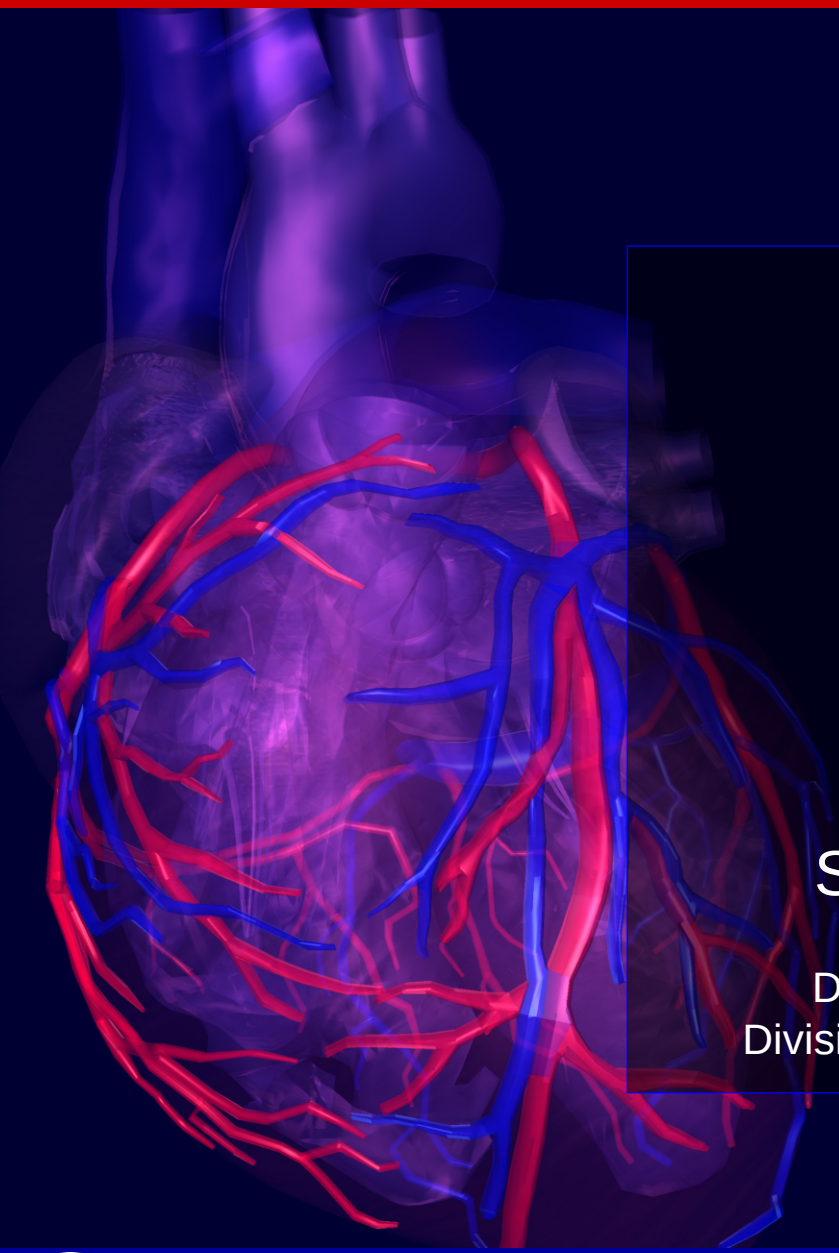

Diastolic Dysfunction Cases

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  - » Actelion, Novartis
- Consulting:
  - » AstraZeneca, Bayer, Merck, Novartis
- Honoraria:
  - » ASE, ABIM, Pulmonary Hypertension Assoc.

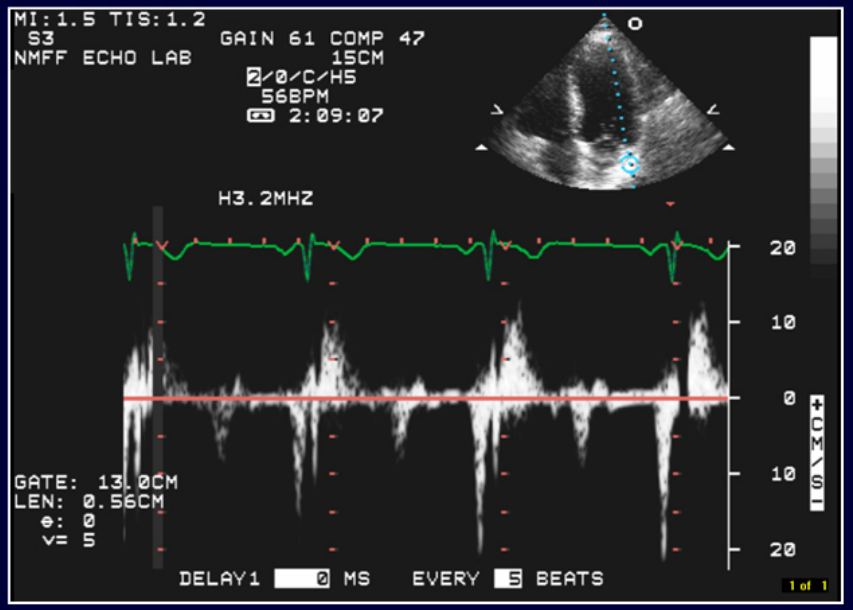
Case #1:

62-year-old woman with HTN, DM, CKD presents with DOE

PEX: BP 148/52, HR 88, RR 12
JVP 10 cm, bibasilar crackles,
irregularly irregular; nl S1 S2
No S3 or S4; soft systolic murmur
1+ LE edema

Echo from 3 years ago reviewed

- Based on TDI of lateral, how would you grade DD?
  - » A. Normal diastolic function for age
  - » B. Grade I DD
  - » C. Grade II DD
  - » D. Abnormal diastolic function (cannot determine grade)
  - » E. None of the above



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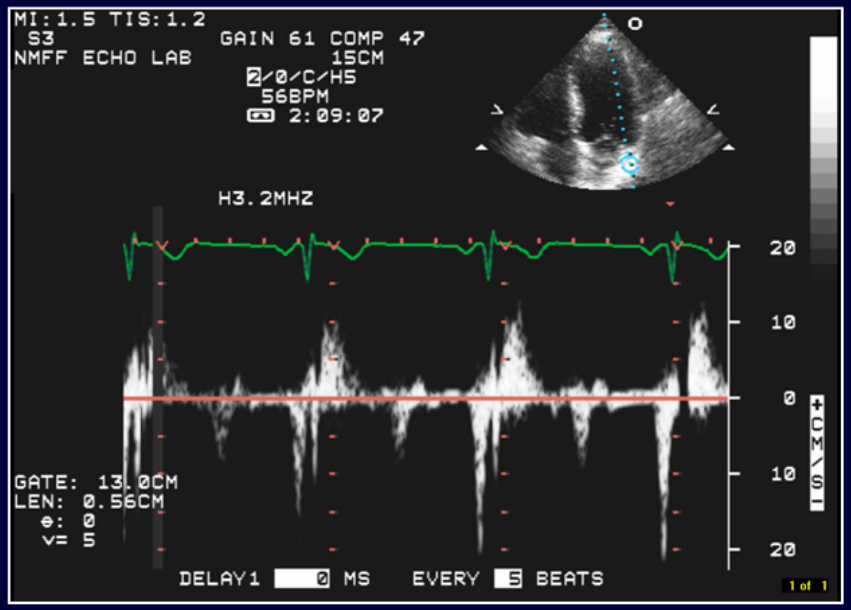
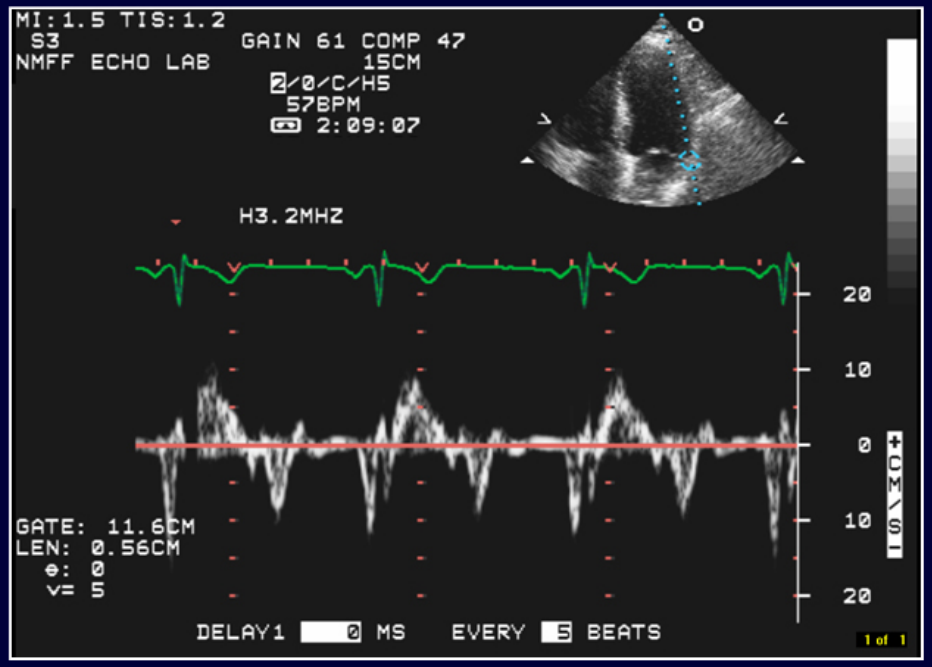


