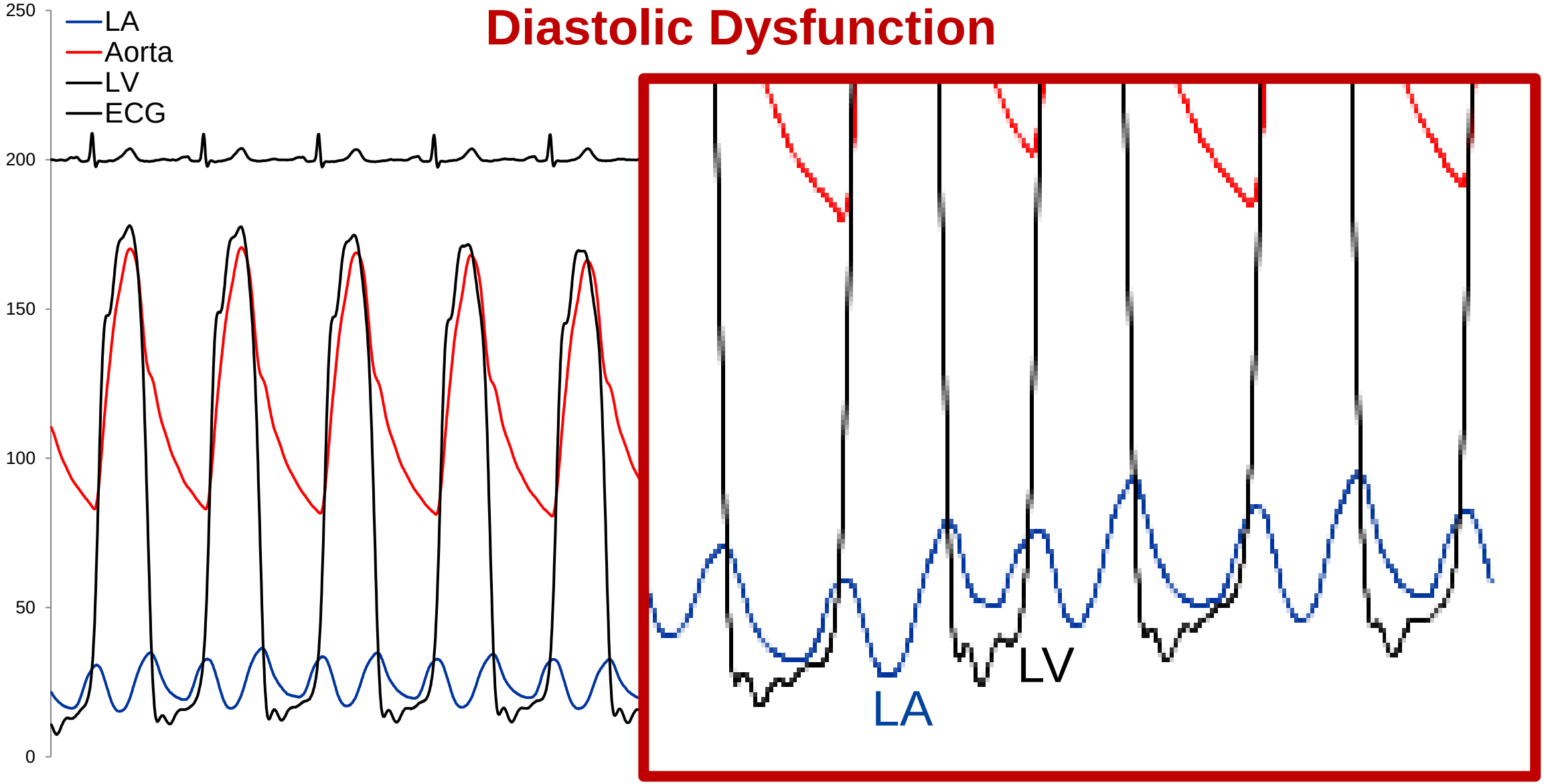




Mitral gradient 9 mmHg; valve area 2.0 cm^2

LVEDP 27 mmHg with no end-diastolic gradient

Diastolic Dysfunction



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Class IIa Recommendation : Exercise in VHD

Exercise testing is reasonable in selected patients with asymptomatic severe VHD to

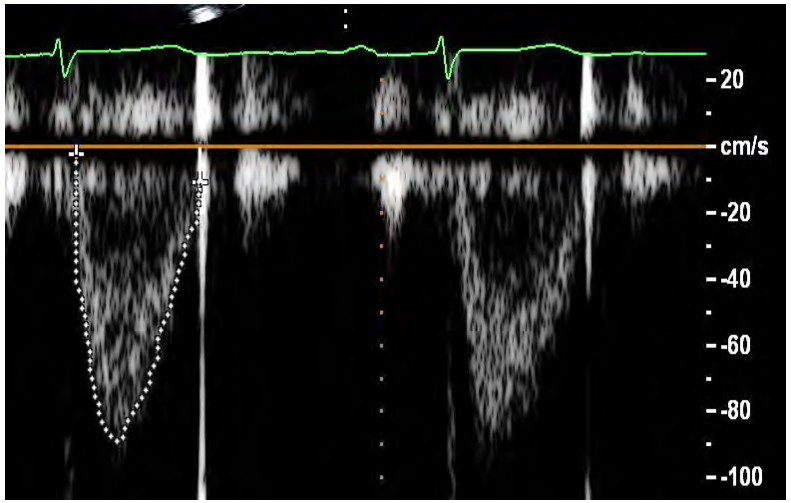
1) confirm the absence of symptoms, or

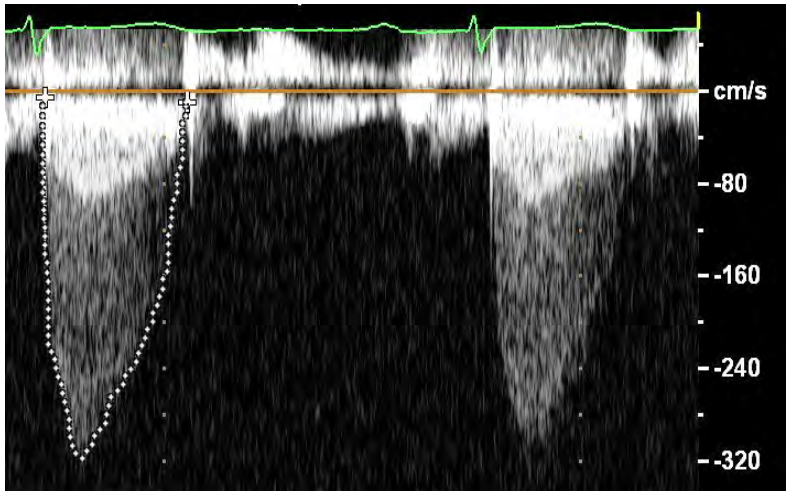
2) assess the hemodynamic response to exercise, or

