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**Diastolic Dysfunction
in Heart Failure**

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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

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There are many reasons for Diastolic heart failure. Echo and Doppler are essential for its measurement.

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**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

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Diastolic heart failure is deadly and a disease of the elderly

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Diastolic Dysfunction

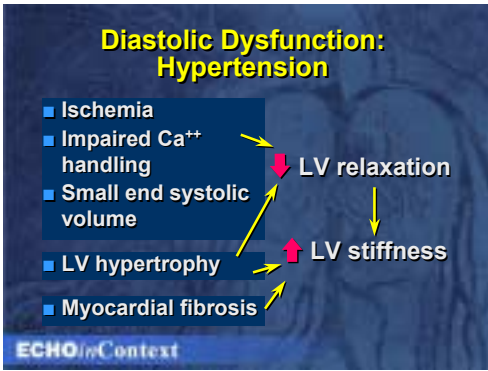
Impaired relaxation
Elevated filling pressures

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

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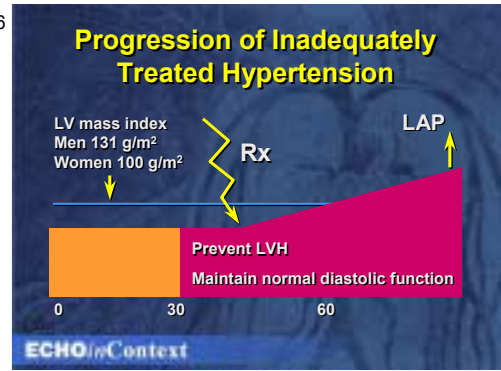
Diastolic dysfunction frequently complicates these conditions. There is usually a progression from impaired relaxation to elevated filling pressures

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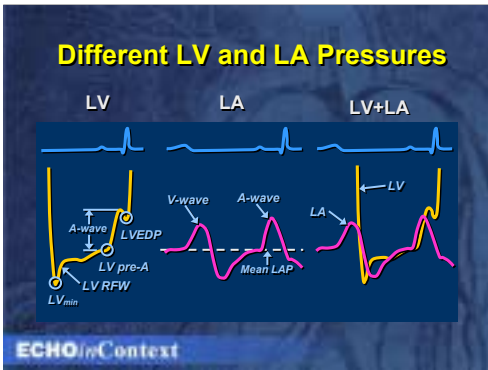
In hypertension, the causes of decreased relaxation and increased stiffness are many.

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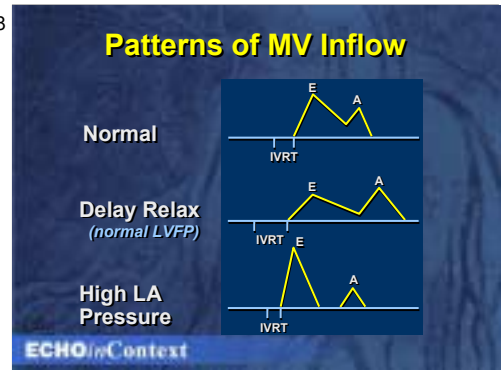
Progression of LVH and diastolic dysfunction in hypertension

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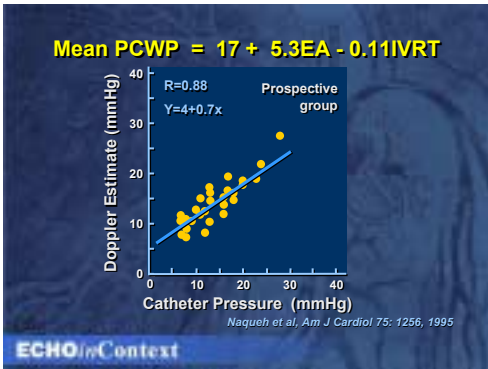
Filling pressures that can be evaluated by Doppler studies

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A normal mitral inflow and those with restrictive disease (bottom) may be similar. The whole story of diastole is not in the mitral tracings alone.

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Formula for wedge pressure in patients with decreased EF

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Issue	Echo Doppler Pitfalls
Technical	<i>all methods</i>
Aging	<i>relaxation</i>
Volume depletion	<i>relaxation</i>
Normal EF, HCM	<i>pressures by MV</i>
Pseudonormal MV	<i>need other methods</i>

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Pitfalls exist everywhere in Doppler but can be categorized.

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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

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Normal Doppler Velocities

S D
E A

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

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To fully evaluate diastolic filling, multiple sites need to be sampled

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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

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MVO: Pseudonormalization

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Mitral flow looks normal due to the combination of impaired relaxation and elevated filling pressures

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**LVEDP
PVa - Mitral A duration**

$r = 0.73$
 $p < 0.01$

Δd (ms)

EDP (mmHg)

Mayo Clinic

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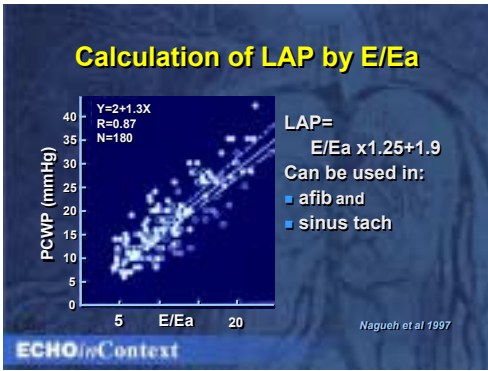
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Restrictive Physiology: High LAP

Annulus
E
A
Pressure
Mitral
D
S
Pulm Vein

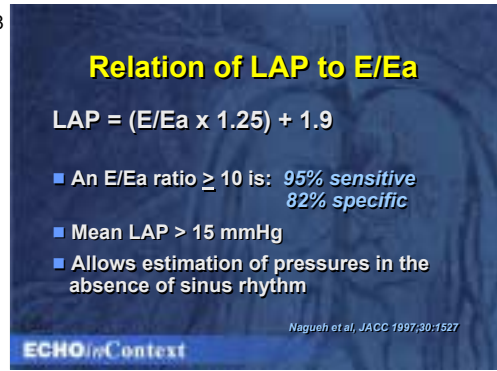
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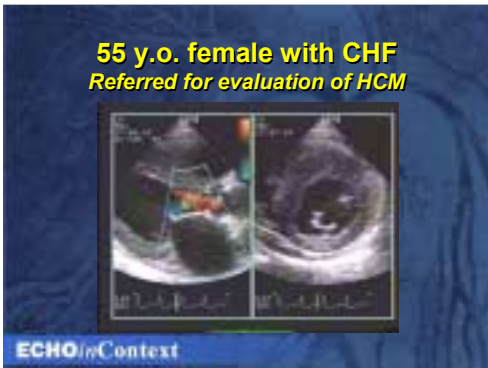
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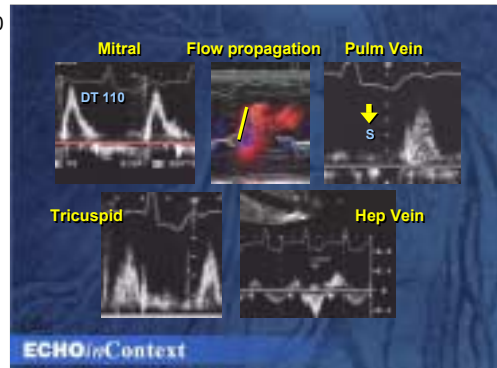
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Abnormal right and left sided flow suggests biventricular diastolic dysfunction and infiltrative disease

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Cardiac Amyloidosis



Prognosis worse when:

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

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Echo Assessment of Diastolic Failure

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

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