Diastolic Function Guideline
Is it helpful ?

Jae K. Oh, MD

For Echo Hawaii 2022

Disclosures

I have no relevant financial relationship(s) with industry for this presentation.

Learning Objectives

1. To review the current (2016) ASE/EACVI Guidelines

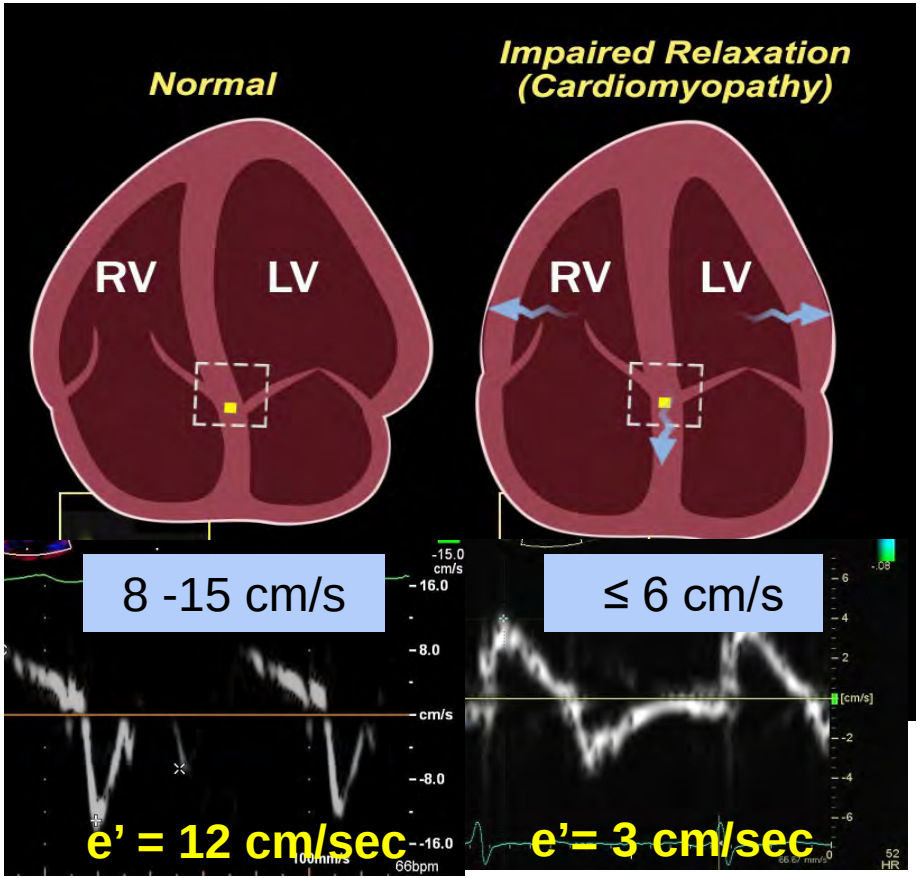
- There are 2 algorithms
- Strengths and Limitations

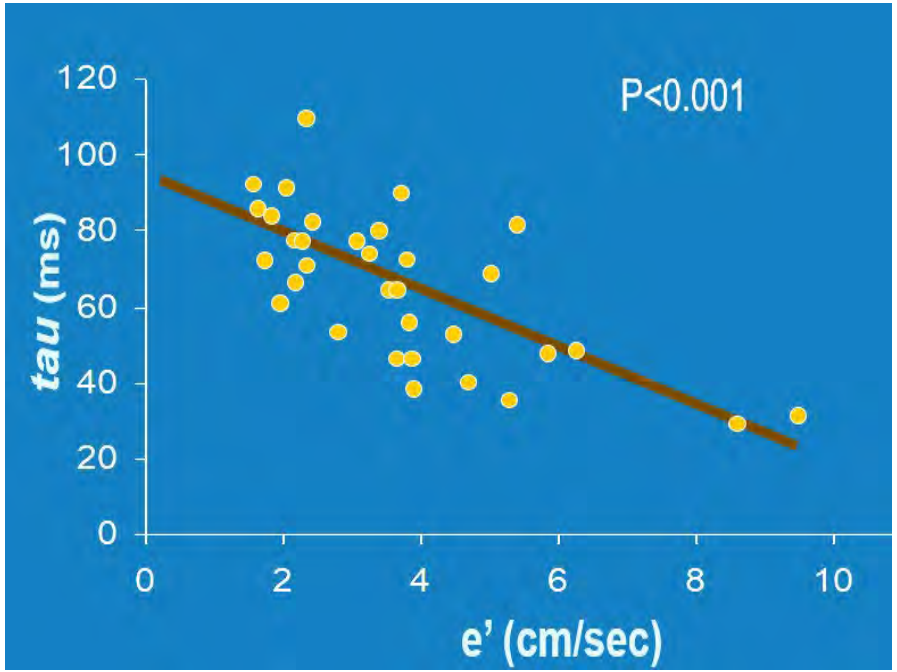
2. To understand Guideline Nuances

- Modifications
- Special circumstances
  - i. Mitral annulus calcification
  - ii. Atrial fibrillation
  - iii. Hypertrophic cardiomyopathy
  - iv. Conduction delay
  - v. Pulmonary hypertension

Mitral annulus e' velocity reflects LV relaxation (Echo *tau*)

e' velocity is reduced in ALL myocardial diseases



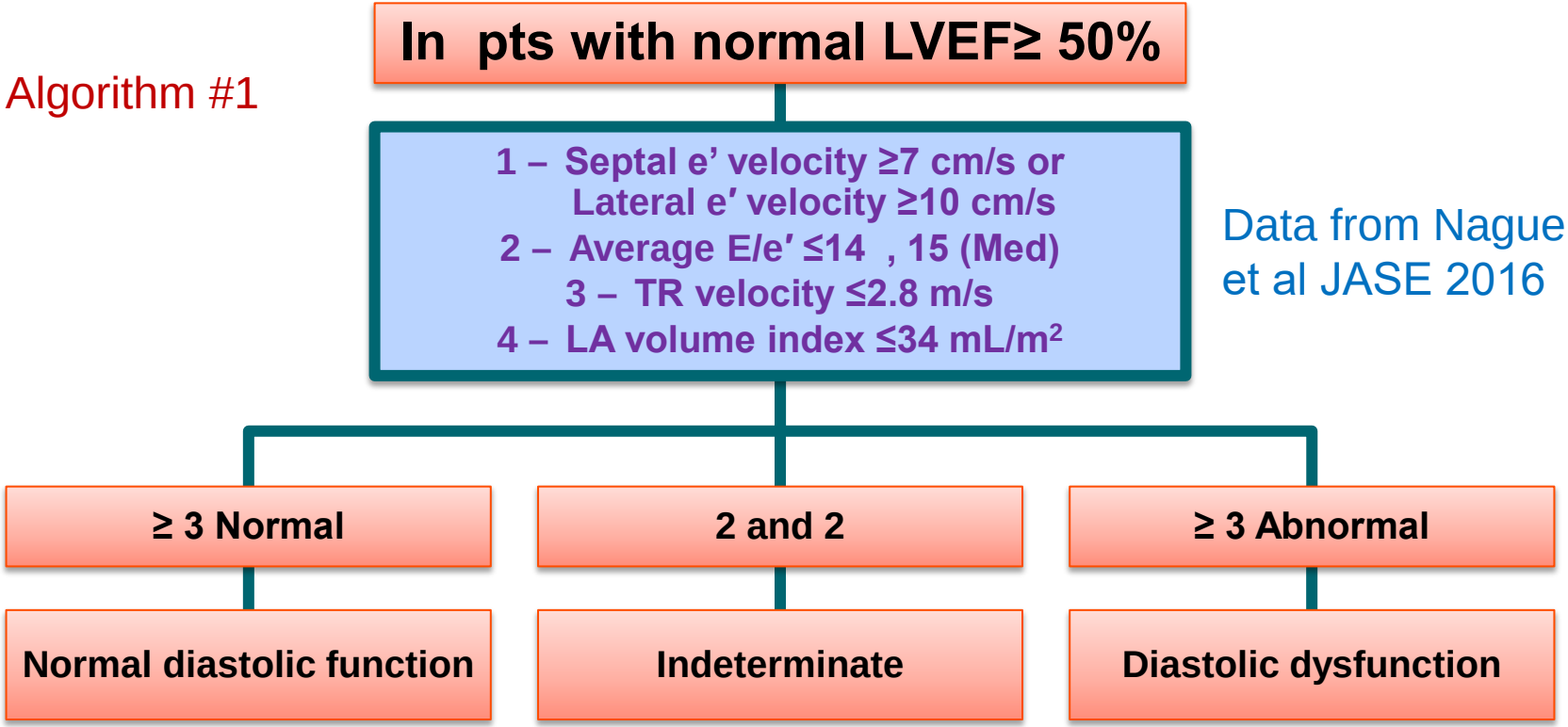


Nagueh et al JACC 1997

Courtesy of R. Espinoza, MD

ASE/EACVI Algorithm for Diastolic Function Assessment (2016)

Algorithm #1

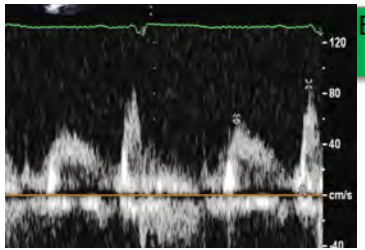


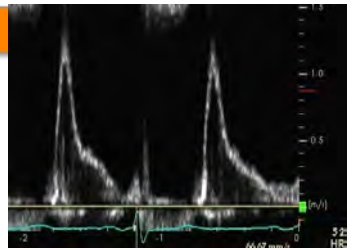
Data from Nagueh et al JASE 2016

This algorithm has a pitfall of making grade 1 dysfunction to normal

Algorithm #2

The 2016 Algorithm for Reduced EF (<50%) or Known (or Suspected) Diastolic Dysfunction/EF≥50% (Hypertension, CAD, Diabetes, MI, History of HF, LVH, LAE)





