Management of significant asymptomatic aortic stenosis.

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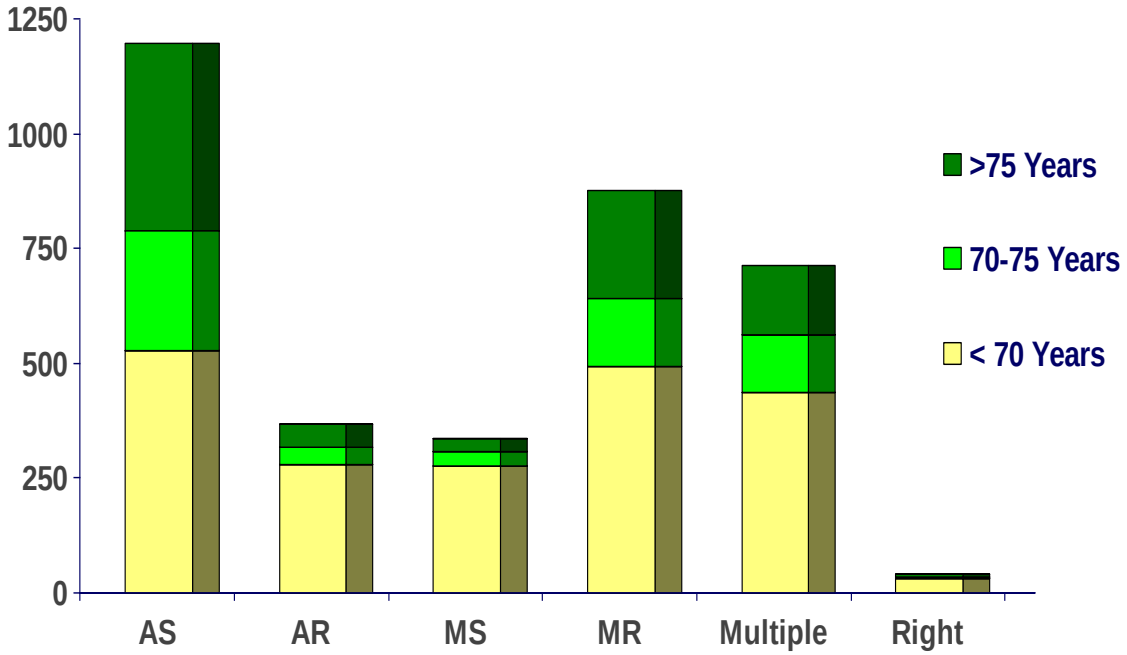
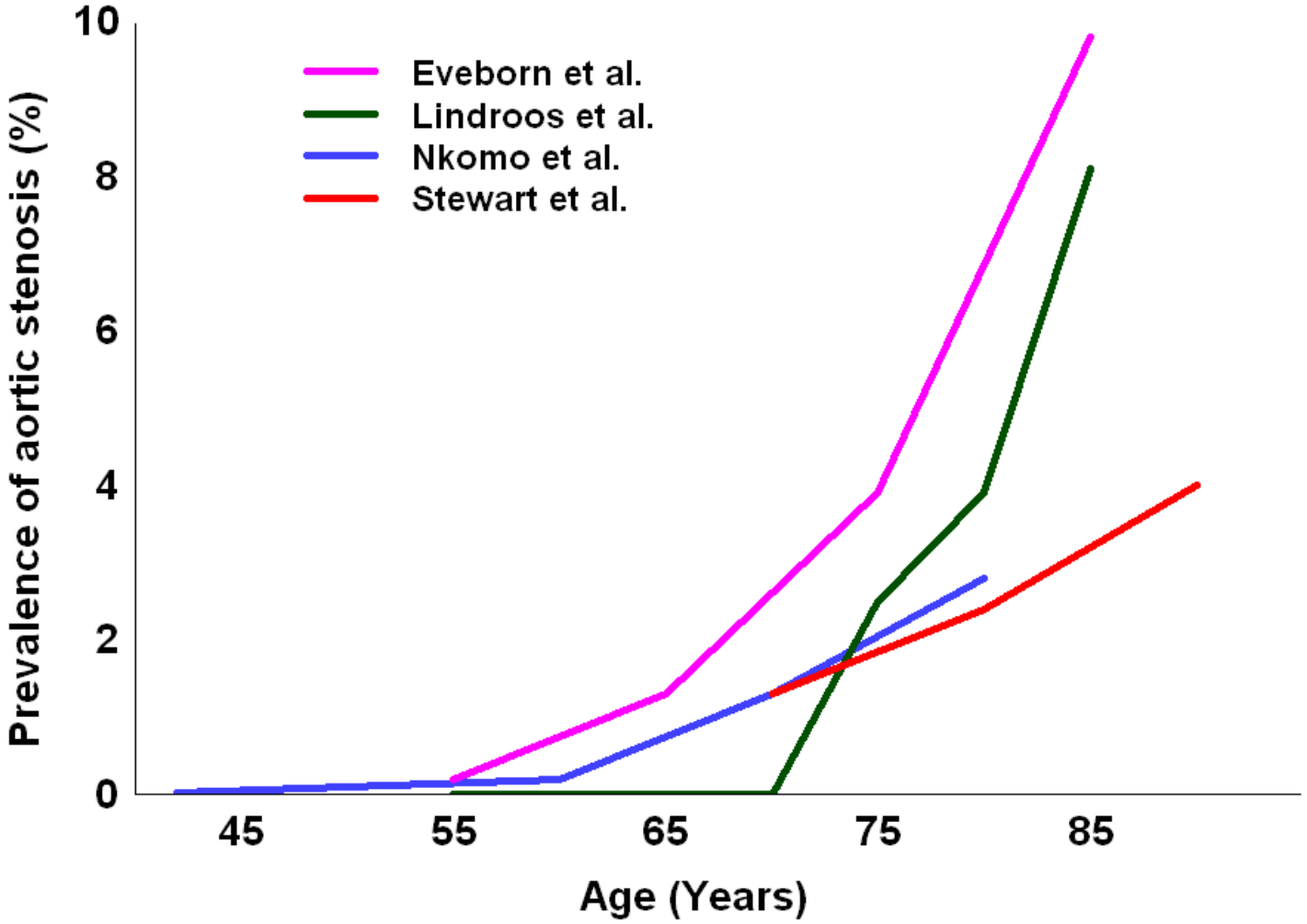
Background

Aortic stenosis (AS) is the most frequent valve disease among referred patients.



It is frequently identified at an asymptomatic stage.

Prevalence of AS /age



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(Iung and Vahanian :Can J Cardiol ;2014;30:1073-9)

Echocardiographic criteria for the definition of severe valve stenosis: *an integrative approach*

	Aortic stenosis	Mitral stenosis	Tricuspid stenosis
Valve area (cm^2)	< 1.0	< 1.0	–
Indexed valve area (cm^2/m^2 BSA)	< 0.6	–	–
Mean gradient (mmHg)	> 40	> 10	≥ 5
Maximum jet velocity (m/s)	> 4.0	–	–
Velocity ratio	< 0.25	–	–

Adapted from Baumgartner, EAE/ASE recommendations. *Eur J Echocardiogr* 2010;10:1-25

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

Asymptomatic AS

- Sudden death
- Myocardial dysfunction

Amato *et al,* Heart 2001

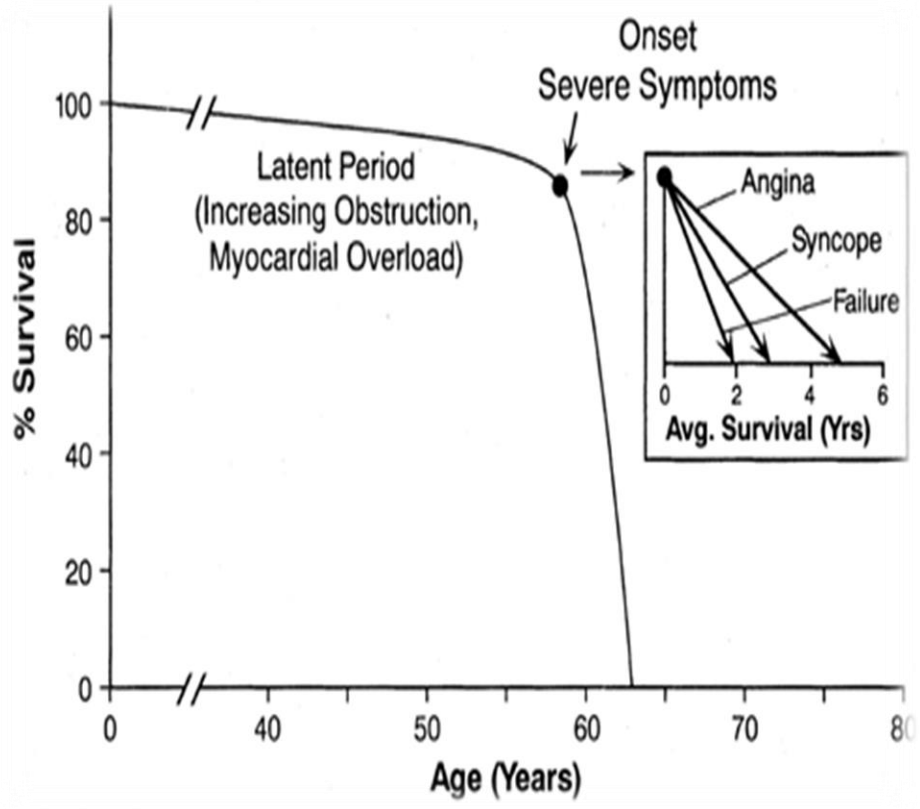
- Operative risk
- Prosthesis complications

Edwards *et al,* JACC, 2001

Identify subgroups of asymptomatic patients at high risk of complications that could benefit from prophylactic aortic valve replacement+++.

- ***Natural history***

Natural History of Aortic Stenosis



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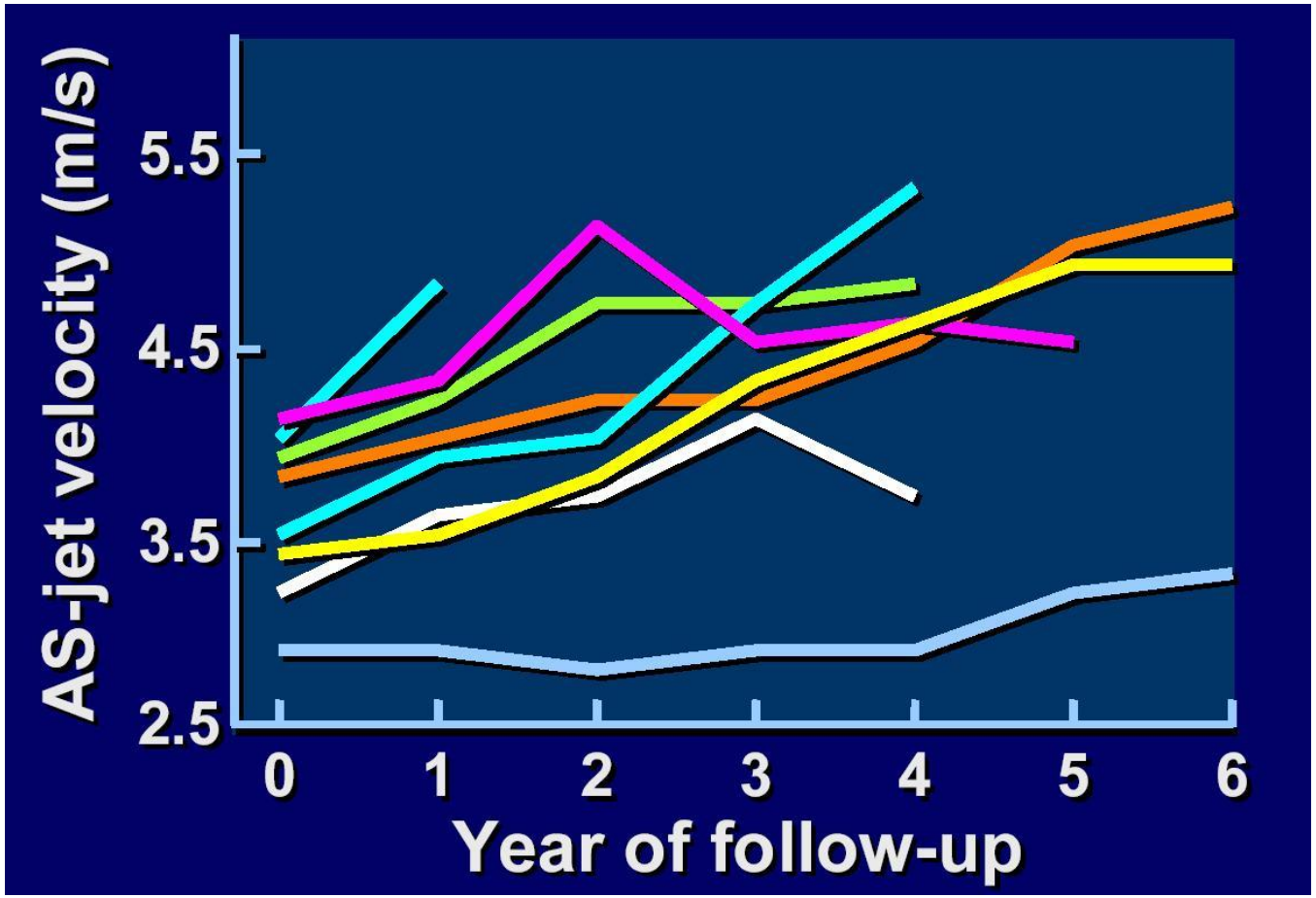
E.Braunwald

Important Interindividual Variability in the progression of AS



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(Otto Circ 1997)

Natural history of asymptomatic AS
Prospective series

	n	AS Severity		Mean FU	Sudden
		V.max (m/s)	AVA (cm^2)	(months)	**Death** (n)
Otto (1997)	123	≥ 2.5		30	0
Rosenhek (2000)	128	≥ 4		22	1
Amato (2001)	66		≤ 1.0	15	4
Das (2005)	125		≤ 1.4	12	0
Monin (2009)	211	≥ 3	≤ 1.5	22	2
Rosenhek (2010)	116	≥ 5		41	1
Lancellotti (2010)	126		≤ 1.2	20	2
Kang (2010)	95	≥ 4.5	≤ 0.75	59	9
Maréchaux (2010)	135		≤ 1.5	20	0
Cueff (2013)	102		≤ 1.5	22	1

Incidence of sudden death < 1 per 100 pts-year

Asymptomatic AS

- Do not operate before symptoms, but :
  - Rapid symptom onset
  - High inter-patient variability
  - Symptoms are subjective, progressive and often under-reported

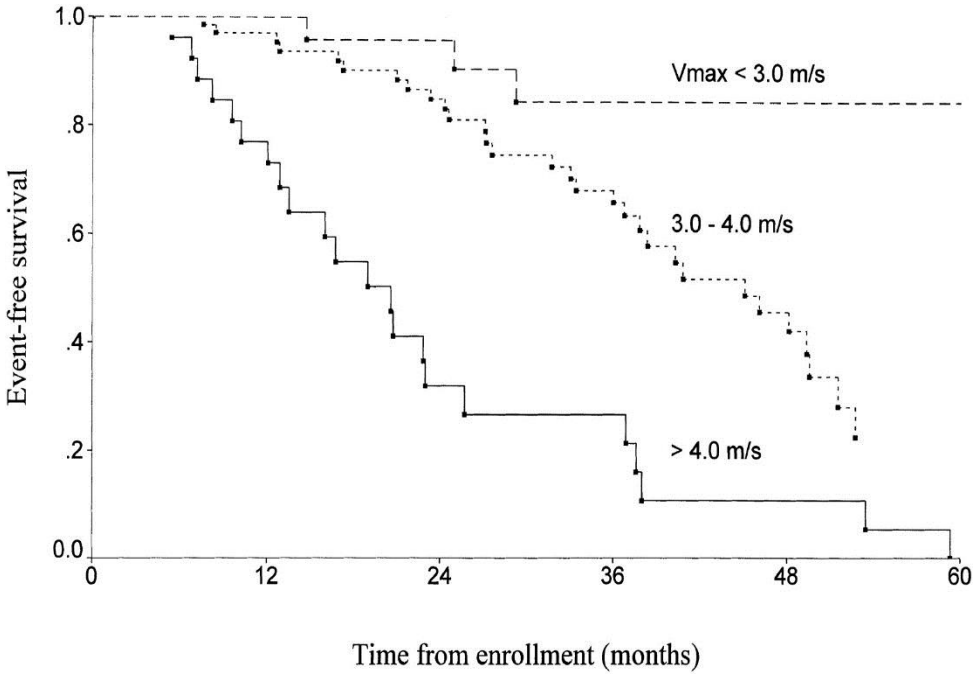
➢ ***Identify patients at high risk for early symptom onset***

