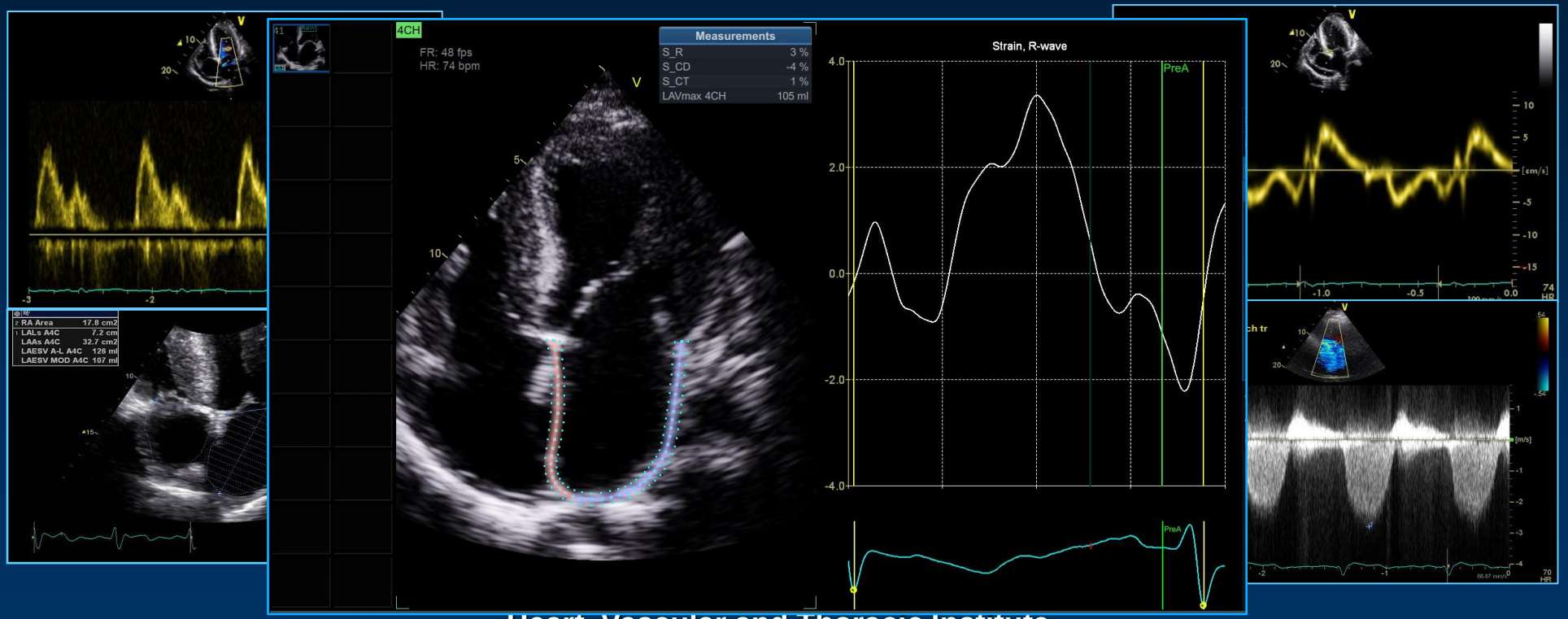
Diastology Guidelines 2025:

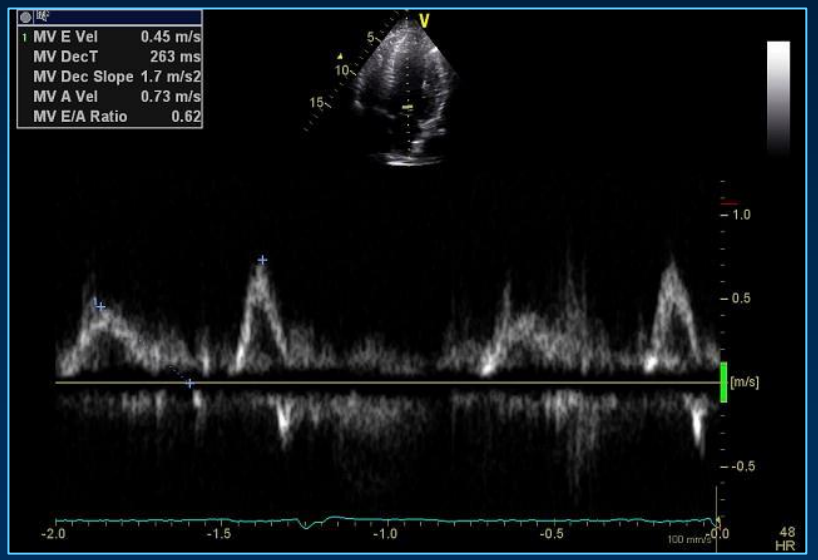
What Will the New Guidelines Say?



Heart, Vascular and Thoracic Institute
Cleveland Clinic
Past- President, ASE
President-Elect, NBE

Diastology Guidelines 2025:
What Will the New Guidelines Say?

- Introduction
- Physiology
- 2016 guidelines
- Case presentations
- Preliminary 2025 guidelines



ASE Diastology Guidelines

2009

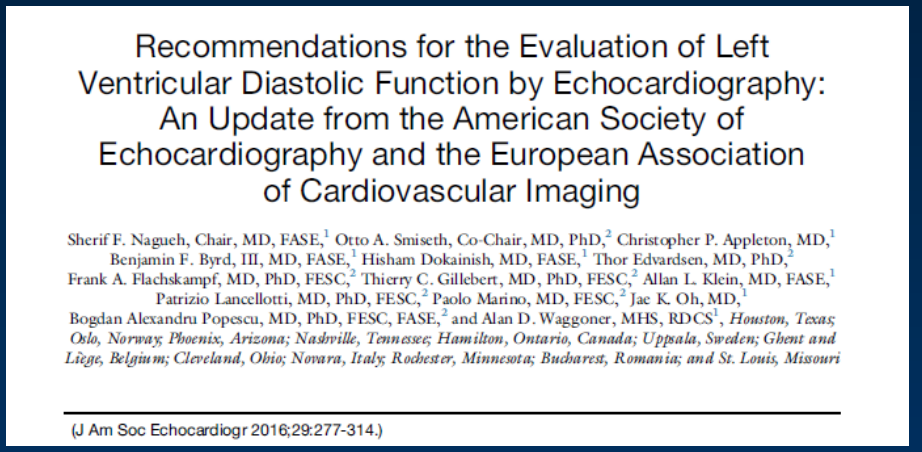
GUIDELINES AND STANDARDS

Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography

Sherif F. Nagueh, MD, Chair,† Christopher P. Appleton, MD,† Thierry C. Gillebert, MD,*
Paolo N. Marino, MD,* Jae K. Oh, MD,† Otto A. Smiseth, MD, PhD,*
Alan D. Waggoner, MHS,† Frank A. Flachskampf, MD, Co-Chair,*
Patricia A. Pellikka, MD,† and Arturo Evangelista, MD,* *Houston, Texas; Phoenix, Arizona; Ghent, Belgium; Novara, Italy; Rochester, Minnesota; Oslo, Norway; St. Louis, Missouri; Erlangen, Germany; Barcelona, Spain*

Keywords: Diastole , Echocardiography, Doppler, Heart failure

2016



Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Sherif F. Nagueh, Chair, MD, FASE,[1] Otto A. Smiseth, Co-Chair, MD, PhD,[2] Christopher P. Appleton, MD,[1]
Benjamin F. Byrd, III, MD, FASE,[1] Hisham Dokainish, MD, FASE,[1] Thor Edvardsen, MD, PhD,[2]
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(J Am Soc Echocardiogr 2016;29:277-314.)

PRESIDENT'S MESSAGE

AMERICAN SOCIETY OF ECHOCARDIOGRAPHY NEWS

PRESIDENT'S MESSAGE

Diastology: What Does the New Updated Guideline Do for You?

My wife recently said to me that the mitral "E's and A's" have been good to me over the years. What does she mean? She is referring to the Doppler assessment of diastolic function. I wanted this President's page to focus on a topic that is close to my heart, "Diastology." This is not "Systology," which is actually intrinsically linked to diastole (global longitudinal strain as an example) but a field that I have been working in for a long time. In fact, there have been over 30,000 publications on diastolic function in the last 20 years. I was taught by the "Diastology" masters including Drs. Hatle, Tajik, Seward, and Thomas. In fact, I was so enthusiastic about diastolic function that I have written a book called "Diastology" and have held yearly symposiums for the last 17 years on the topic.

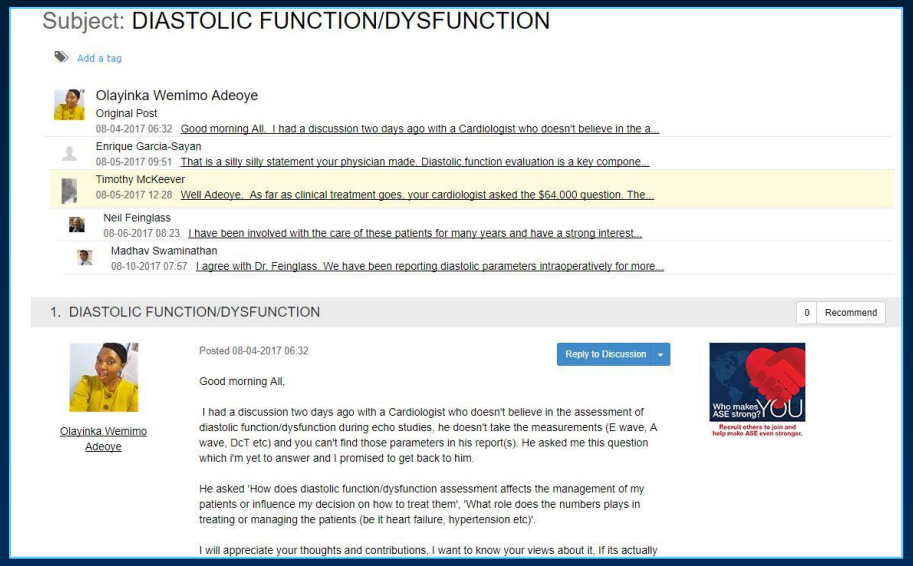
Why is "Diastology" important to the ASE? Recently Drs. Sherif Nagueh and Otto Smiseth led a team of investigators from ASE and EACVI (who like to "relax" in diastole) in updating the 2009 diastole guideline.[1] The new recommendations on diastolic function were published in JASE in April 2016. After some [illegible] and [illegible]

> 34 ml/m^2 and peak TR velocity > 2.8 m/s. If there is a patient referred to the echo lab with hypertension and no known cardiac pathology and preserved systolic function, the clinician can see if > 2 of these 4 parameters are beyond the accepted normal cutoff values and then can label this patient as having abnormal diastolic function with preserved systolic function. Such patients with cardiac pathology (i.e., left ventricular hypertrophy) with preserved EF or a reduced EF (i.e., EF 35%) can get right into the new diastology algorithm.

Allan L. Klein, MD, FRCP (C), FACC, FAHA, FESC, FASE

What does the new algorithm show? Let me tell you! In my view, it is very straightforward to diagnose two conditions: elevated LV filling pressures with Grade 3 diastolic function when the mitral E/A ratio is > 2 or normal filling pressures and Grade [illegible] when the E/A ratio is < 8 and the mitral E [illegible]

@ASE Connect
Ongoing Dialogue


Subject: DIASTOLIC FUNCTION/DYSFUNCTION

Add a tag

Olayinka Wemimo Adeoye
Original Post
08-04-2017 06:32 Good morning All, I had a discussion two days ago with a Cardiologist who doesn't believe in the a...