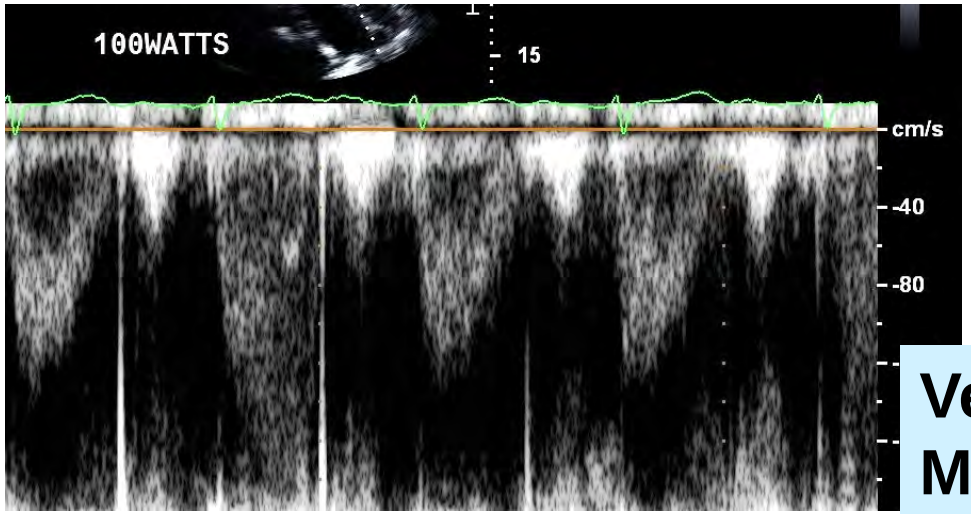
3) determine prognosis

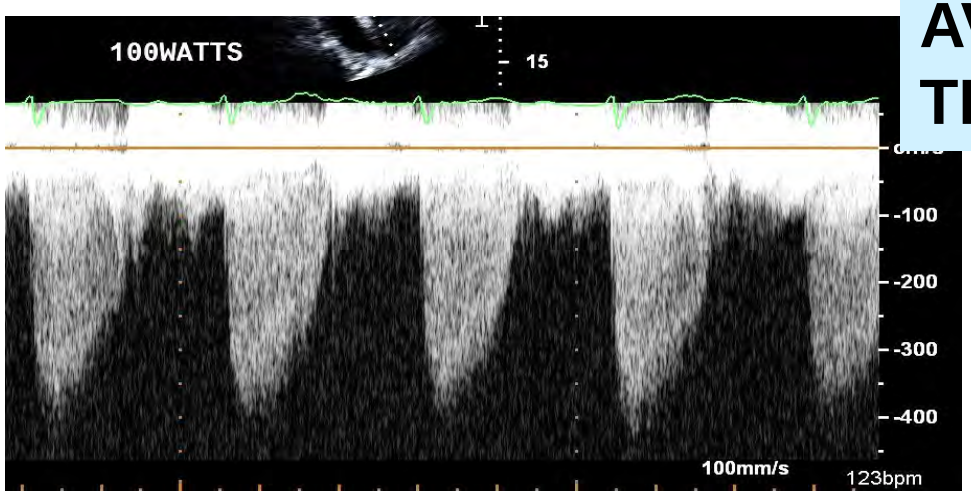
(*Level of Evidence: B*)

Exercise Test for Low Gradient Severe AS





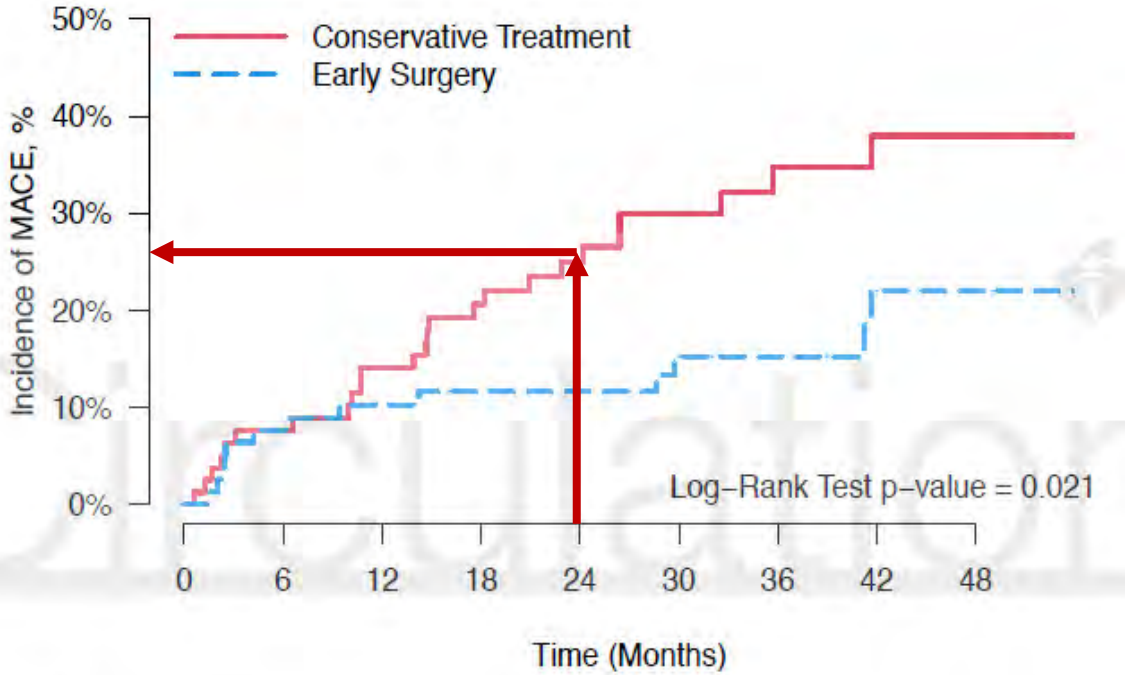




Vel 3.2 to 4.2 m/sec
MG 24 to 41 mmHg
AVA 0.9 cm
TR V 2.5 to 4.0 m/sec

Aortic Valve ReplAcemenT versus Conservative Treatment in Asymptomatic SeveRe Aortic Stenosis: The AVATAR Trial

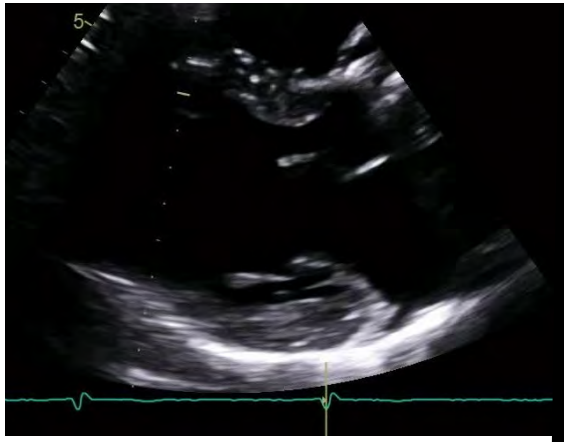
Marko Banovic ✉, Svetozar Putnik, Martin Penicka, Gheorghe Doros, Marek A. Deja, Radka Kockova, Martin Kotrc, Sigita Glaveckaite, Hrvoje Gasparovic, Nikola Pavlovic, Lazar Velicki, Stefano Salizzoni, Wojtek Wojakowski, Guy Van Camp, Serge D. Nikolic, Bernard Iung, and Jozef Bartunek
and on behalf of the AVATAR-trial investigators

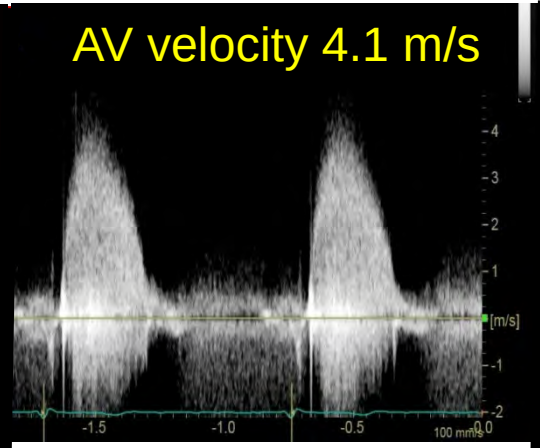


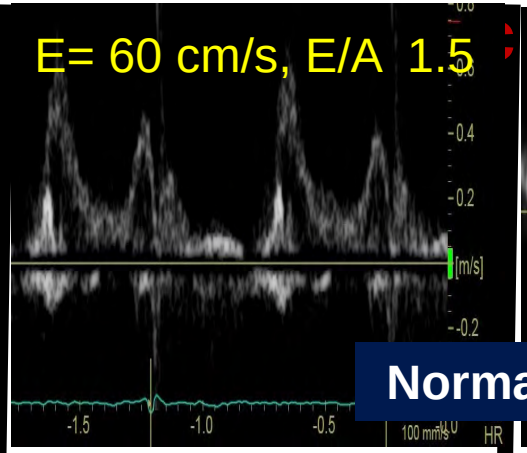
Patients, n									
Conservative Treat.	79	73	66	59	49	36	25	19	12
Early Surgery	78	72	68	63	56	46	38	23	13

