

Element 20.00

Rakowski

Diastolic Heart Failure

- Occurs with systolic failure or alone
- Impaired relaxation
- Increased myocardial stiffness
- LV fills with elevated pressures
- Increasing problem with age
- High morbidity and mortality
- Echo Doppler essential

Diastolic Failure

Health Care Crisis

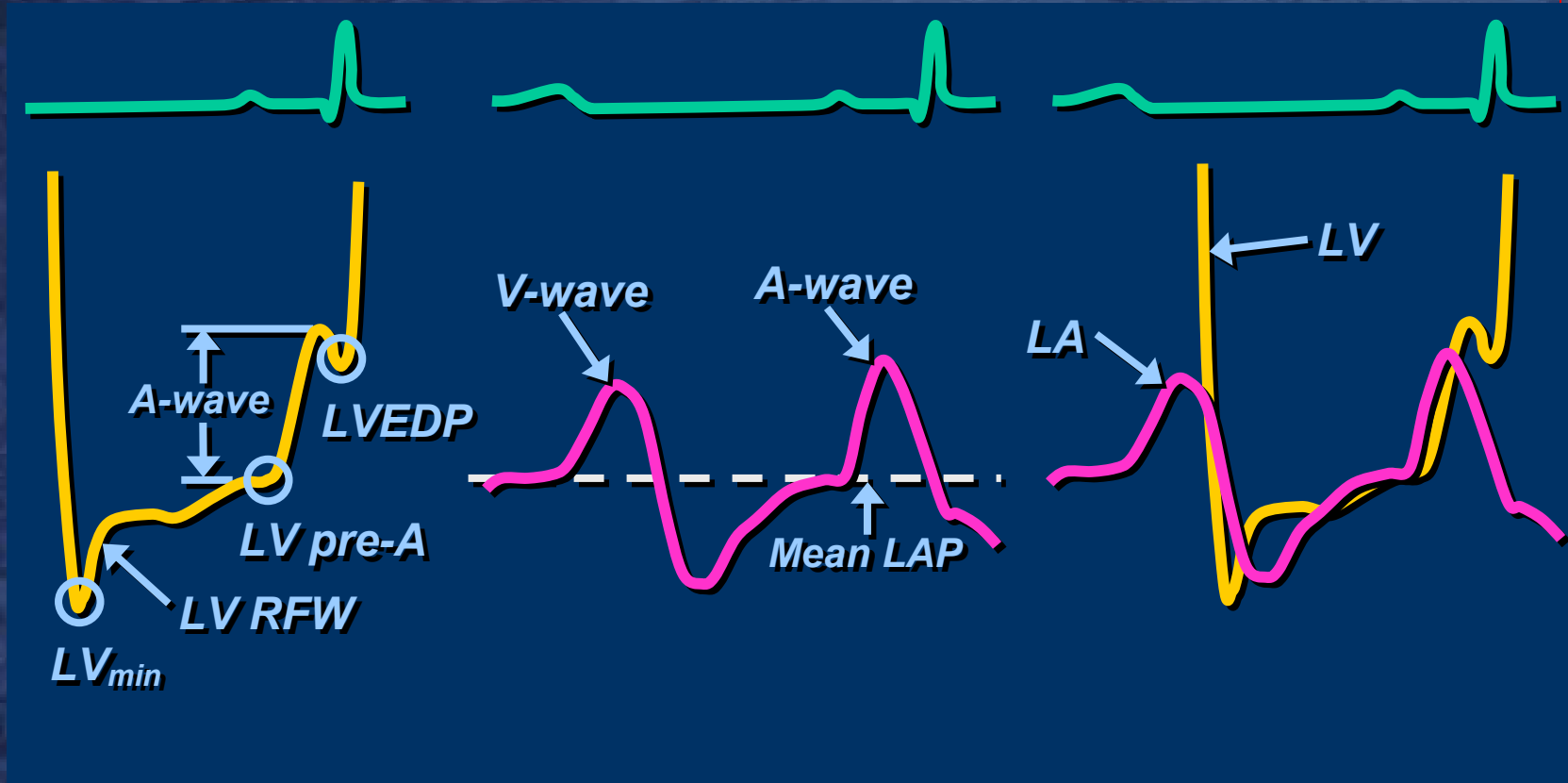
Study	Pts	% DHF /age	DHF %mort	SHF %mort
Cohen 1999	623	13 / 60	8	19
Permenkil 1997	501	34 / 81	28	38
McAllister 1999	566	21 / 65	12	17
Ansari 2001	376	27 / 72	20	20

Different LV and LA Pressures

LV

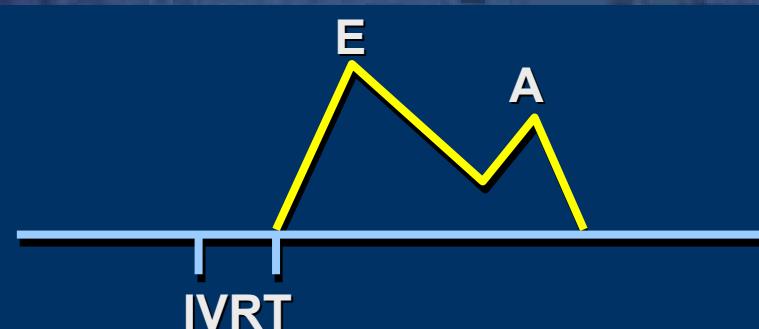
LA

LV+LA

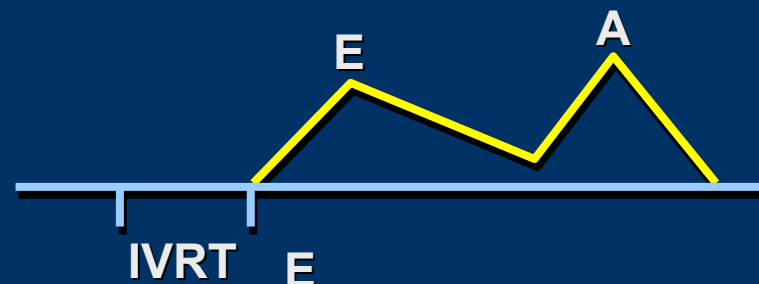


Patterns of MV Inflow

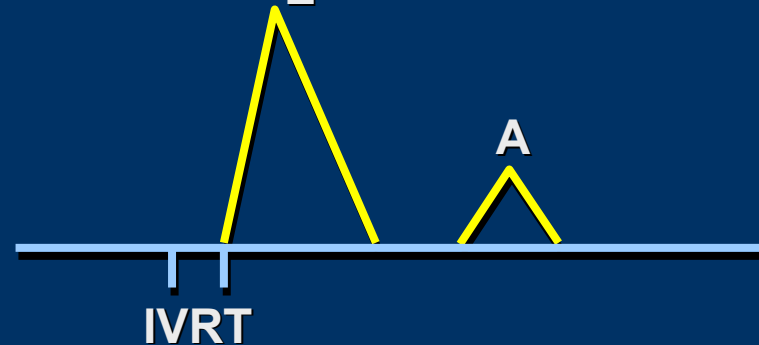
Normal



Delay Relax
(normal LVFP)



