The added value of echocardiography in hypertensive heart disease

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האיגוד הישראלי לכירורגית לב וחזה
THE ISRAEL SOCIETY OF CARDIOTHORACIC SURGERY
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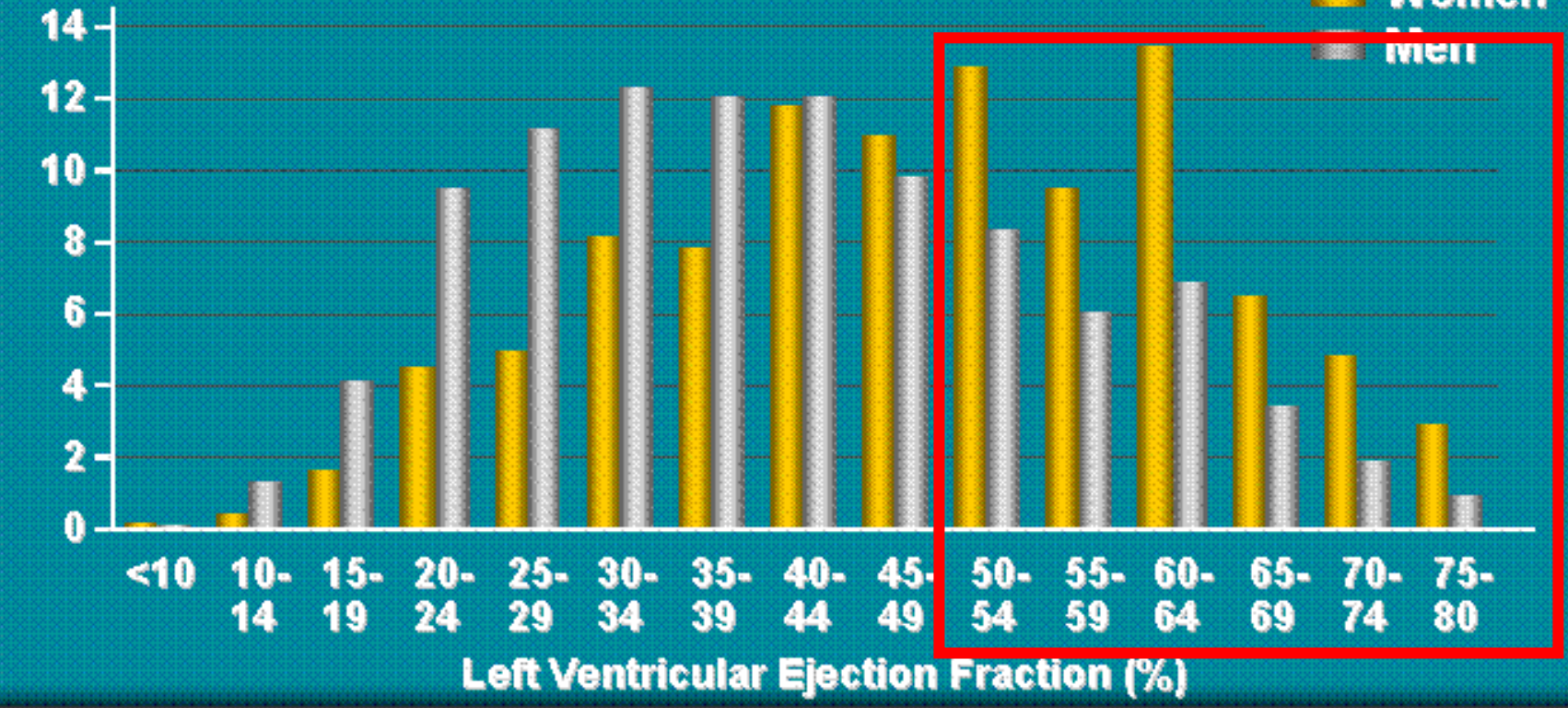
Euroheart Survey on HF
Distribution of Ejection Fraction

11 015 patients in 115 hospitals in 24 countries

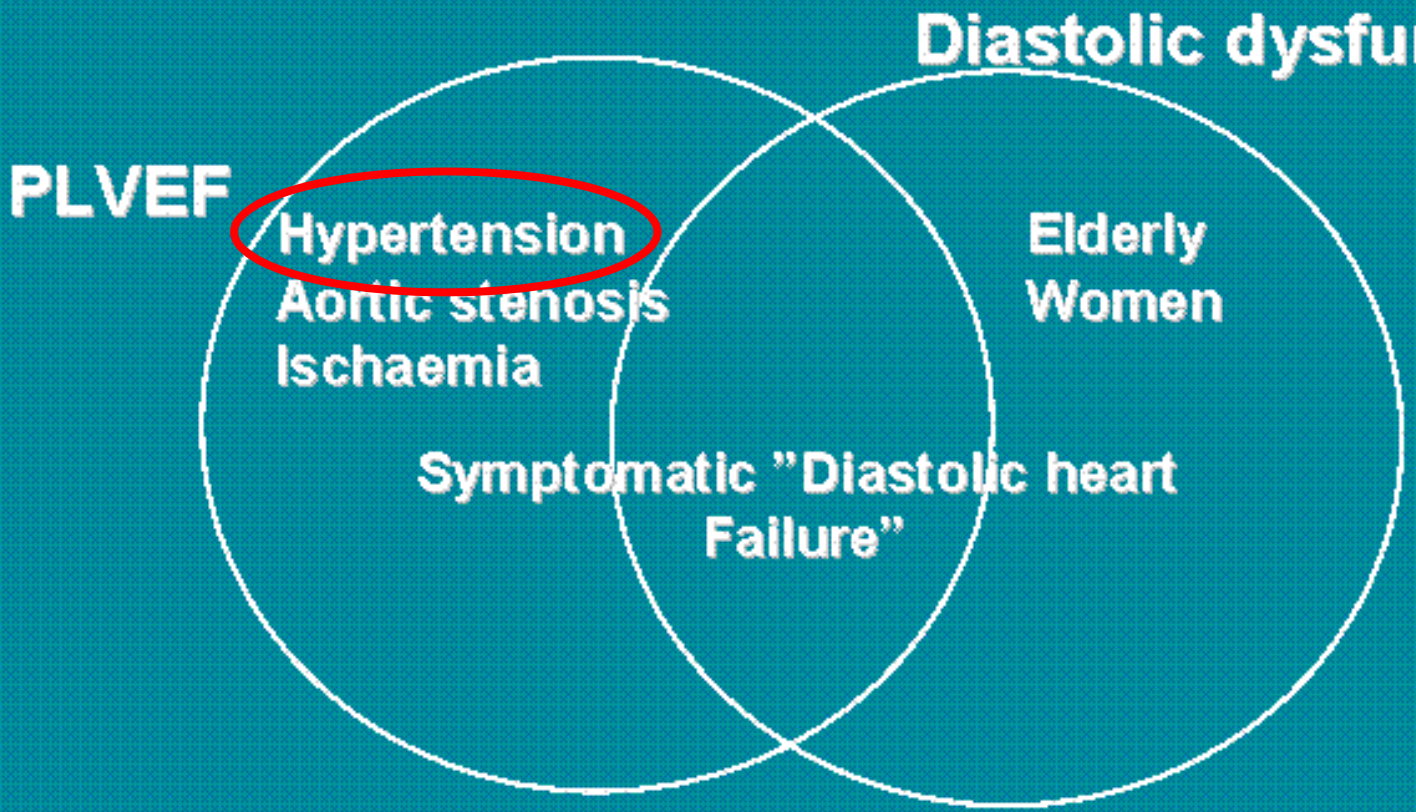
Cleland et al Euroheart Survey EHJ 2003



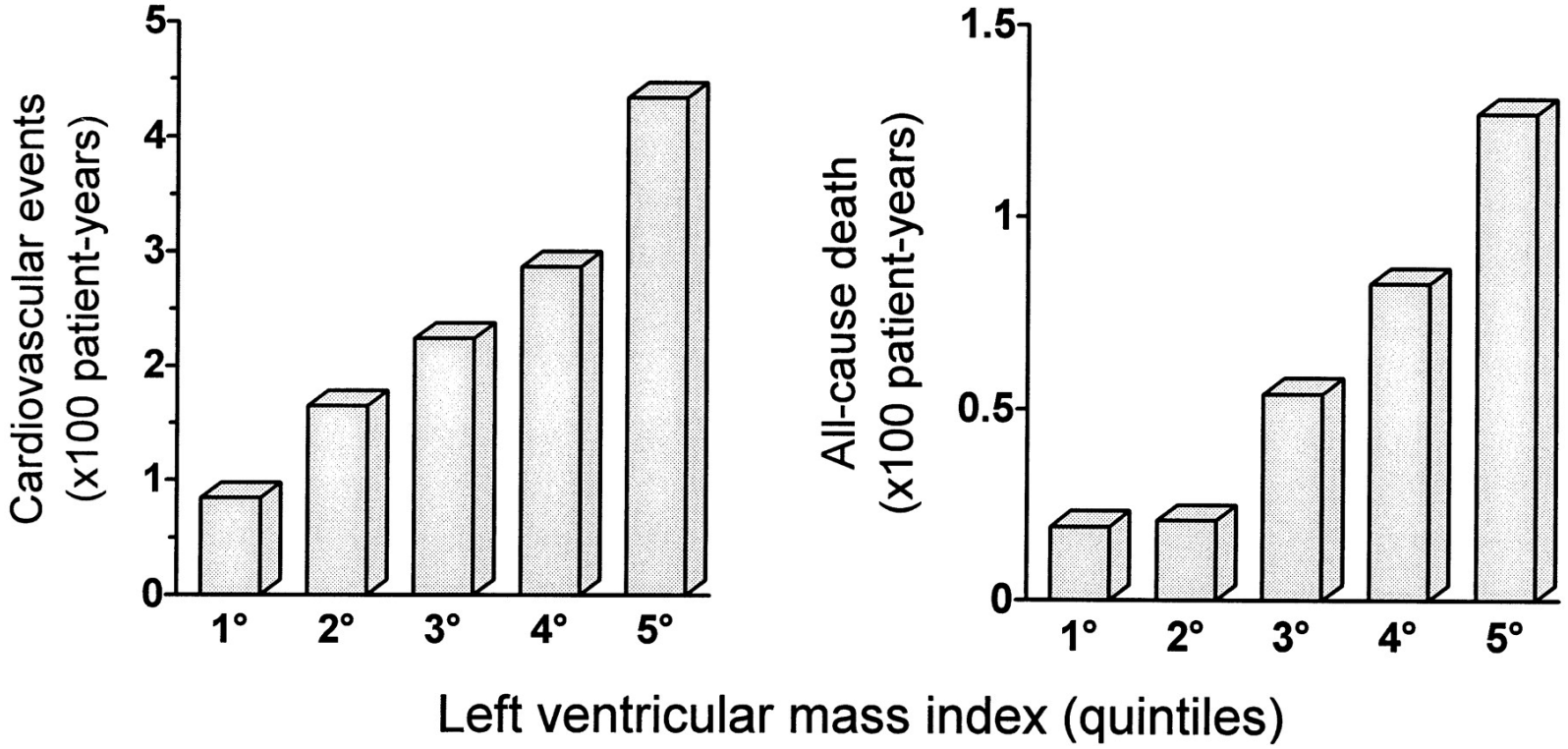
Diastolic dysfunction or Preserved Left Ventricular Ejection Fraction (PLVEF)

- Diastolic heart failure is often presumed to be present when symptoms and signs of heart failure occur in the presence of a PLVEF (normal ejection fraction/normal end-diastolic volume) at rest.
- Predominant diastolic dysfunction is relatively uncommon in younger patients but increases in importance in the elderly, in particular women, in whom systolic hypertension and myocardial hypertrophy with fibrosis are contributors to cardiac dysfunction.

