

# EuroValve

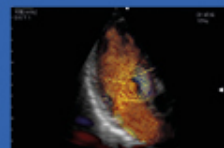
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## Exercise Testing/Echocardiography in Asymptomatic AS

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[www.eurovalvecongress.com](http://www.eurovalvecongress.com)

Disclosure related to this  
presentation: None

# VALVULAR HEART DISEASE

## Prevalence

### First valvular disease in Europe

- Severe AS
- Pooled prevalence in the elderly (>75 y)  
3.4% (4.9 million pts in EU)
- 50% are asymptomatic

# Management in severe AS

- **Surgery** → when symptoms develop

- **Asymptomatic patients** → matter of debate

- risk of sudden death
- risk of rapid progression
- risk of irreversible myocardial damage
- risk of shifting into a higher surgical risk category

- risk of surgery
- risks related to the presence of a prosthesis:
  - hemorrhagic
  - thrombotic
  - prosthesis dysfunction
  - endocarditis

# Management in asymptomatic severe AS

- based on a risk stratification algorithm

- rest echocardiographic parameters (**LVEF<50%, Vmax, Vmax progression, calcification +++**, **LVH**, **PHT**, **GLS**, **Zva**, **LA area etc...**)
- **exercise stress testing (exercise echocardiography)**
- **natriuretic peptides** BNP/Nt-pro-BNP (rest and exercise)
- MDCT (Aortic Valve Calcium scoring)
- CMR (Mid-wall fibrosis)
- PET/CT (?)

Role of exercise testing/echocardiography  
for risk stratification in asymptomatic  
severe AS?

# Prevalence of normal stress test

Study	n	Normal Stress Test Results
Alborino et al <sup>2</sup>	30	12 (40%)
Amato et al <sup>3</sup>	66	22 (33%)
Das et al <sup>4</sup>	125	79 (63%)
Lancellotti et al <sup>5</sup>	69	43 (62%)
Maréchaux et al <sup>6</sup>	50	26 (52%)
Peidro et al <sup>7</sup>	102	35 (34%)
Takeda et al <sup>8</sup>	49	36 (73%)

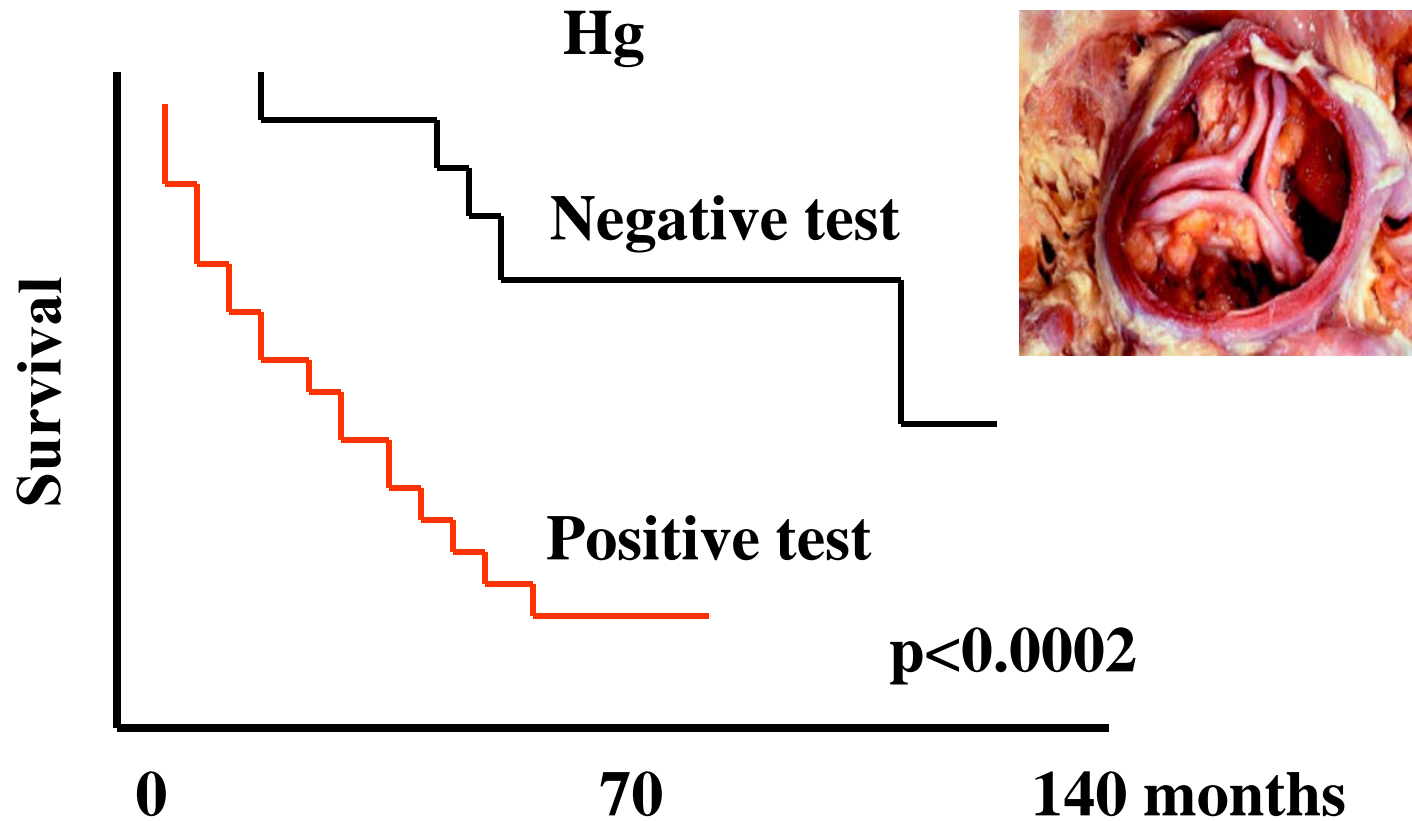
**Limiting symptoms in more than 1/3**

For unmasking symptoms in patients  
who claim to be asymptomatic



# *Risk Stratification with Exercise Testing*

30 asymptomatic patients, age =  $62 \pm 14$  years,  
AVA =  $0.7 \pm 0.2$  cm<sup>2</sup>, Peak Gradient =  $79 \pm 21$  mm



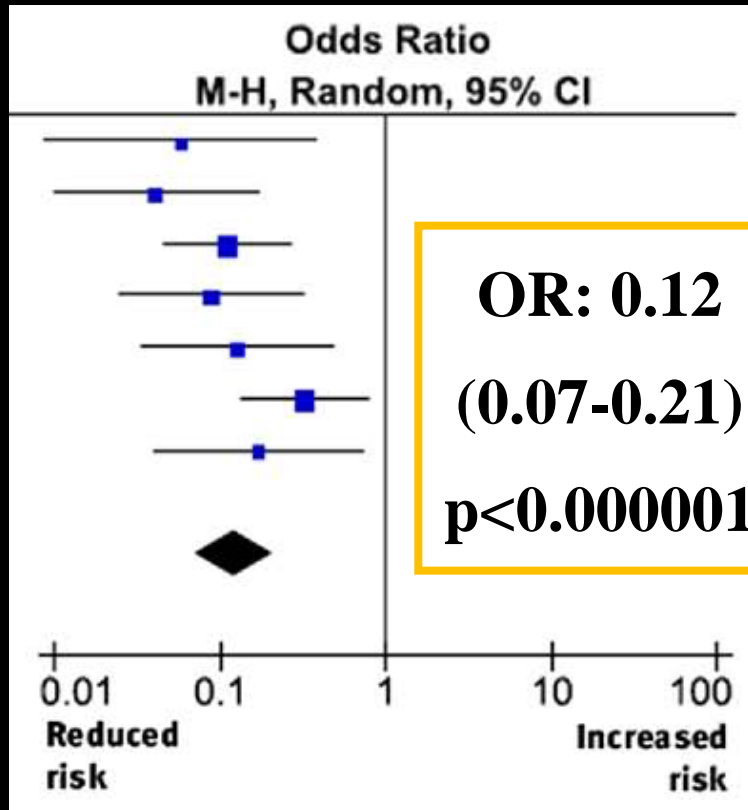
*Alborino D et al J Heart Valve D 2002; 11:204*