High LA Pressure



Quantitating LV Filling Pressures

- What do Echo-Doppler studies measure

LV Pre A (mean LAP), LVEDP

- Integrated approach to quantitation

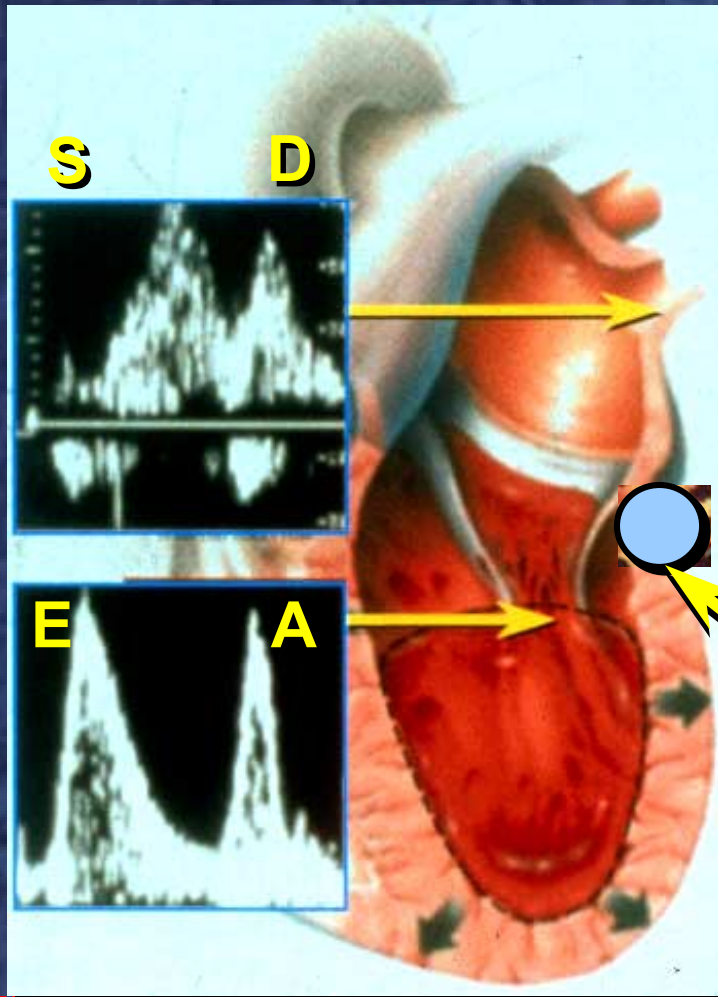
*mitral inflow, pulmonary vein flow,
tissue Doppler annular velocities,
color flow propagation, caval flow,
use of Valsalva*