Enrique Garcia-Sayan
08-05-2017 09:51 That is a silly silly statement your physician made. Diastolic function evaluation is a key compone...

Timothy McKeever
08-05-2017 12:28 Well Adeoye, As far as clinical treatment goes, your cardiologist asked the $64,000 question. The...

Neil Feinglass
08-06-2017 08:23 I have been involved with the care of these patients for many years and have a strong interest...

Madhav Swaminathan
08-10-2017 07:57 I agree with Dr. Feinglass. We have been reporting diastolic parameters intraoperatively for more...

1. DIASTOLIC FUNCTION/DYSFUNCTION 0 Recommend

Olayinka Wemimo Adeoye

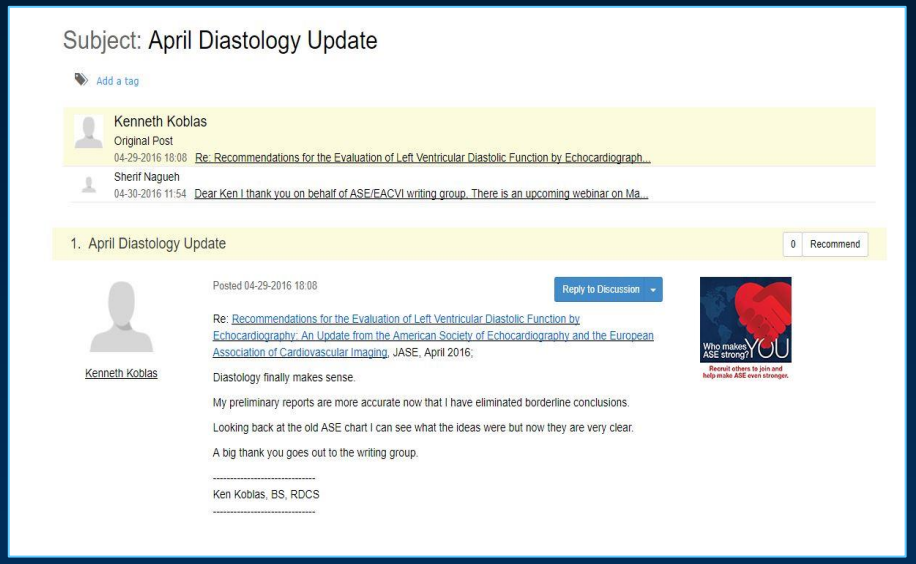
Posted 08-04-2017 06:32 Reply to Discussion

Good morning All,

I had a discussion two days ago with a Cardiologist who doesn't believe in the assessment of diastolic function/dysfunction during echo studies, he doesn't take the measurements (E wave, A wave, DcT etc) and you can't find those parameters in his report(s). He asked me this question which I'm yet to answer and I promised to get back to him.

He asked 'How does diastolic function/dysfunction assessment affects the management of my patients or influence my decision on how to treat them', 'What role does the numbers plays in treating or managing the patients (be it heart failure, hypertension etc)'.

I will appreciate your thoughts and contributions, I want to know your views about it. If its actually


Subject: April Diastology Update

Add a tag

Kenneth Koblas
Original Post
04-29-2016 18:08 Re: Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiograph...

Sherif Nagueh
04-30-2016 11:54 Dear Ken I thank you on behalf of ASE/EACVI writing group. There is an upcoming webinar on Ma...

1. April Diastology Update 0 Recommend

Kenneth Koblas

Posted 04-29-2016 18:08 Reply to Discussion

Re: Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging, JASE, April 2016;

Diastology finally makes sense.

My preliminary reports are more accurate now that I have eliminated borderline conclusions.

Looking back at the old ASE chart I can see what the ideas were but now they are very clear.

A big thank you goes out to the writing group.

Ken Koblas, BS, RDCS

"I had a discussion with a cardiologist who doesn't believe in the assessment of diastolic function"

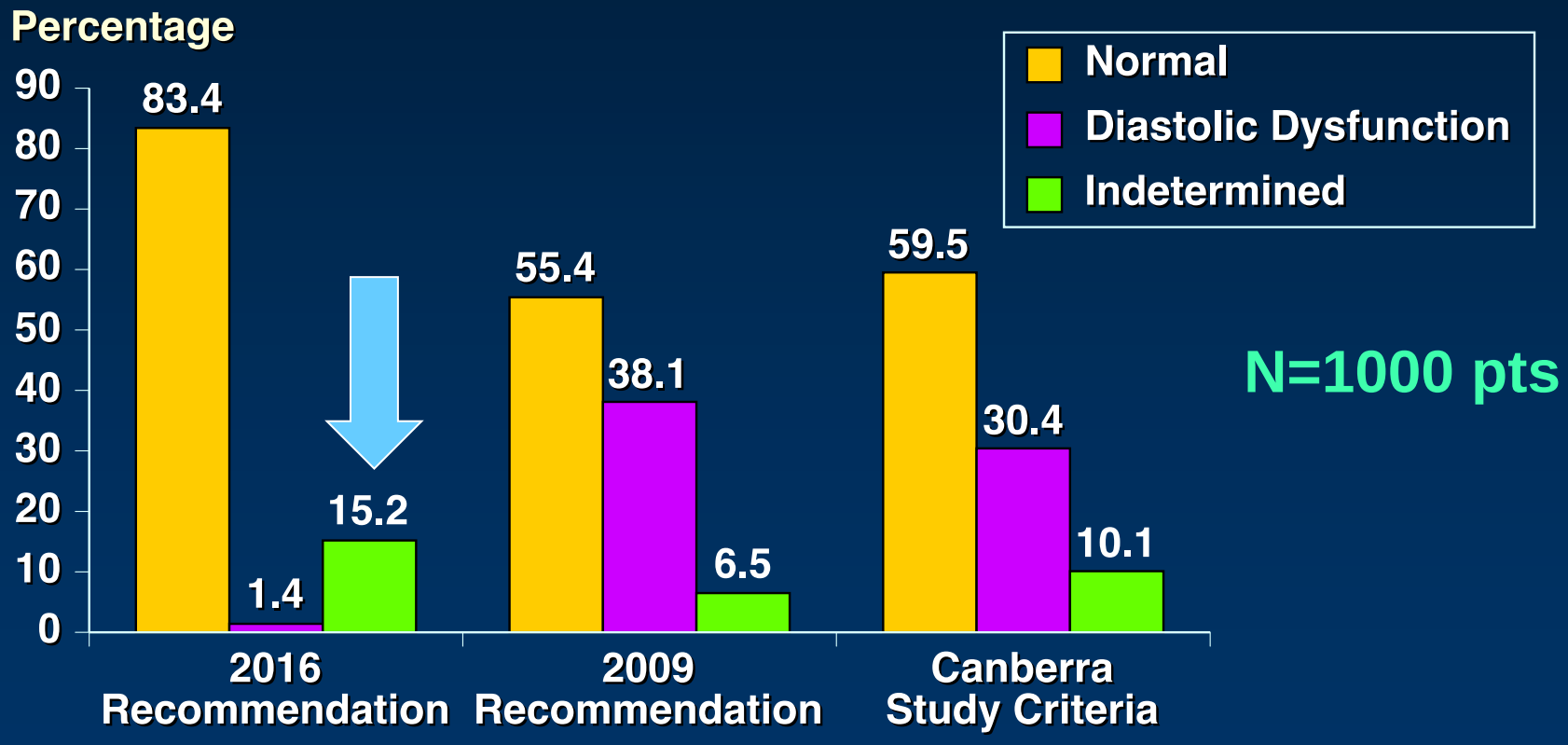
"Diastology finally makes sense.. A big thanks to the writing group"

Troubles with 2016 Guidelines

- Incomplete data
- Conflicting parameters
- Uncertainty about who is in or not
- Association with HFpEF
- Indeterminate findings

Impact of the 2016 ASE/EACVI recommendations on the prevalence of diastolic dysfunction in the general population

João G. Almeida[1†], Ricardo Fontes-Carvalho[1,2*†], Francisco Sampaio[1], José Ribeiro[1], Paulo Bettencourt[3], Frank A. Flachskampf[4], Adelino Leite-Moreira[2,5], and Ana Azevedo[6,7]

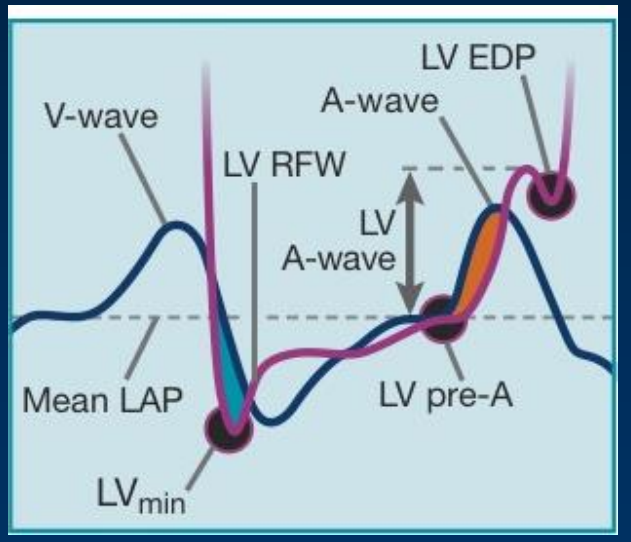


N=1000 pts

European Heart Journal CV Imaging 2018:19:380-386

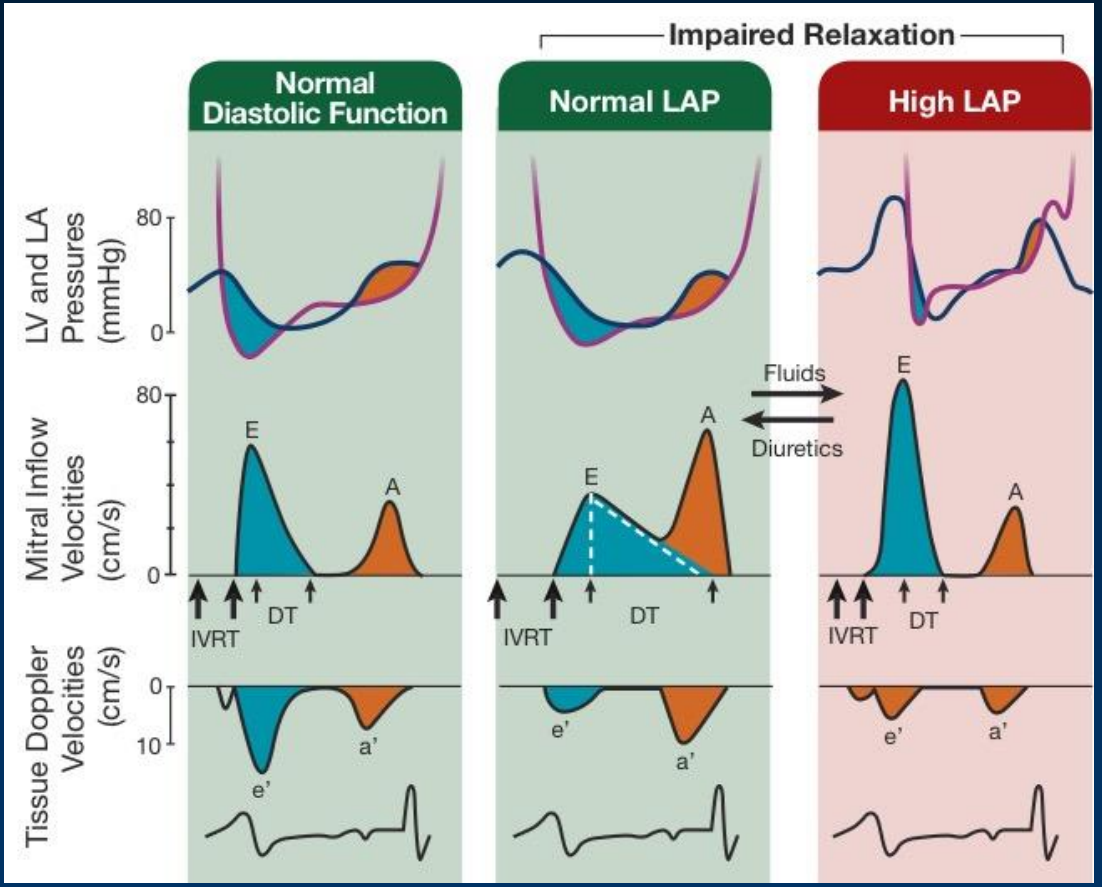
Relation of Mitral Inflow and TD Velocities with LV Filling Pressures

