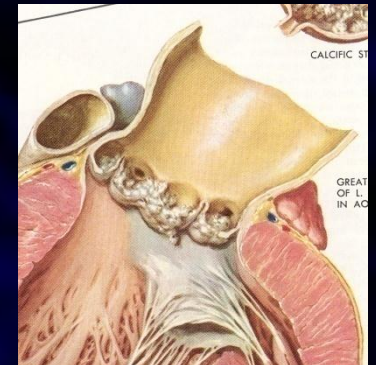
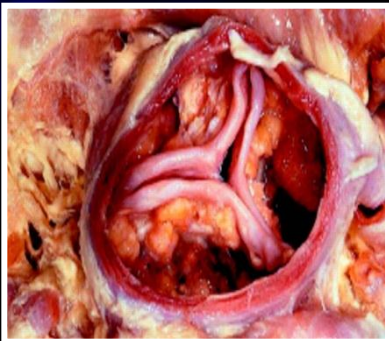


Clinical Significance of Valvulo-Arterial Impedance in Aortic Valve Stenosis

Dr. Julien Magne, PhD

Sart Tilman Liège, BELGIUM



Conflict of Interest Disclosure

None

Valvulo-Arterial Impedance (Z_{va}): Definition

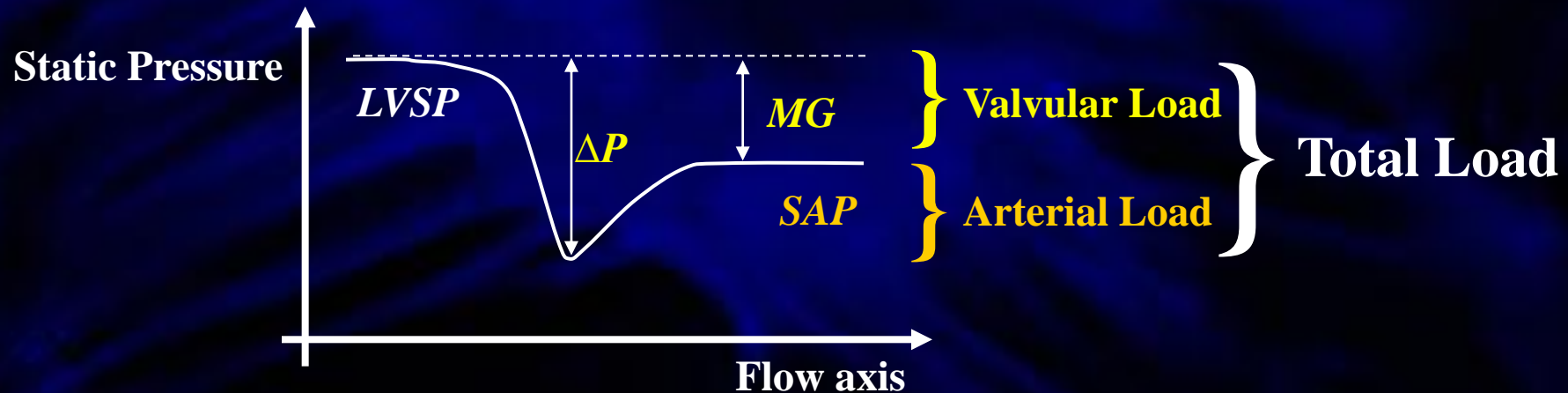
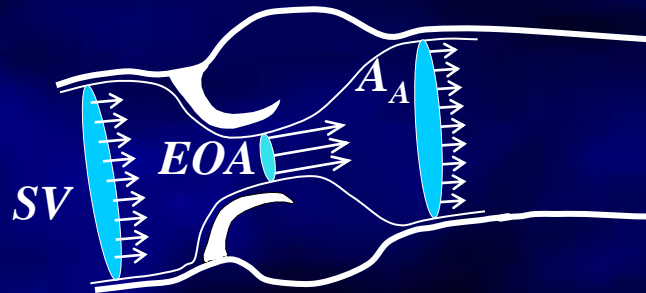
Mechanical Impedance: a measure of how much a structure resists motion when subjected to a given force.

In Aortic stenosis: Z_{va} represents the cost in mmHg for each systemic mL of blood indexed for body size pumped by the left ventricle during systole.

Z_{va} provides an estimate of the global LV hemodynamic load that results from the summation of the valvular and vascular loads:

- stenosis severity
- volume flow rate
- body size
- systemic vascular resistance

Left Ventricular Afterload in Aortic Stenosis = Valvular Load + Arterial Load



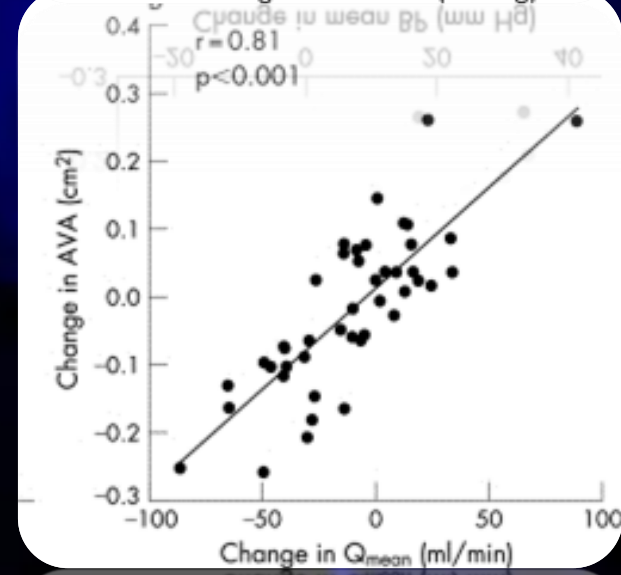
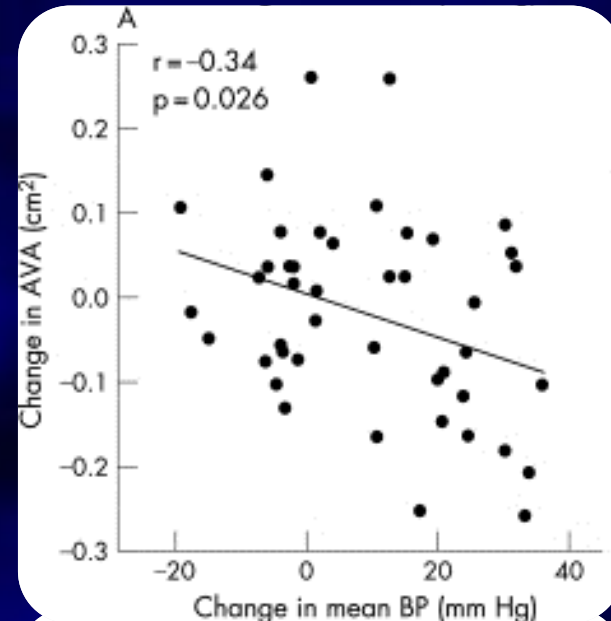
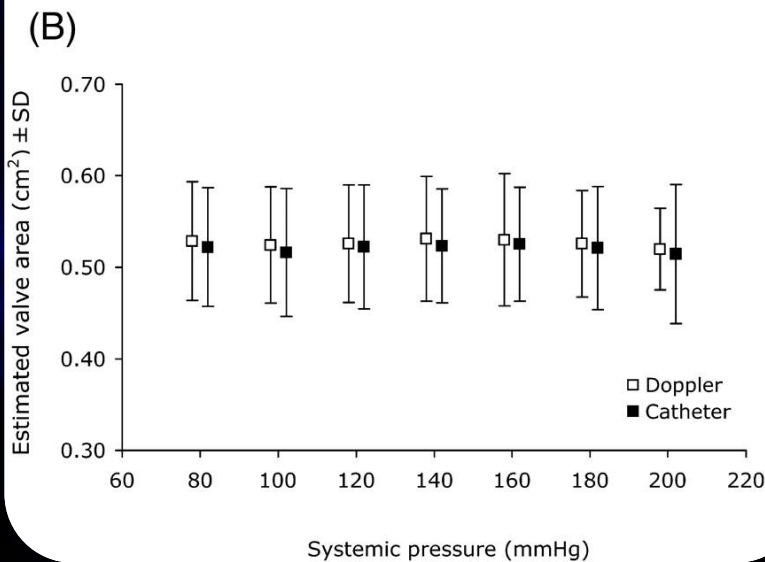
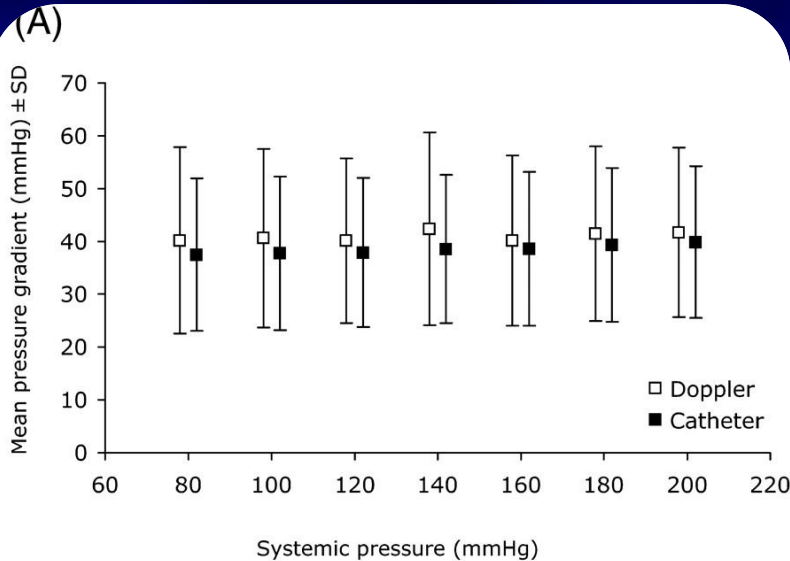
Valvulo-Arterial Impedance

$$Z_{va} = \frac{LVSP}{SV_i} = \frac{MG + SAP}{SV_i}$$

>3.5: Moderate

>4.5: Severe

Impact of Hypertension on AS Severity



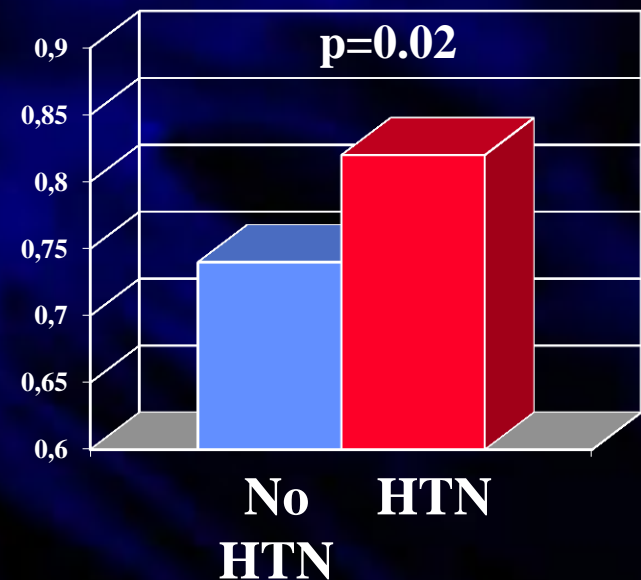
Mascherbauer et al.; Eur Heart J; 2008

Little et al. Heart, 93:848-55. 2007

Impact of Hypertension on the Timing of Symptom Onset in AS

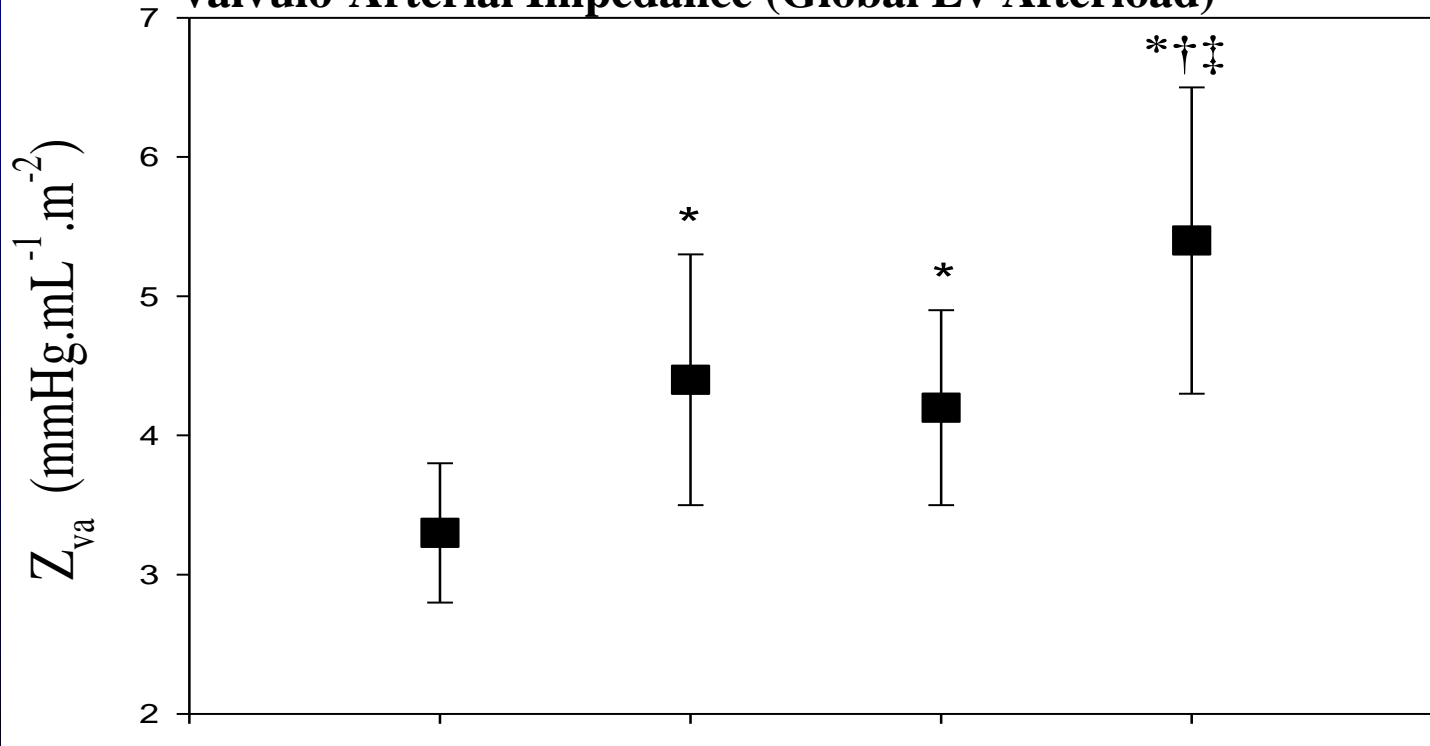
- 193 patients with symptomatic AS
- 32% had concomitant HTN
- Symptoms of AS develop at lower degree of stenosis severity in hypertensive patients, probably because of the additional overload due to hypertension.