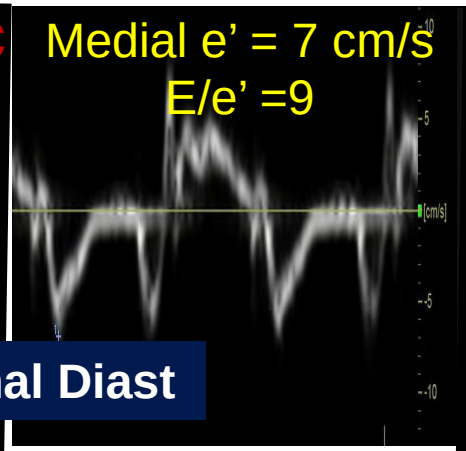
M. Banovic et al

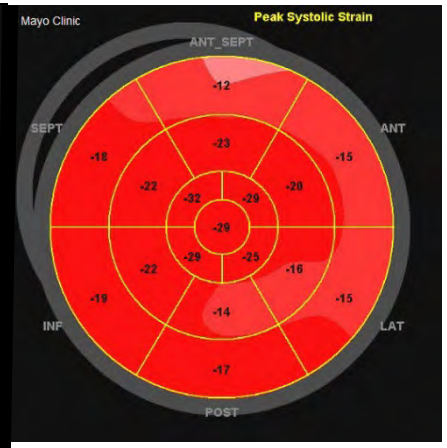
3 patients with severe aortic stenosis



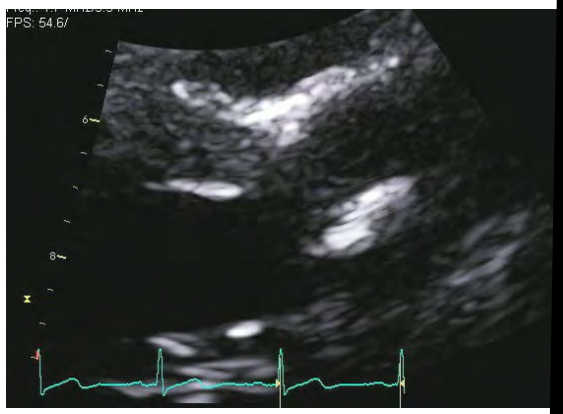


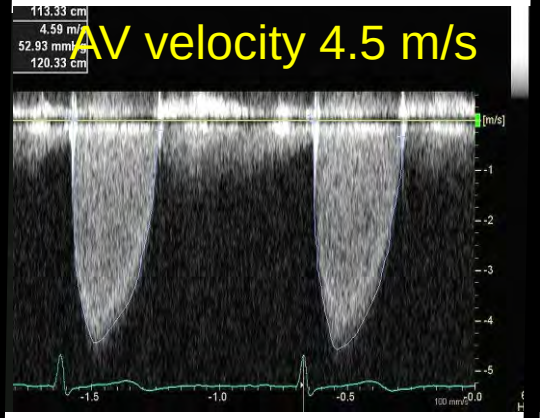


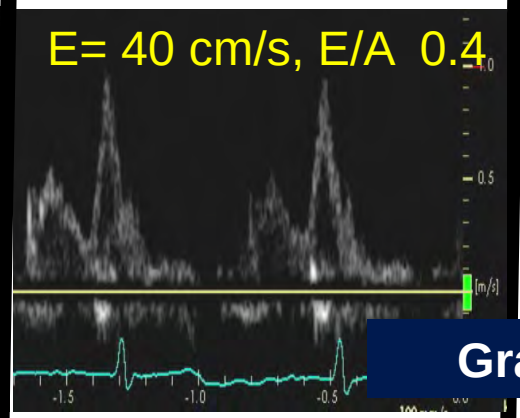


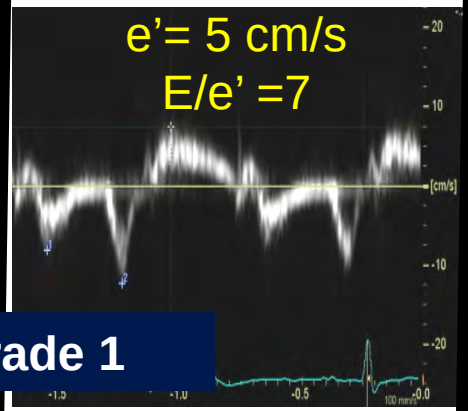


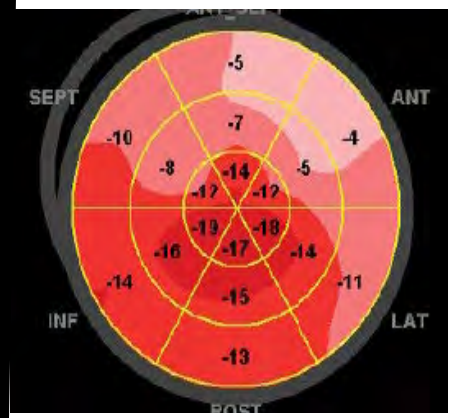
Normal Diast



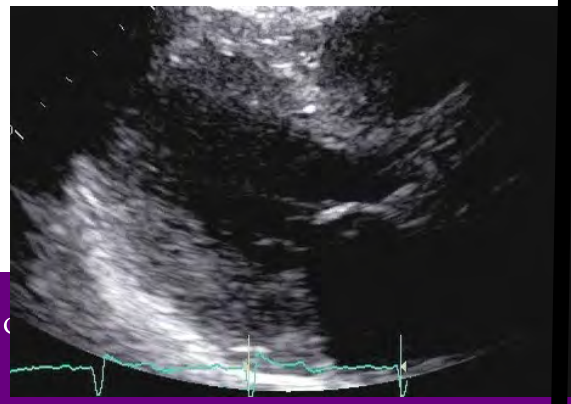


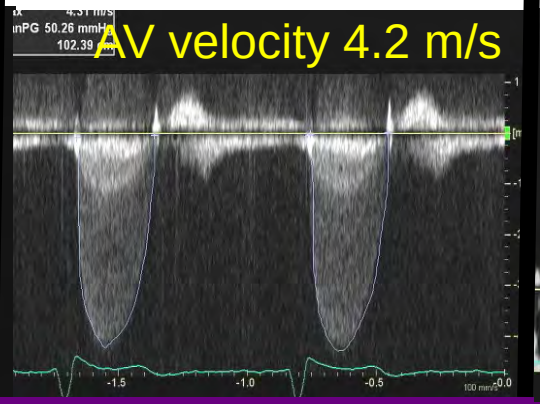


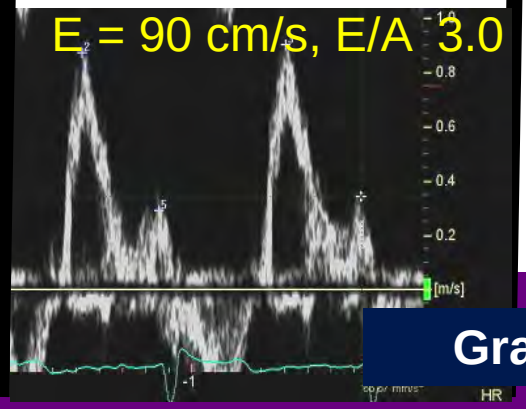


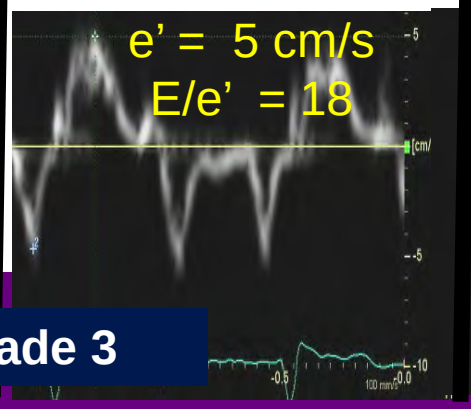


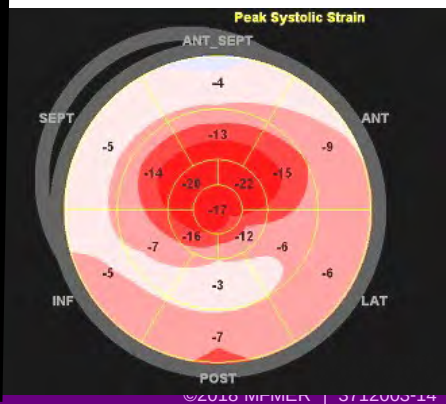
Grade 1











Grade 3

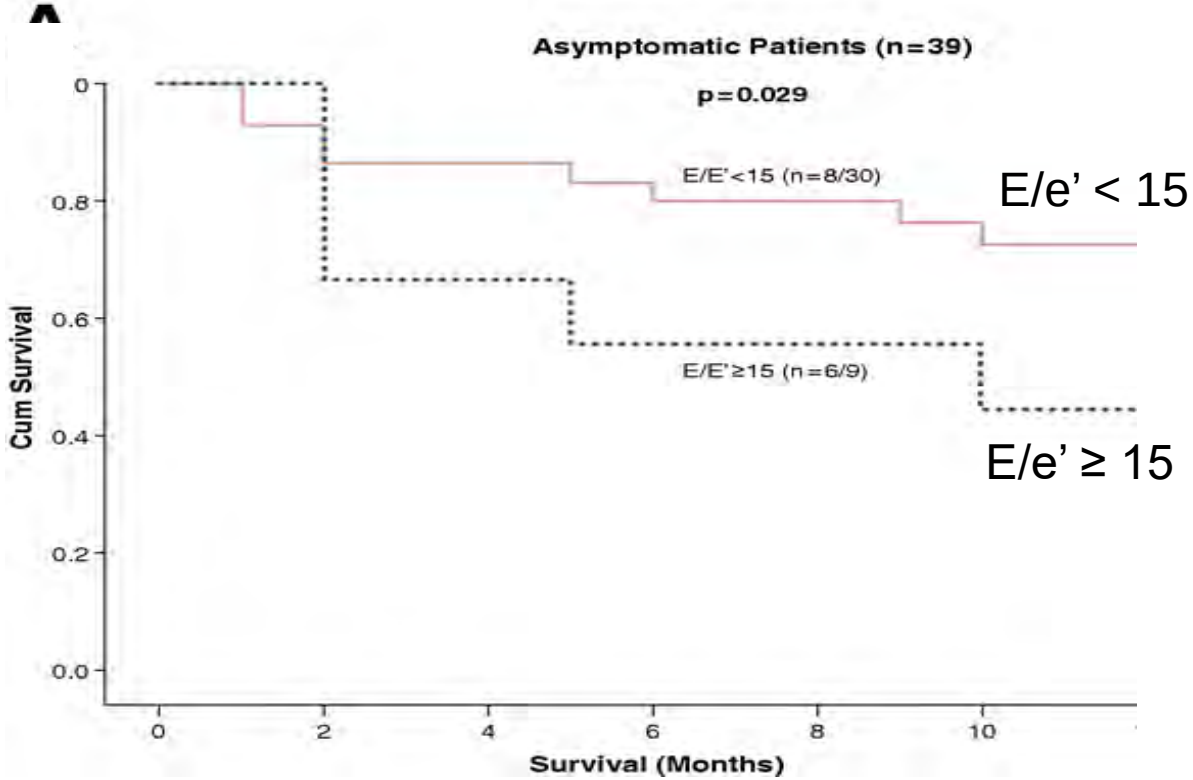
Prognostic Value of E/E′ Ratio in Patients With Unoperated Severe Aortic Stenosis

Simon Biner, MD,*† Asim M. Rafique, MD,* Pavel Goykhman, MD,*