PLVEF and diastolic dysfunction

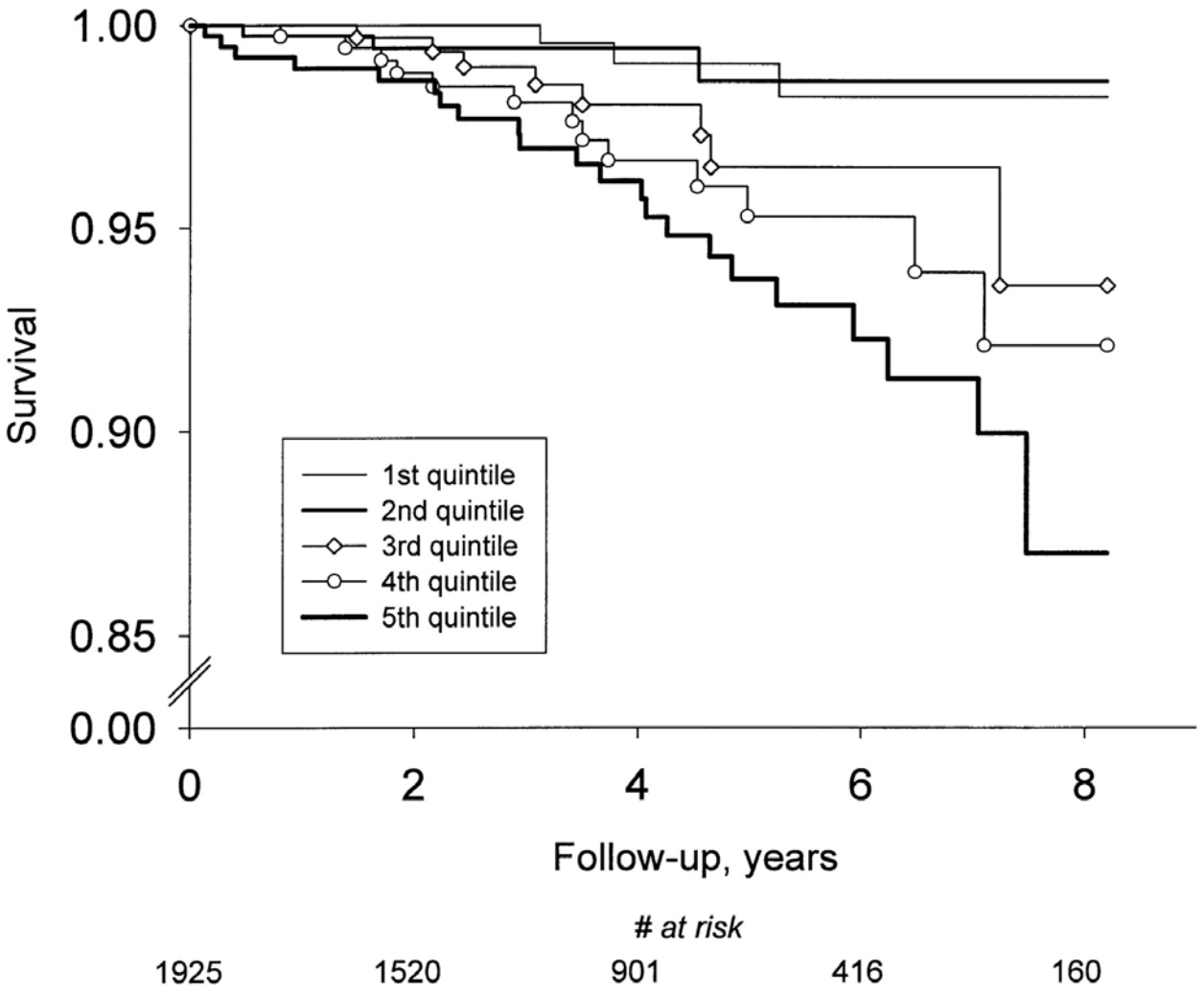


Progressive increase in cardiovascular morbidity (left) and all-cause mortality (right) rates from first to fifth quintile of distribution of LV mass index



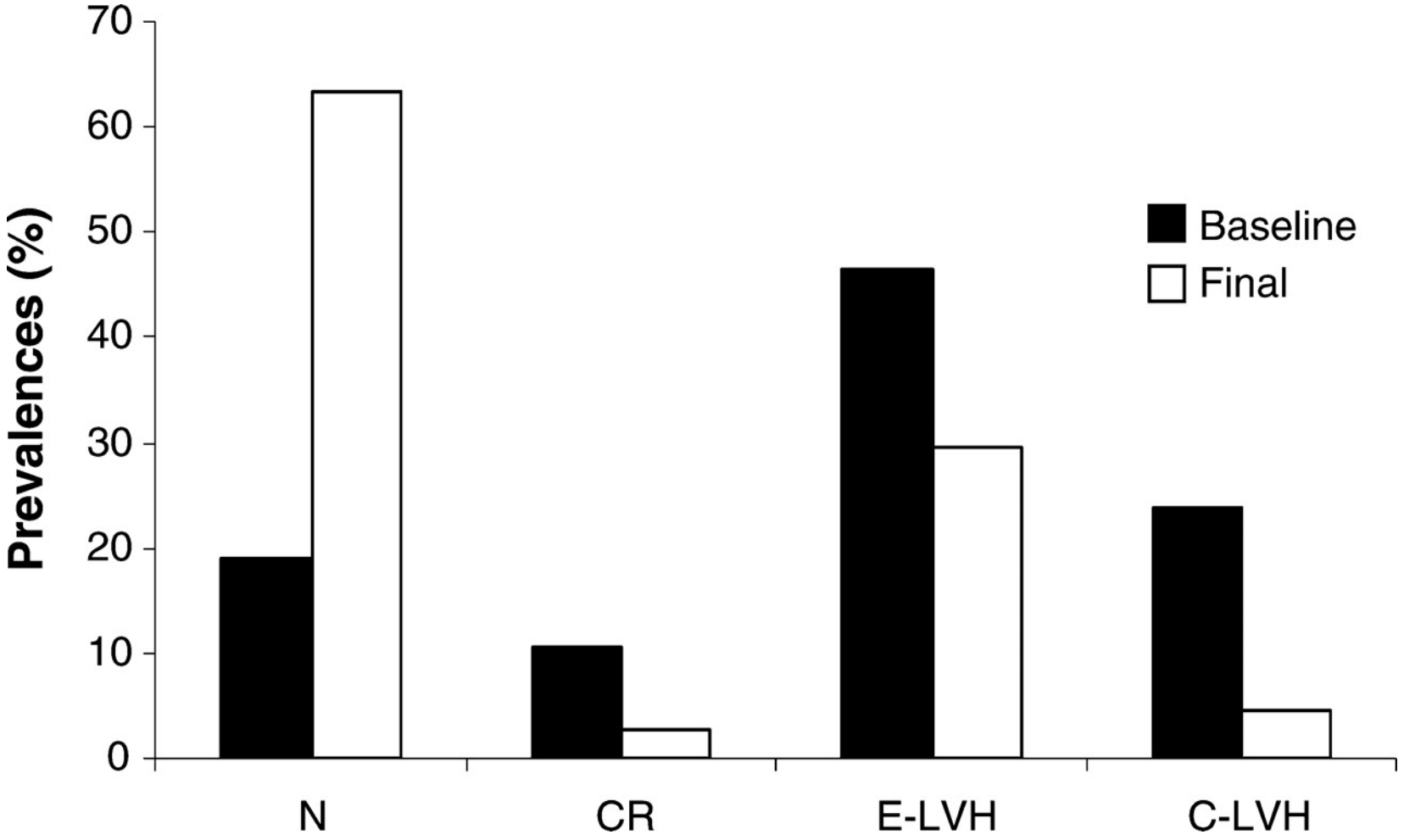
Schillaci, G. et al. Hypertension 2000;35:580-586

Cumulative survival by quintile of LV mass index



Schillaci, G. et al. Hypertension 2000;35:580-589

Left ventricular geometry at baseline and after 4.8 years antihypertensive treatment. (LIFE Trial)



Gerdts E et al. Eur J Echocardiogr 2008;9:809-815

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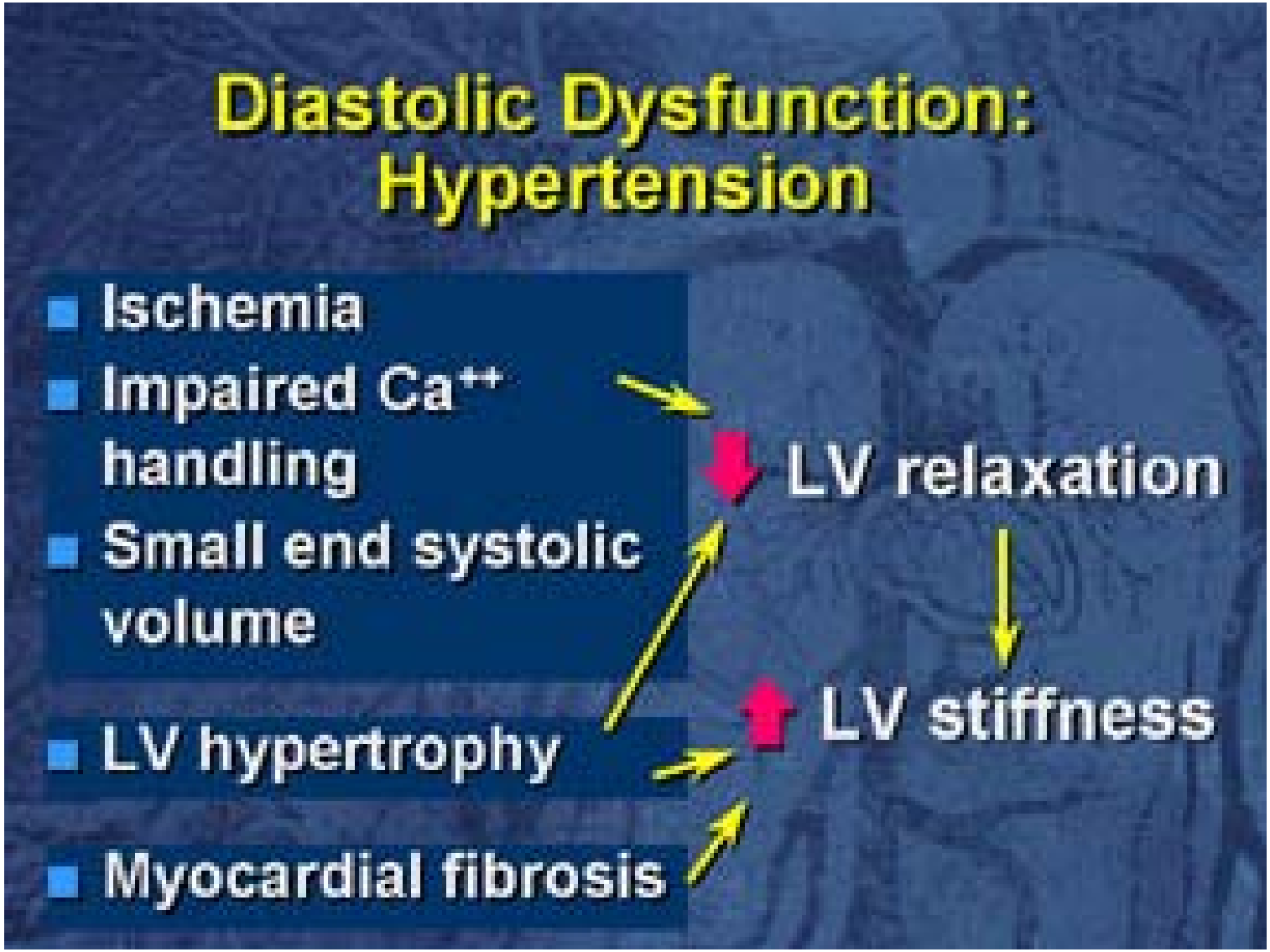
Diastolic Dysfunction:
Hypertension
Ischemia
Impaired Ca++ handling
Small end systolic volume
LV hypertrophy
Myocardial fibrosis
LV relaxation
LV stiffness