Mitral inflow

E/A ≤0.8 + E <50 cm/s

E/A ≤0.8 + E >50 cm/s or E/A >0.8-<2

E/A ≥2

3 criteria to be evaluated*

2 of 3 negative

1 – Average E/e' >14
2 – TR velocity >2.8 m/s
3 – LA volume index >34 mL/m²

2 of 3 or 3 of 3 positive

When only 2 criteria are available

2 negative

1 positive and 1 negative

2 positive

Normal LAP
Grade I diastolic dysfunction

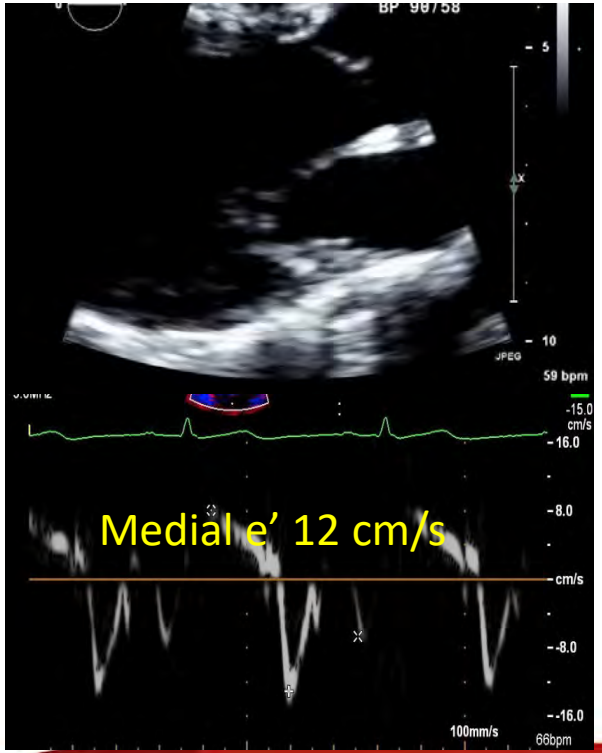
Cannot determine LAP and diastolic dysfunction grade*

↑ LAP
Grade II diastolic dysfunction

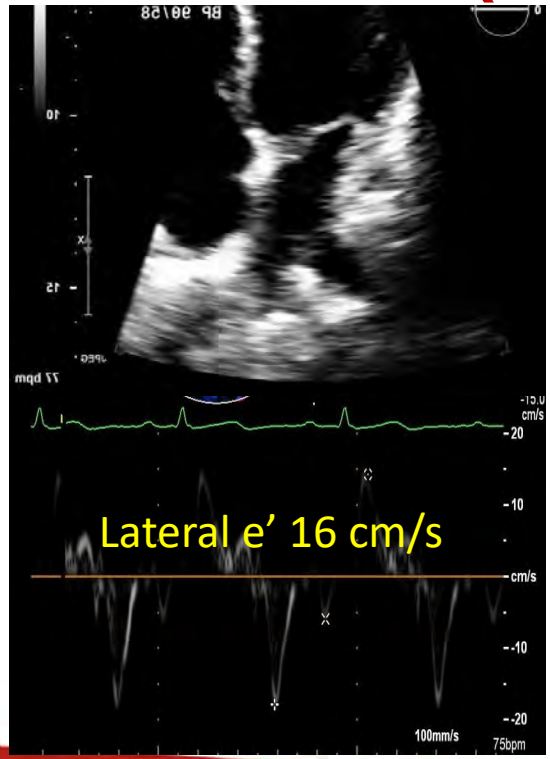
↑ LAP
Grade III diastolic dysfunction

If symptomatic consider CAD or proceed to diastolic stress test

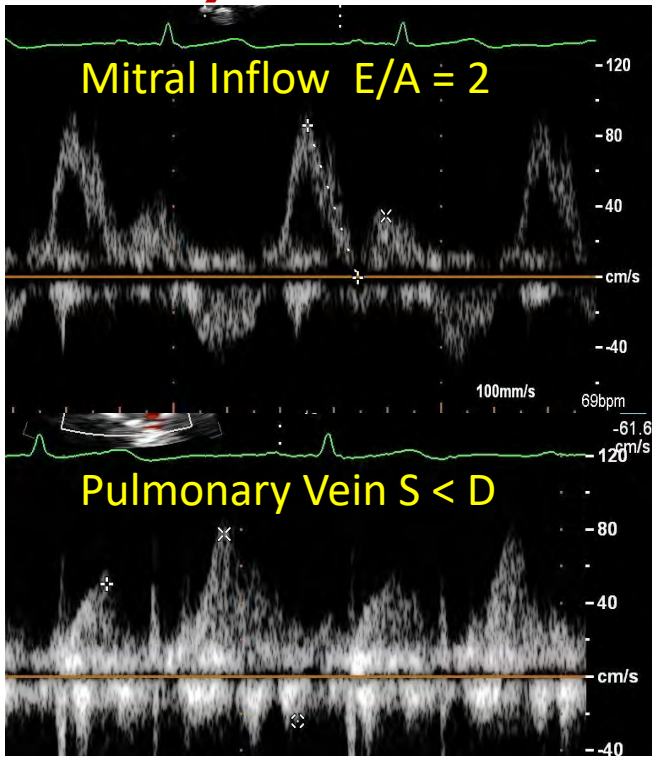
True Normal Diastolic Function in 42 yo
Normal Relaxation (Mitral e')



Medial e' 12 cm/s



Lateral e' 16 cm/s



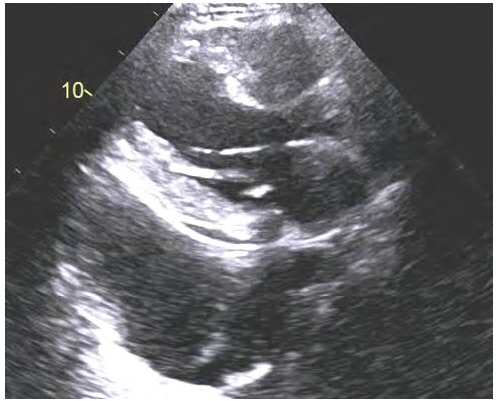
Mitral Inflow E/A = 2

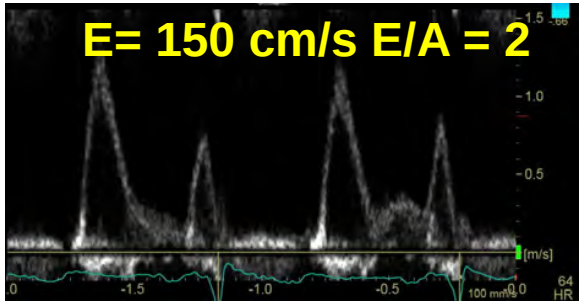
Pulmonary Vein S < D

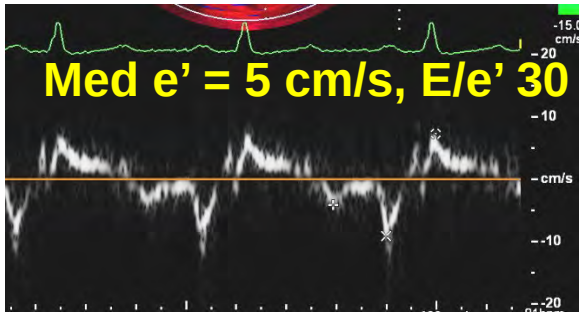
Slam Dunk Dx. HF*p*EF

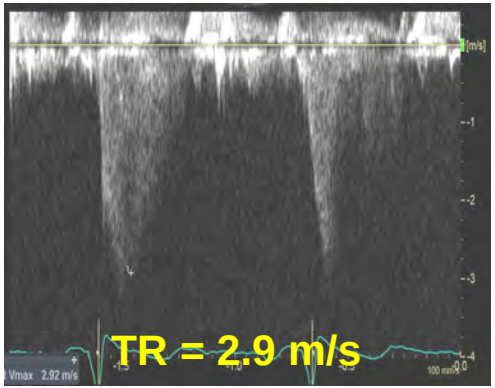
55 yo woman with SOB and hypertension

- Grade 2 – 3
- Increased filling pressure
  - **Medial e’ < 7 cm/s**
  - **E/e’ ≥ 15**
  - **TR > 2. 8 m/s**
  - **LAVI > 34 ml/m²**

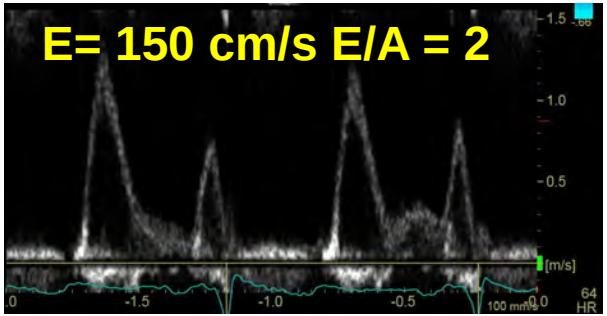


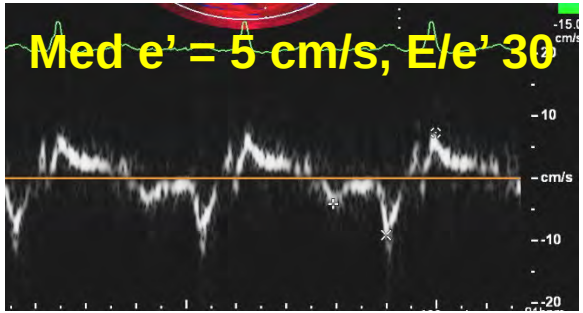


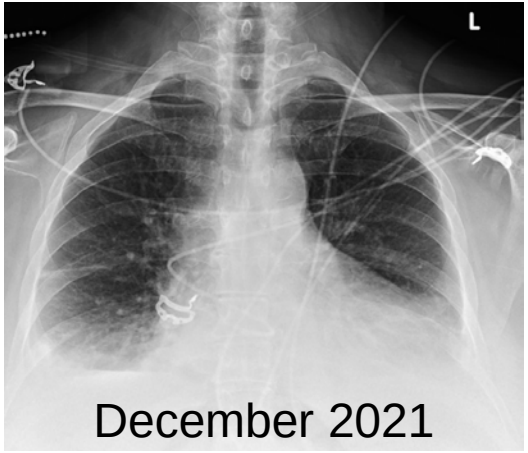


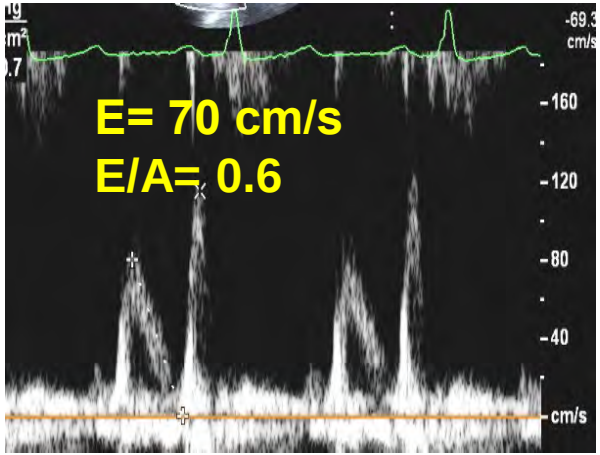


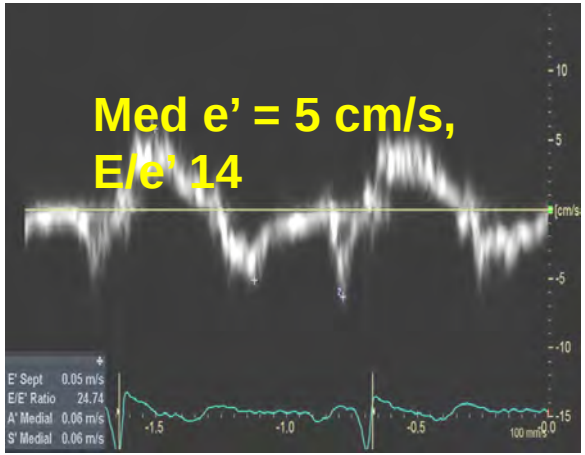
55 yo woman with HFpEF
Weight 120 vs 92 Kg