Asymptomatic AS

- **123 pts with V max ≥ 2.5 m/s**
  (max. gradient ≥ 25 mmHg)
  - Age 63 ± 16 yrs
  - Annual exercise test

- **Death or AVR**
  (≈ symptoms)

  Predictive factor
  - *V max. ≥ 4m/s*



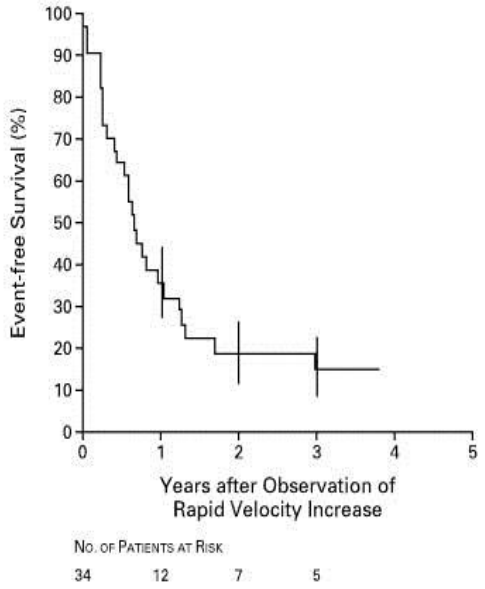
(Otto et al. Circulation 1997;95:2262-70)

Severe Asymptomatic AS

- 128 pts with V max. ≥ 4 m/s
  (max. gradient ≥ 64 mmHg)
  - Valve area ≤ 0.8 cm², mean 0.68 cm²
  - Age 60 ± 18 yrs

- Death or AVR
  (≈ symptoms)

  Predictive factors
  - *Progression of V max.*
  - *Extent of calcification*

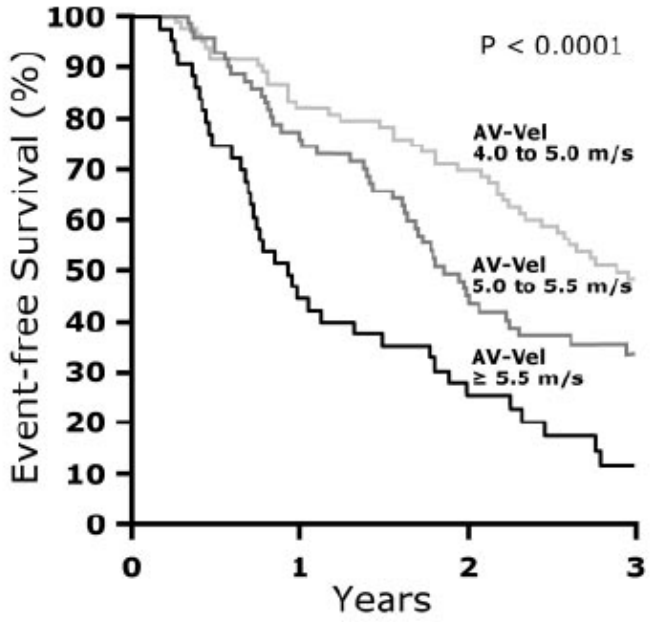


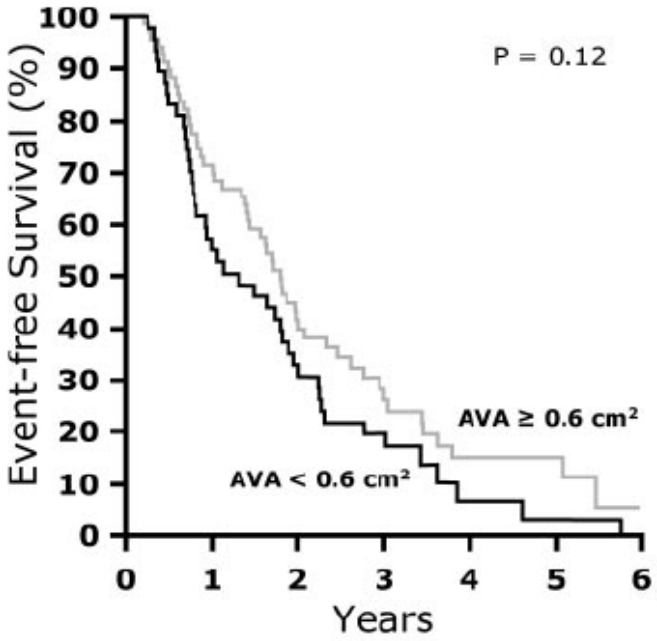
(Rosenhek et al.
N Engl J Med 2000;343:611-7)

Severe asymptomatic AS and aortic velocity

116 asymptomatic patients with severe AS

- 6 cardiac deaths (1 sudden death)
- 90 AVRs





(Rosenhek et al. Circulation 2010;121;151-6)

Asymptomatic AS and exercise ECG

125 asymptomatic patients with AS < 1.4 cm²

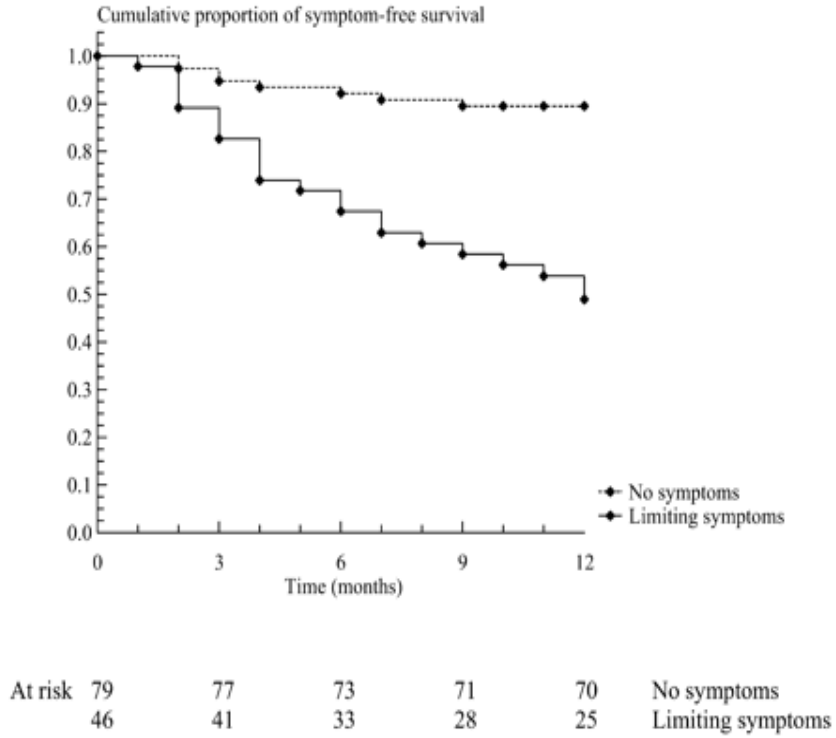
- 46 (37%) had symptoms at exercise ECG
- 29 (23%) had inadequate blood pressure response

➢ 36 (29%) became symptomatic at 1 yr

➢ Predictive factors

– *Symptoms at exercise ECG (p<0.001)*

– *BP response (p=0.17)*



(Das et al. Eur Heart J 2005;26:1309-13)

Asymptomatic AS and exercise ECG

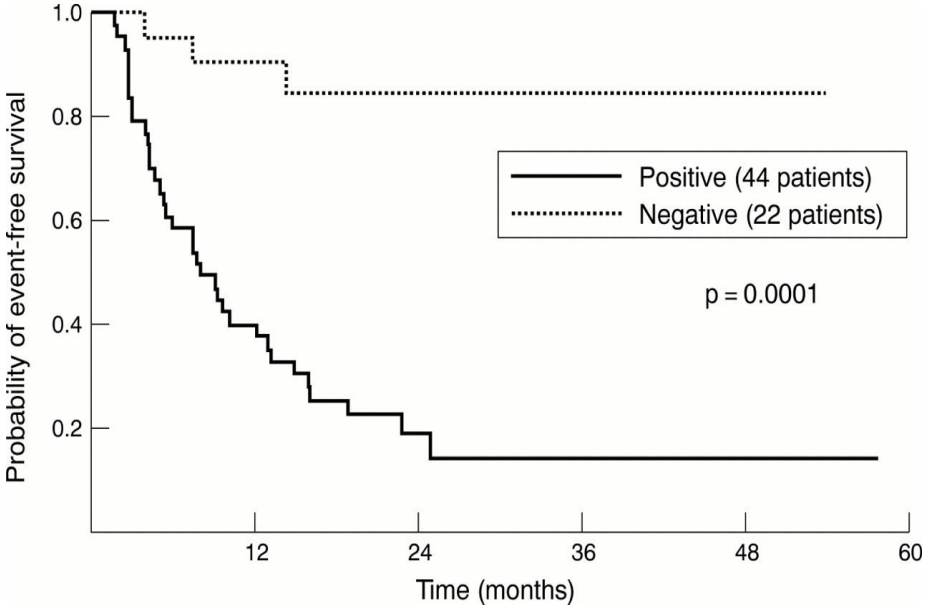
66 asymptomatic patients with AS < 1.0 cm²

Death or symptoms

Initial exercise ECG

Positivity criteria:

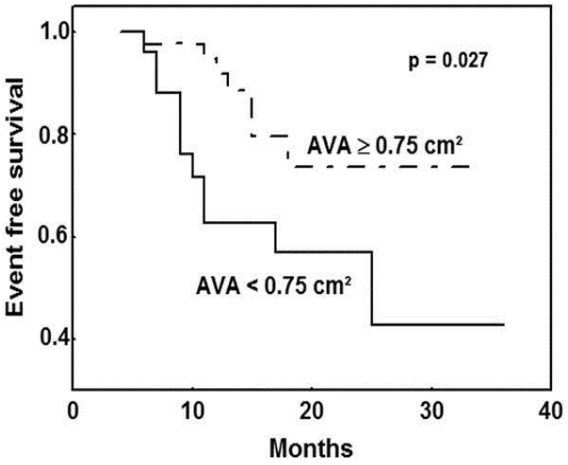
- Chest pain or near syncope
- ↑systolic BP < 20 mmHg
- ↓ST
- Ventricular arrhythmia

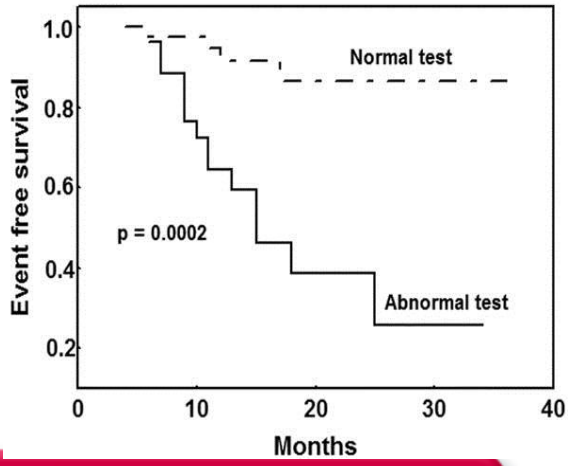


(Amato et al. Heart 2001;86:381-6)

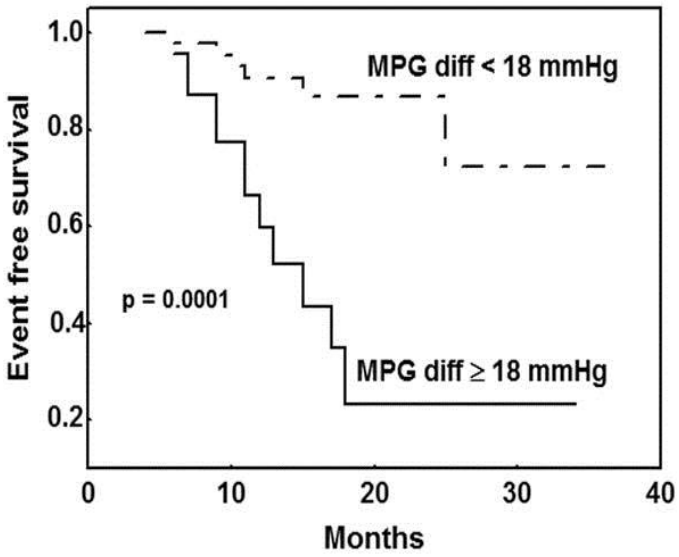
Asymptomatic AS and exercise echo

- 69 patients with asymptomatic severe AS





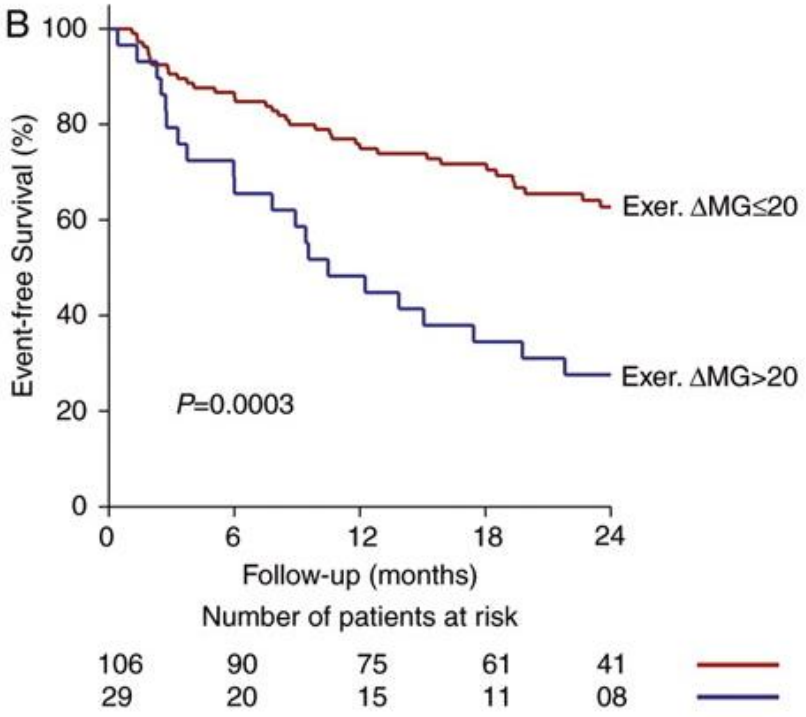
Predictors of cardiac events	p
Increase in mean gradient 18 mmHg	<0.015
Abnormal exercise test	0.0003
Aortic valve area < 0.75 cm²	0.0003