LA and LV Diastolic Pressures
Mean LAP, Pre-A wave and LVEDP



Nagueh et al. J Am Soc Echocardiogr 2016:29:277-314

Relation of Mitral Inflow and TD Velocities with LV Filling Pressures



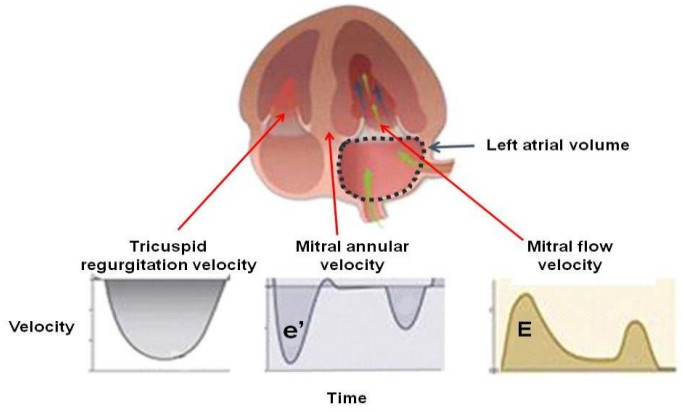
Nagueh et al. J Am Soc Echocardiogr 2016;29:277-314

Key Diastology Parameters

Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Sherif F. Nagueh, Chair, MD, FASE,[1] Otto A. Smiseth, Co-Chair, MD, PhD,[2] Christopher P. Appleton, MD,[1] Benjamin F. Byrd, III, MD, FASE,[1] Hisham Dokainish, MD, FASE,[1] Thor Edvardsen, MD, PhD,[2] Frank A. Flachskampf, MD, PhD, FESC,[2] Thierry C. Gillebert, MD, PhD, FESC,[2] Allan L. Klein, MD, FASE,[1] Patrizio Lancellotti, MD, PhD, FESC,[2] Paolo Marino, MD, FESC,[2] Jae K. Oh, MD,[1] Bogdan Alexandru Popescu, MD, PhD, FESC, FASE,[2] and Alan D. Waggoner, MHS, RDCS[1], *Houston, Texas; Oslo, Norway; Phoenix, Arizona; Nashville, Tennessee; Hamilton, Ontario, Canada; Uppsala, Sweden; Ghent and Liège, Belgium; Cleveland, Ohio; Novara, Italy; Rochester, Minnesota; Bucharest, Romania; and St. Louis, Missouri*

(J Am Soc Echocardiogr 2016;29:277-314.)



Nagueh et al. J Am Soc Echocardiogr 2016;29:277-314

Diastology
Common Questions
Which Algorithm?

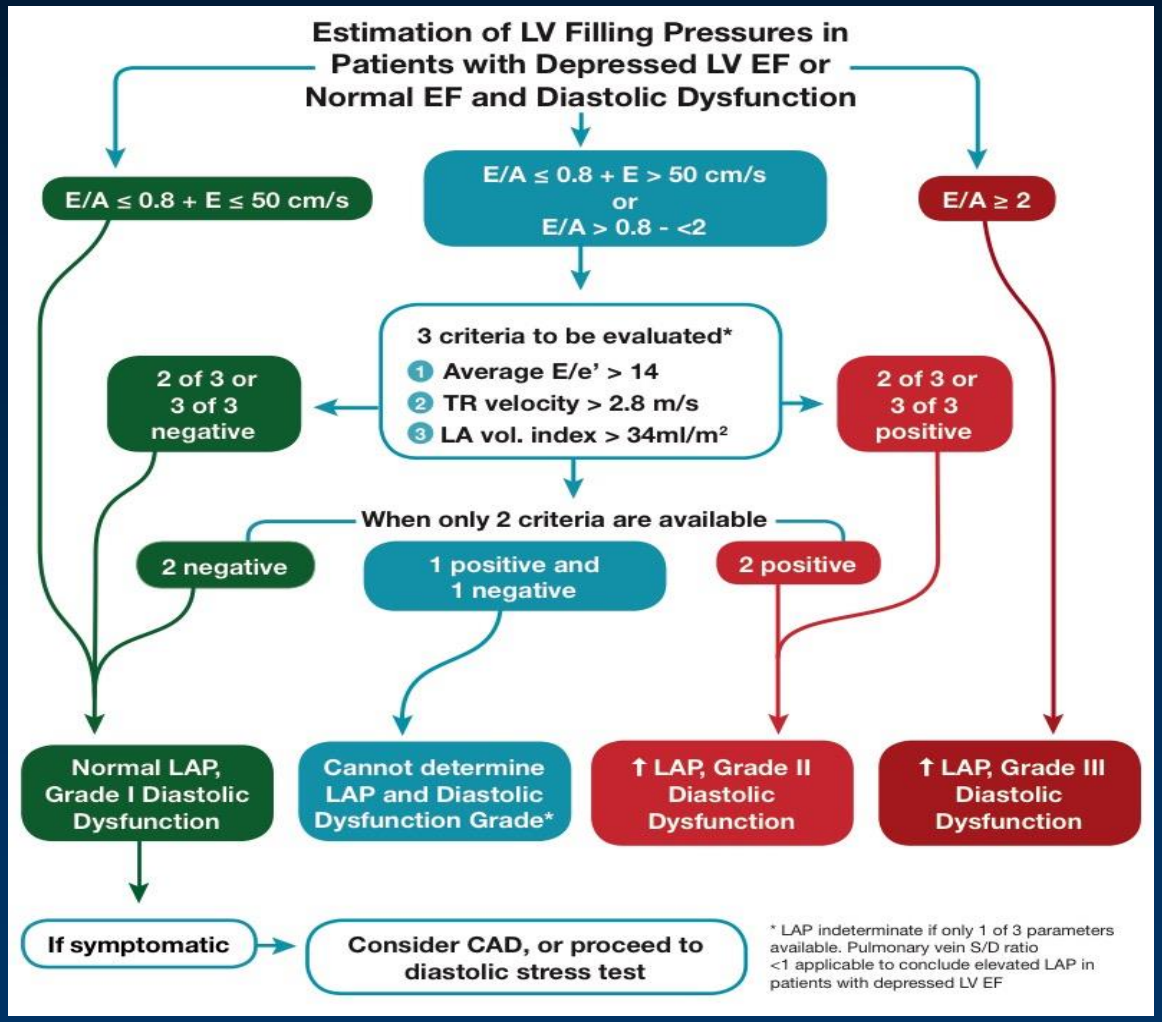
- **Is there diastolic dysfunction or a high likelihood of diastolic dysfunction?**
- **How to estimate LV filling pressure?**

Nagueh et al. J Am Soc Echocardiogr 2016;29:277-314

How Do You Determine Diastolic Dysfunction
Myocardial Pathology

- Extensive cardiac history
- Known CV disease as coronary artery disease
  - Wall motion
- Pathologic LVH
- Hypertensive CV Disease
- Cardiomyopathy
- Established Diagnosis of HFpEF
- If 3/4 positive parameters from Algorithm 1
- EF reduced
- Specific Doppler signals

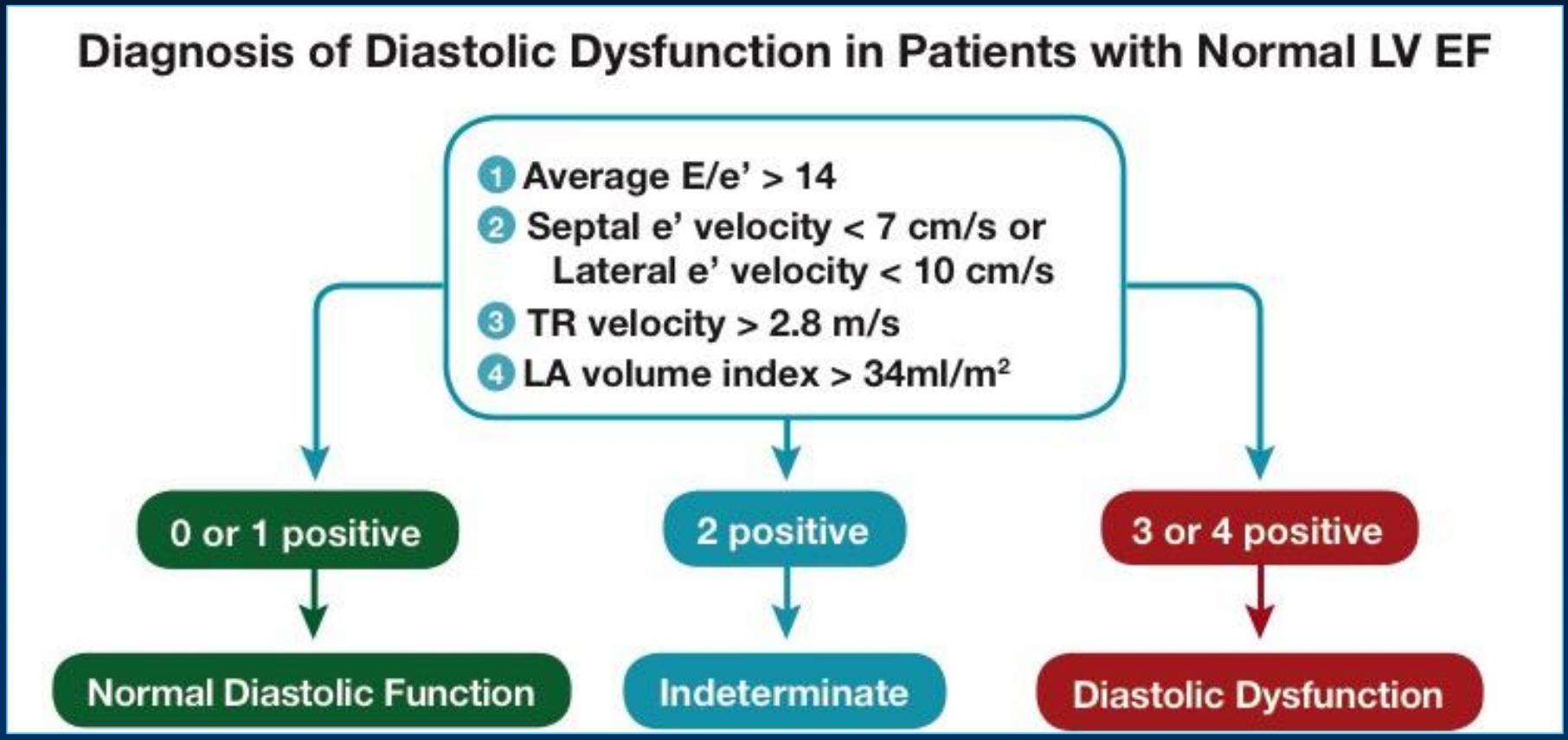
Estimation of LV Filling Pressures and Grading DF (Algorithm 2)



Nagueh et al. J Am Soc Echocardiogr 2016;29:277-314

What do you do if normal study based on clinical history, 2-D echo and Doppler flows?