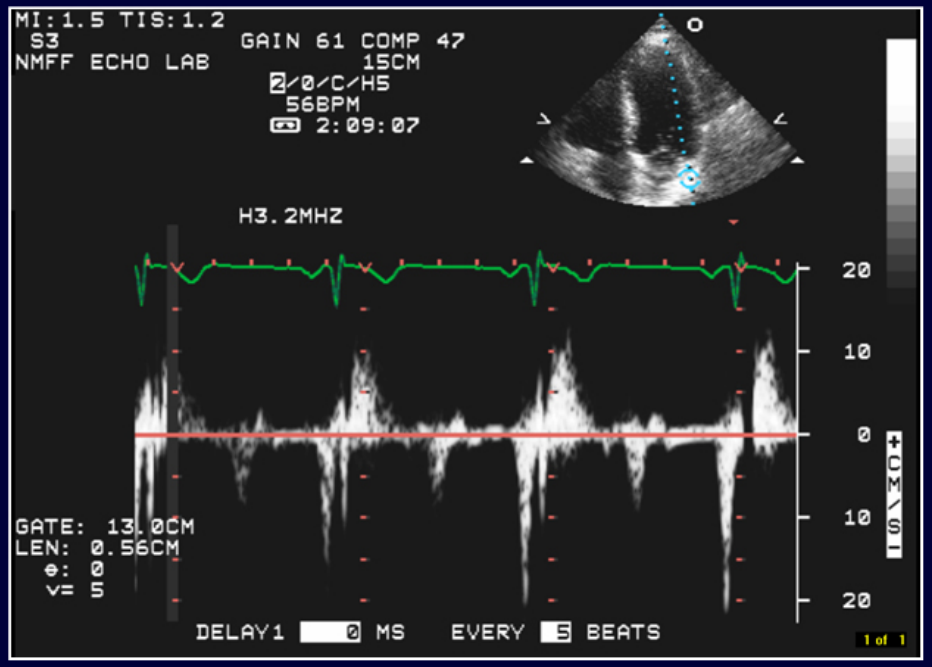
Good vs. bad TDI



E' = 8 cm/s A' = 12 cm/s

correct

(sample volume placed on lateral mitral annulus)



E' = 6 cm/s A' = 20 cm/s

incorrect

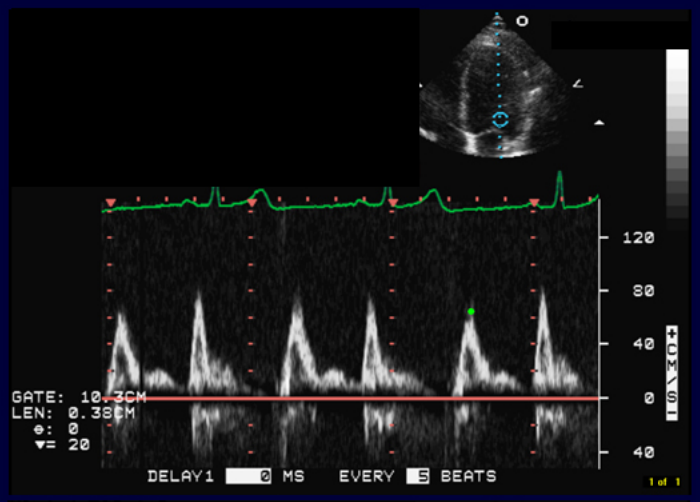
(sample volume placed on lateral atrial wall)

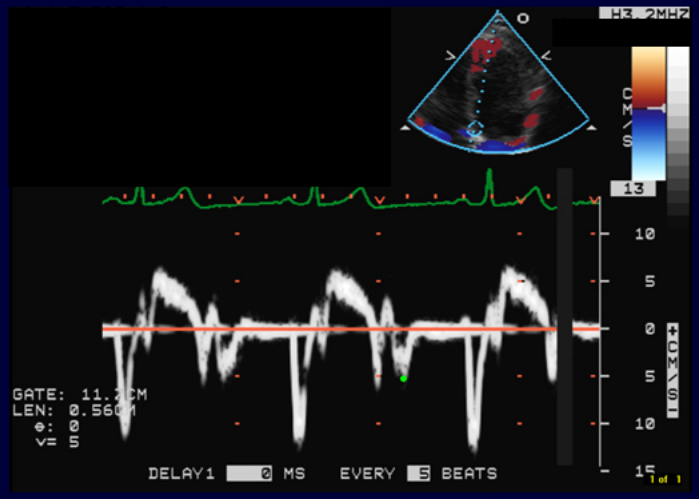
Case #1 (continued)

- 1 year ago: Started to develop DOE
- Stress echo ordered to evaluate for CAD
  - » She exercised for 6 minutes (7.2 METs)
  - » Exercise was stopped due to dyspnea
  - » No evidence of ischemia
  - » Diastolic stress echocardiography performed

Case #1: Diastolic stress echo

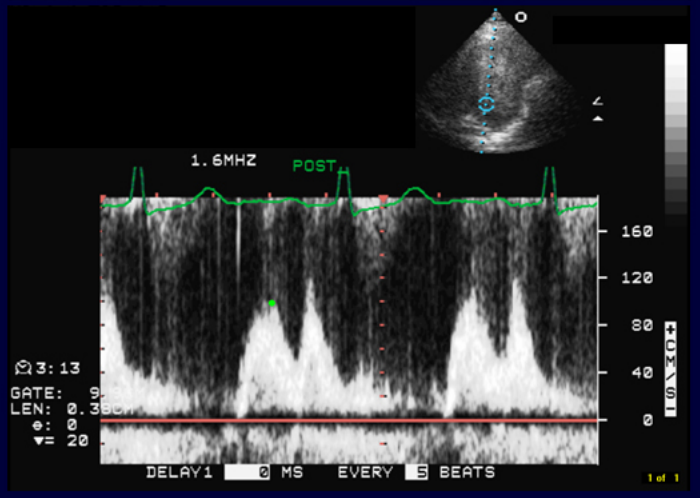
REST

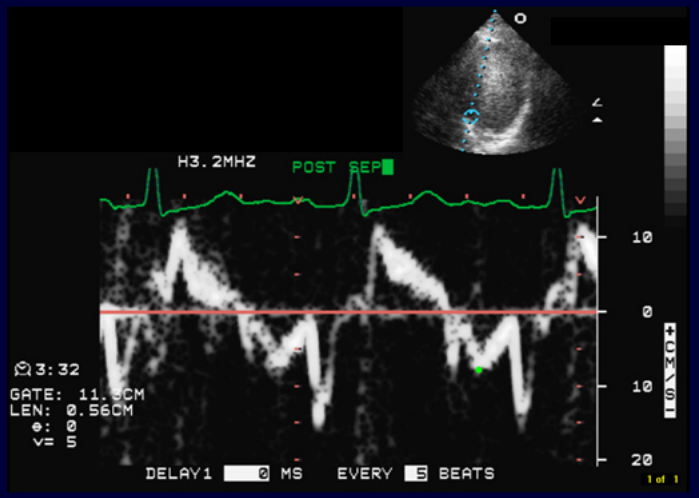




Rest
E/E' = 13.5

STRESS





Stress
E/E' = 16.7

Case #1: Diastolic stress echo

- Based on the results of diastolic stress echo, what is the most likely cause of this patient's dyspnea?
  - A. Non-cardiac cause of dyspnea
  - B. Epicardial coronary artery disease
  - C. Exercise-induced diastolic dysfunction
  - D. Exercise-induced arrhythmias
  - E. None of the above