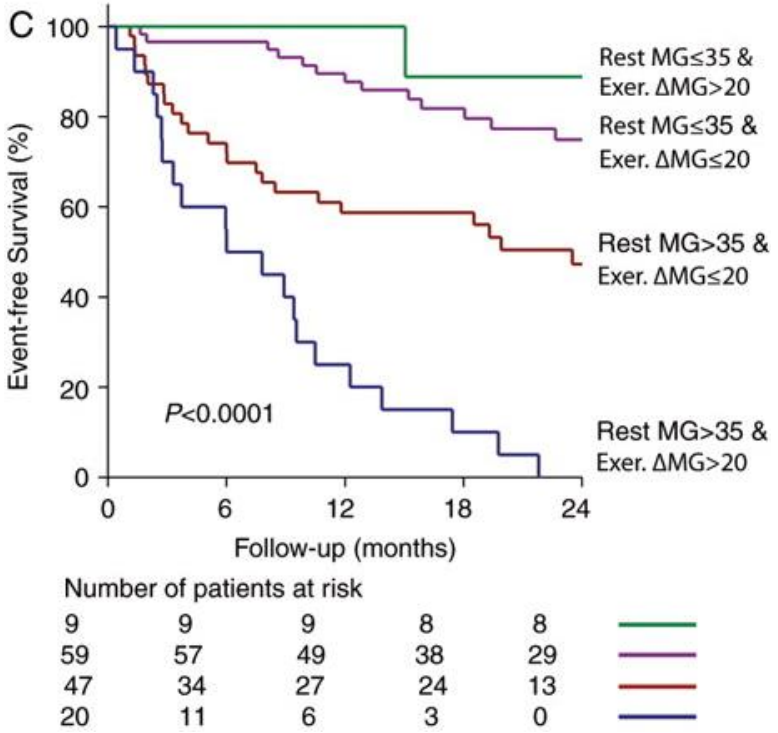


(Lancellotti et al. Circulation 2005, 112(suppl.I):I377-82)

Asymptomatic AS and exercise echo

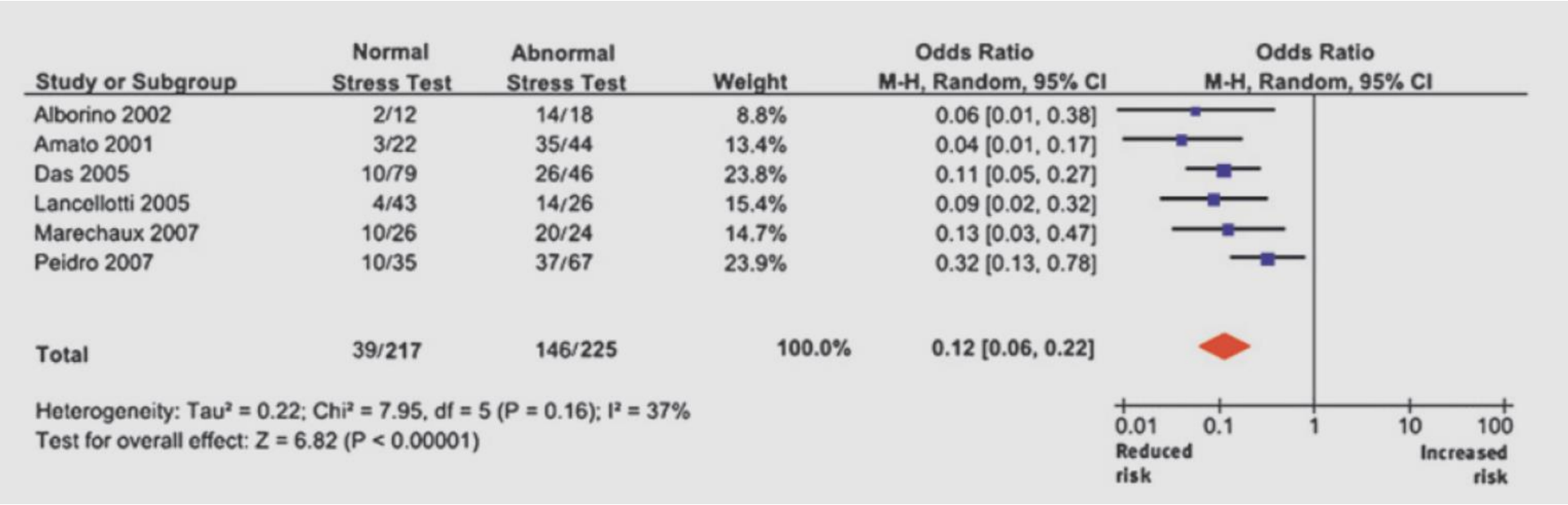
- 135 patients with asymptomatic ≥ moderate AS and normal standard exercise test





(Maréchaux et al. Eur Heart J 2010;31:1295-7)

Asymptomatic AS and exercise ECG
Meta-analysis



(Rafique et al. Am J Cardiol 2009;104:972-7)

Method

- **Retrospective, observational study**
- **Inclusion criteria :**
  - We enrolled all consecutive patients with asymptomatic AS of at least moderate degree (MPG ≥ 25 mmHg) who underwent an exercise echocardiography between January 2005 and December 2014 at our institution
- **Exclusion criteria :**
  - LV dysfunction (LVEF <50%),
  - Congenital stenosis except bicuspid valve,
  - Rheumatic stenosis,
  - Aortic regurgitation or other valvular disease with a grade > 2/4
  - Presence of significant aortic acceleration or aortic obstruction.

(Goublaire ,Submitted)

Method

- **All patients underwent first a comprehensive TTE at rest followed by a symptom-limited exercise echocardiography .**
- **A positive exercise test was defined by :**
  - occurrence of symptoms (dyspnea, angina, syncope),
  - fall in systolic BP or rise < 20 mmHg,
  - ST segment depression (≥ 2 mm)
  - ventricular arrhythmia
- **A positive stress echocardiography was defined as :**
  - exercise-induced MPG increase > 20 mmHg
  - SPAP increase above 60 mmHg at peak stress,
  - impaired LVEF
  - Apparition of wall motion abnormalities.

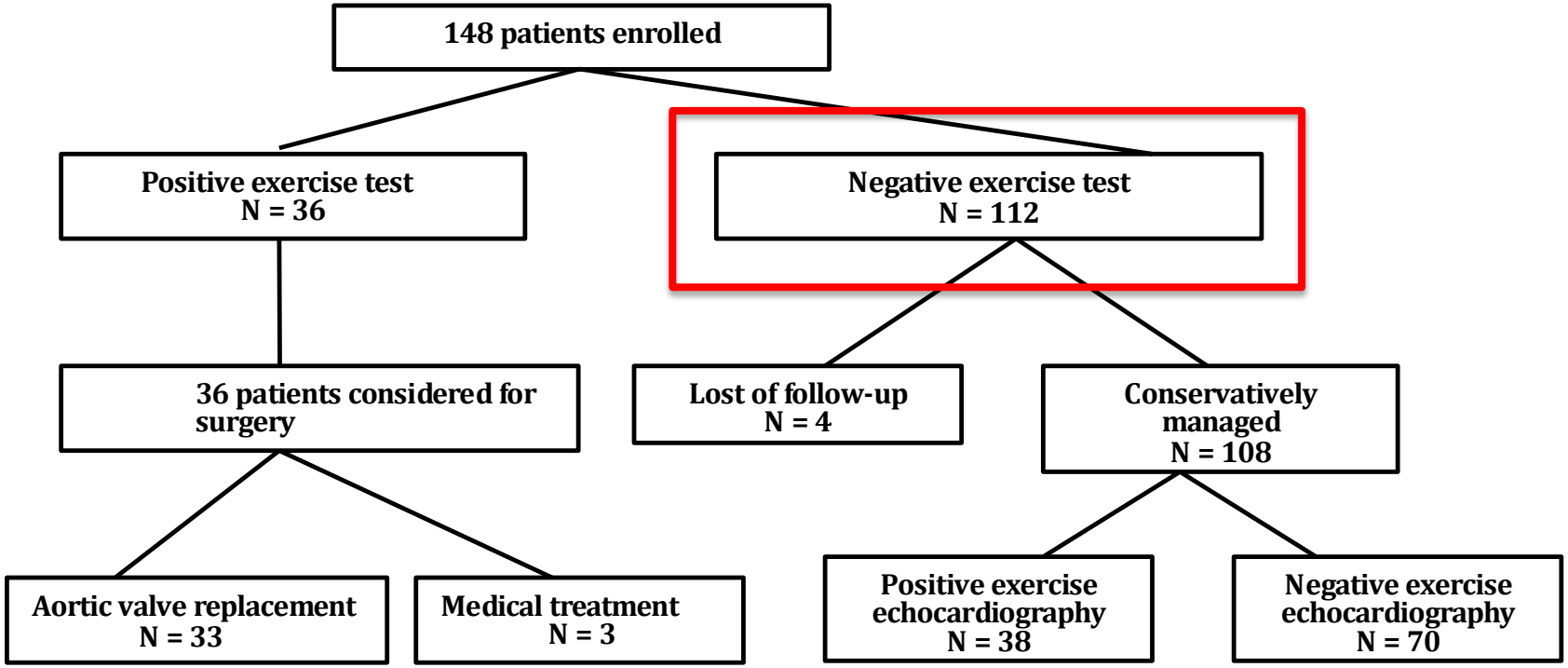
- **Patients with a positive exercise test were considered for surgery as well as those who developed LV dysfunction or wall motion abnormalities during exercise. The remaining population was conservatively managed.**

Results

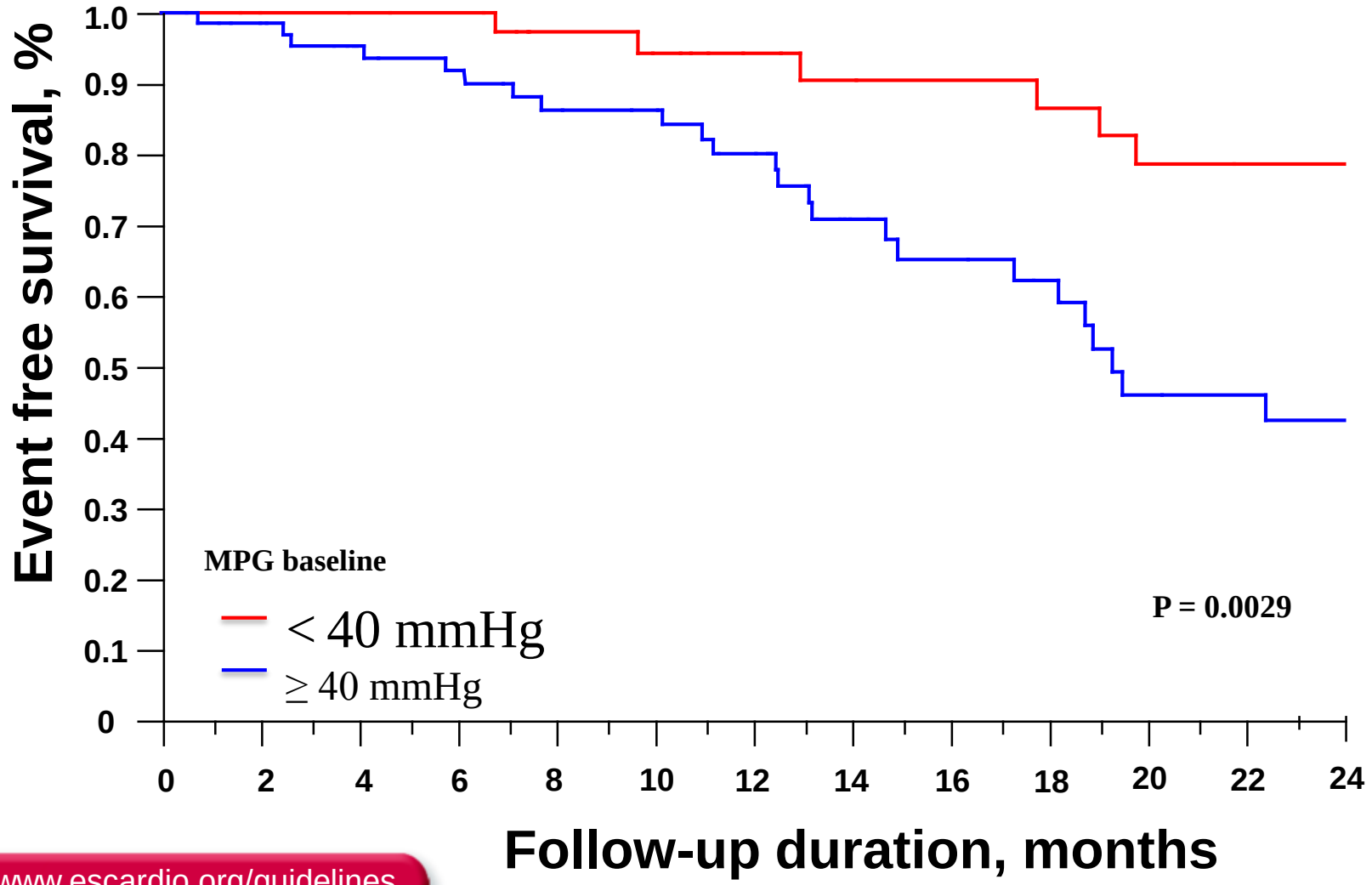
Primary endpoint :