Criteria for Diagnosis of LV Diastolic Dysfunction (Algorithm 1)

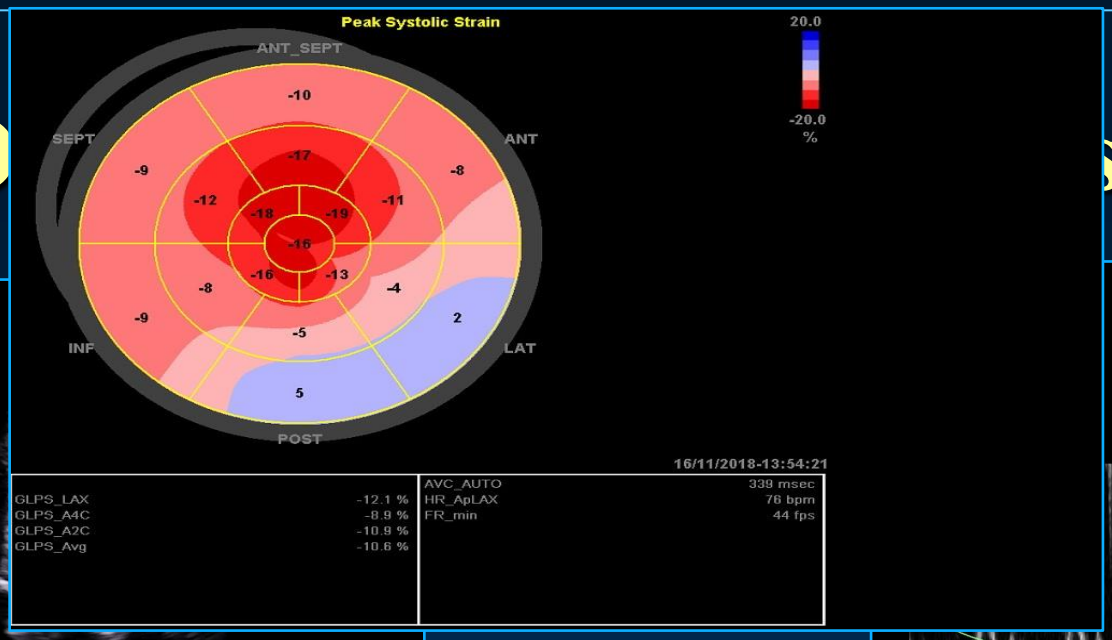


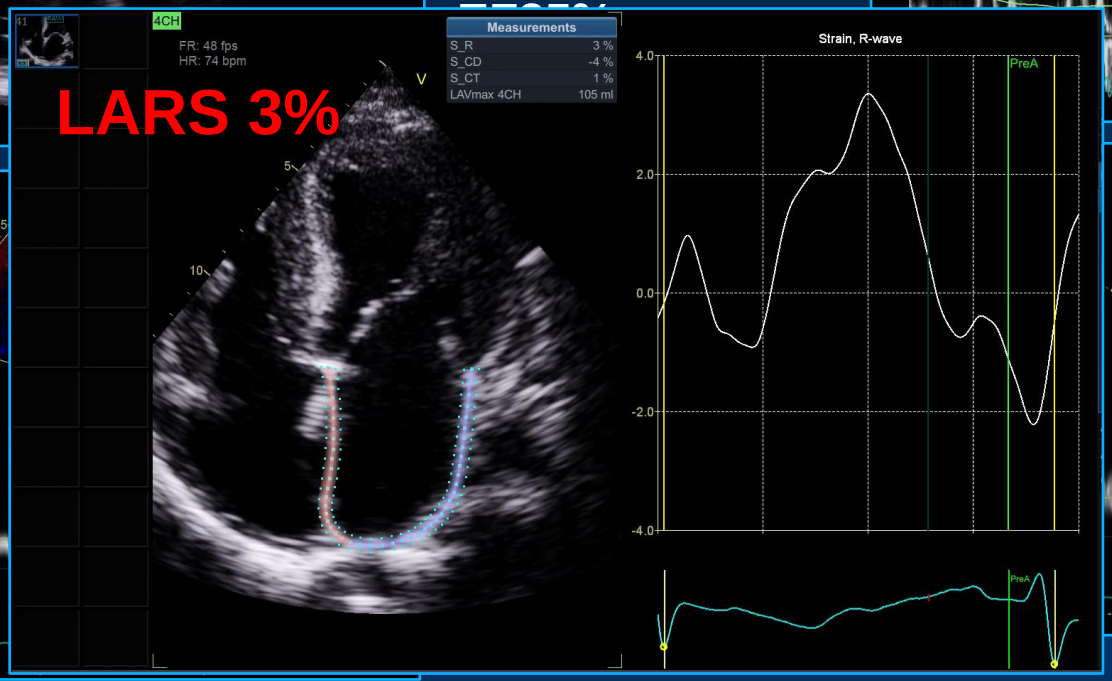
Nagueh et al. J Am Soc Echocardiogr 2016;29:277-314

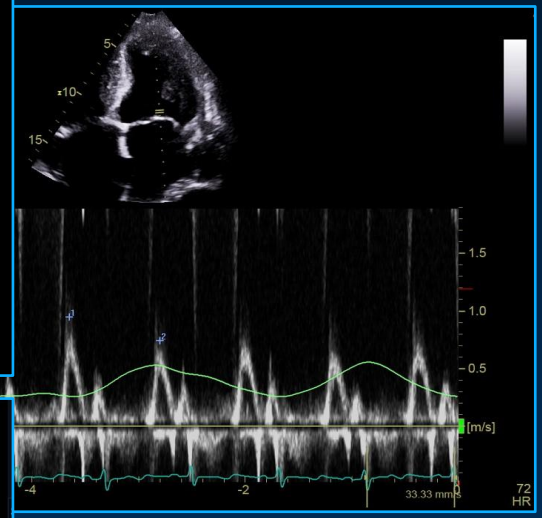
Diastology Clinical Report
What Should Be Included in Our Reports?

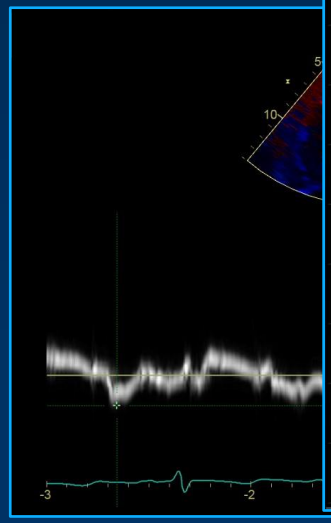
- Status of LV filling pressures
  - normal, elevated or cannot be determined
- Grade of diastolic function
  - Grade 1, 2 and 3