Ryan P. Morrissey, MD,* Jesse Naghi, MD,* Robert J. Siegel, MD*
Los Angeles, California; and Tel Aviv,

Left ventricular filling pressure and survival following aortic valve replacement for severe aortic stenosis

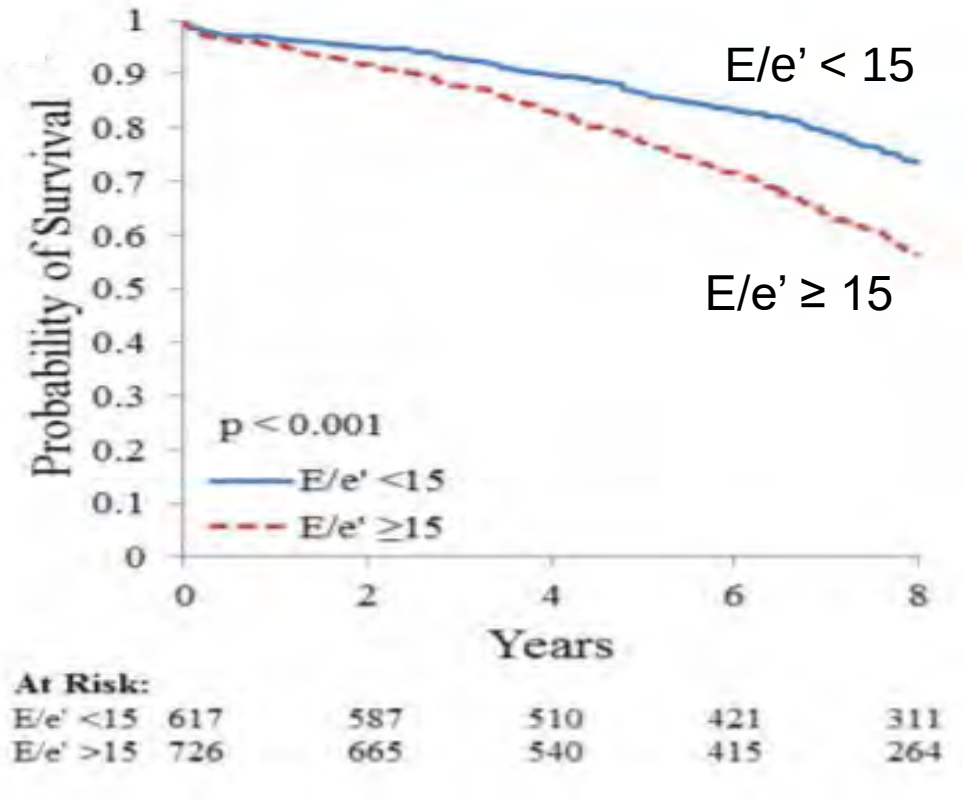
Jeremy J Thaden [1], Mahesh Balakrishnan,[1] Jose Sanchez,[1] Rosalyn Adigun,[1]
Vuyisile T Nkomo [1], Mackram Eleid,[1] Jordi Dahl,[1] Christopher Scott [2],
Sorin Pislaru,[1] Jae K Oh,[1] Hartzell Schaff,[3] Patricia A Pellikka [1]

E/e’ ≥ 15 is a Bad Prognostic Sign in AS



E/e’ < 15

E/e’ ≥ 15



E/e’ < 15

E/e’ ≥ 15

Biner and Siegel et al JACC Imaging 2010

Thaden et al Heart 2020

Moderate Aortic Stenosis at Mayo

- A total of 696 patients
  - Median age 77 years
  - Mean AVA 1.3 cm^2,
  - 57% male
  - 45% symptomatic
- During a median follow-up of 3.4 years, there were 279 deaths (40%).