Courtesy of dr. J Magne

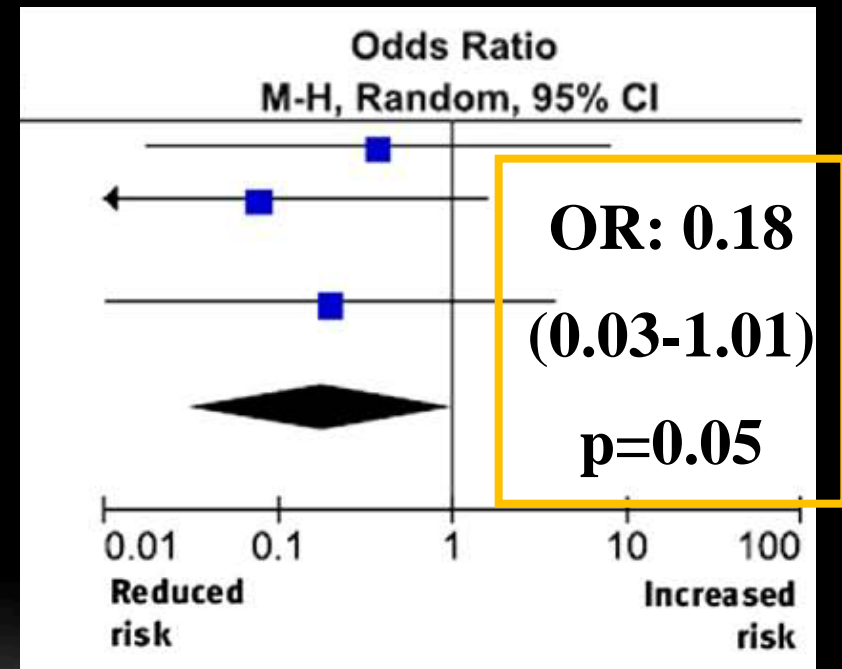
# Prognostic Value of Exercise Test in AS

**Meta-analysis: 7 studies, 2002-2007 491 pts**

## Risk for cardiac events



## Risk of sudden death (n=362)



**5% of pts with abnormal stress test  
vs. 0%**

# For Individual Risk Stratification

To aid to Clinical Decision Making  
and Guide the Type of Treatment

# Indications for AVR in AV Stenosis ACC/AHA/ESC Practice Guidelines

## **Asymptomatic pts with severe AS**

ACC/AHA (2008)

Symptoms or Fall in SBP IIb C

ESC (2012)

if symptoms I C

if fall in SBP IIa C

# Indications for AVR in AV Stenosis ACC/AHA/ESC Practice Guidelines

## Asymptomatic pts with severe AS

### ACC/AHA (2014)

Symptoms during exercise testing (I)

Decreased exercise tolerance or Fall in SBP  
(IIa)

### ESC (2012)

if symptoms

I

if fall in SBP

IIa

Physically  
active,  
<70yrs

# Role of Exercise-testing in AS

*Predictive value for onset of spontaneous symptoms within 12 months (125 pts)*

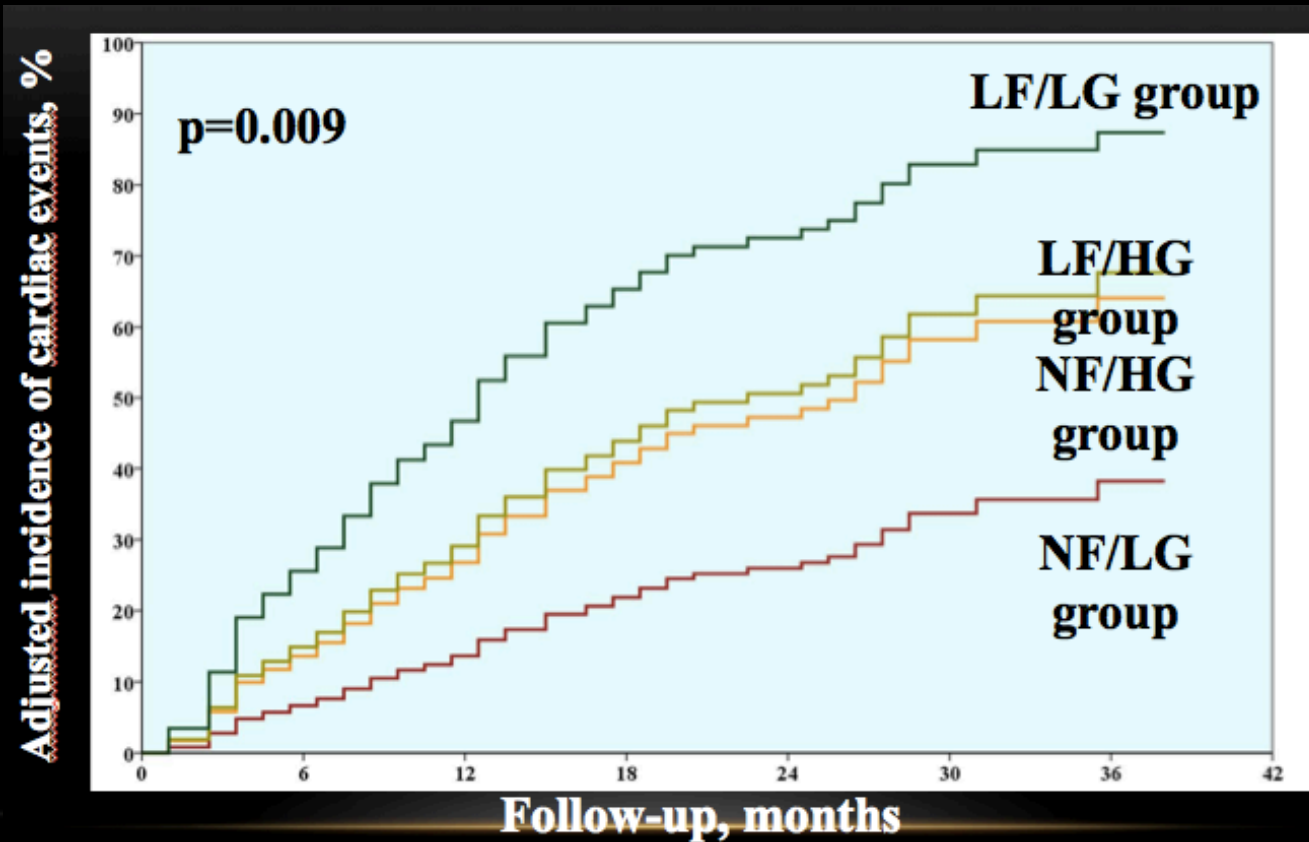
Predictor	NPV	PPV
Symptoms during exercise ( $p < 0.001$ )	(dizziness)	
whole population	87%	57%
physically active, <70yrs		79%
limited activity (> 70 yrs)		41%
Abnormal BP response ( $p = \text{NS}$ )	78%	48%
ST depression > 2mm ( $p = \text{NS}$ )	77%	45%

# Outcome in Asymptomatic AS

## Normal Exercise Testing

150 Pts, asymptomatic, AVA < 1.0 cm<sup>2</sup>, LVEF > 50%; Mean age: 69 ± 8

y



Can exercise stress echocardiography  
help?