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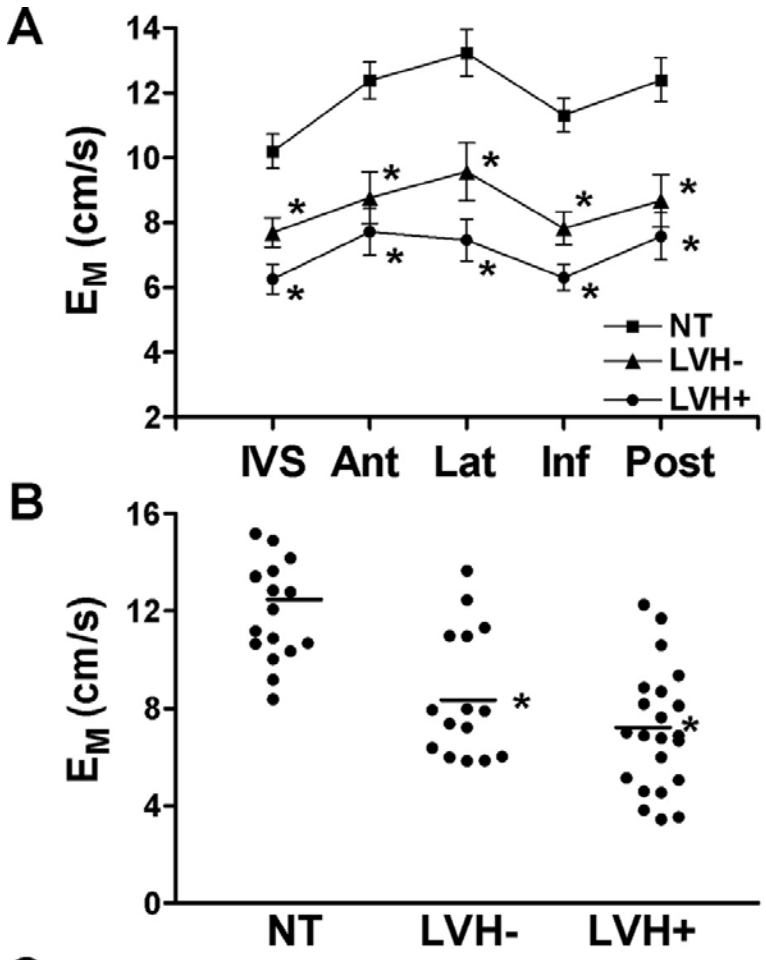
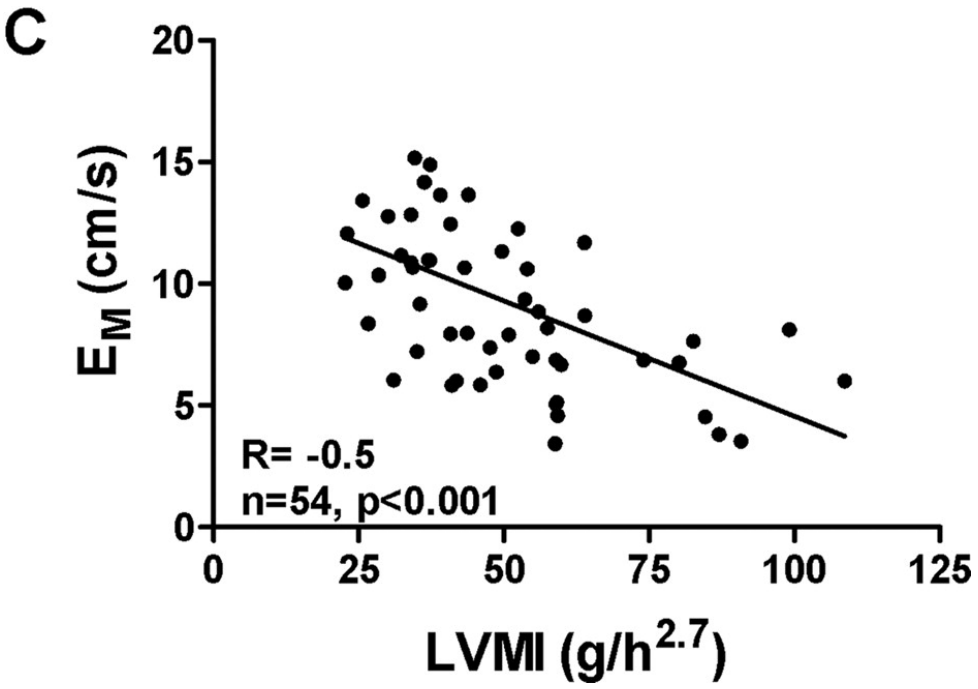
Diastolic function and Hypertension





Borges, M. C. C. et al. Hypertension 2006;47:854-860

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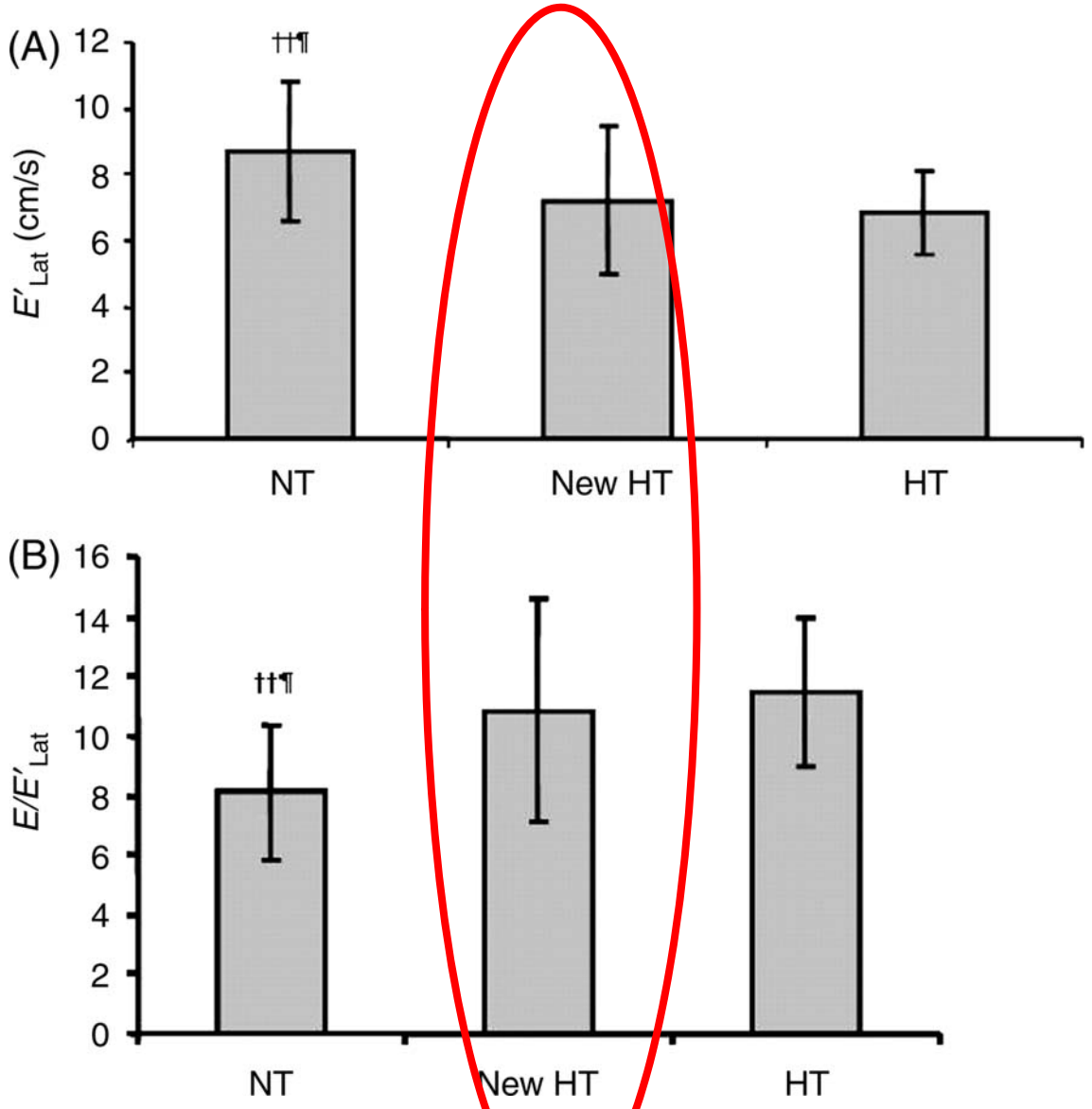
Diastolic function in Hypertension



Strand, A. et al. Eur J Echocardiogr 2008 9:34-39

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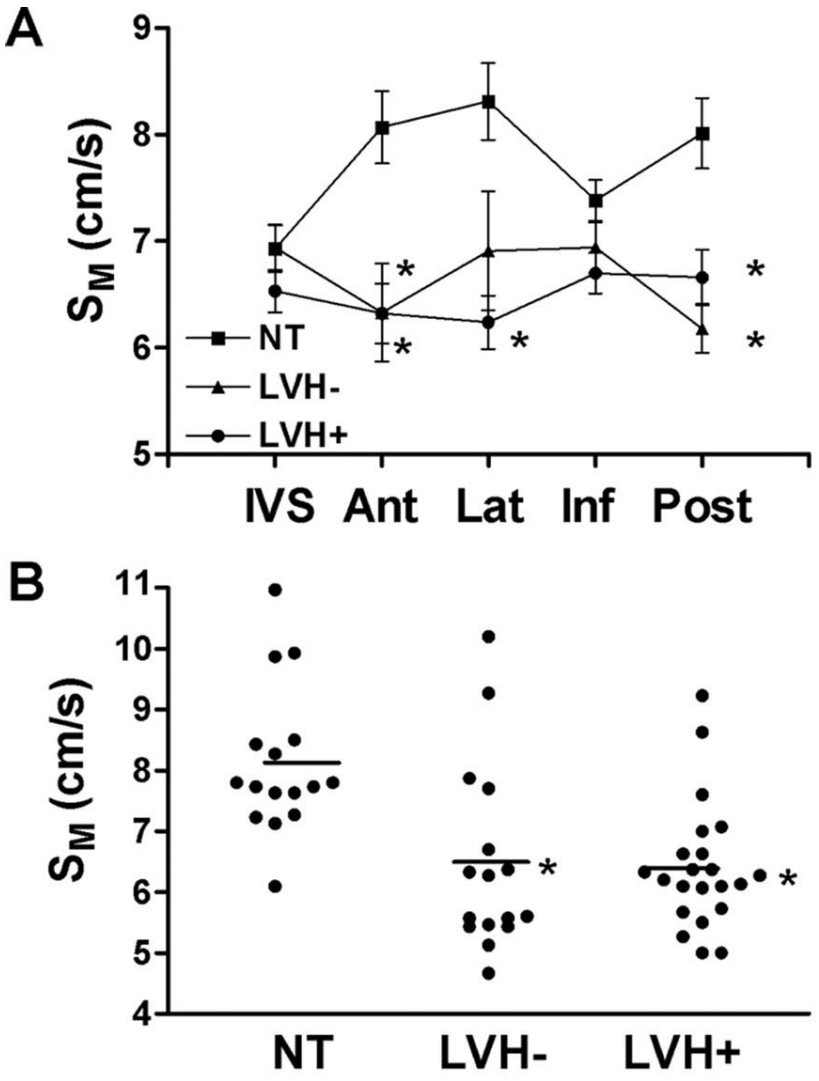
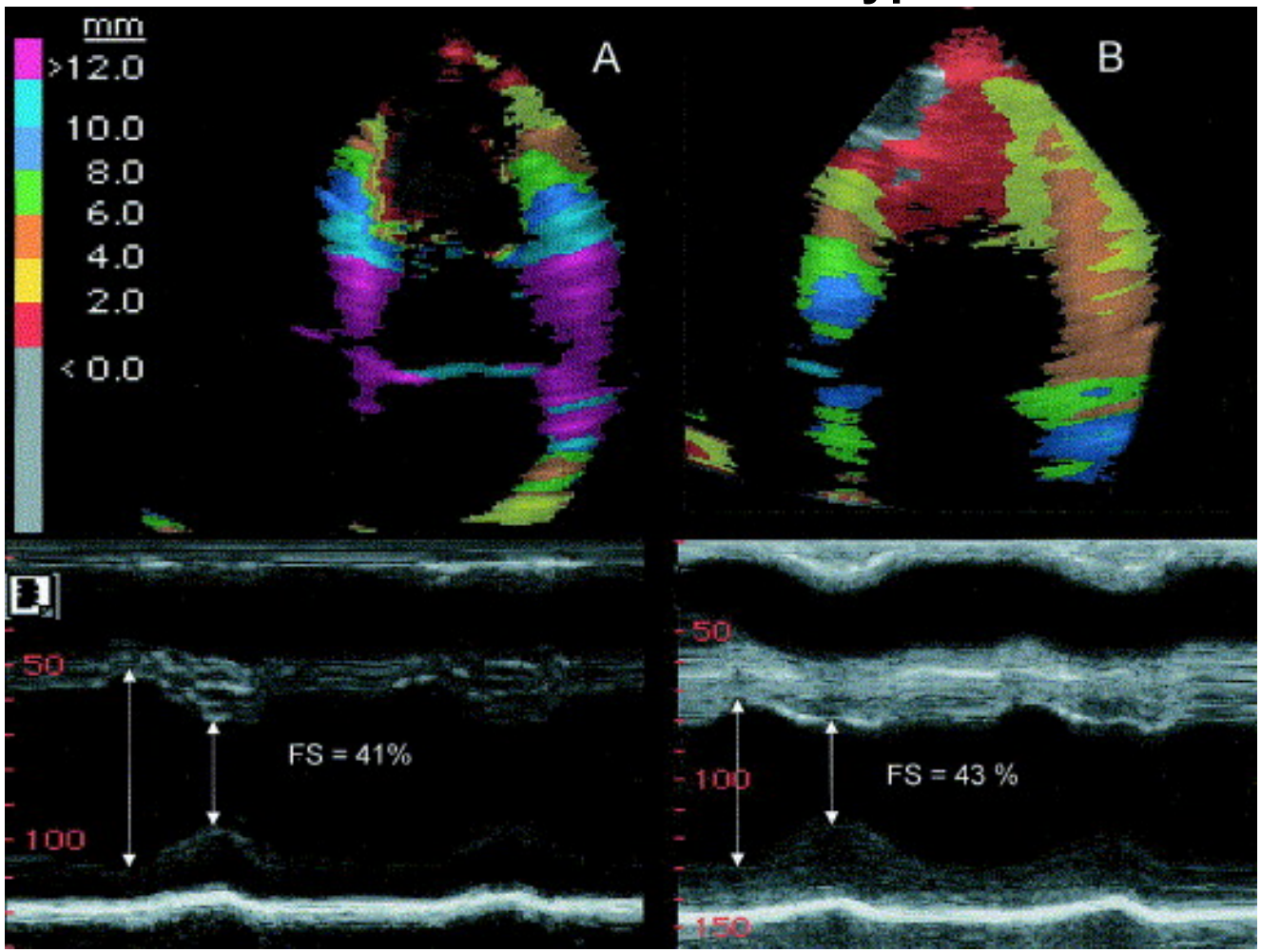
Systolic function and Hypertension