- Occurrence of symptoms
- Congestive heart failure

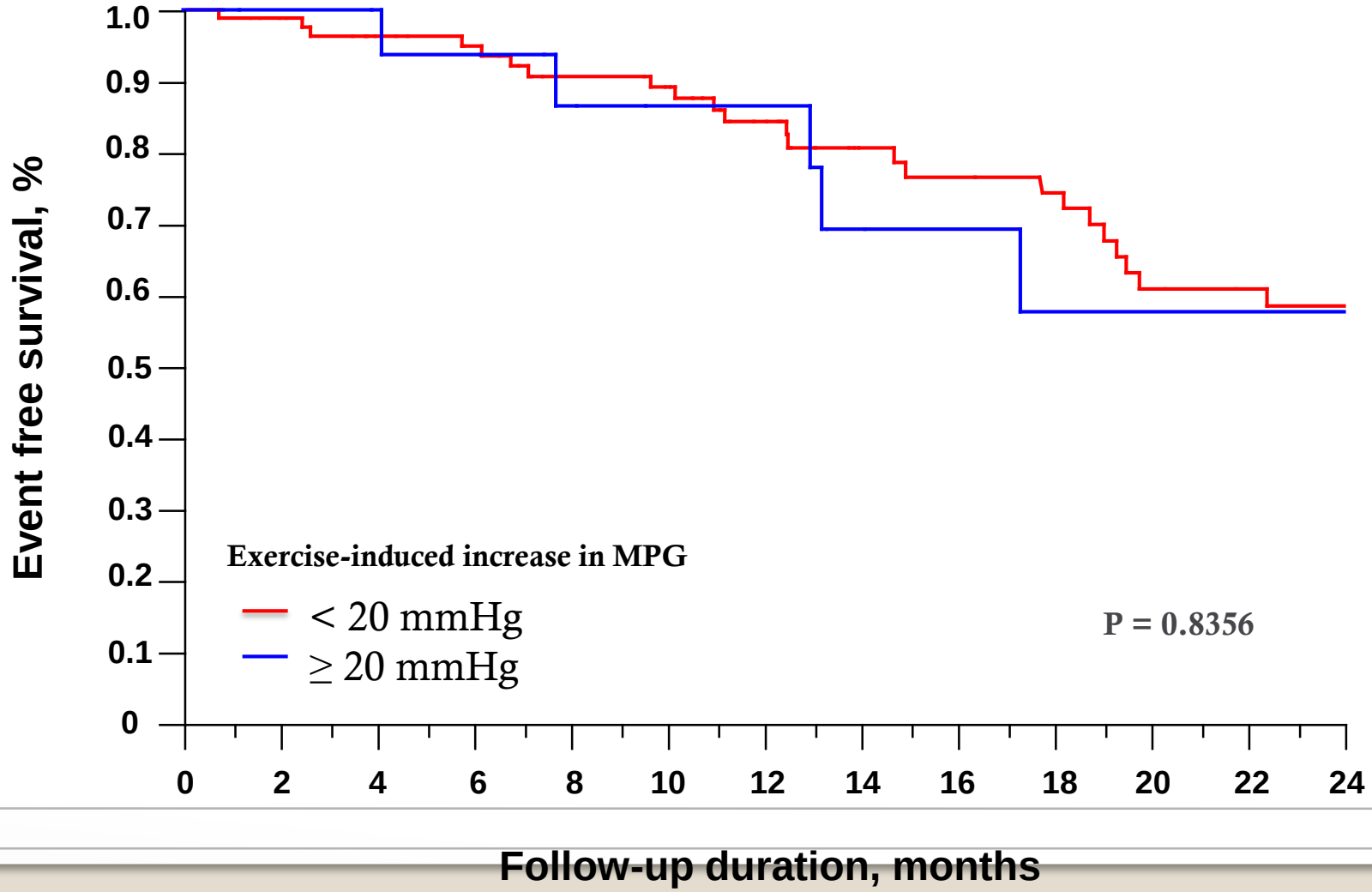
In the 2 years of follow-up



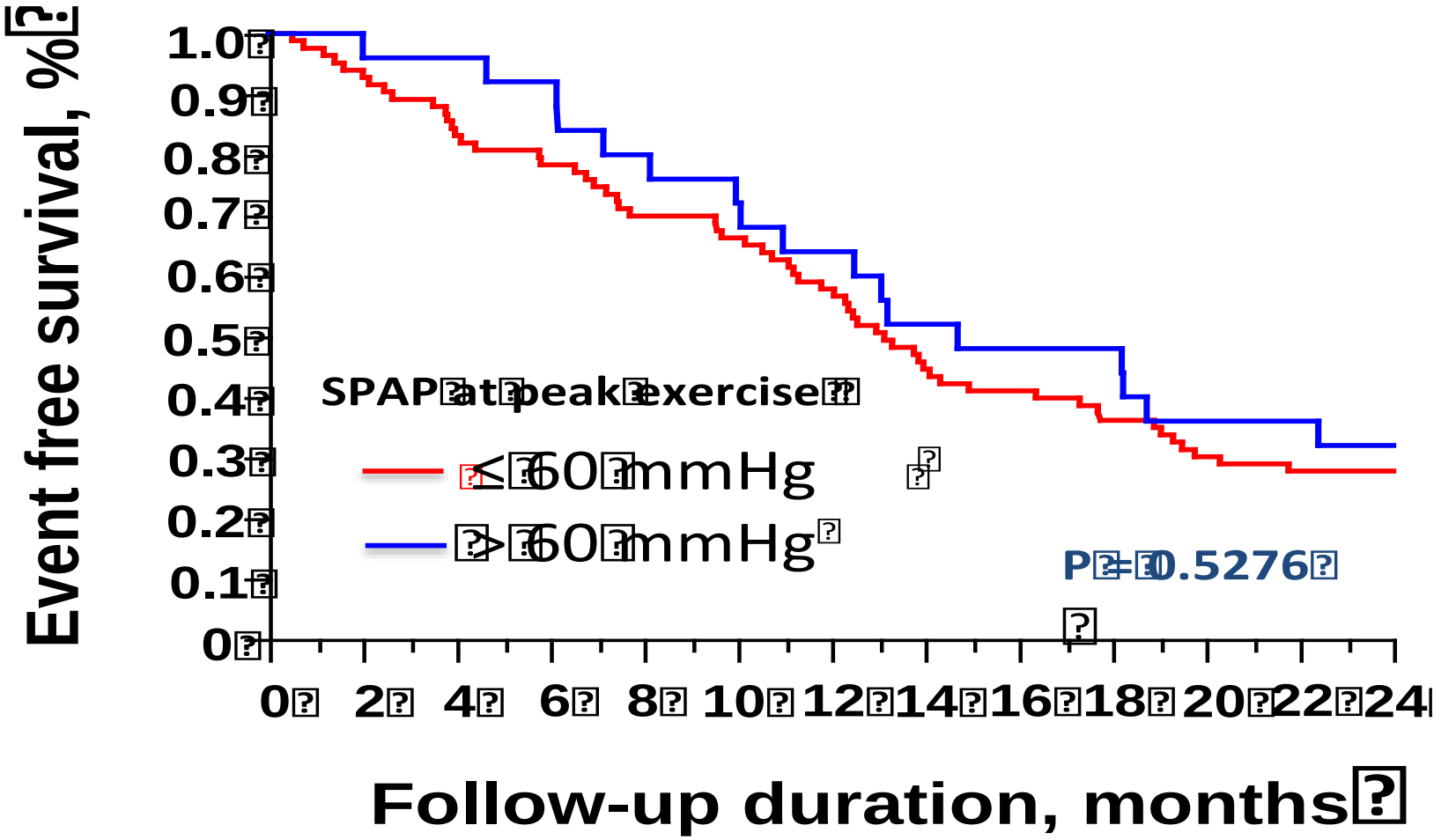
Event-free survival according to MPG at rest



Event free survival according to exercise-induced increase in MPG



Event-free survival according to SPAP at peak exercise



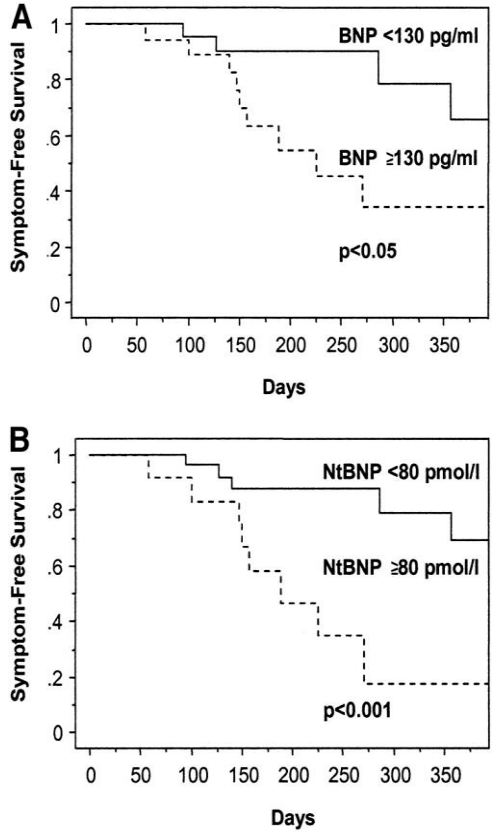
Mid term outcome

	Univariate Analysis	Multivariate Analysis
	p-value	p-value
Age (years)	0.8237	0.9828
Sex	0.9527	0.2819
LVEF (%)	0.4008	0.3452
Exercise-induced MPG > 20 mmHg	0.9727	0.4029
MPG at rest (mmHg)	0.0031	<0.0001

AS and natriuretic peptides

130 patients

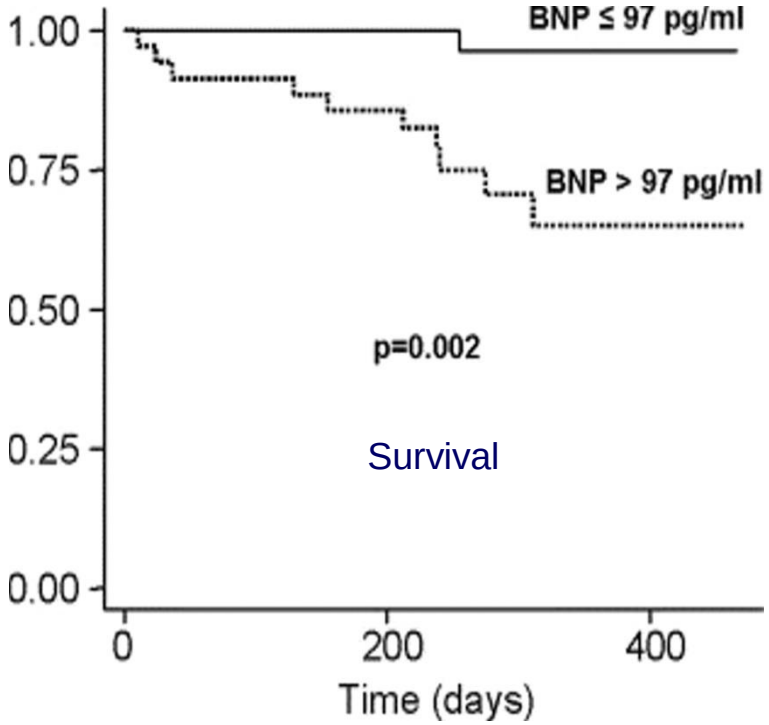
(VA < 1 cm² or V. max > 4 m/sec.)



(Berger-Klein et al. Circulation 2004;109:2302-8)

70 patients

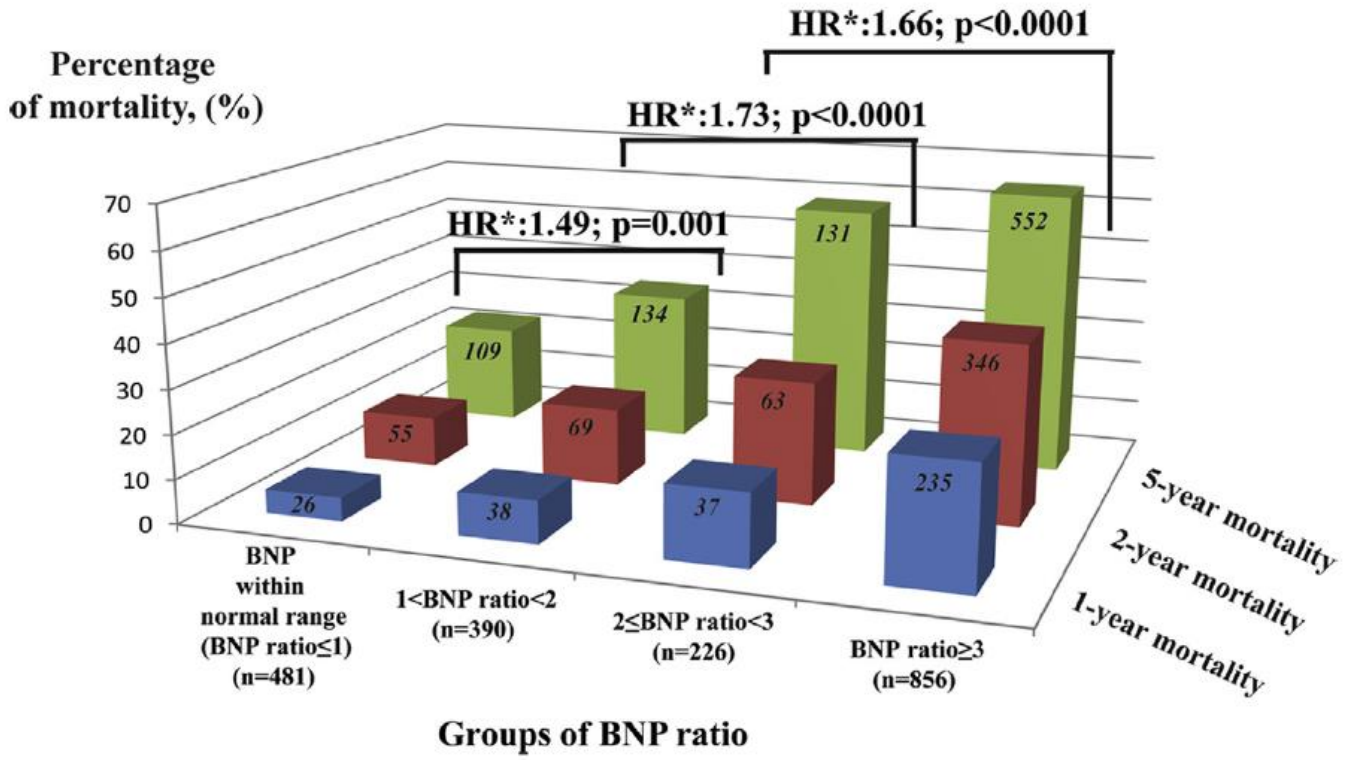
(VA < 1 cm² and EF > 50%)



(Lim et al. Eur Heart J 2004;25:2048-53)

Asymptomatic AS and natriuretic peptides

- 1953 patients with ≥ moderate AS
- 40% asymptomatic



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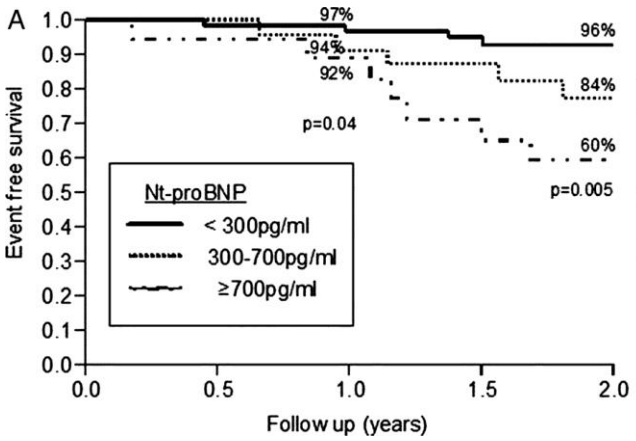
(Clavel et al. J Am Coll Cardiol 2014;63:2016-25)

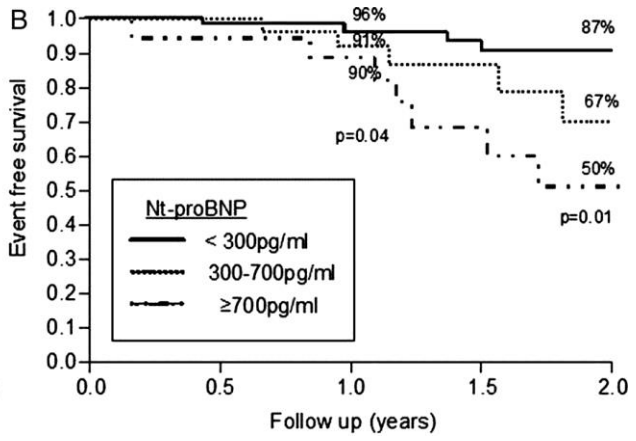
Asymptomatic AS and natriuretic peptides

- 142 asymptomatic patients with ≥ mild AS (102 ≥ moderate AS). Mean FU 1.8 years
- Event-free survival and Nt-proBNP:

142 ≥ mild AS



102 ≥ moderate AS



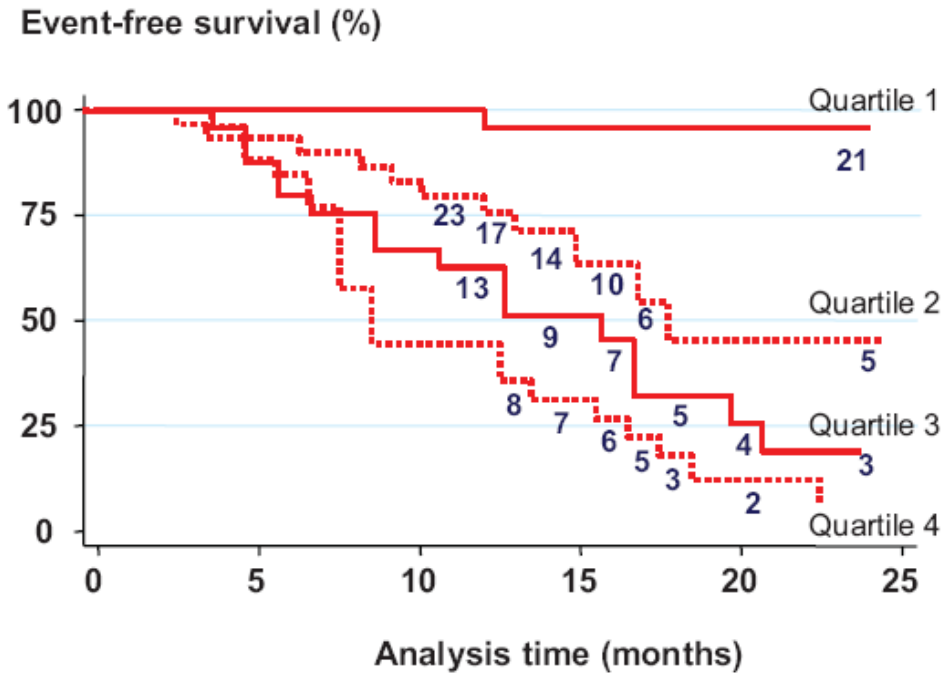
- Nt-proBNP and event free-survival, adjusted on age, gender and AVA

p=0.40 p=0.43

(Cueff et al. Heart 2013;99:461-7)