AVA (cm²) at symptom onset



AS and Reduced Systemic Arterial Compliance: Impact on LV Afterload

Valvulo-Arterial Impedance (Global LV Afterload)



$$SAC = \frac{PP}{SV_i}$$

Low SAC: ≤ 0.6

$$Z_{VA} = \frac{SAP + MG}{SV_i}$$

Groups

(n=208)

I

Moderate AS

Normal SAC

(n=77, 37%)

II

Moderate AS

Low SAC

(n=50, 24%)

III

Severe AS

Normal SAC

(n=45, 22%)

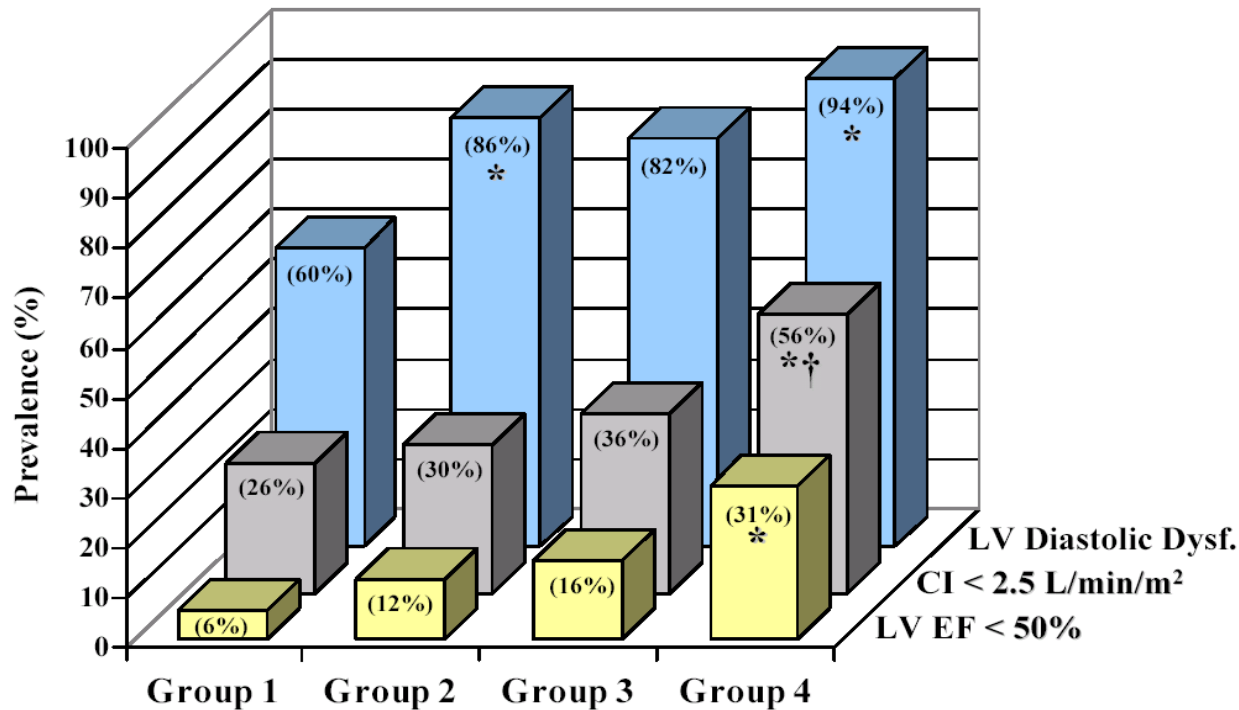
IV

Severe AS

Low SAC

(n=36, 17%)

AS and Reduced Systemic Arterial Compliance: Impact on LV Function



LV Diast. dysfunction
 $Z_{va} \geq 4.5$
 OR=5.4, $p < 0.0001$

LV Syst. dysfunction
 $Z_{va} \geq 4.5$
 OR=4.2, $p = 0.001$

Moderate AS Severe AS

Norm SAC Low SAC Norm SAC Low SAC

Features of Patients with Elevated Zva

Usefulness of the Valvuloarterial Impedance to Predict Adverse Outcome in Asymptomatic Aortic Stenosis

Zeineb Hachicha, MD, Jean G. Dumesnil, MD, Philippe Pibarot, DVM, PhD
 Québec City, Québec, Canada

Asymptomatic patients with \geq moderate AS (peak Ao jet velocity $\geq 2.5 \text{ m.s}^{-1}$) and LVEF $> 50\%$: n=544

Low: $Z_{va} \leq 3.5 \text{ mmHg.mL}^{-1}.\text{m}^2$
 n=172, 32%

Medium: $3.5\text{-}4.5 \text{ mmHg.mL}^{-1}.\text{m}^2$
 n=192, 35%

High: $\geq 4.5 \text{ mmHg.mL}^{-1}.\text{m}^2$
 n=180, 33%

Group	Low Z_{va} (n = 172)	Medium Z_{va} (n = 192)	High Z_{va} (n = 180)	p Value
Age, yrs	66 \pm 15	70 \pm 12*	73 \pm 13*†	<u><0.001</u>
Female sex	69 (40)	73 (38)	82 (46)	NS
Body surface area, m^2	1.8 \pm 0.2	1.8 \pm 0.2	1.8 \pm 0.2	NS
Body mass index, kg/m^2	27 \pm 6	27 \pm 5	28 \pm 5	NS
Obesity	39 (23)	53 (27)	55 (31)	NS
Hypertension	96 (56)	138 (72)*	128 (71)*	<u>0.02</u>
Hypercholesterolemia	93 (54)	109 (57)	76 (42)	NS
Diabetes	39 (23)	40 (21)	34 (19)	NS
Coronary artery disease	96 (56)	128 (67)	106 (59)	NS

Hachicha et al., JACC, 2009

Features of Patients with Elevated Z_{va}

Group	Low Z _{va} (n = 172)	Medium Z _{va} (n = 192)	High Z _{va} (n = 180)	p Value
Valvular load				
Aortic valve area, cm ²	1.2 ± 0.2	1.0 ± 0.3*	0.8 ± 0.2*†	<0.0001
Aortic valve area index, cm ² ·m ⁻²	0.66 ± 0.13	0.56 ± 0.15*	0.45 ± 0.12*†	<0.0001
Energy loss index, cm ² ·m ⁻²	0.78 ± 0.18	0.65 ± 0.23*	0.51 ± 0.15*†	<0.0001
Peak gradient, mm Hg	44 ± 16	46 ± 20	56 ± 26*†	<0.0001
Mean gradient, mm Hg	25 ± 10	27 ± 12	34 ± 17*†	<0.0001
Vascular load				
Systolic arterial pressure, mm Hg	122 ± 16	135 ± 19*	145 ± 23*†	<0.001
Diastolic arterial pressure, mm Hg	68 ± 9	73 ± 10*	78 ± 10*†	<0.0001
Systemic arterial compliance, ml·m ⁻² ·mm Hg ⁻¹	0.94 ± 0.24	0.69 ± 0.18*	0.57 ± 0.18*†	<0.0001
Systemic vascular resistance, dyne·s·cm ⁻⁵	1,303 ± 287	1,605 ± 361*	1,824 ± 398*†	<0.001
Global LV hemodynamic load				
Valvuloarterial impedance, mm Hg·ml ⁻¹ ·m ²	3.1 ± 0.4	4.0 ± 0.3*	5.2 ± 0.9*†	<0.0001

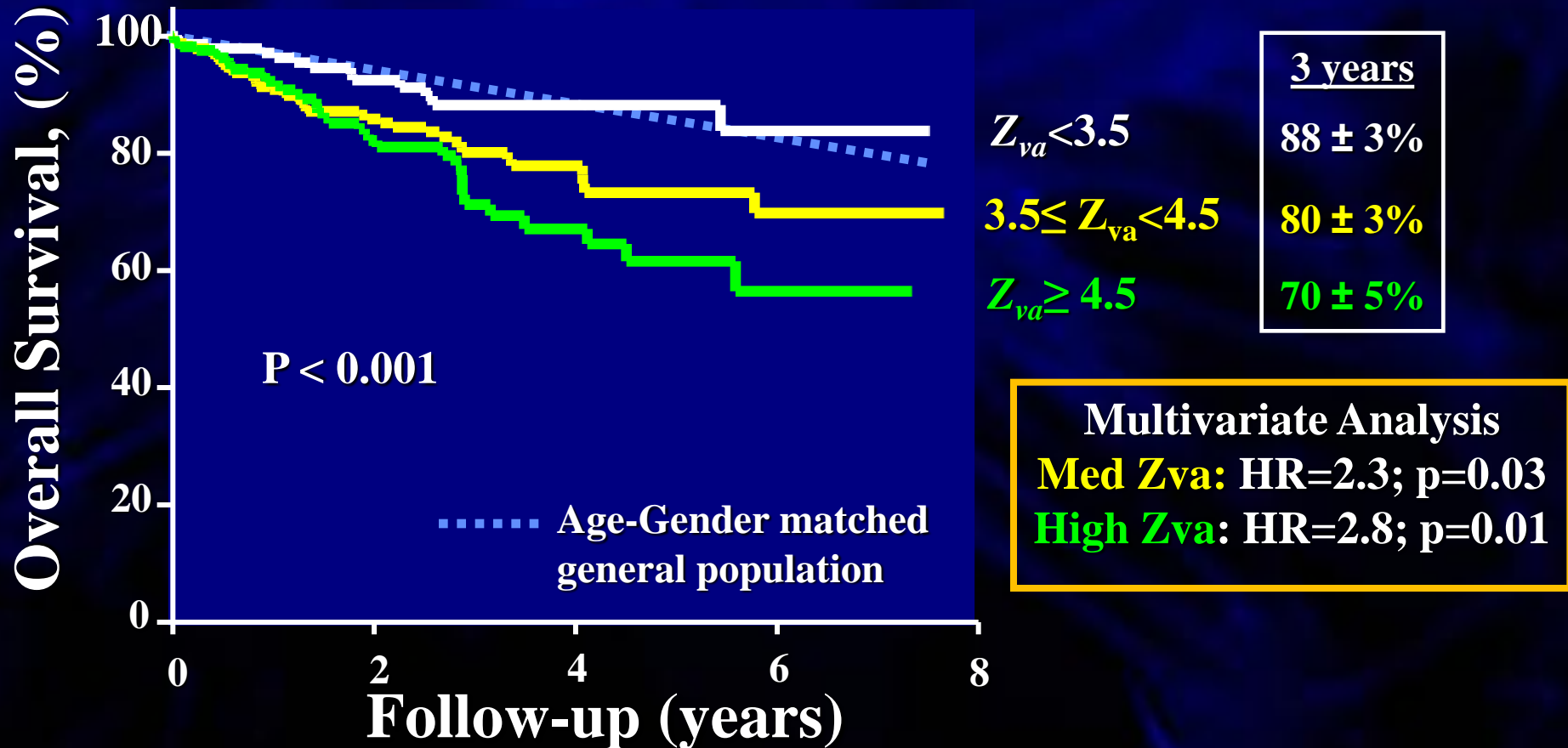
Hachicha et al., JACC, 2009

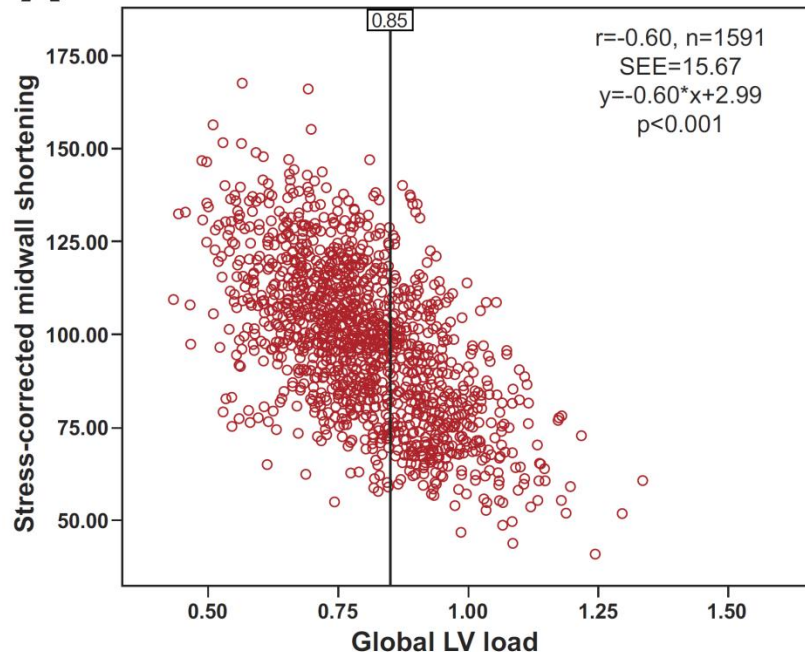
Features of Patients with Elevated Zva

Group	Low Z _{va} (n = 172)	Medium Z _{va} (n = 192)	High Z _{va} (n = 180)	p Value
LV geometry				
IVSTd, mm	12 ± 3	12 ± 2	13 ± 3*†	<0.001
PWTd, mm	10 ± 2	11 ± 2	11 ± 2*	0.02
LVIDd, mm	48 ± 5	47 ± 5	45 ± 5*†	<0.001
LVEDV, ml	111 ± 27	106 ± 27	96 ± 25*†	<0.001
LVEDV index, ml·m ⁻²	61 ± 13	58 ± 13*	52 ± 12*†	<0.001
Relative wall thickness, %	44 ± 10	46 ± 10*	49 ± 10*†	<0.001
LV systolic function				
LV ejection fraction, %	67 ± 7	66 ± 7	65 ± 7*	0.025
Stroke volume, ml	87 ± 16	75 ± 12*	65 ± 15*†	<0.001
Stroke volume index, ml·m ⁻²	48 ± 8	41 ± 5*	35 ± 7*†	<0.001
Cardiac output, l·min ⁻¹	5.5 ± 1.2	4.8 ± 1.0*	4.6 ± 1.1*†	<0.001
Cardiac index, l·min ⁻¹ ·m ⁻²	3.1 ± 0.7	2.6 ± 0.5*	2.5 ± 0.5*†	<0.001
Mean transvalvular flow rate, ml·s ⁻¹	268 ± 61	232 ± 49*	210 ± 55*†	<0.001
LV diastolic function, %				
Normal	20	13	11	NS
Abnormal	80	87	89	<0.001
Abnormal	80	87	89	<0.001
Normal	20	13	11	NS
LV diastolic function, %				

Prognostic Impact of Global Afterload

Retrospective analysis of 544 asymptomatic pts
 \geq moderate AS (≥ 2.5 m/s), LVEF $\geq 50\%$; Follow-up 2.5 ± 1.8 years



A

Zva in the SEAS trial

**n=1 591 asymptomatic patients
with AS (67 ± 10 yrs, 51% of
hypertensive, 39% of women)**

Cramariuc et al. JACC CV Img, 2009

In patients with asymptomatic AS without diabetes or known CAD:

- **LVEF generally preserved**
- **LV myocardial dysfunction: 33%**

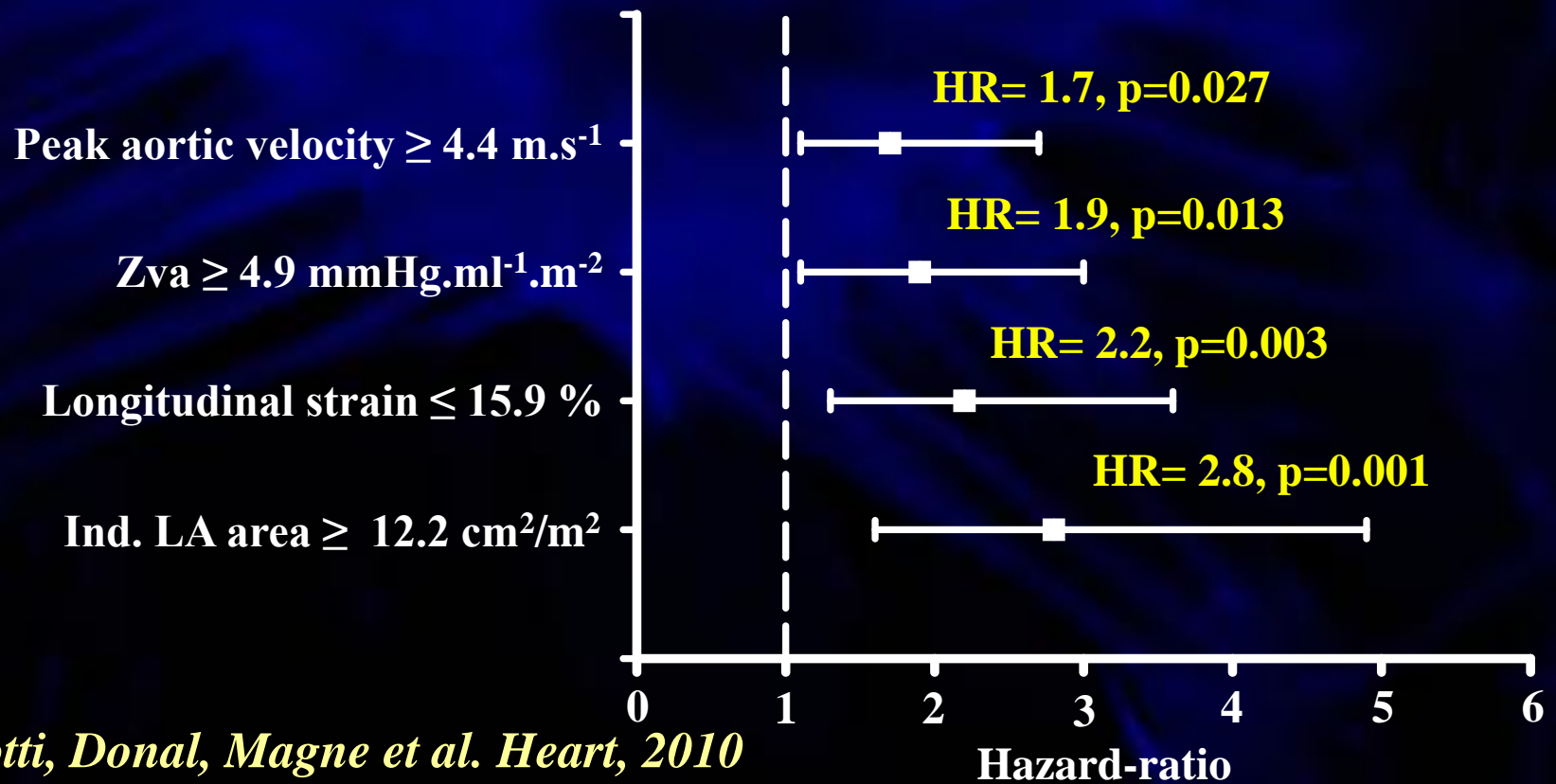
LV myocardial dysfunction:

- **common in patients with increased Zva**
- **especially in the subgroup with low-flow AS**
- **more concentric LV geometry, LV hypertrophy, and male**

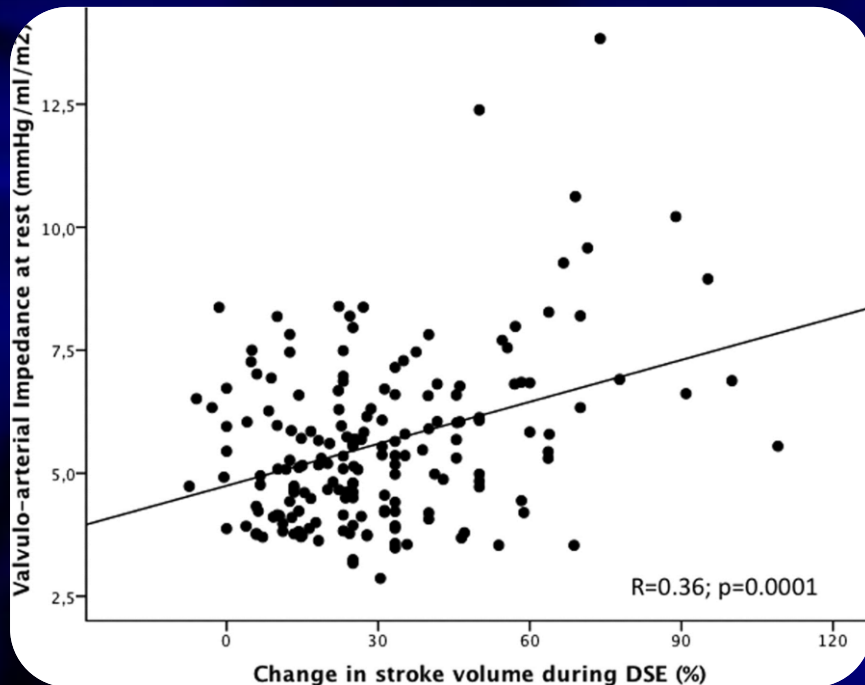
Zva in Asymptomatic AS

Prospective study: 163 patients with asymptomatic AS and preserved LV function

Adjustment for gender, systemic arterial compliance, E-wave, E/A ratio and response to exercise (abnormal vs. normal)



Zva in LF/LG AS



n=184 patients with severe LF/LG AS included in the French study.

LVEF ☐

SV ☐

ex. SV ☐



LV contractile

reserve ☐

($\Delta SV > +20\%$)



Zva is inaccurate to differentiate TS and PS AS

Valvuloarterial impedance
(Zva) threshold
(mmHg/mL/m²)

P-value to predict perioperative
mortality (by univariate
analysis)

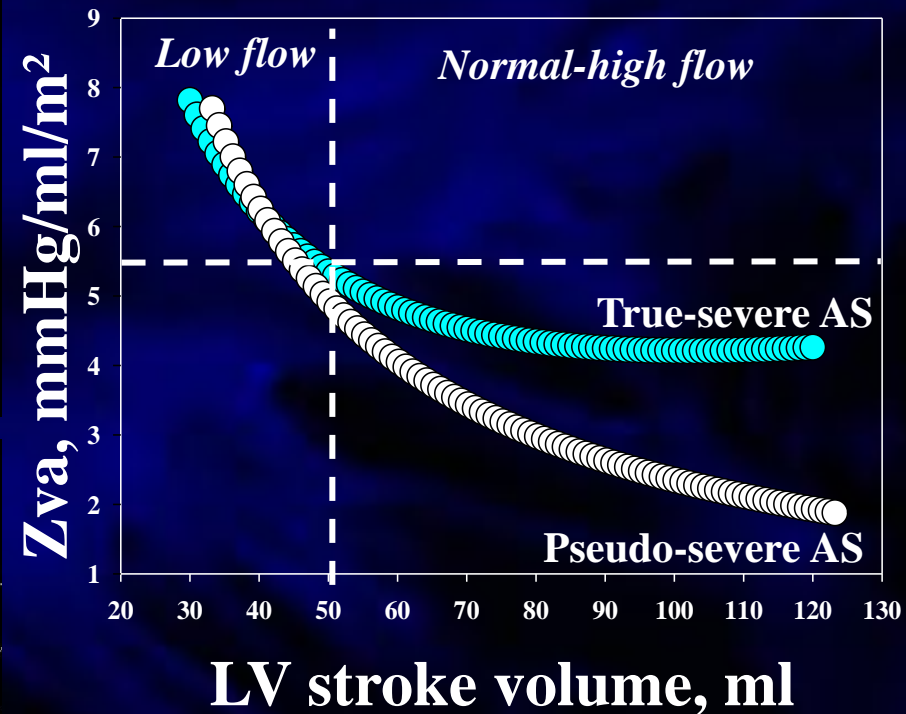
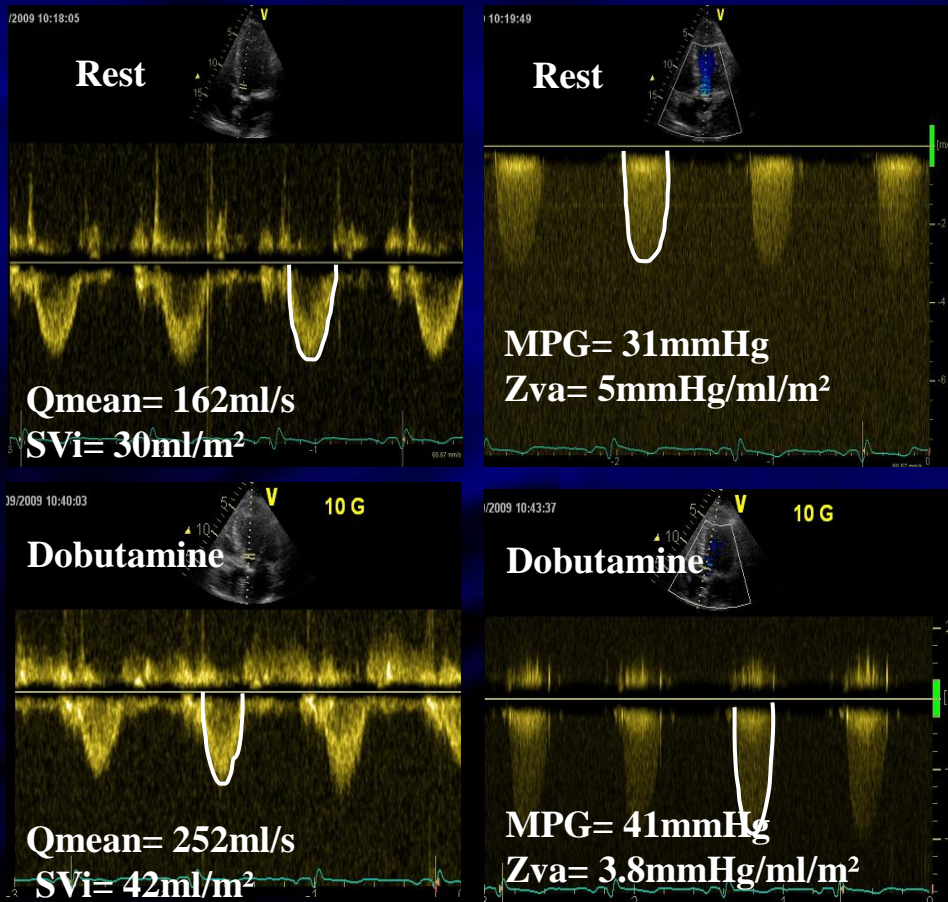
Results of multivariate analysis
to predict perioperative
mortality

Results of multivariate
analysis to predict 5 year
mortality

4	0.48	HR: 0.37 (0.064–2.131); P = 0.43	OR: 0.73 (0.27–1.98); P = 0.54
4.5	0.54	HR: 2.24 (0.34–11.91); P = 0.35	OR 1.07 (0.48–2.37); P = 0.87
5	0.99	HR 0.78 (0.14–4.38); P = 0.78	OR 0.59 (0.28–1.22); P = 0.16
5.5	0.66	HR 0.57 (0.10–3.54); P = 0.57	OR 0.60 (0.28–1.29); P = 0.19
6	0.62	HR 1.30 (0.22–7.57); P = 0.77	OR 1.04 (0.50–2.14); P = 0.91

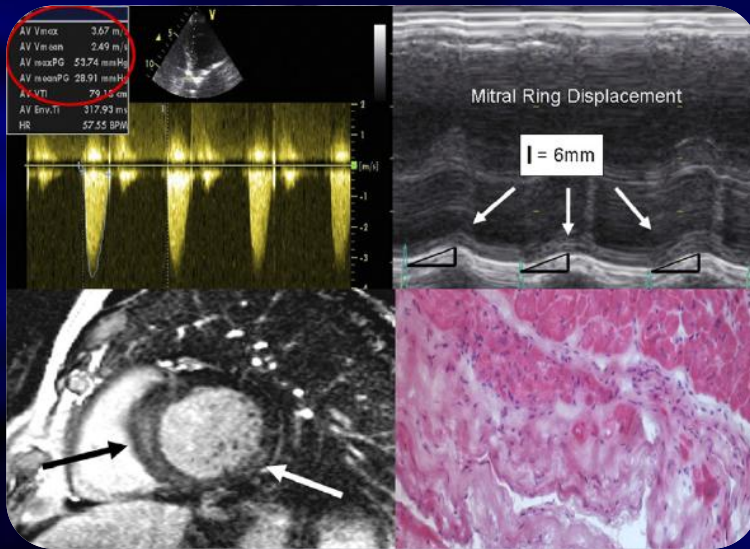
Zva in LF/LG AS

Zva vs. SV in patients with true-severe and pseudo-severe AS.

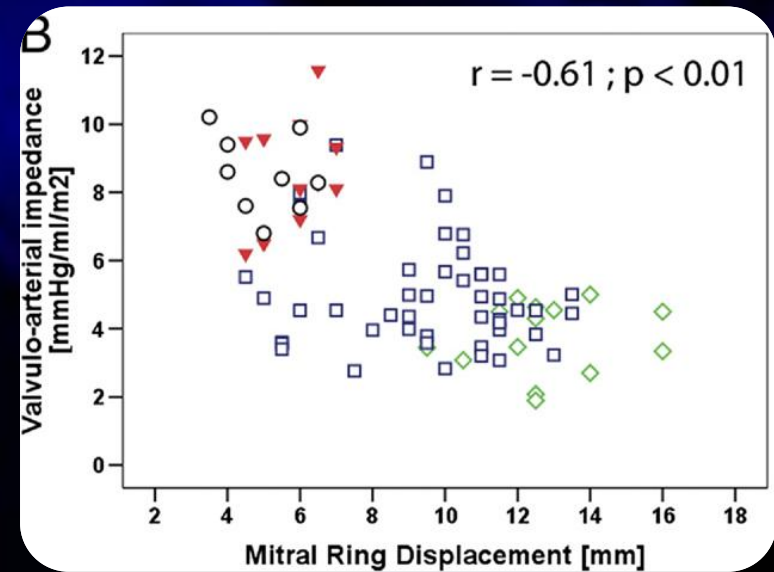
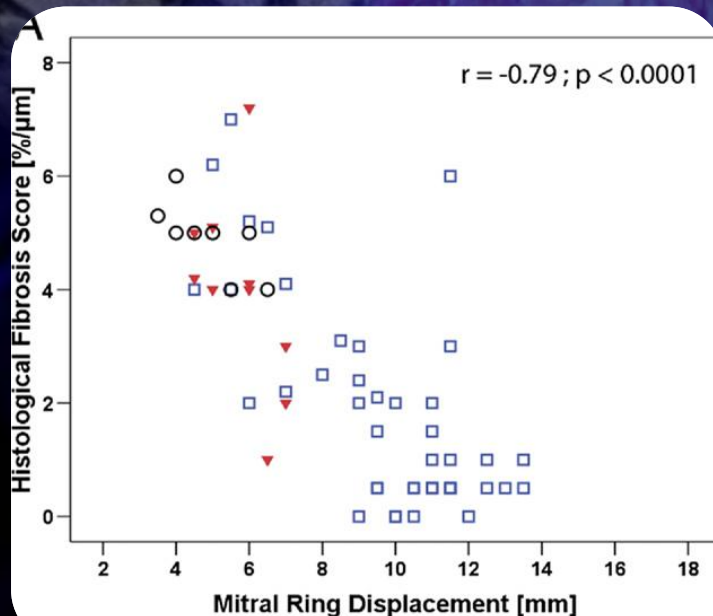


BSA was assumed at 1.8 m², LVED vol at 120 mL, HR at 65 b.p.m., and SAP at 120 mmHg.