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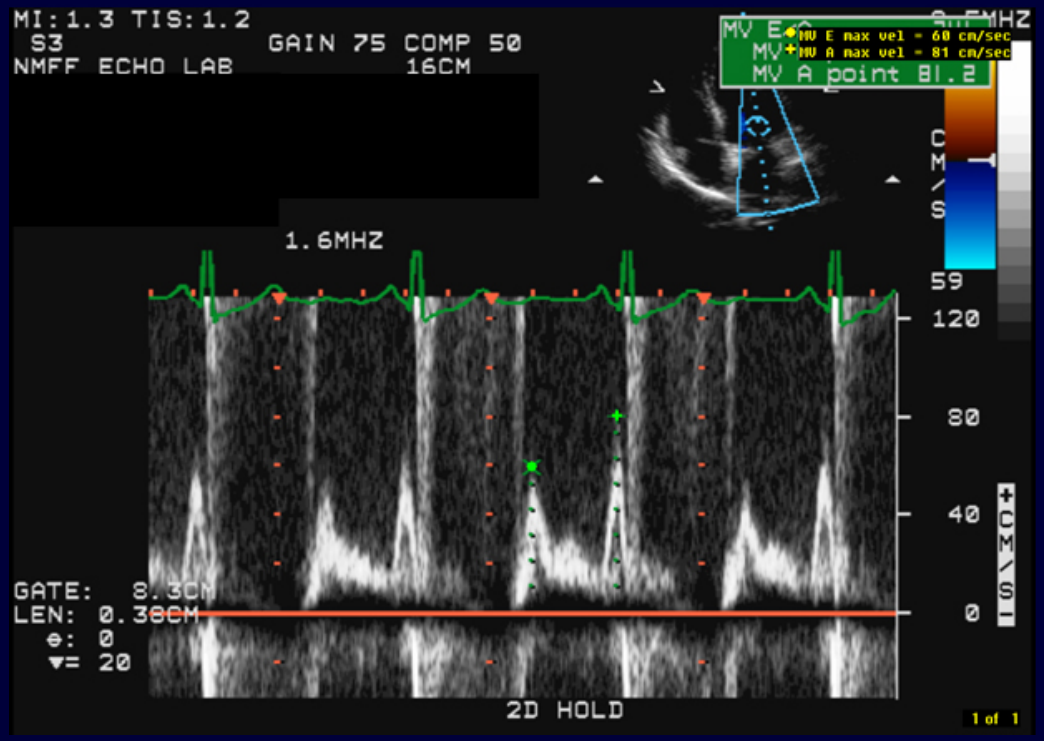
Diastolic stress echocardiography

- Useful test to determine whether or not patients have exercise-induced DD
- E/e' estimates LV filling pressures at rest and with exercise
- Based on published studies, an E/e' > 13 (using the septal E' velocity) can be used to diagnose exercise-induced DD
- Okay to wait until heart rate < 90 bpm

Burgess M, et al. JACC 2006; Grewal J, et al. JAMA 2009

Case #1: continued

- 6 months ago:
  - » Worsening dyspnea; echo: concentric LVH
  - » Mitral inflow:



Case #1: continued

- What is the best interpretation of the mitral inflow tracing?
  - A. Severe mitral regurgitation
  - B. Normal diastolic function for age
  - C. Mild diastolic dysfunction
  - D. Moderate or greater diastolic dysfunction
  - E. Hypertrophic cardiomyopathy

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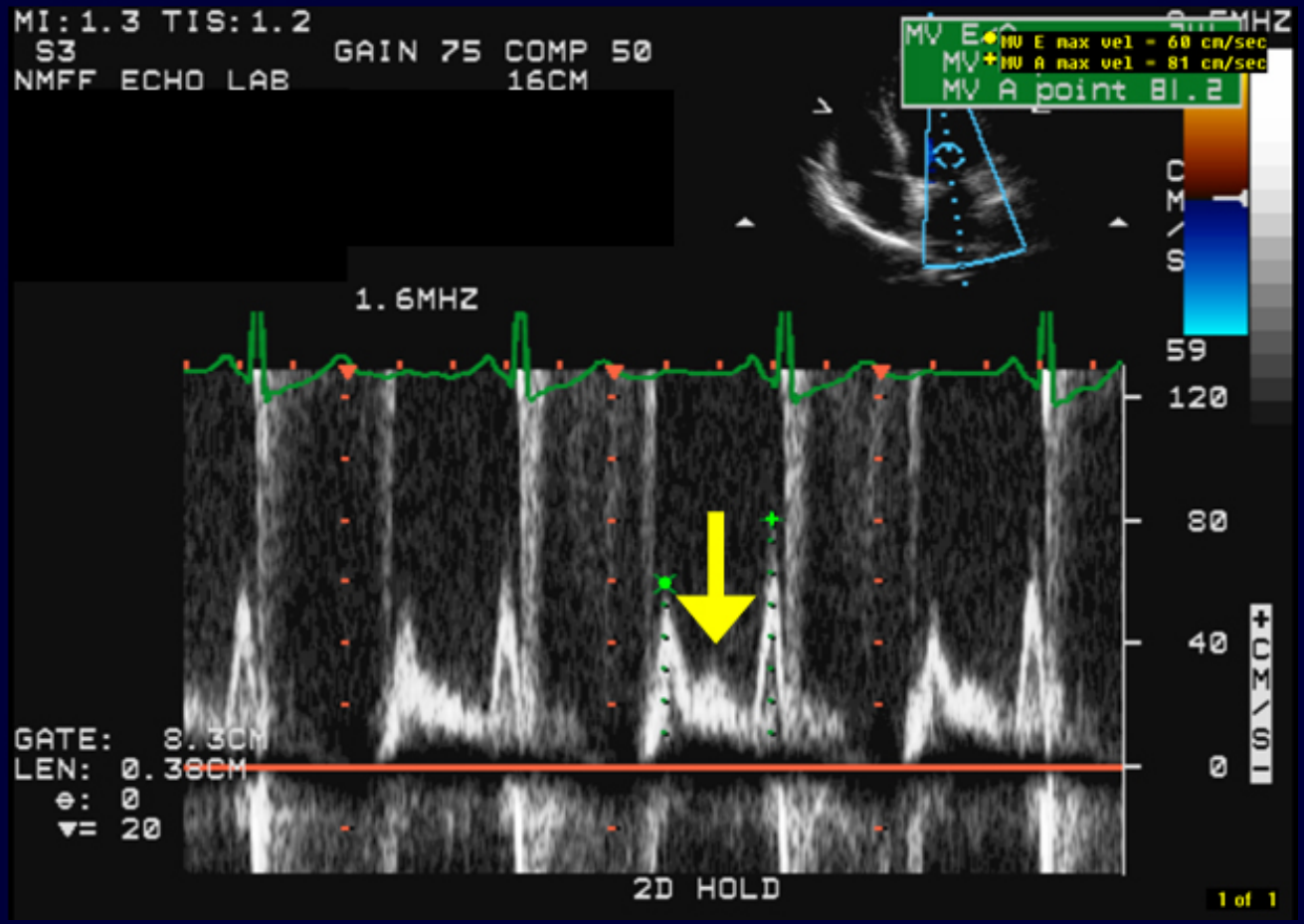
The mitral inflow “L” wave