LV Global Longitudinal Strain in Moderate Aortic Stenosis

Circulation: Cardiovascular Imaging

ORIGINAL ARTICLE

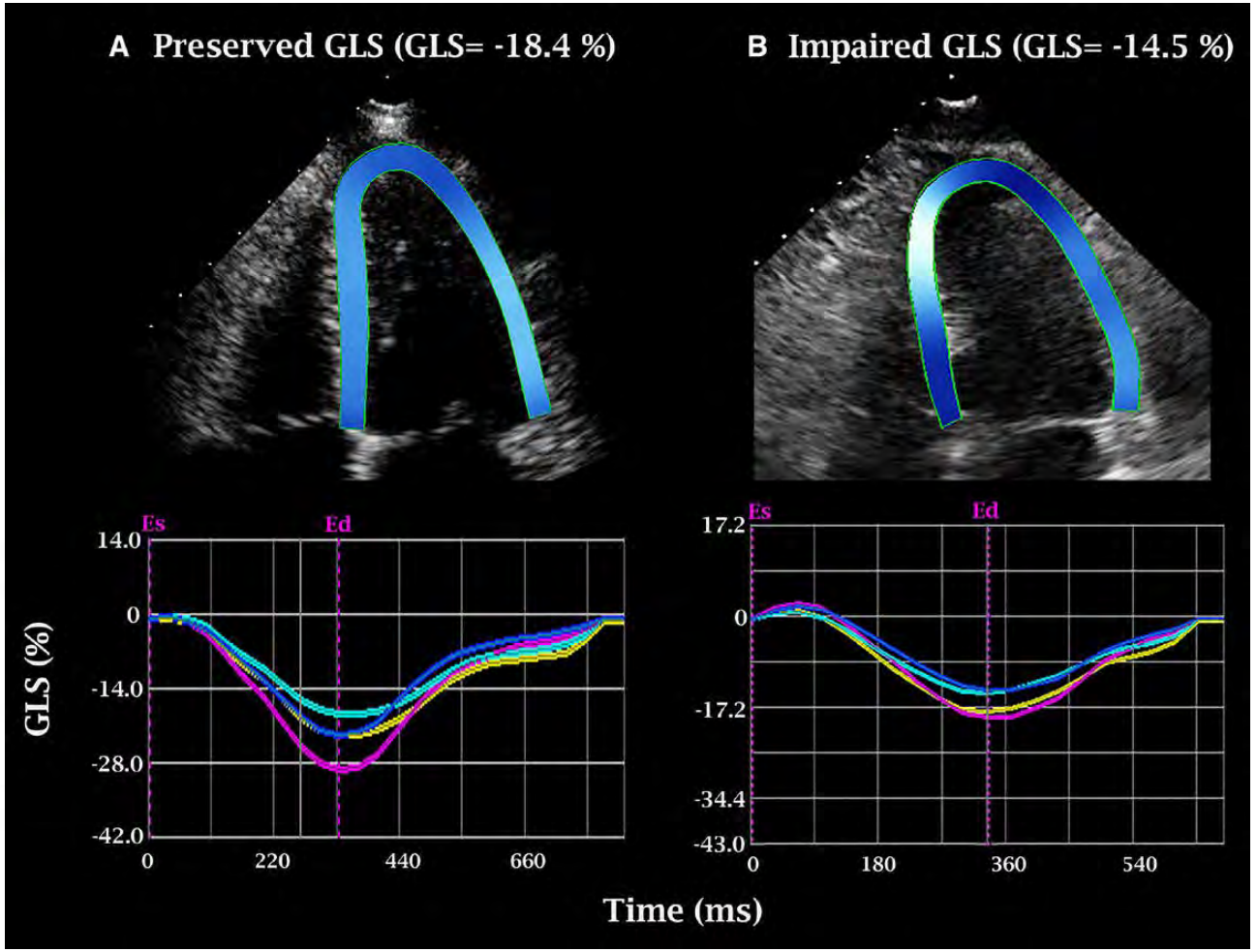
Left Ventricular Global Longitudinal Strain Is Associated With Long-Term Outcomes in Moderate Aortic Stenosis

See Editorial by Lakatos and Kovács

Dan Zhu, MD
Saki Ito, MD, MSc
William R. Miranda, MD
Vuyisile T. Nkomo, MD, MPH
Sorin V. Pislaru, MD, PhD
Hector R. Villarraga, MD
Patricia A. Pellikka, MD
Daniel J. Crusan, BS
Jae K. Oh, MD

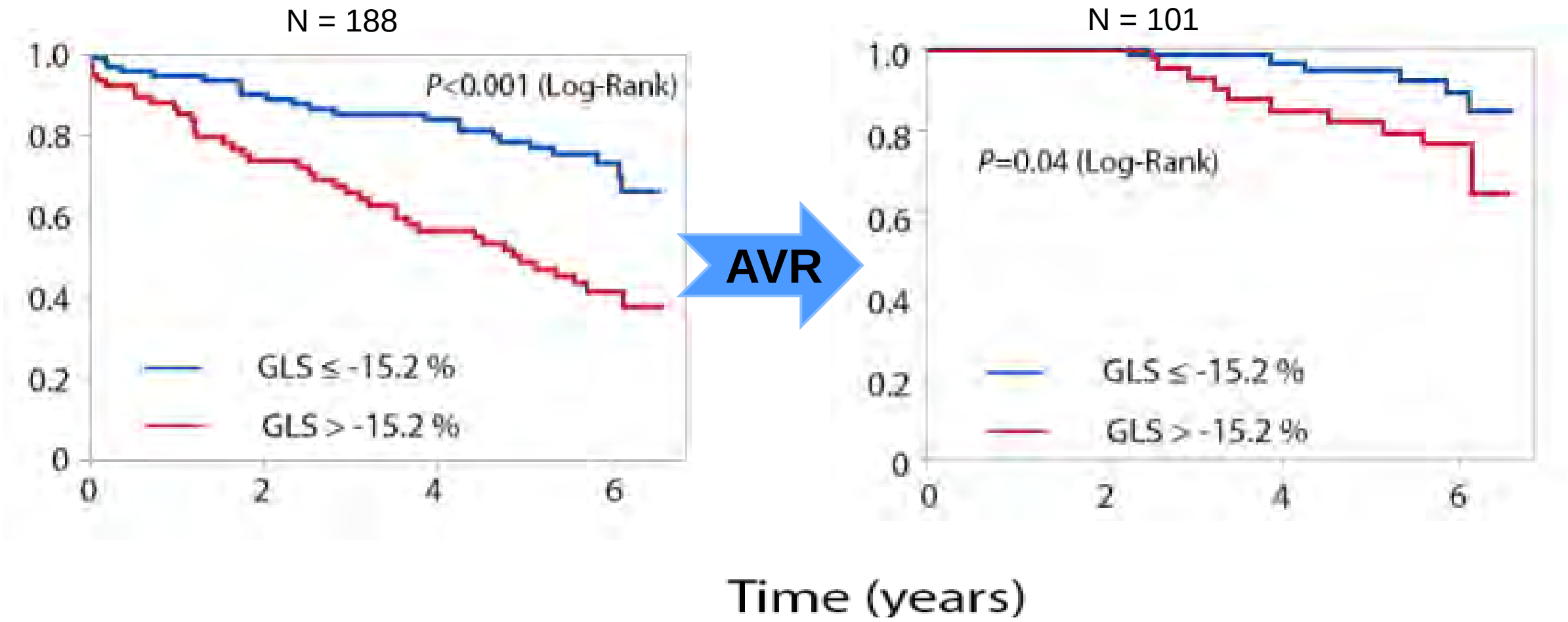
BACKGROUND: Left ventricular global longitudinal strain (GLS) is associated with long-term outcomes of patients with severe aortic stenosis. However, its prognostic value in patients with moderate aortic stenosis remains unknown.