Myocardial Function and Zva in Severe AS

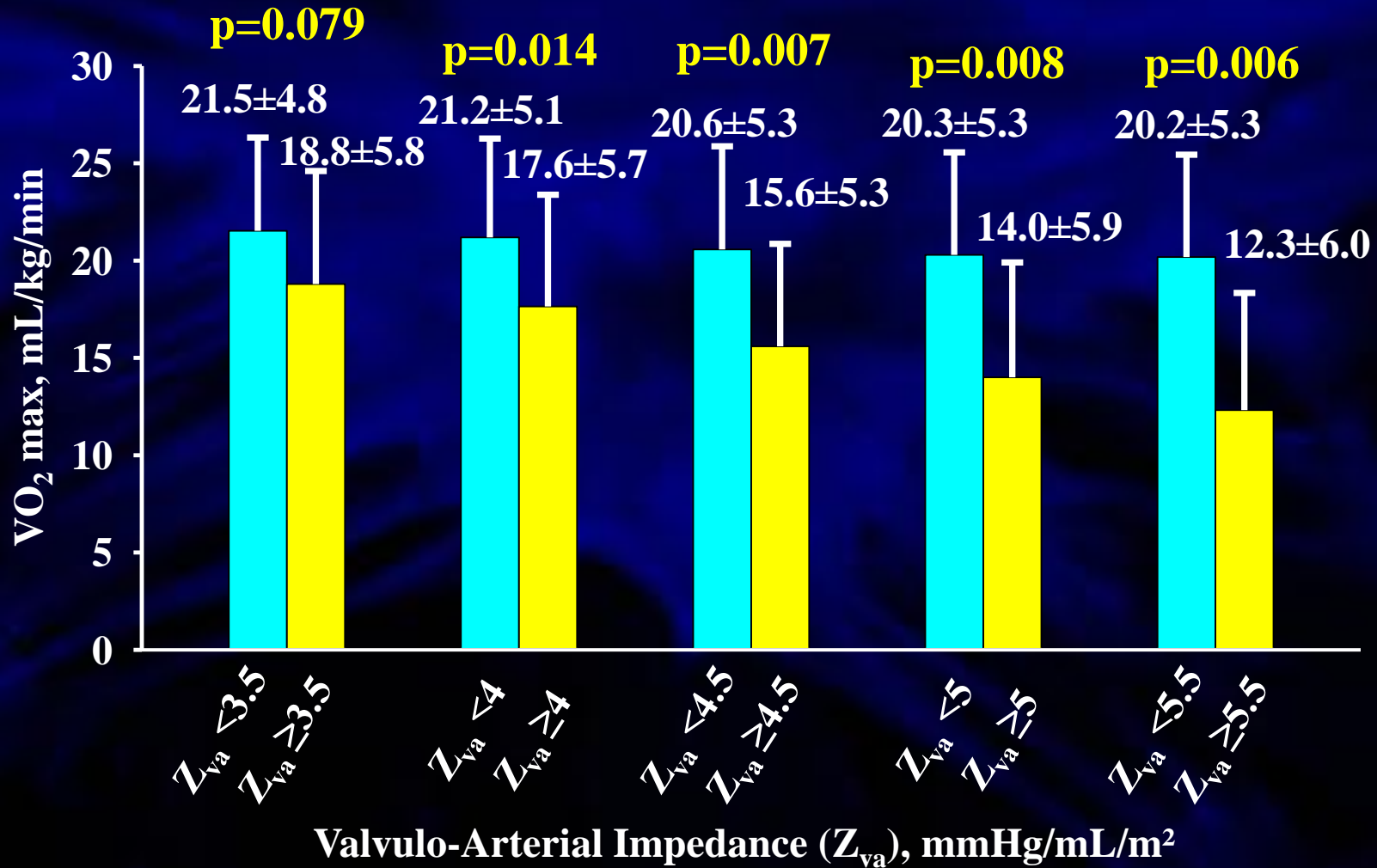


**Depressed LV longitudinal function,
basal septal and lateral LGE,
elevated myocardial fibrosis score,
and high myocyte diameter**



Hermann et al, JACC, 2011

Maximal Exercise Capacity and Z_{va}



Conclusion

- **Blood pressure** should be routinely measured in the echo lab. and **Zva** calculated
- **High Zva** in AS patients is an accurate marker of **advanced stage** of the disease and is associated with **reduced maximal exercise capacity**
- **High Zva** is associated with **poor mid- and long-term outcome**, even in asymptomatic patients
- In patients **with severe asymptomatic AS and high Zva**, follow-up could be shorten and **exercise test and/or exercise echo** should be recommended

THE EUROPEAN ASSOCIATION OF ECHOCARDIOGRAPHY (EAE)
PRESENTS

Athens - Greece
5-8 December

Euroecho²⁰¹² & other imaging modalities

The 16th Annual Meeting of the European Association of Echocardiography, a Registered Branch of the ESC,
in cooperation with the Working Group on Echocardiography of the Hellenic Cardiological Society

www.escardio.org/EAE



DON'T MISS

5-8 December 2012
MAICC – Athens, Greece

Abstract submission deadline
31 May

Early bird registration
30 September



*Thank you for your
attention.*

Fonds Léon Frederico

*“In these matters the only certainty is
that nothing is certain.”*

Pliny The Elder, 23 AD-79 AD

fnrs
LA LIBERTÉ DE CHERCHER

Université
de Liège



CHU
de Liège

“Severe” AS with Low Gradient and Low LVEF

- $AVA \leq 1.0 \text{ cm}^2$
- Mean gradient $\leq 30\text{-}40 \text{ mmHg}$
- $LVEF \leq 40\%$

- Approximately 5-10% of AS population

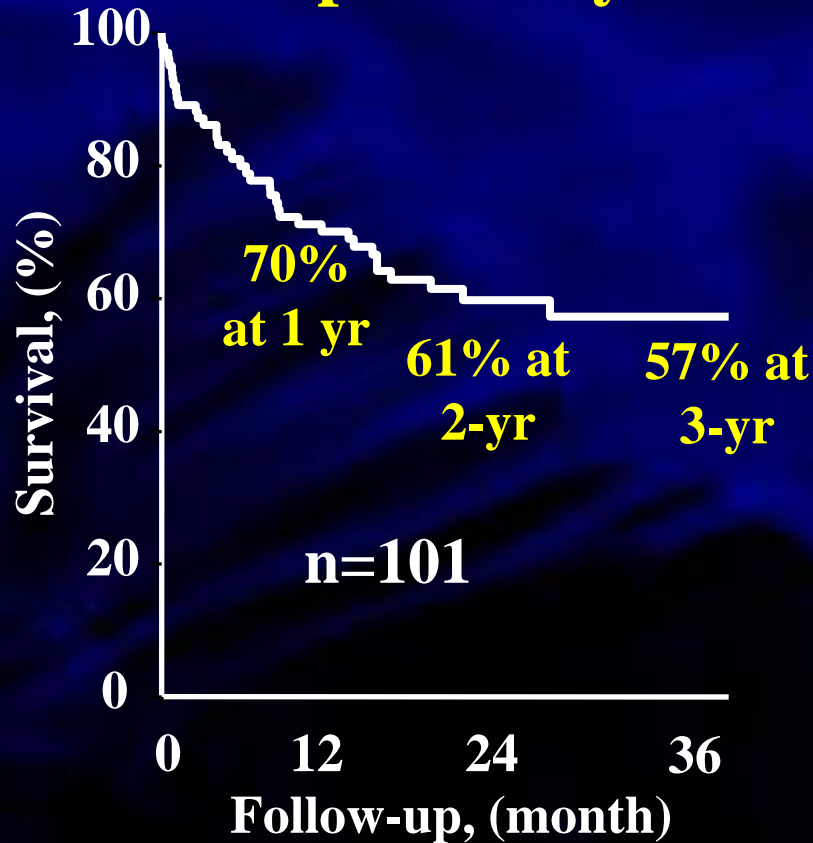
- **High risk patients:**
 - 3-year survival 50-60%
 - If operated (AVR): operative mortality: 8-30%



Prospective Studies: Topas/Euro Trial

Severe AS, LG, Low LVEF

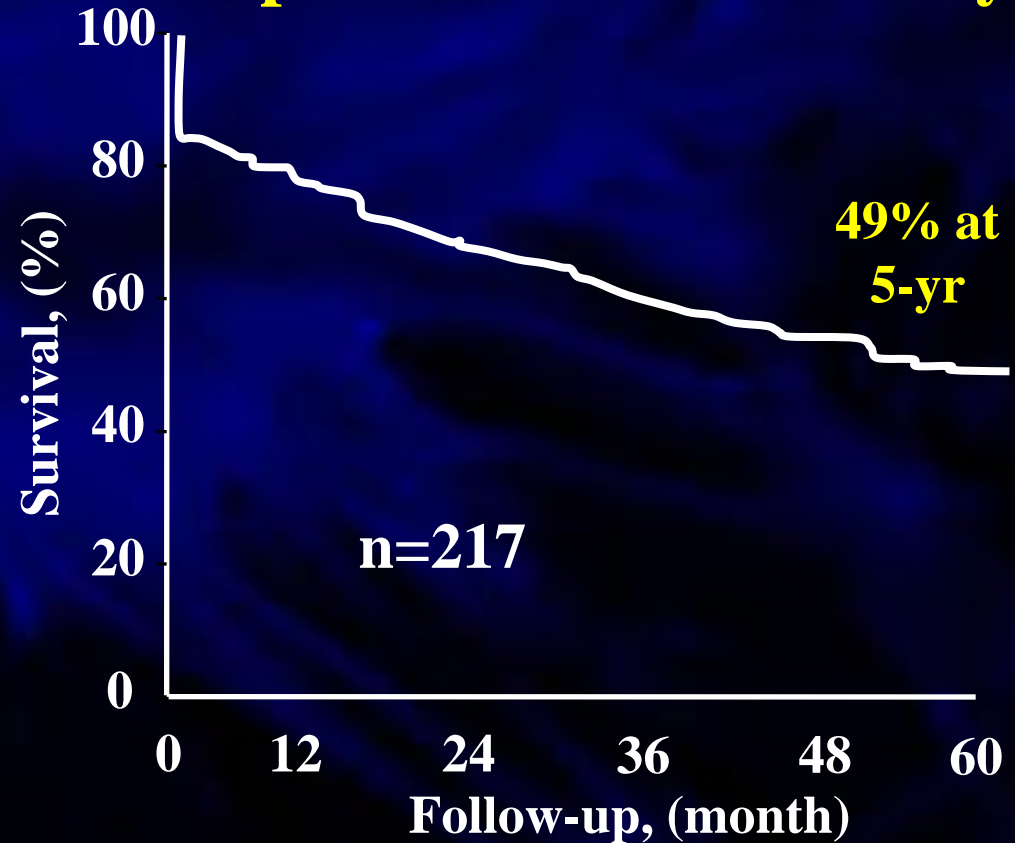
Topas Study



Operative mortality: 18%

Clavel et al. Circulation, 2008

European Multicenter Study



Operative mortality: 16%

Levy et al. JACC, 51:1466-72, 2008

Usefulness of Dobutamine Stress Echo (DSE) in LF/LG AS

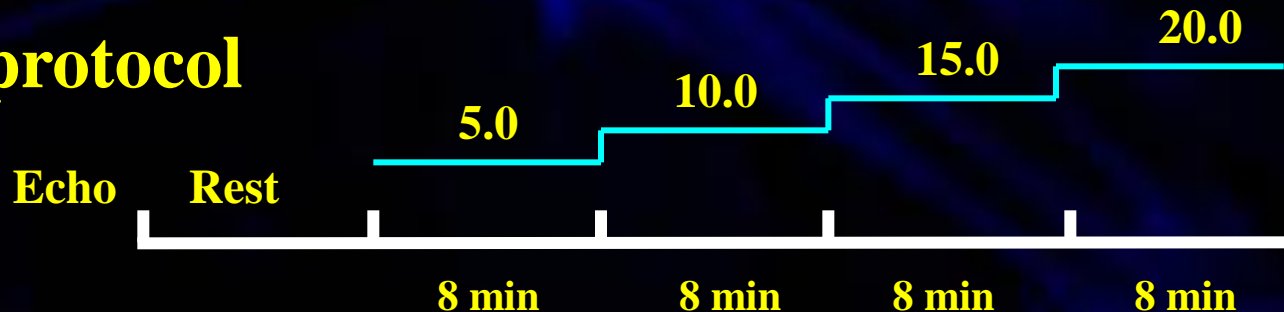
Low Flow, Low Gradient Severe AS
 $AVA < 1.0 \text{ cm}^2$, $DP_{\text{mean}} < 30-40 \text{ mmHg}$, $LV \text{ EF} \leq 40\%$

Dobutamine Stress Echocardiography

Stenosis Severity
(True vs. Pseudo Severe AS)