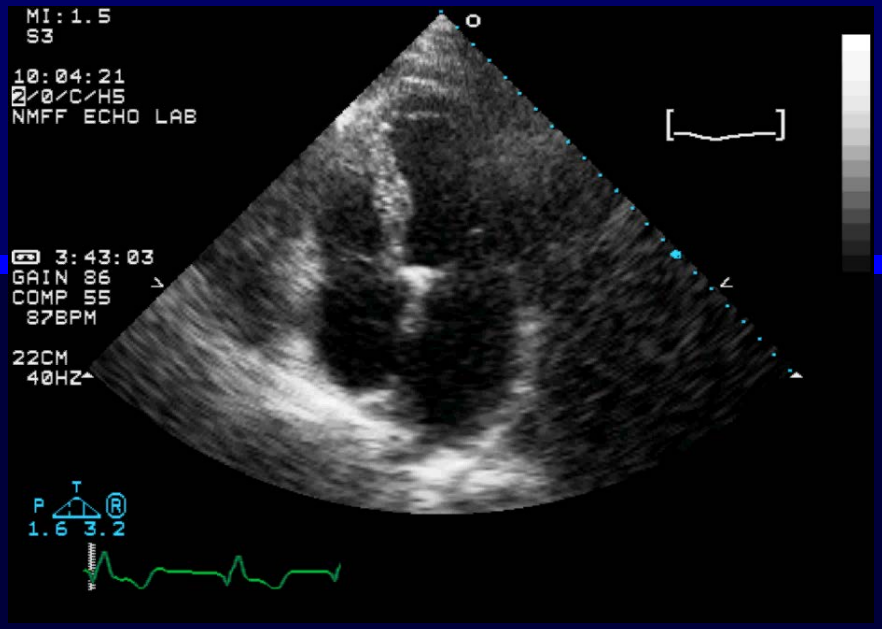


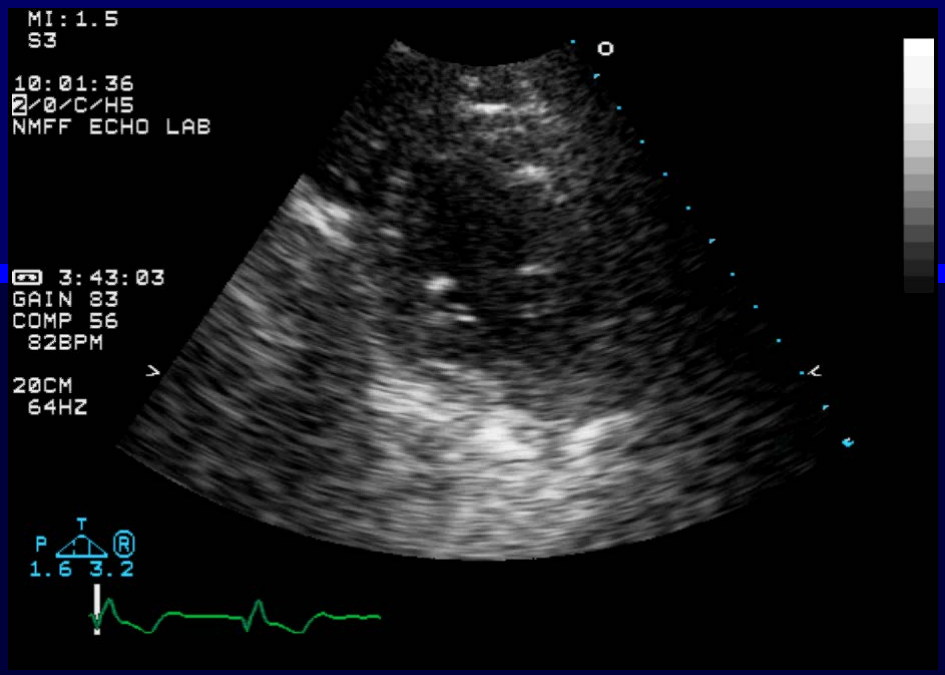
The mitral inflow “L” wave

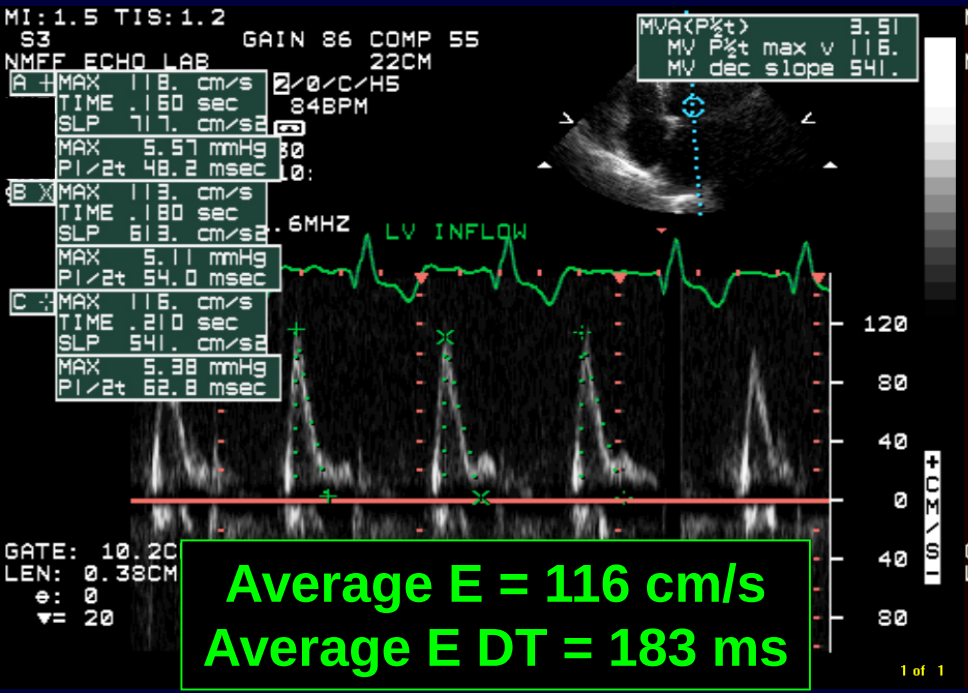
- L wave = transmitral flow during diastasis
  - » Need very impaired LV relaxation + elevated LA pressure to generate L wave
  - » Very slow LV relaxation causes pressure gradient b/w LA and LV to equilibrate early
  - » In diastasis, LV is still relaxing and LA pressure is high, so transmitral flow occurs, generating L wave

Case #1: continued

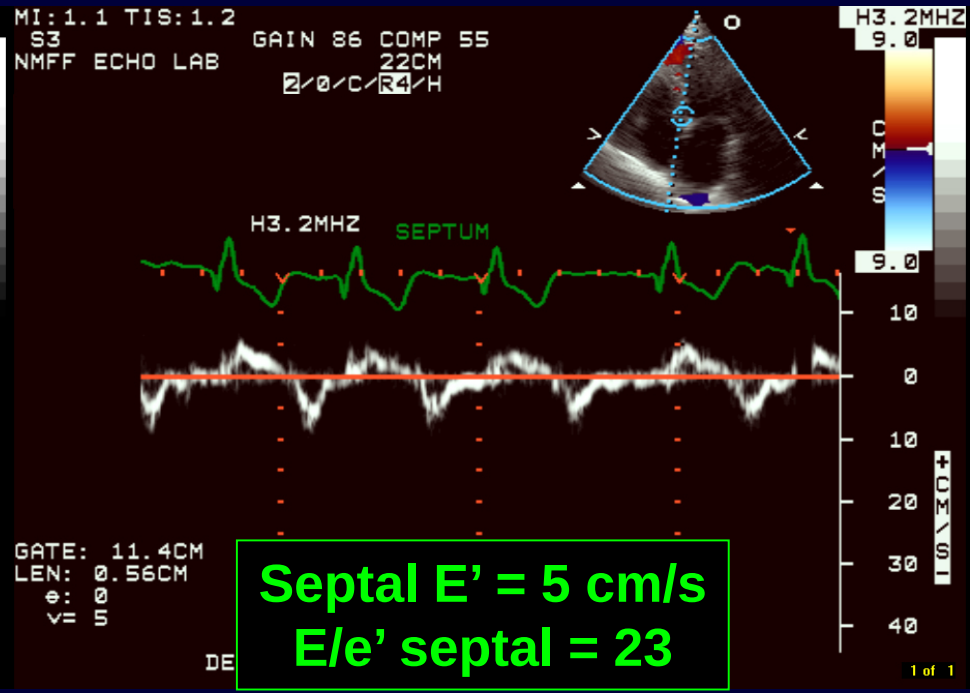
- In clinic, prior echo studies reviewed
- Current meds: diltiazem, warfarin, HCTZ
- Atrial fibrillation:
  - » Diagnosed 3 months ago, Rx'd with rate-control, anti-coagulation but pt still SOB
- Further work-up:
  - » BNP 120 pg/ml, mildly anemic; PFTs: normal
- Repeat echo performed







Average E = 116 cm/s
Average E DT = 183 ms



Septal E’ = 5 cm/s
E/e’ septal = 23

Diastology in setting of atrial fibrillation

- Echo evaluation of diastolic dysfunction in setting of AF is difficult
- Several parameters are available for estimation of LV filling pressures:
  - » E/E' (septal) > 11
  - » Pulmonary vein diastolic (D) wave deceleration time < 150 ms
  - » E wave deceleration time < 100 ms

Al-Omari MA, et al. Am J Cardiol 2008

E/e' 11-13-15 rule

- LV filling pressures are elevated when:
  - » E/e' septal > 11 in A-fib
  - » E/e' septal > 13 at peak exercise
  - » E/e' septal > 15 at rest

Case #1: Take home points

- Always evaluate quality of TDI tracings when evaluating diastolic function
- Diastolic stress echo: peak stress E/e' (septal) > 13 = exercise-induced DD
- Mitral inflow "L" wave = significant diastolic dysfunction, ↑LA pressure
- In atrial fibrillation, you can evaluate for ↑LV filling pressure (E/E' septal > 11)

Case #2:

63-year-old woman with long-standing rheumatoid arthritis presents with dyspnea, LE edema, fatigue

