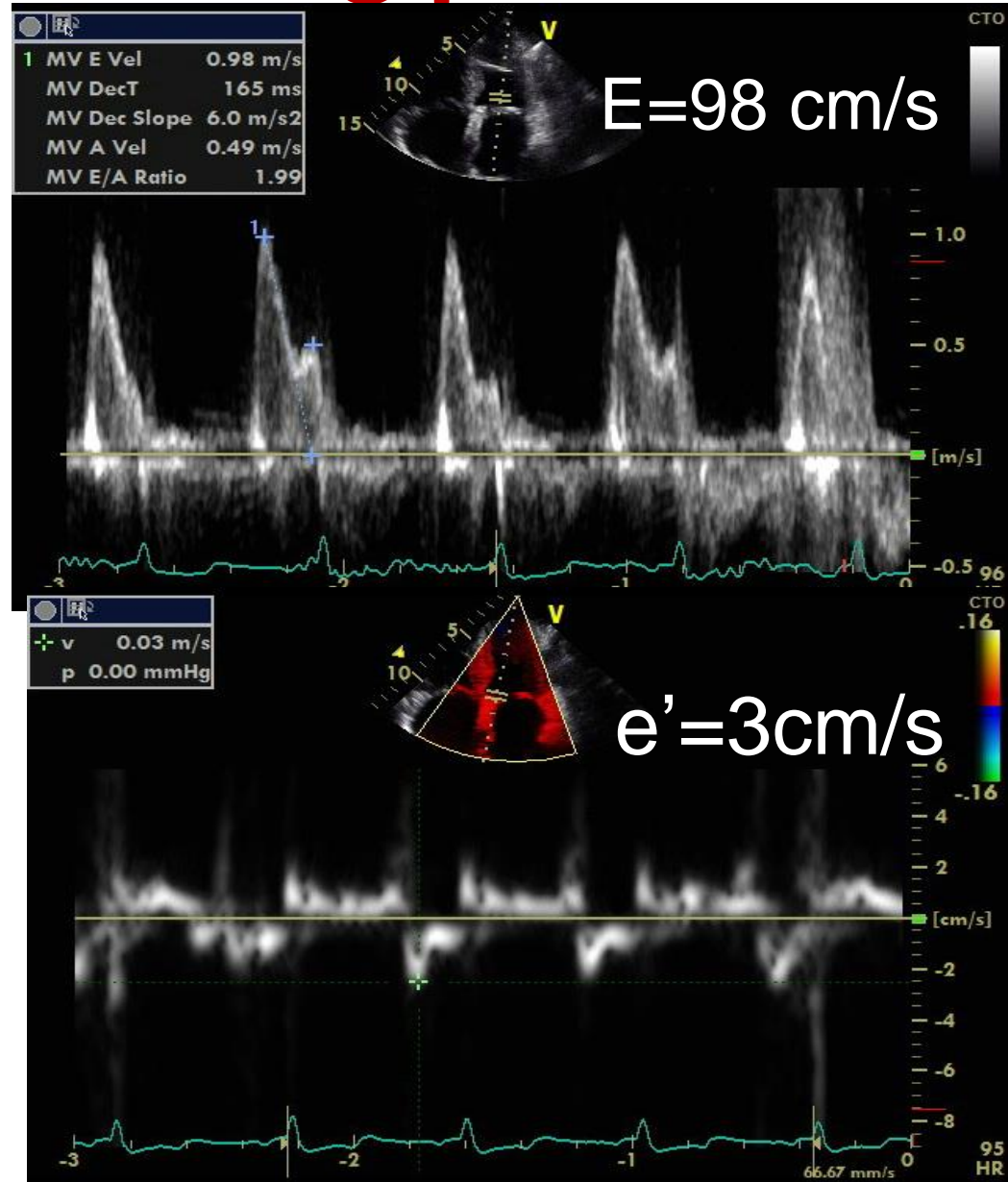


**The filling pressures in this patient are:**

1. high
2. low (abnl)
3. normal
4. cannot tell

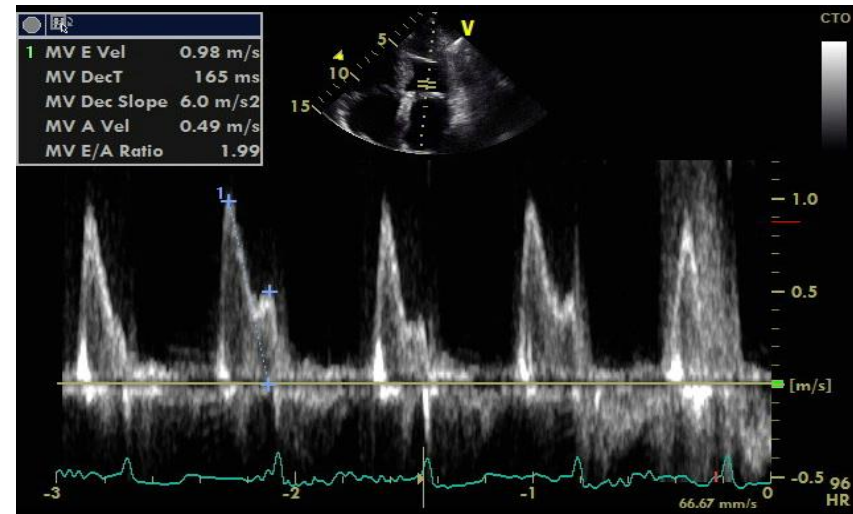
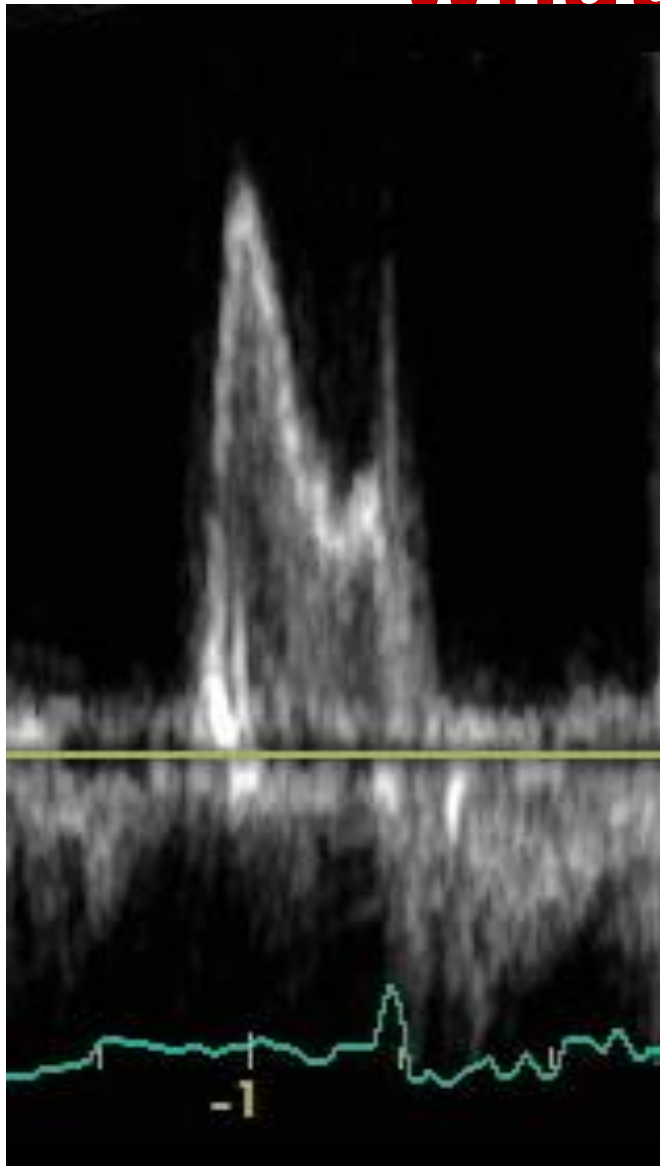
# What are the filling pressures ?

1. Normal
2. High
3. Low
4. Indeterminate



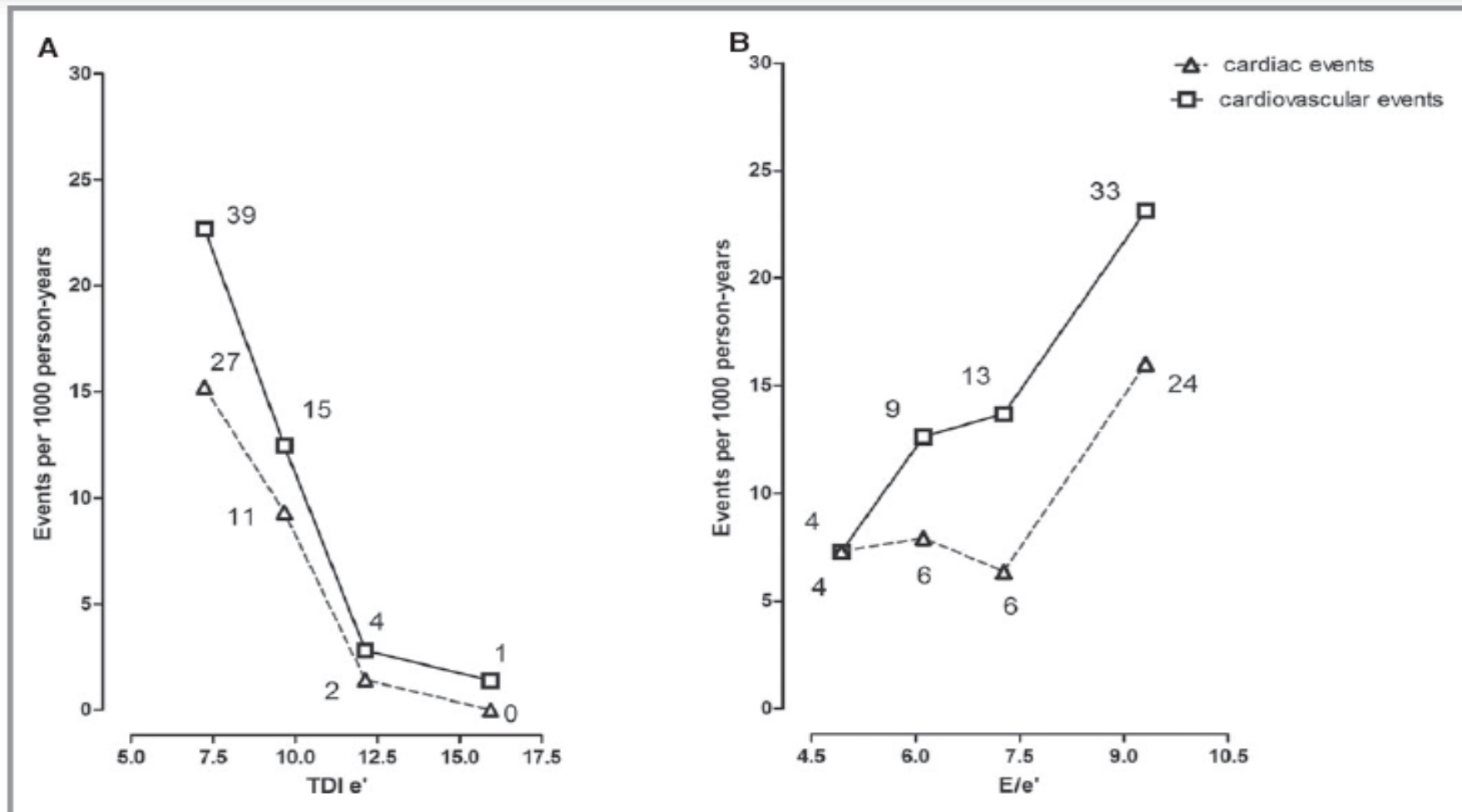
# Bonus question: what is the rhythm?

- 1.
- 2.
- 3.