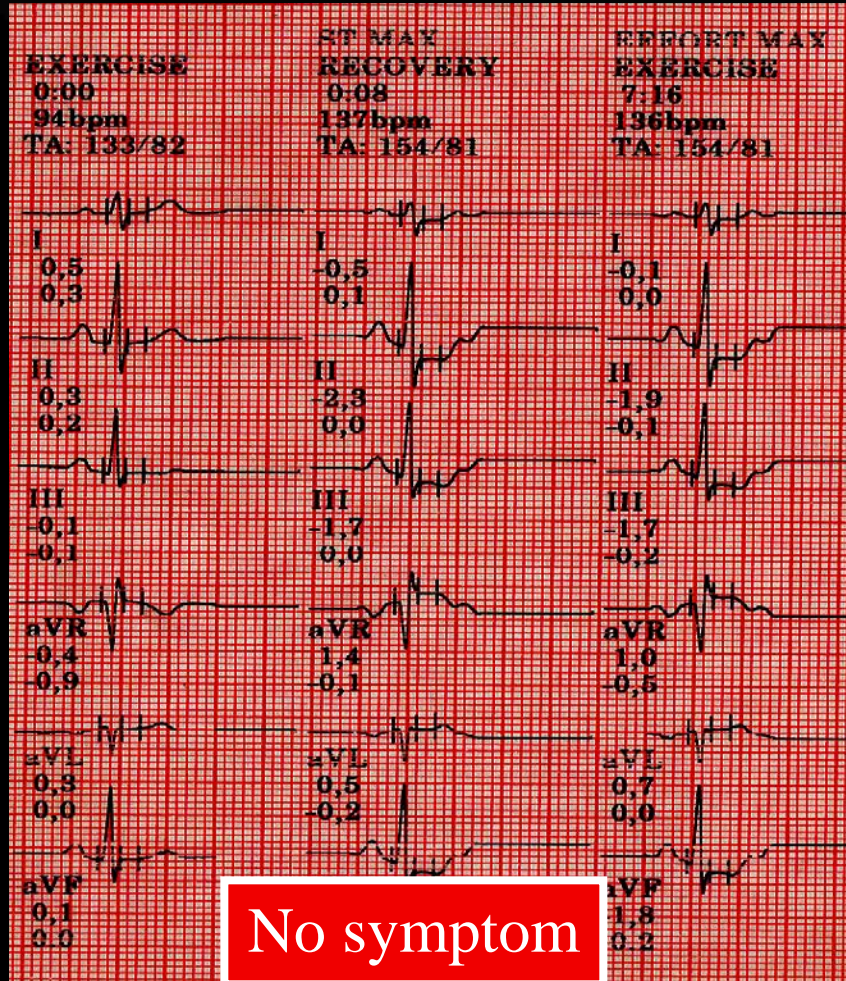


M 75 y, No RF

Who is moderately active

AVA 0.65 cm<sup>2</sup>

# CASE 1



**HR**  
(bpm)

**SBP**  
(mmHg)

**Rest**

94

133

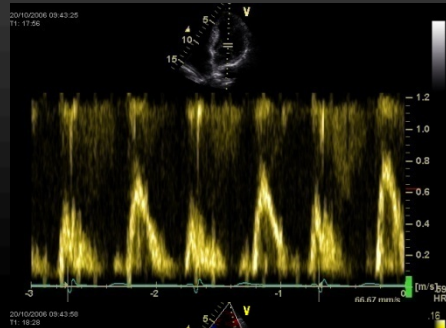
**Exer**

137

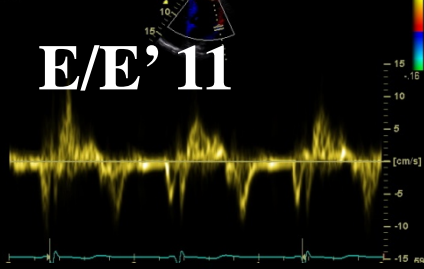
154

# REST

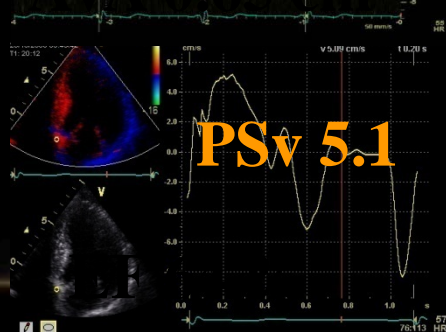
# EXERCISE



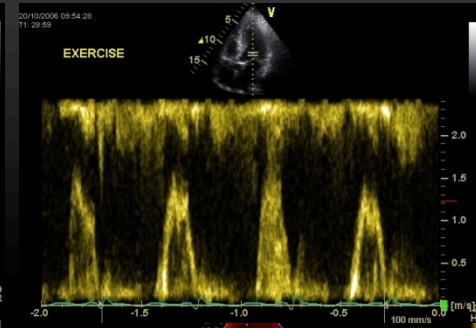
**E/E' 11**



**PPG 79**  
**MPG 48**



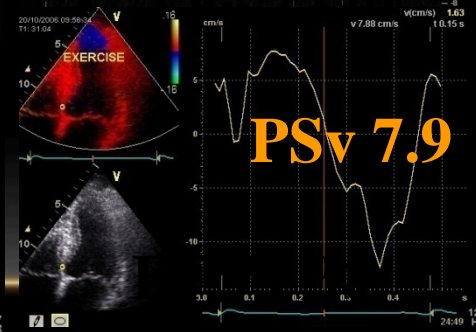
**PSv 5.1**



**E/E' 16**



**PPG 119**  
**MPG 89**

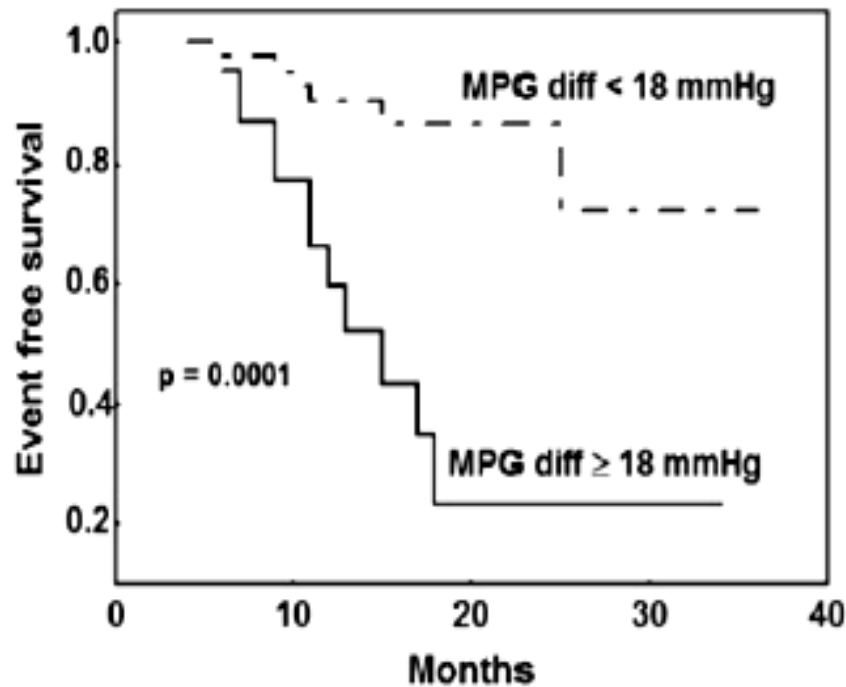


**PSv 7.9**

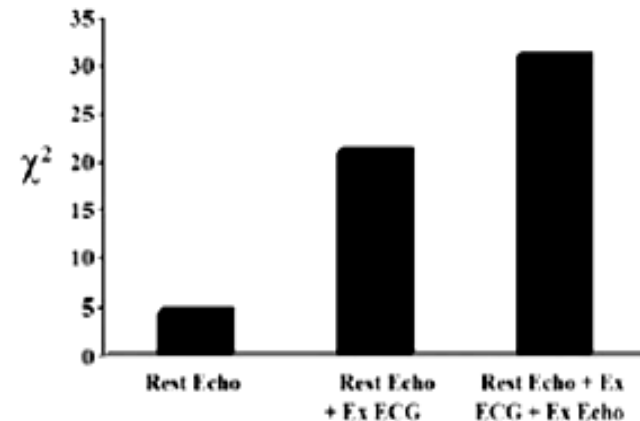
**Increase in mean pressure gradient = 41 mmHg**

# Exercise Echo in Asymptomatic AS

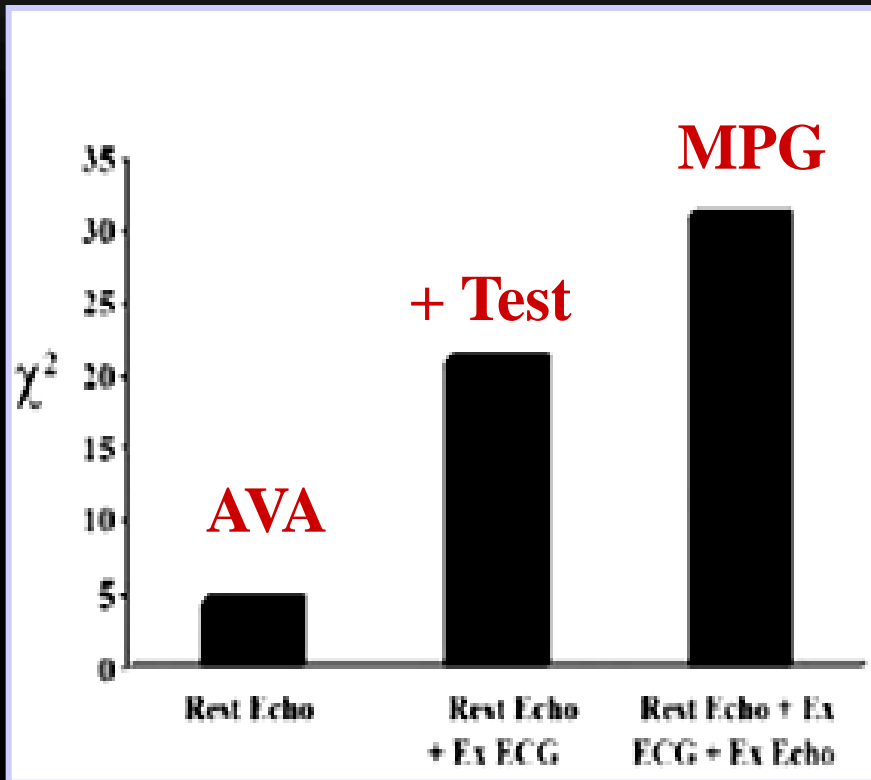
**n=69 asymptomatic severe AS with preserved LV ejection fraction**  
**n=26 abnormal exercise test**