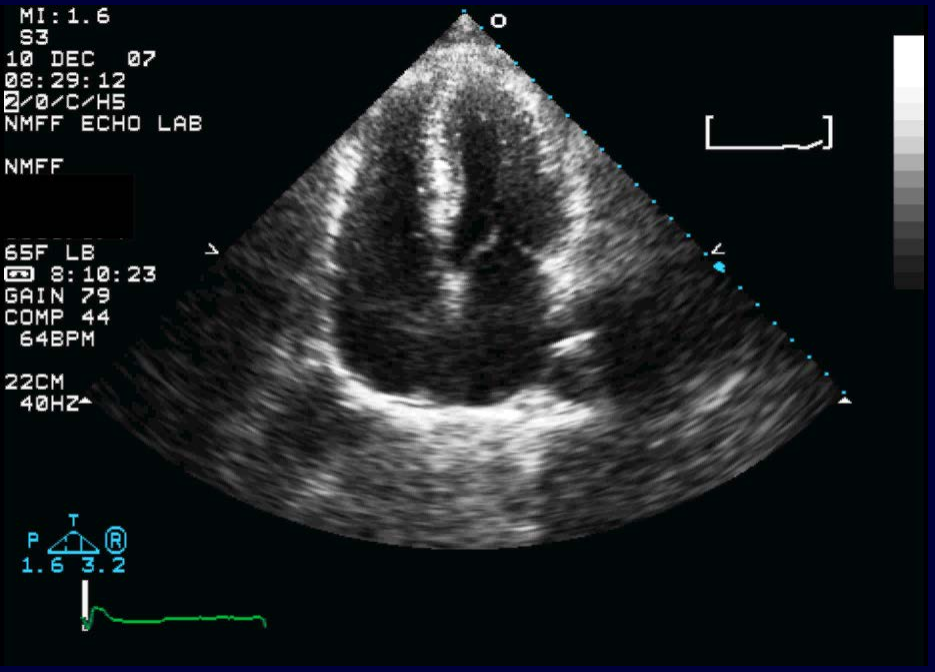
Meds: furosemide, hydroxychloroquine, NSAIDs PRN

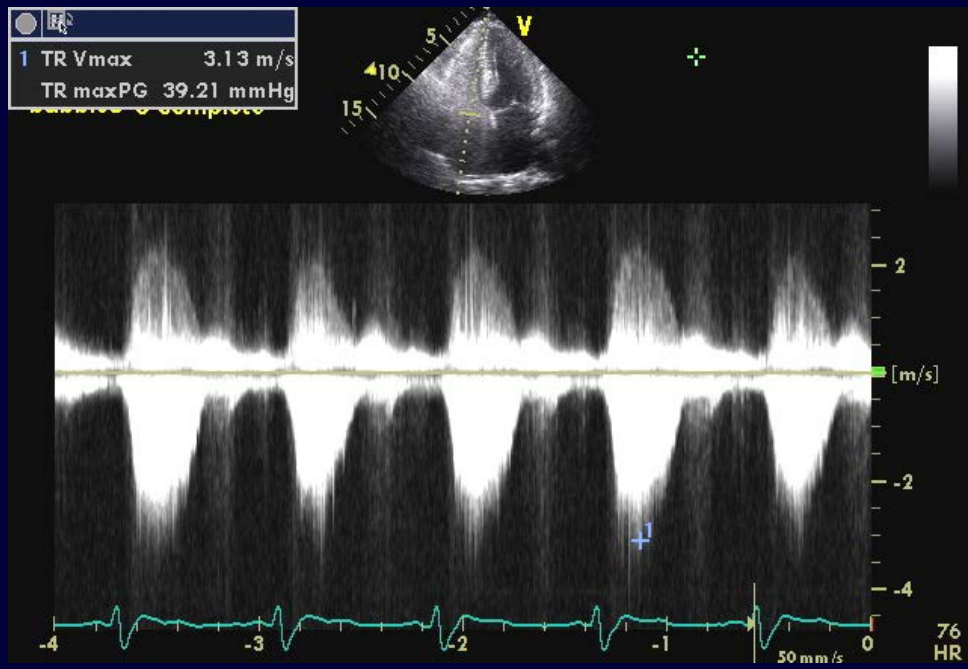
PEX: BP 108/62, HR 84, RR 12
JVP 12 cm, clear lungs, RRR nl S1 S2
3/6 holosystolic murmur LSB, 1+ LE edema

Case #2

Normal LVEF = 60%

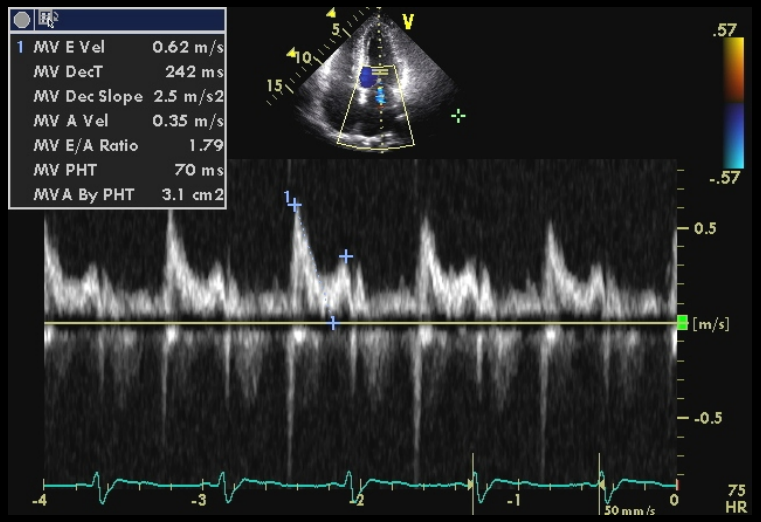
PASP = 55 mmHg



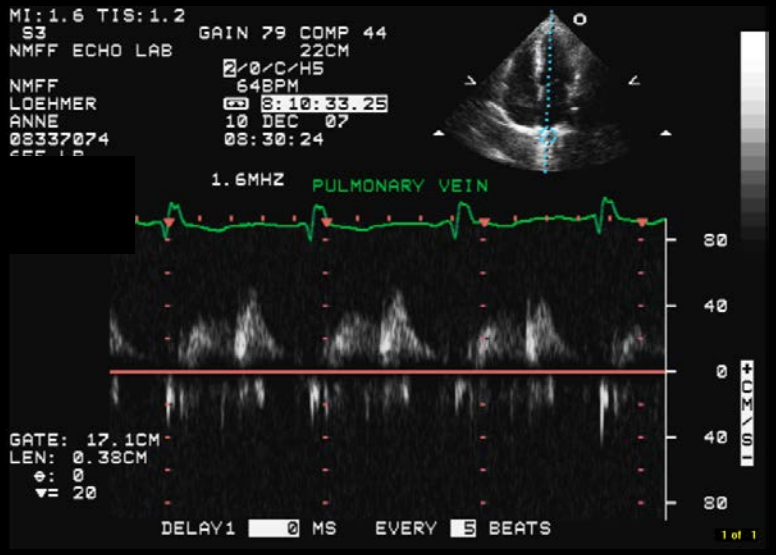


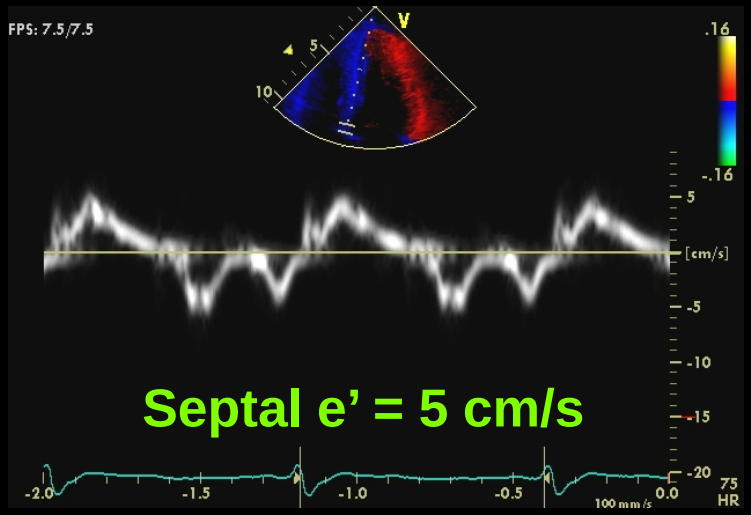
E/A ratio = 2:1

LV filling pressures: indeterminate

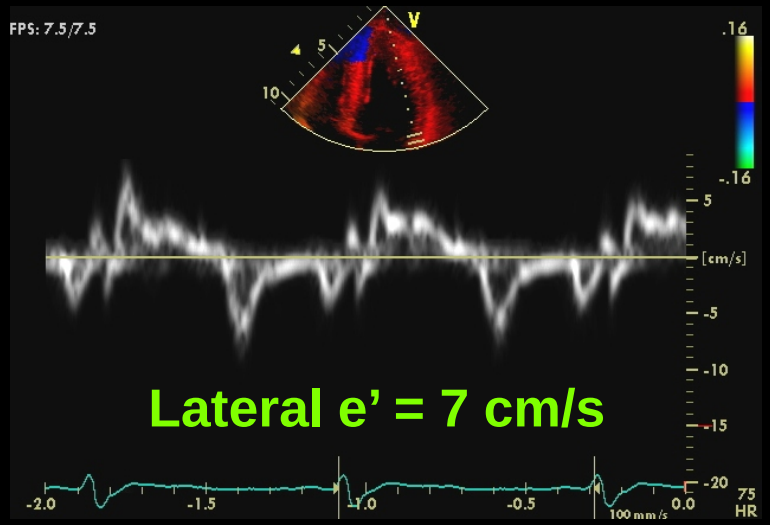


Pulmonary vein S/D ratio = 0.7





Septal e' = 5 cm/s



Lateral e' = 7 cm/s

What is the best Rx option?