- LV and LA size and function

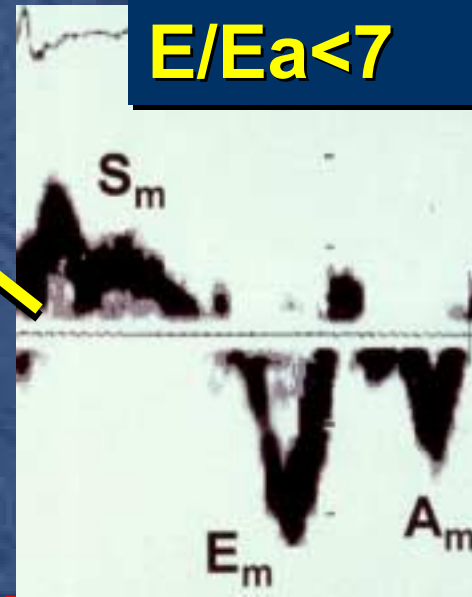
- Understanding limitations

hypertrophic cardiomyopathy, normal LV fx

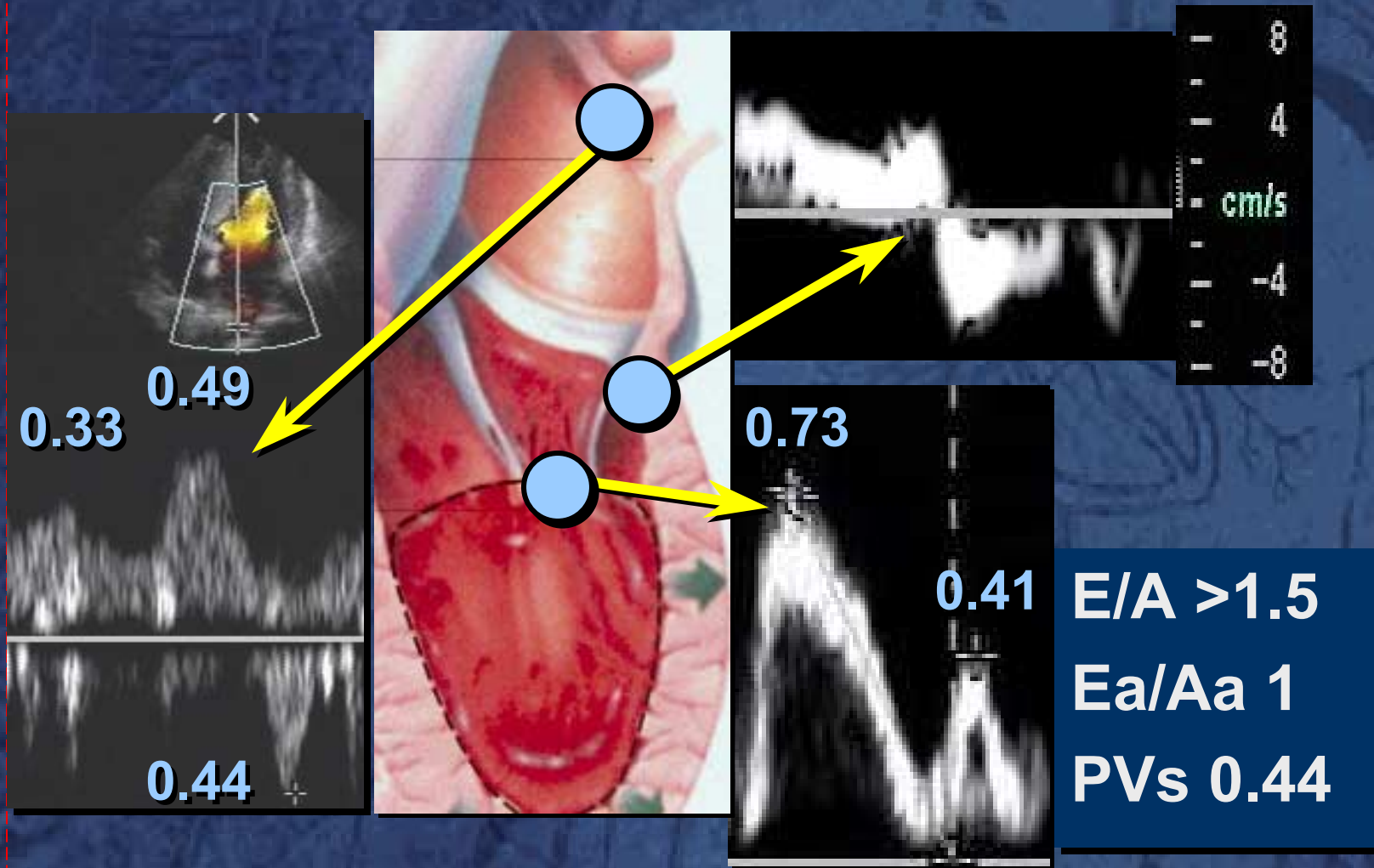
Normal Doppler Velocities



$E/A > 1$
 $PVs = PVd$
 $Pva < .35m/s$
 $Ea > .1m/s$
 $E/Ea < 7$

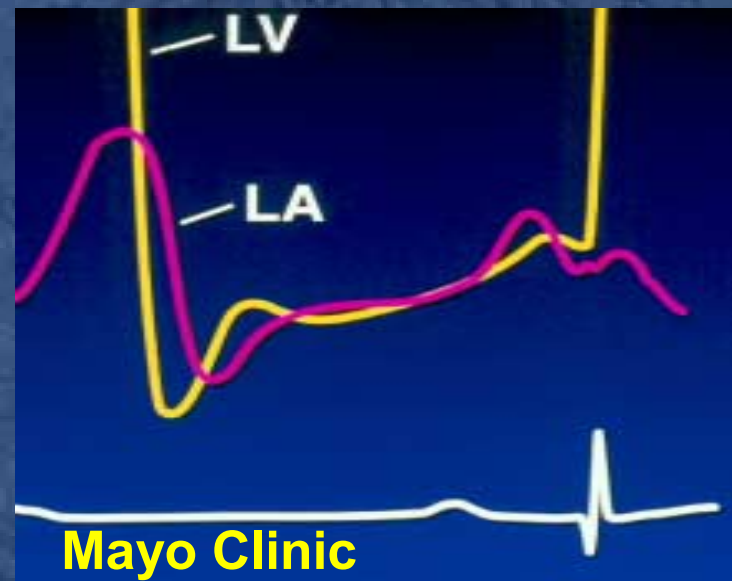
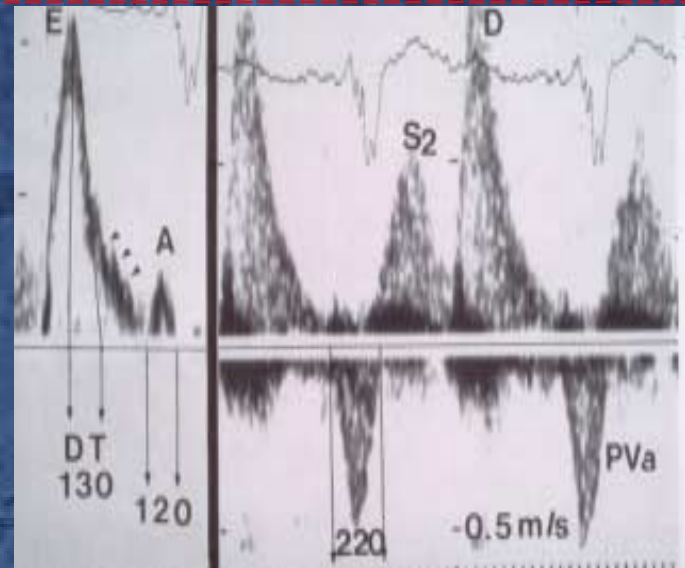
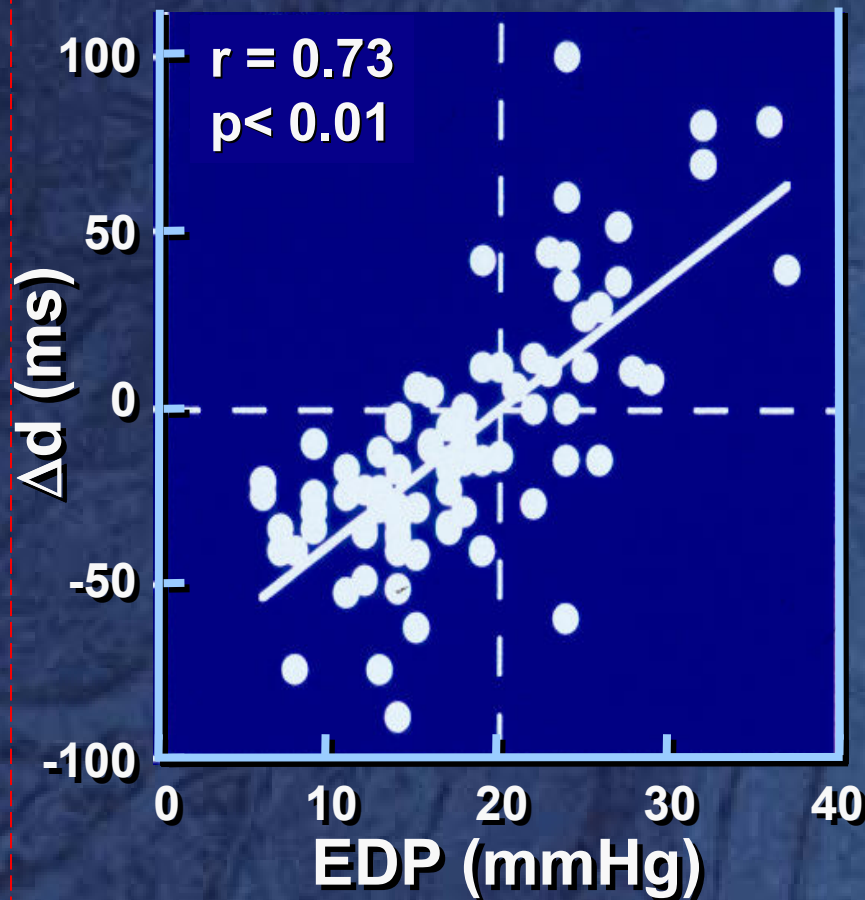