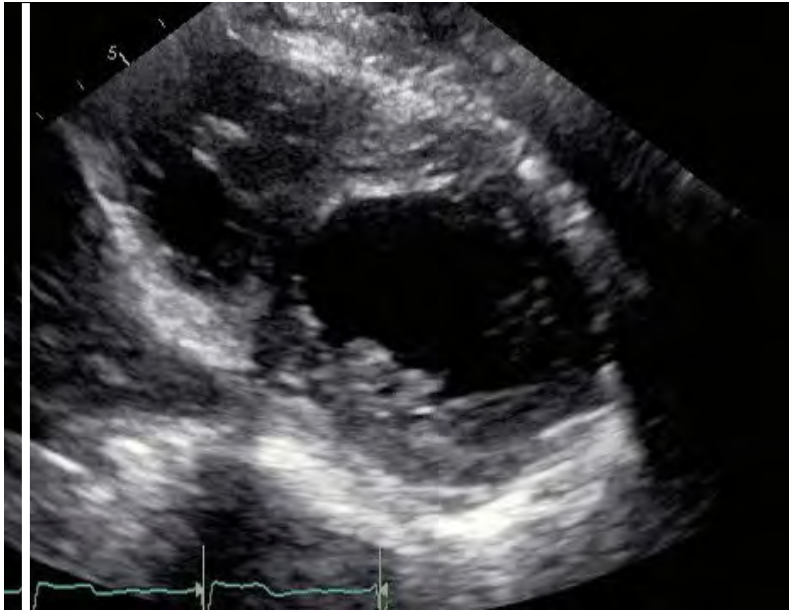






59 year old male with multiple myeloma
No cardiac symptoms

LAVI = 28 mL/m^2



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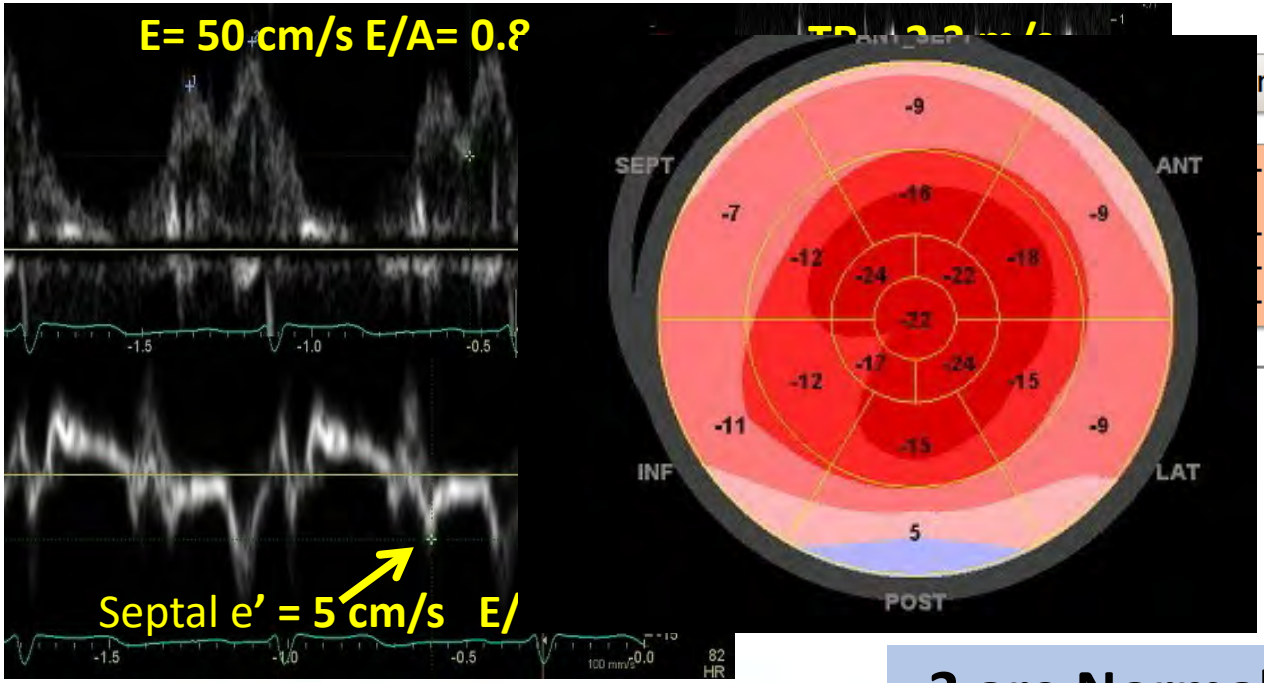


n pts with normal LVEF≥ 50%

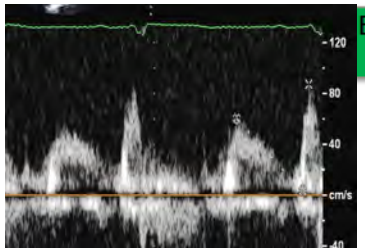
- Septal e' velocity ≥7 cm/s or lateral e' velocity ≥10 cm/s
- Average E/e' ≤14 , 15 (Med)
- TR velocity ≤2.8 m/s
- LA volume index ≤34 mL/m^2

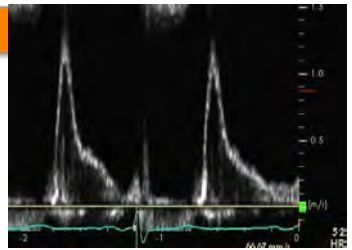
2 and 2	≥ 3 Abnormal
Indeterminate	Diastolic dysfunction

3 are Normal → **Normal DF**

Algorithm #2

The 2016 Algorithm for Reduced EF (<50%) or Known (or Suspected) Diastolic Dysfunction/EF≥50% (Hypertension, CAD, Diabetes, MI, History of HF, LVH, LAE)





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Normal LAP
Grade I diastolic dysfunction

Cannot determine LAP and diastolic dysfunction grade*

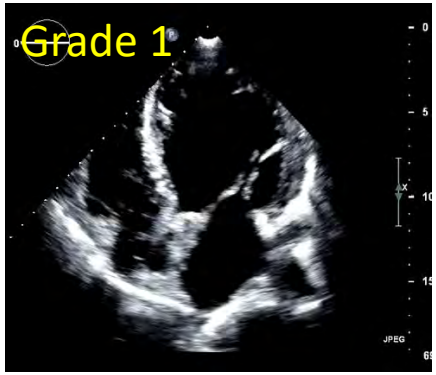
↑ LAP
Grade II diastolic dysfunction

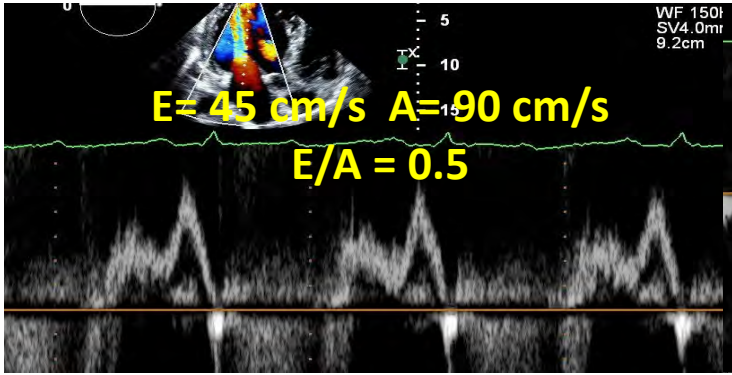
↑ LAP
Grade III diastolic dysfunction

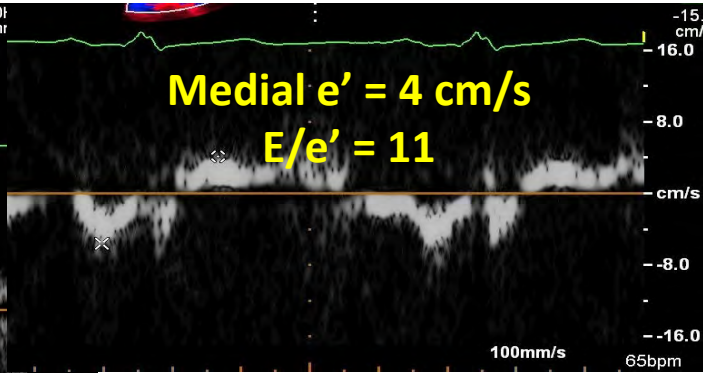
If symptomatic consider CAD or proceed to diastolic stress test

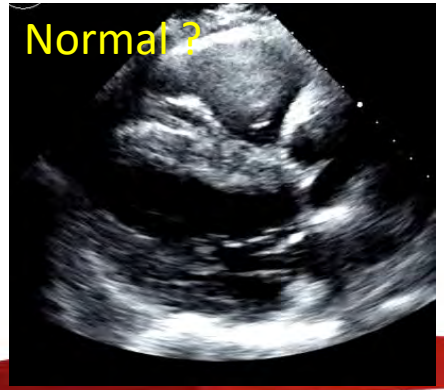
Grade 1 Diastolic Dysfunction

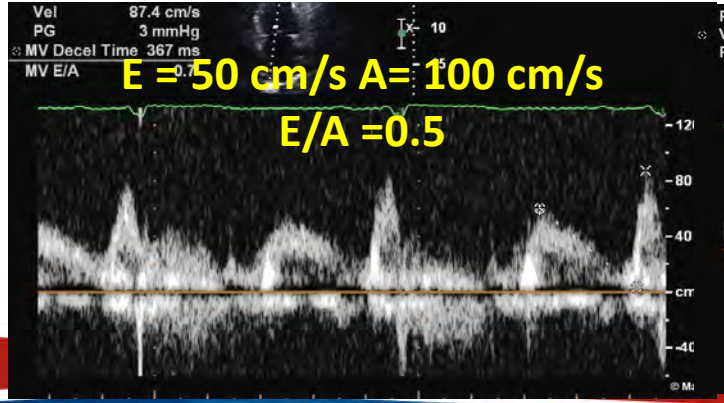
Can be normal if LVEF >50% and no suspicion of DDys