Borges, M. C. C. et al. Hypertension 2006;47:854-860

Tissue Tracking and LV systolic function in HTN

NORMAL **Hypertensive**



Poulsen SH et al J Am Soc Echocardiog 2003;16:724

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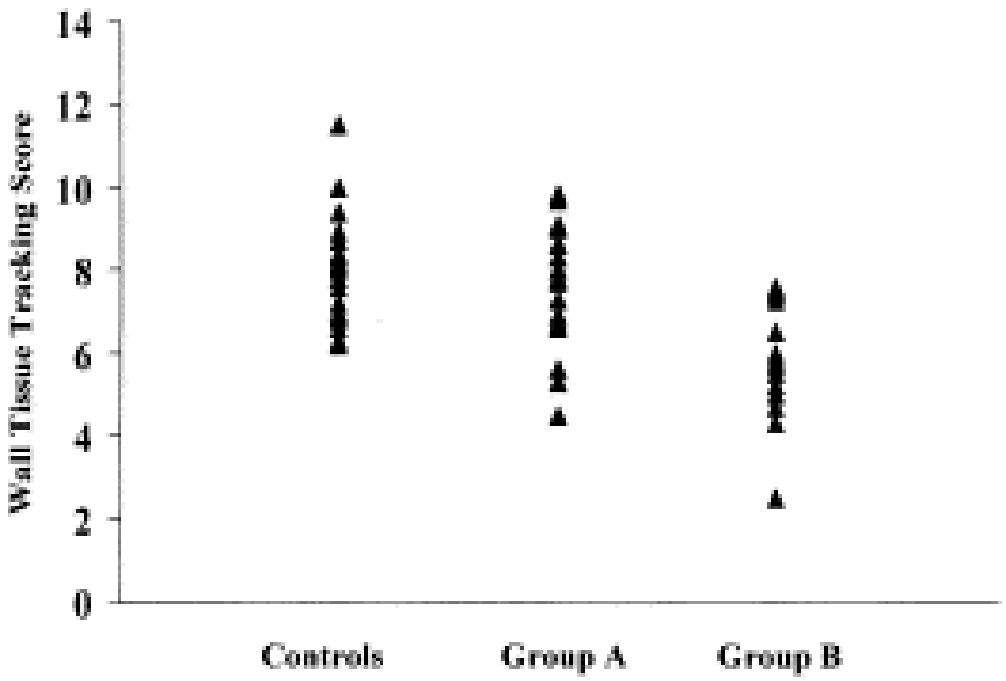
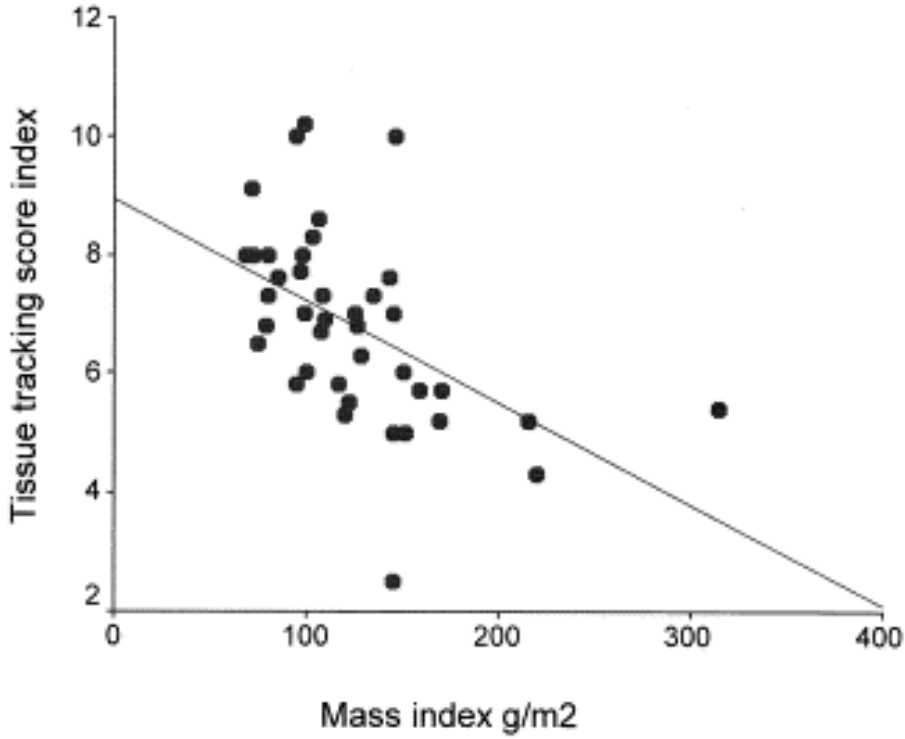
Tissue Tracking Score Index

LV Mass Index vs Tissue Tracking wall score index





Poulsen SH et al J Am Soc Echocardiog 2003;16:724

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Mitral Ring Displacement in HTN

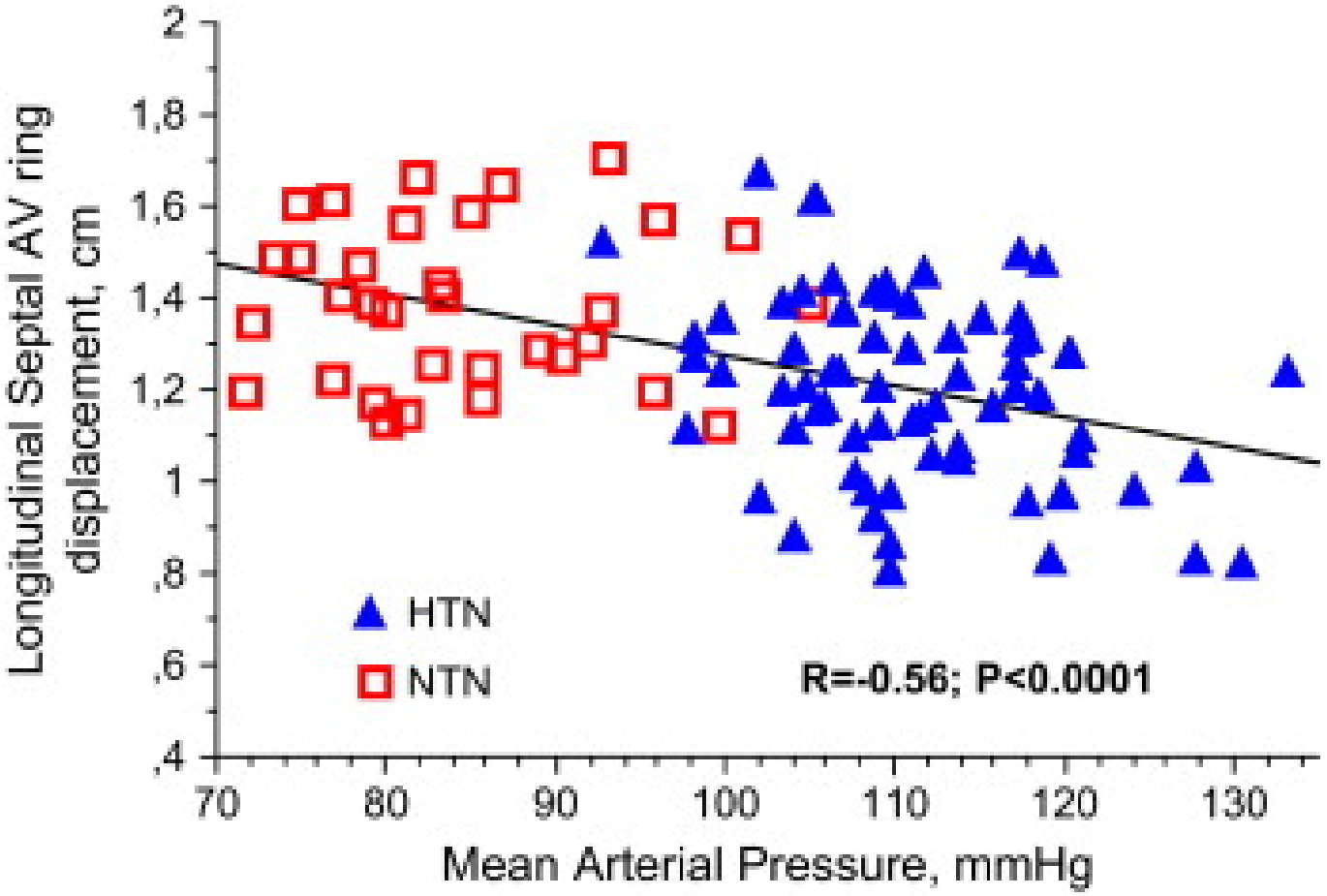
Table 4 Longitudinal mitral ring displacement in HTN and NTN

	HNT	NTN
Septum (mm)	$10.1 \pm 0.2^{\dagger}$	13.0 ± 0.3
Anterior wall (mm)	$11.2 \pm 0.3^{\dagger}$	13.5 ± 0.4
Lateral wall (mm)	13.8 ± 0.4	14.8 ± 0.4
Inferior wall (mm)	$12.7 \pm 0.3^{*}$	14.4 ± 0.5
Average over the four walls (mm)	$12.0 \pm 0.3^{\dagger}$	13.9 ± 0.3

$^{*}p < 0.005$ and $^{\dagger}p < 0.0001$.