Asymptomatic AS: multifactorial approach

- 107 patients with asymptomatic moderate or severe AS
- Score = (2 x V.max)+ (1.5 x log BNP) + 1.5 if female gender
- Event-free survival



(Monin et al. Circulation 2009;120:69-75)

Other prognostic factors

- Resting heart rate

  (Greve et al. Int J Cardiol 2015;180:122-8)

- Valvulo-arterial impedance

  (Banovic et al. J Heart valve Dis 2015;24:156-63)

- Left ventricular deformation

  (Nagata et al. J Am Coll Cardiol Img 2015;8:235-45)

- BNP at exercise

  (Capoulade et al. Heart 2014;100:1606-12)

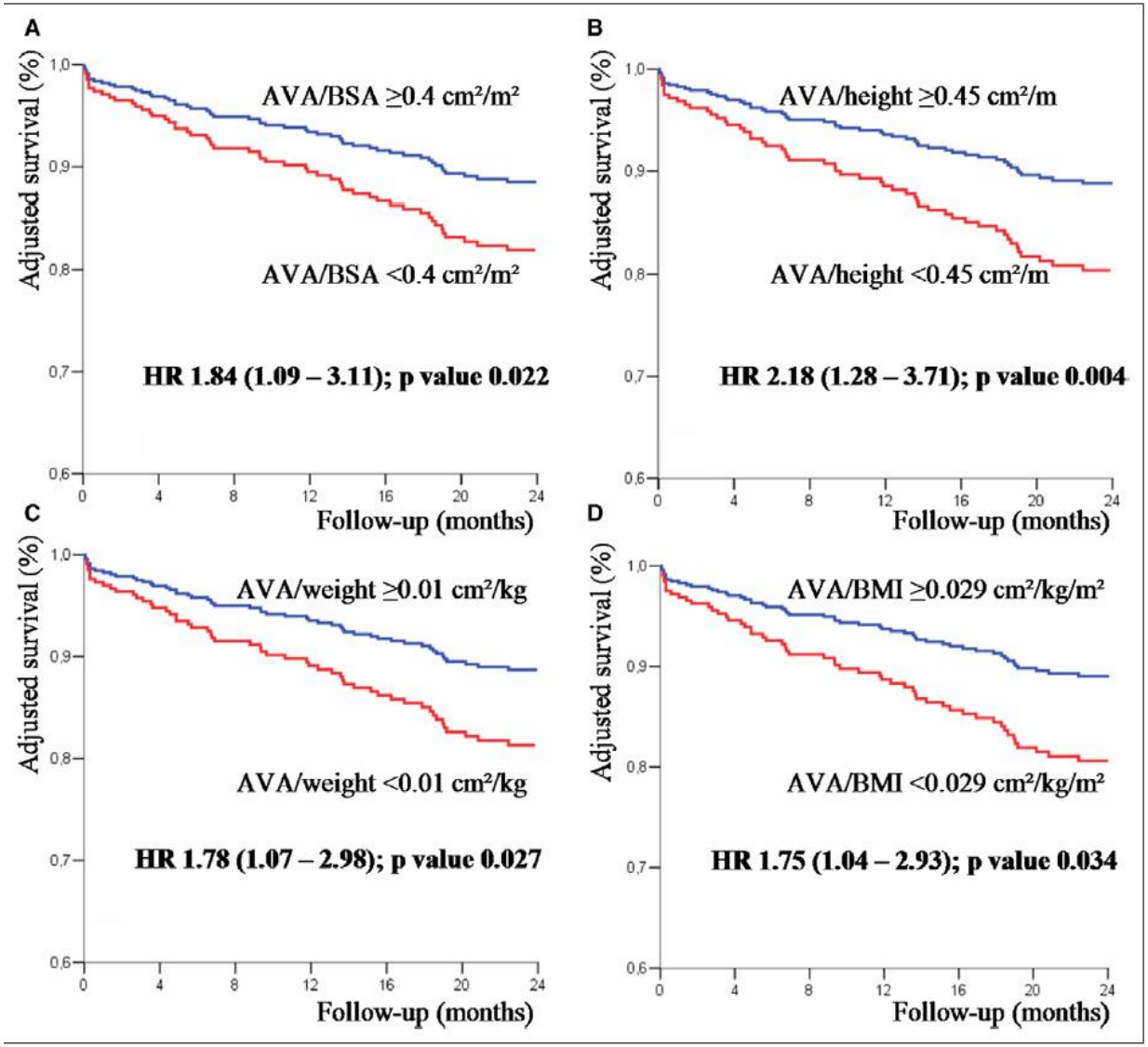
- Cardiopulmonary exercise testing

  (Levy et al. Arch Cardiovasc Dis 2014;107:519-23)

- Myocardial fibrosis in CMR

  (Lee et al. Radiology 2015;274:259-69)

Index aortic valve area and outcome



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(Tribouilloy Circ Cardiovasc Imaging 2016)

Haemodynamic and anatomic progression of aortic stenosis

Virginia Nguyen,[1,2,3] Claire Cimadevilla,[1,2] Candice Estellat,[4] Isabelle Codogno,[1] Virginie Huart,[5] Joelle Benessiano,[5] Xavier Duval,[6] Philippe Pibarot,[7] Marie Annick Clavel,[8] Maurice Enriquez-Sarano,[8] Alec Vahanian,[1,2,3] David Messika-Zeitoun[1,2,3]

ABSTRACT

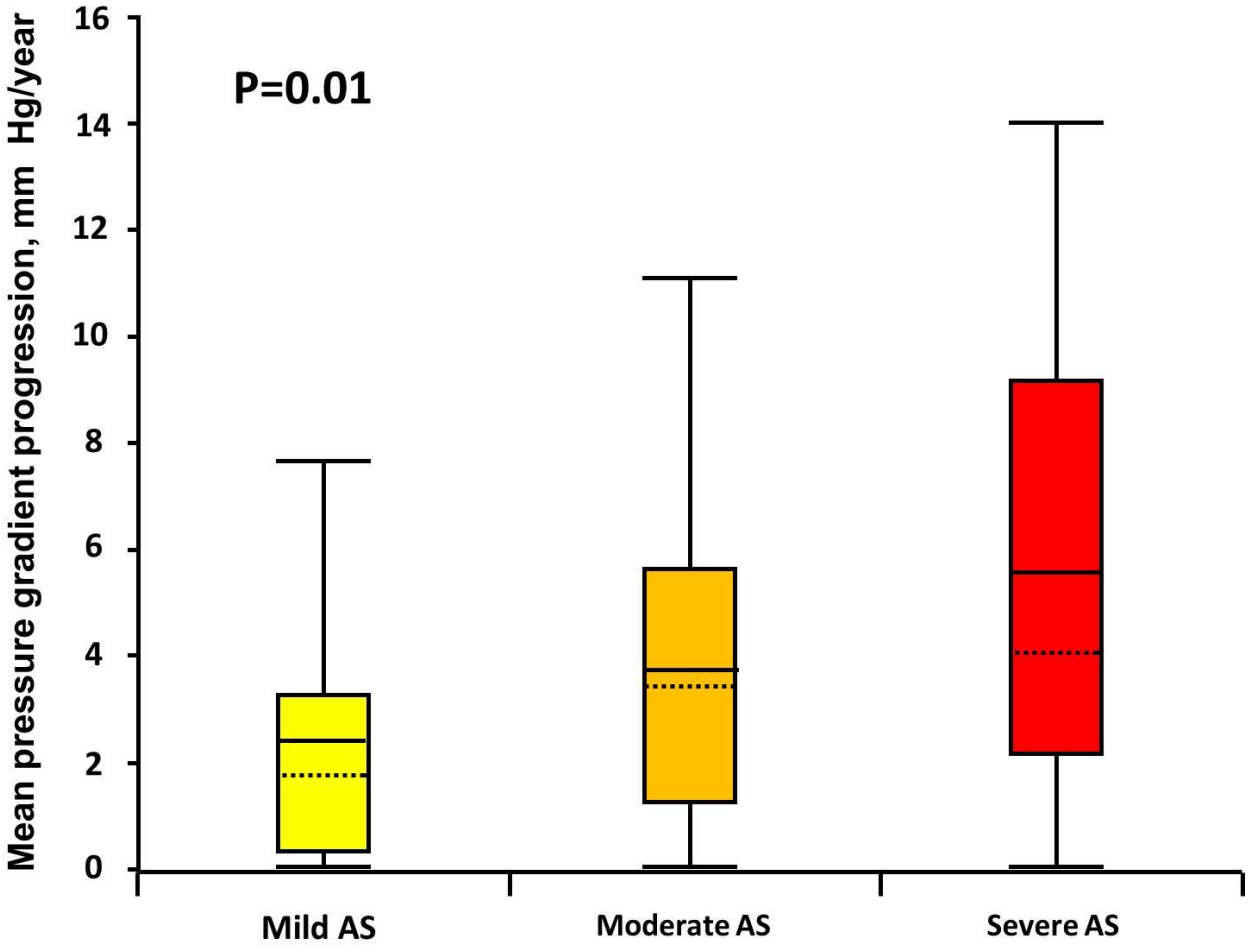
Background Aortic valve stenosis (AS) is a progressive disease, but the impact of baseline AS haemodynamic or anatomic severity on AS progression remains unclear.

Methods In 149 patients (104 mild AS, 36 moderate AS and 9 severe AS) enrolled in 2 ongoing prospective cohorts (COFRASA/GENERAC), we evaluated AS haemodynamic severity at baseline and yearly, thereafter, using echocardiography (mean pressure gradient (MPG)) and AS anatomic severity using CT (degree of aortic valve calcification (AVC)).

Results After a mean follow-up of 2.9±1.0 years, mean MGP increased from 22±11 to 30±16 mm Hg (+3±3 mm Hg/year), and mean AVC from 1108±891 to 1640±1251 AU (arbitrary units) (+188±176 AU/year). Progression of AS was strongly related to baseline haemodynamic severity (+2±3 mm Hg/year in mild AS, +4±3 mm Hg/year in moderate AS and +5±5 mm Hg/year in severe AS (p=0.01)), and baseline haemodynamic severity was an independent predictor of haemodynamic progression (p=0.0003). Annualised haemodynamic and anatomic progression rates were significantly correlated (r=0.55, p<0.0001), but AVC progression rate was also significantly associated with baseline haemodynamic severity (+141±133 AU/year in mild AS, +279±189 AU/year in moderate AS and +361 ±293 AU/year in severe AS, p<0.0001), and both baseline MPG and baseline AVC were independent determinants of AVC progression (p<0.0001).

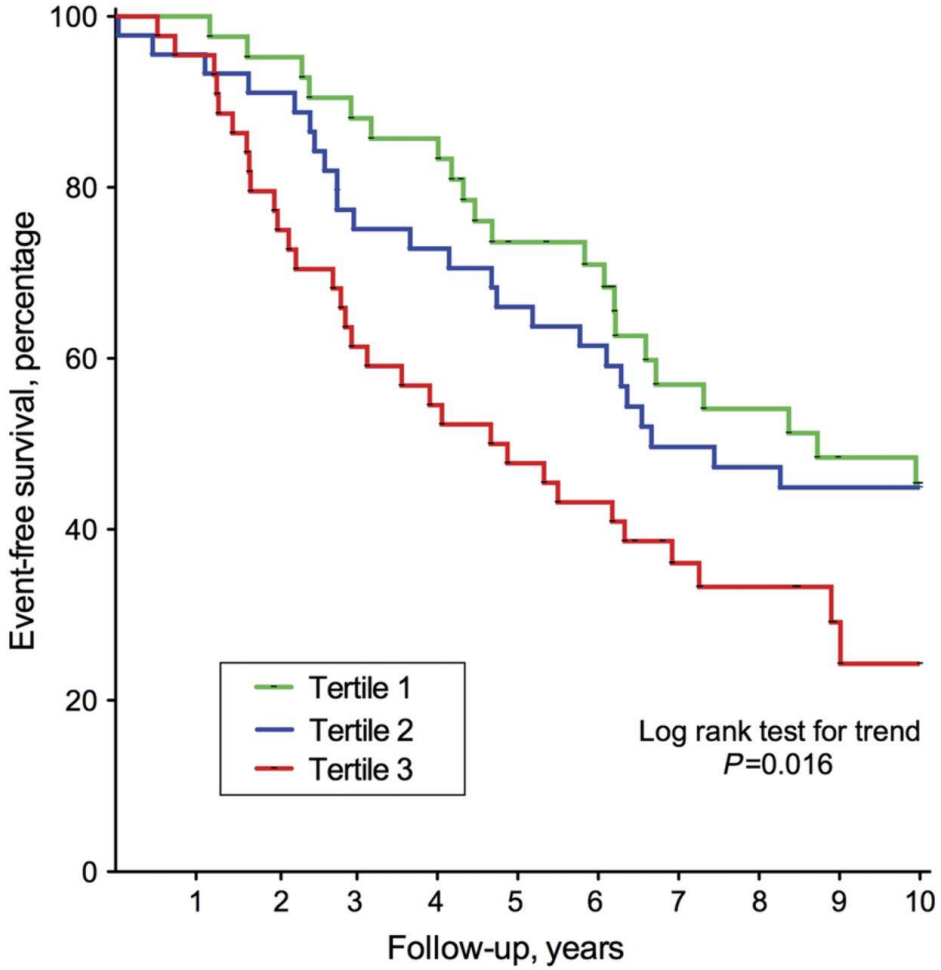
Conclusions AS progressed faster with increasing haemodynamic or anatomic severity. Our results suggest that a medical strategy aimed at preventing AVC progression may be useful in all subsets of patients with AS including those with severe AS and support the recommended closer follow-up of patients with AS as AS severity increases.