Contractile Reserve

Infusion protocol

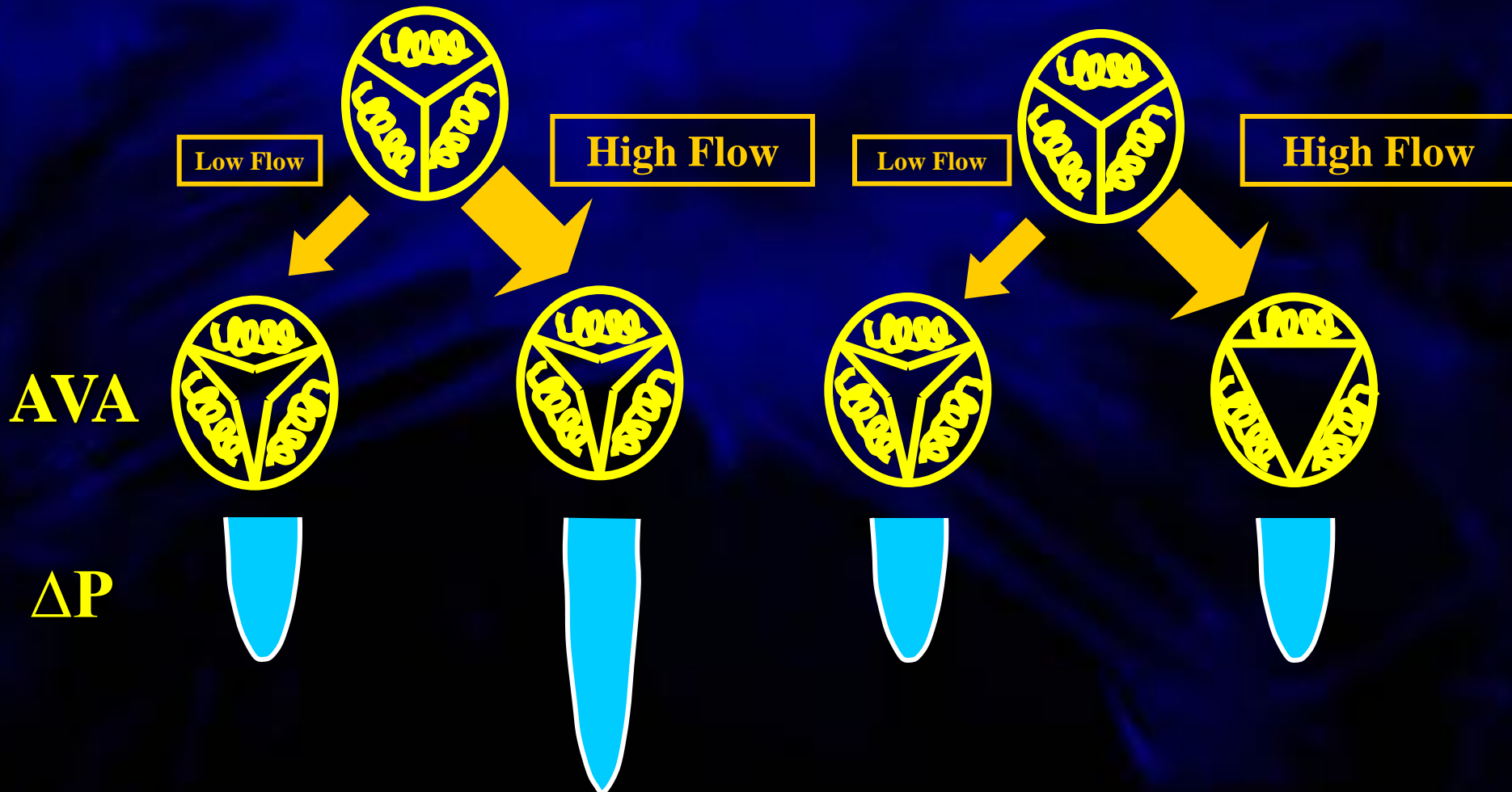


Monitoring: ECG, blood pressure

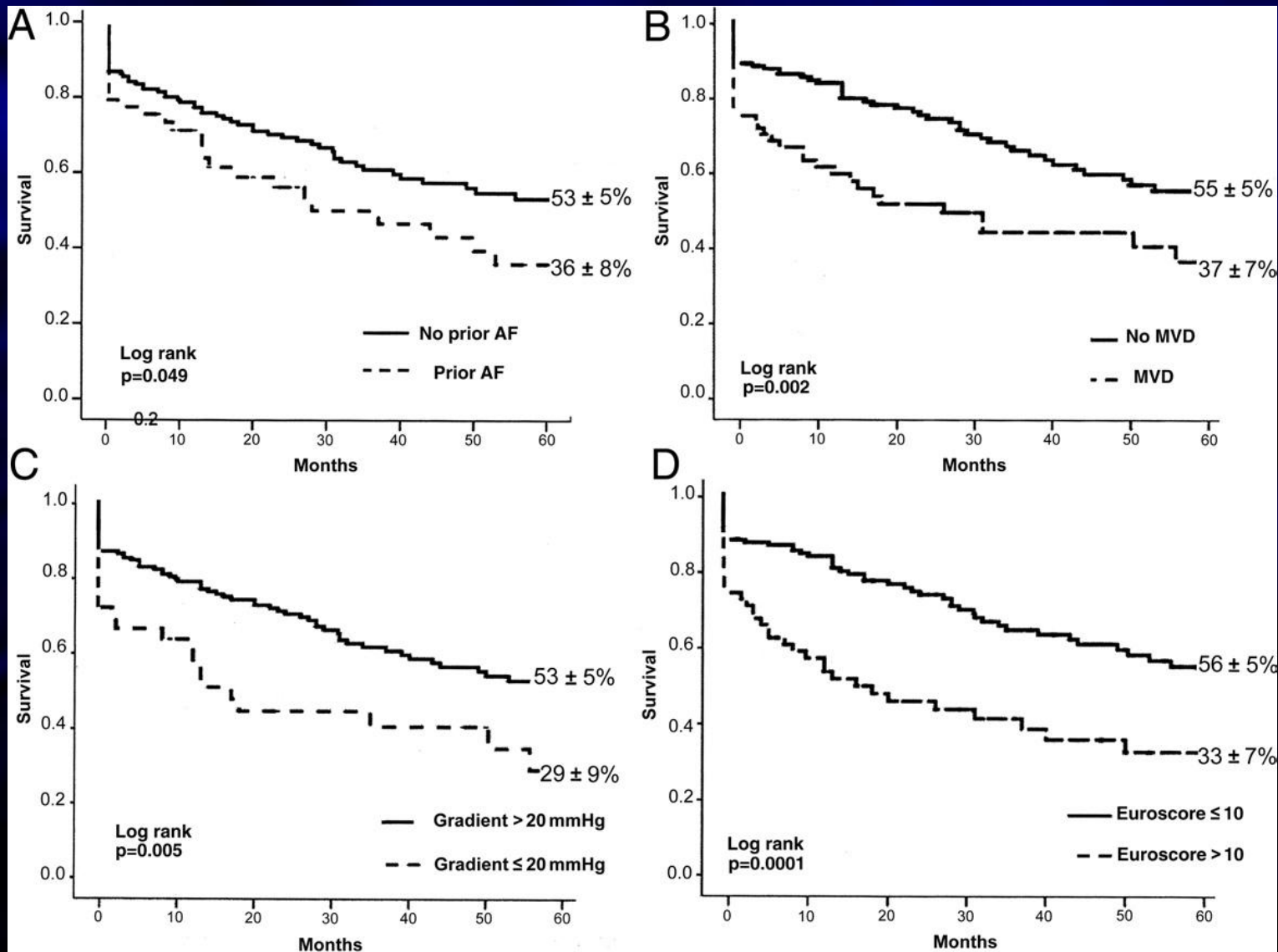
True Severe AS vs. Pseudo Severe AS ?

True Severe AS

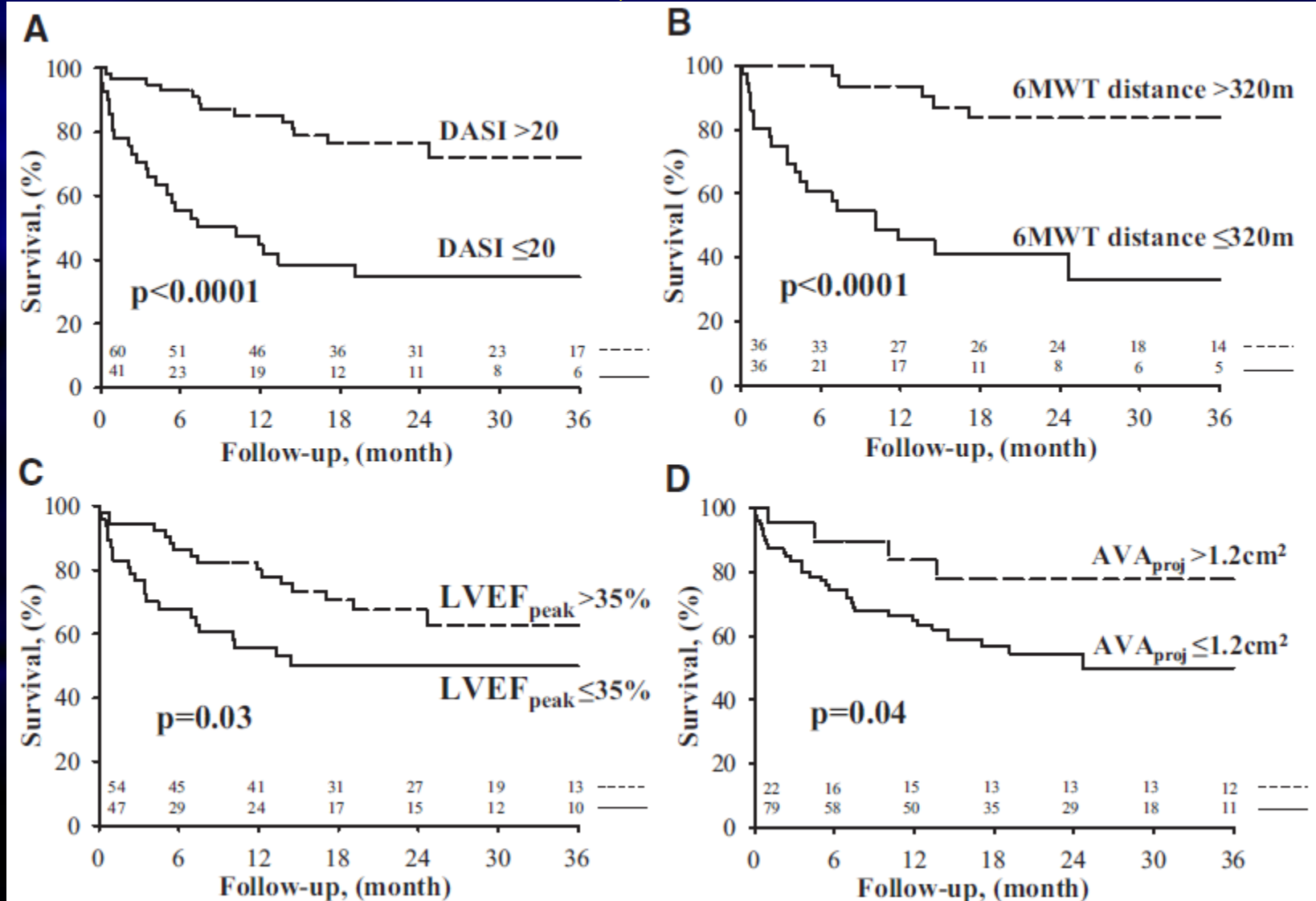
Pseudo Severe AS



Risk Stratification in LF/LG Severe AS, Low LVEF



Risk Stratification in LF/LG Severe AS, Low LVEF



$\Delta P < 30-40$
 $AVA \leq 1.0$



Dobutamine Stress Echo

$\uparrow SV \geq 20\%$

$\uparrow SV < 20\%$

Contractile Reserve

No Contractile Reserve

$\Delta P > 30-40$
 $AVA \leq 1.0$



$\Delta P \leq 30-40$
 $AVA > 1.0$



$\Delta P < 30-40$
 $AVA \leq 1.0$



True Severe AS

Pseudo Severe AS

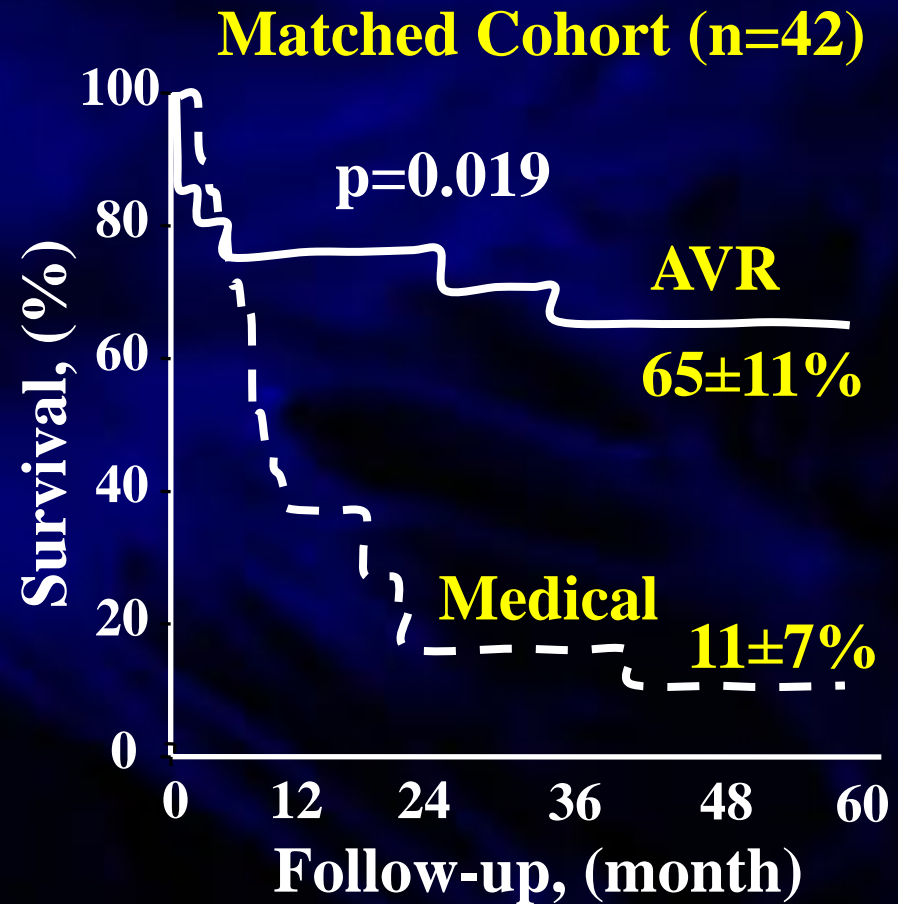
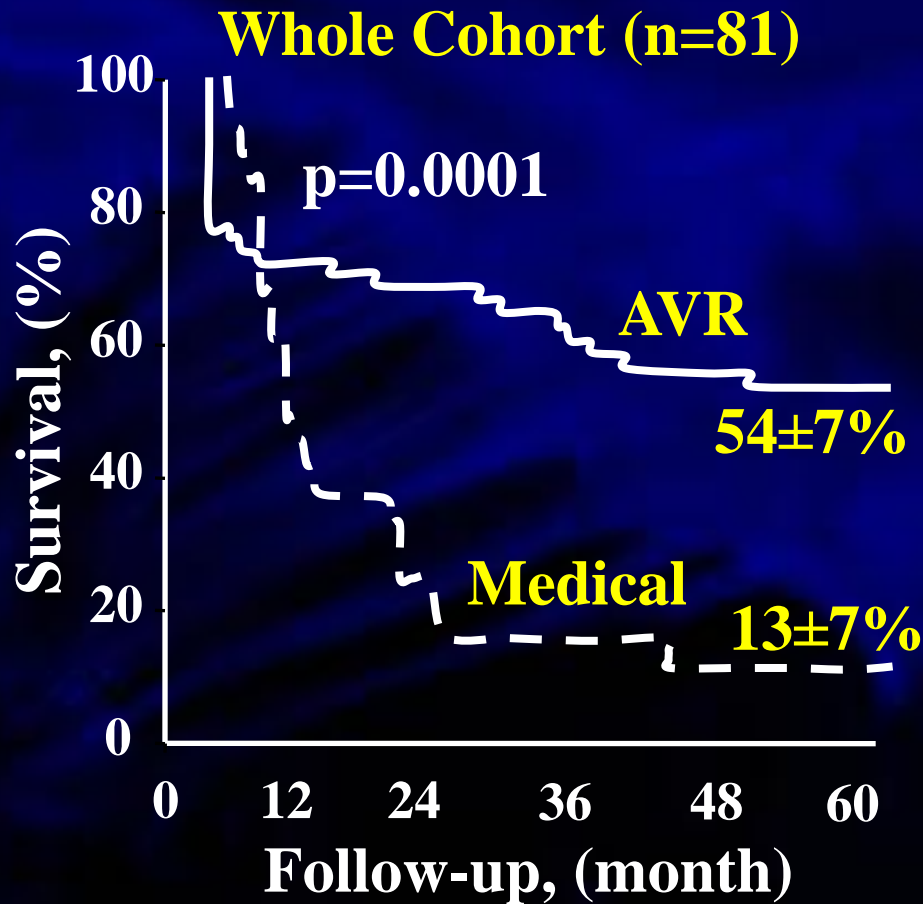
Indeterminate

AVR \pm CABG

MEDICAL

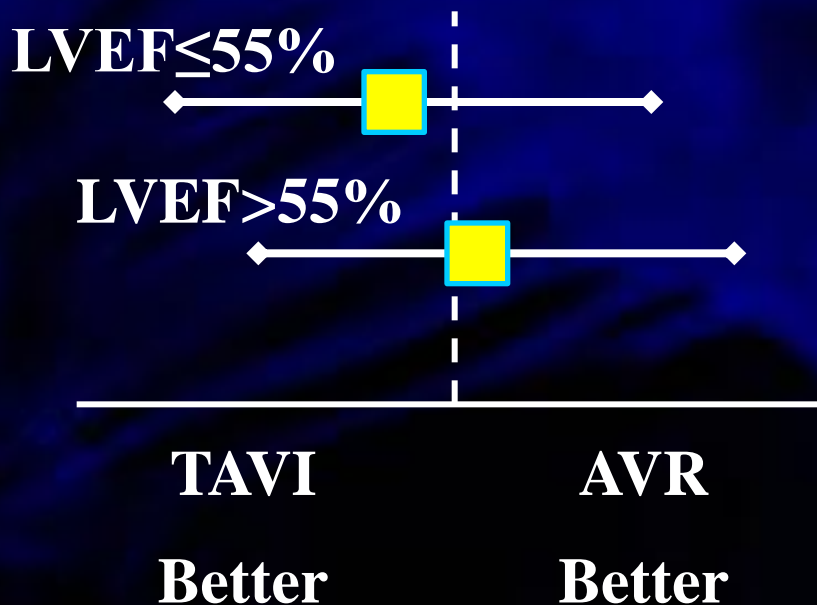
AVR? MEDICAL?