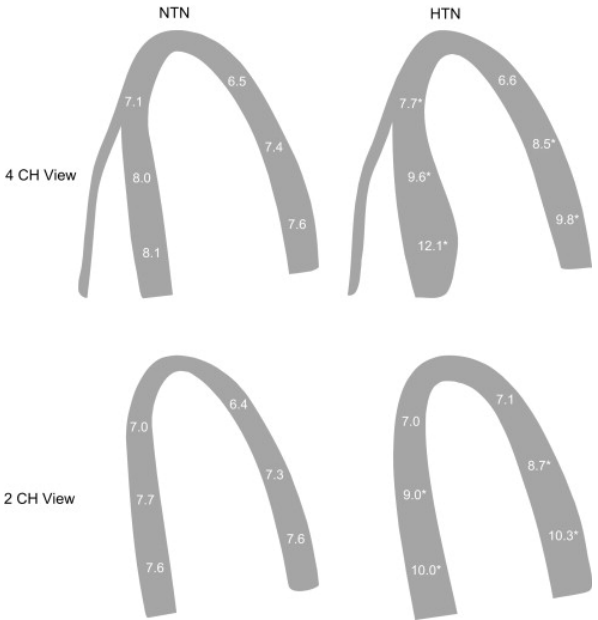
Baltabaeva A et al Eur J Echocardiogr 2007

Longitudinal Septal displacement and MAP



Baltabaeva A et al Eur J Echocardiogr 2007

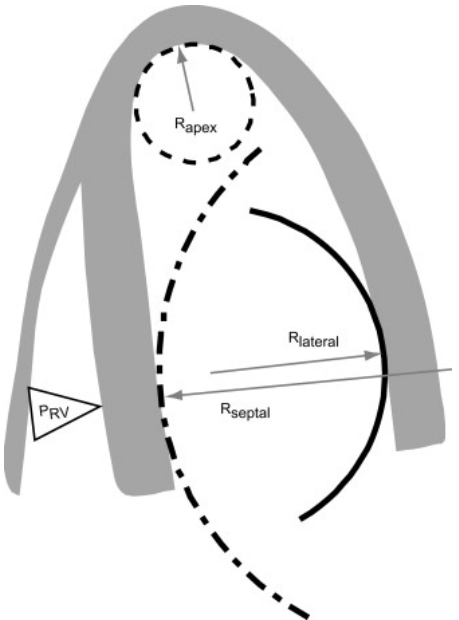
Patterns of Hypertensive Heart



Baltabaeva A et al

Eur J Echocardiogr

2007



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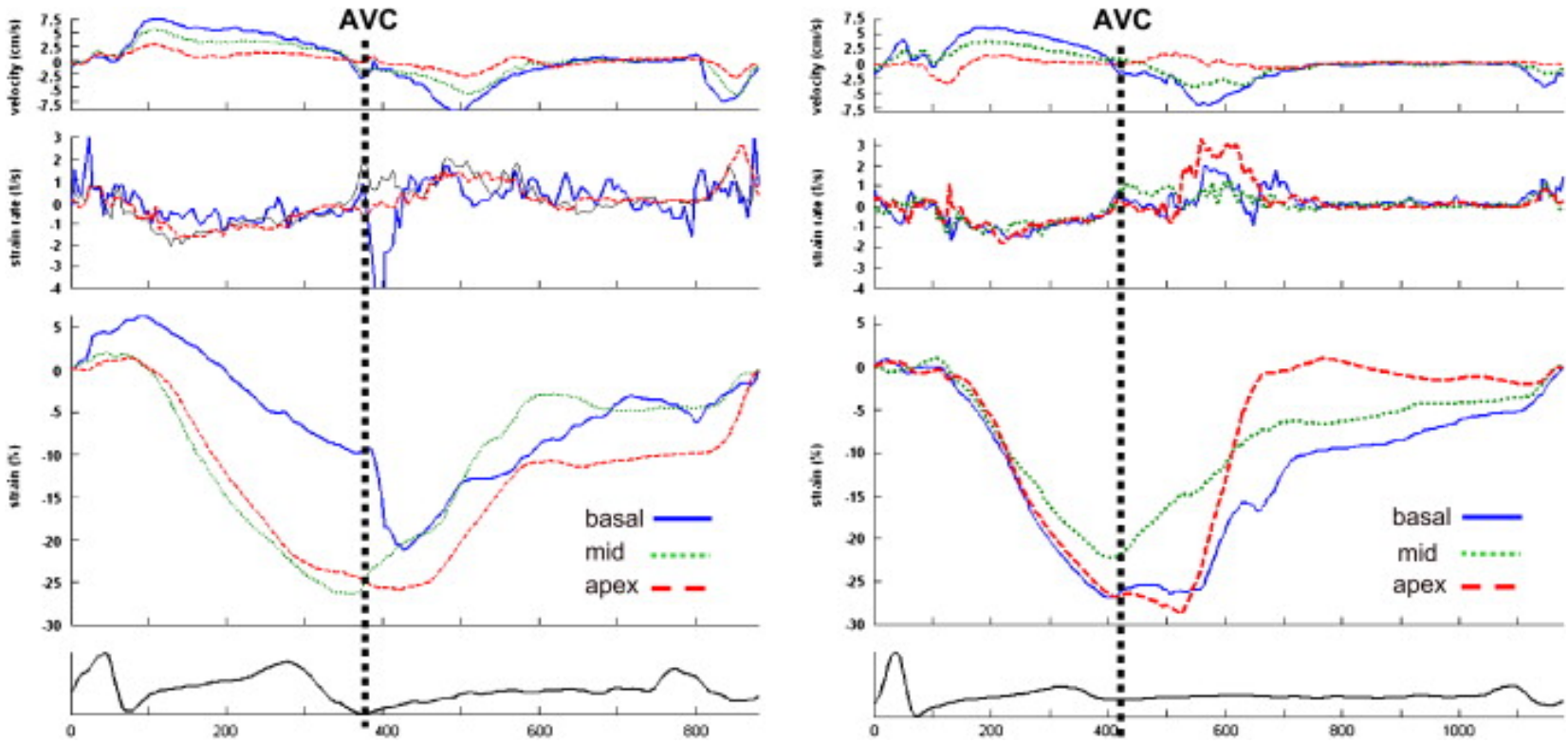
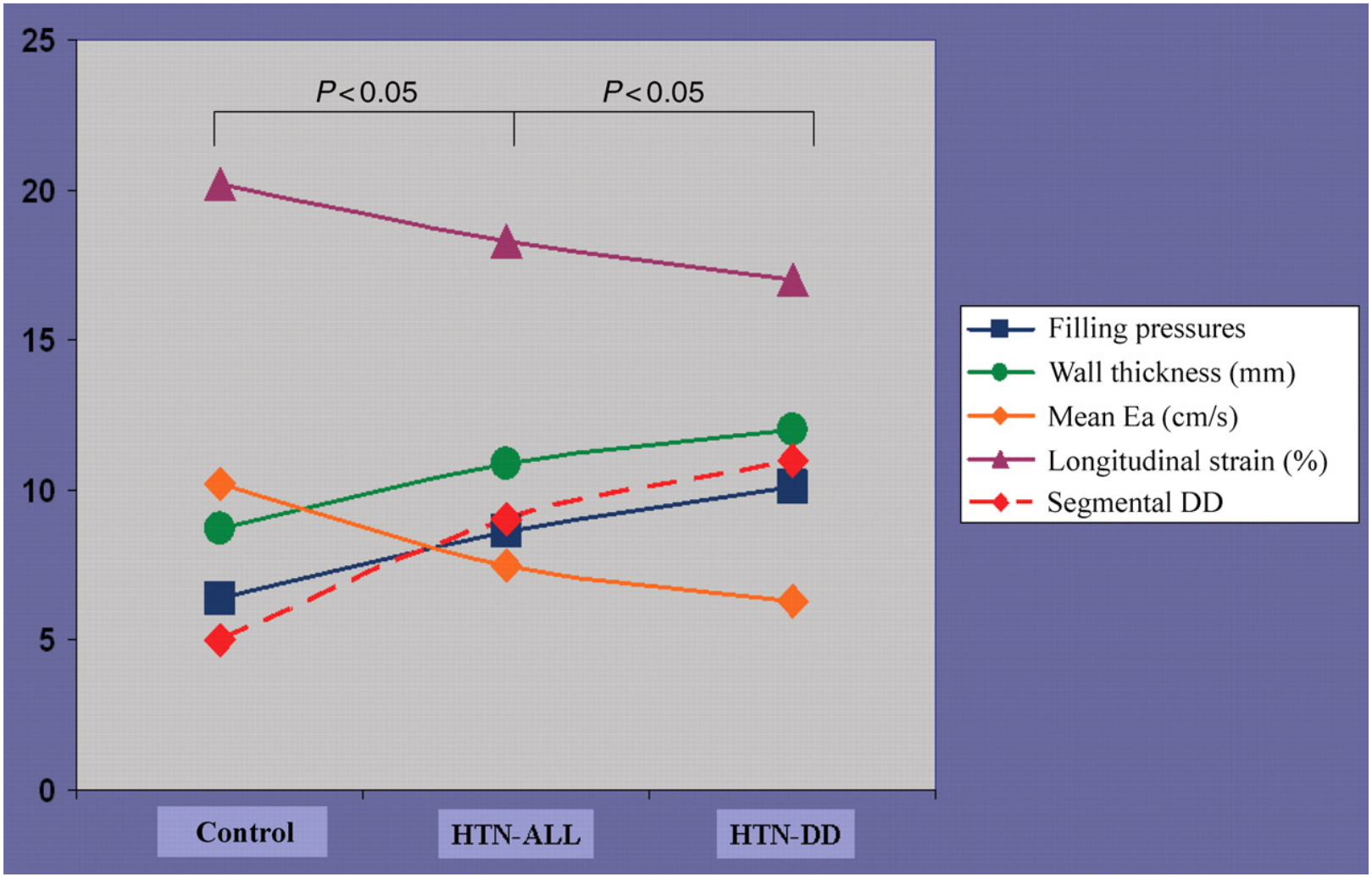
Septal velocities, S/SR

HTN **Non HTN**



Baltabaeva A et al Eur J Echocardiogr 2007

Graph representing the parallel changes in mean Ea, longitudinal strain, as well as filling pressures, wall thickness and number of segments with altered relaxation pattern-Segmental



Pavlopoulos H et al. Eur J Echocardiogr 2008;9:741-747

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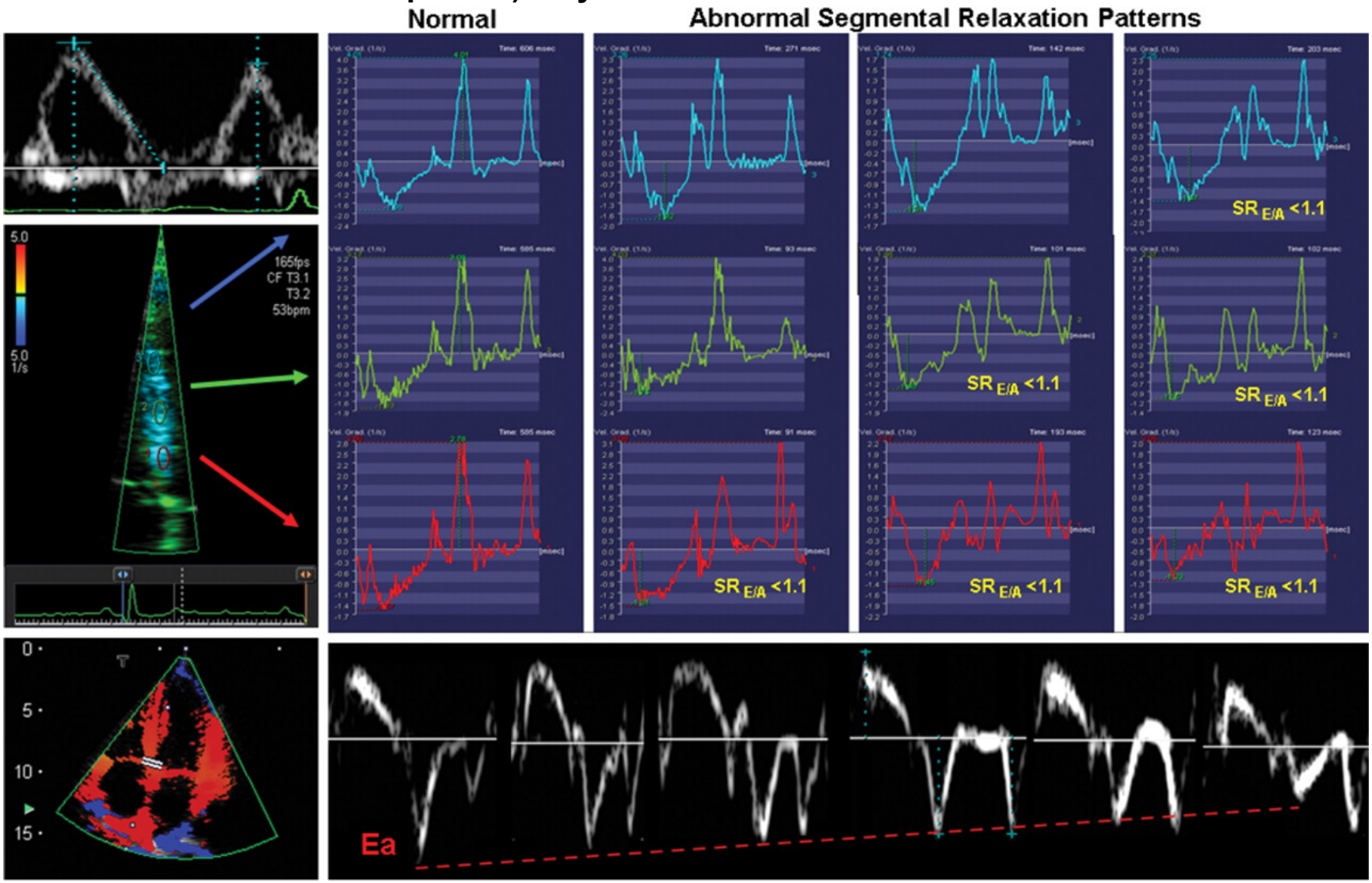
Relation of abnormal segmental relaxation and annular septal Ea. Blood pool indices (upper left picture) may remain within normal limits.