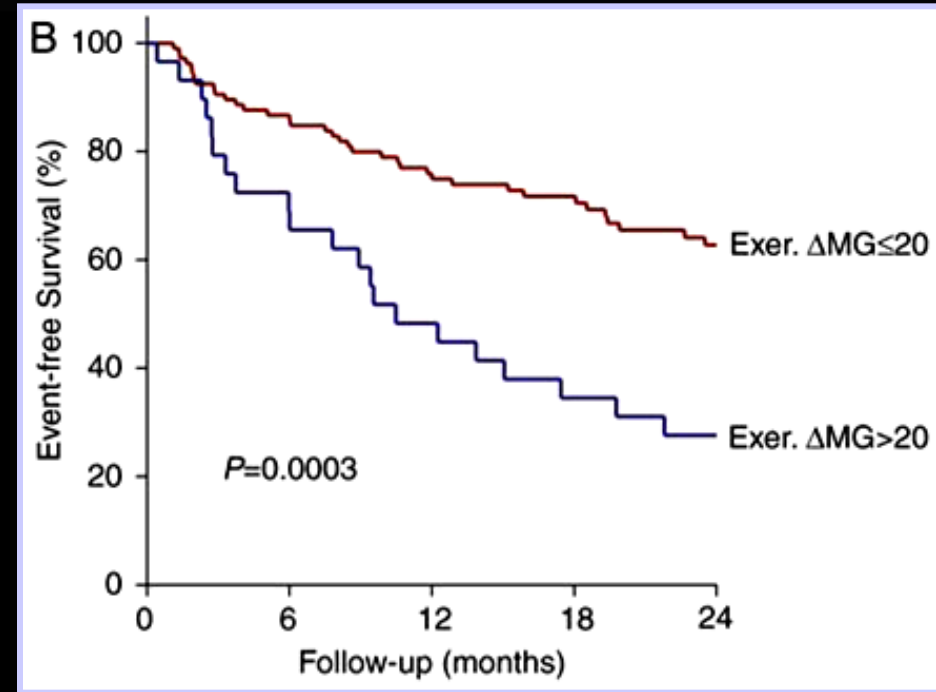
Exercise Echo in Asymptomatic Aortic Stenosis I-381



# Exercise Echo in Asymptomatic AS



## Truly Asymptomatic Patients



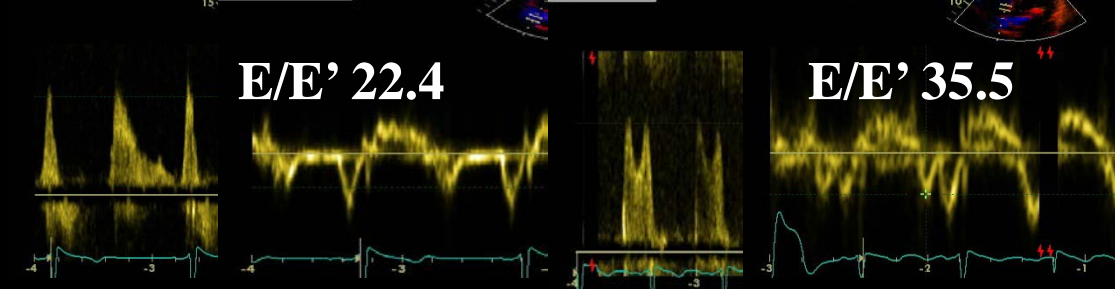
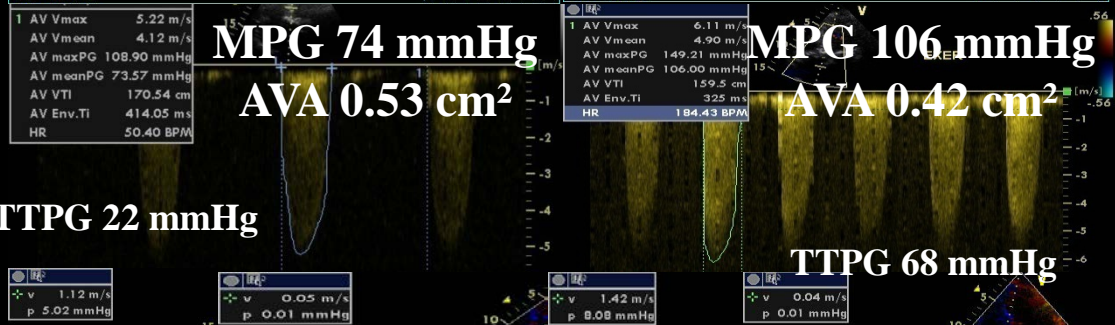
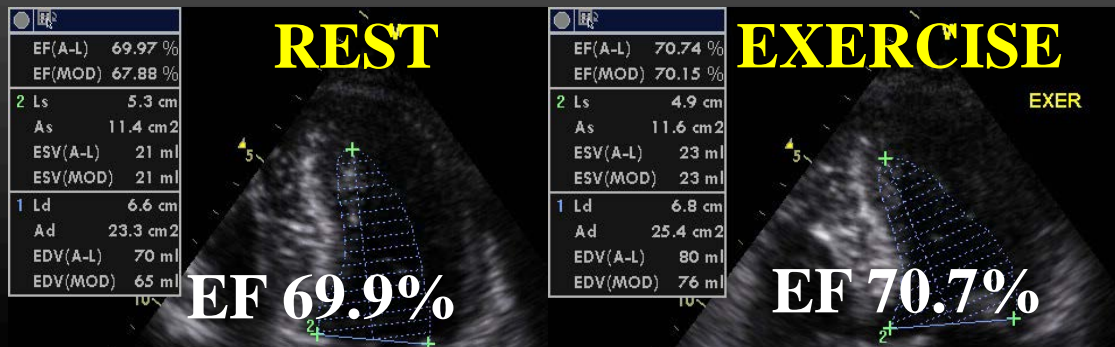
Lancellotti et al Circulation 2005

Maréchaux et al, Eur H J 2010; 31,1390

Incremental prognostic value of Exercise Doppler Echo

# CASE 2

F 83 y, Hypertension,  
 ↑ Chol , AVA 0.53 cm<sup>2</sup>



**HR**      **SBP**  
 (bpm)      (mmHg)

**Rest**      **72**      **128**

**Exer**      **120**      **147**

**No dyspnea+chest pain**

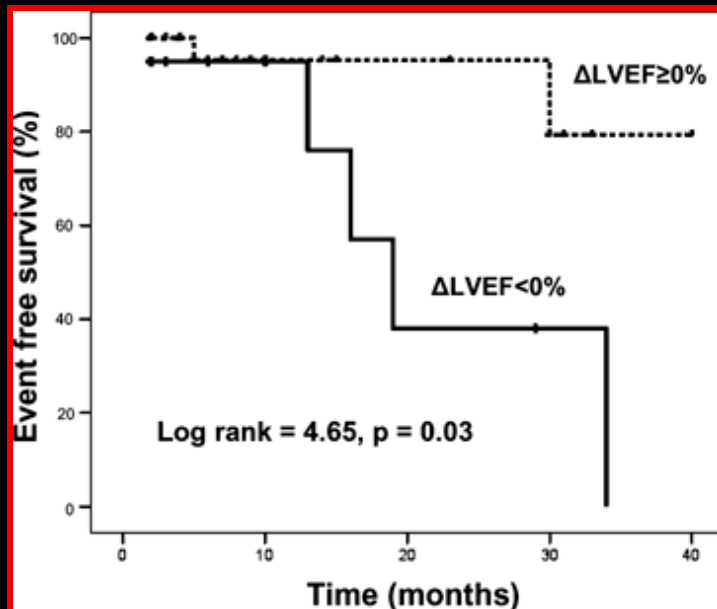
**Stop for leg discomfort**

**Few VES**

# PREDICTORS OF AN ABNORMAL EXERCISE RESPONSE

	<b>OR</b>	<b>p</b>
<b>MPG diff</b>	<b>1.1</b>	<b>0.0084</b>
<b>Ejection Fraction diff</b>	<b>0.89</b>	<b>0.010</b>

Lancellotti et al Eur J Echo 2008;9:338

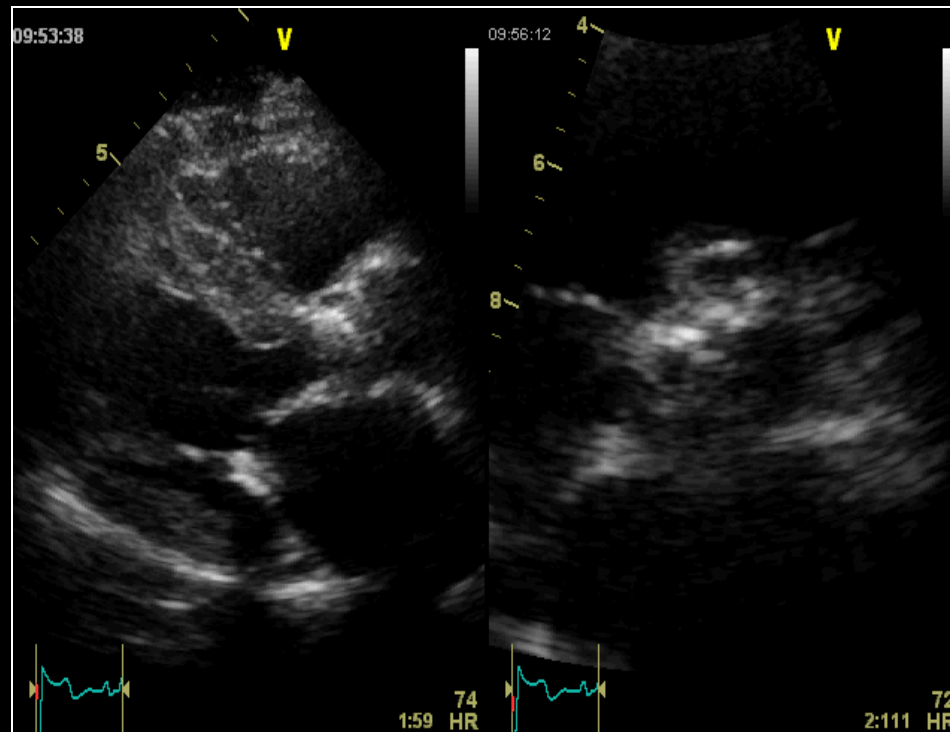


- **50 pts with AS  $< 1 \text{ cm}^2$**
- **Semi-supine exercise test**
- **48% developed symptoms**