# Prognostic Value of Left Ventricular Diastolic Dysfunction in a General Population

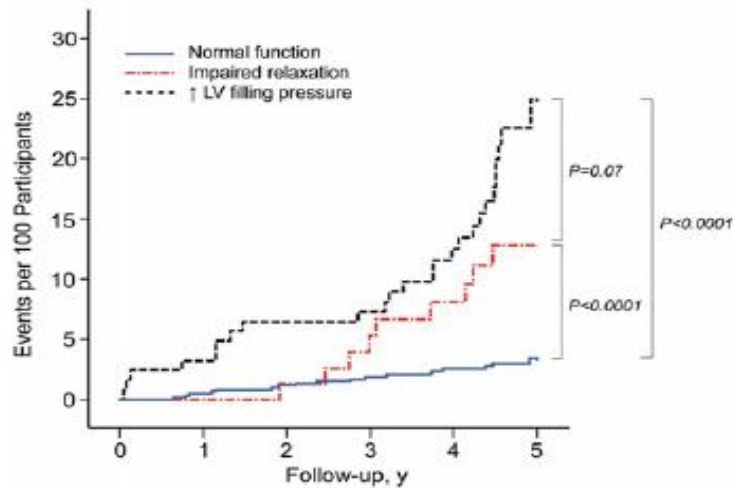
Tatiana Kuznetsova, MD, PhD; Lutgarde Thijs, MSc; Judita Knez, MD; Lieven Herbots, MD, PhD; Zhenyu Zhang, MD; Jan A. Staessen, MD, PhD



# Prognostic Value of Left Ventricular Diastolic Dysfunction in a General Population

Tatiana Kuznetsova, MD, PhD; Lutgarde Thijs, MSc; Judita Knez, MD; Lieven Herbots, MD, PhD; Zhenyu Zhang, MD; Jan A. Staessen, MD, PhD

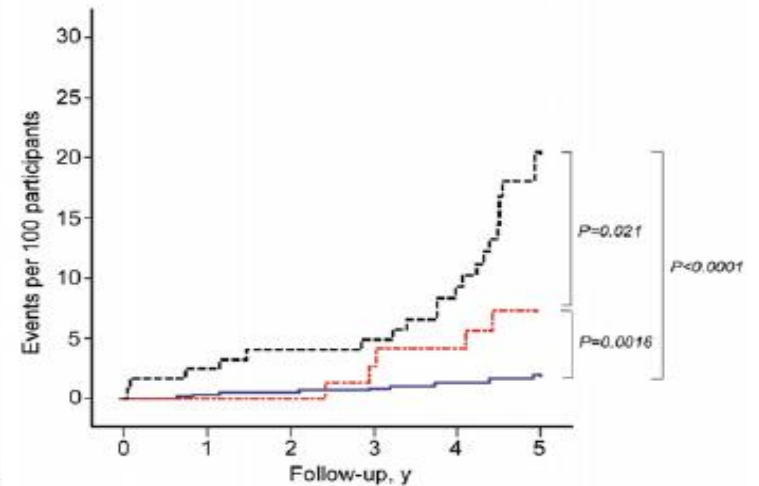
**A Cardiovascular Events**



N at risk by LVDD group

	0	1	2	3	4	5
Normal function	594	591	586	565	485	250
Impaired relaxation	76	76	75	89	61	22
↑ LV filling pressure	123	119	115	111	94	25

**B Cardiac Events**

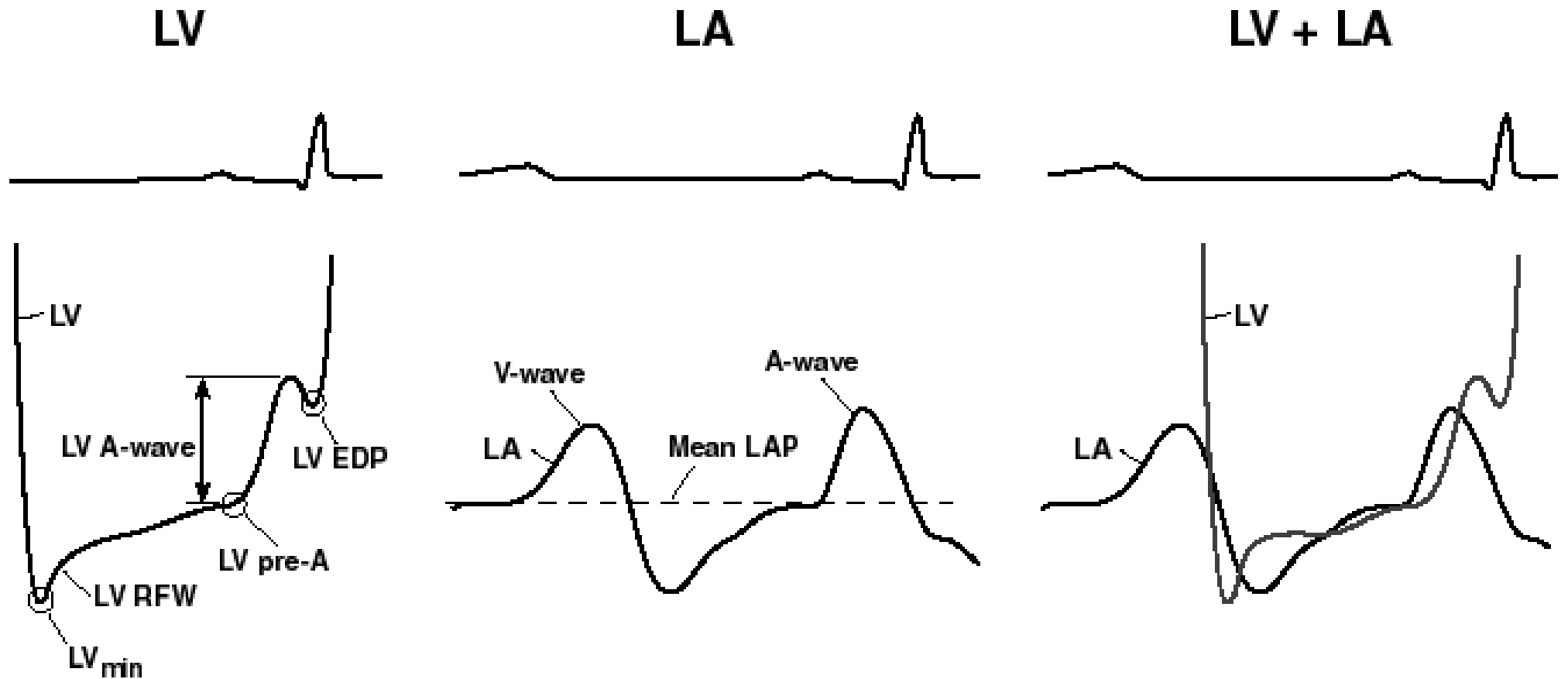


N at risk by LVDD group

	0	1	2	3	4	5
Normal function	594	591	589	570	490	251
Impaired relaxation	76	76	75	70	62	23
↑ LV filling pressure	123	120	117	113	97	26

# LV Filling Pressures

## The Different LA and LV Pressures



*Courtesy: Chris Appleton, Mayo Clinic*

# Diastolic Function Exam

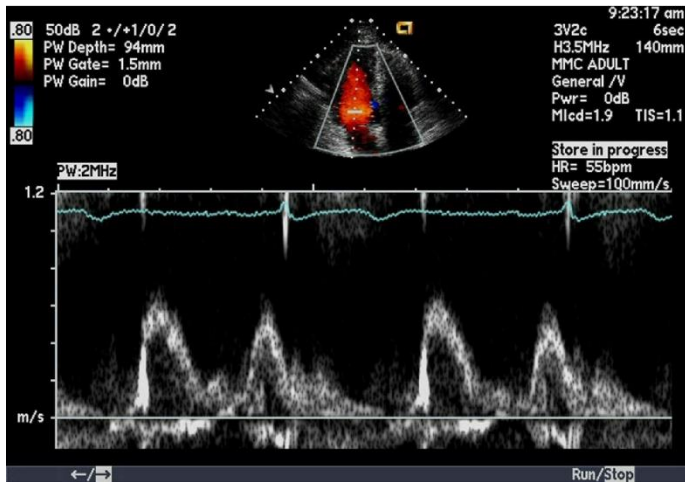
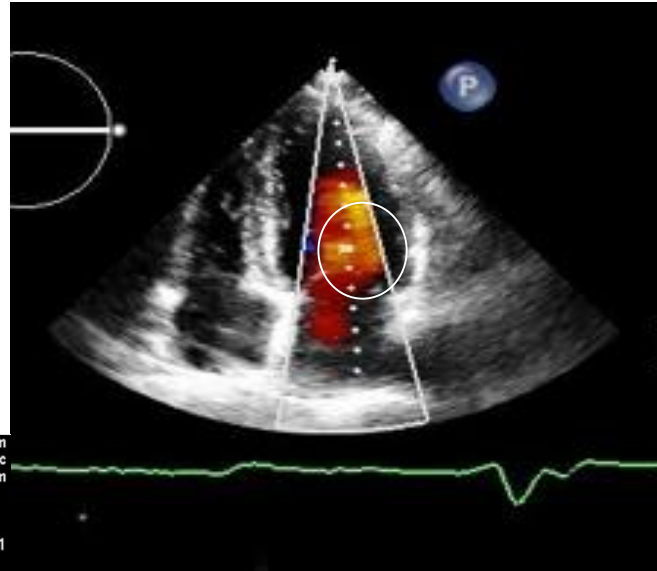
## MV Inflow PW Doppler

- **Apical 4 chamber view**
- **Color flow imaging for optimal alignment**
- **Sometimes SV should be slightly angulated to define laterally oriented flow**
- **SV size 1 – 3 mm placed at leaflet tips**
- **Optimize spectral gain and wall filters**
- **Sweep speed 25 to 50 mm/s. measure at 100 mm/s**

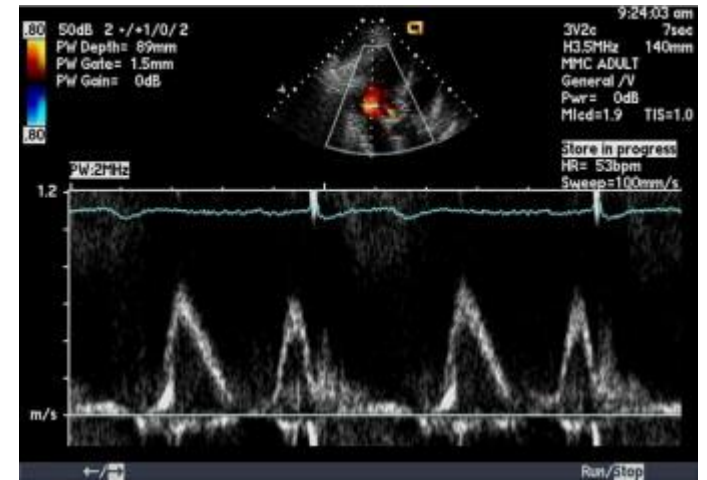


# Diastolic Function Exam

## MV SV Placement

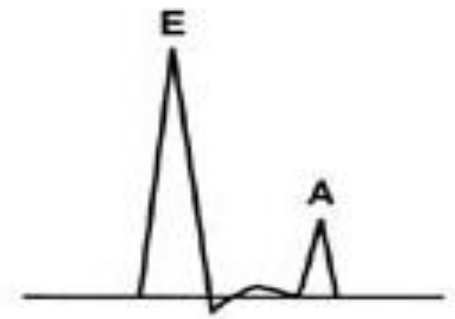
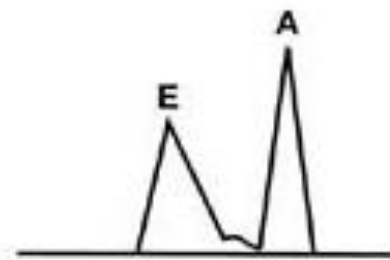
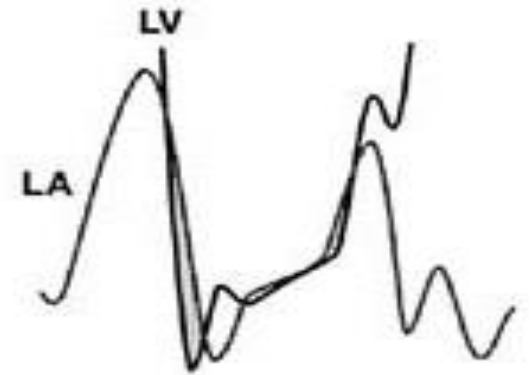
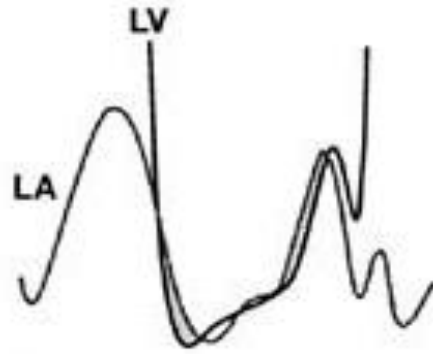
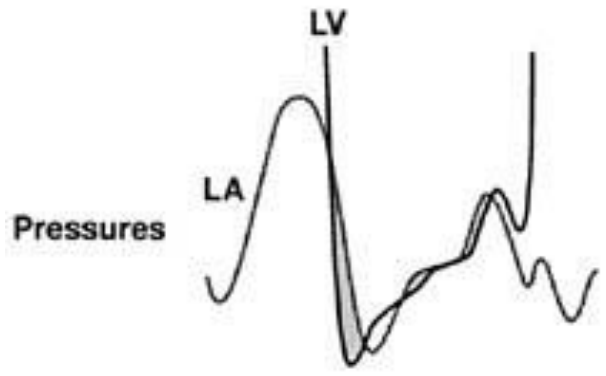