Pavlopoulos H , Nihoyannopoulos P Eur J Echocardiogr 2009;10:654-662

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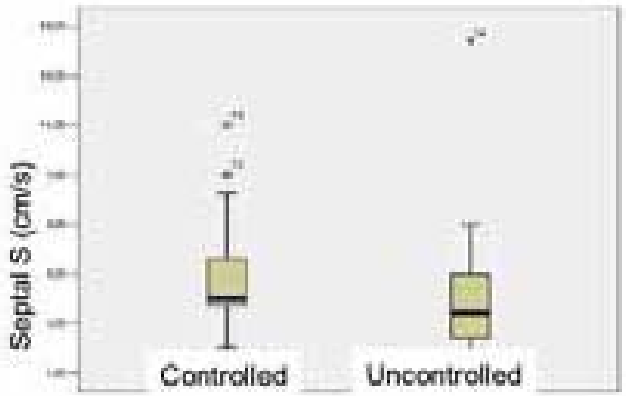
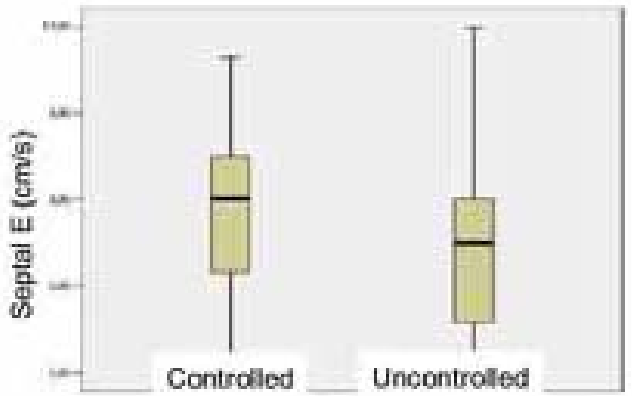
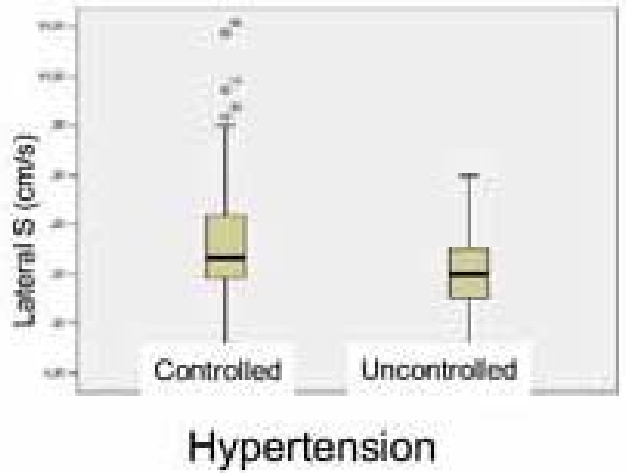
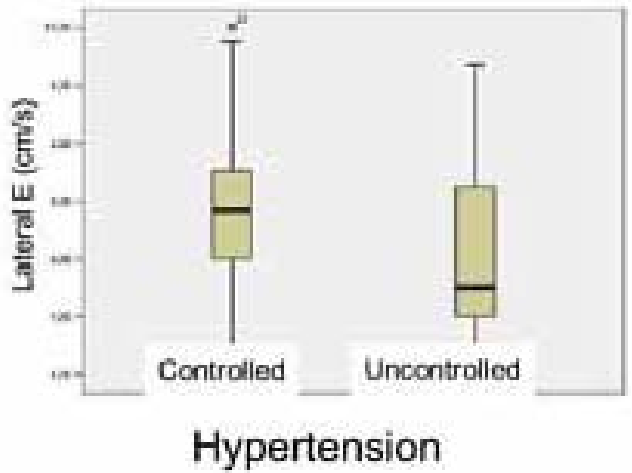
Hypertensive Heart Disease









Sousa C, Gonçalves S, Pinto FJ Rev Port Cardiol 2010;29:49

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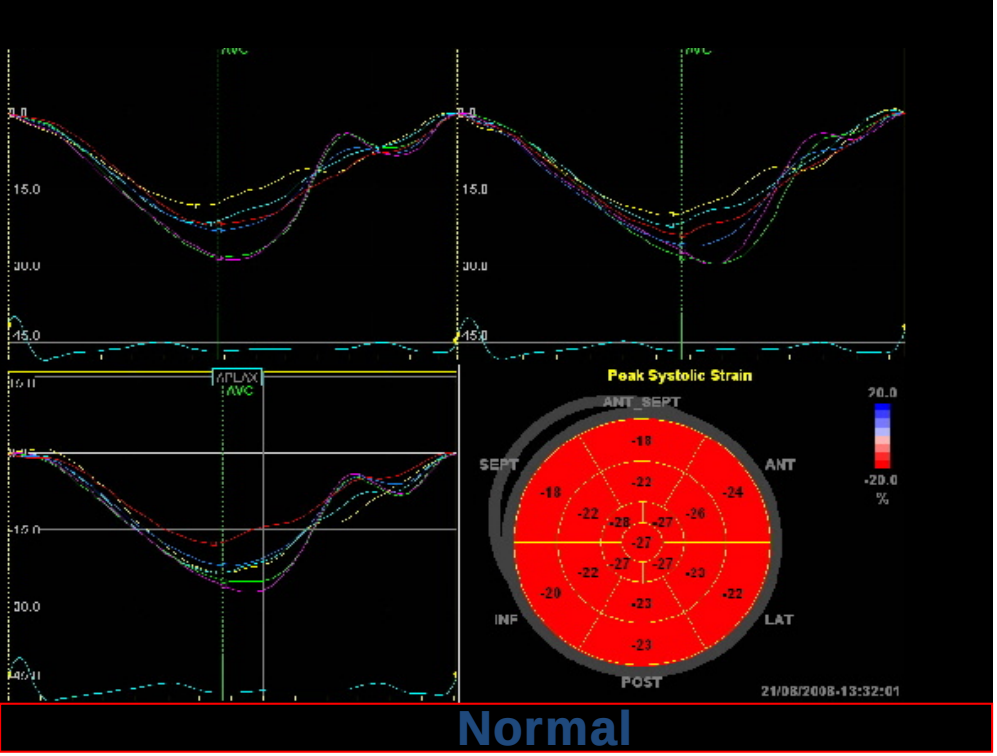
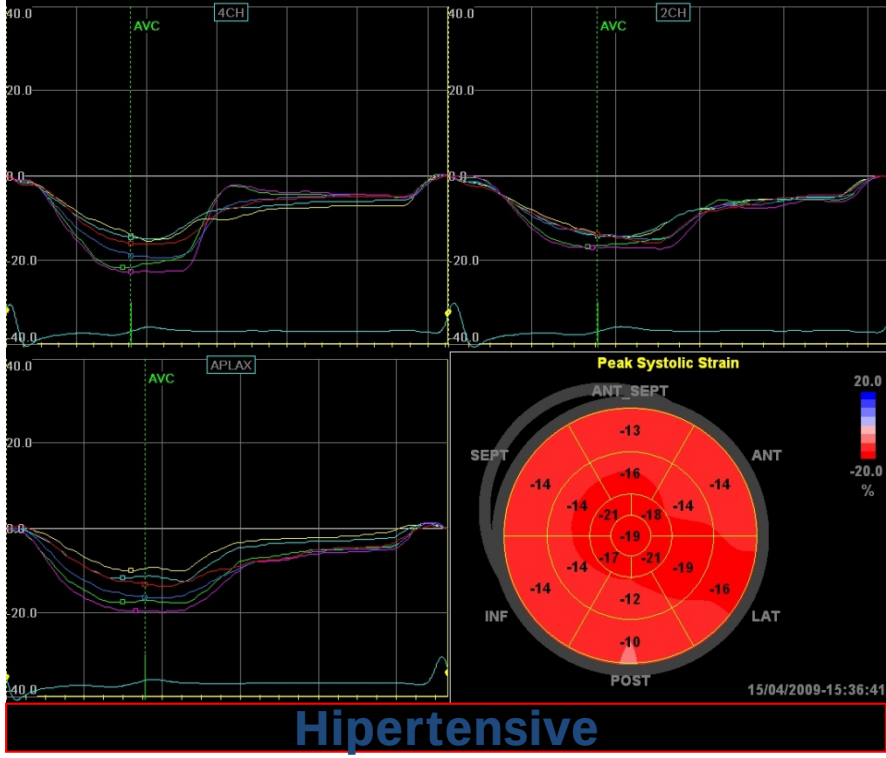


Normal



Hipertensive

	Control	HTN	p
GS (%)	-19,98 ± 2,17	-18,28 ± 3,09	**p = 0,015***
GSRs (1/sec)	-1,03 ± 0,14	-0,94± 0,19	**p = 0,021***
GSRe (1/sec)	1,43 ± 0,33	1,03 ± 0,28	**p <0,001***
GSRa (1/sec)	0,89±0,19	0,94±0,27	p = 0,234

Gonçalves S, Pinto FJ ESC 2009

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LV longitudinal and radial function in essential hypertension

- N=81 pts
- LV longitudinal systolic fx and radial deformation (strain-sE, SR, postsystolic strain psE)

sE (%)	Controls	NYHA I	NYHA II	NYHA III	NYHA IV
Septal basal	17,5+/-2,9	12,4+/-5,1*	12,2+/-4,8*	11,1+/-4,1*	4,3+/-3,8*§
Septal mid-api	20,7+/-4,8	20,6+/-4,1	20,7+/-3,3	17,1+/-4,2*.	7,4+/-4,7*§
Lateral basal	21,1+/-3,7	21,1+/-3,6	16,4+/-4,1*.	15,6+/-4,8*.	6,7+/-4,4*§
Lateral mid-api	22,06+/-2,9	20,5+/-3,9	19,8+/-2,7	17,3+/-4,4*.	10,7+/-3,9*§
Posterior basal	39,7+/-11,6	50,8+/-12,7*	39,7+/-15,5.	37,2+/-13,2.	16,3+/-9,1*§

p<0.05: * - vs controls; § - vs NYHA I, II and III; ╪ - vs NYHA I; ┼ - vs NYHA I and II

Plaksej R et al. EUROECHO 2007

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LV longitudinal and radial function in essential hypertension

- In hypertensive pts:
  - LV longitudinal fx progressively deteriorates from NYHA cl I to IV
  - LV radial fx enhances in the early phase (compensatory response?) and then declines