Maréchaux et al Echocardio  
2007;24:955

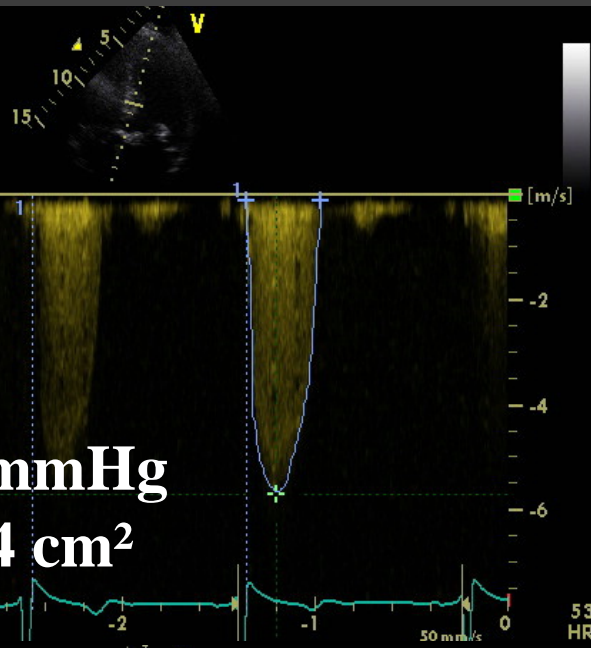
# A Year Later: ECHO IN 2008

++ Decrease in daily activities → Exercise intolerance



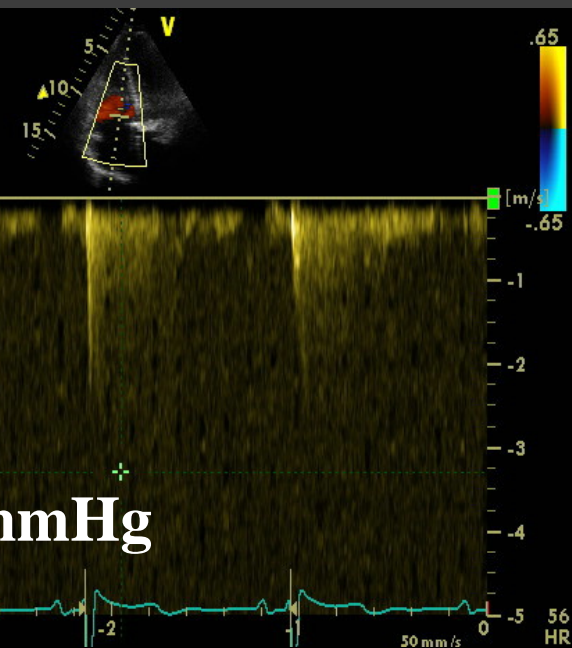
**BNP : 636 pg/ml**

+	v	5.72 m/s
p		130.89 mmHg
1	AV Vmax	5.66 m/s
	AV Vmean	4.24 m/s
	AV maxPG	128.34 mmHg
	AV meanPG	81.44 mmHg
	AV VTI	163.1 cm
	AV Env.Ti	384 ms
	HR	54.10 BPM



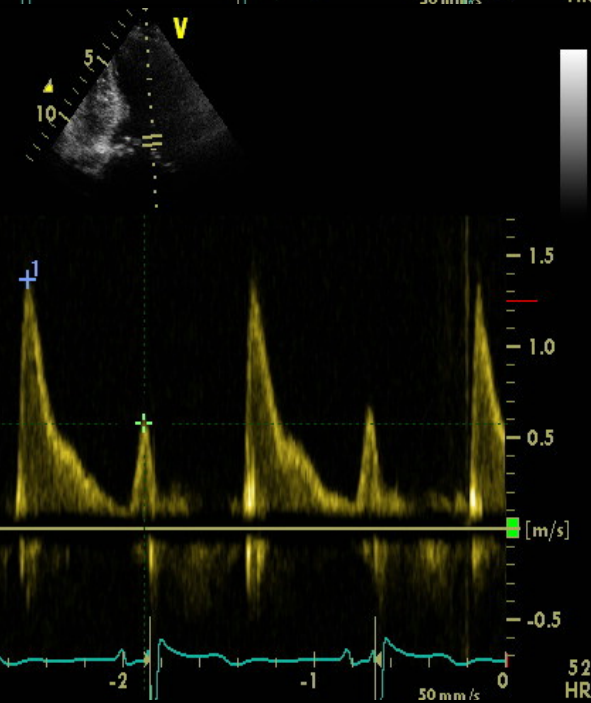
**MPG 81 mmHg**  
**AVA 0.44 cm<sup>2</sup>**