Progression of Aortic Valve Calcification in Aortic Stenosis - Impact of Severity. The COFRASA - GENERAC Study



(N'Guyen ,Heart 2016)

Aortic valve replacement or cardiovascular death and cardiac troponin I concentrations



(Chin C W L et al. Eur Heart J 2014;eurheartj.ehu189)

Predictors of Outcome in Asymptomatic AS

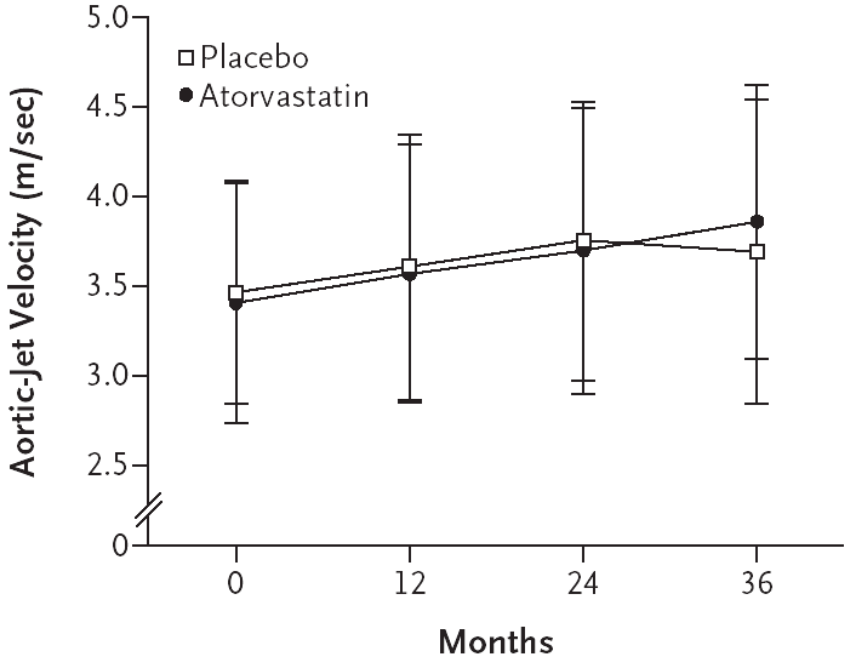
- **Clinical:** older age, presence of CV risk f
- **Echocardiography:** higher peak ... evere calcification, rapid hemody... gression, reduced LVEF, excessi... rease in gradient with exer...
- **Exercise te...** ptoms on exercise (blood press...
- **...rs:** markedly elevated natriuretic ...des (BNP, Nt-proBNP)

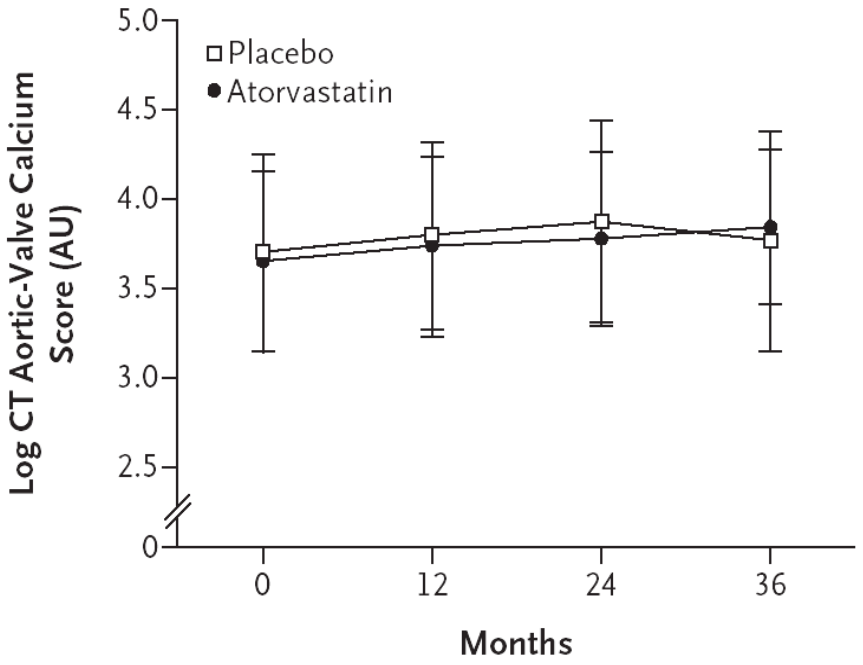
Predictors of events
Most events were AVR because of symptom development

- Natural history
- ***Medical therapy***

Scottish Aortic Stenosis and Lipid Lowering Trial, Impact on Regression (SALTIRE) Investigators

- **Double blinded randomized study: high-dose atorvastatine versus placebo**

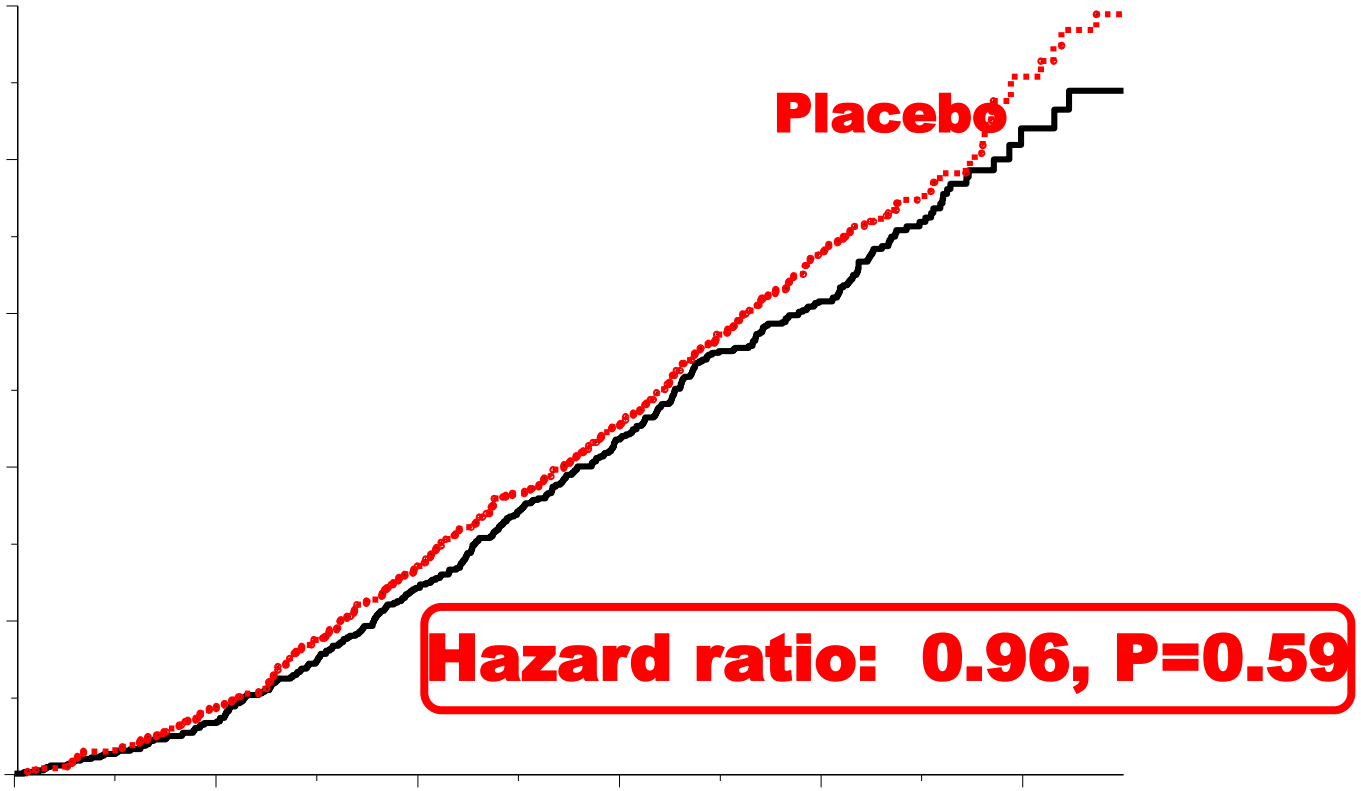




(Cowell. N Engl J Med 2005;352:283-97)

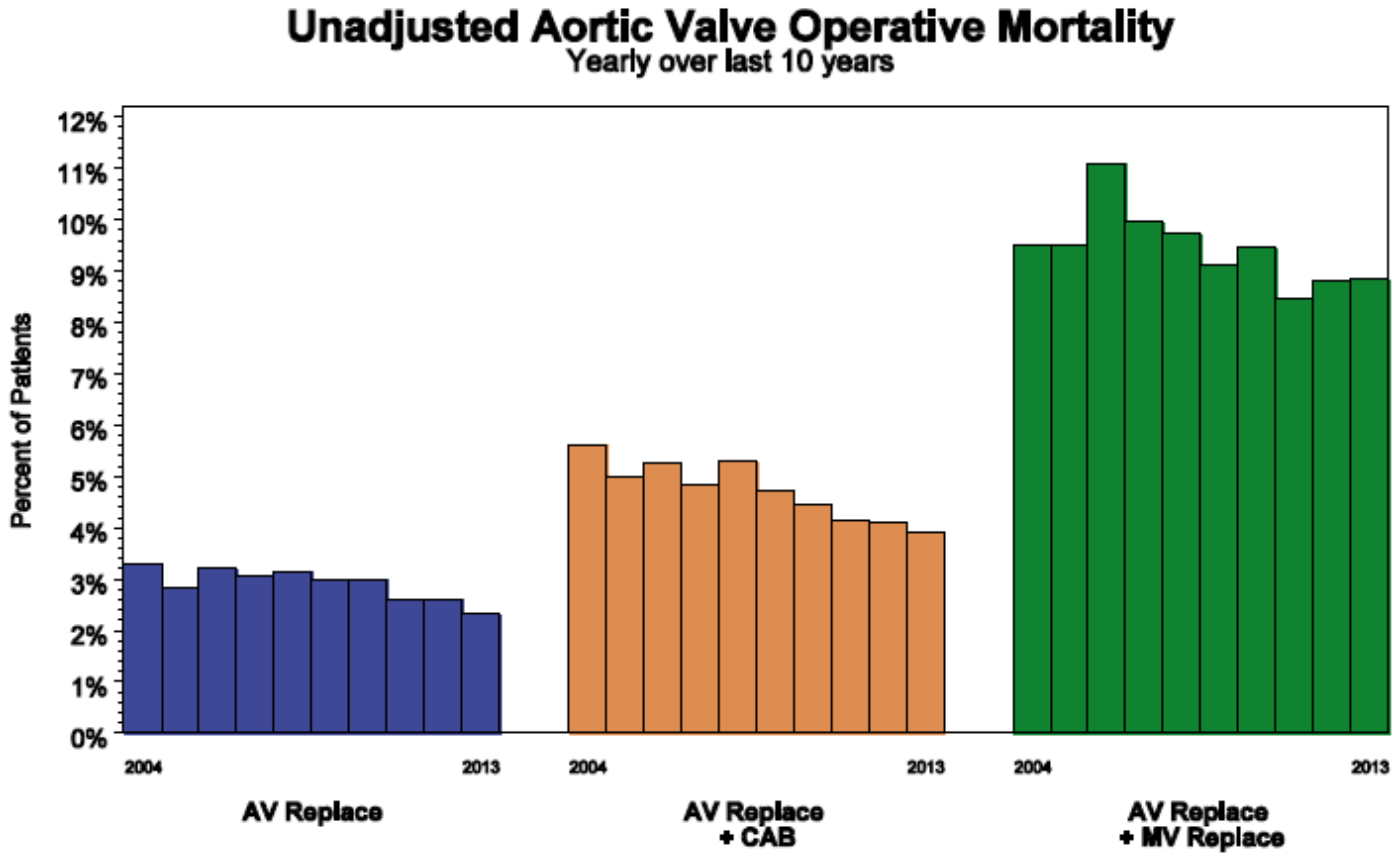
SEAS

Primary Endpoint



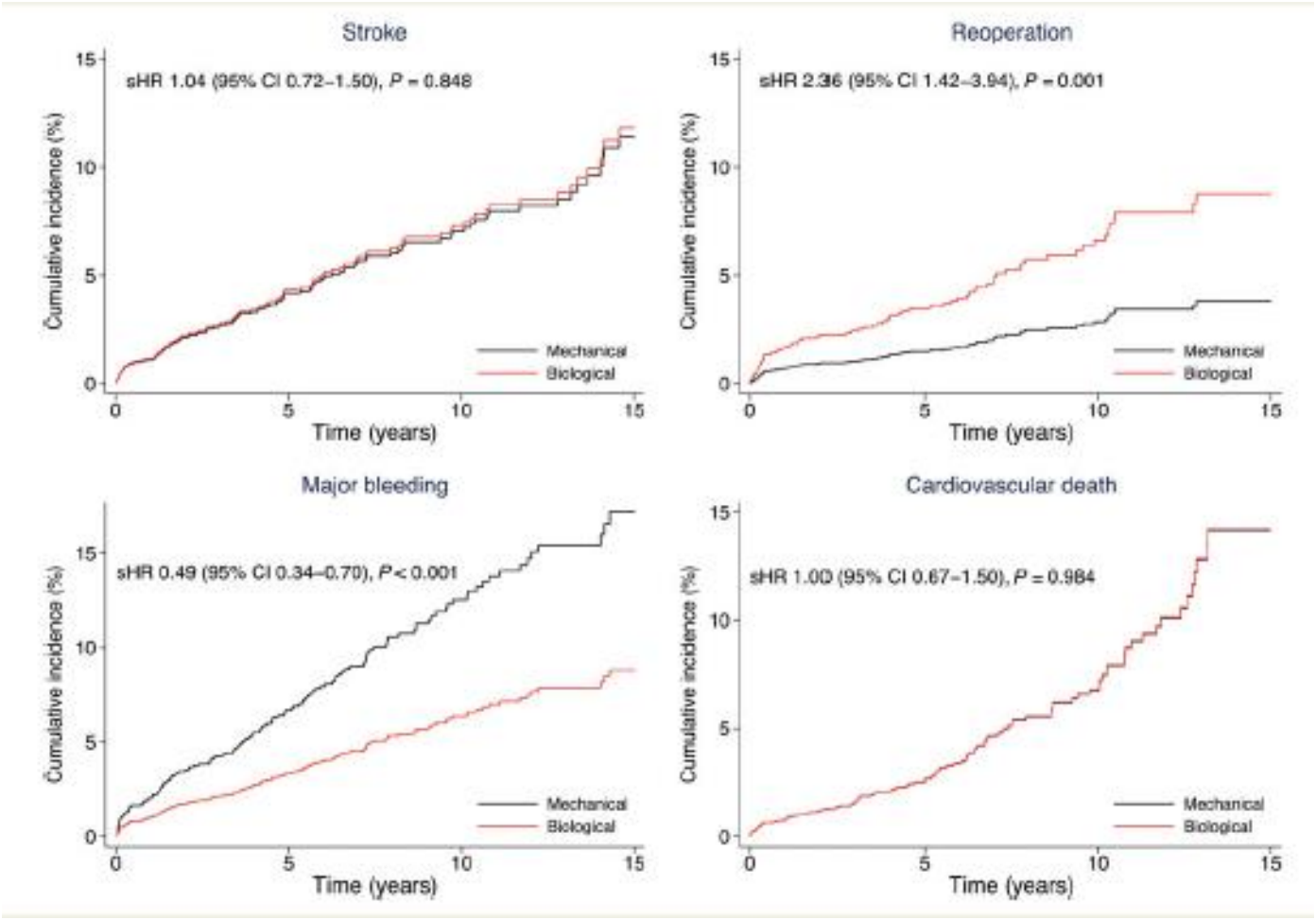
- Natural history
- Medical therapy
- ***Surgery***

Operative mortality



STS Database 2013

Long-term outcomes



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(Glaser Eur Heart J 2016)

ACC/AHA Guidelines

2.5. Evaluation of Surgical and Interventional Risk

See Table 5 for risk assessment combining STS risk estimate, frailty, major organ system dysfunction, and procedure-specific impediments.