Plaksej R et al. EUROECHO 2007

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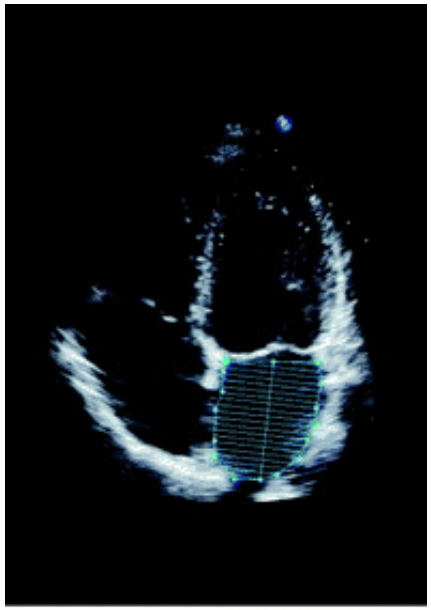
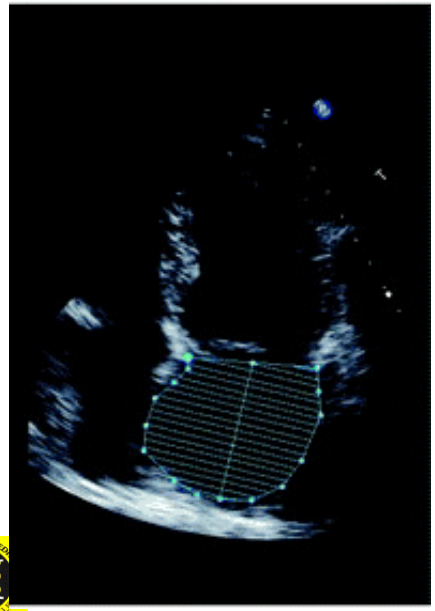
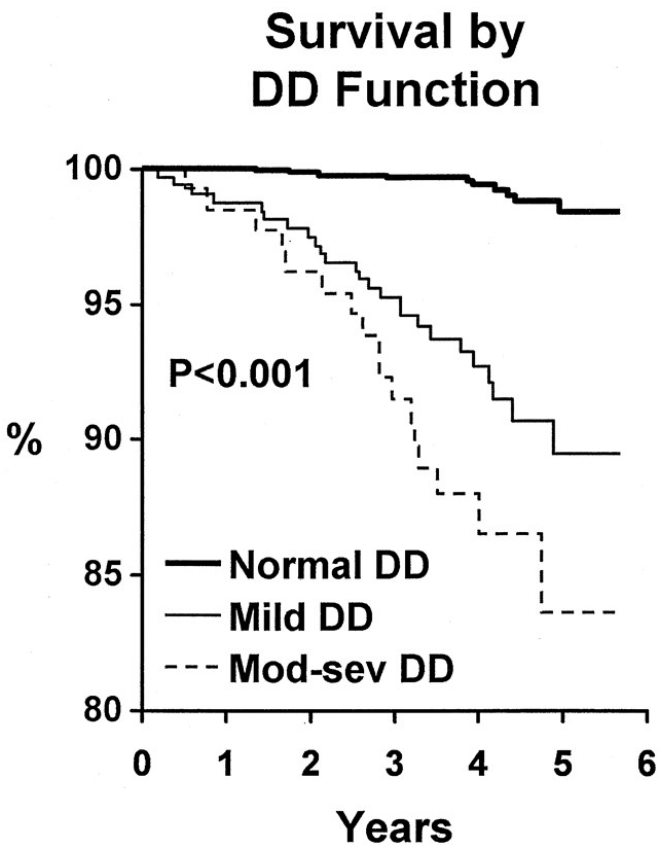
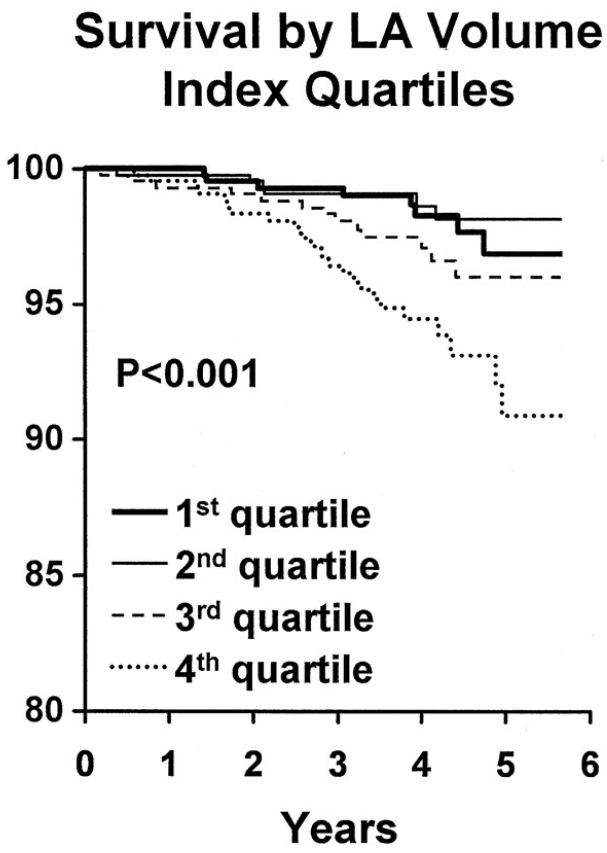
Relationships between severity of diastolic dysfunction (DD) (left) and left atrial (LA) volume index (right) and survival









Pritchett, A. M. et al. J Am Coll Cardiol 2005;45:87-92

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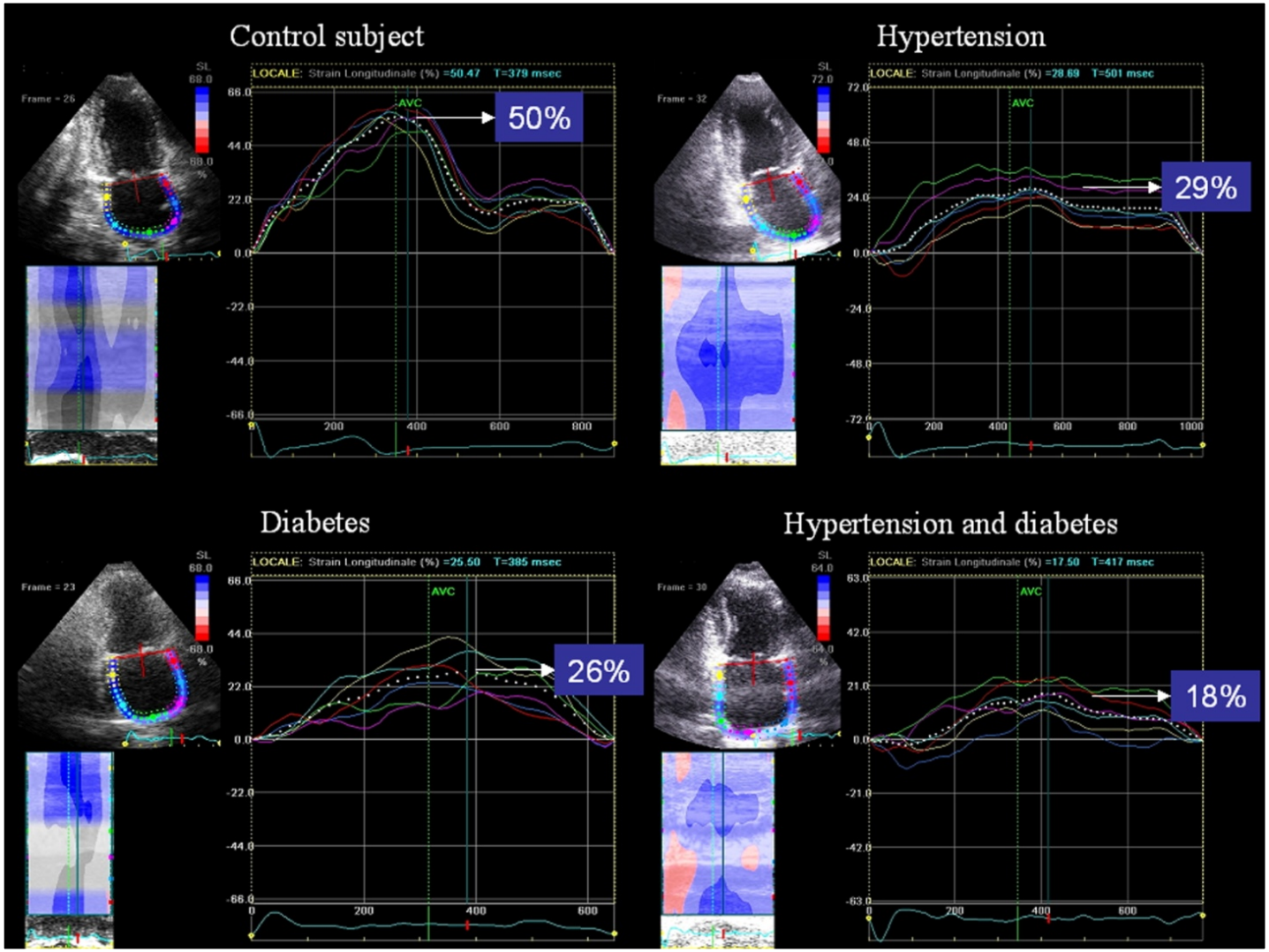
LA strain curves obtained from the apical four-chamber view in four example patients



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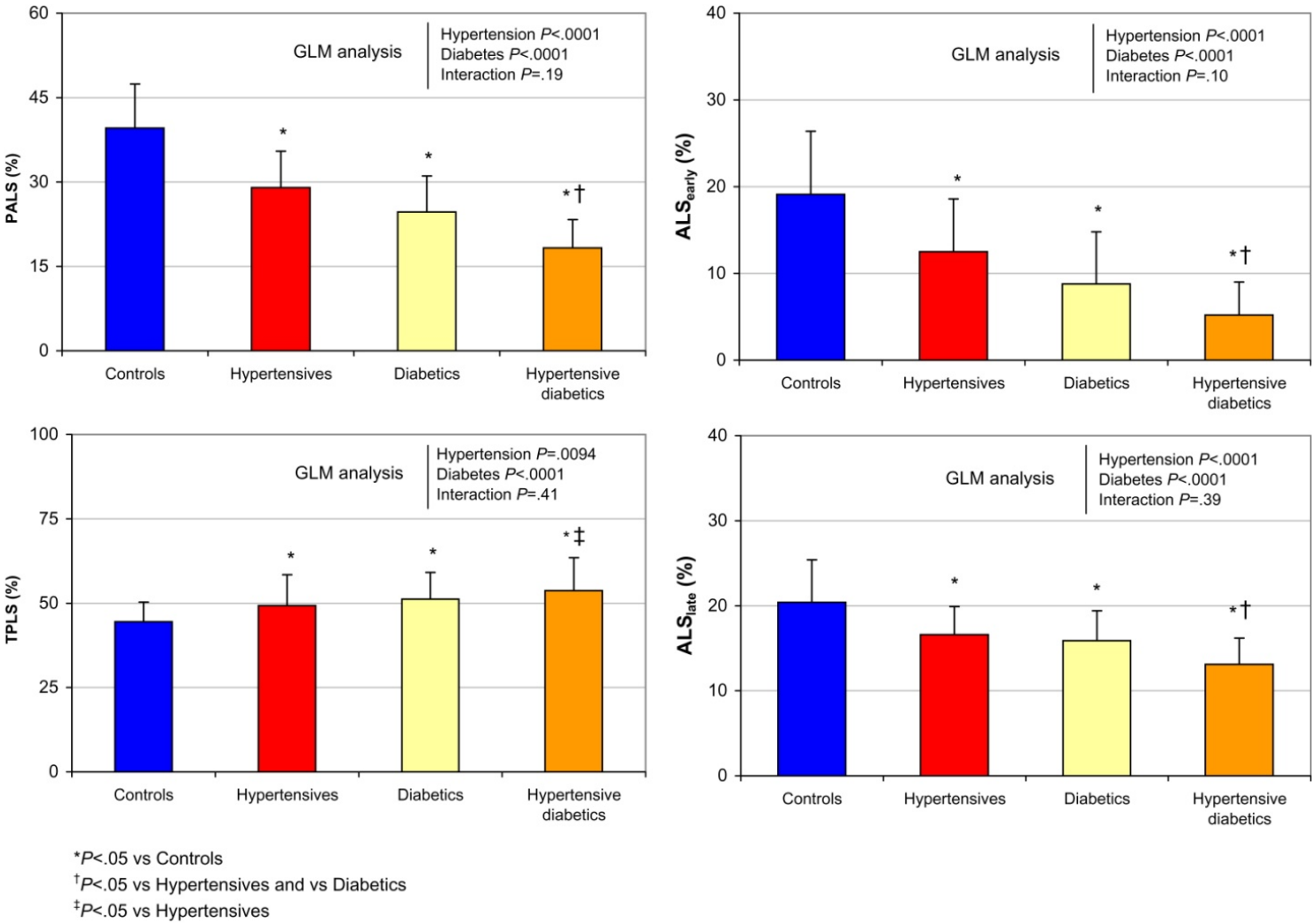
LA strain indexes in the four study groups.