**Incorrect**



**Correct**





Normal

Impaired  
Relaxation

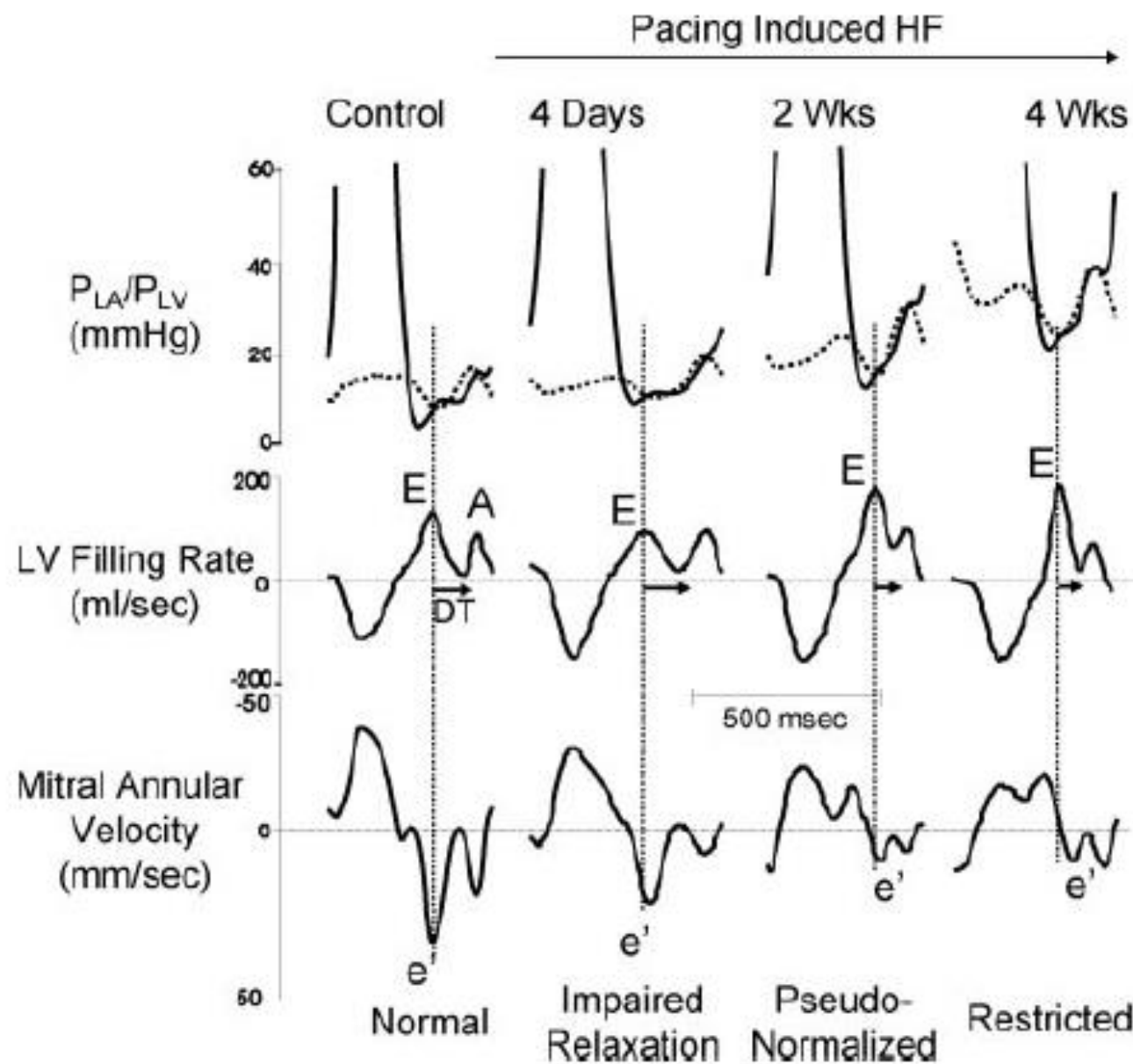
Relaxation  
abnormal

Mean LA pressure  
not elevated

Compliance  
abnormal

Prevalent in aging

Filling pressures  
elevated

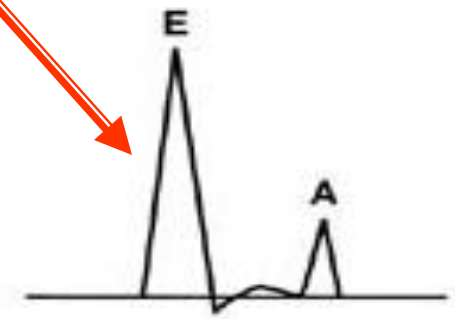
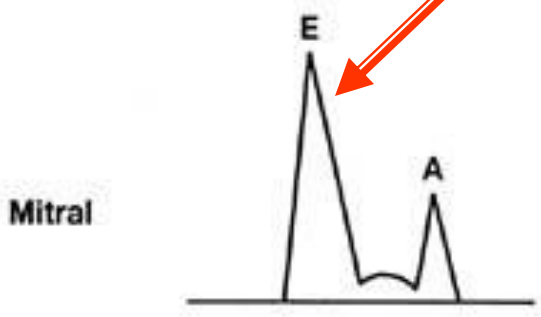
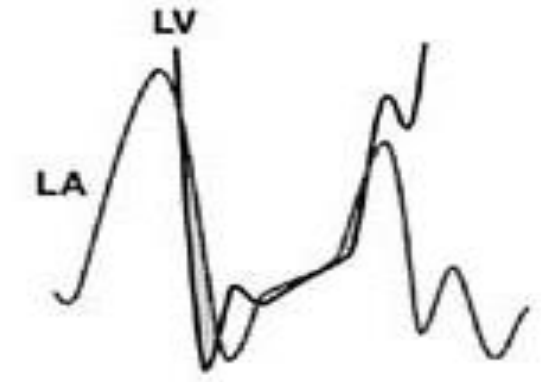
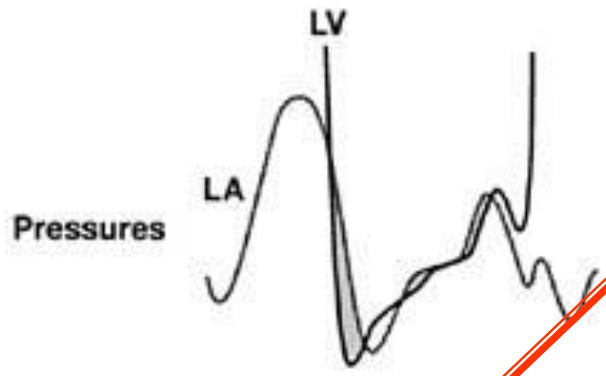


**Echocardiographic Evaluation of Diastolic Function Can Be Used to Guide Clinical Care**

William C. Little and Jae K. Oh  
*Circulation* 2009;120:802-809



**Transmitral  
gradient  
determines  
E wave**



**Normal**

**Relaxation  
abnormal**

**Compliance  
abnormal**

**Filling pressures  
elevated**

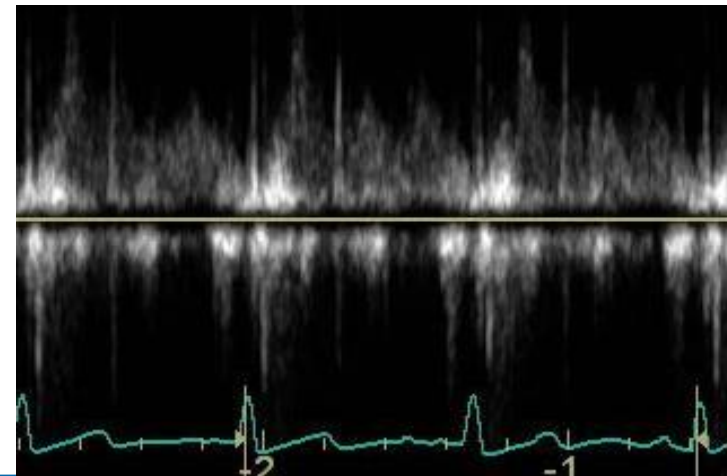
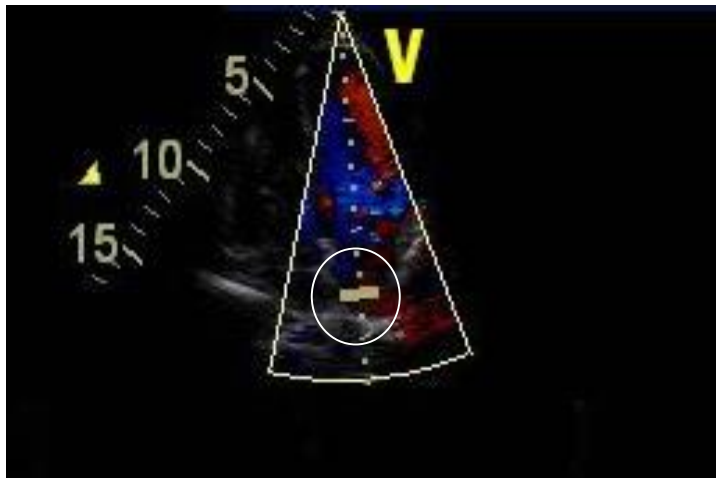
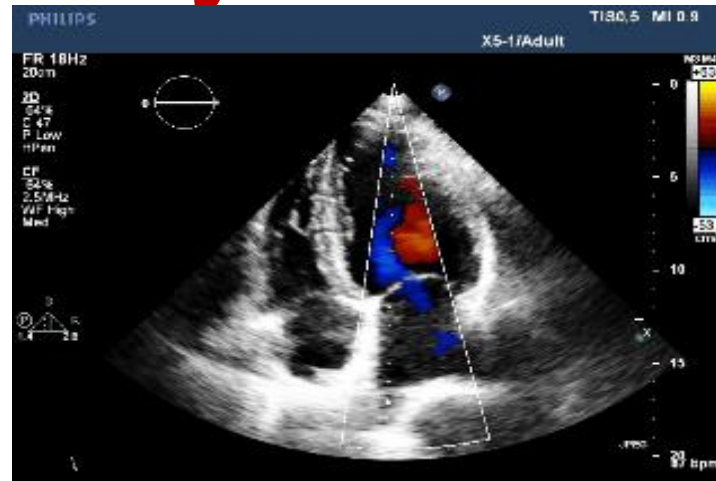
# Diastolic Function Exam

## PV PW Doppler

- **Apical 4 chamber view**
- **Color flow alignment of right upper pulmonary vein**
- **SV size 2 - 3 mm. placed  $> .5$  cm into vein**
- **Optimize wall filters until onset and cessation of atrial reversel displayed**
- **Sweep speed 50 to 100 mm/s**