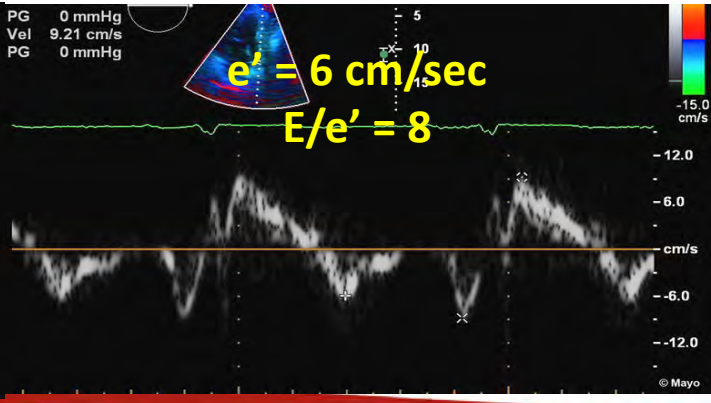








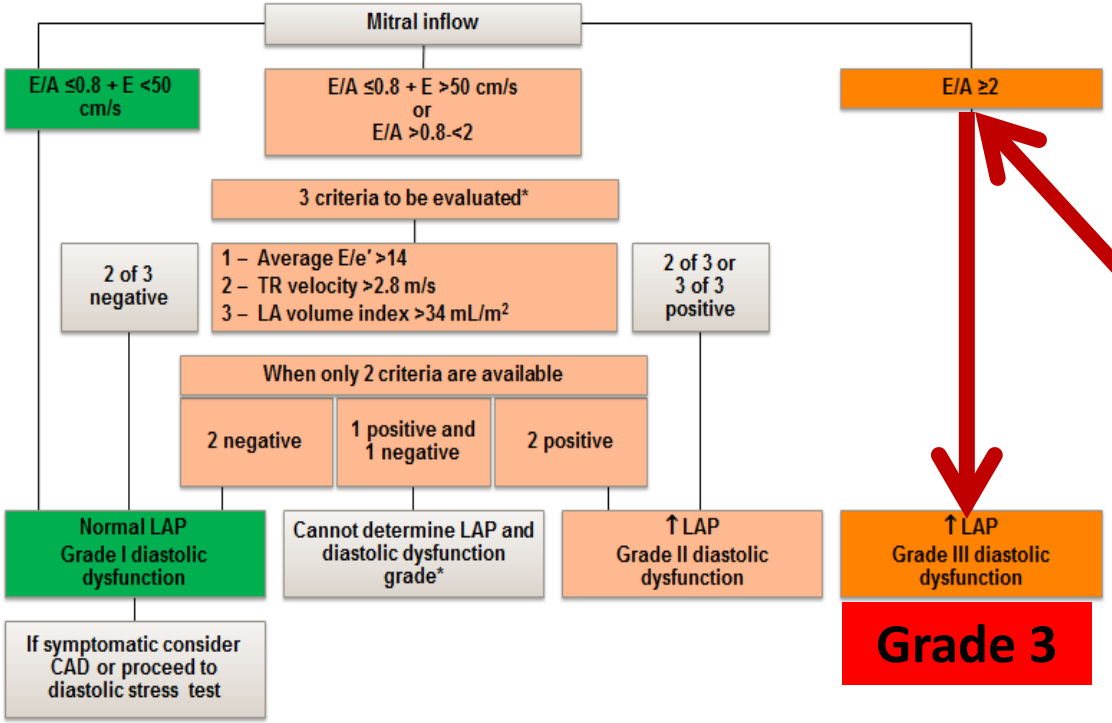


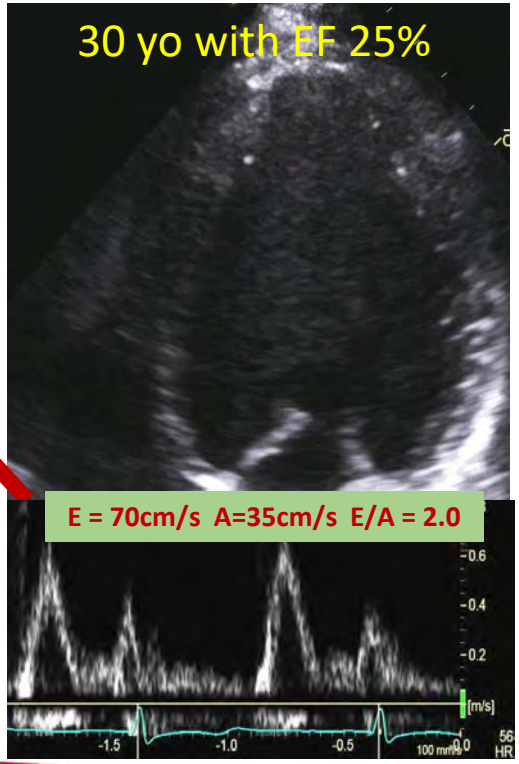


The 2016 Algorithm for Reduced EF (<50%) or Known (or Suspected) Diastolic Dysfunction/EF≥50%

(Hypertension, CAD, Diabetes, MI, History of HF, LVH, LAE)

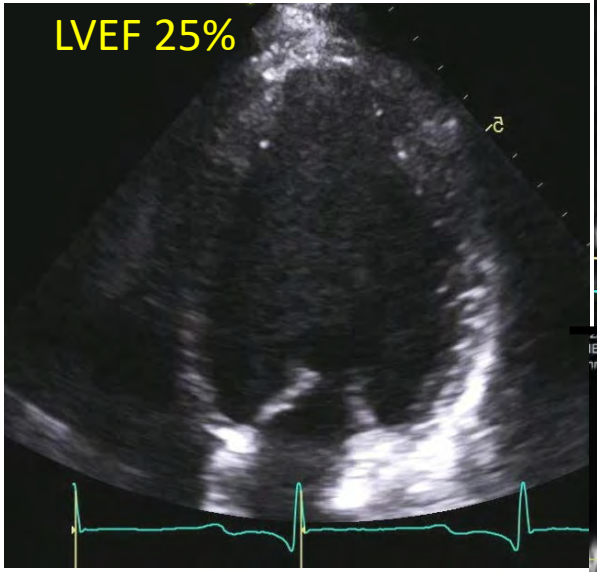
ASE American Society of Echocardiography — Sound Saves Lives

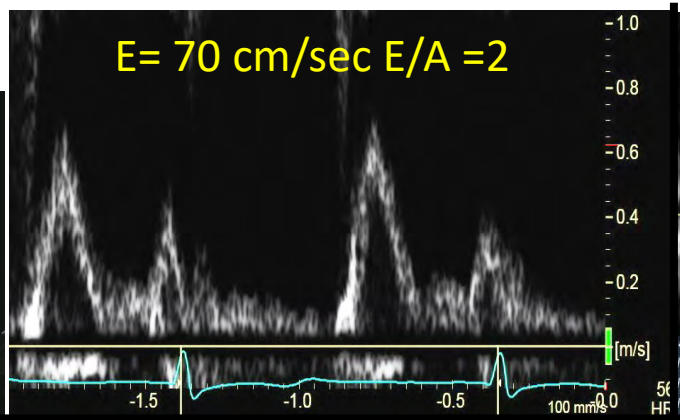


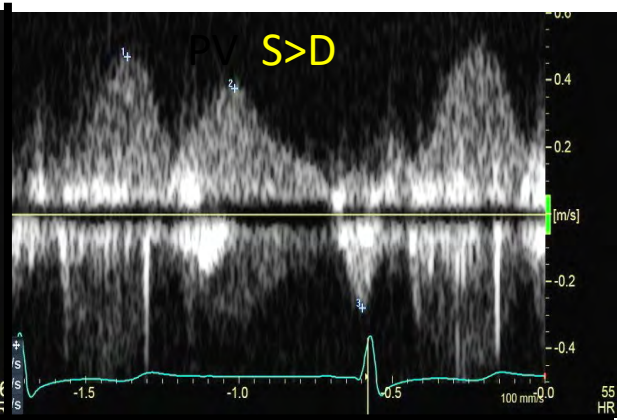


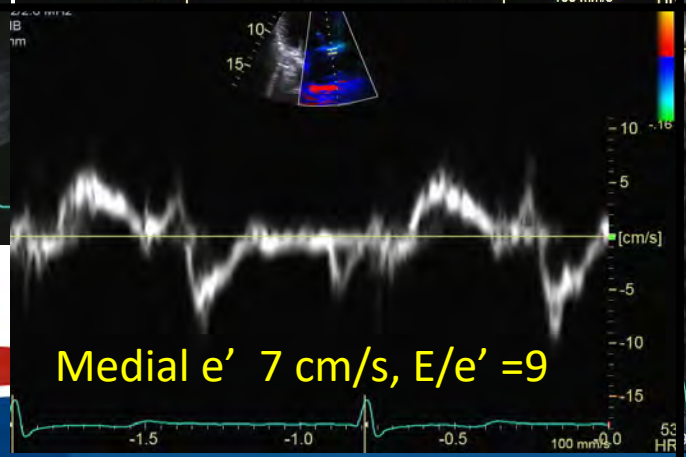
A Young Woman with LM Spontaneous Coronary Dissection

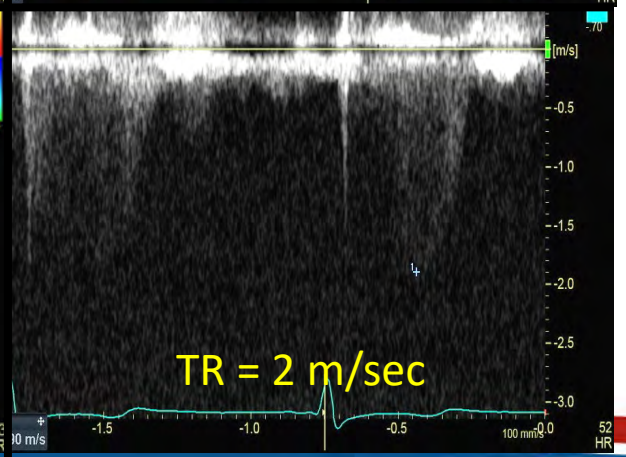
Normal Filling Pressure and Normal Diastolic Function











What about combining 2 algorithms together?