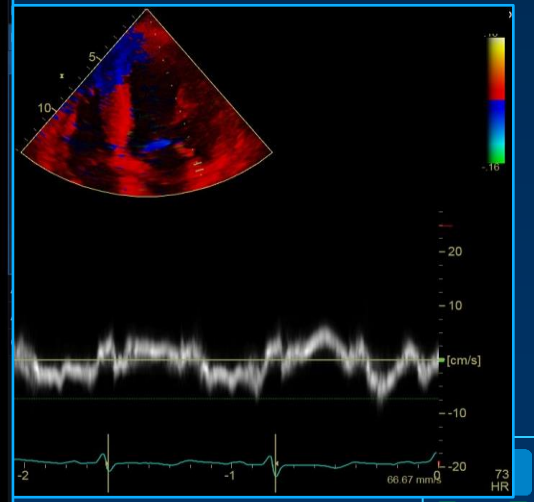
60 Year O ss of Breath











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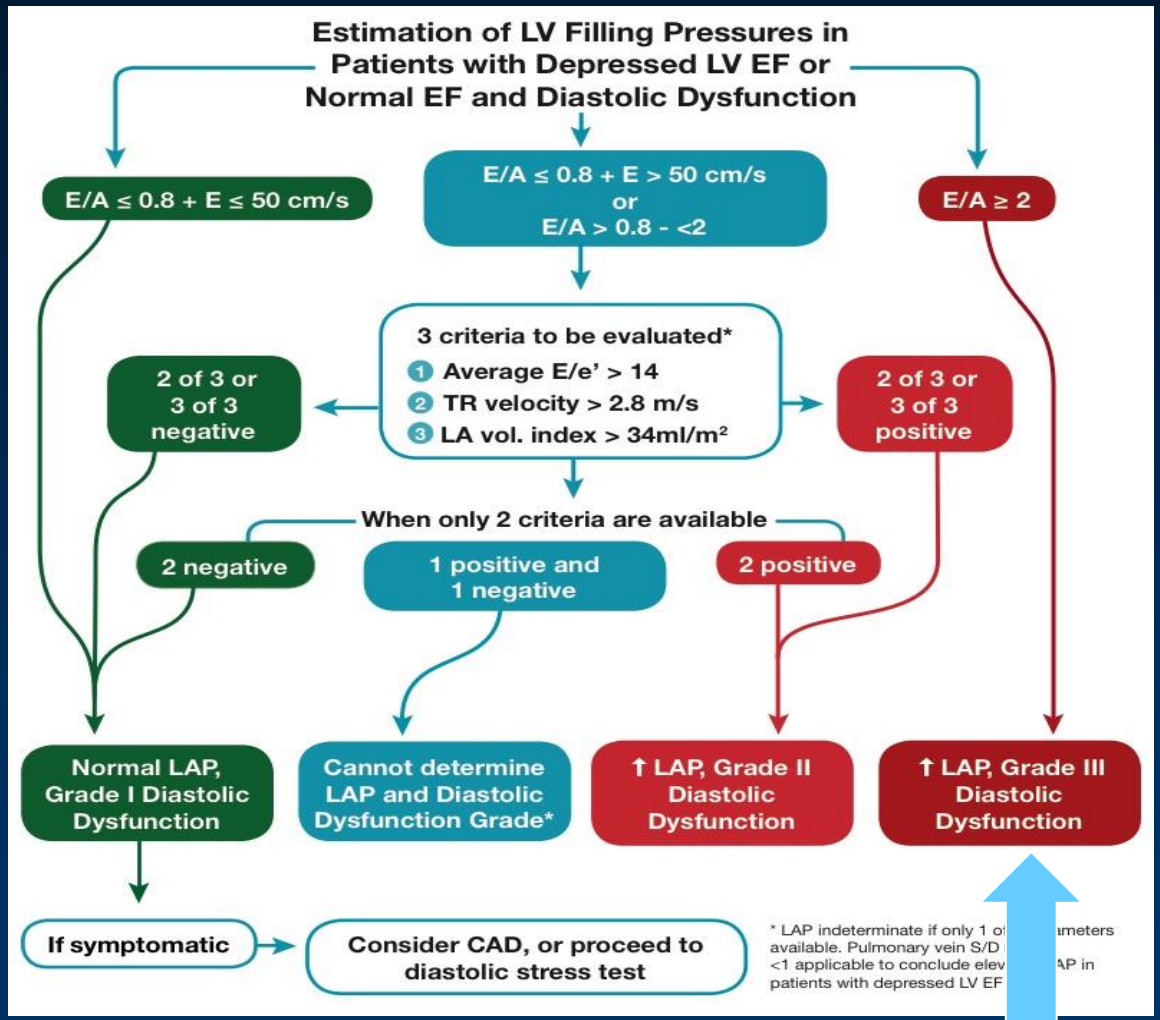
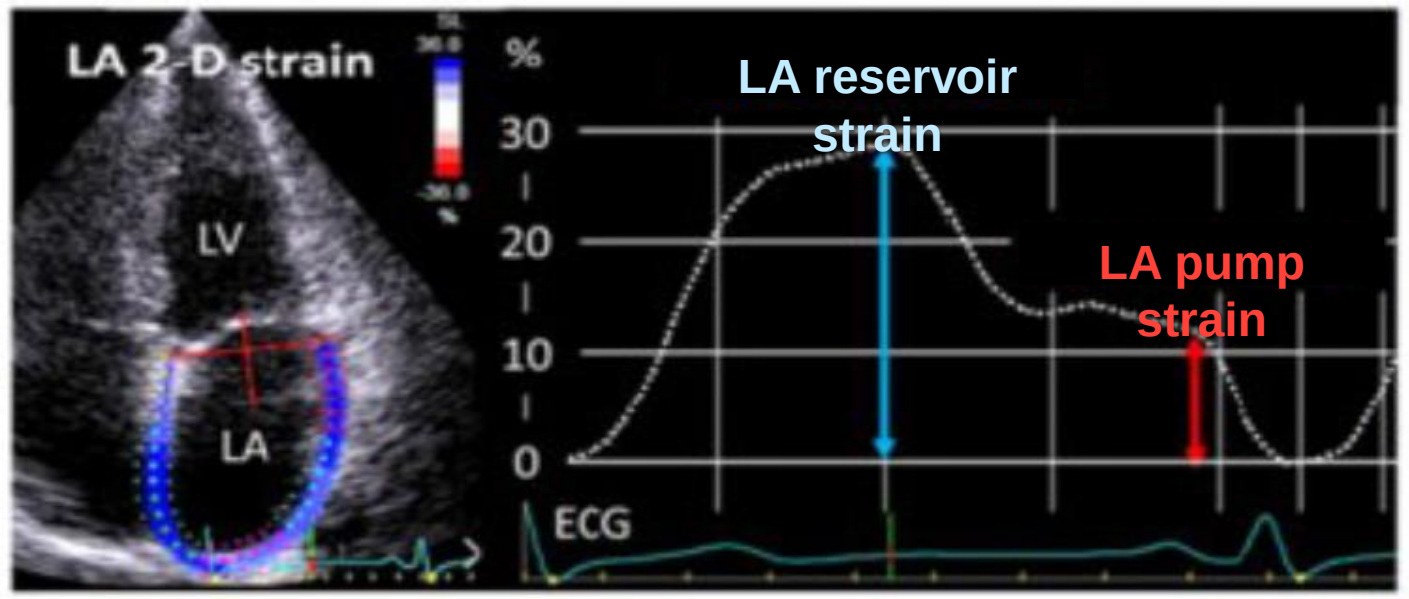
Estimation of LV Filling Pressures and Grading DF (Algorithm 2)



Nagueh et al. J Am Soc Echocardiogr 2016;29:277-314

Multimodality imaging in patients with heart failure and preserved ejection fraction: an expert consensus document of the European Association of Cardiovascular Imaging

Otto A. Smiseth (Chair)[1,2,3]*, Daniel A. Morris[4], Nuno Cardim[5], Maja Cikes[6], Victoria Delgado[7], Erwan Donal[8,9], Frank A. Flachskampf[10], Maurizio Galderisi[11,†], Bernhard L. Gerber[12], Alessia Gimelli[13], Allan L. Klein[14], Juhani Knuuti[15], Patrizio Lancellotti[16,17], Julia Mascherbauer[18], Davor Milicic[6], Petar Seferovic[19,20], Scott Solomon[21], Thor Edvardsen[1,2,3], and Bogdan A. Popescu (Co-Chair)[22,*]



Inoue et al. European Heart Journal Cardiovascular imaging 2022;23:61-70
Smiseth et al. European Heart Journal CV imaging 2022;23: 334-61

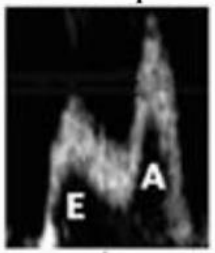
Estimation of left ventricular filling pressure

Mitral E/A > 0.8 and < 2

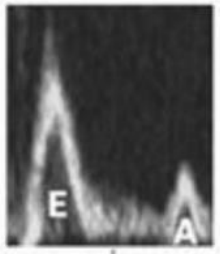
Apply these additional criteria

Mitral E/A ≤ 0.8

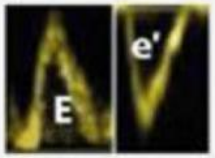
If E > 50 cm/s, use the criteria in middle panel



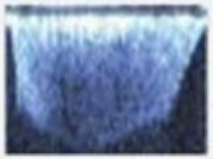
Mitral E/A ≥ 2



E/e' > 14



TR velocity > 2.8 m/s



LA volume > 34 ml/m²

2 or 3 criteria negative

Only 2 criteria available and 1 positive and 1 negative

2 or 3 criteria positive

Normal filling pressure

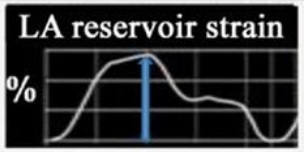
≥18%

Use LA reservoir strain to replace missing parameter

<18%

Elevated filling pressure

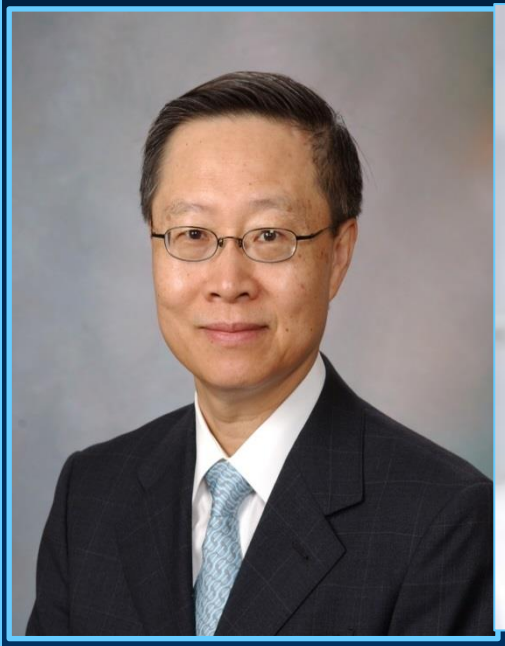
LA reservoir strain



Caveat – Algorithm not to be applied in any of the following conditions:
No suspicion of heart disease; Atrial fibrillation; LBBB/CRT/RV pacing; HCM; Severe MR/MS/MAC; MV prosthesis or repair; High output HF; LV assist device

Smiseth et al. European Heart Journal CV imaging 2022;23: 334-61

Giants of Diastology Guidelines



Rochester

Houston

Cleveland

Oslo

Preliminary Unpublished Diastolic Function Evaluation and HFpEF Diagnosis Guidelines 2025

Steps for Diagnosing Diastolic Function

STEP 1

Assess e' as marker of impaired LV relaxation

- *e' septal ≤6 cm/s or*
- *lateral ≤ 7 or*
- *Average ≤ 6.5**

STEP 2

Assess markers of LA/LV remodeling and elevated LAP

- Average E/e' > 14
- LARS ≤ 18%
- E/A≤0.8*, or ≥2
- LAVI > 34 ml/m^2 | ¶

Diastolic dysfunction present if:

- e' reduced & 1 or more markers in Step 2 present or
- e' preserved, but 2 or more markers in Step 2 present

* : can also consider age specific cutoff values to identify abnormally reduced e' velocity or abnormally reduced E/A ratio

| : after excluding LA enlargement in athletes, or due to anemia, atrial fibrillation or flutter, and mitral valve disease

¶ : another finding consistent with diastolic dysfunction: LV mass index >95 g/m^2 in women or 115 g/m^2 in men, after exclusion of increased LV mass in athletes

LV Diastolic Function Grading & LAP Estimation

1. Reduced e' velocity: septal ≤6 or lateral ≤ 7 or average ≤ 6.5 cm/s *
2. Increased E/e': septal ≥ 15 or lateral ≥ 13 or average ≥ 14
3. Increased TR velocity ≥ 2.8 m/s or PASP ≥ 35 mmHg

Except in
MAC, MR, MS¶
Atrial Fibrillation
LVAD
Non-cardiac PH
HTX
Pericardial constriction

All normal

Reduced e' only

Increased TR/PASP only or Increased E/e' only or Any 2 abnormal variables

3 of above

E/A≤ 0.8

E/A > 0.8

Pulmonary Vein S/D ≤0.67 or LARS ≤ 18% or LAVi > 34 mL/m²

Alternatively IVRT ≤ 70 ms

If none available or reliable use Supplemental methods†

≥ 1 present

Increased LAP

None

Normal LAP

E/A < 2

E/A ≥ 2

Normal DF

Grade 1

If symptomatic

Diastolic Exercise Echo

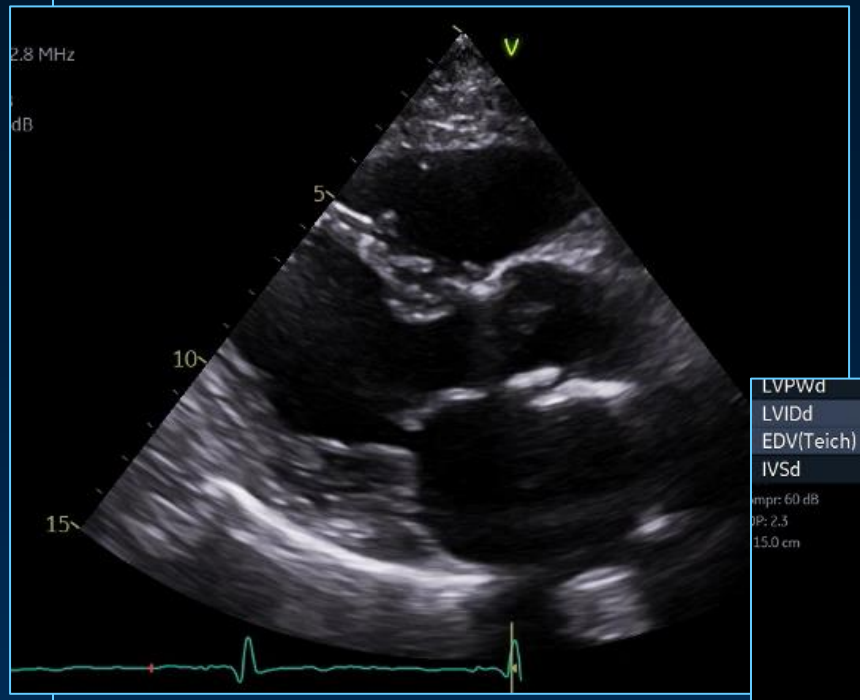
Grade 2 (Mild/Moderate ↑ LAP)