MVO: Pseudonormalization



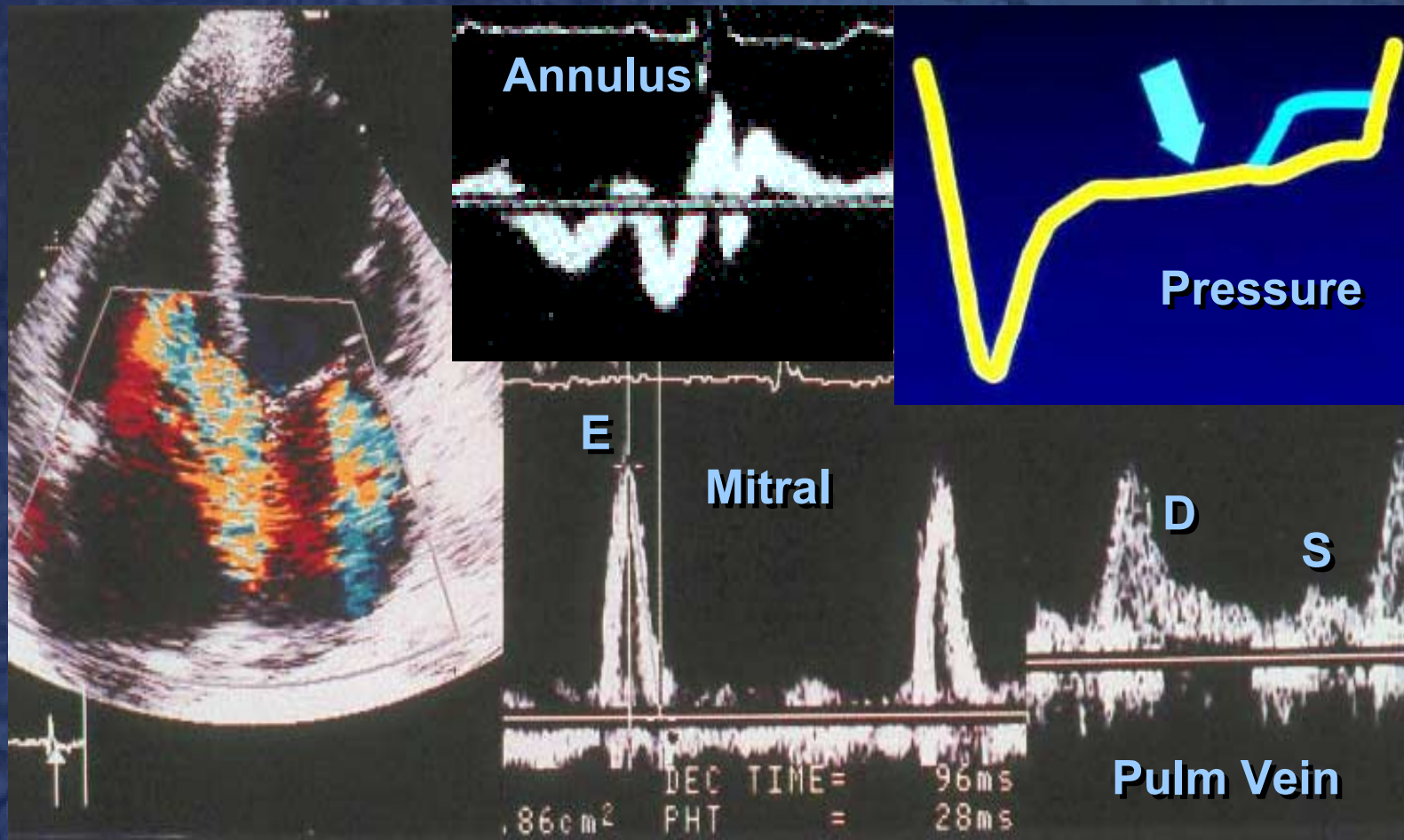
LVEDP

PVa - Mitral A duration

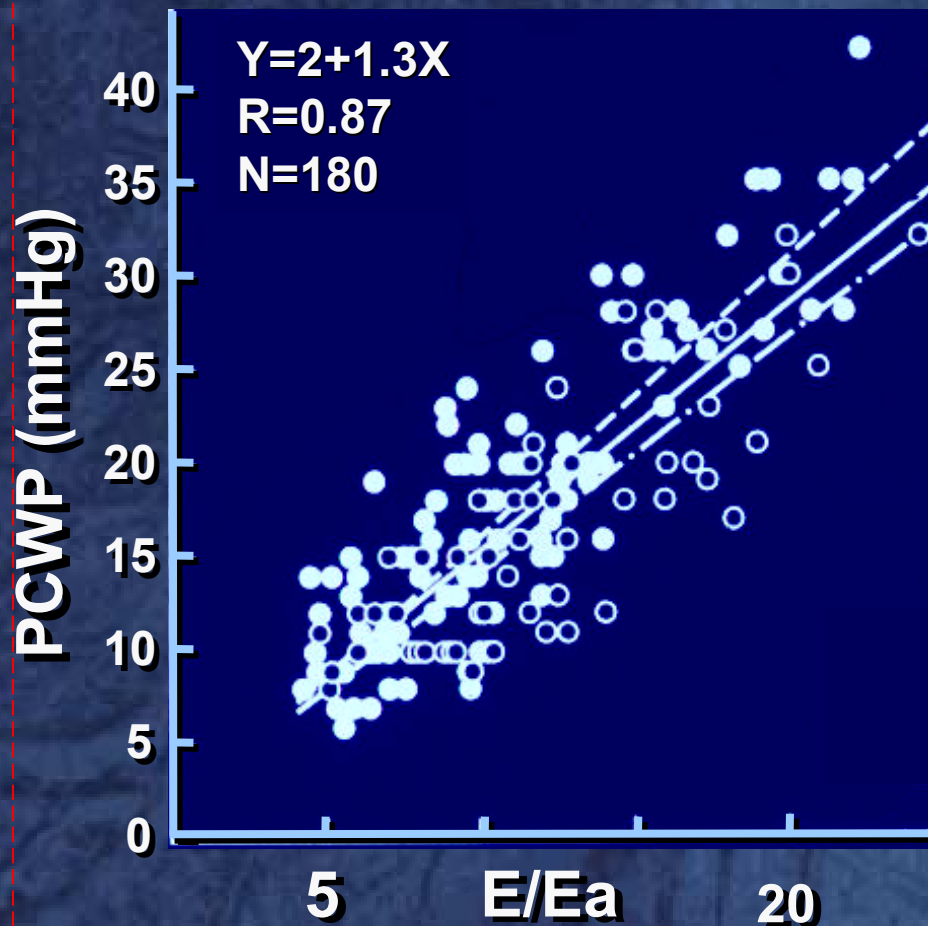


Mayo Clinic

Restrictive Physiology: High LAP



Calculation of LAP by E/Ea



LAP=

$$E/Ea \times 1.25 + 1.9$$

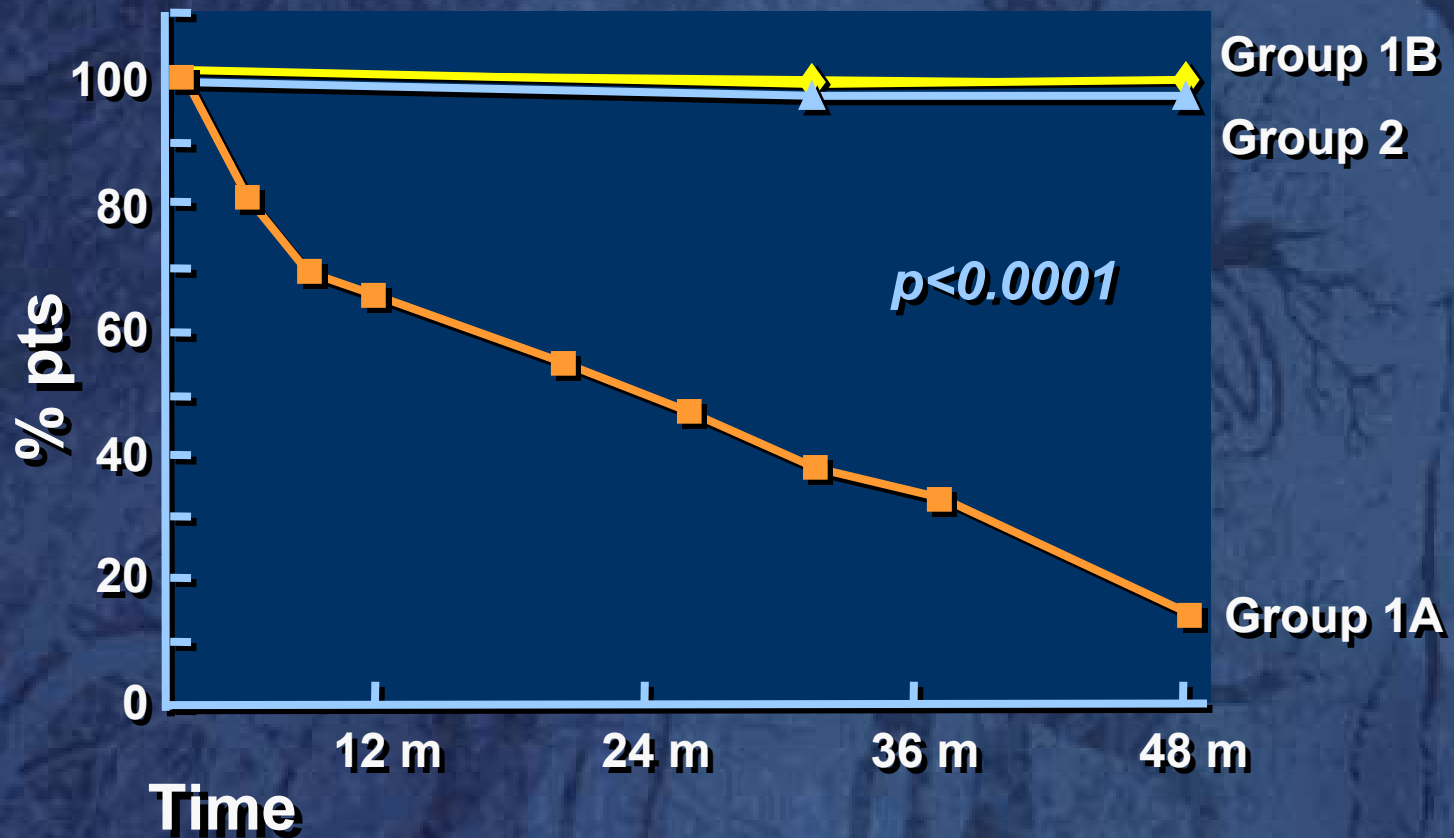
Can be used in:

- afib and
- sinus tach

Nagueh et al 1997

Prognostic Value of Mitral Velocity

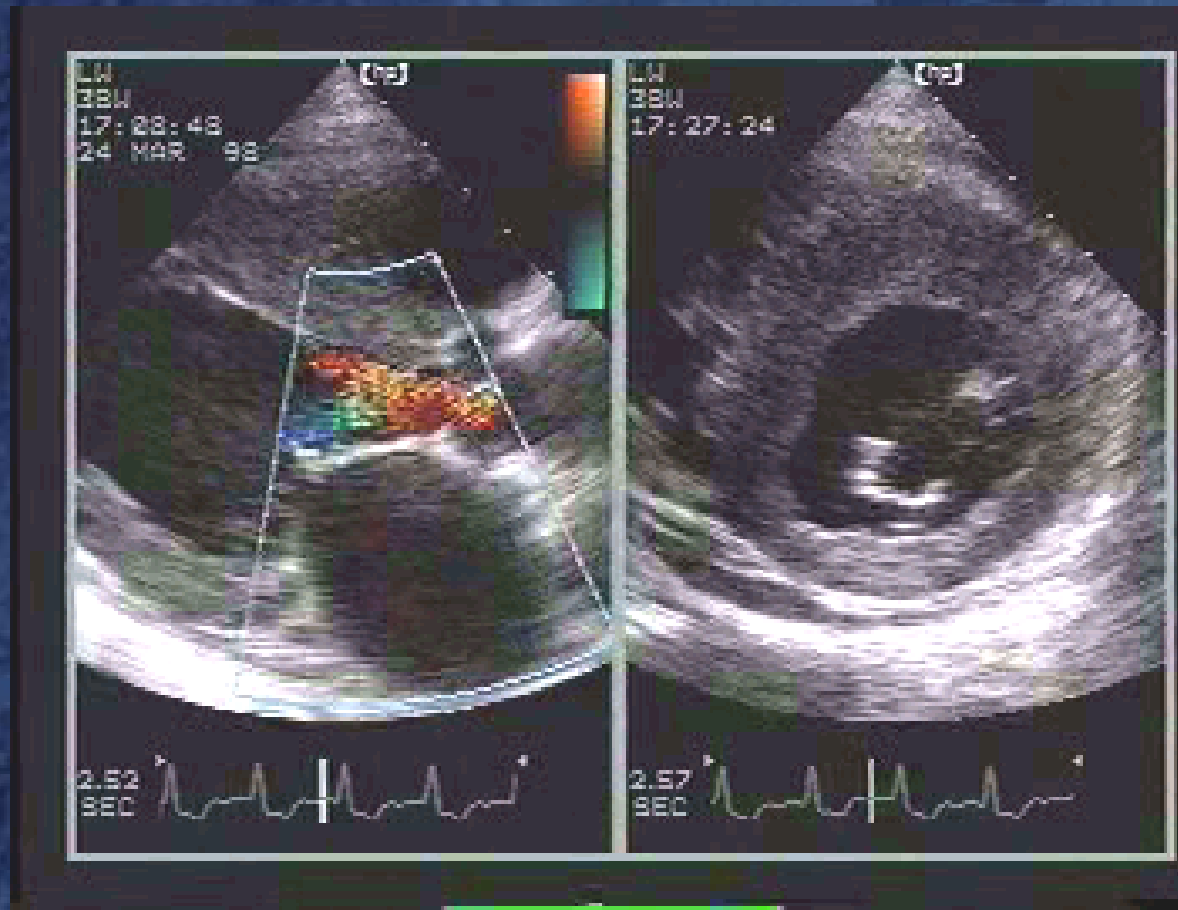
Persistent restrictive pattern in DCM



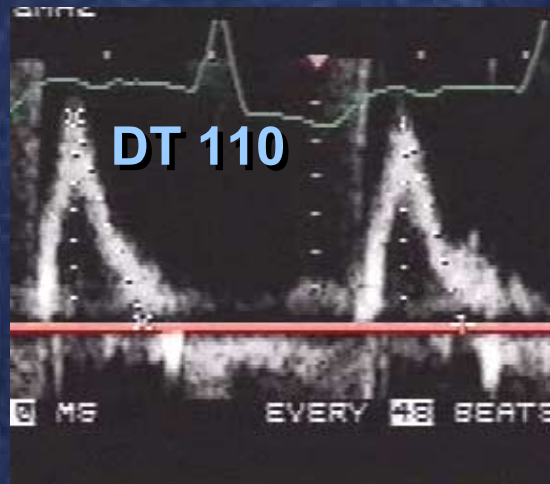
Pinamonti et al, JACC 1997;29:604

55 y.o. female with CHF

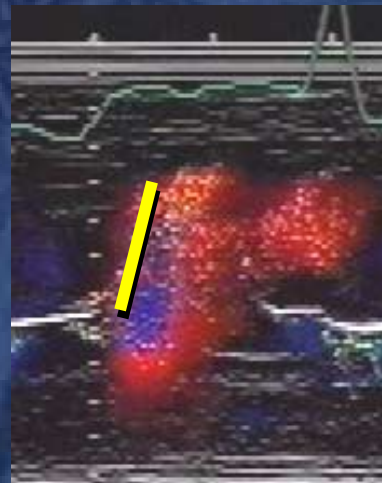
Referred for evaluation of HCM



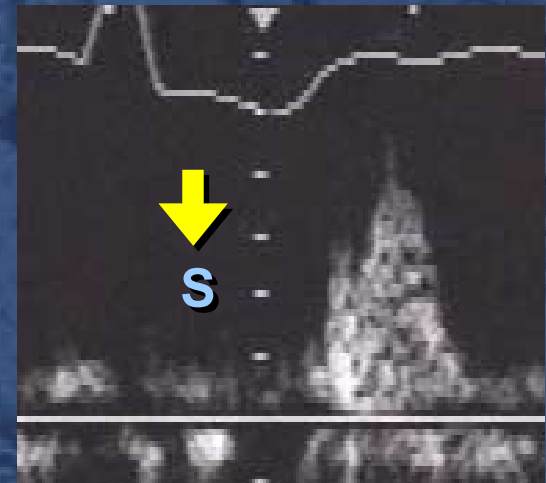
Mitral



Flow propagation



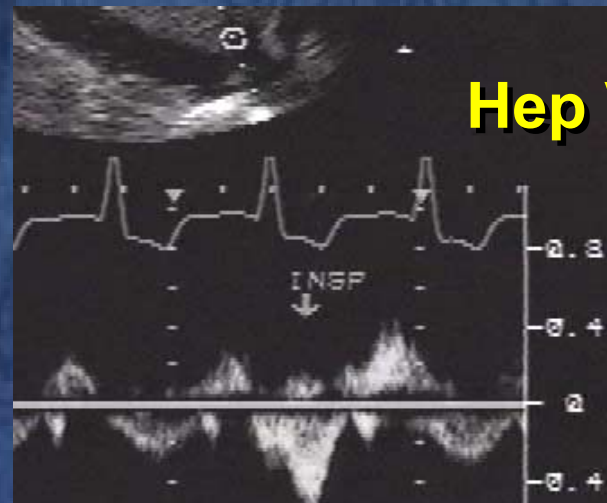
Pulm Vein



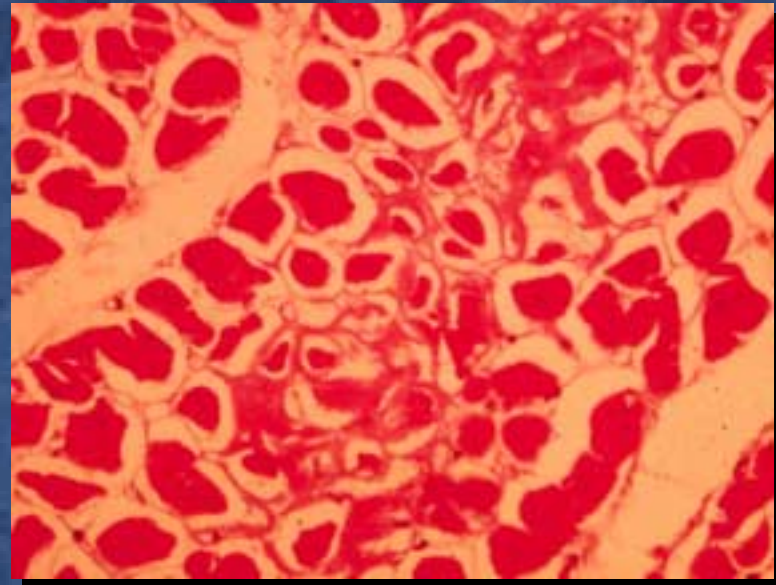
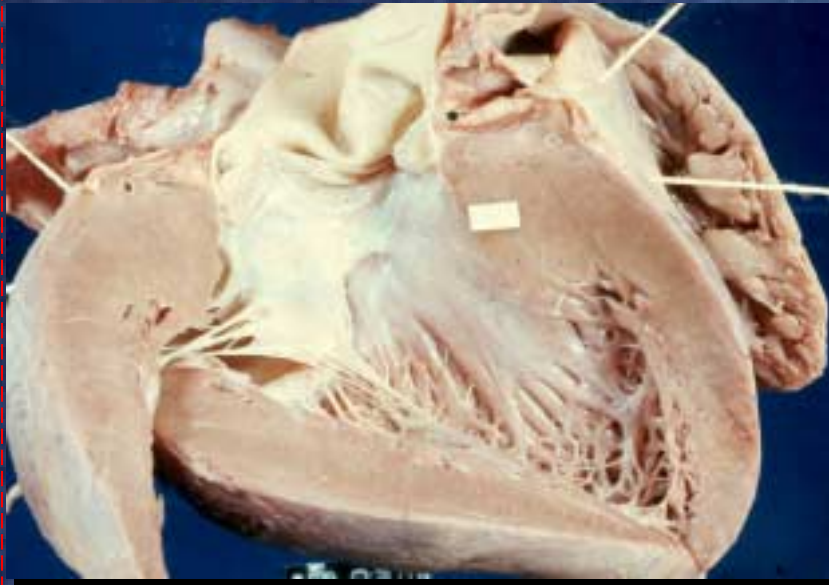
Tricuspid



Hep Vein



Cardiac Amyloidosis



Prognosis worse when:

- *LV thickness > 14mm*
- *Restrictive physiology*
- *LV dysfunction*

Issue

Echo Doppler Pitfalls

Technical

all methods

Aging

relaxation

Volume depletion

relaxation

Normal EF, HCM

pressures by MV

Pseudonormal MV

need other methods

Echo Assessment of Diastolic Failure

- **Systolic/diastolic failure or both**
- **Evaluate relaxation/filling pressures**
- **Determine *etiology/staging/prognosis***
- **Evaluate therapy**

Rakowski Element 20

Extra Slides

Diastolic Dysfunction

Impaired relaxation

Elevated filling pressures

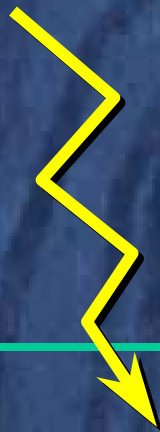