SPECIAL ISSUE: NONINVASIVE ASSESSMENT OF LEFT VENTRICULAR DIASTOLIC FUNCTION

DEBATES IN IMAGING

The 2016 Diastolic Function Guideline

Is it Already Time to Revisit or Revise Them?

Jae K. Oh, MD,[a] William R. Miranda, MD,[a] Jared G. Bird, MD,[a] Garvan C. Kane, MD, PhD,[a] Sherif F. Nagueh, MD[b]

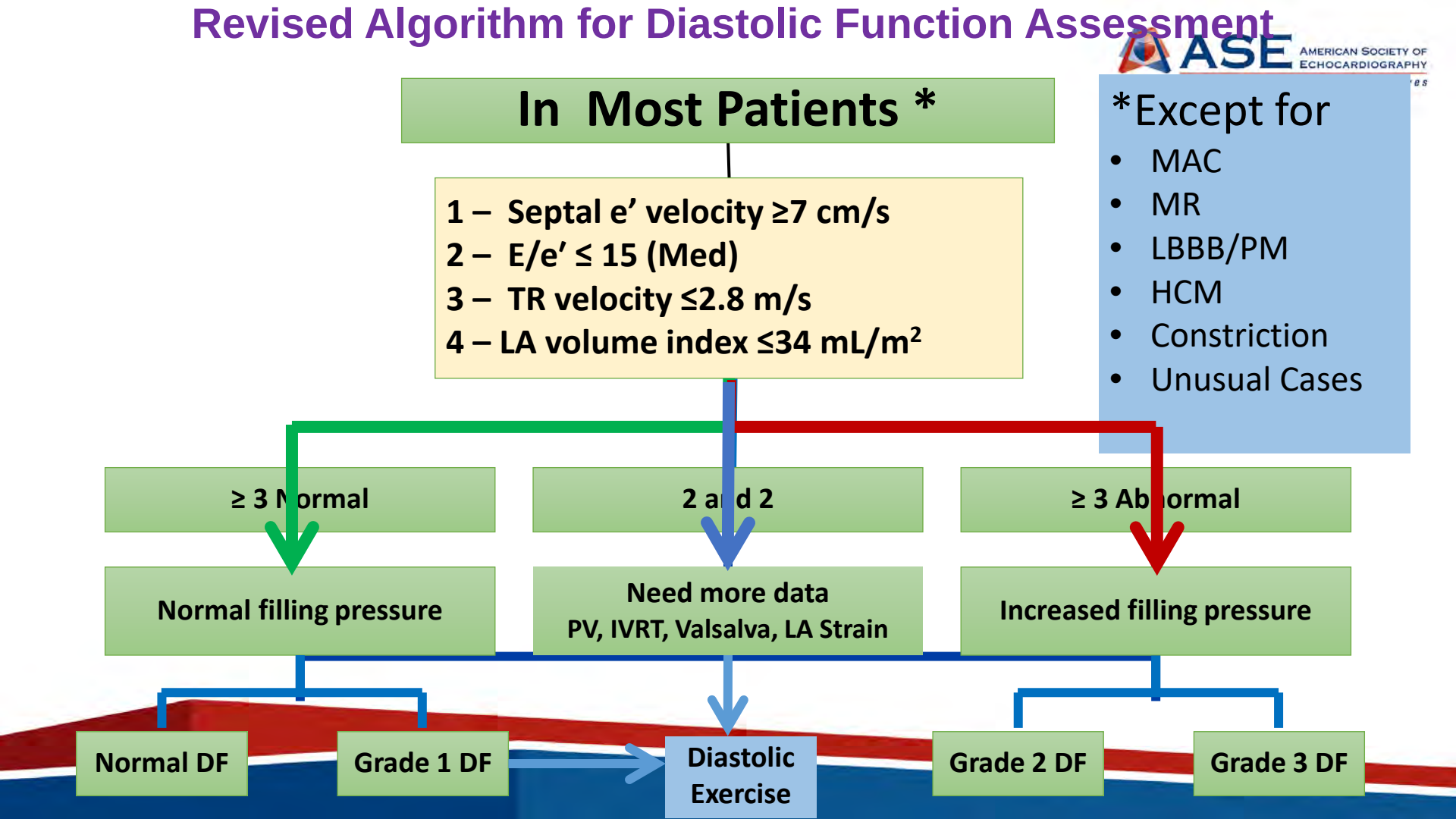
A Proposal For Modifications To The Current Diastolic Function Guideline

Jae K. Oh, MD, William R. Miranda, MD, Jared G. Bird, MD, Garvan C. Kane, MD, PhD

(DD), designed for estimating left ventricular (LV) filling pressure and grading diastolic function. The 2016 guideline emphasized the specificity for detecting DD. In selected patients who were referred to cardiac catheterization, assessment of filling pressure according to the 2016 guideline was shown to be reliable and interobserver variability was excellent

Oh et al JACC IMG 2020

Revised Algorithm for Diastolic Function Assessment



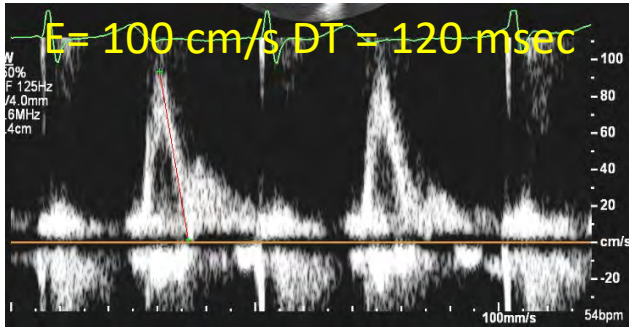
Diastolic Function Assessment in Atrial Fibrillation