# Diastolic Function Exam

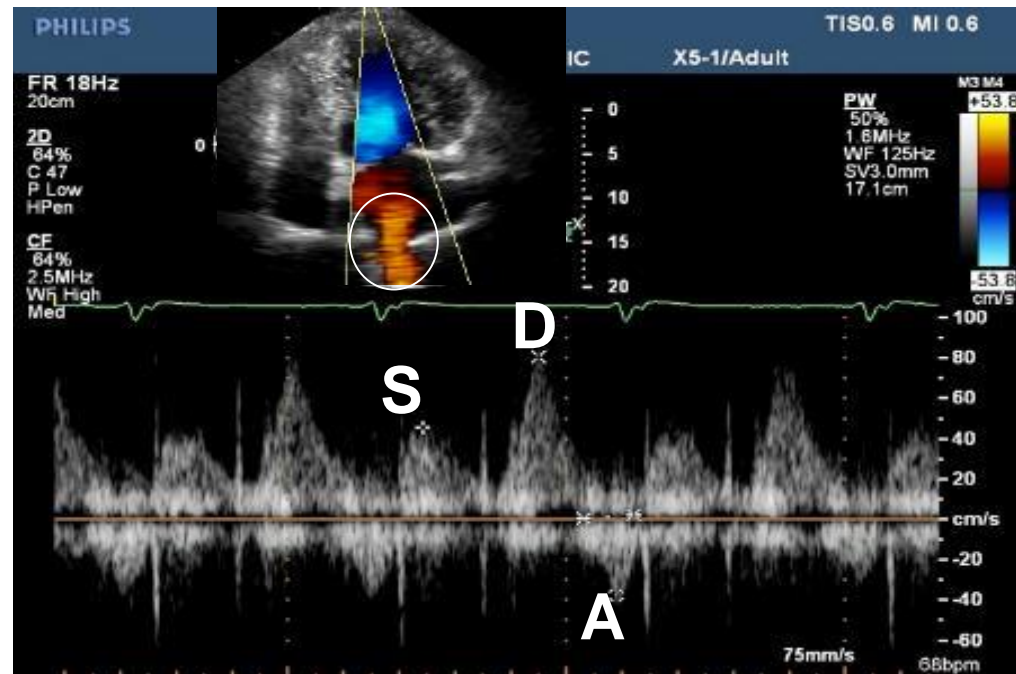
## Pulmonary Vein SV Placement

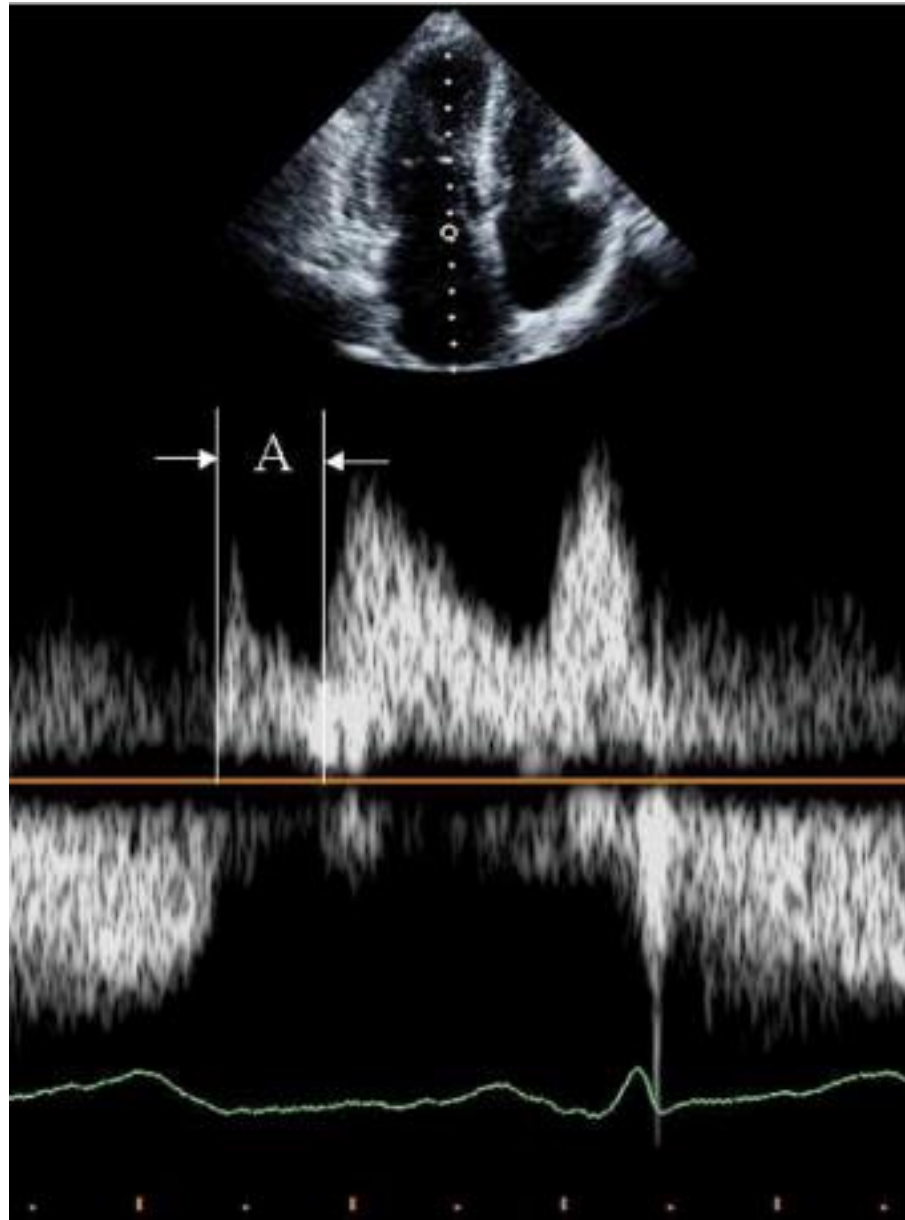


# Diastolic Function Exam

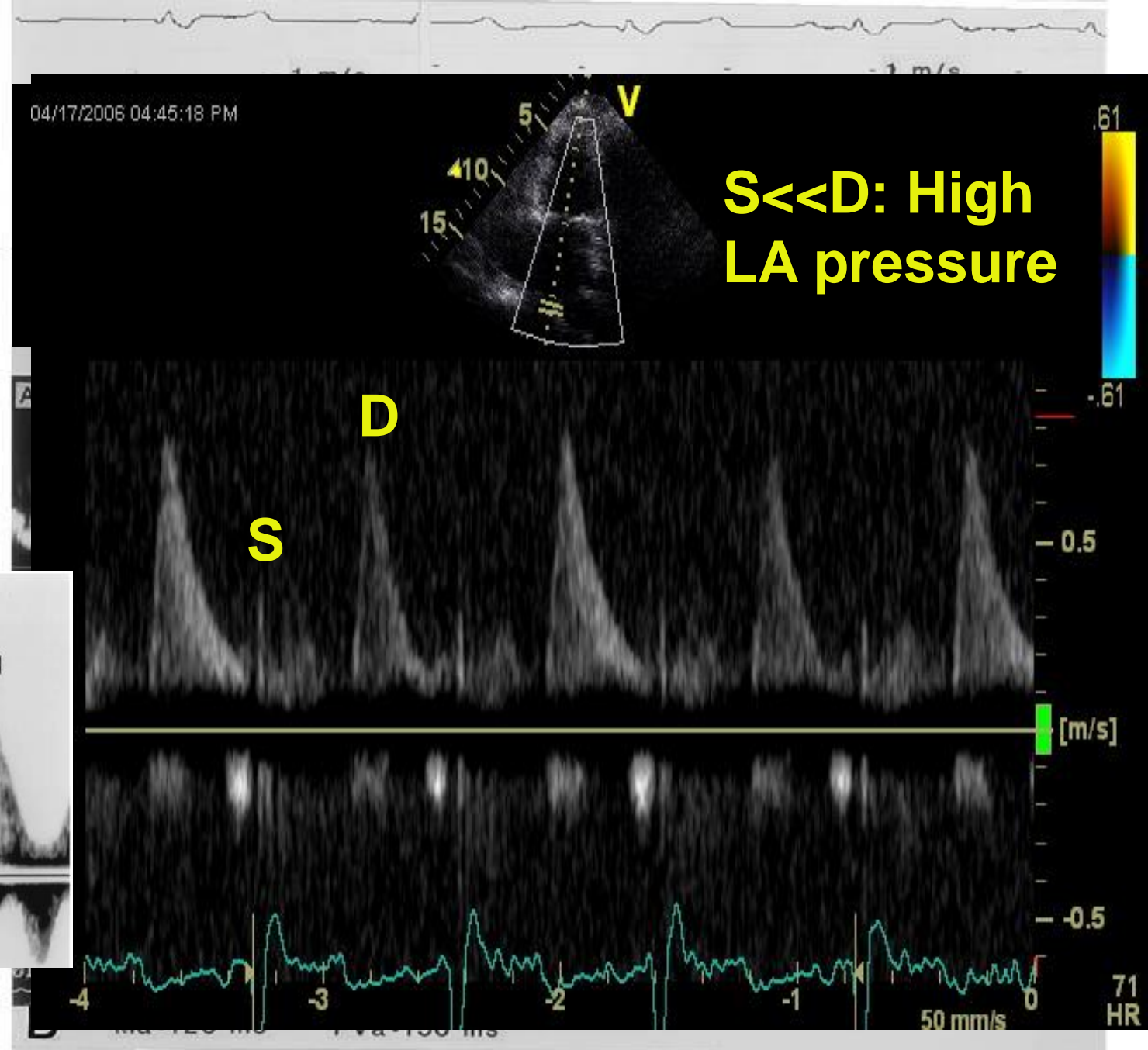
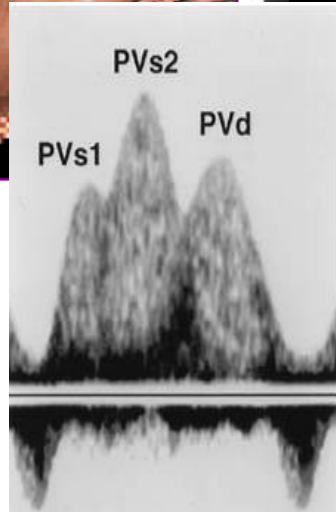
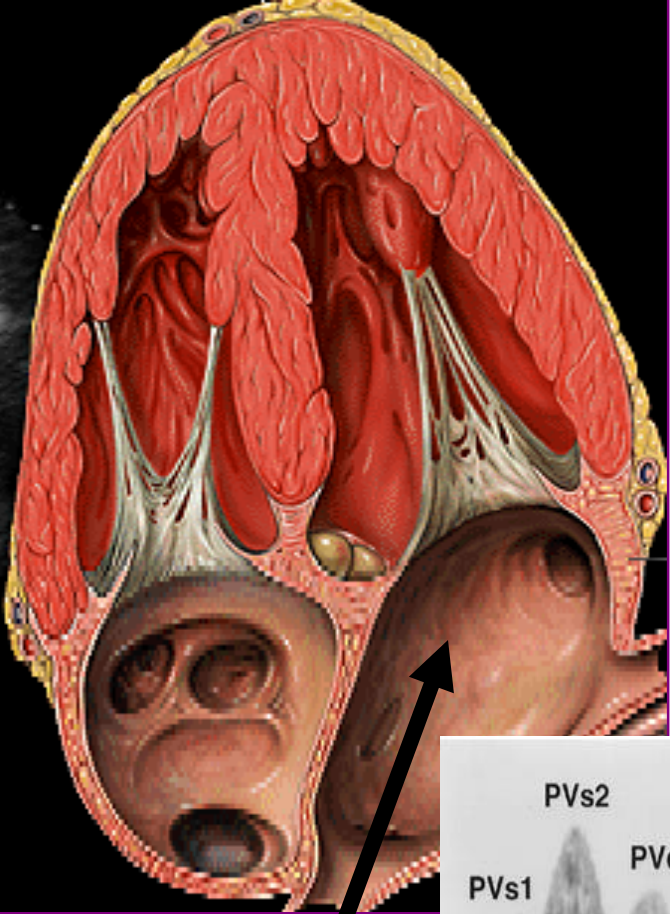
## Pulmonary Vein Measurements

☞ Pulm A Revs Dur	180 ms
☉ Pulm A Revs Vel	
Vel	37.7 cm/s
PG	1 mmHg
☒ Pulm Dias Vel	
Vel	80.5 cm/s
PG	3 mmHg
☎ Pulm Sys Vel	
Vel	45.5 cm/s
PG	1 mmHg
Pulm S/D	0.6

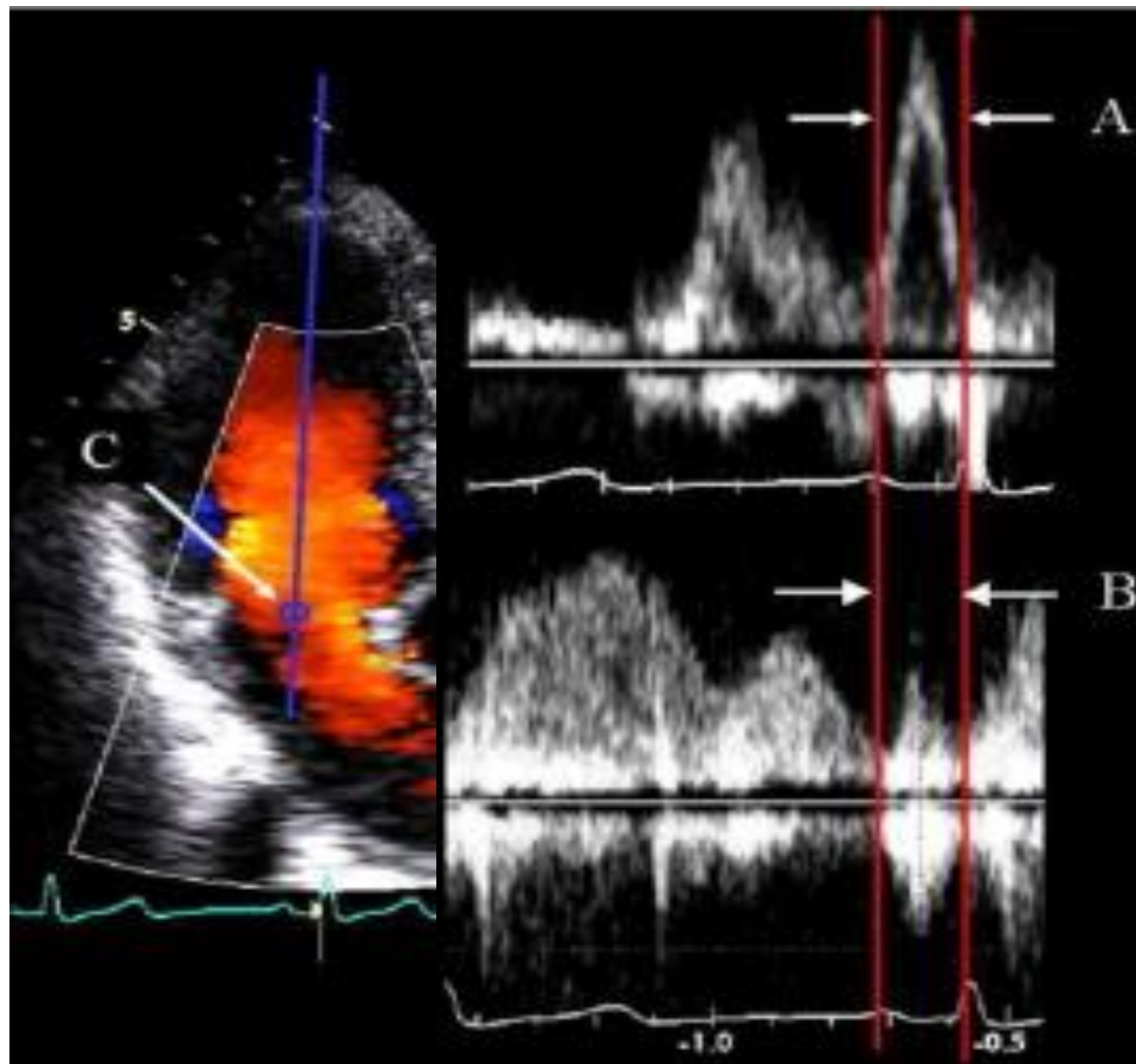








Rossvoll JACC 1993



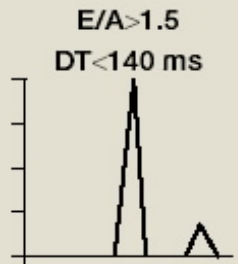
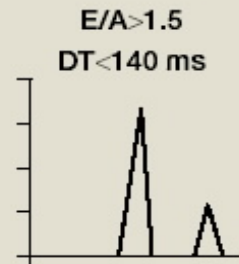
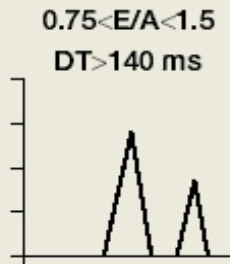
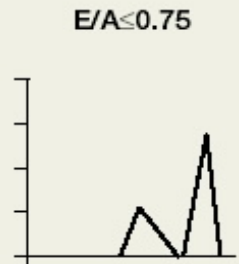
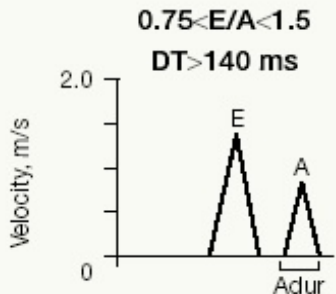
**Normal Diastolic Function**