- **Ischemic heart disease**
- **Cardiomyopathies**
- **Systemic disease**
- **Hypertension**
- **Valvular heart disease**

Progression of Inadequately Treated Hypertension

LV mass index
Men 131 g/m²
Women 100 g/m²

Rx

LAP



0

30

60

Diastolic Dysfunction: Hypertension

- Ischemia
- Impaired Ca^{++} handling
- Small end systolic volume
- LV hypertrophy
- Myocardial fibrosis

↓ LV relaxation

↑ LV stiffness

The diagram illustrates the pathophysiology of diastolic dysfunction. On the left, a list of factors (Ischemia, Impaired Ca⁺⁺ handling, Small end systolic volume, LV hypertrophy, and Myocardial fibrosis) is shown in blue boxes. Yellow arrows point from these factors to a central point. From this point, a pink arrow points down to 'LV relaxation' and a pink arrow points up to 'LV stiffness'. A yellow arrow then points from 'LV relaxation' down to 'LV stiffness', indicating that impaired relaxation leads to increased stiffness.

Doppler Evaluation of Elevated LV Filling Pressures

Mitral:

DT < 200ms

E/A > 1.5

Pulmonary vein:

PVa dur > MVa;

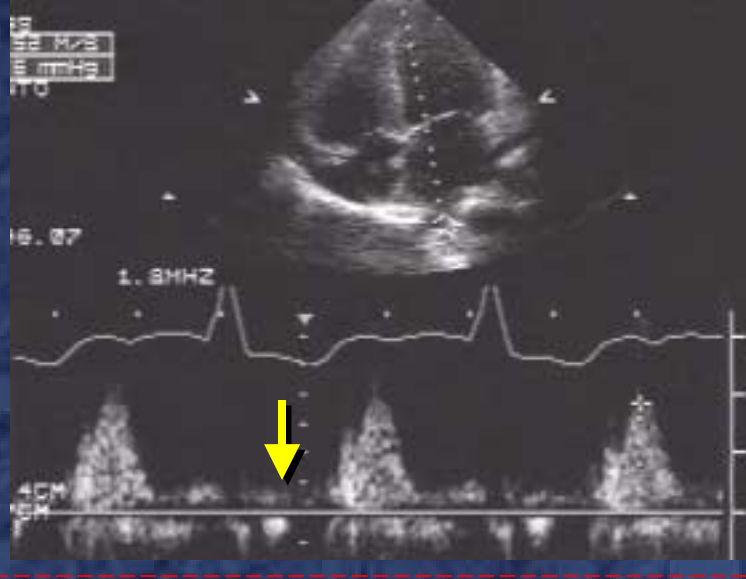
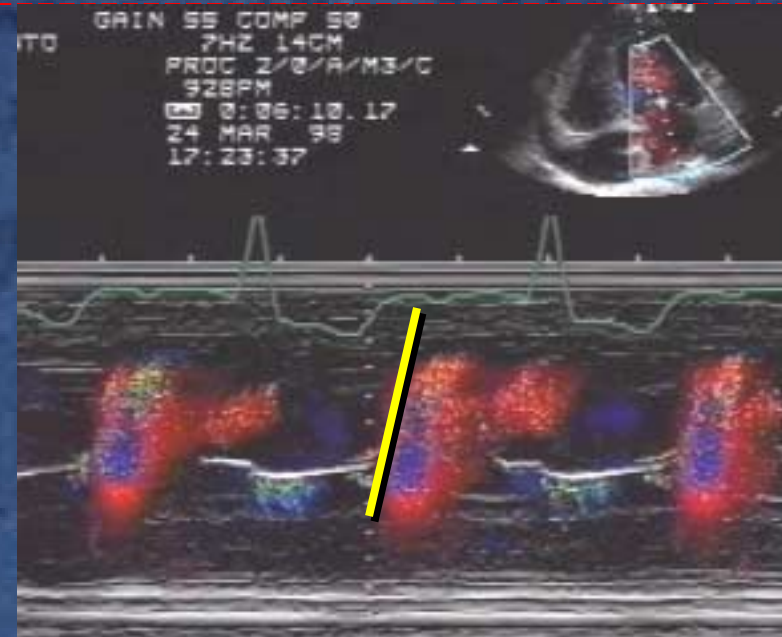
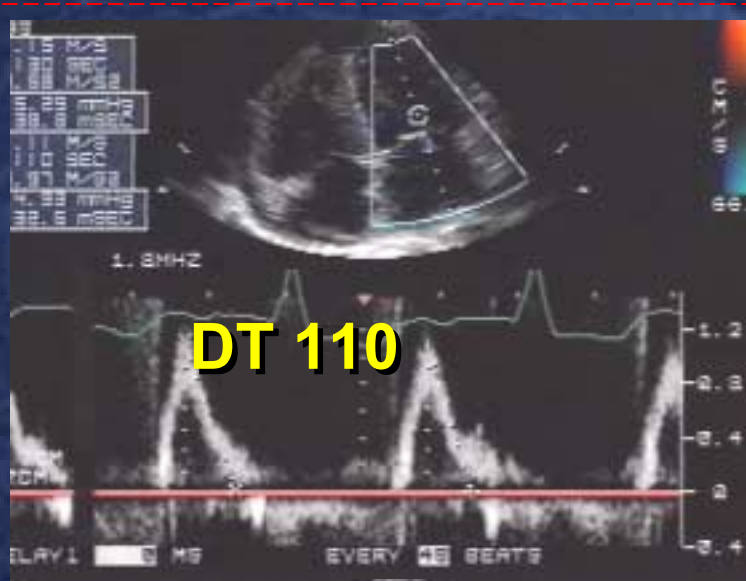
PVa > .35m/sec