Outcome after AVR in Patients without Contractile Reserve



Outcome after TAVI in LF/LG Severe AS

Partner Study



Smith et al., NEJM, 2011

TAVI in LF/LG

	Patients with low-flow, low gradient aortic stenosis (n = 15)	Patients without low-flow, low gradient aortic stenosis (n = 152)	P value
Age (years)	79 ± 6	79 ± 6	0.997
Women, n (%)	5 (33)	83 (55)	0.174
Log EuroSCORE (%)	38 ± 20	19 ± 14	<0.001
Aortic valve area (cm ²)	0.7 ± 0.1	0.7 ± 0.1	0.818
Aortic mean gradient (mm Hg)	27 ± 7	48 ± 13	<0.001
Left ventricular ejection fraction (%)	32 ± 6	57 ± 11	<0.001
Diabetes mellitus, n (%)	5 (33)	50 (33)	1.000
Coronary artery disease, n (%)	12 (80)	70 (46)	0.015
Prior myocardial infarction, n (%)	6 (40)	29 (19)	0.062
Prior PCI, n (%)	6 (40)	41 (27)	0.368
Prior CABG, n (%)	5 (33)	16 (11)	0.012
Atrial fibrillation, n (%)	5 (33)	53 (35)	1.000
Prior stroke, n (%)	3 (20)	12 (8)	0.140
Kidney disease, n (%)	11 (73)	75 (49)	0.458
COPD, n (%)	3 (20)	48 (32)	0.558



Early mortality: 33%, p=0.037

Gotzmann et al., Cath CV Interv, 2011

(*Circulation*. 2007;115:2856-2864.)

Paradoxical Low-Flow, Low-Gradient Severe Aortic Stenosis Despite Preserved Ejection Fraction Is Associated With Higher Afterload and Reduced Survival

Zeineb Hachicha, MD; Jean G. Dumesnil, MD; Peter Bogaty, MD; Philippe Pibarot, DVM, PhD

n=512

SEVERE AS
($AVA_i \leq 0.6 \text{ cm}^2/\text{m}^2$)

PRESERVED LV FUNCTION
($LVEF \geq 50\%$)

331 patients (65%)
SVI > 35ml/m²

Normal Flow (NF) Group

181 patients (35%)
SVI ≤ 35ml/m²

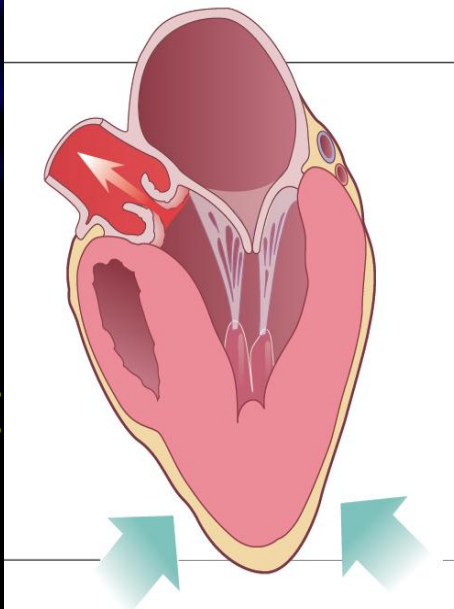
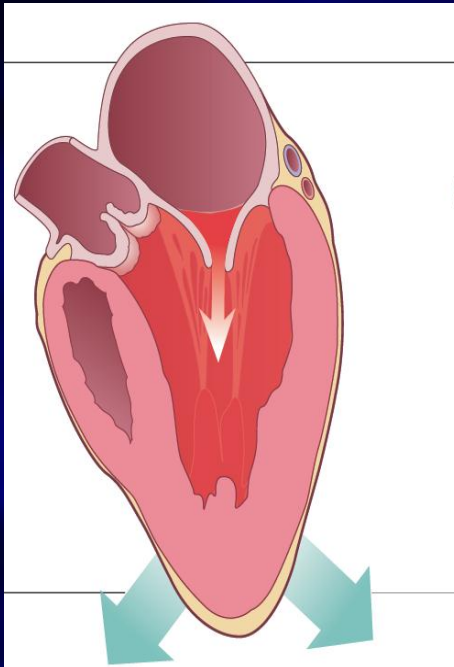
Paradoxical Low Flow (PLF) Group

Normal Flow AS

LVEDV:
115 ml

LVEF: 60%

SV: 70 ml
AVA: 0.7 cm²
 ΔP : 45 mmHg

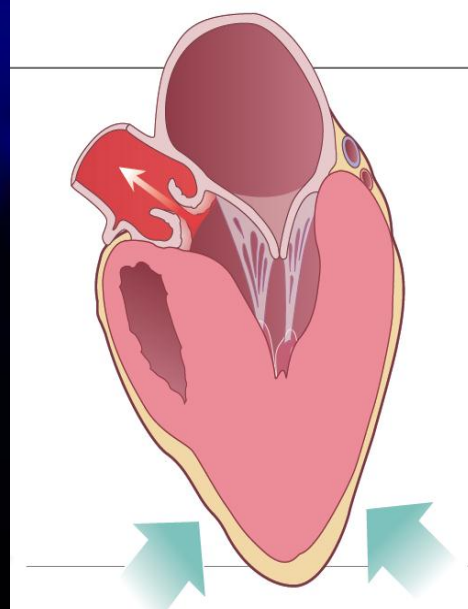
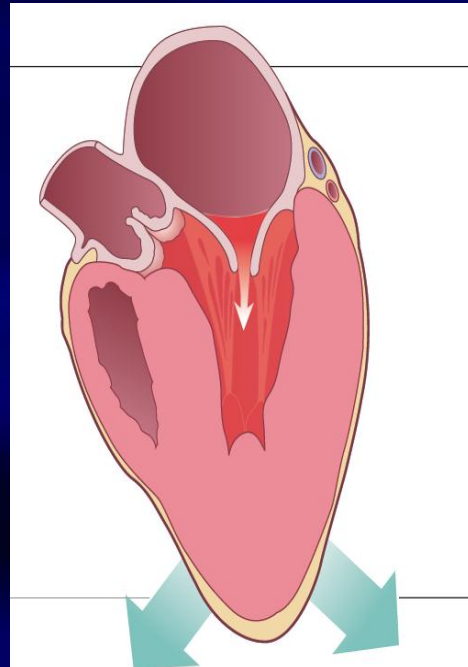


Paradoxical Low Flow AS

LVEDV:
85 ml

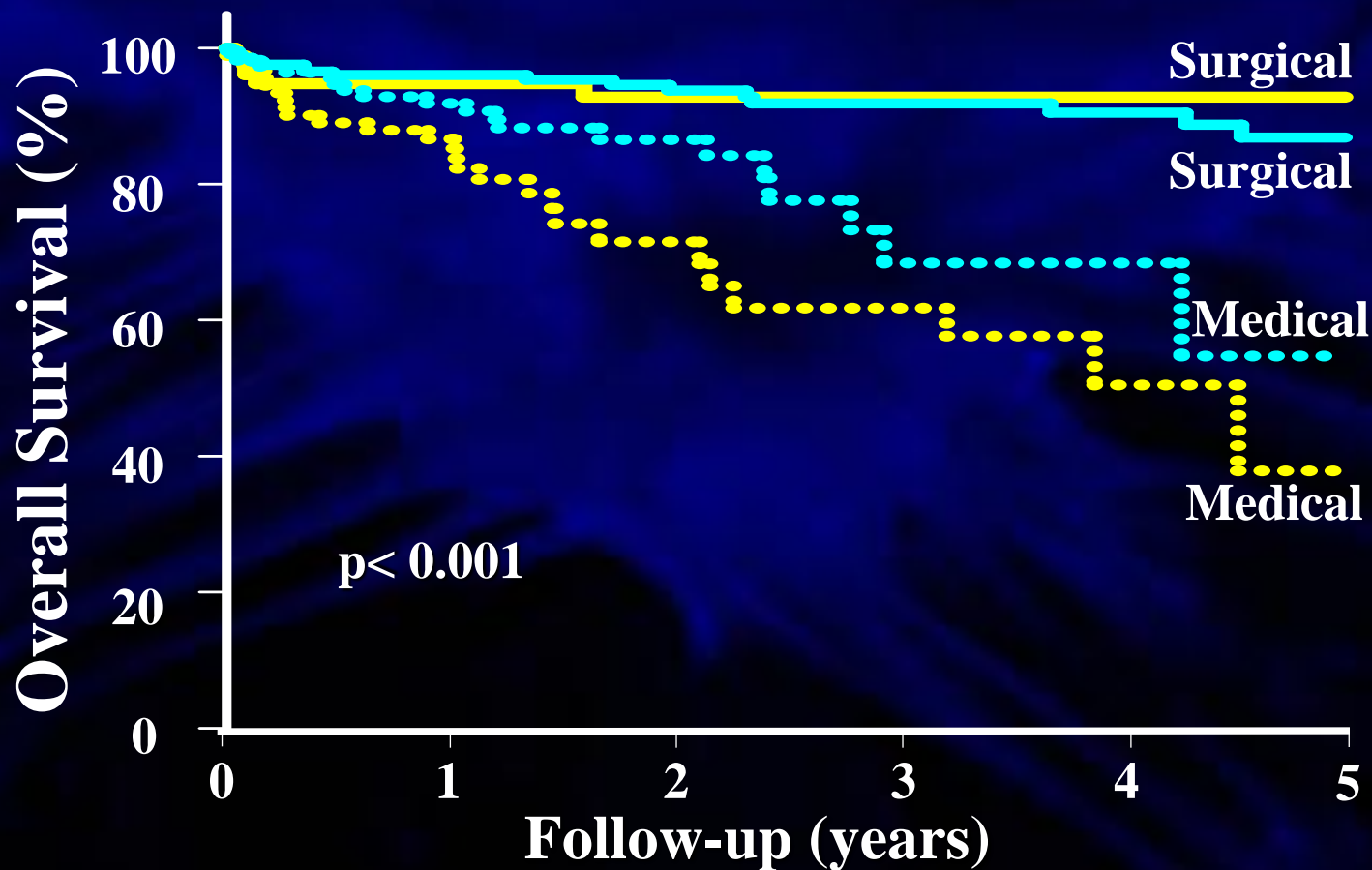
LVEF: 60%

SV: 50 ml
AVA: 0.7 cm²
 ΔP : 25 mmHg



*Pibarot & Dumesnil
iJACC; 2:400-3, 2009*

Outcome of Patients with Paradoxical Low Flow



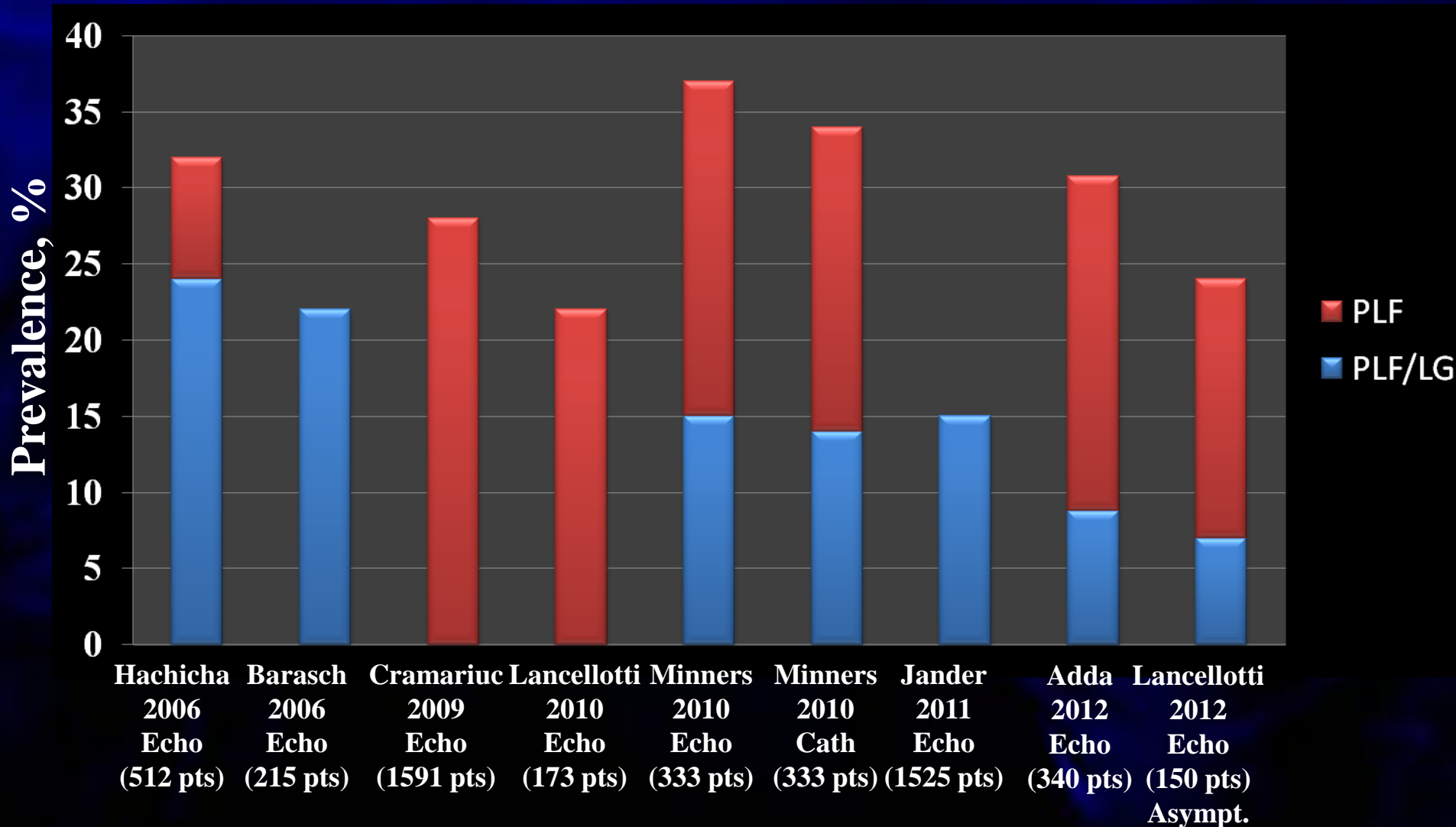
Hachicha Z et al., Circulation.
115:2856-2864, 2007

NF: Normal Flow: $SVI > 35$ (65%)

PLF: Paradoxical Low Flow: $SVI \leq 35$ (35%)