Table 5. Risk Assessment Combining STS Risk Estimate, Frailty, Major Organ System Dysfunction, and Procedure-Specific Impediments

	Low Risk (Must Meet ALL Criteria in This Column)	Intermediate Risk (Any 1 Criterion in This Column)	High Risk (Any 1 Criterion in This Column)	Prohibitive Risk (Any 1 Criterion in This Column)
STS PROM*	<4% **AND**	4% to 8% **OR**	>8% **OR**	Predicted risk with surgery of death or major morbidity (all-cause) >50% at 1 y **OR**
Frailty†	None **AND**	1 Index (mild) **OR**	≥2 Indices (moderate to severe) **OR**	
Major organ system compromise not to be improved postoperatively‡	None **AND**	1 Organ system **OR**	No more than 2 organ systems **OR**	≥3 Organ systems **OR**
Procedure-specific impediment§	None	Possible procedure-specific impediment	Possible procedure-specific impediment	Severe procedure-specific impediment

Consultation with or referral to a Heart Valve Center of Excellence is reasonable when discussing treatment options for 1) asymptomatic patients with severe VHD, 2) patients who may benefit from valve repair versus valve replacement, or 3) patients with multiple comorbidities for whom valve intervention is considered. (*Level of Evidence: C*)

ESC/ EACTS Guidelines for the Management of Valvular Heart Disease

« In the absence of a perfect quantitative score, the risk assessment should mostly rely on the clinical judgement of the heart team in addition to a combination of scores »

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

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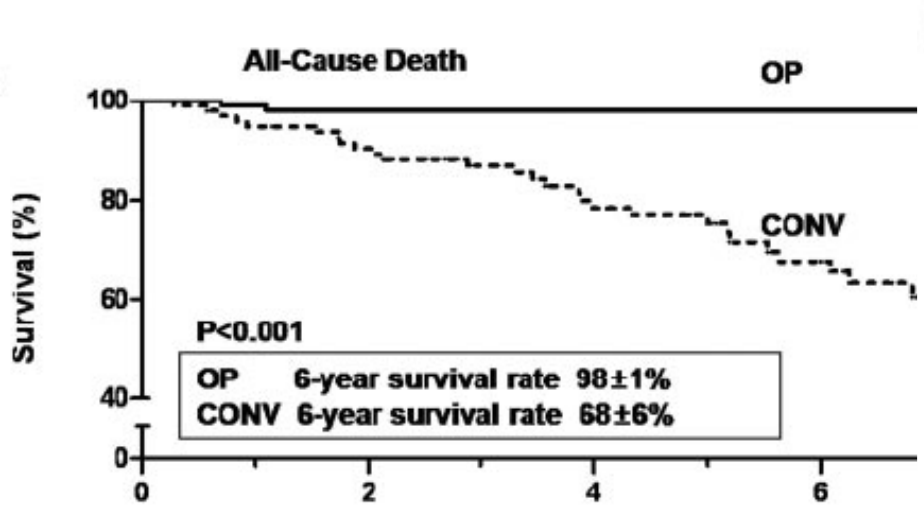
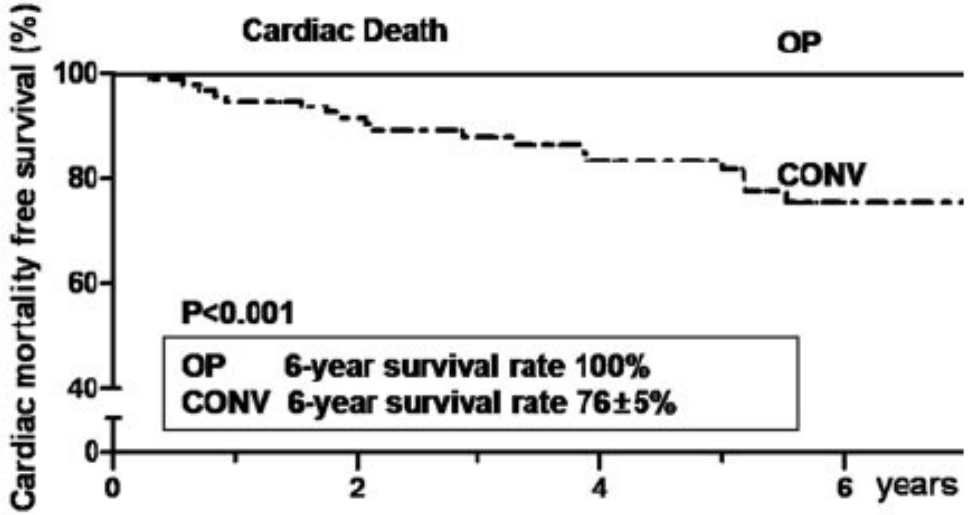
Early AVR vs conservative strategy

197 asymptomatic patients with AS

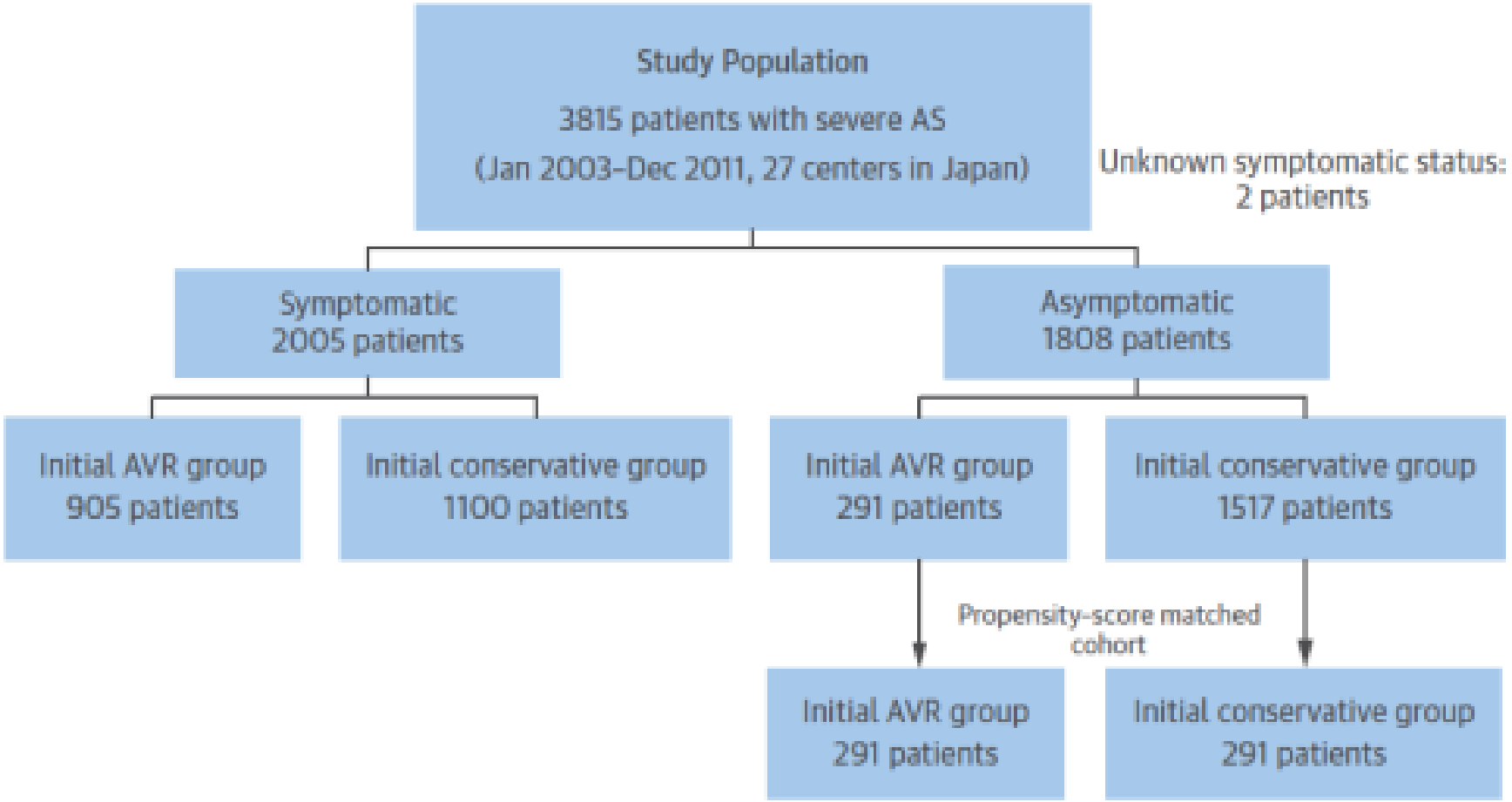
- AVA ≤ 0.75 cm² and v.max ≥ 4.5 m/s or mean gradient ≥ 50 mmHg
- Mean age 63 yrs, mean Euroscore 3.7
- Early surgery in 102 patients
- 57 propensity matched pairs
- Follow-up in 95 patients





(Kang et al. Circulation 2010;121;1502-9)

AVR vs Conservative strategy



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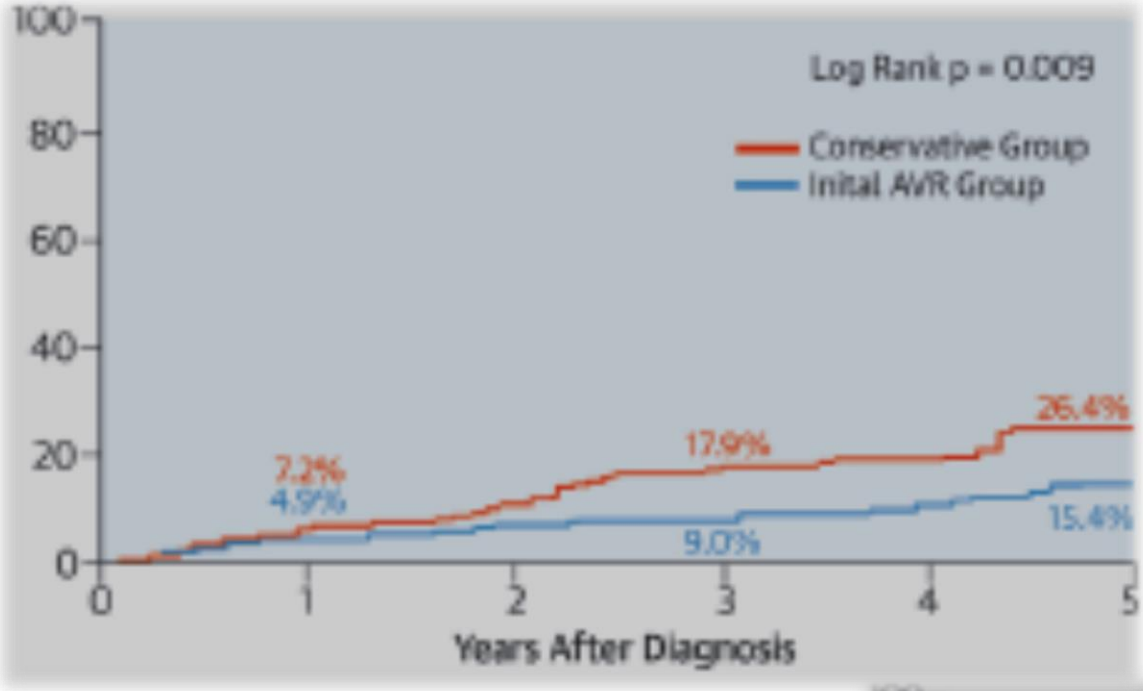
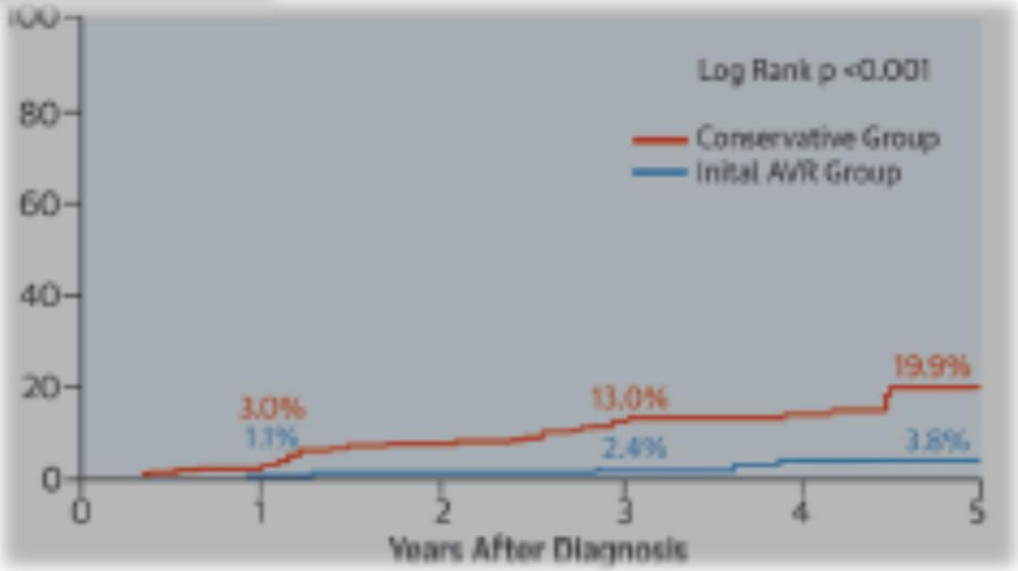
(Tanigushi ;J Am Coll Cardiol 2015)

AVR vs conservative strategy



All cause death

Heart failure hospitalization



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Among 116 patients (40%) with emerging symptoms related to AS during follow-up in the conservative group, AVR was performed in 80 patients (69%) with median interval of 72 (IQR: 42 to 121) days after symptom onset.

European Heart Journal Advance Access published November 11, 2015

European Heart Journal
doi:10.1093/eurheartj/ehv580

CLINICAL RESEARCH
Cardiovascular surgery

Aortic valve replacement with mechanical vs. biological prostheses in patients aged 50–69 years

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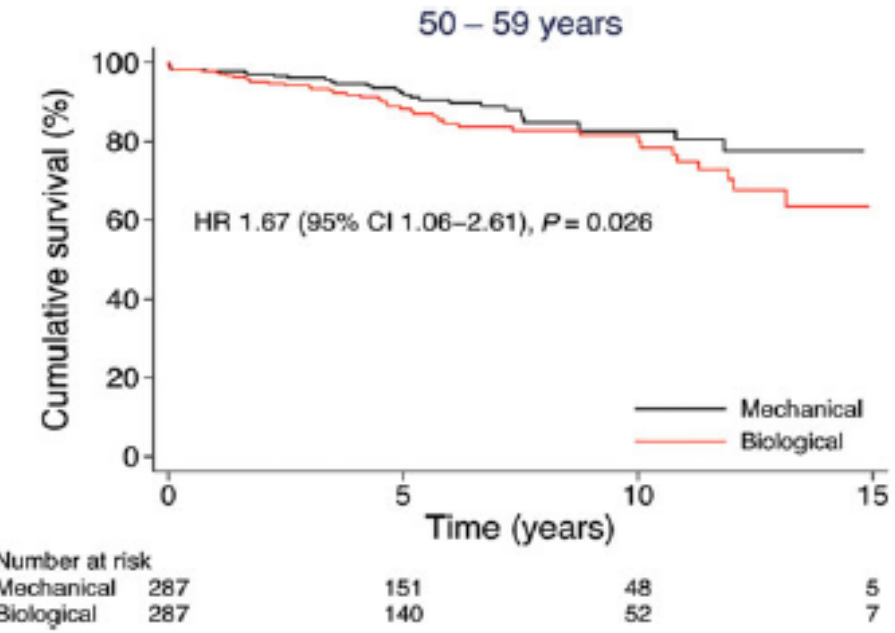
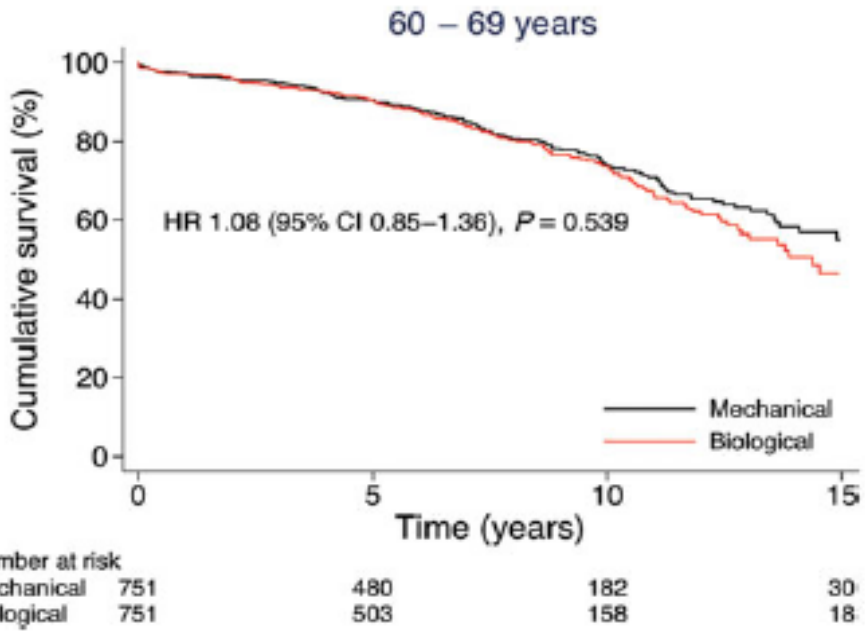