PVs < 50% of PVd

Mitral annular:

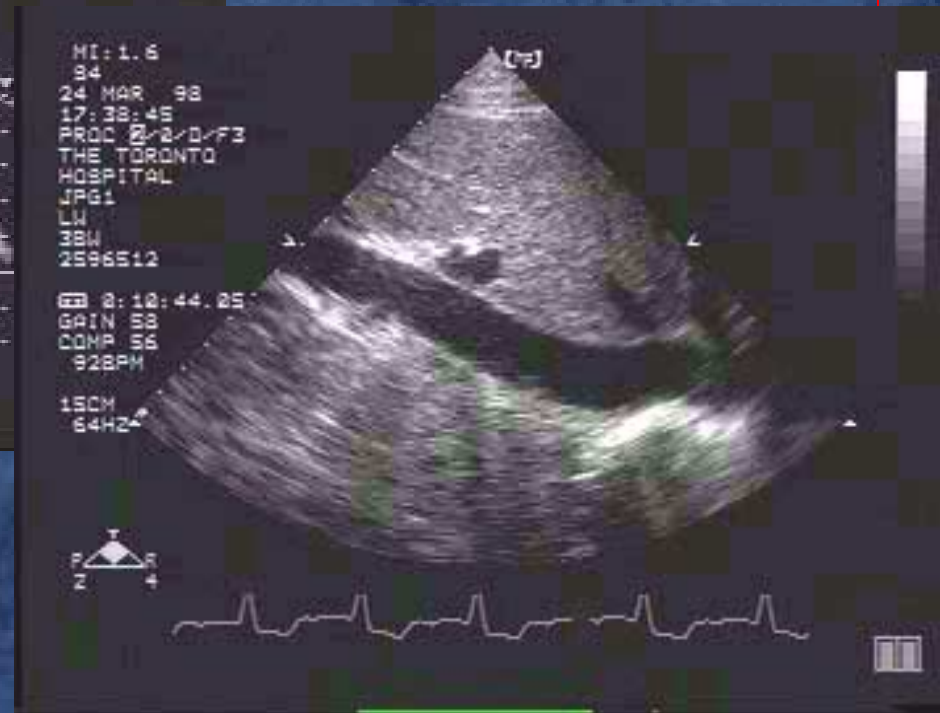
E/Ea > 10

Dilated LA with decreased LA contraction

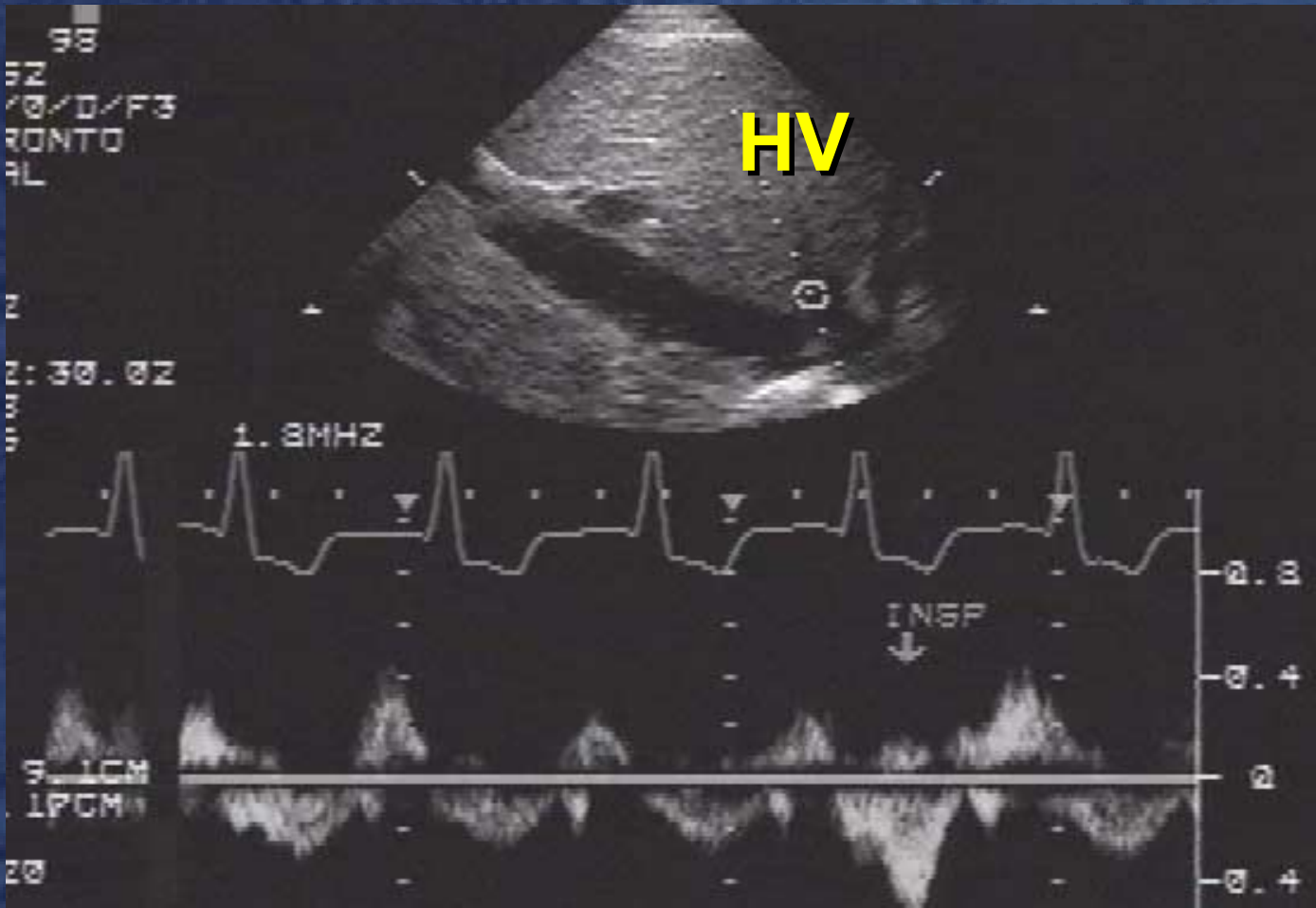




Hepatic vein



Inferior vena cava



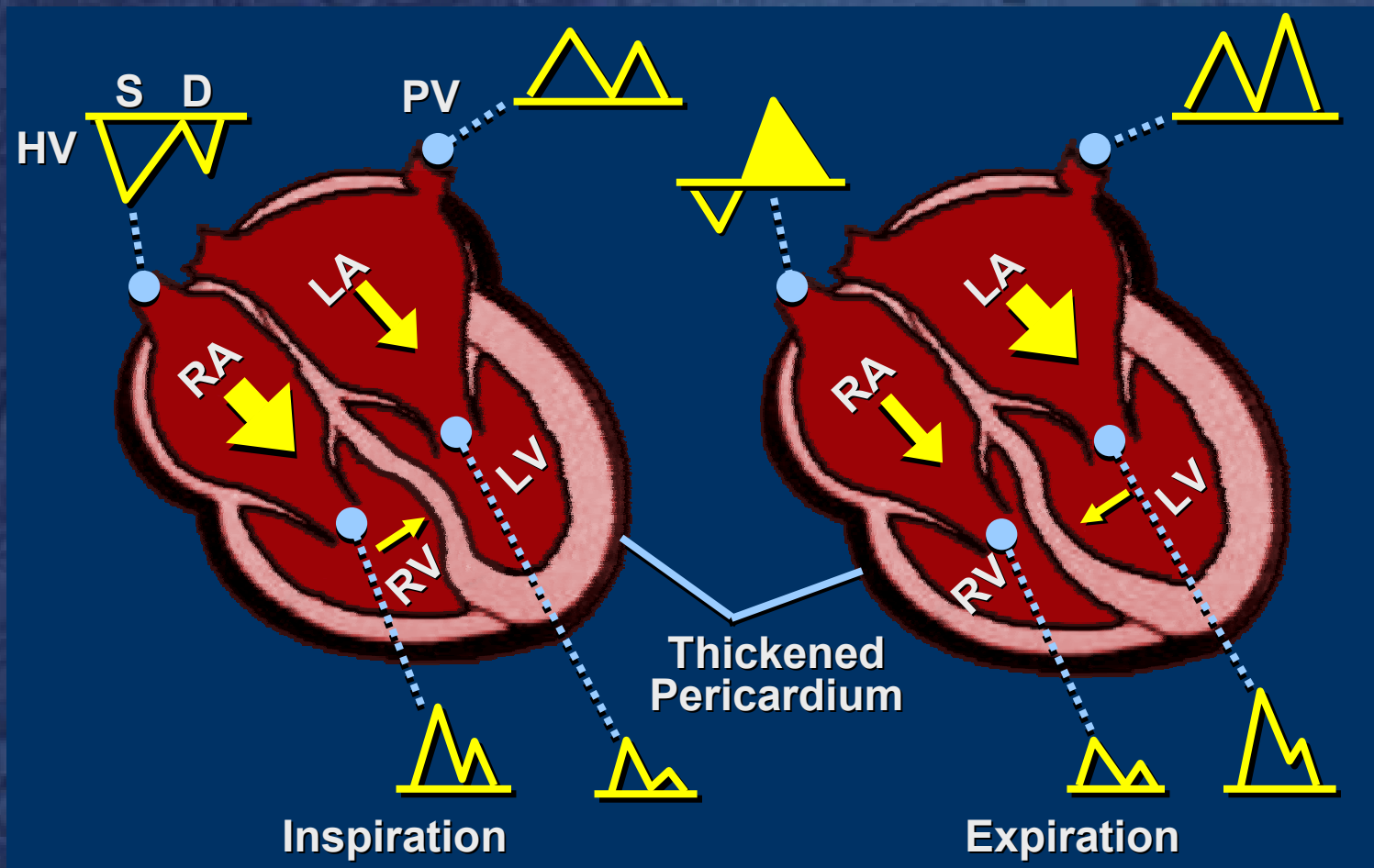
Relation of LAP to E/Ea

$$\text{LAP} = (\text{E/Ea} \times 1.25) + 1.9$$