+	v	3.29 m/s
p		43.18 mmHg

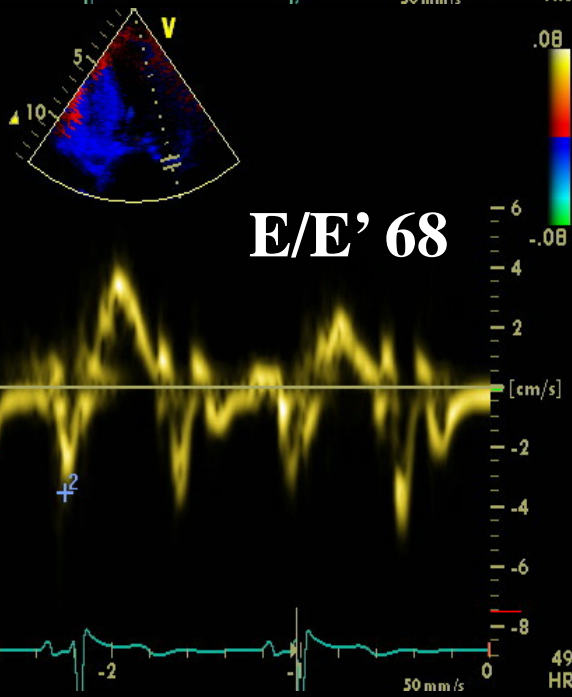


**TTPG 43 mmHg**

+	v	0.57 m/s
p		1.32 mmHg
1	v	1.37 m/s
	p	7.47 mmHg
	Frq	3.52 kHz

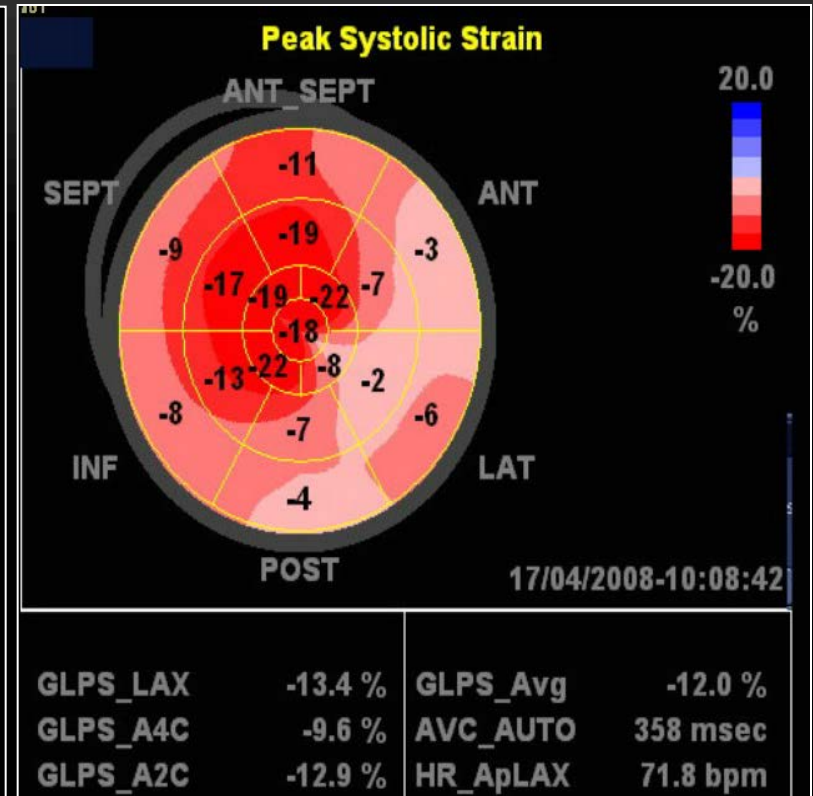
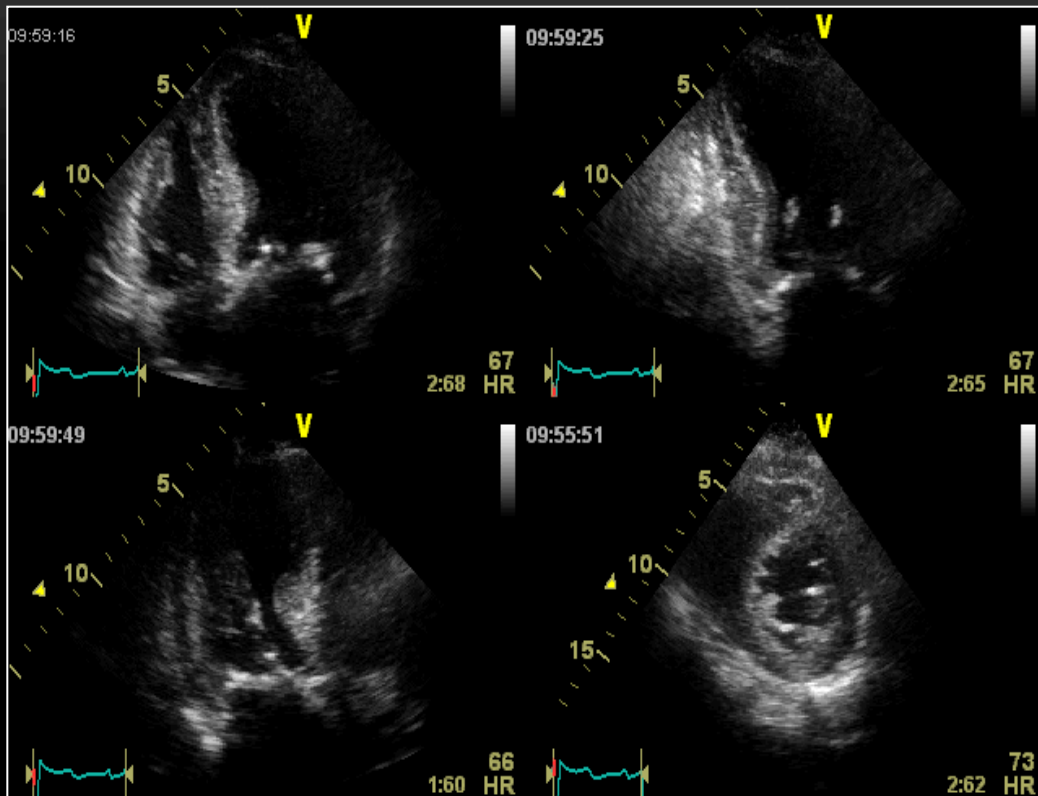


2	v	0.04 m/s
	p	0.01 mmHg
	Frq	0.12 kHz
1	v	0.02 m/s
	p	0.00 mmHg
	Frq	0.07 kHz



**E/E' 68**



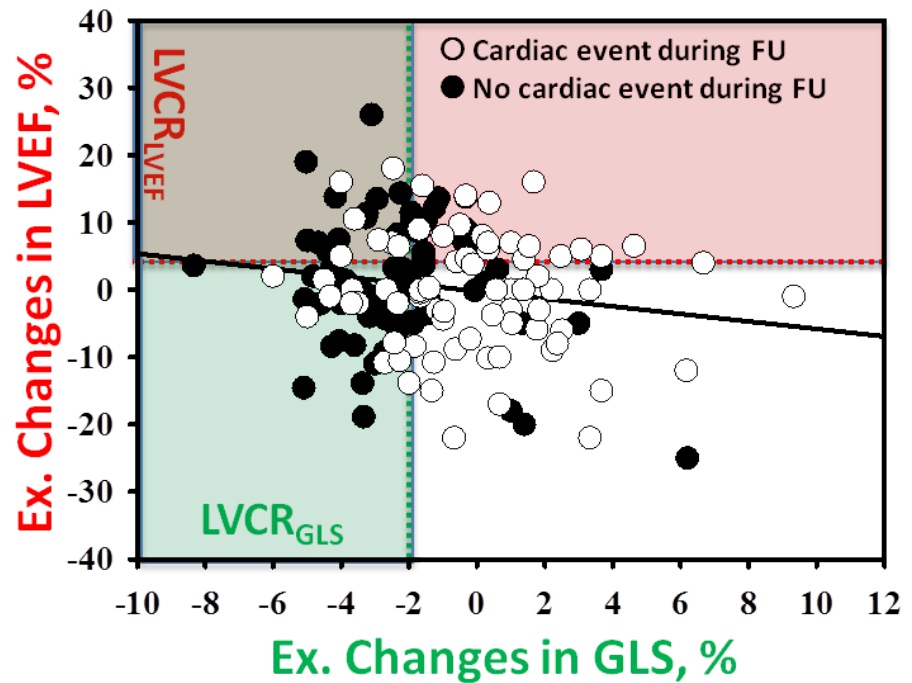
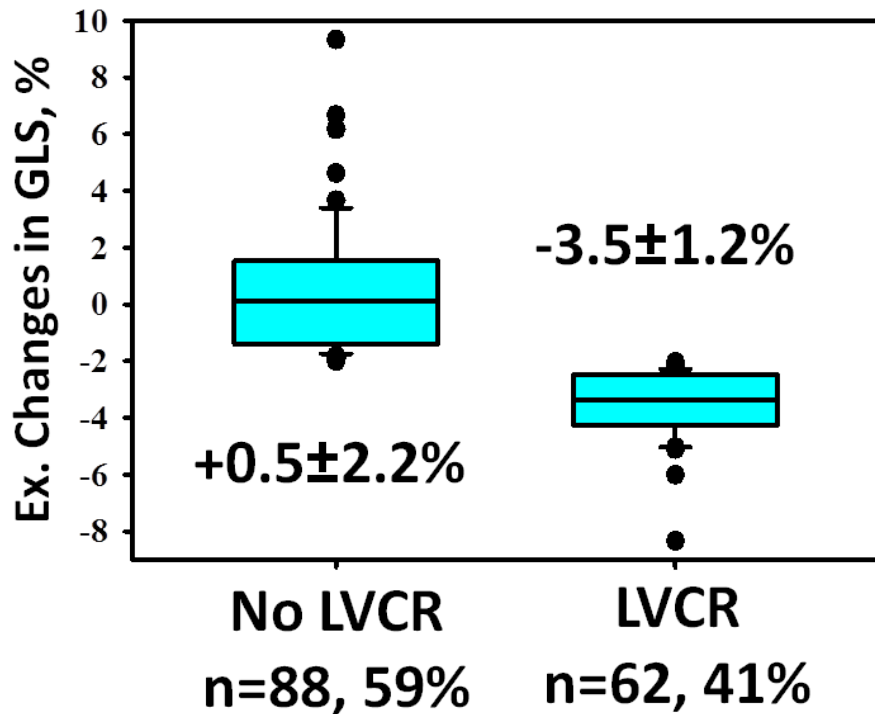