*P<.05 vs Controls
†P<.05 vs Hypertensives and vs Diabetics
‡P<.05 vs Hypertensives

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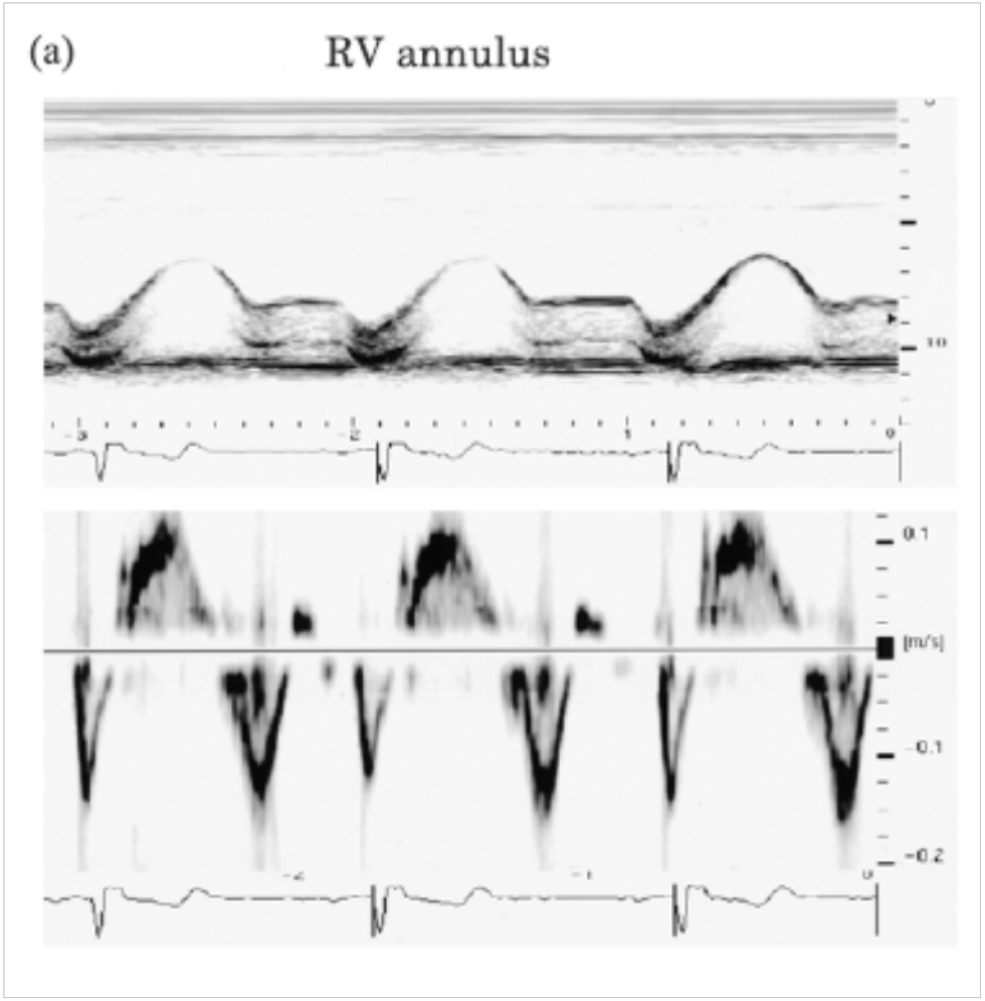
The importance of RV function



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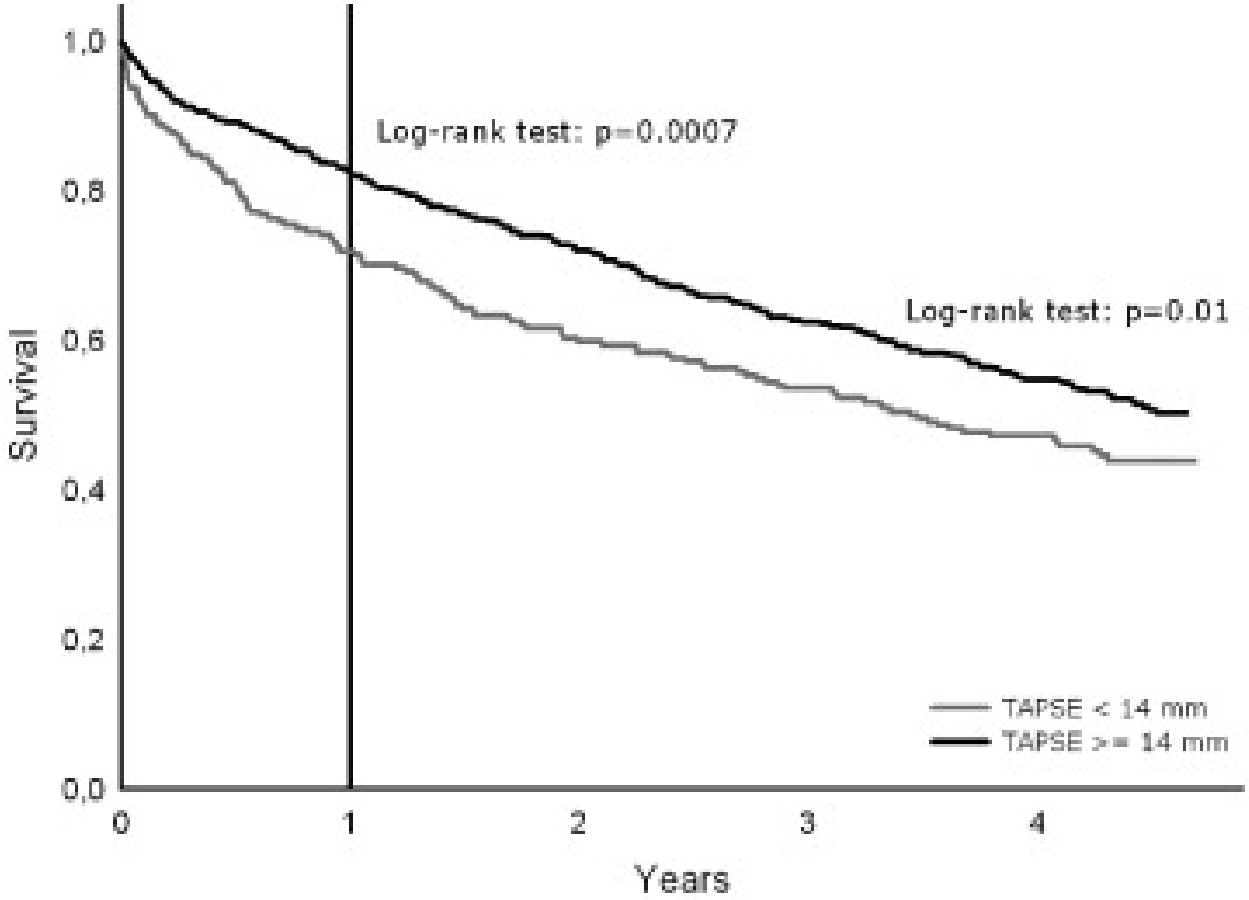
RV Dysfunction as a predictor of mortality in heart failure



Kjaergaard J et al Eur J Heart Failure 2007;9:610

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Tricuspid annular velocities/motion

	Systolic Velocity (s - cm/s)	Early Diastolic velocity (e' - cm/s)	Late diastolic velocity (a' - cm/s)	Tricuspid Annular motion (mm)
Group A (n=28)	19.3 +/- 4.5	16.3 +/- 3.4	13.2 +/- 3.9	29.6 +/- 5.5
Group B (n=31)	12.3 +/- 3.1	9.12+/- 3.0	13.9 +/- 4.7	24.4+/- 8.9
p	<0.01	<0.01	ns	<0.05

Sousa C, Gonçalves S, Pinto FJ 2008

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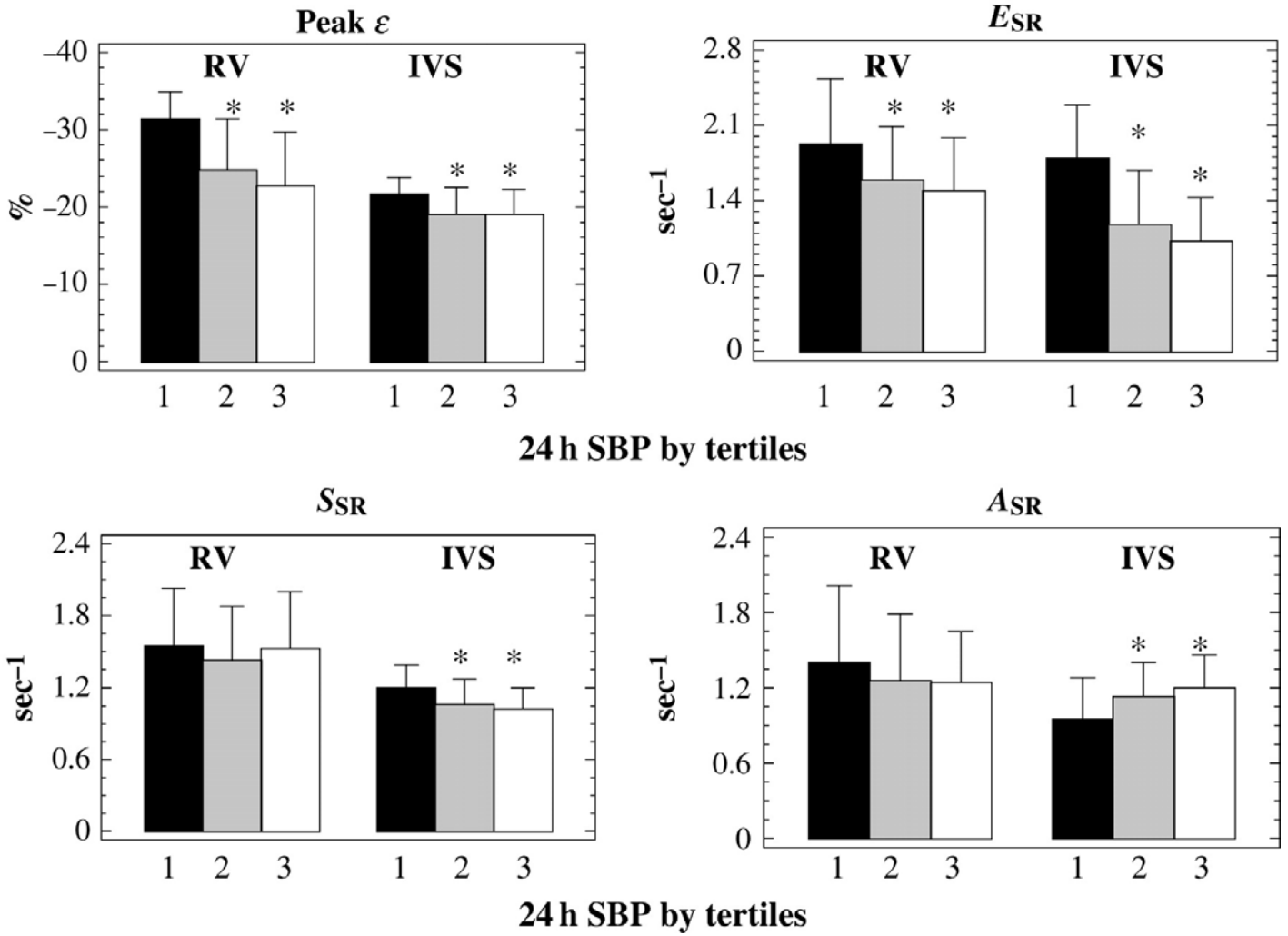
Peak systolic strain (peak ε, top left panel), and systolic (SSR, bottom left panel) and diastolic (early, ESR, top right panel, and late, ASR, bottom right panel) strain rate by ascending 24 h systolic blood pressure tertiles (n = 29, 30, and 30, respectively, cut-offs: 117 and 130 mmHg).



Pedrinelli R et al. Eur J Echocardiogr 2010;11:738-742

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Assessment of RV/LV Function in Hypertension

- Early impairment of systolic and diastolic function can be detected by tissue velocities and myocardial deformation parameters at early stages in hypertensive pts.
- RV assessment as a risk marker for HTN?
- Monitoring therapeutic interventions?

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Echocardiography in HTN

Thank you

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