**Mild Diastolic Dysfunction**  
Impaired Relaxation

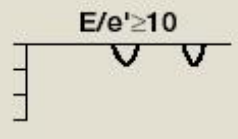
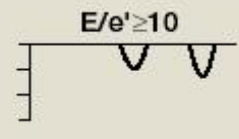
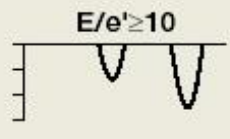
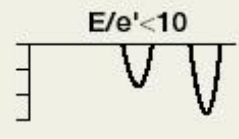
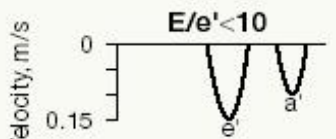
**Moderate Diastolic Dysfunction\***  
Pseudonormal

**Severe Diastolic Dysfunction**  
Reversible Restrictive → Fixed Restrictive

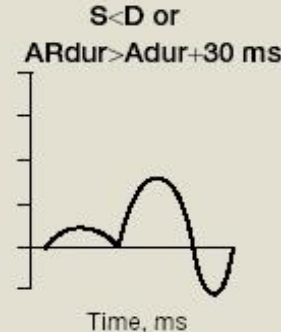
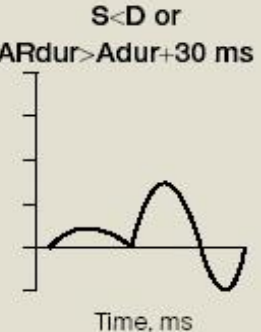
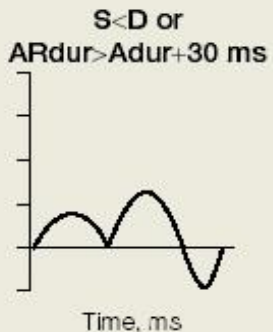
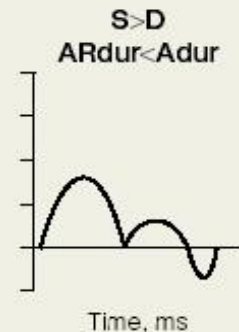
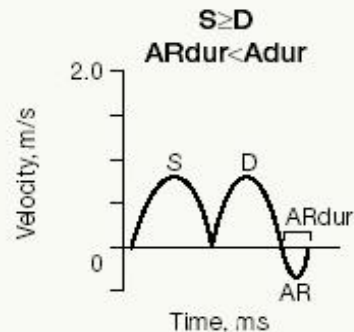
**Mitral Inflow**



**Doppler Tissue Imaging of Mitral Annular Motion**



**Pulmonary Venous Flow**



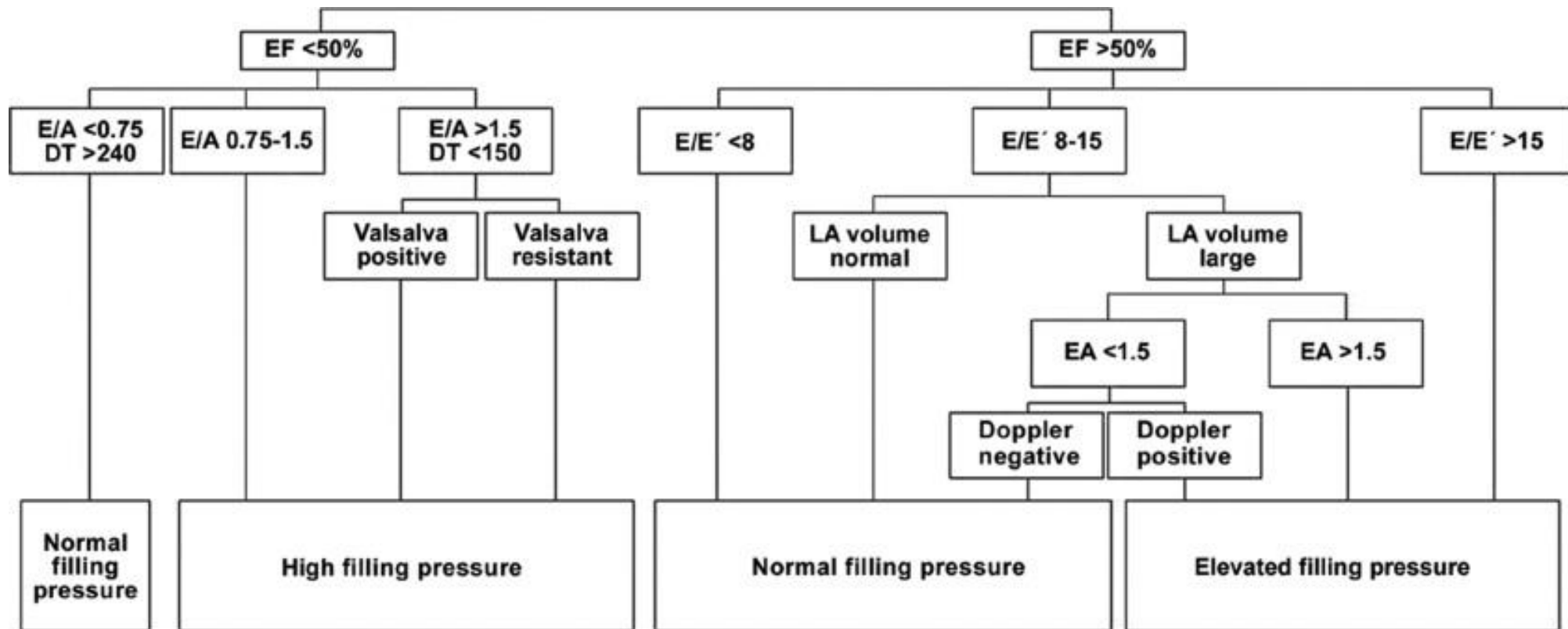
Left Ventricular Relaxation Normal  
Left Ventricular Compliance Normal  
Atrial Pressure Normal

Impaired  
Normal to ↓  
Normal

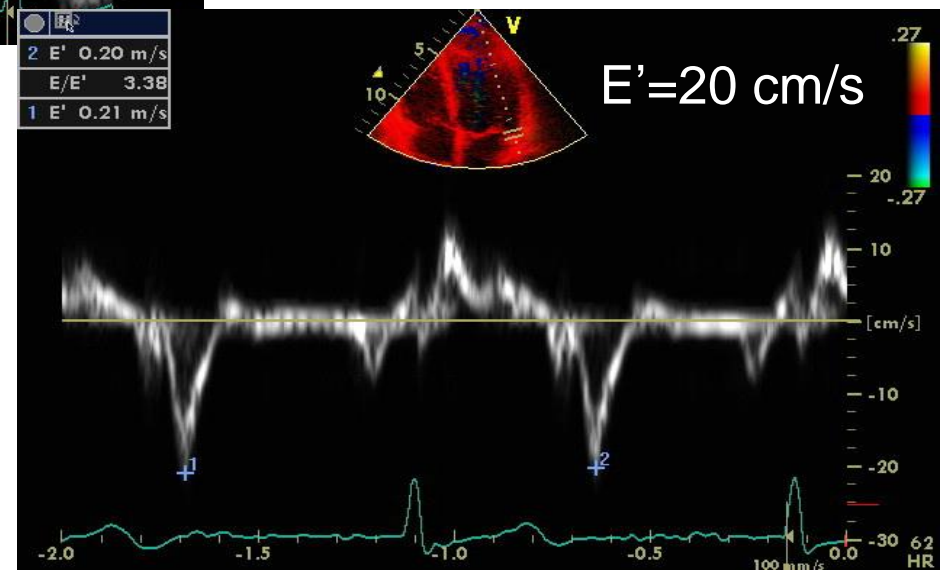
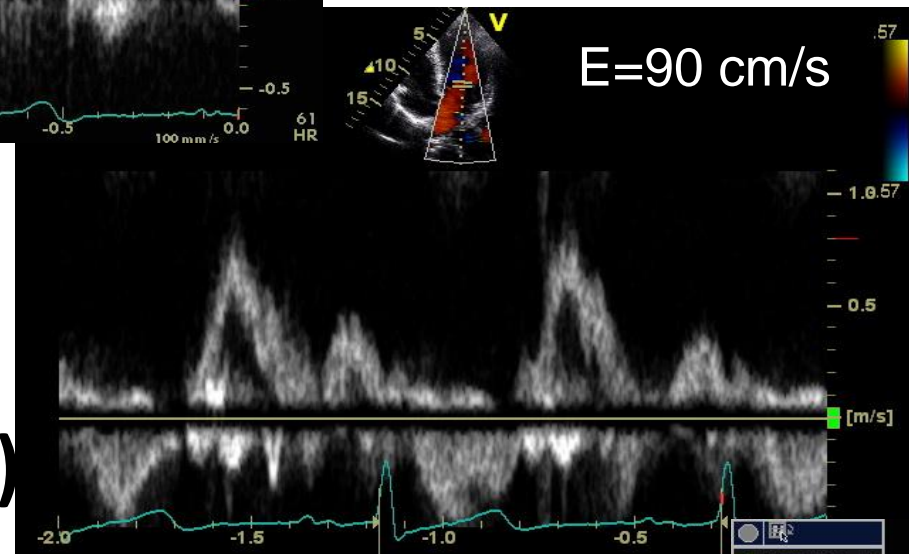
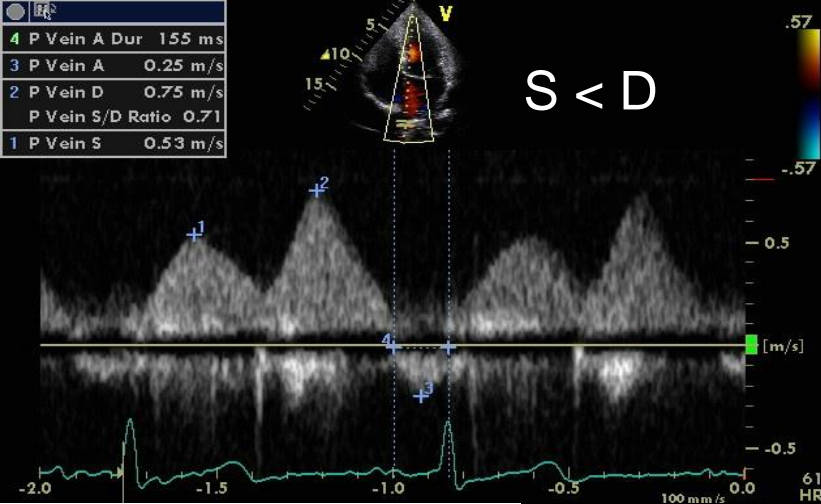
Impaired  
↓↓  
↑↑

Impaired  
↓↓↓  
↑↑↑

Impaired  
↓↓↓↓  
↑↑↑↑







**The filling pressures in this patient are:**

1. high
2. low (abnl)
3. normal
4. cannot tell

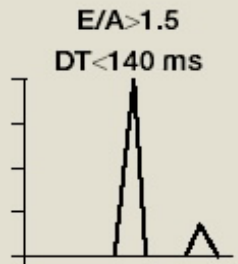
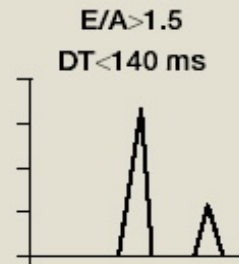
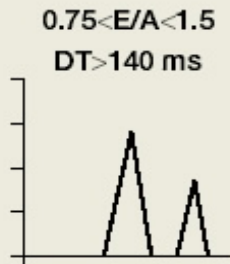
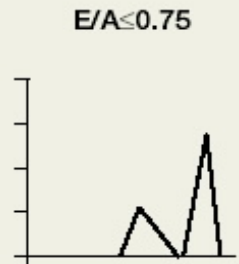
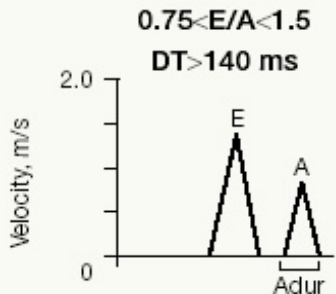
**Normal Diastolic Function**

**Mild Diastolic Dysfunction**  
Impaired Relaxation

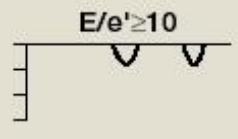
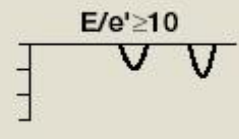
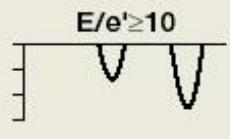
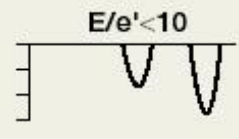
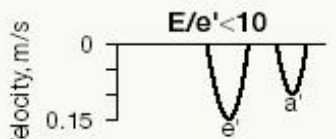
**Moderate Diastolic Dysfunction\***  
Pseudonormal