A. Sildenafil
B. Bosentan
C. Treprostinil
D. Riociguat
E. None of the above

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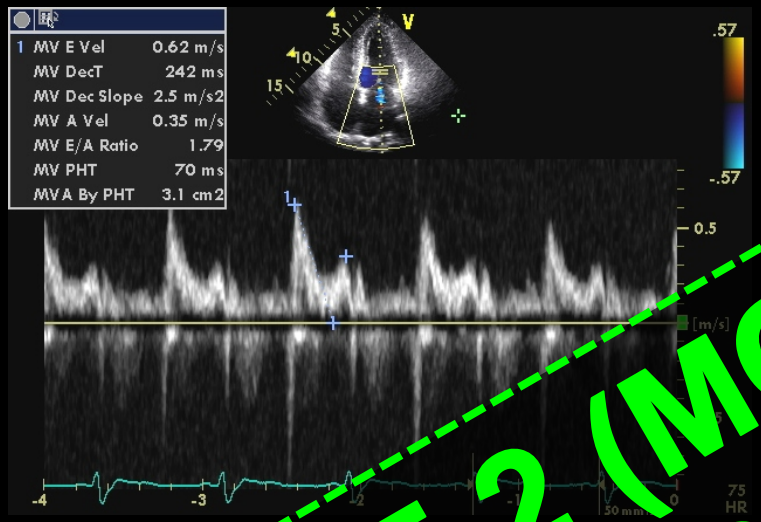
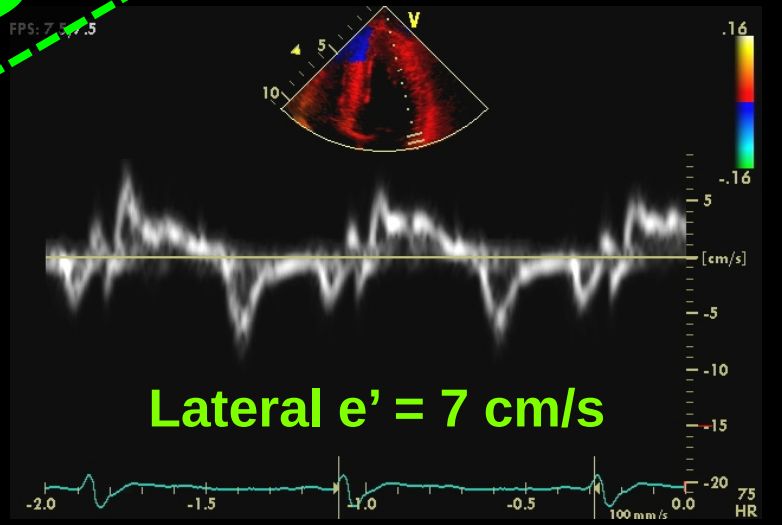