## IMPAIRED LONGITUDINAL FUNCTION

17% 2007 → 12% in 2008

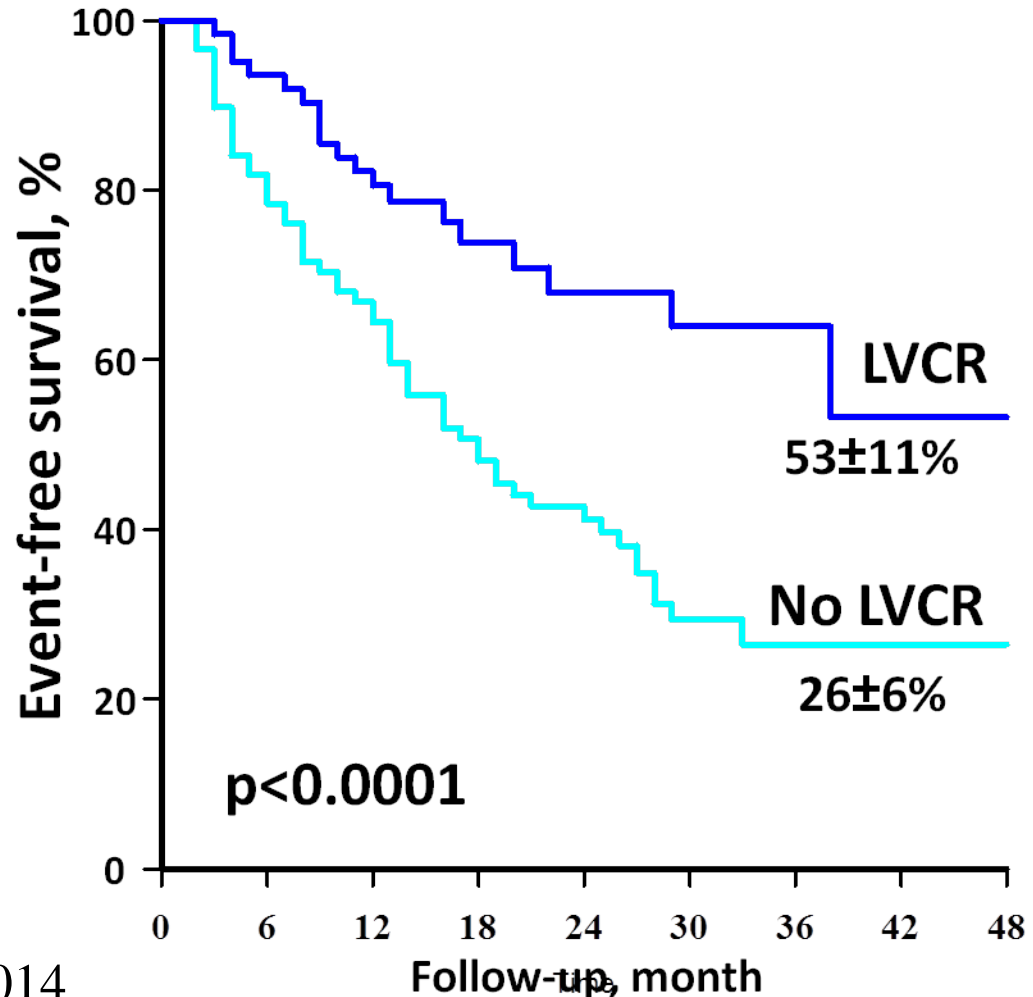
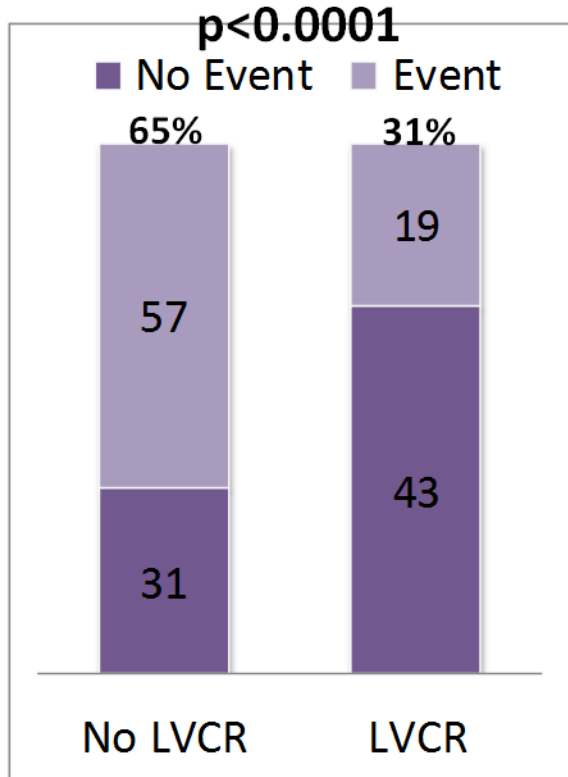
# Asymptomatic severe AS, preserved LVEF

Population  
n=150; 70±9 yo; 64% of male



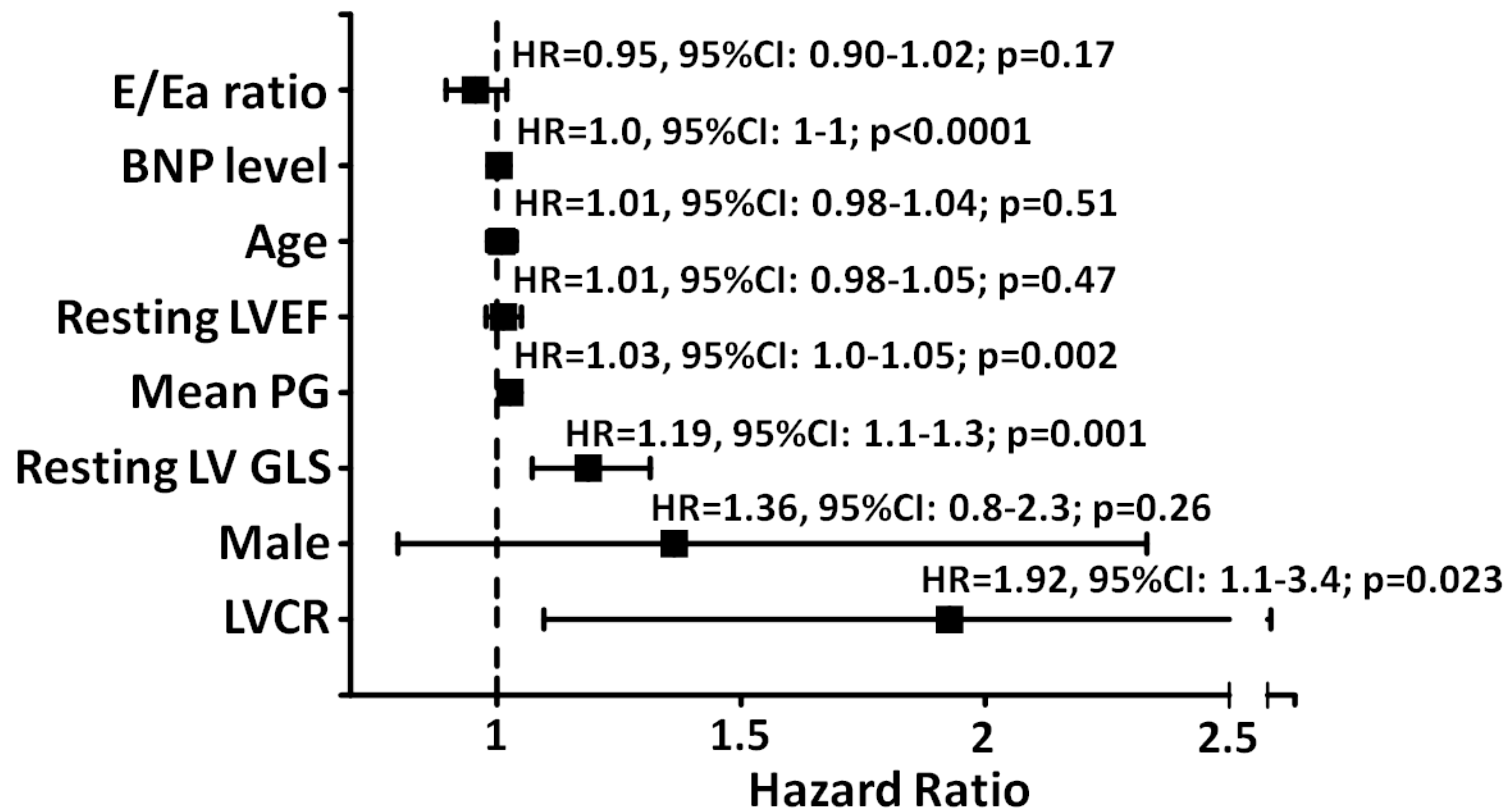
# Asymptomatic severe AS, preserved LVEF

Cardiac event: Death, hospitalization for HF, aortic valve replacement  
Mean FU:  $19 \pm 12$  months; 76 events, 51%