Prevalence of PLF/LG Severe AS

$\approx 5\text{-}15\%$ of Severe AS



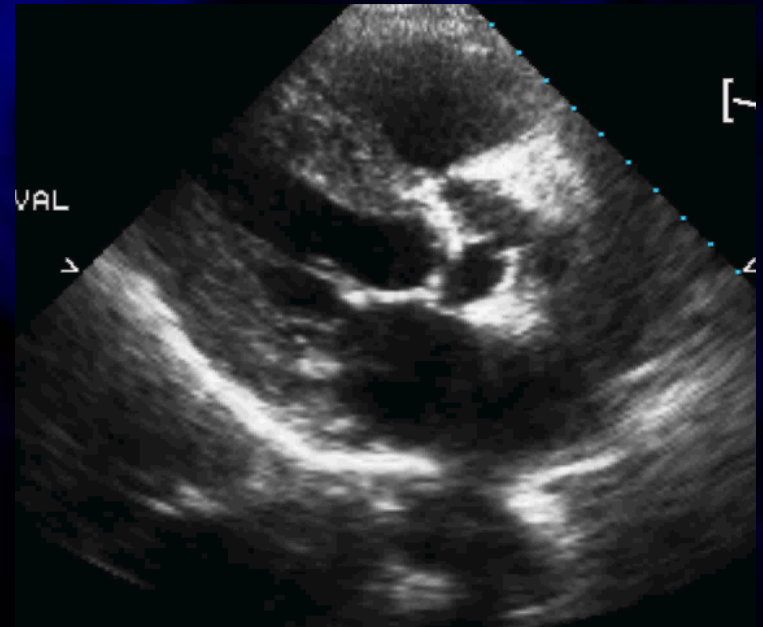
Echo Features of Paradoxical LF/LG Severe AS

The Aortic Valve:

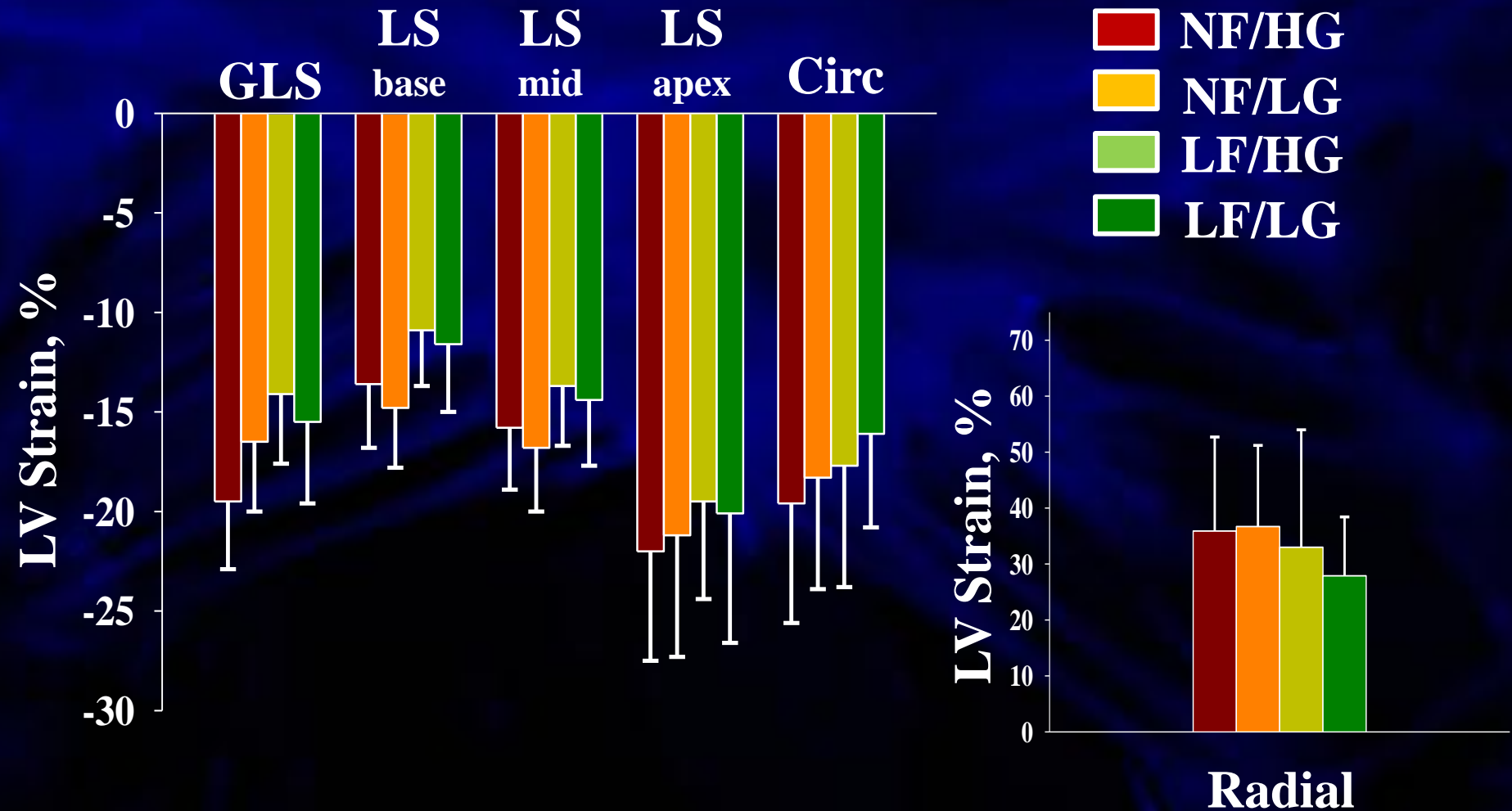
- $AVA < 1.0 \text{ cm}^2$ $AVA_i < 0.6 \text{ cm}^2/\text{m}^2$
- Severely thickened/calcified valve
- Mean gradient $< 40 \text{ mmHg}$
- Valvulo-arterial impedance $> 4.5 \text{ mmHg.ml}^{-1}.\text{m}^{-2}$

The Left Ventricle

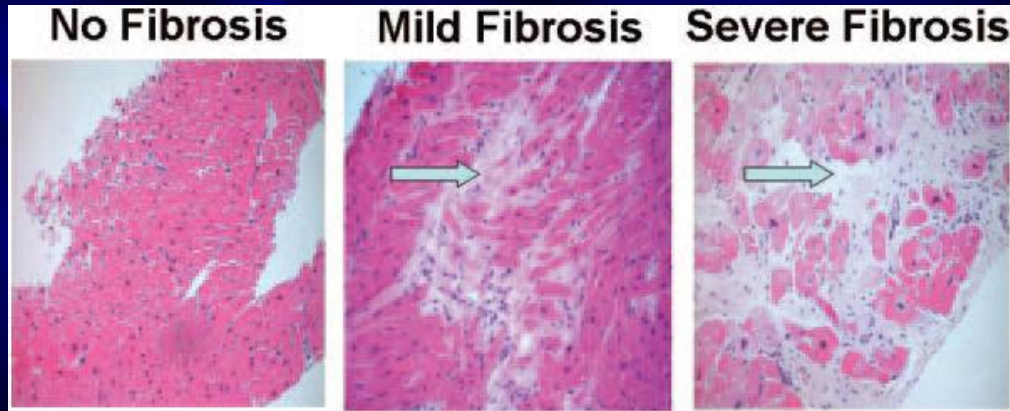
- $EDD < 47 \text{ mm}$ $EDV < 55 \text{ mL/m}^2$
- RWT ratio > 0.50
- Impaired LV filling
- $LVEF > 50\%$
- $GLS < 16\%$ $GRS < 30\%$
- $SV_i < 35 \text{ mL/m}^2$



Advanced Echo Features of Paradoxical LF/LG Severe AS

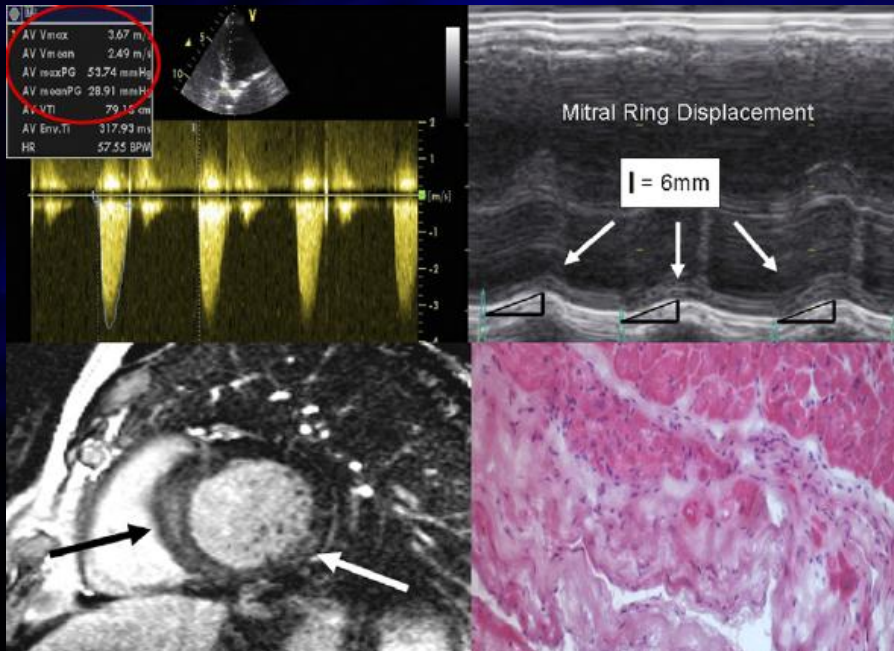


Myocardial Function in Paradoxical LF/LG Severe AS



Characterized by similar
LVEF and AVA but lower
MPG and LV SV

Weidemann, Hermann et al, Circ, 2009



Depressed LV longitudinal
function, basal septal and
lateral LGE, elevated
myocardial fibrosis score, and
high myocyte diameter

Hermann et al, JACC, 2011

Discordant Findings:

$AVA < 1.0 \text{ cm}^2$ &
 $\Delta P_{\text{mean}} < 40 \text{ mmHg}$
 $LVEF > 50\%$

Rule out small body size:
 $AVA_i > 0.6 \text{ cm}^2/\text{m}^2$

Rule out measurement errors:
corroborating methods:
(Teichholz, Simpson, 3D-contrast,
AV Planimetry)

Features of paradoxical low flow:

$SV_i \leq 35 \text{ mL/m}^2$ $Z_{va} > 4.5$
 $EDD < 47 \text{ mm}$ $EDV_i < 55 \text{ mL/m}^2$
 $RWTR > 0.50$ $GLS < 16\%$

Present:

Consider paradoxical low flow AS

Absent:

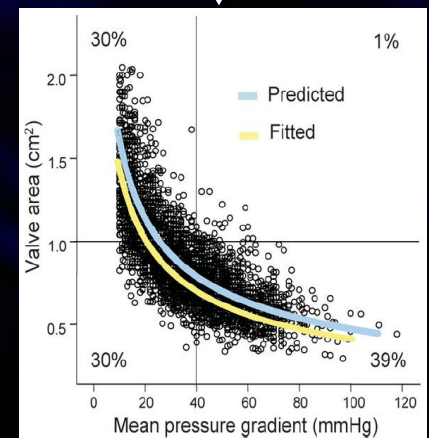
Consider inconsistencies in
guidelines criteria

Rule out pseudo-severe AS:

Valve morphology by echo
Exercise/dobutamine stress echo
Calcium score by CT
BNP



Consider paradoxical low flow severe AS:
AVR



Outcome of Paradoxical LF/LG Severe AS

SEAS trial

n=1 873



LVEF ≥ 55%

n=1 525



LG Severe AS

Mod. AS

n= 435, 29%

n= 184, 12%

Severe AS

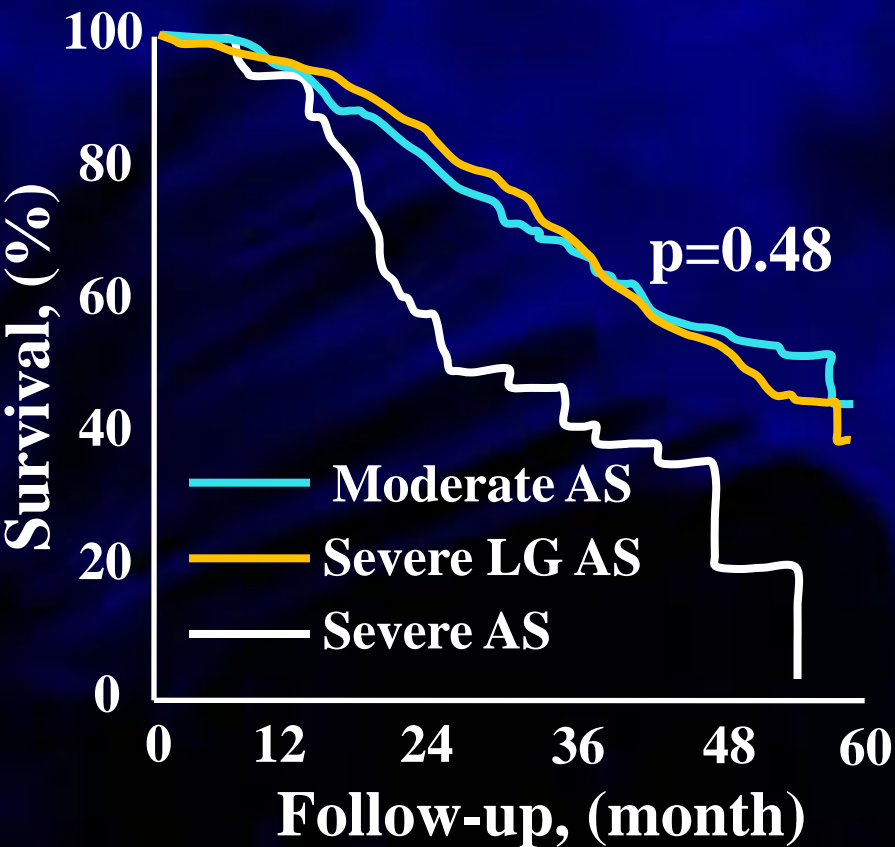
n= 35, 2%

Jander et al, Circulation, 2011

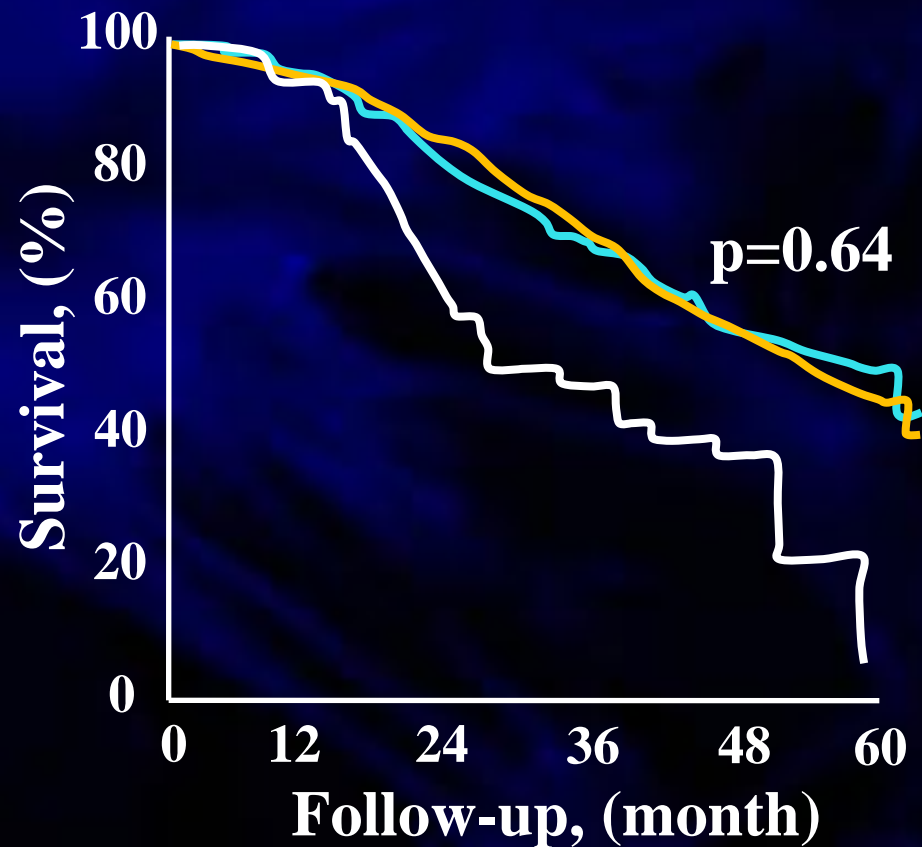
	Aortic Valve Stenosis		P
	Low-Gradient "Severe" (AVA <1.0 cm ² ; MPG ≤40 mm Hg) (n=435)	Moderate (AVA 1.5–1.0 cm ² ; MPG 25–40 mm Hg) (n=184)	
Aortic valve			
Peak aortic jet velocity, m/s	3.3±0.5	3.6±0.3	<0.01
Transaortic peak pressure gradient, mm Hg	44.8±11.9	53.0±7.4	<0.01
Transaortic mean pressure gradient, mm Hg	26.2±7.3	31.2±4.1	<0.01
Aortic valve area, cm	0.82±0.13	1.19±0.13	<0.01
Aortic valve area index, cm /m	0.46±0.08	0.63±0.09	<0.01
Velocity time integral aortic valve, cm	78.0±13.0	82.0±10.0	<0.01
Dimensionless velocity index	0.26±0.06	0.30±0.06	<0.01
Stroke volume			
LV outflow tract diameter, mm	20.2±0.2	22.8±0.2	<0.01
Velocity time integral LV outflow tract, cm	20.1±4.1	24.2±4.9	<0.01
Stoke volume, mL	63.8±13.1	97.5±13.9	<0.01
Stoke volume index, mL/m	35.1±7.3	50.7±8.5	<0.01
Cardiac output, L/min	4.3±1.0	6.6±1.2	<0.01
Cardiac index, L/min	2.4±0.56	3.4±0.71	<0.01
LV			
LV ejection fraction, %	66.9±5.7	66.7±5.8	0.68
LV end-diastolic diameter, mm	49.0±6.1	50.7±5.6	<0.01
LV end-diastolic diameter index, mm/m	26.9±3.4	26.3±3.2	0.04
LV end-diastolic volume, mL	115.3±32.7	124.4±31.1	<0.01
LV end-diastolic volume index, mL/m	63.0±16.5	64.3±15.6	0.36
LV end-systolic diameter, mm	31.0±5.1	31.6±5.0	0.18
LV end-systolic diameter index, mm/m	17.0±2.7	16.4±2.7	<0.01
Fractional shortening, %	36.8±5.6	37.8±6.0	0.05
LV end-diastolic septum thickness, mm	11.4±2.8	12.3±2.9	<0.01
LV end-diastolic posterior wall thickness, mm	8.8±1.9	9.4±1.9	<0.01
LV mass, g	182.3±63.6	211.6±67.5	<0.01
LV mass index, g/m	98.9±30.6	108.9±33.3	<0.01
Relative wall thickness, %	36.5±9.5	37.3±8.9	0.30

Outcome of Paradoxical LF/LG Severe AS

Aortic Valve Events



Major CV Events



Outcome of Paradoxical LF/LG

Similar AS severity,
similar outcome!



AVA: 0.99 vs. 1.01 cm²

AVAi: 0.54 vs 0.52 cm²/m²

SVi: 42.1 vs. 42.7 mL/m²

SV = LVEF x LVED vol

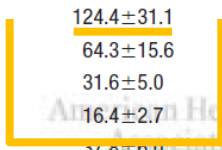
BSA: 1.83m² vs. 1.94m²

Jander et al, Circulation, 2011

	Aortic Valve Stenosis		
	Low-Gradient "Severe" (AVA <1.0 cm ² ; MPG ≤40 mm Hg) (n=435)	Moderate (AVA 1.5–1.0 cm ² ; MPG 25–40 mm Hg) (n=184)	P
Aortic valve			
Peak aortic jet velocity, m/s	3.3±0.5	3.6±0.3	<0.01
Transaortic peak pressure gradient, mm Hg	44.8±11.9	53.0±7.4	<0.01
Transaortic mean pressure gradient, mm Hg	26.2±7.3	31.2±4.1	<0.01
Aortic valve area, cm	0.82±0.13	1.19±0.13	<0.01
Aortic valve area index, cm /m	0.46±0.08	0.63±0.09	<0.01
Velocity time integral aortic valve, cm	78.0±13.0	82.0±10.0	<0.01
Dimensionless velocity index	0.26±0.06	0.30±0.06	<0.01
Stroke volume			
LV outflow tract diameter, mm	20.2±0.2	22.8±0.2	<0.01
Velocity time integral LV outflow tract, cm	20.1±4.1	24.2±4.9	<0.01
Stroke volume, mL	63.8±13.1	97.5±13.9	<0.01
Stroke volume index, mL/m	35.1±7.3	50.7±8.5	<0.01
Cardiac output, L/min	4.3±1.0	6.6±1.2	<0.01
Cardiac index, L/min	2.4±0.56	3.4±0.71	<0.01
LV			
LV ejection fraction, %	66.9±5.7	66.7±5.8	0.68
LV end-diastolic diameter, mm	49.0±6.1	50.7±5.6	<0.01
LV end-diastolic diameter index, mm/m	26.9±3.4	26.3±3.2	0.04
LV end-diastolic volume, mL	115.3±32.7	124.4±31.1	<0.01
LV end-diastolic volume index, mL/m	63.0±16.5	64.3±15.6	0.36
LV end-systolic diameter, mm	31.0±5.1	31.6±5.0	0.18
LV end-systolic diameter index, mm/m	17.0±2.7	16.4±2.7	<0.01
Fractional shortening, %	36.8±5.6	37.8±6.0	0.05
LV end-diastolic septum thickness, mm	11.4±2.8	12.3±2.9	<0.01
LV end-diastolic posterior wall thickness, mm	8.8±1.9	9.4±1.9	<0.01
LV mass, g	182.3±63.6	211.6±67.5	<0.01
LV mass index, g/m	98.9±30.6	108.9±33.3	<0.01
Relative wall thickness, %	36.5±9.5	37.3±8.9	0.30

77.1

82.9



Asymptomatic Paradoxical LF/LG Severe AS

Clinical Outcome in Asymptomatic Severe Aortic Stenosis

Insights From the New Proposed
Aortic Stenosis Grading Classification

JACC Vol. 59, No. 3, 2012
January 17, 2012:224-32

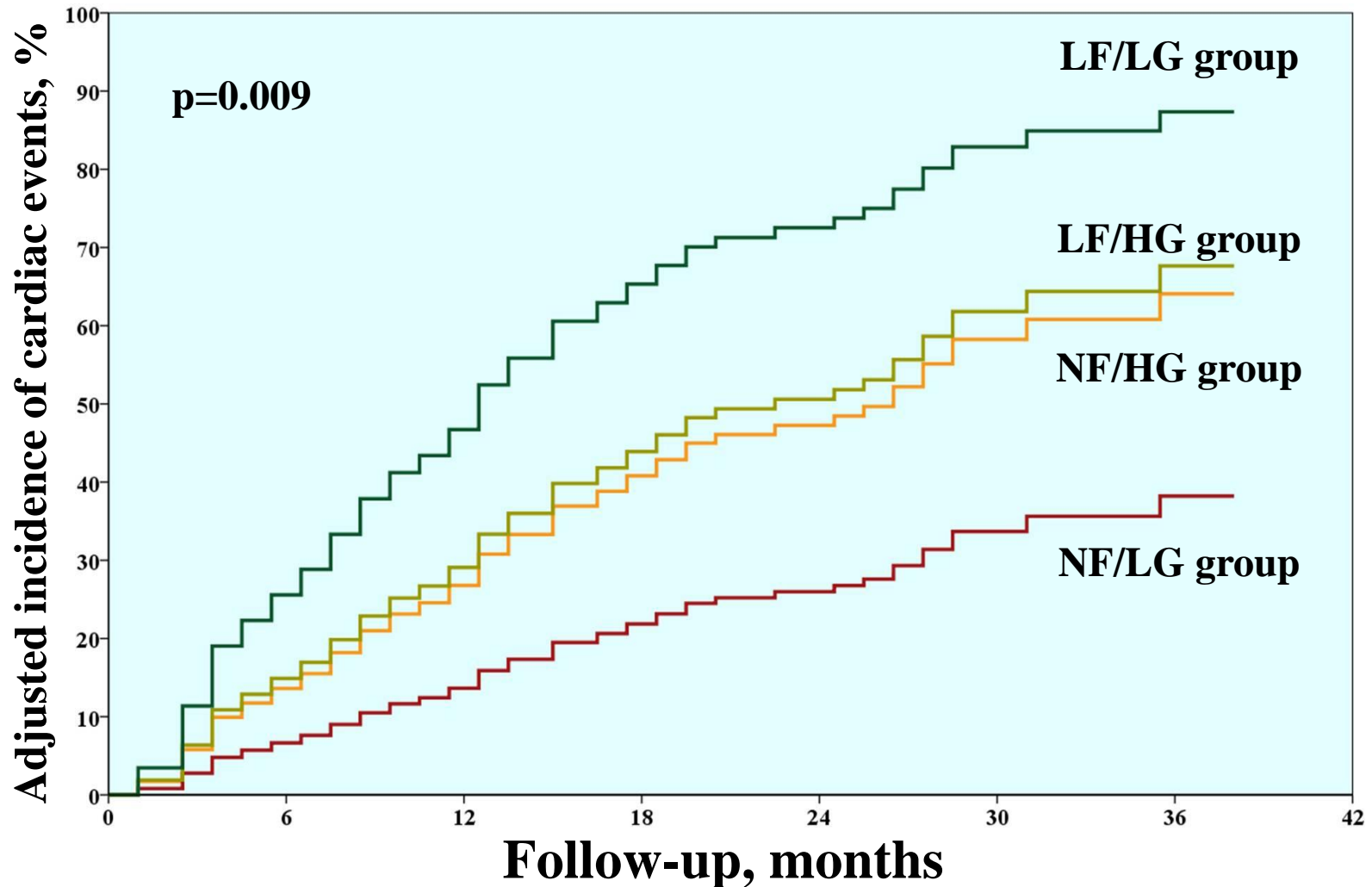
Patrizio Lancellotti, MD, PhD,* Julien Magne, PhD,* Erwan Donal, MD, PhD,† Laurent Davin, MD,*
Kim O'Connor, MD,*‡ Monica Rosca, MD,* Catherine Szymanski, MD,* Bernard Cosyns, MD, PhD,§
Luc A. Piérard, MD, PhD*

Asymptomatic severe AS with
preserved LV ejection fraction,
n=150

	NF/LG (n = 46) (31%)	NF/HG (n = 78) (52%)	LF/HG (n = 15) (10%)	LF/LG (n = 11) (7%)	p Value
Age, yrs	69 ± 8	71 ± 10	71 ± 8	65 ± 14	NS
Male, %	29 (63)	53 (68)	9 (60)	5 (45)	NS
Body surface area, m ²	1.8 ± 0.2	1.8 ± 0.2	1.9 ± 0.2	1.8 ± 0.2	NS
AVA, cm ²	0.85 ± 0.08	0.79 ± 0.1	0.74 ± 0.15*	0.80 ± 0.14	0.04
Indexed AVA, cm ² /m ²	0.47 ± 0.07	0.45 ± 0.08	0.39 ± 0.09*	0.45 ± 0.09	0.04
Peak aortic velocity, m/s ⁻¹	3.5 ± 0.4	4.5 ± 0.6*	4.6 ± 0.4*	3.8 ± 0.5††	<0.0001
Mean aortic gradient, mm Hg	32 ± 5	53 ± 12*	50 ± 14*	33 ± 5††	<0.0001
Valvulo-arterial Impedance, mm Hg/ml/m ²	3.7 ± 0.8	3.9 ± 0.9	5.9 ± 1.1*†	6.0 ± 1.1*†	<0.0001
LVEDV Index, ml/m ²	58 ± 14	61 ± 18	55 ± 14	52 ± 16	NS
LVESV Index, ml/m ²	21 ± 7	23 ± 12	20 ± 11	19 ± 12	NS
LV stroke volume, ml	74 ± 16	73 ± 16	63 ± 7*†	59 ± 10*†	0.003
Indexed LV stroke volume, ml/m ²	41 ± 10	41 ± 11	33 ± 2*†	31 ± 2*†	<0.0001
LVEF, %	67 ± 8	67.0 ± 7.5	66 ± 7	66 ± 8	NS
LV longitudinal strain, %	16.7 ± 2.6	16.0 ± 2.6	14.8 ± 2.7*	13.6 ± 4.3*†	0.002
LA area Index, cm/m ²	12.4 ± 4.0	11.9 ± 3.0	13.4 ± 3.0	13.0 ± 3.0	NS
BNP, pg/ml	34 ± 5	67 ± 10	110 ± 14*†	95 ± 18*	<0.0001
Risk score	12.2 ± 2.0	15.1 ± 2.0*	16.5 ± 2.0*	14.9 ± 2.0*	<0.0001

Asymptomatic Paradoxical LF/LG

Severe AS



Key Messages

- The presence of a **moderately** increased transvalvular gradient (<40 mmHg) does not exclude the presence of a **severe AS**, even in patients with **preserved LVEF**
- DSE is very useful for **the management** of LF/LG AS
- Paradoxical LF/LG entity is found **in 5-15% of AS** patients and is often associated with **more advanced stage** of the disease and **worse prognosis**, even in **asymptomatic patients**
- It is important to recognize this entity so we do not deny surgery to a symptomatic patient with small AVA and LG



*Thank you for your
attention.*

Fonds Léon Frederico

*“In these matters the only certainty is
that nothing is certain.”*

Pliny The Elder, 23 AD-79 AD

fnrs
LA LIBERTÉ DE CHERCHER

Université
de Liège



CHU
de Liège

THE EUROPEAN ASSOCIATION OF ECHOCARDIOGRAPHY (EAE)
PRESENTS

Athens - Greece
5-8 December

Euroecho²⁰¹² & other imaging modalities

The 16th Annual Meeting of the European Association of Echocardiography, a Registered Branch of the ESC,
in cooperation with the Working Group on Echocardiography of the Hellenic Cardiological Society

www.escardio.org/EAE



DON'T MISS

5-8 December 2012
MAICC – Athens, Greece

Abstract submission deadline
31 May

Early bird registration
30 September



*Thank you for your
attention.*

Fonds Léon Frederico

*“In these matters the only certainty is
that nothing is certain.”*

Pliny The Elder, 23 AD-79 AD

fnrs
LA LIBERTÉ DE CHERCHER

Université
de Liège



CHU
de Liège