METHODS: Patients diagnosed with moderate aortic stenosis (1.0< aortic valve area ≤1.5 cm^2) and left ventricular ejection fraction ≥50% were identified. GLS was assessed by 2-dimensional strain imaging using



Zhu and Ito et al Circ Imaging 2020

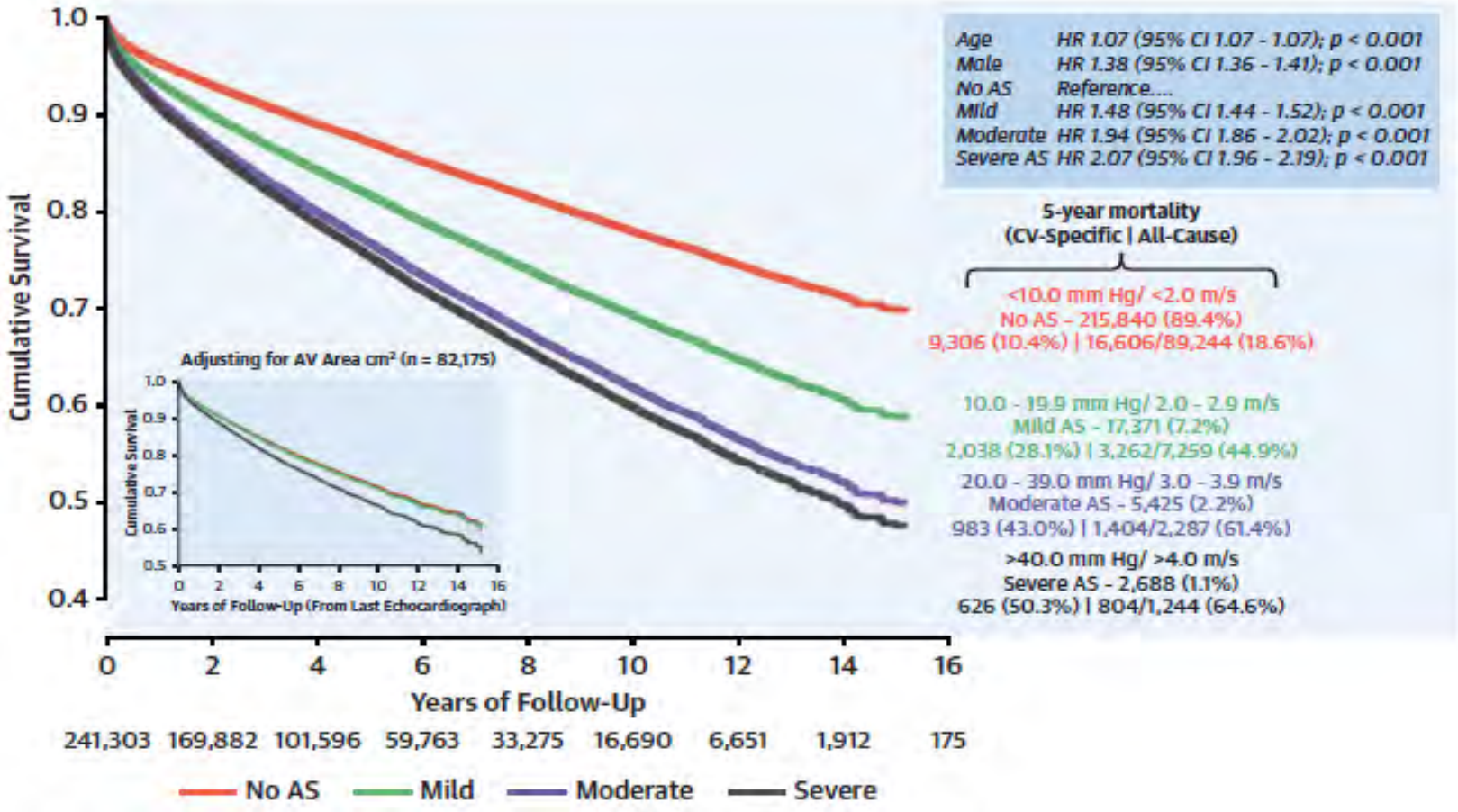
Survival outcomes for patients with moderate AS with LVEF ≥60%



Zhu and Ito et al Circ Imaging 2020

Poor Long-Term Survival in Patients With Moderate Aortic Stenosis

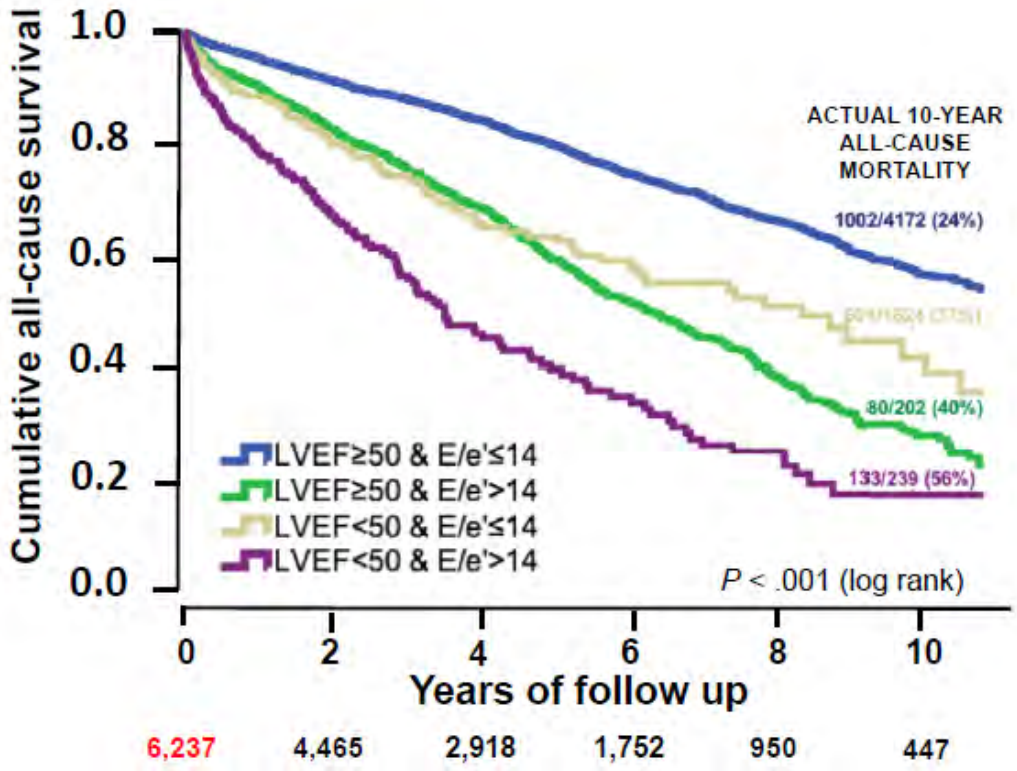
Geoff Strange, PhD,[a] Simon Stewart, PhD,[b] David Celermajer, MD, PhD,[c] David Prior, MBBS, PhD,[d] Gregory M. Scalia, MBBS (Hons), MMedSc,[e] Thomas Marwick, MBBS, PhD,[f] Marcus Ilton, MD,[g] Majo Joseph, MBBS,[h] Jim Codde, PhD,[i] David Playford, MBBS, PhD,[a] on behalf of the National Echocardiography Database of Australia contributing sites



Strange et al JACC 2019

Markers of Elevated Left Ventricular Filling Pressure Are Associated with Increased Mortality in Nonsevere Aortic Stenosis

Lauren C. Giudicatti, MBBS, Sally Burrows, BMath, GradDipMedStat, David Playford, MBBS, PhD, FESC, FACC, Geoff Strange, PhD, and Graham Hillis, BMedBiol, MBChB, PhD, *Perth and Fremantle, Australia*