**Severe Diastolic Dysfunction**  
Reversible Restrictive → Fixed Restrictive

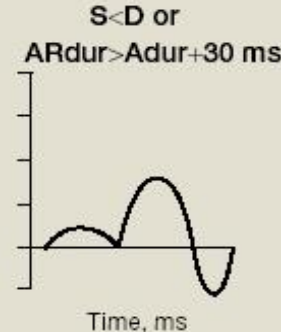
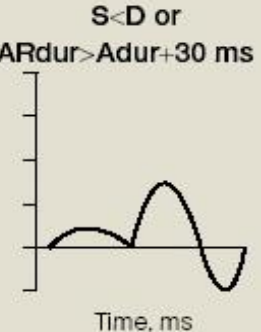
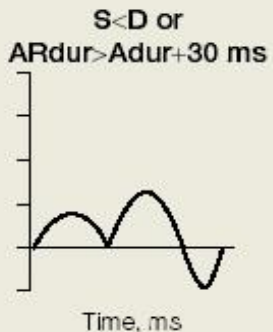
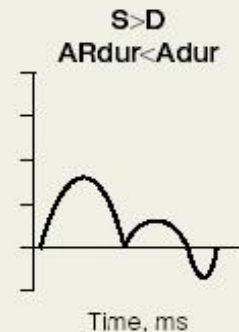
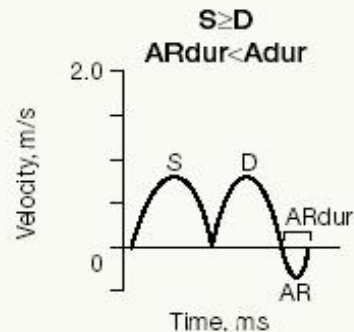
**Mitral Inflow**



**Doppler Tissue Imaging of Mitral Annular Motion**



**Pulmonary Venous Flow**



Left Ventricular Relaxation Normal  
Left Ventricular Compliance Normal  
Atrial Pressure Normal

Impaired  
Normal to ↓  
Normal

Impaired  
↓↓  
↑↑

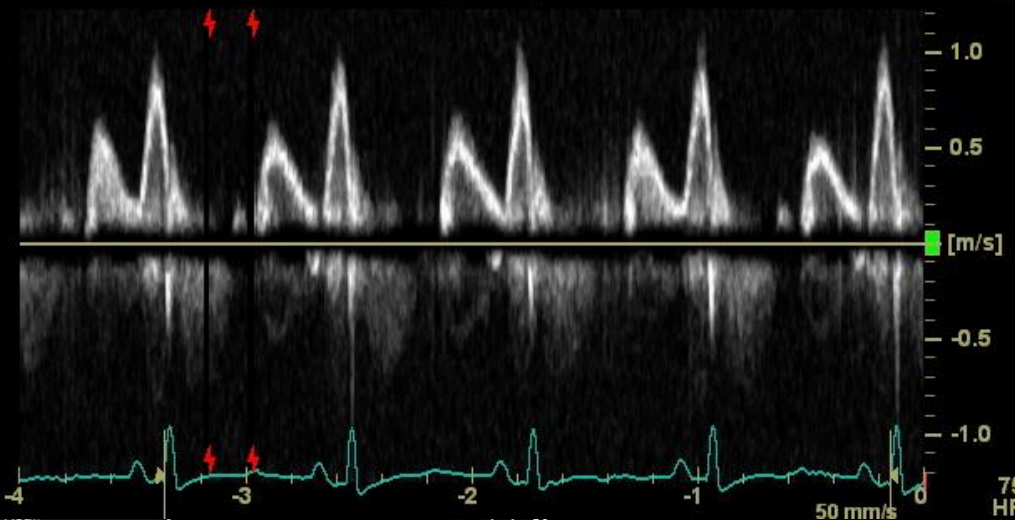
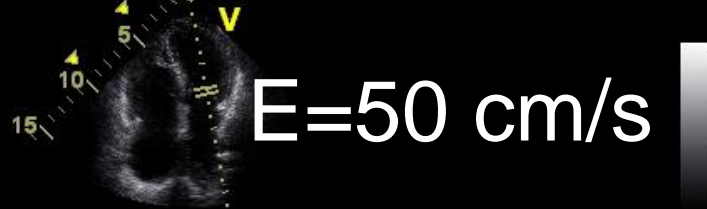
Impaired  
↓↓↓  
↑↑↑

Impaired  
↓↓↓↓  
↑↑↑↑

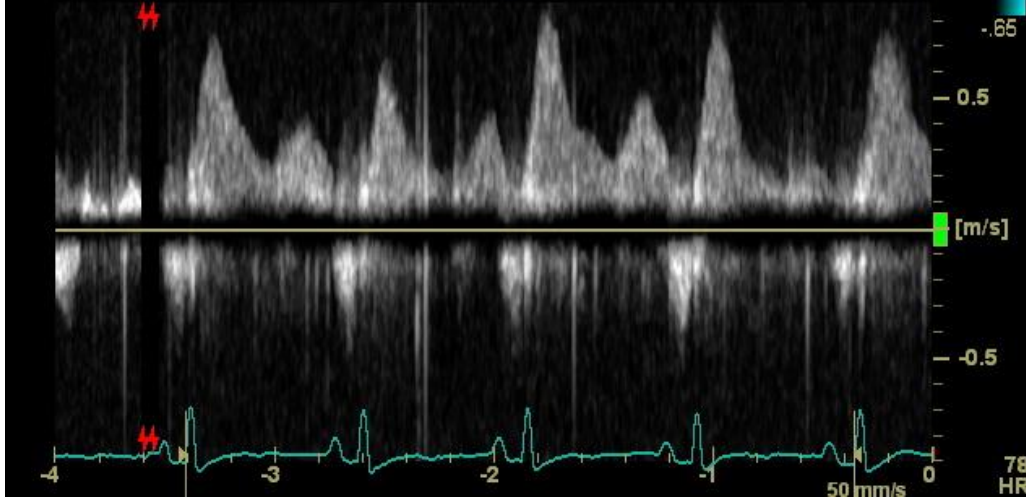
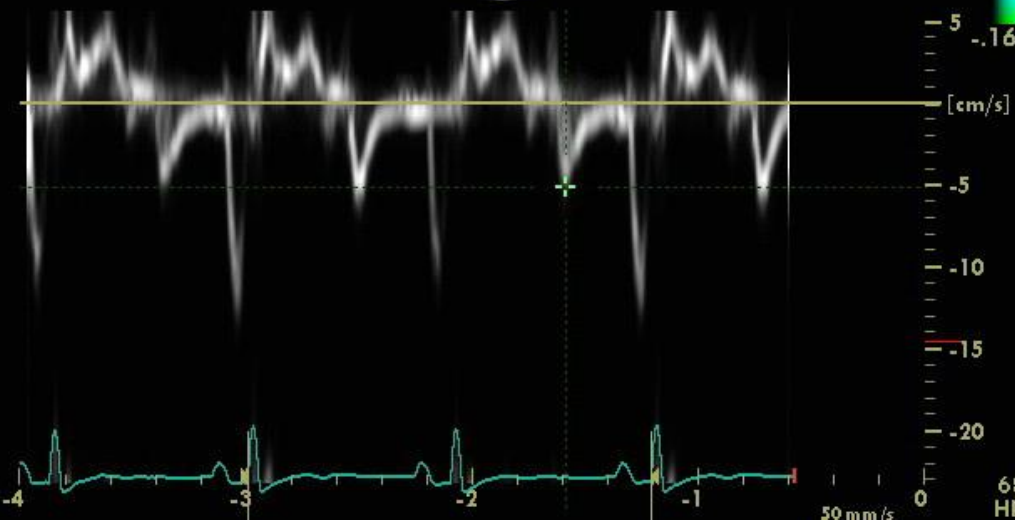
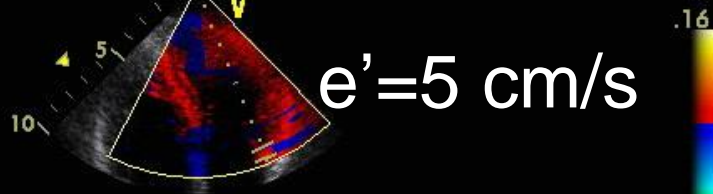
**A 79 year old immigrant is seen by you in the ED for dyspnea and persistent cough.  
You recommend:**

- 1. Admit to Cardiology for diuresis**
- 2. Admit to Pulmonary for evaluation**
- 3. Admit to CT surgery for pericardiectomy**
- 4. Cough elixir and outpatient PCP appointment**

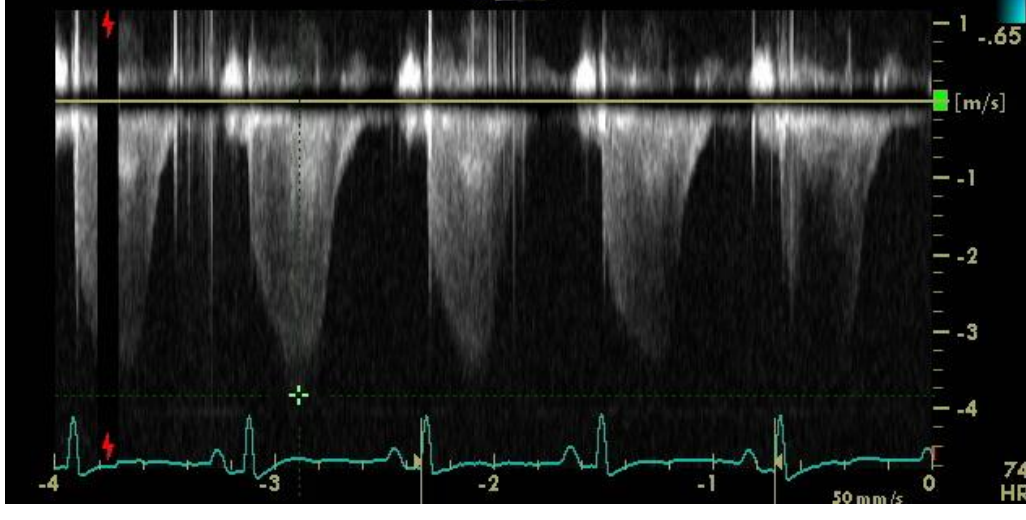
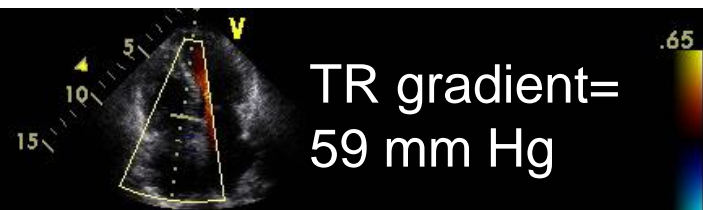