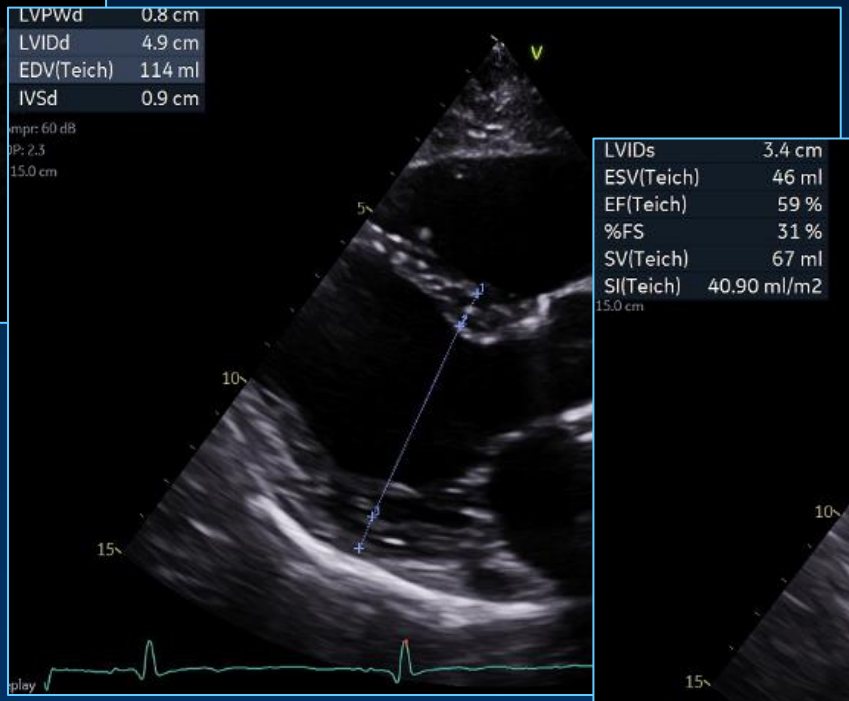
Grade 3 (Marked ↑ LAP)

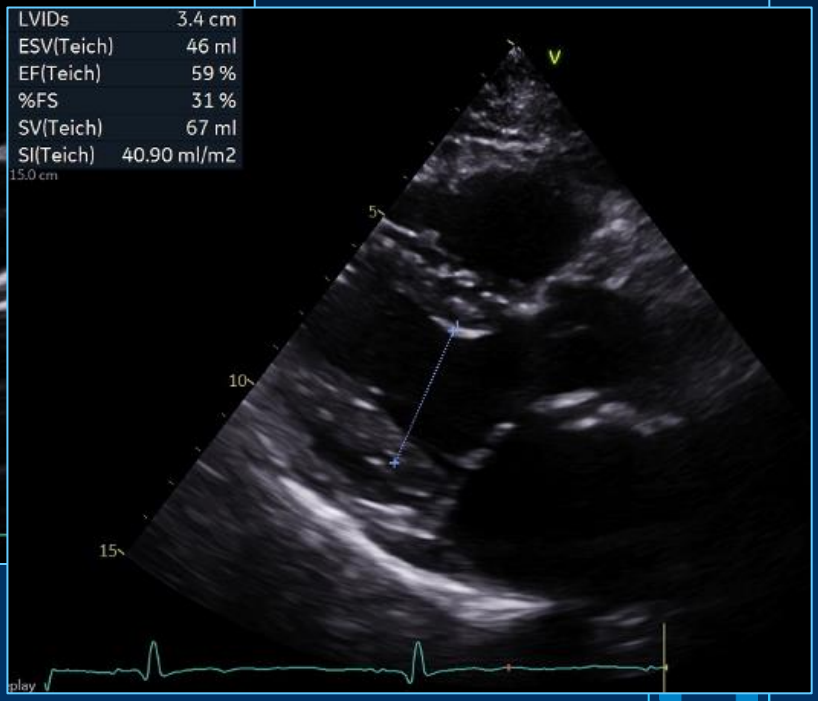
Patient History

- 73-year-old female with history of an AVR in 2005
- Redo in 2018 with ascending aorta replacement

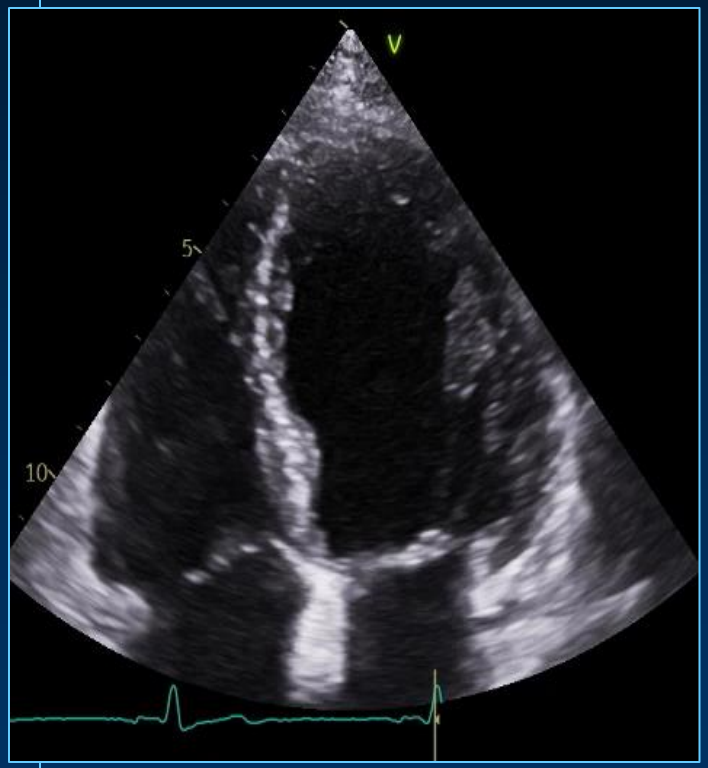
LV Dimensions







APICAL IMAGES



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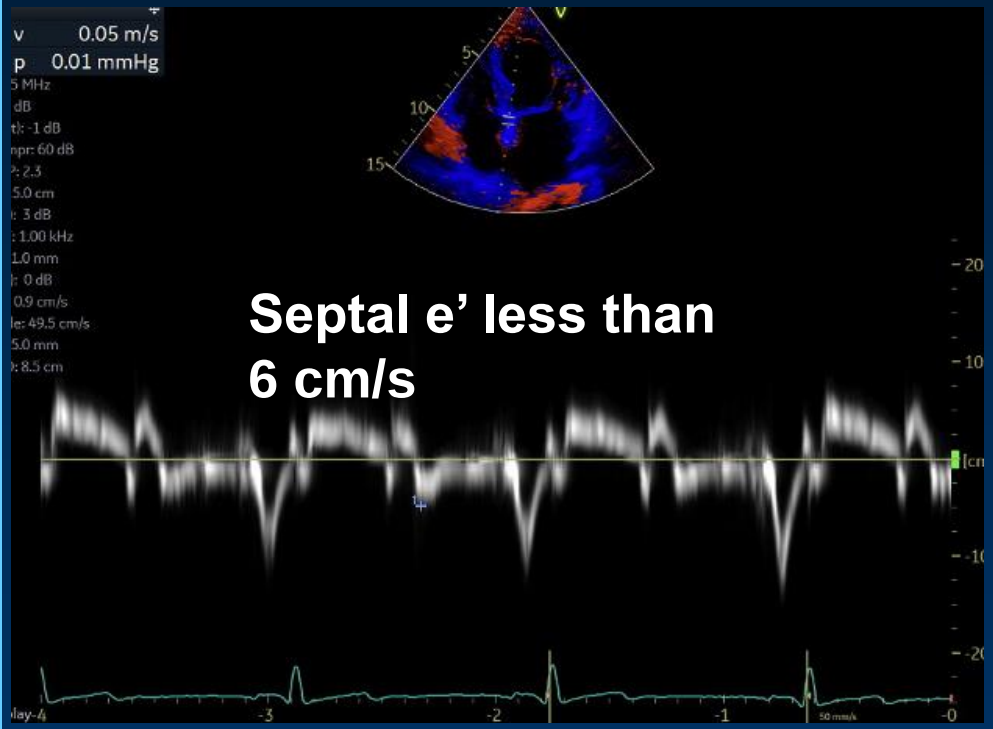
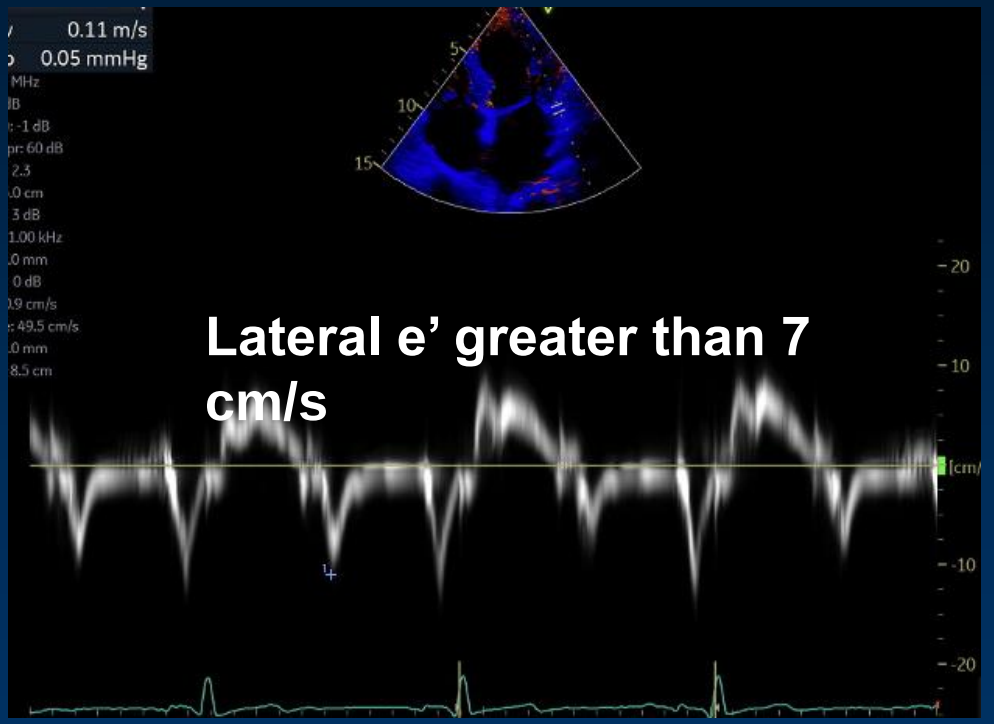
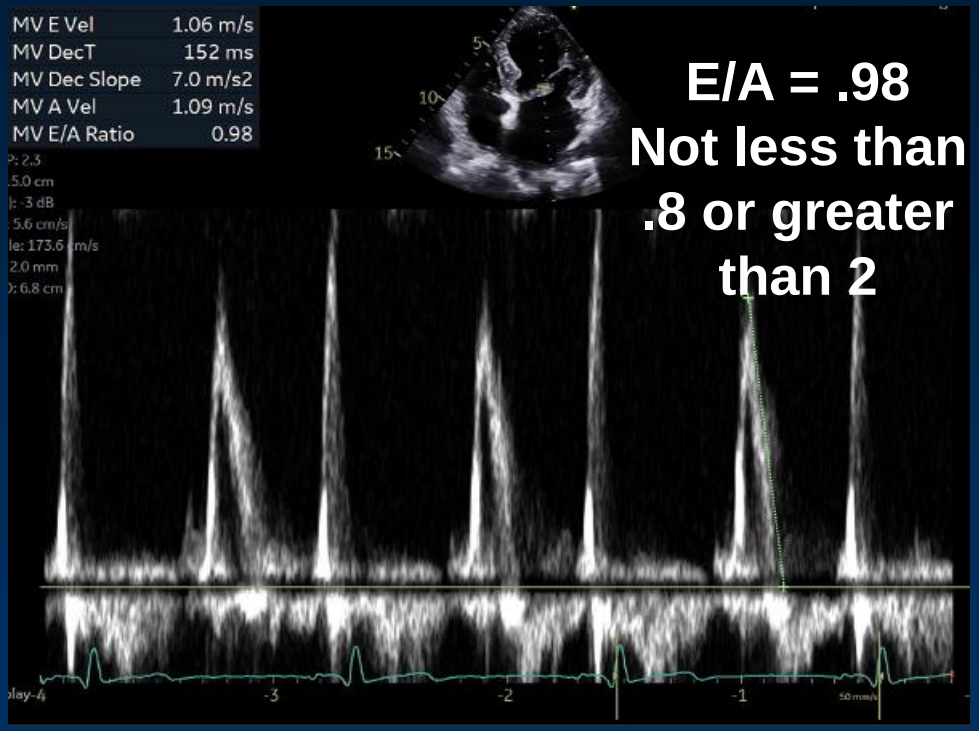
¶ : another finding consistent with diastolic dysfunction: LV mass index >95 g/m^2 in women or 115 g/m^2 in men, after exclusion of increased LV mass in athletes