E/e'≤ 14

E/e' > 14

Giudicatti et al. JASE 2021

Clinical Trials to test following AS Rx

Asymptomatic Severe AS
Symptomatic Moderate AS

UNLOAD
PROGRESS
EXPAND
Trials

LVEF < 60%

LVEF ≥ 60%

E/e' ≥ 15

GLS < -14%

Fibrosis

Myocardial Work

AVR

Exercise testing in MR and TR

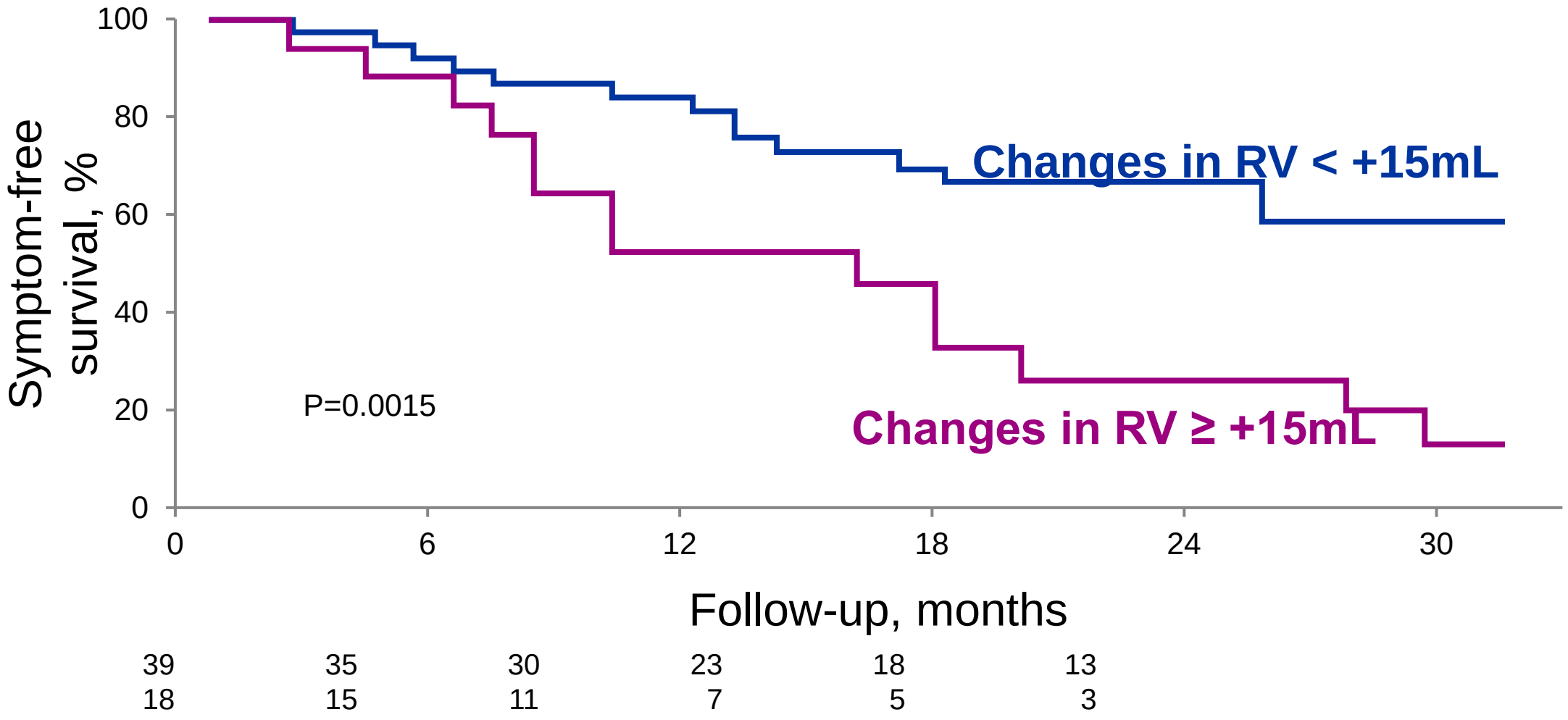
Class IIa

1. Exercise hemodynamics with either Doppler echocardiography or cardiac catheterization is reasonable in symptomatic patients with chronic primary MR where there is a discrepancy between symptoms and the severity of MR at rest (stages B and C) *(Level of Evidence: B)*

2. Exercise treadmill testing can be useful in patients with chronic primary MR to establish symptom status and exercise tolerance (stages B and C). *(Level of Evidence: C)*

3.* Exercise testing may be considered for the assessment of exercise capacity in patients with severe TR with no or minimal symptoms (stage C). *(Level of Evidence: C)

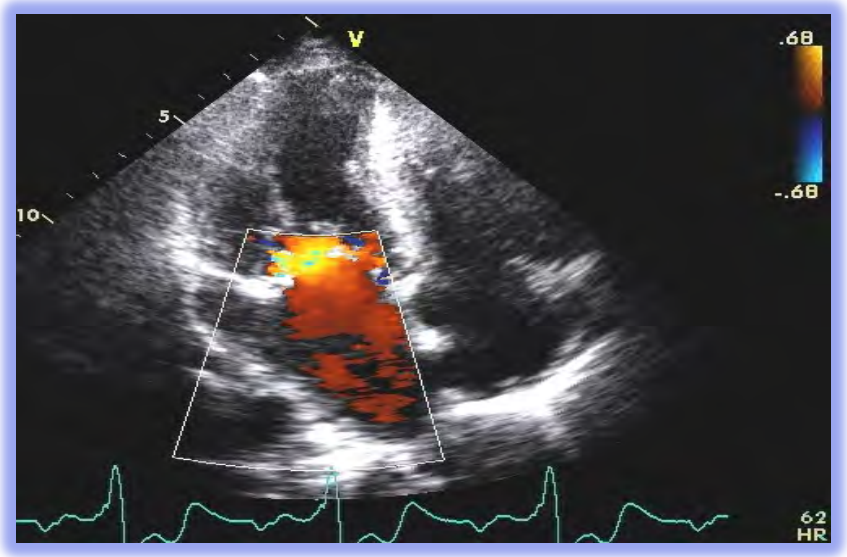
Symptom-Free Survival with MR Change in Reg Volume with Exercise