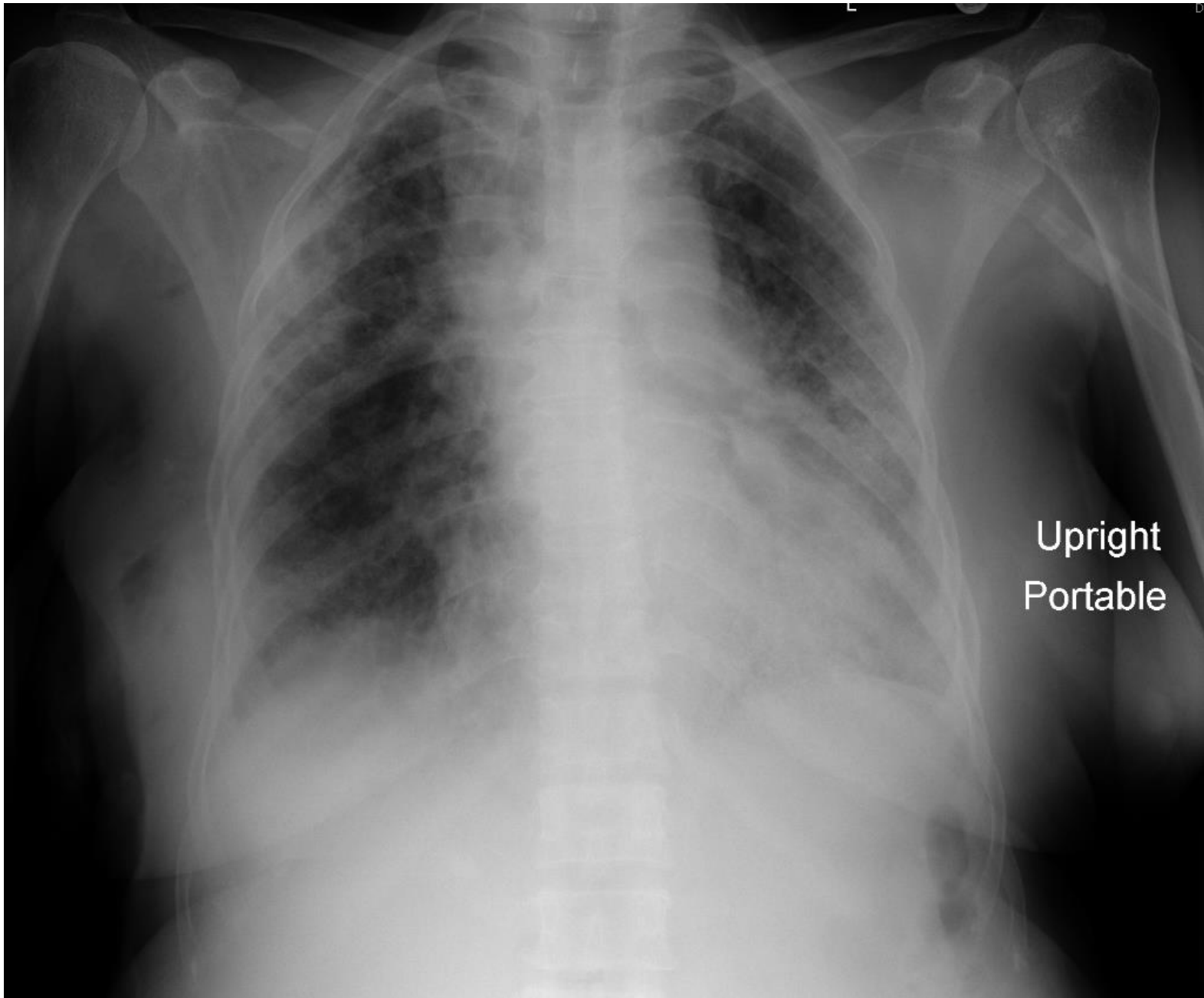


v 0.05 m/s  
 p 0.01 mmHg



v 3.85 m/s  
 p 59.41 mmHg

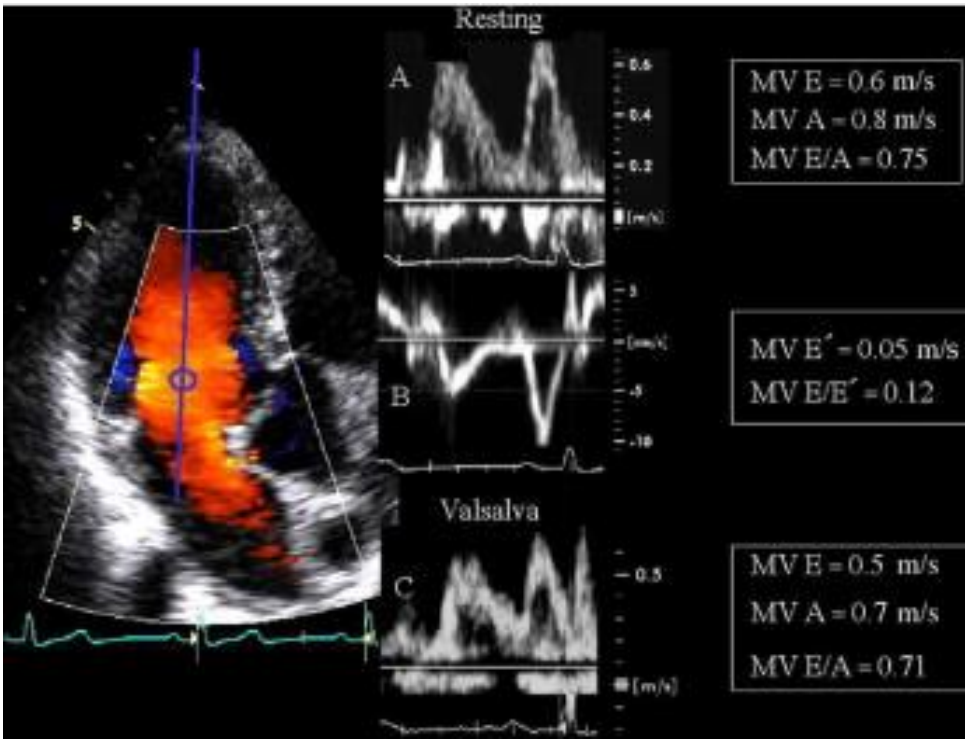




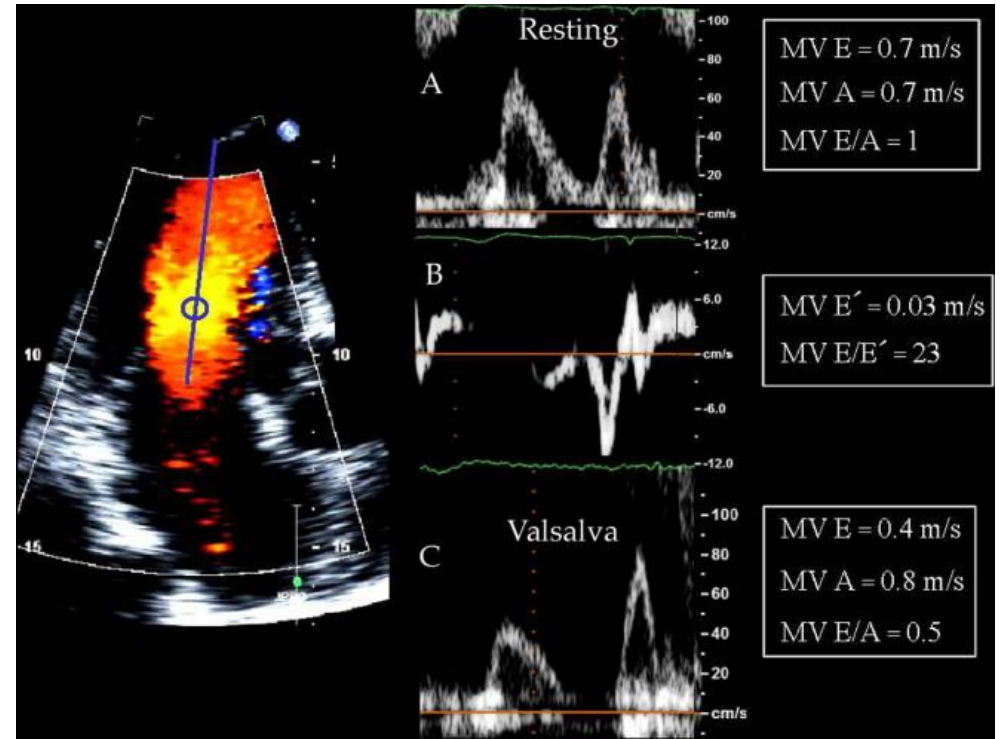
Upright  
Portable

**A 79 year old immigrant is seen by you in the ED for dyspnea and persistent cough.  
You recommend:**

- 1. Admit to Cardiology for diuresis**
- 2. Admit to Pulmonary for evaluation**
- 3. Admit to CT surgery for pericardiectomy**
- 4. Cough elixir and outpatient PCP appointment**



**A**



**B**

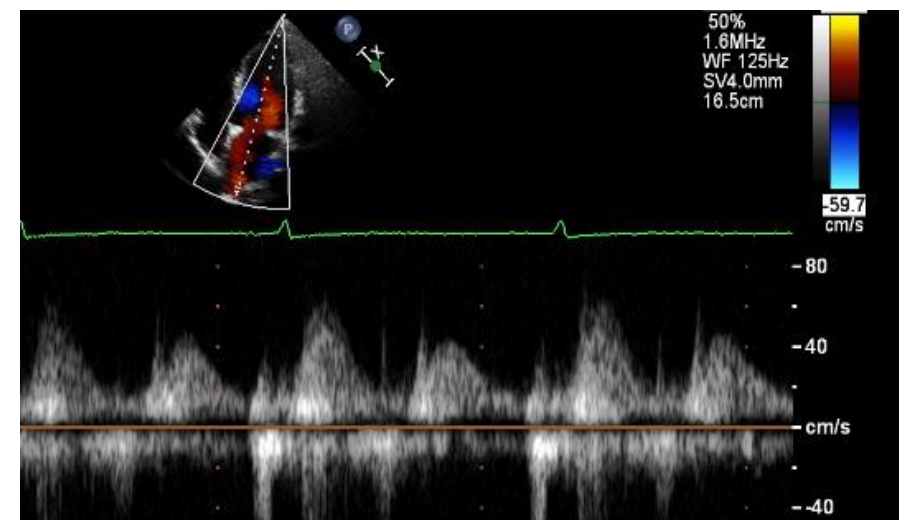
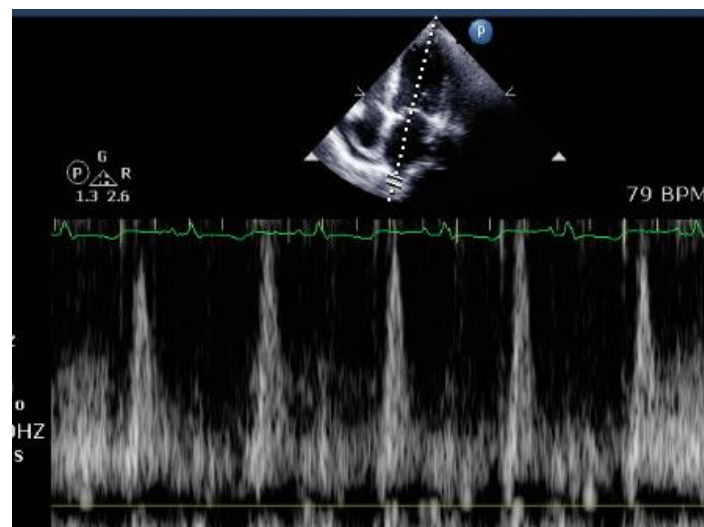
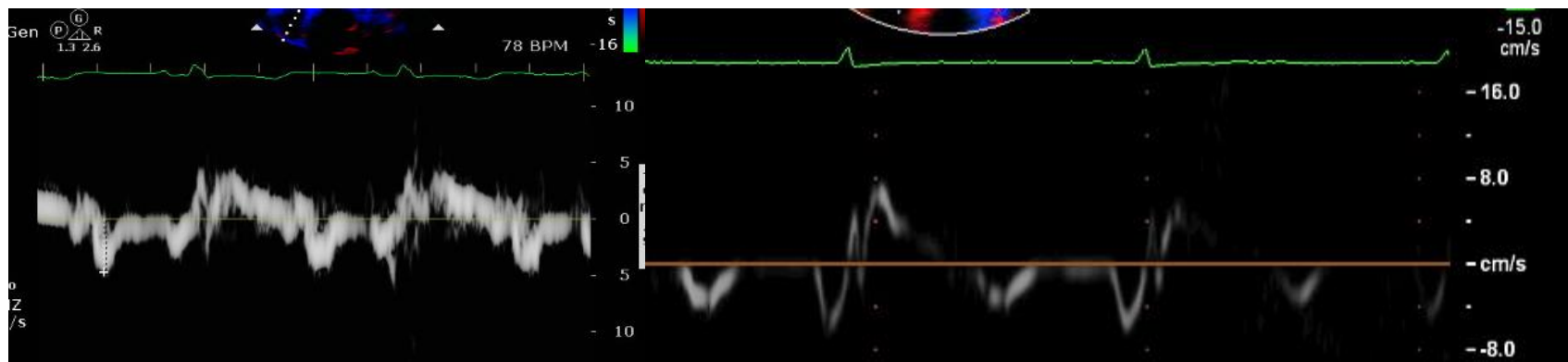
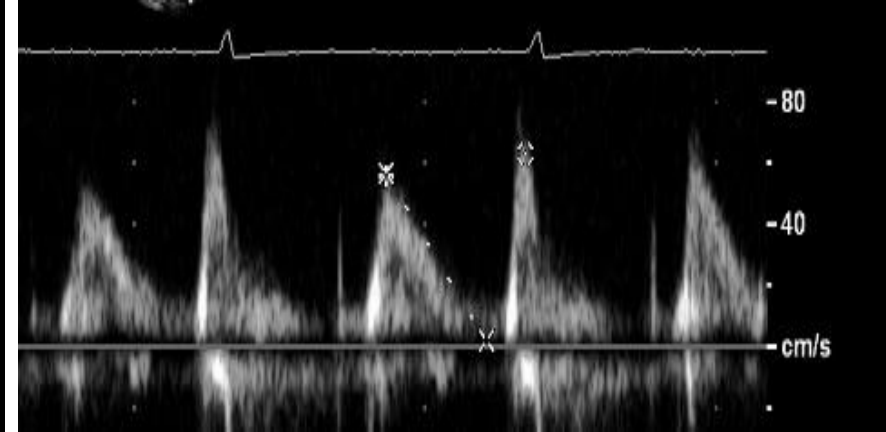
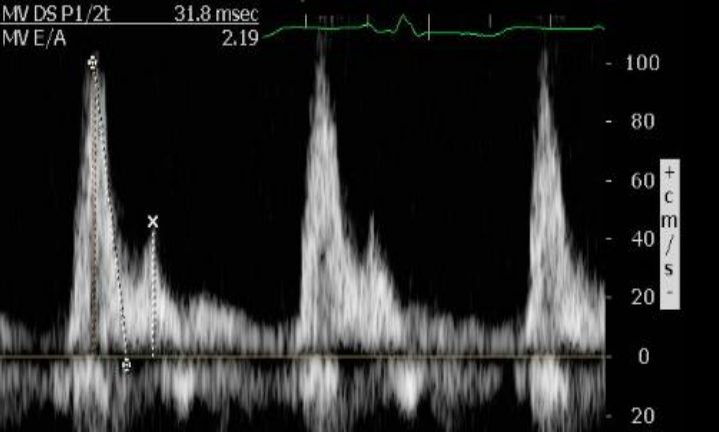
**Which patient has higher filling pressures?**