STEP ONE – (e’)


v 0.05 m/s
p 0.01 mmHg
Septal e’ less than 6 cm/s

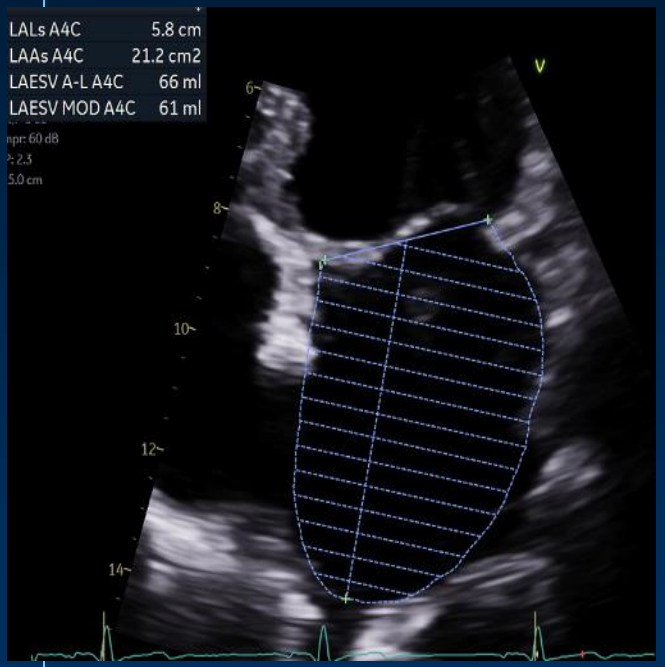

0.11 m/s
0.05 mmHg
Lateral e’ greater than 7 cm/s

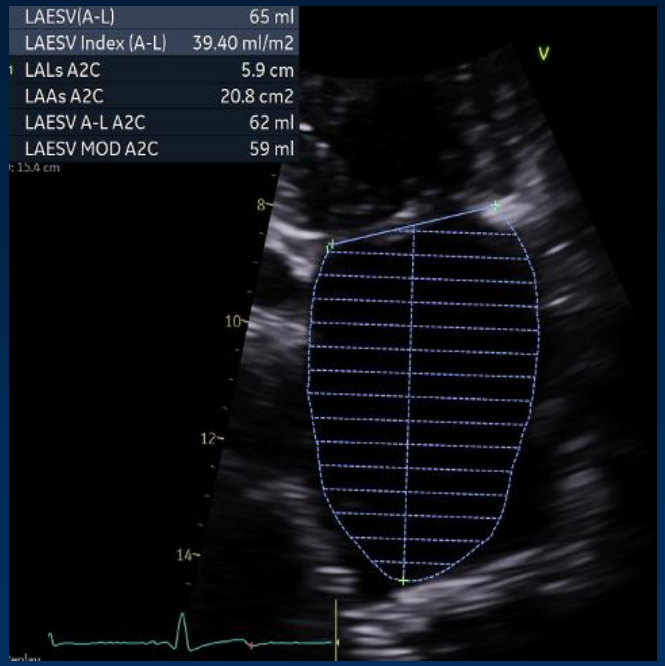
STEP TWO – Markers of LA/LV Remodeling

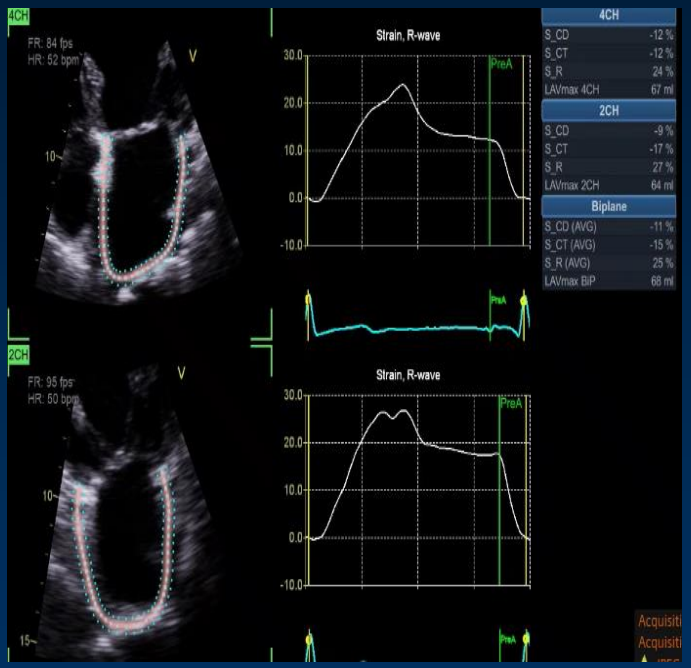


Average E/e’ = 15.4
(greater than 14)

STEP TWO – Markers of LA/LV Remodeling







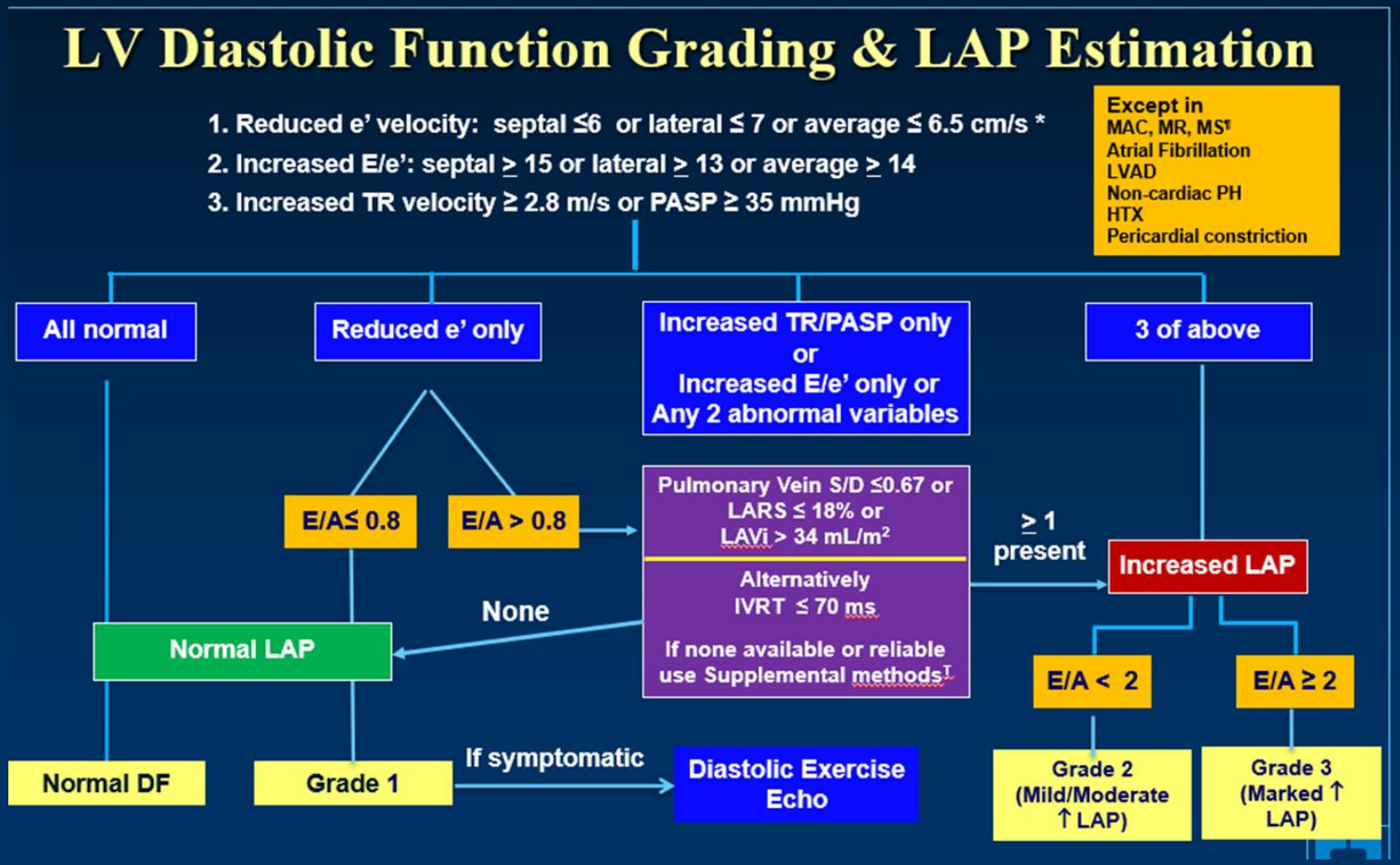
LAVI = 40 ml/m2
(greater than 34 ml/m2)

LASr = 25%
(greater than 18%)