Pulmonary vein S/D ratio = 0.7

GRADE 2 (MODERATE) DIASTOLIC DYSFUNCTION

Septal e' = 5 cm/s



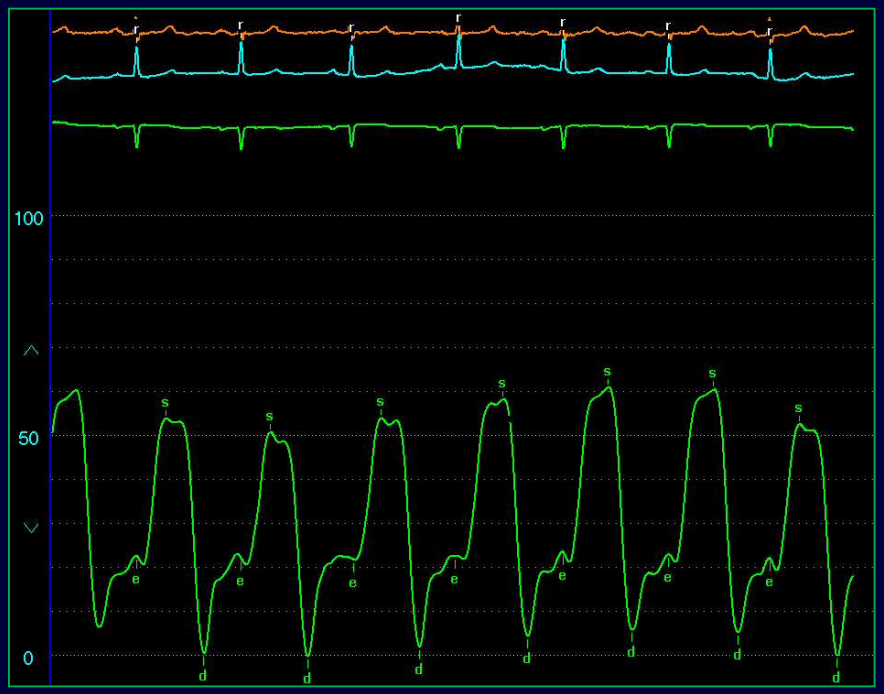
Lateral e' = 7 cm/s

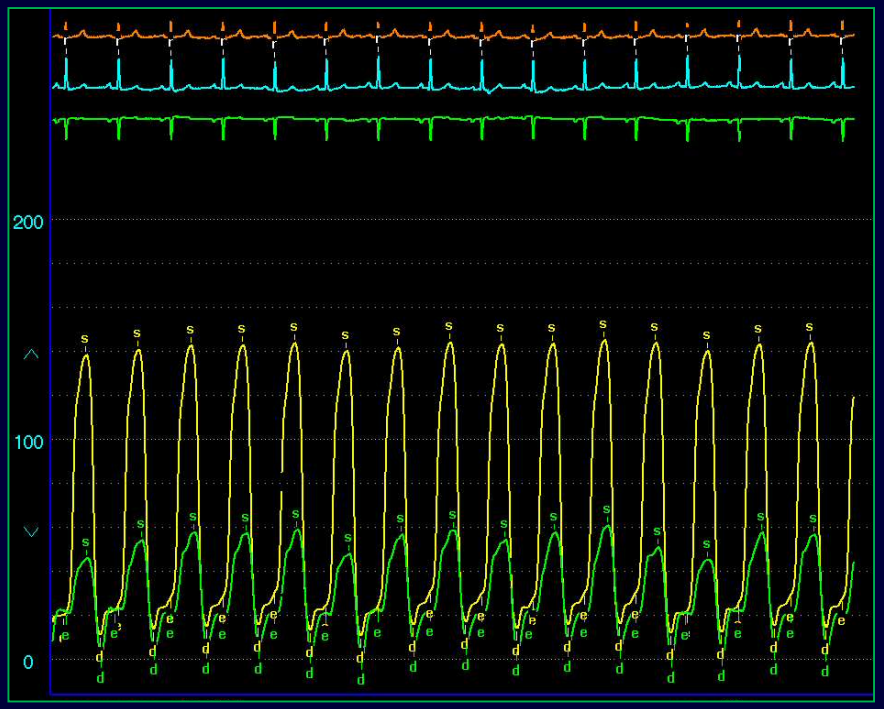
Invasive hemodynamics

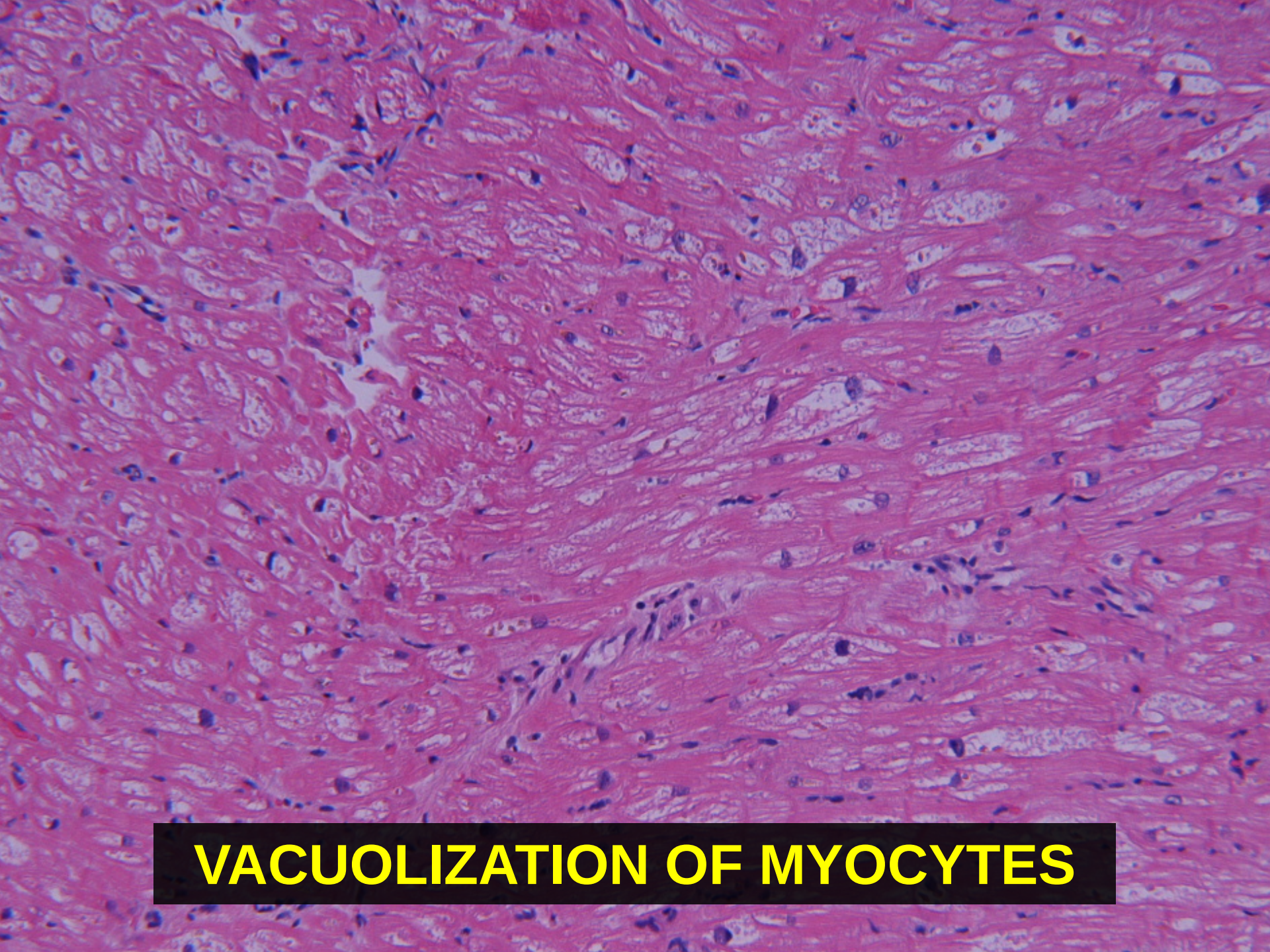
- RA 14 mmHg
- PA 65/24 mmHg (mean 38 mmHg)
- PCWP 22 mmHg
- Transpulmonary gradient = 16 mmHg
- CO 3 L/min
- PVR 5.3 Wood units