- A.
- B.
- C. Need pulmonary venous flow to be certain

# What happened to this patient?

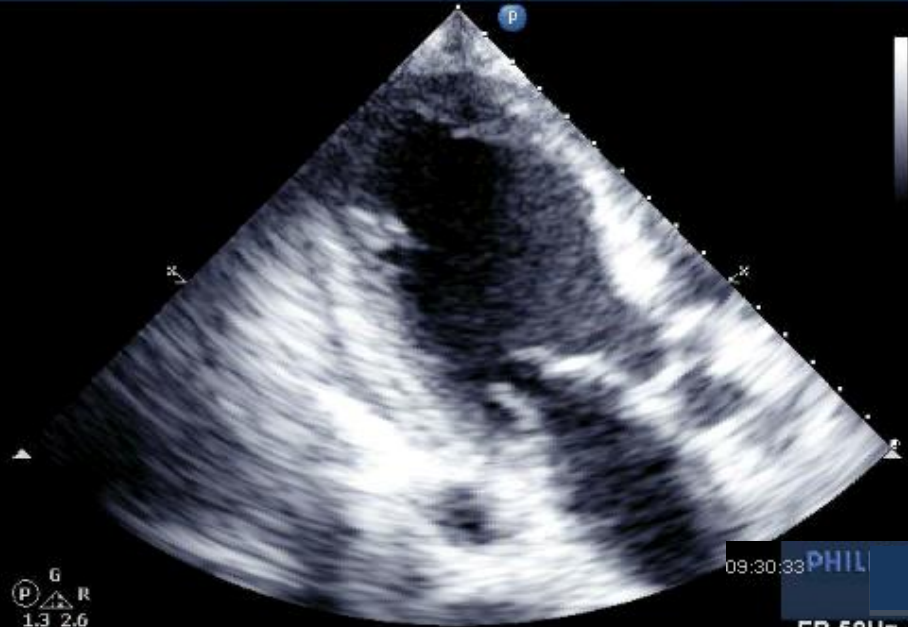
1. AVR for  
uncomplicated AS
2. MVR for MS
3. CABG
4. Pericardiectomy for  
CP





UMMHC  
S5-1  
30Hz  
16cm

2D  
HPen  
Gn 67  
C 47  
3/4/1  
75 mm/s



G  
P R  
1.3 2.6



09:30:33 PHIL

ISO.8 MI 1.3<sup>L</sup>

FR 52Hz  
14cm

2D  
64%  
C 50  
P Low  
HPen

G  
P R  
1.4 2.8



M3

JPEG

53 bpm

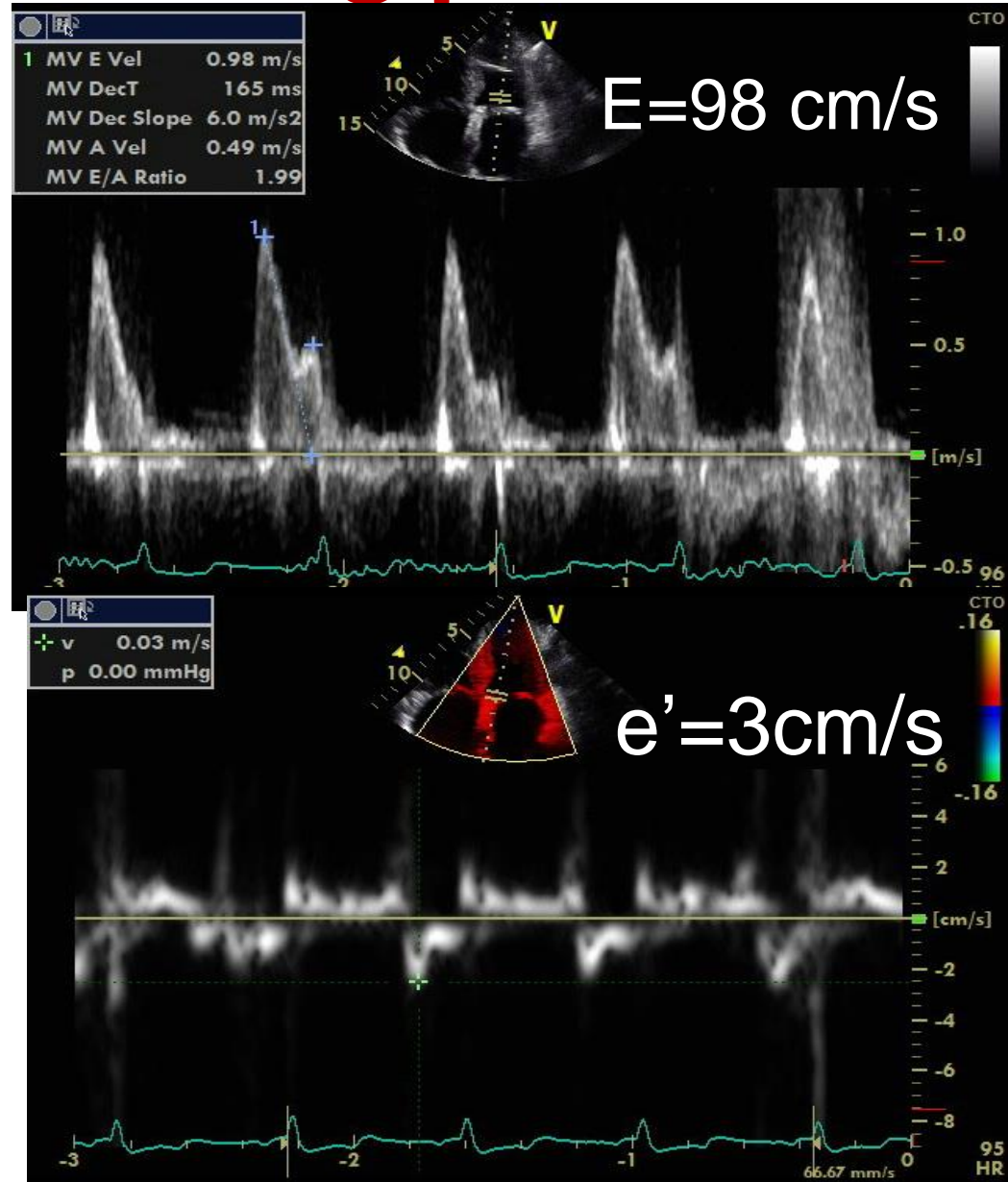


# What happened to this patient?

1. AVR for  
uncomplicated AS
2. MVR for MS
3. CABG
4. Pericardiectomy for  
CP

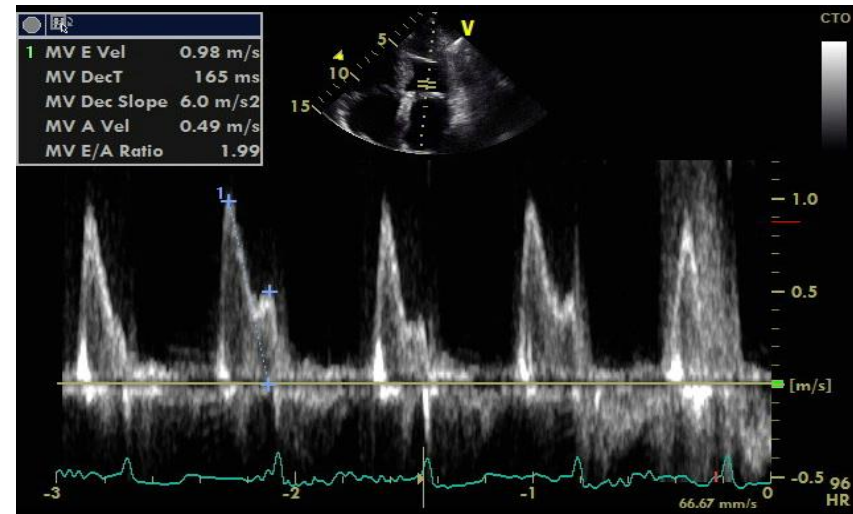
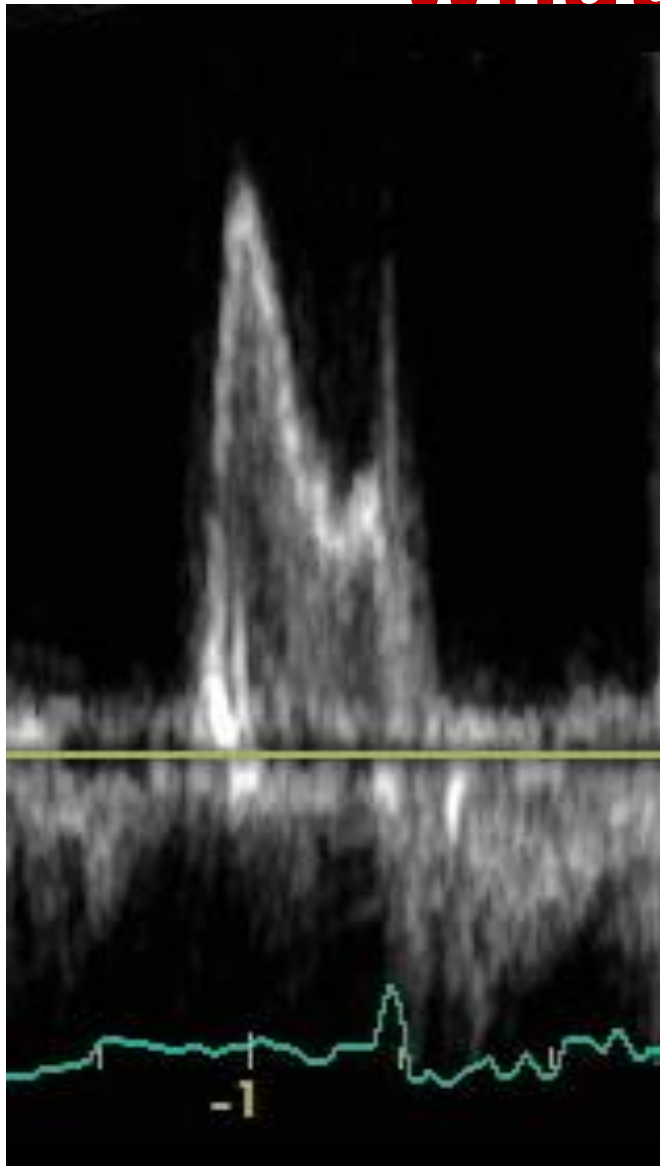
# What are the filling pressures ?

1. Normal
2. High
3. Low
4. Indeterminate



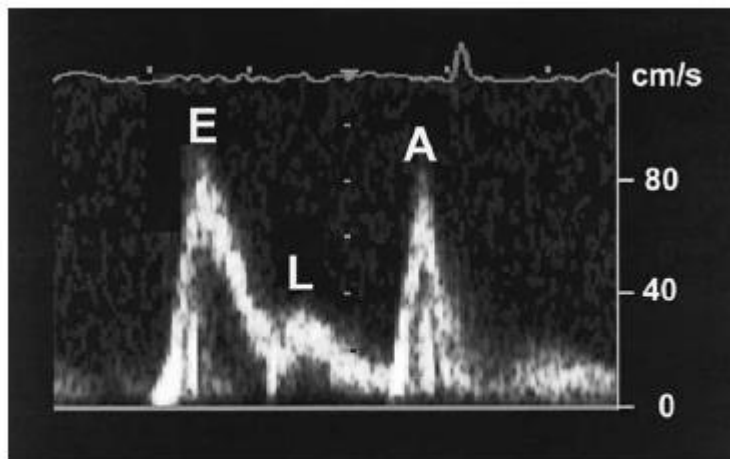
# Bonus question: what is the rhythm?

- 1.
- 2.
- 3.

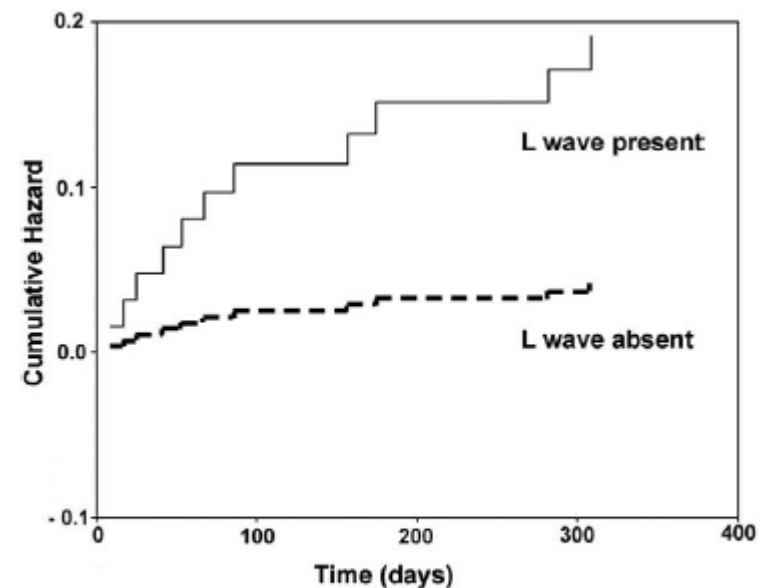


# The Mitral L Wave: A Marker of Pseudonormal Filling and Predictor of Heart Failure in Patients with Left Ventricular Hypertrophy

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**Figure 1** Spectral Doppler tracing of mitral flow velocity curve, showing early (E), late (A), and middiastolic (L) waves.



**Figure 2** Cox proportional hazards graph (unadjusted) for incident heart failure. *Broken line*, group II (L wave absent); *solid line*, group I (L wave present).