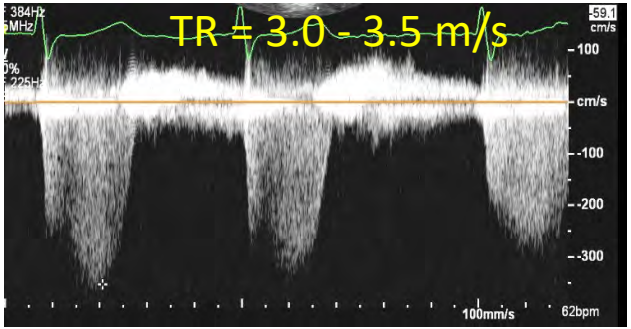
Mitral DT ≤ 140 msec

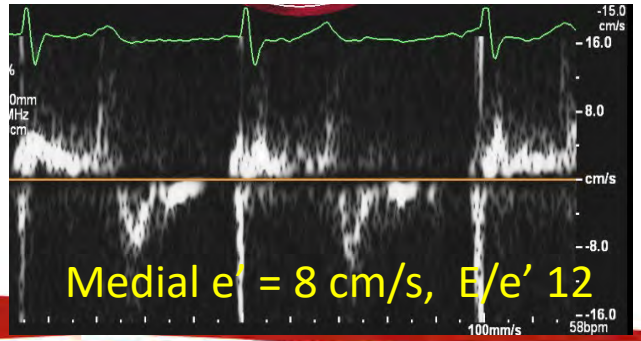
E/medial e' ≥ 11

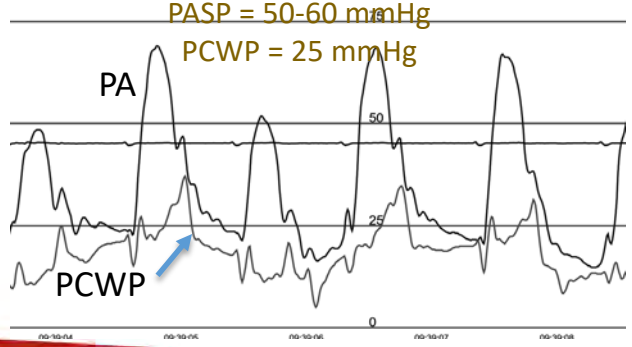
TR velocity ≥ 2.8 m/s

IVRT < 65 msec

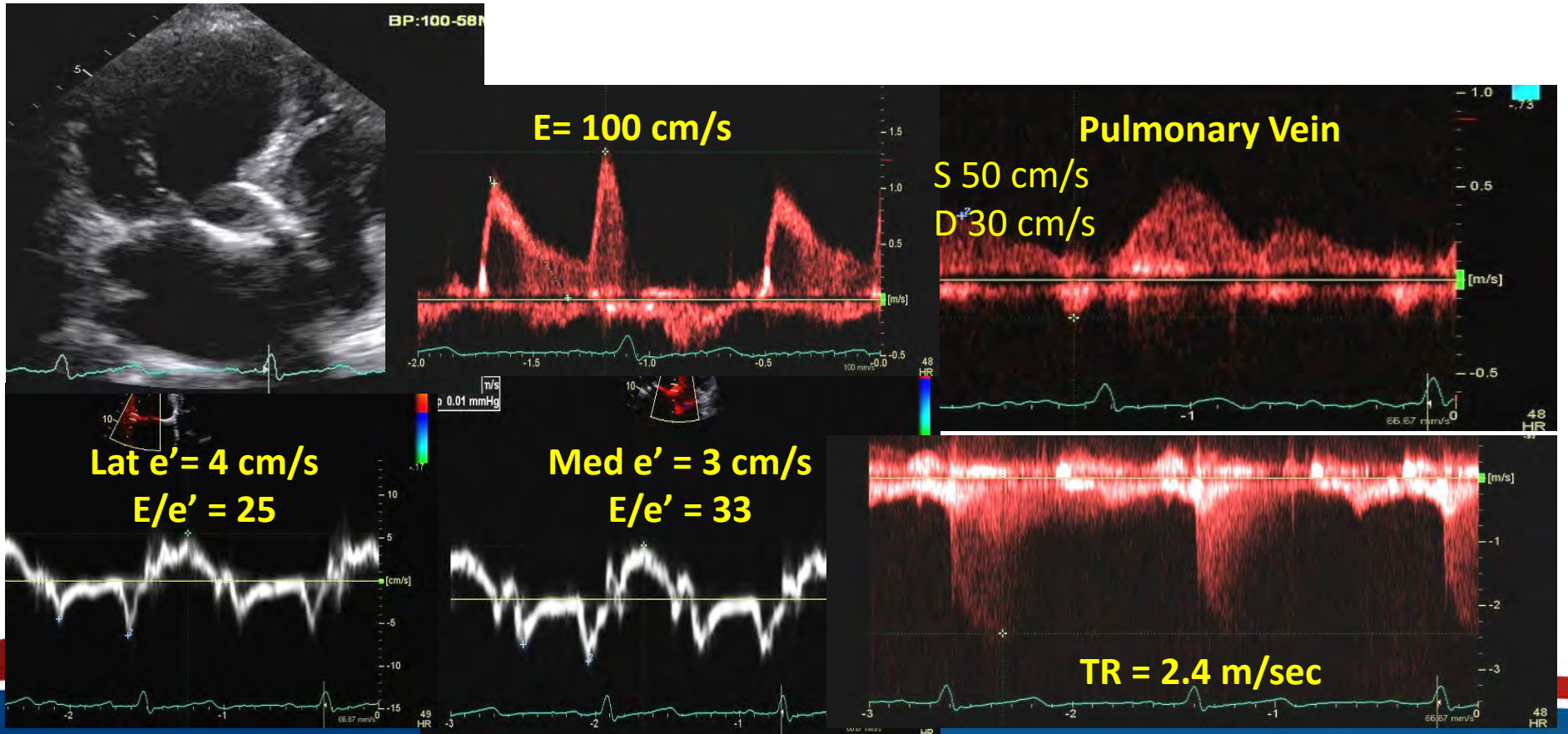




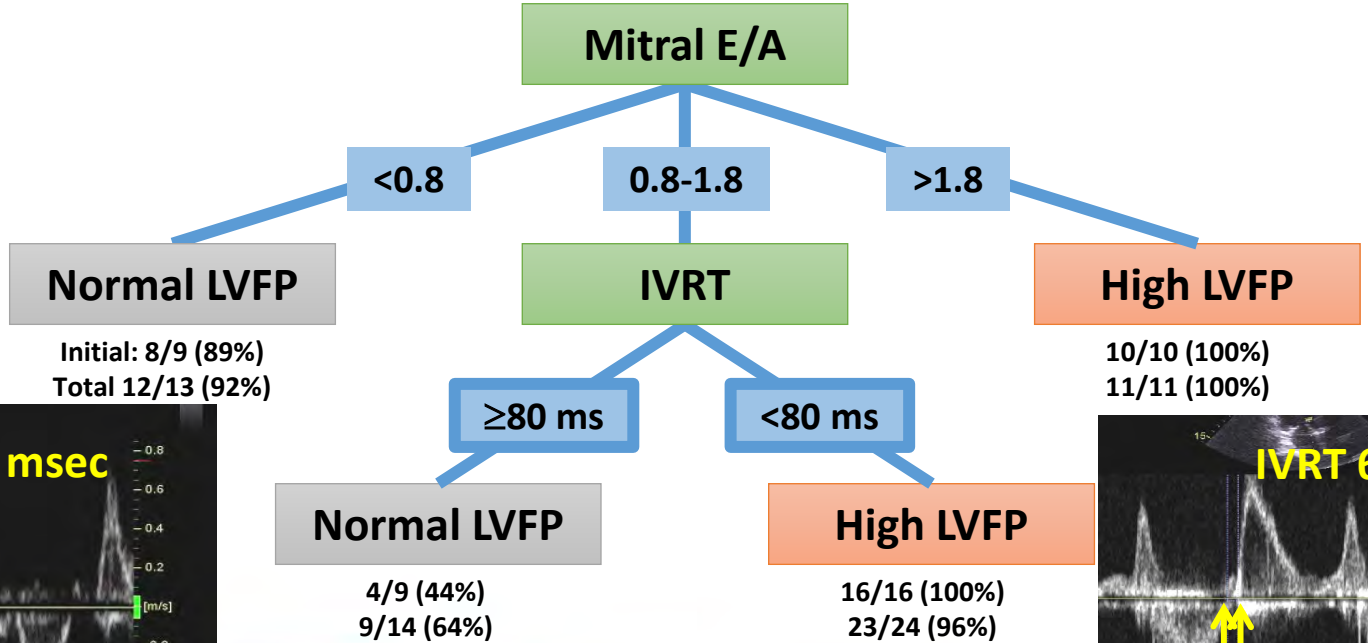


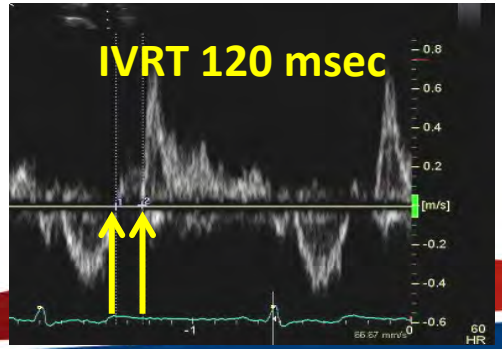


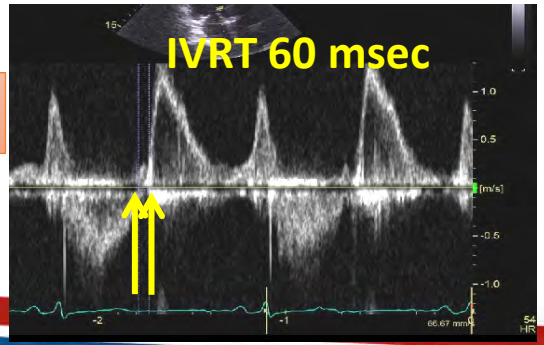
80 yo woman with MAC and TAVR



Proposed Clinical Algorithm for Estimation of Left Ventricular Filling Pressure in Subjects With Mitral Annular Calcification



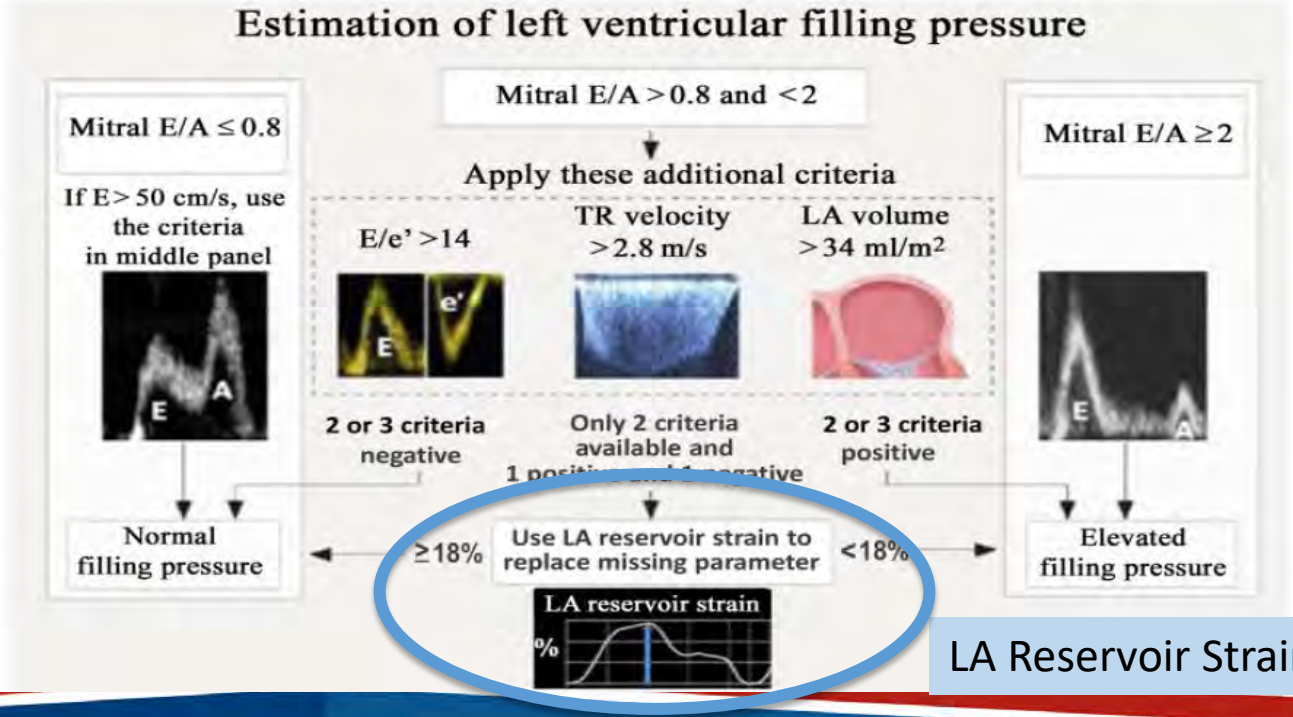




Data from Abudiab & Zoghbi et al: JACC Img, 2017

ESC European Society of Cardiology
European Heart Journal - Cardiovascular Imaging (2021) 00, 1–28
doi:10.1093/ehjci/jeab154
EACVI DOCUMENT
American Society of Echocardiography
Sound Saves Lives

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

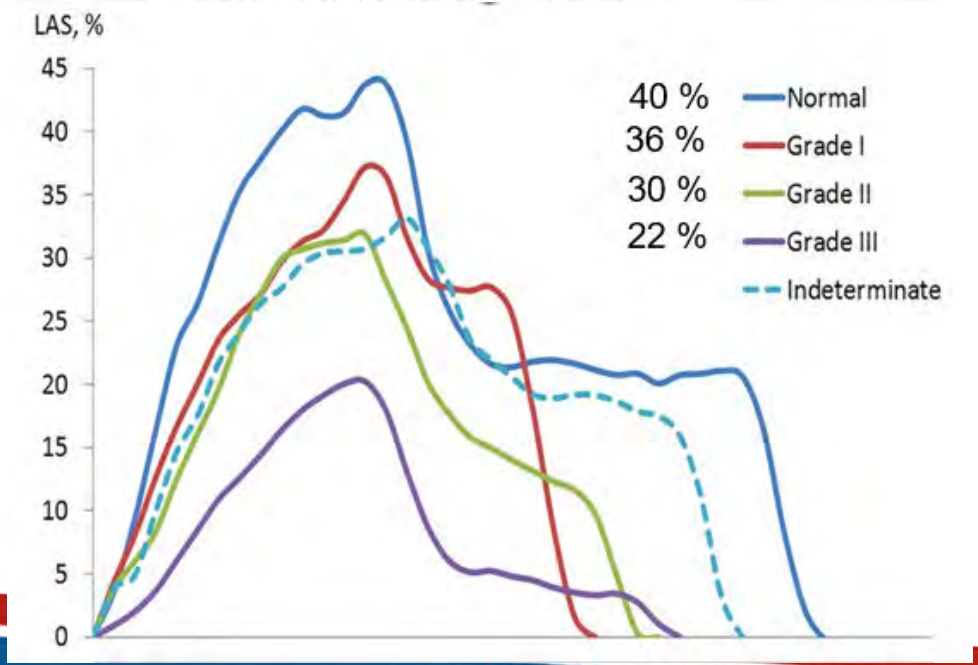


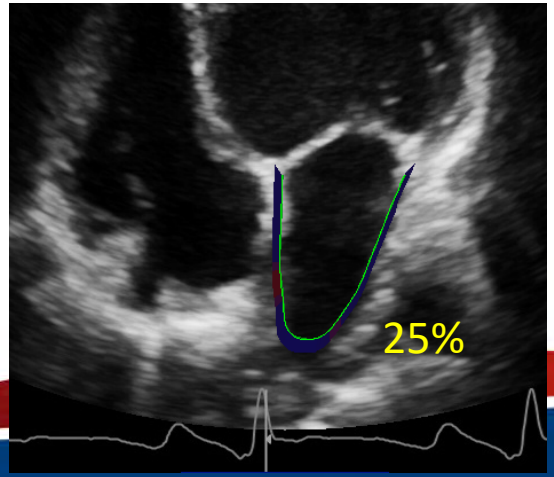
LA Reservoir Strain

OA Smiseth et al EHJ CV Imaging 2021

Left Atrial Strain in Evaluation of Heart Failure with Preserved Ejection Fraction