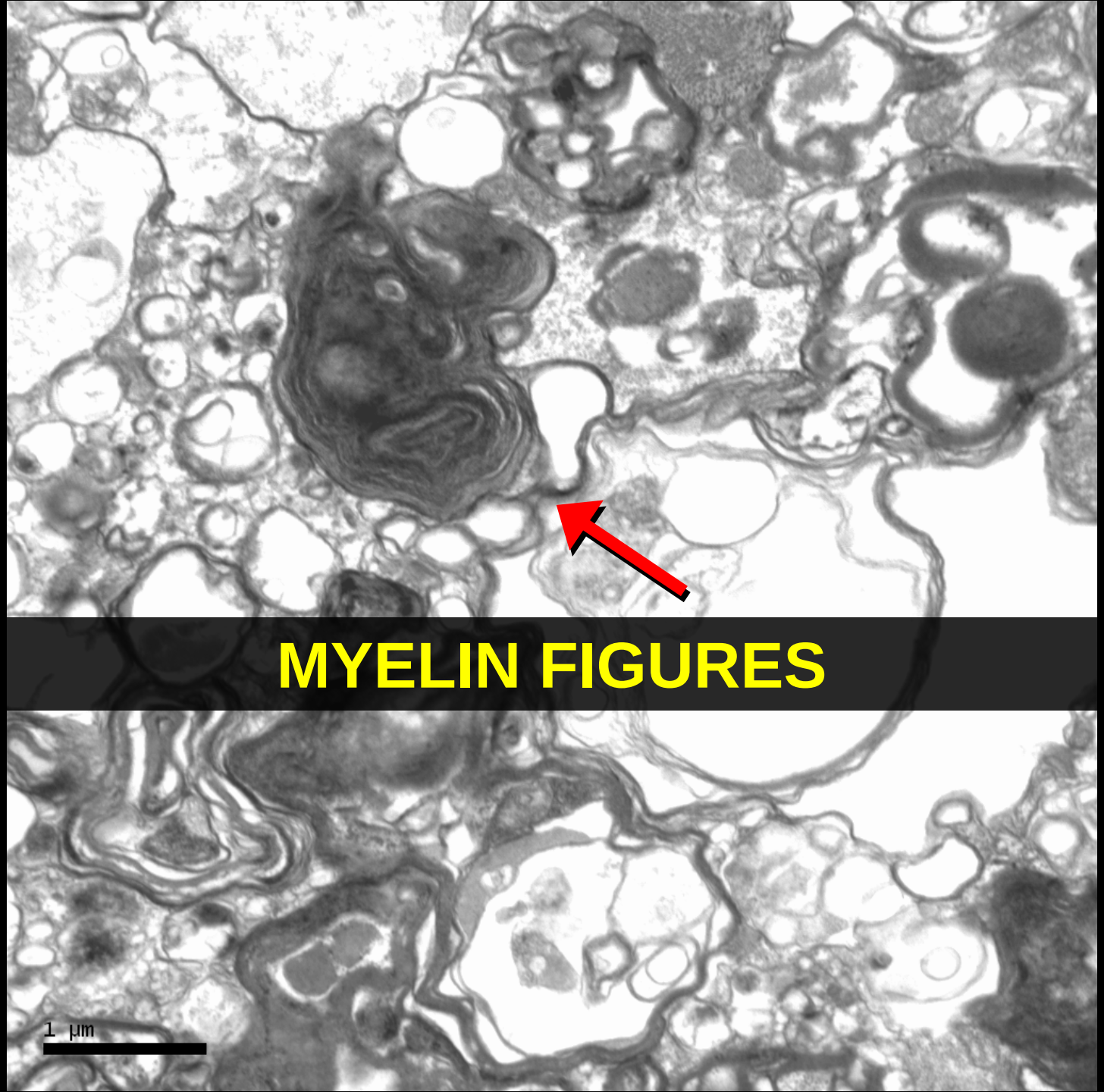
Case #2: Hemodynamics

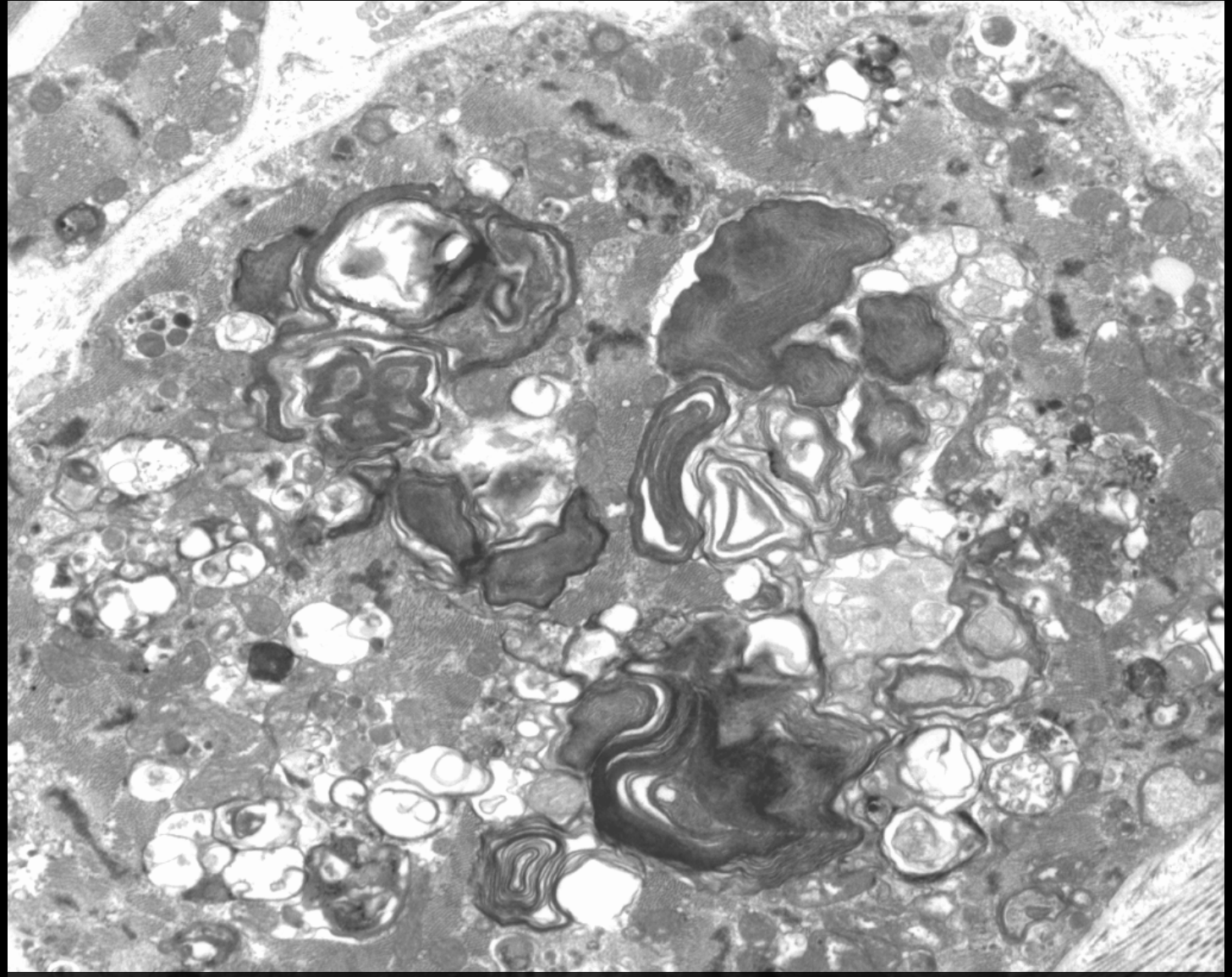
- Dip-and-plateau in RV pressure tracing
- Concordant RV and LV pressure tracings






VACUOLIZATION OF MYOCYTES

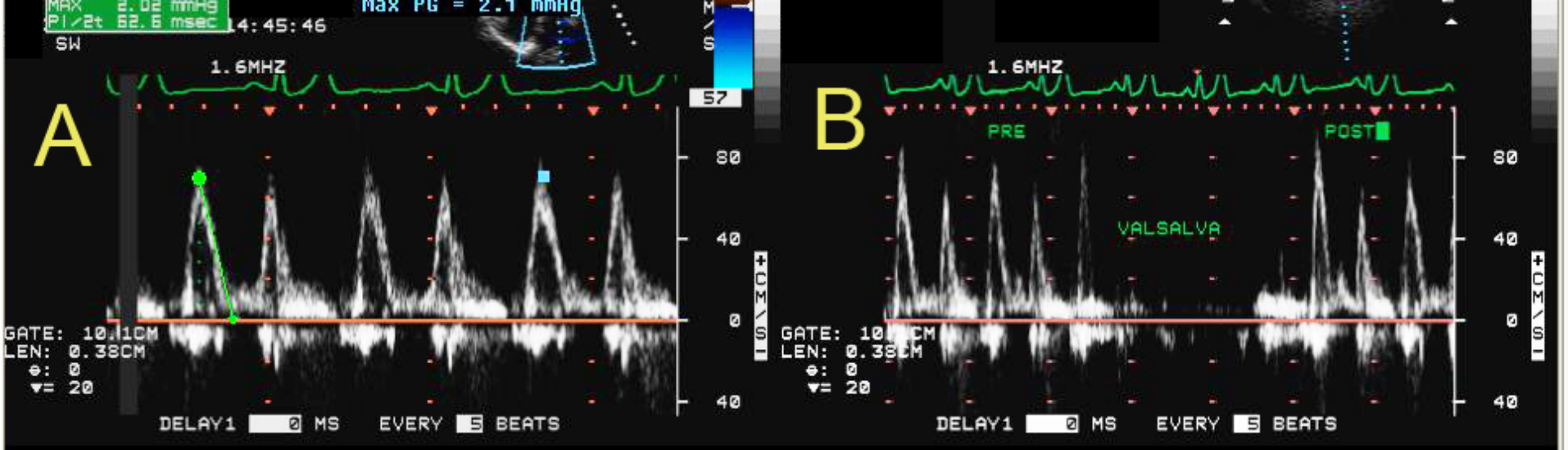

MYELIN FIGURES
1 µm



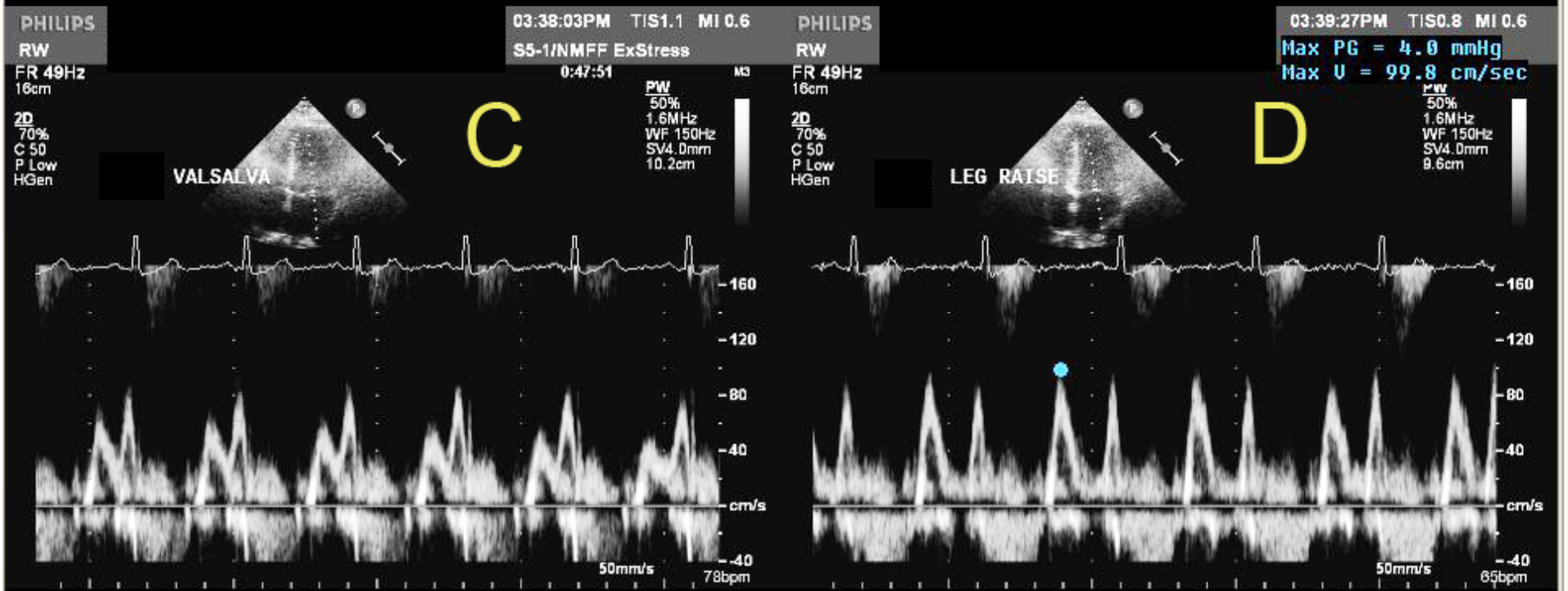
PLAQUENIL (HYDROXYCHLOROQUINE) CARDIOMYOPATHY

Case #2: Take home points

- e' better than e'/a' ratio for dx of DD
- Small thick LV, RV with enlarged LA, RA + signs of R-sided HF: think restrictive CM
- Hydroxychloroquine can cause a restrictive cardiomyopathy



Case #3: 54-year-old woman with progressive dyspnea on exertion



Phases of Valsalva

- Phase I: BP increases transiently
  - » Increased intrathoracic pressure
- Phase II (strain phase): THE KEY PHASE
  - » Gradual decrease in preload of LV
- Phase III: BP decreases further (very brief)
  - » Release of intrathoracic pressure
- Phase IV: Recovery
  - » Preload in LV, aortic pressure, pulse pressure increase


thank you!