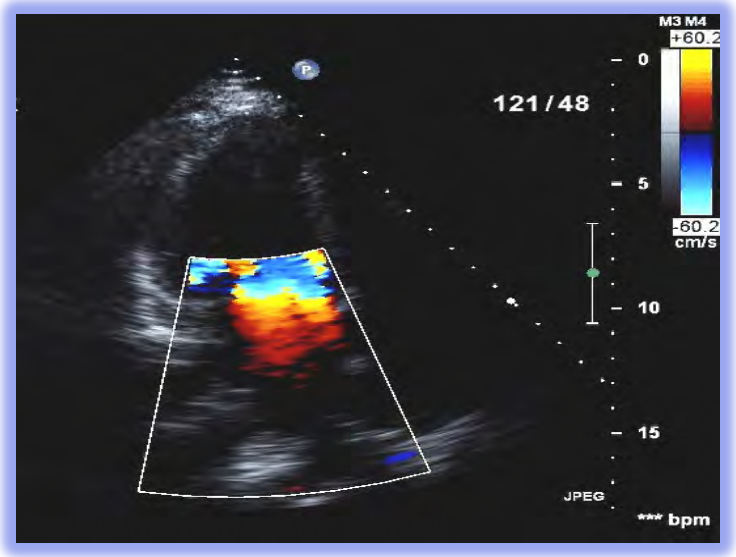


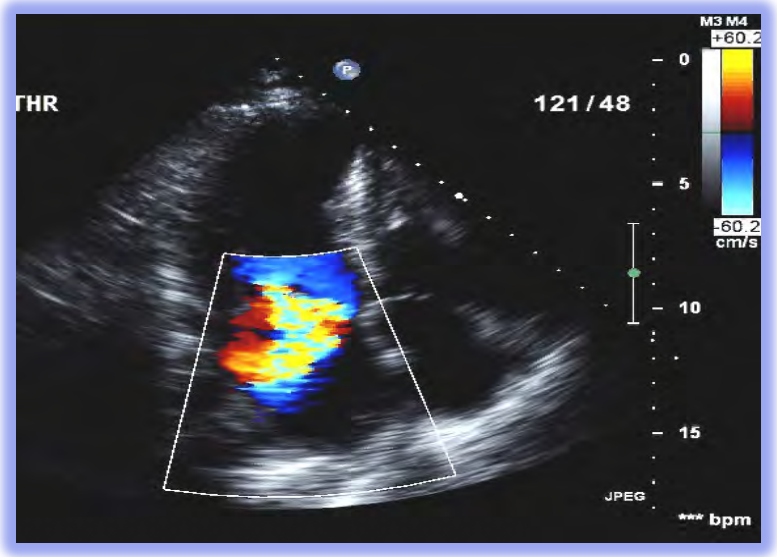
Magne et al: JACC 56(4):300, 2010

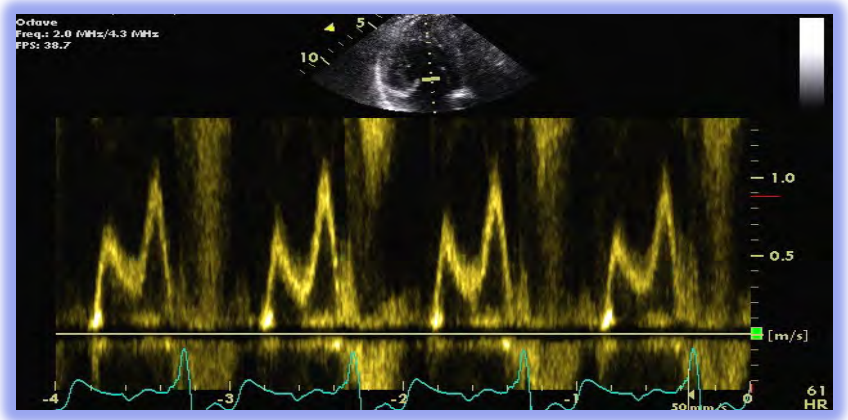
63 year old woman

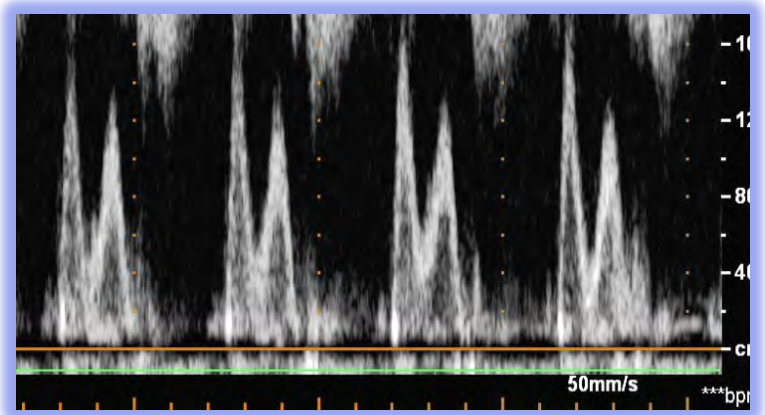
Recurrent Pulmonary Edema

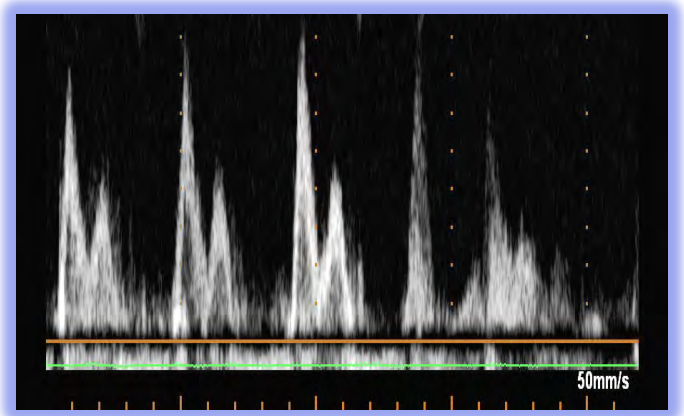










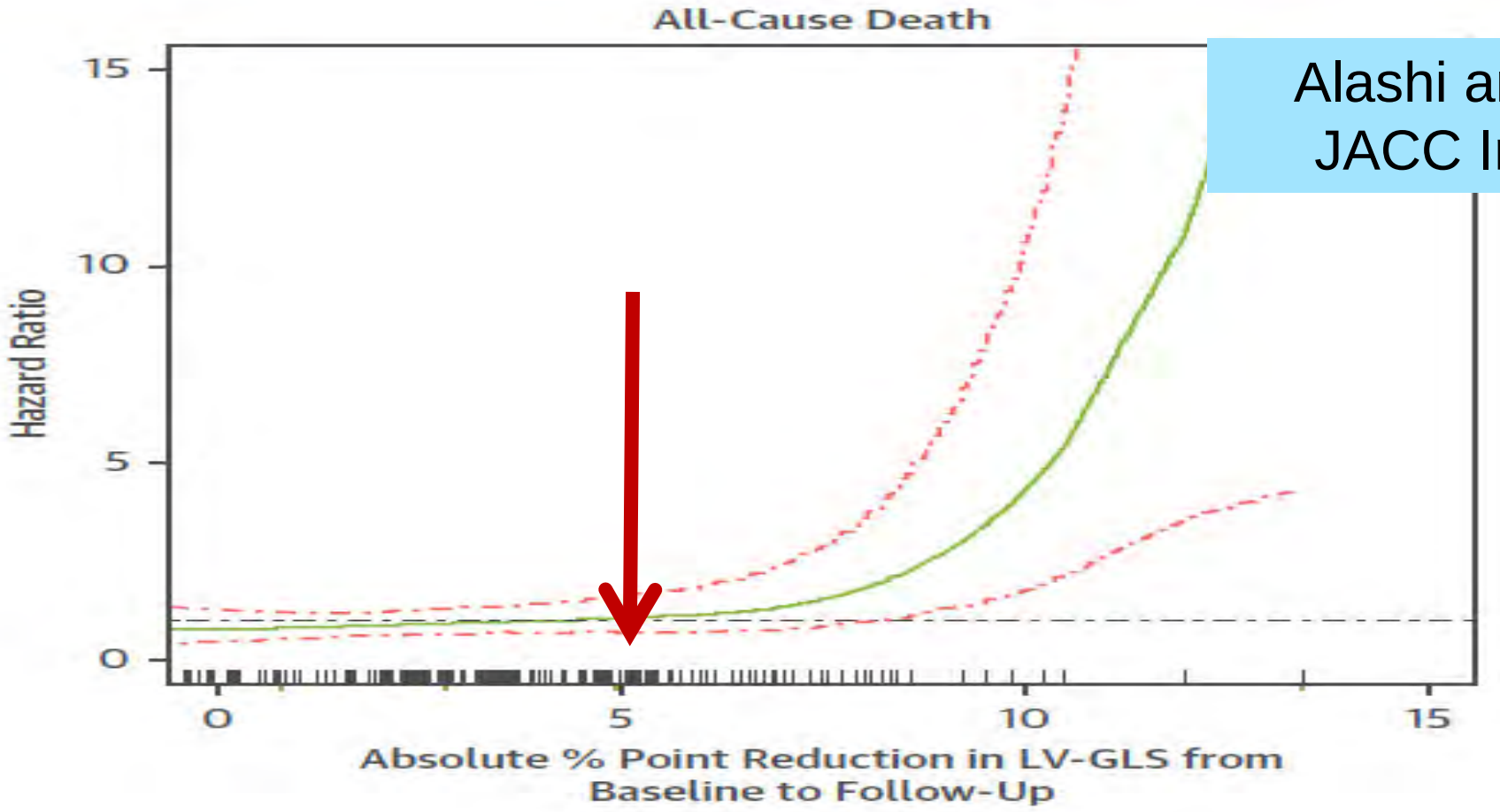


Rest **Stage 2** **Stage 4**

MAYO CLINIC

LV Strain in Aortic Regurgitation

In patients with ≥ 3+ chronic AR and preserved LVEF undergoing AVR, a baseline LV-GLS value worse than 19% was associated with reduced survival. When returned for 3- and 12-month follow-up examinations, persistently impaired LV-GLS was associated with increased mortality.



Alashi and Desai et al
JACC Imaging 2020

“Valvulo-Myocardial Interaction”

Valvular Heart Disease

Systolic or Diastolic Dysfunction

Stenosis
Regurgitation

LVH
Fibrosis
LV/RV Dilation
LA/RA Dilation

▼ Ejection Fraction
▲ Filling Pressure

Exercise, Diastolic Function and Strain for VHD

- Exercise when the severity of VHD does not match with symptoms
- VHD intervention should be based on (in addition to symptoms)
  - Symptoms
  - Exercise response
  - Strain
  - Diastolic function
  - Evidence of fibrosis or myocardial dysfunction

Please perform diastolic function and strain imaging for all VHD patients

Thank you for listening!

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