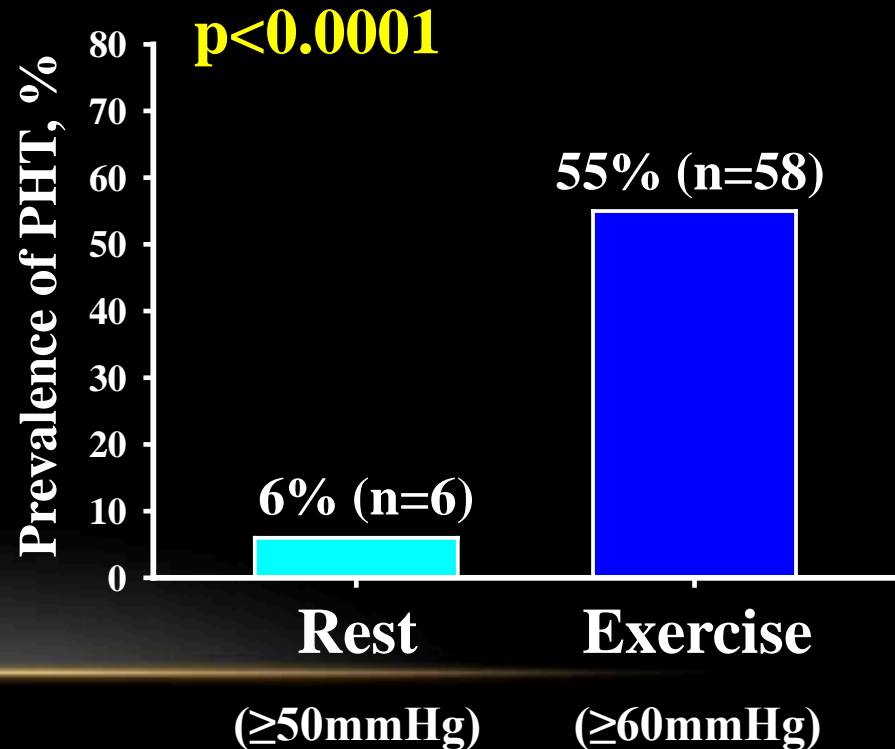
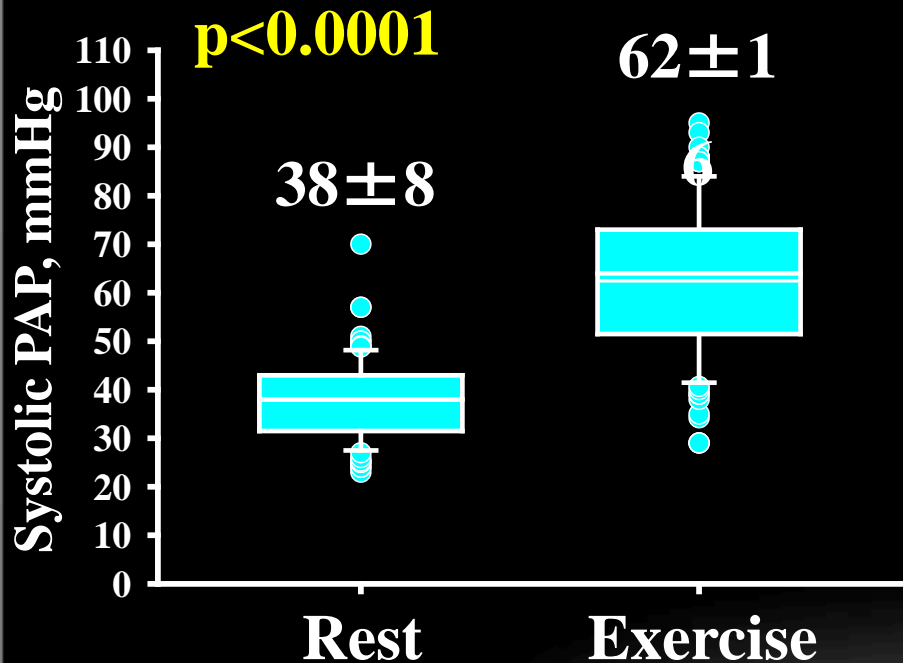
# Asymptomatic severe AS, preserved LVEF

## Multivariate Cox Proportional Hazard model

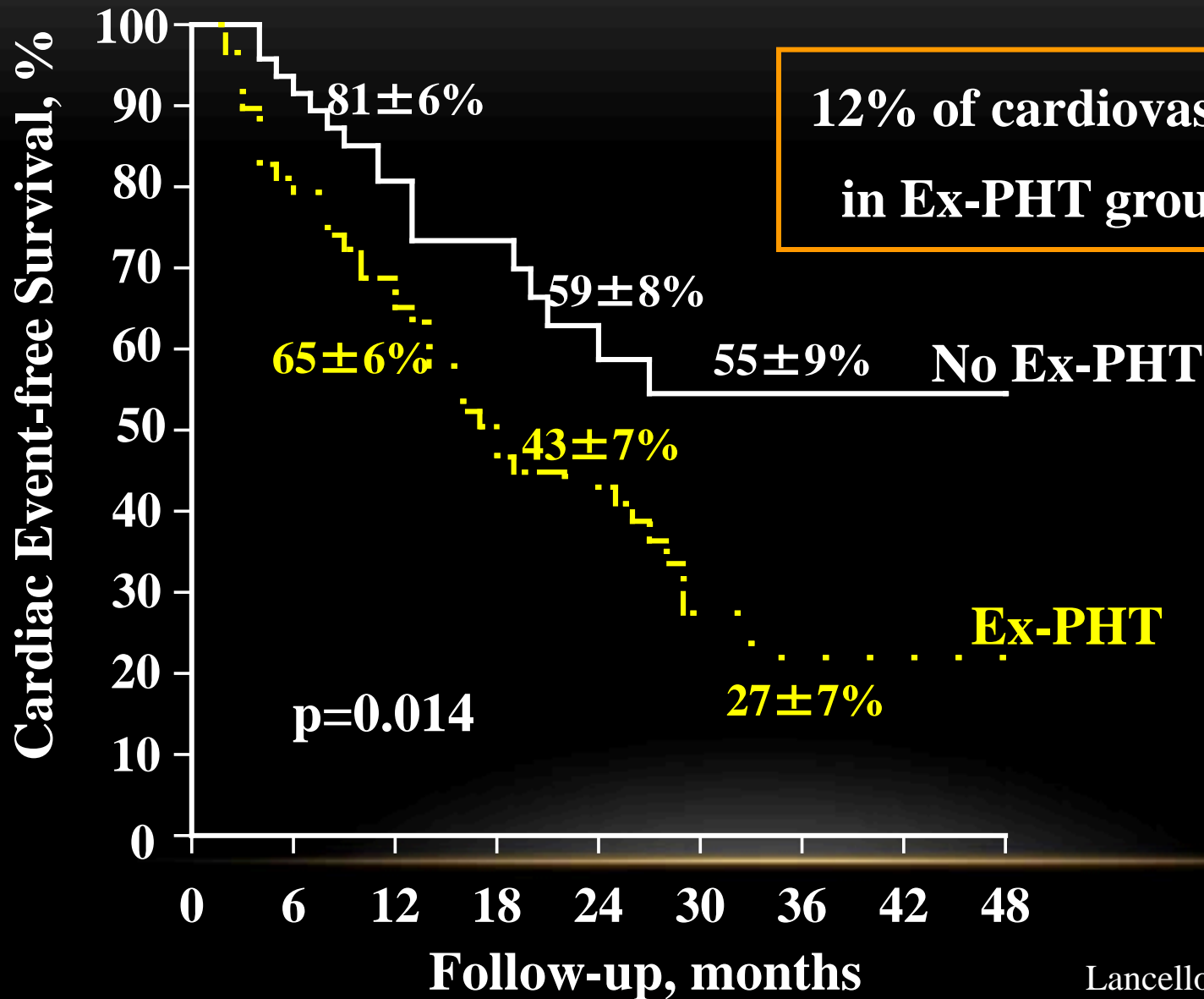


# Exercise-induced changes in SPAP

Consecutive **asymptomatic** patients (n=105) with severe AS (AVA<1cm<sup>2</sup>), **preserved LV systolic function** (LVEF >55%), normal exercise test



# Cardiac Event-free Survival according to Ex-PHT



# Indications for aortic valve replacement in asymptomatic aortic stenosis

	Class	Level
AVR is indicated in asymptomatic patients with severe AS and systolic LV dysfunction (LVEF < 50%) not due to another cause.	I	C
AVR is indicated in asymptomatic patients with severe AS and abnormal exercise test showing symptoms on exercise clearly related to AS.	I	C
AVR should be considered in asymptomatic patients, with normal EF and none of the above mentioned exercise test abnormalities, if the surgical risk is low, and one or more of the following findings is present: <ul style="list-style-type: none"> <li>• very severe AS defined by a peak transvalvular velocity &gt; 5.5 m/s,</li> <li>• severe valve calcification and a rate of peak of transvalvular velocity progression <math>\geq 0.3</math> m/s per year.</li> </ul>	IIa	C
AVR may be considered in asymptomatic patients with severe AS, normal EF and none of the above mentioned exercise test abnormalities, if surgical risk is low, and one or more of the following findings is present: <ul style="list-style-type: none"> <li>• markedly elevated natriuretic peptide levels confirmed by repeated measurements without other explanations,</li> <li>• increase of mean pressure gradient with exercise by &gt; 20 mmHg,</li> <li>• excessive LV hypertrophy in the absence of hypertension.</li> </ul>	IIb	C

**ASYMPTOMATIC AS (< 1 cm<sup>2</sup> + EF > 50%)**

**EXERCISE TESTING**

**Symptoms**

**Hypotension**

**Ventricular  
Arrhythmias**

**AVR  
ESC Class I**

**AVR  
ESC Class IIa**

**AVR  
ESC Class IIb**

**'Truly' asymptomatic  
or <20 mmHg increase in SBP  
or confounding factors (COPD)  
or >2 mm ST segment depression  
or > 70 years old with comorbidities**

**EXERCISE ECHO**

**+**

**Exercise increase in  
MPG > 18-20 mmHg**

**-**

**Closer  
F-Up**

**Usual  
F-Up**

**No contractile reserve  
(small changes in EF or  
in longitudinal function)**

**+**

**Pulmonary Hypertension  
SPAP > 60 mmHg**

**-**



# Factors Highlighted by Exercise Test (Echo)

Symptoms

LV Dysfunction

- **LV geometry**
- **LV Function**
- **Severity of VHD**
- **PAsP Changes**
- **BNP changes**

**Risk Stratification/Outcome Prediction**  
**Optimal Timing of Surgery**