- An E/Ea ratio ≥ 10 is: *95% sensitive*
82% specific
- Mean LAP > 15 mmHg
- Allows estimation of pressures in the absence of sinus rhythm

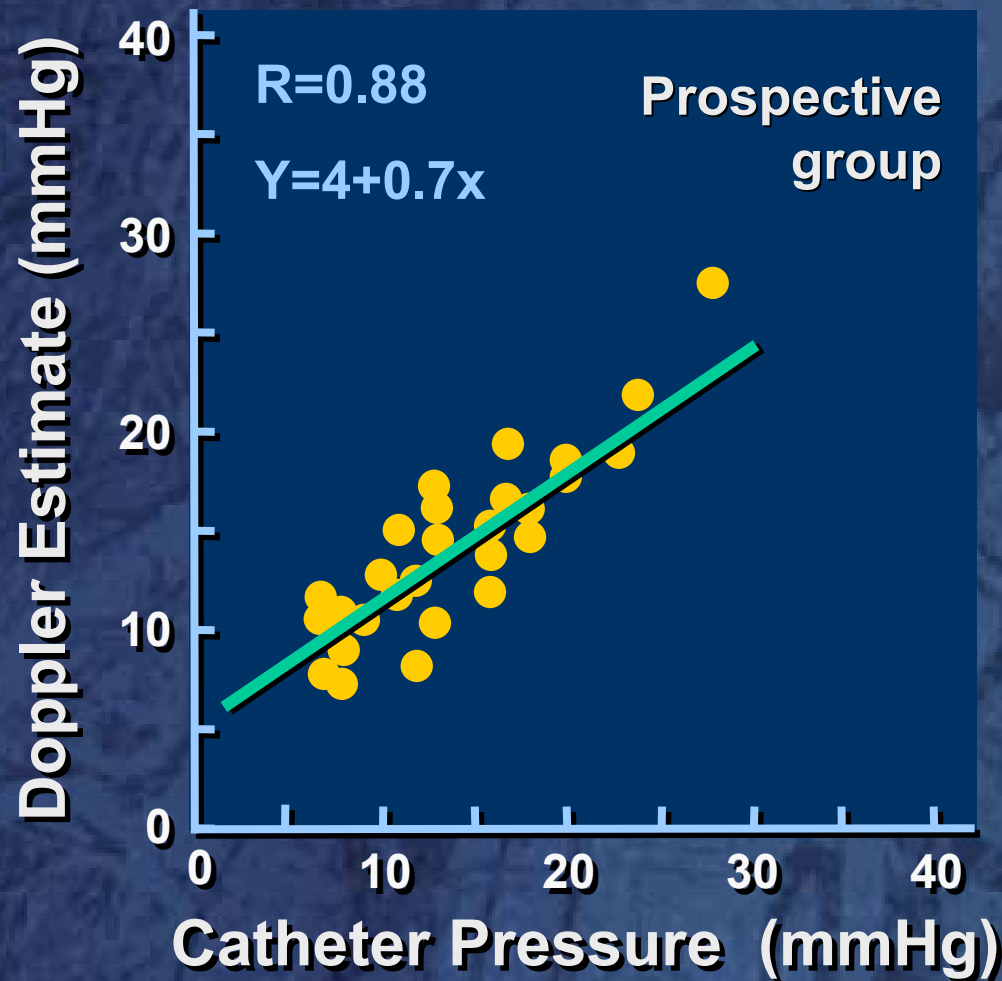
Nagueh et al, JACC 1997;30:1527

Constrictive Pericarditis



Oh et al Mayo

$$\text{Mean PCWP} = 17 + 5.3EA - 0.11IVRT$$



Naqueh et al, Am J Cardiol 75: 1256, 1995