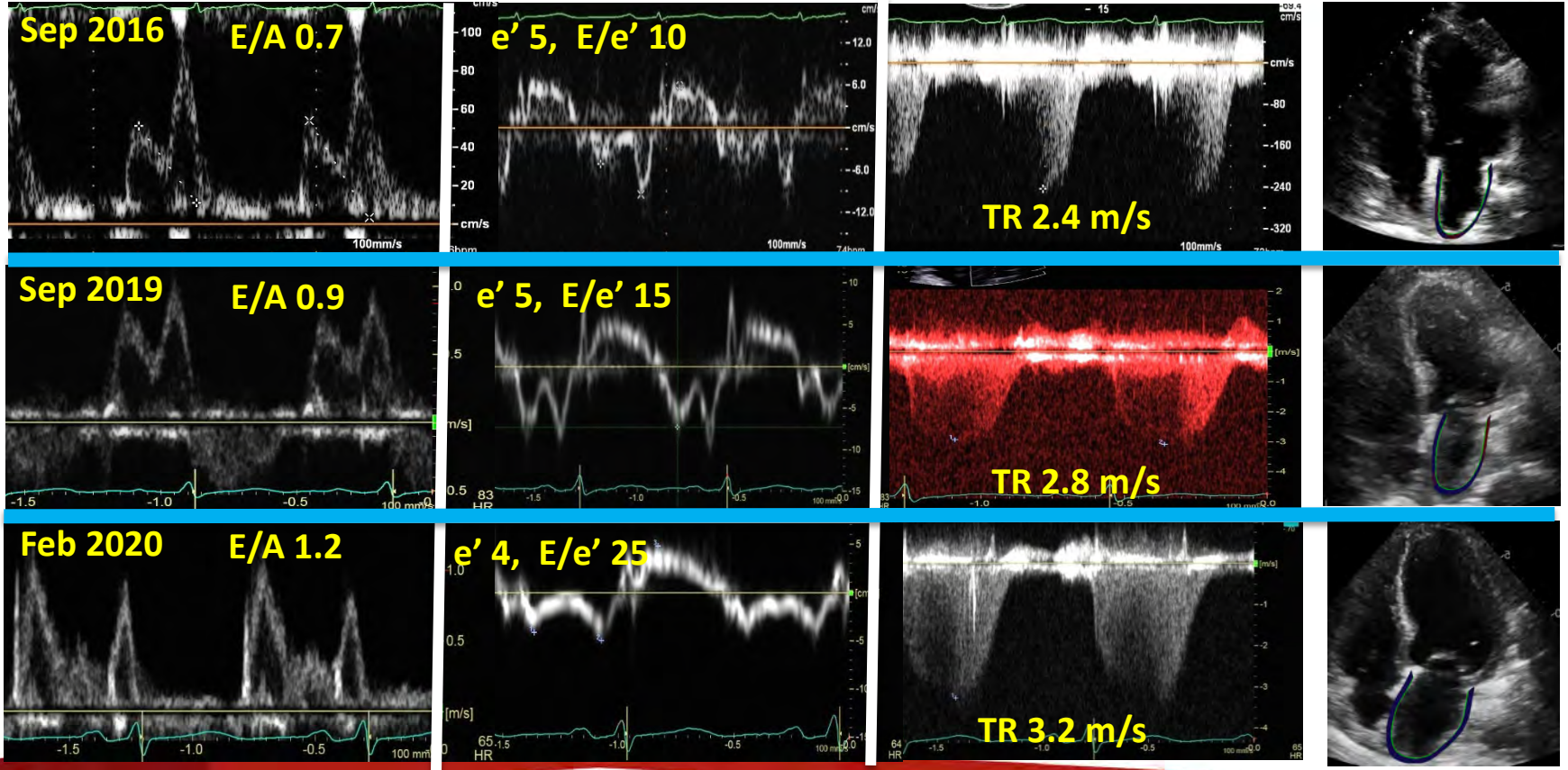
Zi Ye, MD, PhD, William R. Miranda, MD, Darwin F. Yeung, MD, Garvan C. Kane, MD, PhD, and Jae K. Oh, MD, *Rochester, Minnesota*





Ye et al. JASE 2021

Progression of Diastolic Dysfunction



Bicycle Exercise Echo
Diastolic Function Assessment

Trondheim, Norway
1995

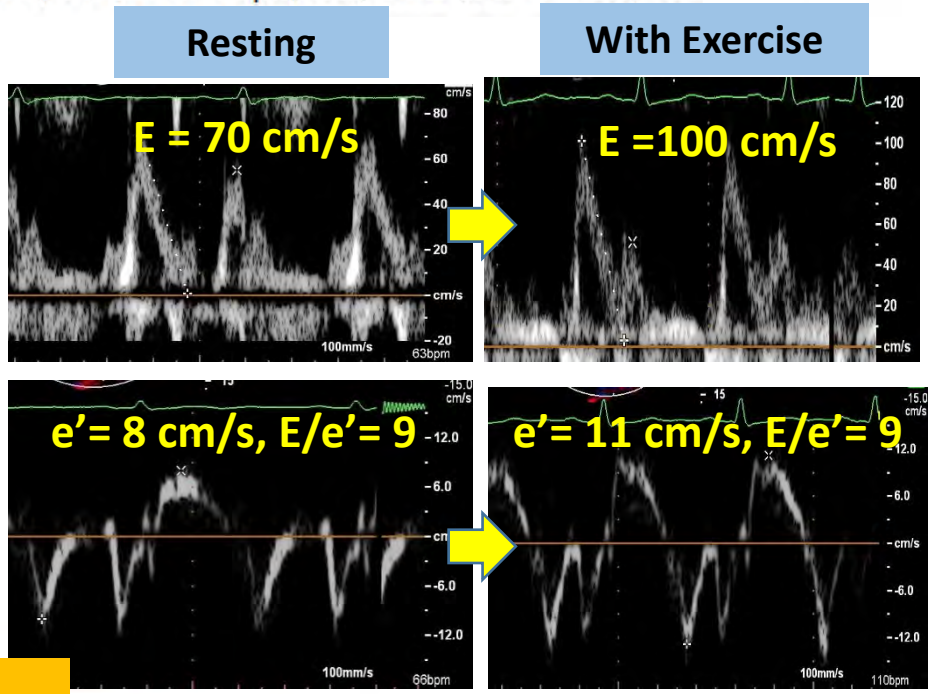
1

Jong-Won Ha, MD

Effects of Treadmill Exercise on Mitral Inflow and Annular Velocities in Healthy Adults

Jong-Won Ha, MD, PhD, Fabijan Lulic, MD, Kent R. Bailey, PhD, Patricia A. Pellikka, MD, James B. Seward, MD, A. Jamil Tajik, MD, and Jae K. Oh, MD

	Resting	Exercise
E (cm/s)	73± 19	90± 25
e' (cm/s)	12± 4	15± 5
E/e'	6± 2	6± 3

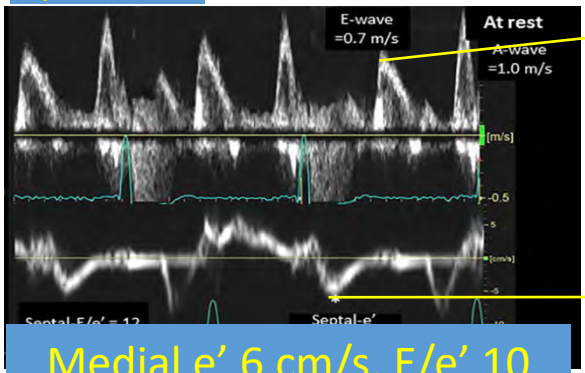


E/e' > 10 is sensitive for Grade 2 and 3 dysfunction especially if TR > 2.8 m/sec