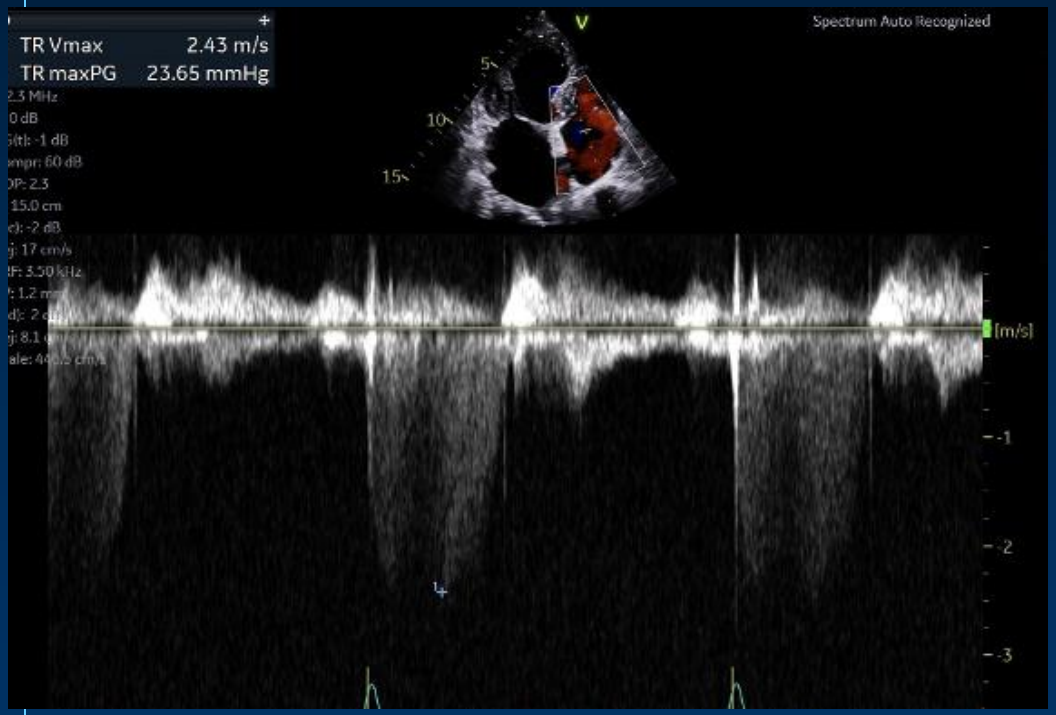
STEP ONE + STEP TWO

- STEP ONE = reduced septal (e’)
- STEP TWO = E/e’ greater than 14
- = DIASTOLIC DYSFUNCTION PRESENT

Preliminary Unpublished Diastolic Function Evaluation and HFpEF Diagnosis Guidelines 2025

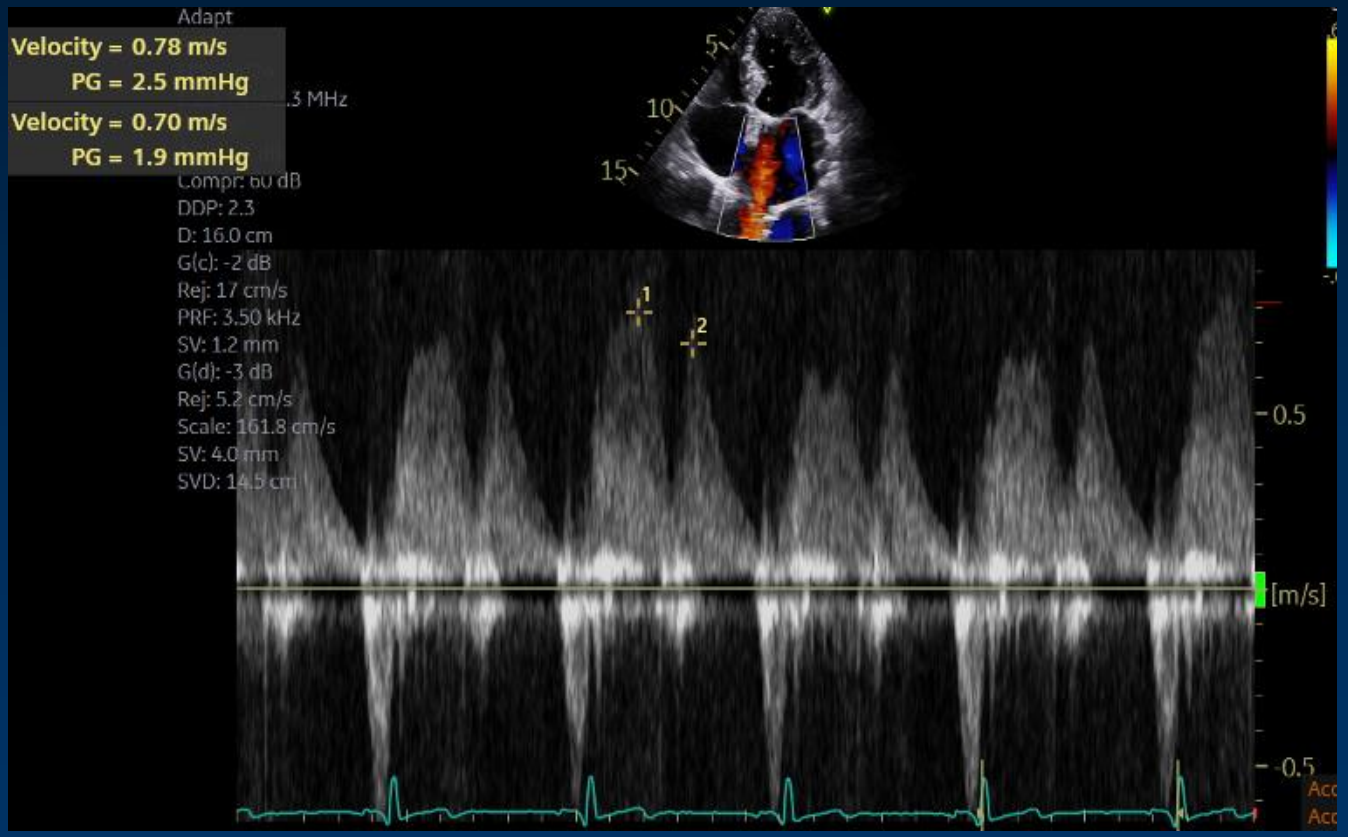


Preliminary Algorithm



TR Velocity less than 2.8 m/s and less than 35 mmHg

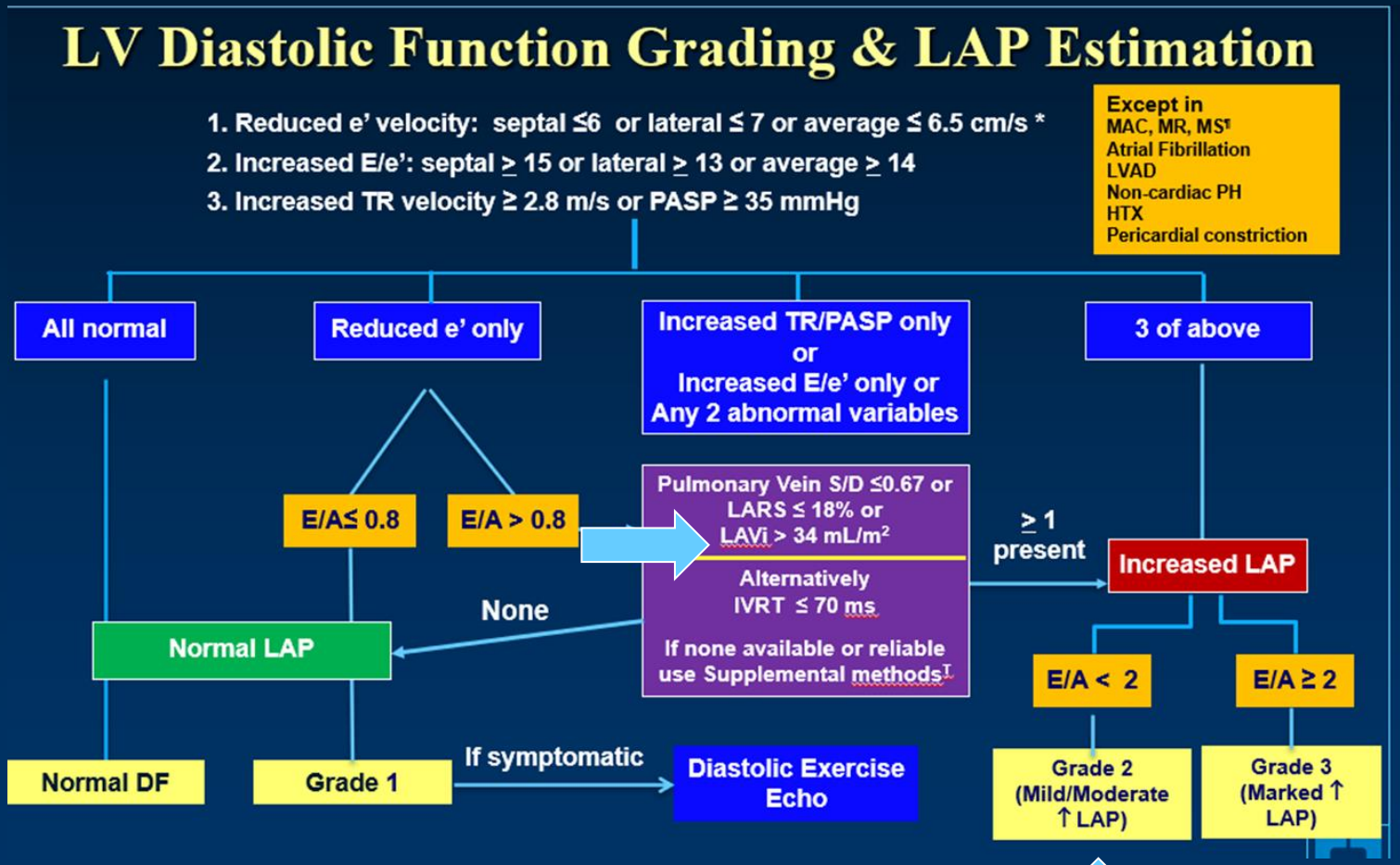
Pulmonary Vein S/D Ratio



Assess Additional Parameters

- LASr less than 18% (normal at 25%)
- Pulm Vein S/D ratio < than or equal to 0.67 (1.1)
- IVRT < than or equal to 70 m/s
- LAVI > 34 ml/m2

Preliminary Unpublished Diastolic Function Evaluation and HFpEF Diagnosis Guidelines 2025



LAVI Greater than 34 ml/m2 !!!

- Increased LAVI = Increased LAP
- E/A Ratio = .98 < 2 =
- GRADE 2 DF 

Diastology Guidelines 2025:

What Will the New Guidelines Say?

Take Home Points

- The important parameters are MV E/A, mitral annular e', E/e', LAVI and RVSP as well as PV S/D, LARS and IVRT
- Step wise approach
- New cutoffs based on large normal datasets
- Ties in HFpEF
- Should be published in 2025

Klein
Garcia

DIASTOLOGY

Clinical Approach to Heart Failure with Preserved Ejection Fraction

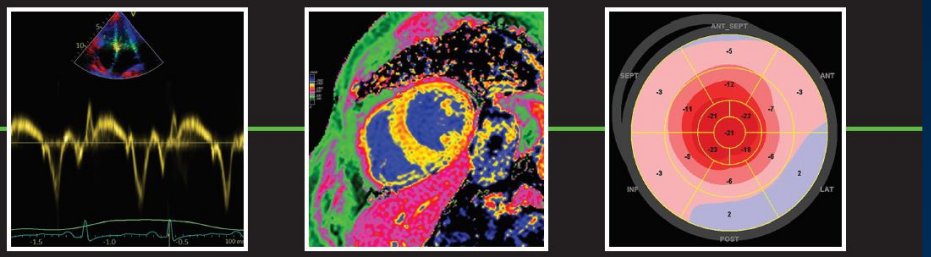
SECOND EDITION

ELSEVIER

Allan L. Klein
Mario J. Garcia

Enhanced DIGITAL VERSION Included

SECOND EDITION



DIASTOLOGY

Clinical Approach to Heart Failure with Preserved Ejection Fraction

ELSEVIER

50 interactive cases and **150** review questions

Thank you

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