JW Ha et al: AJC, 2003

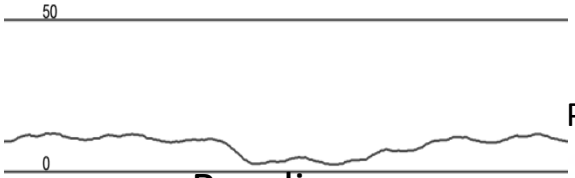
Exercise Diastolic Hemodynamics

E/A = 0.7



Medial e' 6 cm/s, E/e' 10

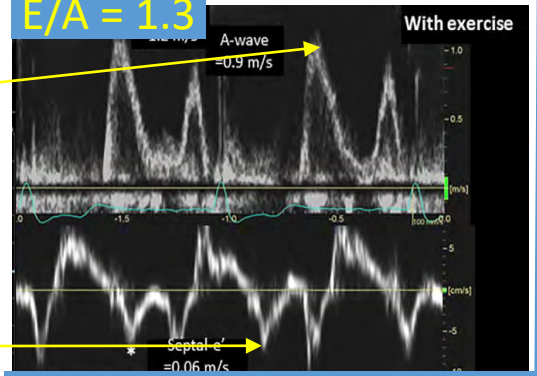
Resting



Baseline

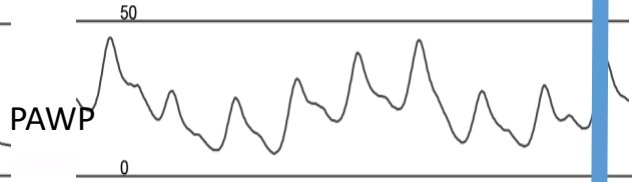
PAWP 8 mmHg

E/A = 1.3



Medial e' 6 cm/s, E/e' 20

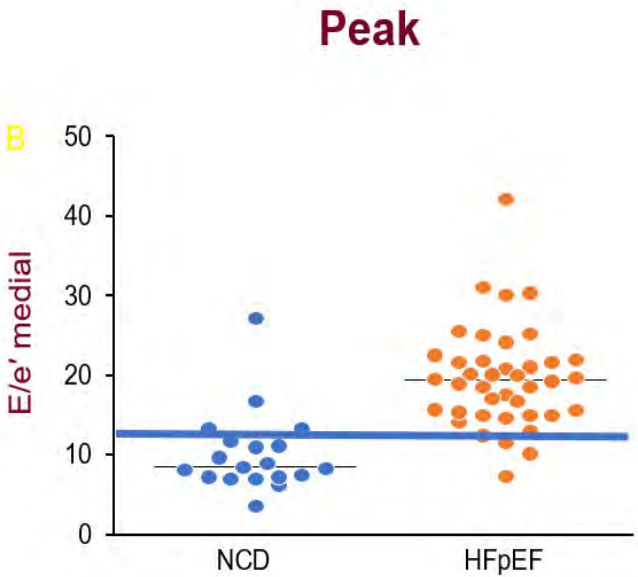
Exercise



Exercise

PAWP 27 mmHg

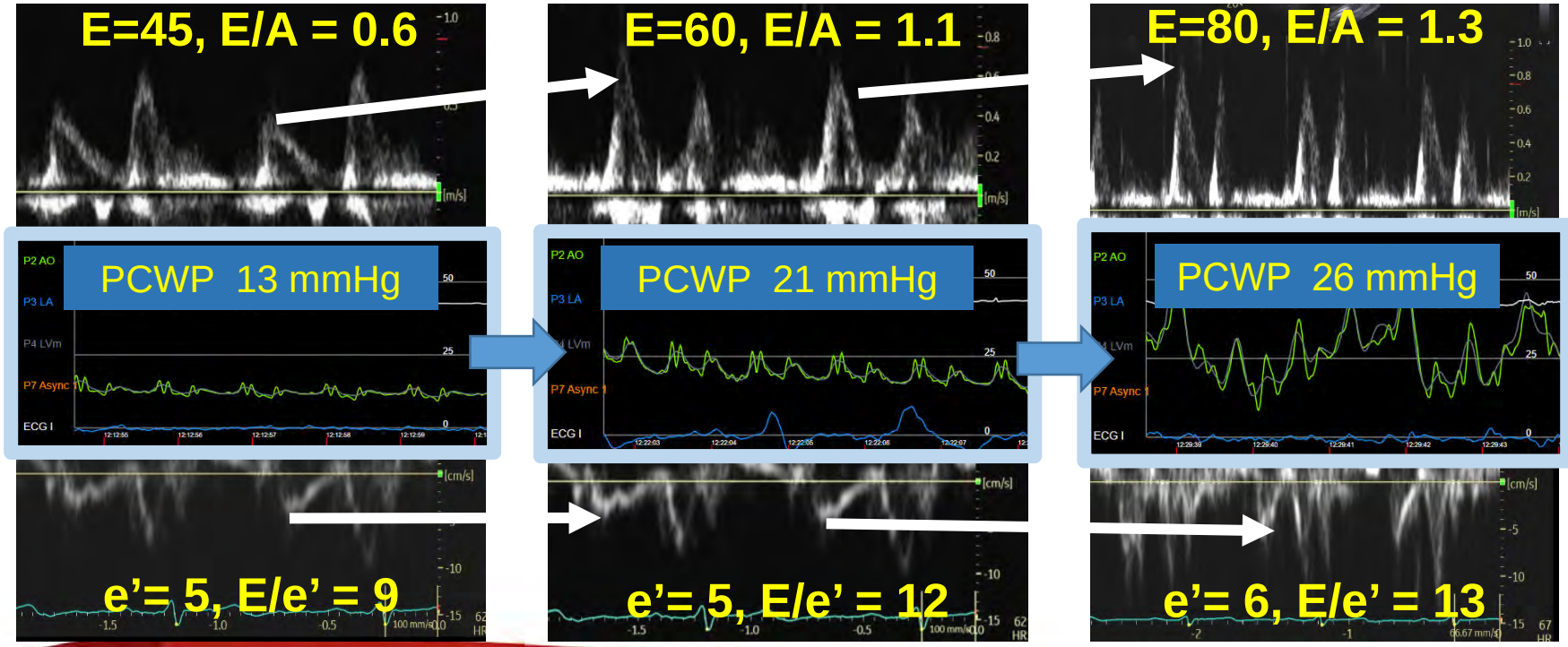
Echo and Cath with Exercise



PCWP ≥ 25 mmHg

70 yo male with exertional dyspnea and normal EF

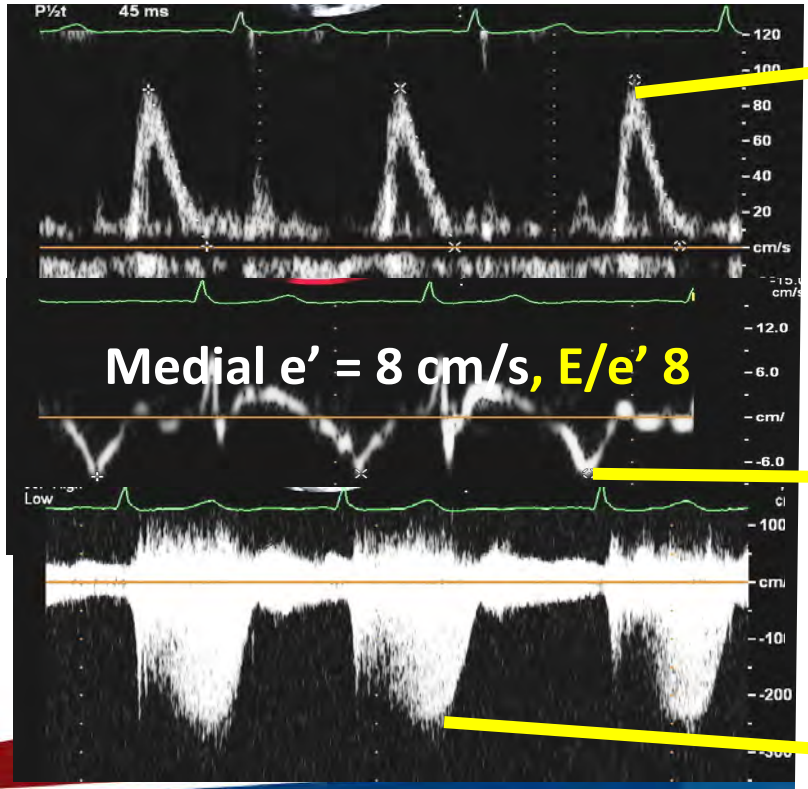
Leg raising and exercise



E/e'≥ 11 (medial) indicates increased FP in A. Fib

Resting

E= 90 cm/s

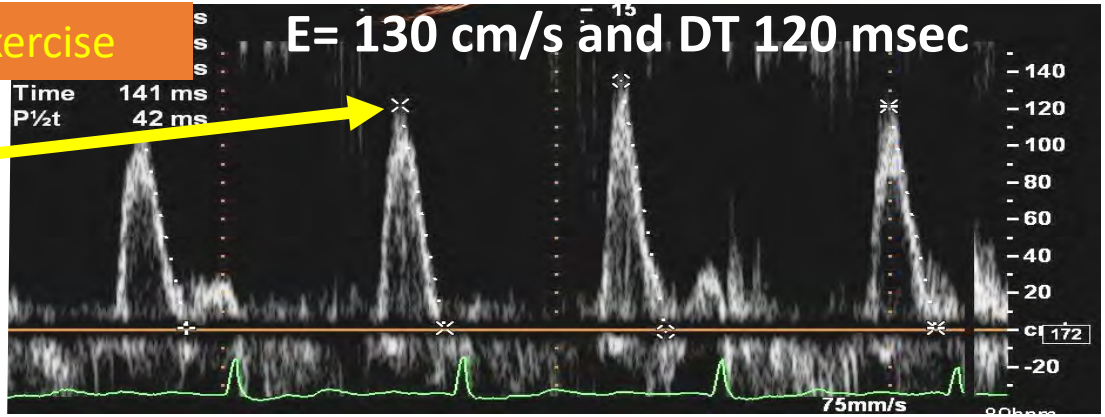


Medial e' = 8 cm/s, E/e' 8

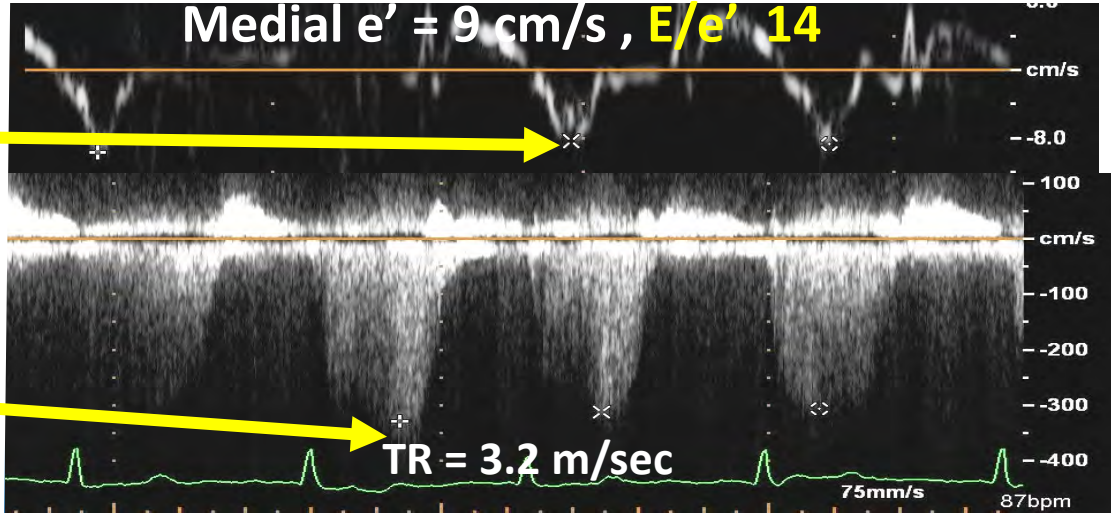
TR = 2.5 m/sec

Exercise

E= 130 cm/s and DT 120 msec



Medial e' = 9 cm/s , E/e' 14



TR = 3.2 m/sec

Diastology Guideline Summary

1. **Mitral e' velocity is the best indicator for myocardial relaxation.**
2. **If myocardial relaxation is normal, diastolic function should be normal**
3. **Assess filling pressure first, then grade**
4. **Need to understand what each parameter indicates and its limitation**