50 – 59 years
Cumulative survival (%)
100
80
60
40
20
0
HR 1.67 (95% CI 1.06–2.61), P = 0.026
Mechanical
Biological
0
5
10
15
Time (years)
Number at risk
Mechanical 287 151 48 5
Biological 287 140 52 7


60 – 69 years
Cumulative survival (%)
100
80
60
40
20
0
HR 1.08 (95% CI 0.85–1.36), P = 0.539
Mechanical
Biological
0
5
10
15
Time (years)
Number at risk
Mechanical 751 480 182 30
Biological 751 503 158 18

- Natural history
- Medical therapy
- Surgery
- ***Guidelines***

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 severe AS and abnormal excercise test showing fall in blood pressure below baseline.	IIa	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: • very severe AS defined by a peak transvalvular velocity > 5.5 m/s, • severe valve calcification and a rate of peak of transvalvular velocity progression ≥ 0.3 m/s per year.	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: • markedly elevated natriuretic peptide levels confirmed by repeated measurements without other explanations, • increase of mean pressure gradient with exercise by > 20 mmHg, • excessive LV hypertrophy in the absence of hypertension.	IIb	C

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European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

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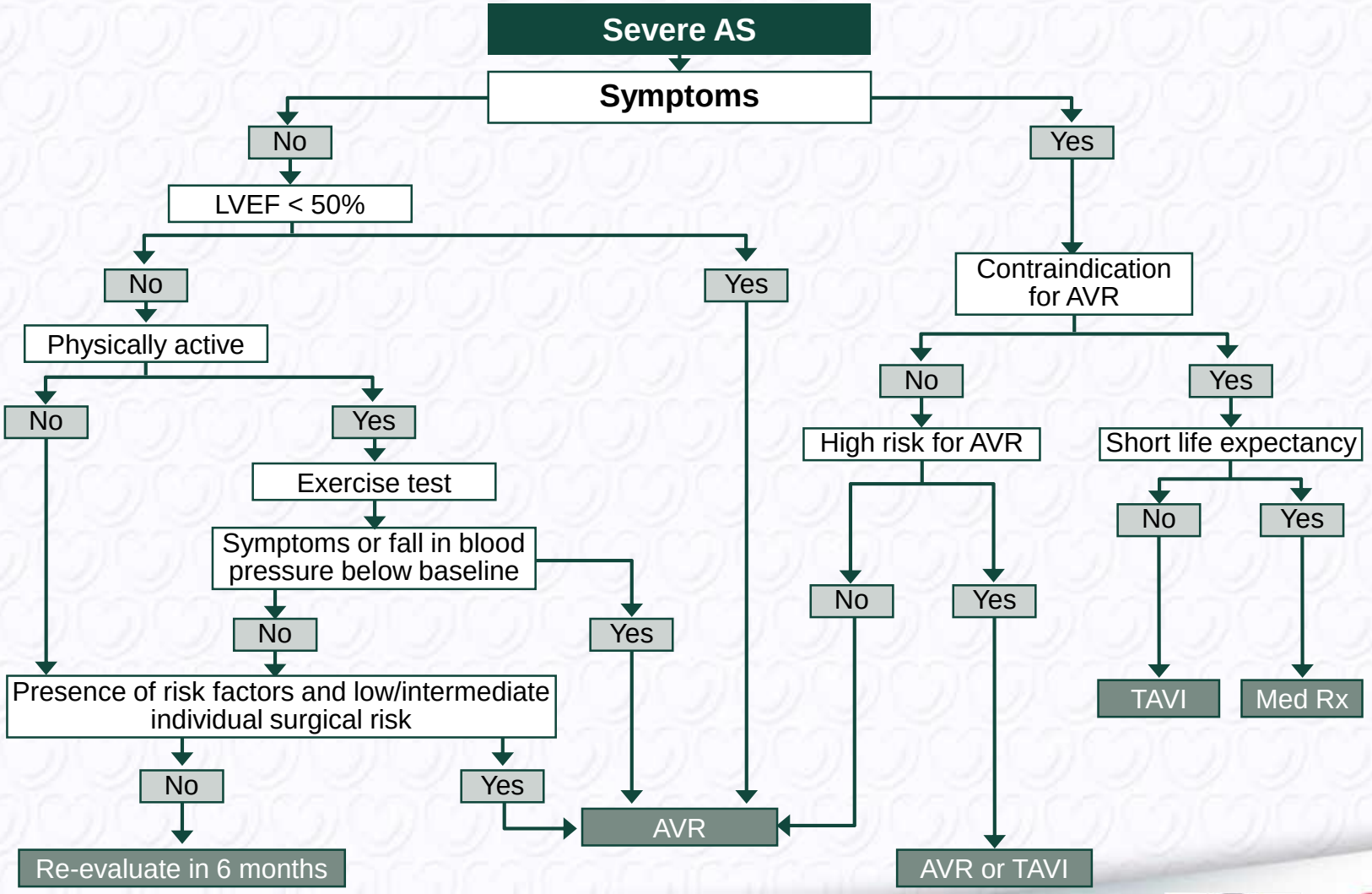
Management of severe aortic stenosis



European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

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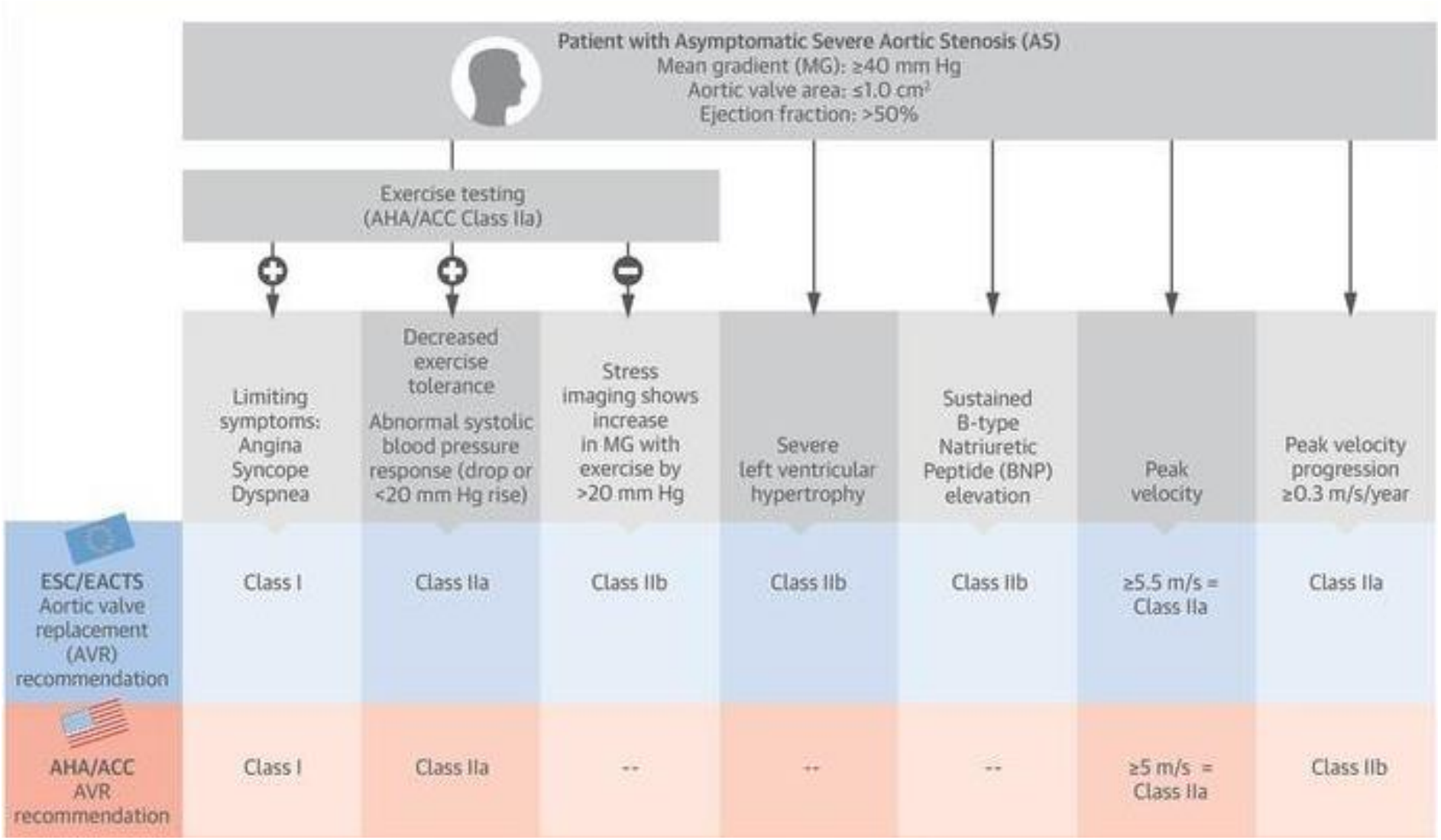
2012 ESC/EACTS v.s. 2014 ACC/AHA Guidelines



(Généreux et al. J Am Coll Cardiol 2016;67:2263–2288)

ESC/EACTS Guidelines : Serial testing

In the asymptomatic patient, the wide variability of the rate of progression of AS heightens the need for ***patients to be carefully educated*** about the importance of F.U. and ***reporting symptoms as soon as they develop.***

Stress tests should determine the recommended level of physical activity.

Follow-up visits should include echocardiography with a focus on haemodynamic progression, LV function and hypertrophy, and the ascending aorta.

Type and interval of follow-up should be determined on the basis of the index exam..

Asymptomatic severe AS should be re-evaluated at least every 6 months for the occurrence of symptoms, change in exercise tolerance (ideally using exercise testing if symptoms are doubtful), and change in echo parameters.

Measurement of natriuretic peptides may be considered.

In the presence of significant calcification, mild and moderate AS should be re-evaluated yearly.

- Natural history
- Medical therapy
- Surgery
- Guidelines
- ***Specific situations***

Management of patients with bicuspid valve disease

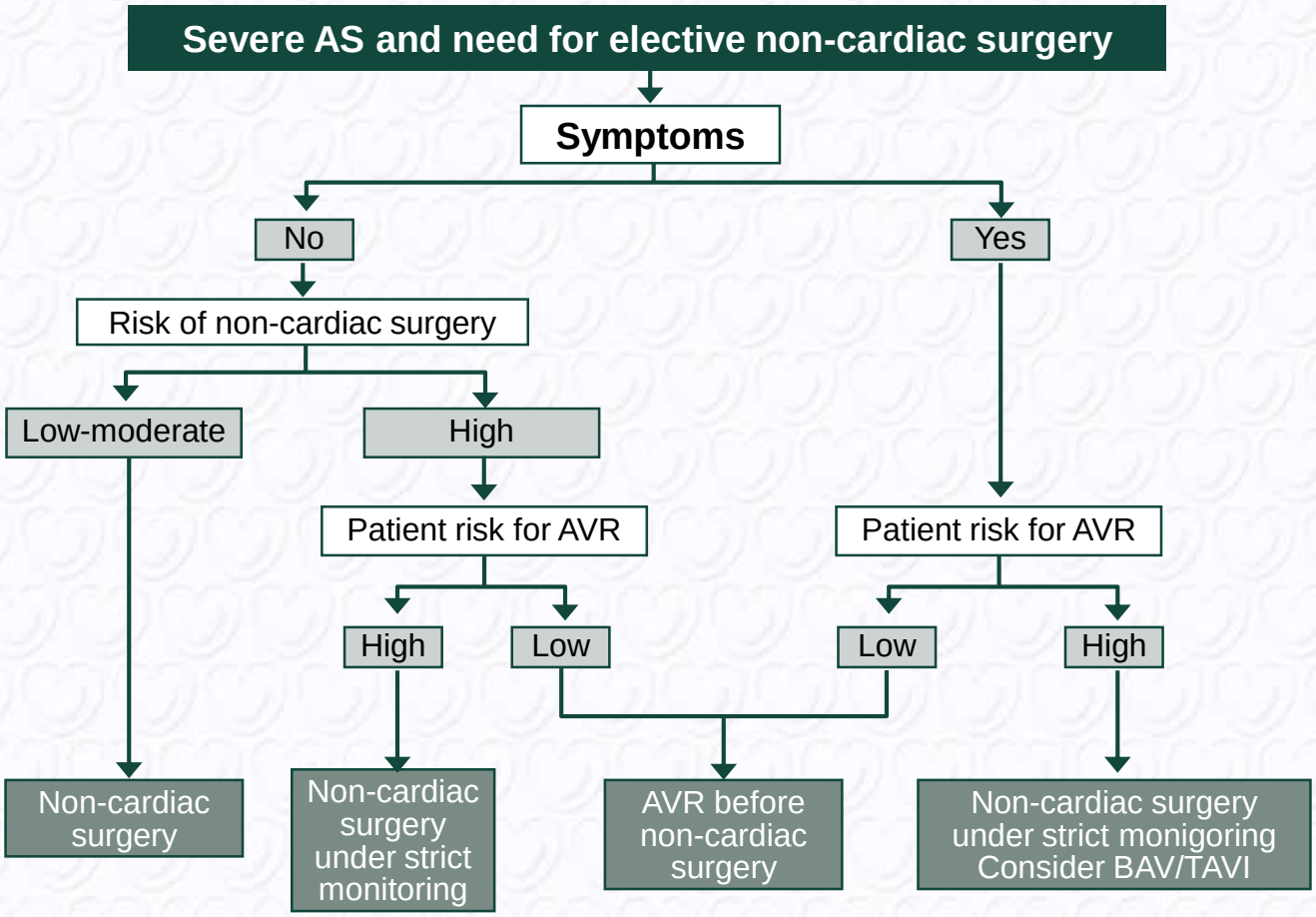
In case of BAV, surgery of the ascending aorta:		
is indicated in case of aortic root or ascending aortic diameter >55 mm.	I	C
is indicated in case of aortic root or ascending aortic diameter >50 mm in the presence of other risk factors.[c]	I	C
is indicated in case of aortic root or ascending aortic diameter >45 mm when surgical aortic valve replacement is scheduled.	I	C

European Heart Journal (2014):doi:10.1093/eurheartj/ehu281

Asymptomatic AS in the Elderly

- High prevalence
- Difficulties of watchful waiting
  - AS is a progressive disease
  - Impact of comorbidities, lifestyle
  - Patient reluctancy
- Limitations of exercise testing
  - Feasibility
  - Lower predictive value *(Das et al. Eur Heart J 2005;26:1309-13)*
- Possible need for non-cardiac surgery
- Higher risk of intervention

Management of severe aortic stenosis and elective non-cardiac surgery according to patient characteristics and the type of surgery



European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 & European Journal of Cardio-Thoracic Surgery 2012 - doi:10.1093/ejcts/ezs455).

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European Heart Journal Advance Access published February 19, 2014

European Heart Journal
doi:10.1093/eurheartj/ehu044

CLINICAL RESEARCH
Valvular heart disease

Perioperative risk of major non-cardiac surgery in patients with severe aortic stenosis: a reappraisal in contemporary practice

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Received 19 July 2013; revised 3 January 2014; accepted 22 January 2014

Perioperative course/symptoms

	Symptomatic AS	*Asymptomatic AS*	*Control*
Total MACE (%)	28.3	***12***	***11***
Death (%)	9.4	***3.3***	***3.1***
Cardiac	2	***0.7***	***0.8***
Non cardiac	7.6	***2.7***	***2.3***
HF (%)	20	***8***	***5.1***

(Tashiro T et al. Eur Heart J 2014;eurheartj.ehu044)

Recommendations for the management of valvular heart disease

Aortic stenosis

Recommendations	Class	Level
Patients with severe AS should undergo intervention pre-pregnancy if:		
• the are symptomatic,	I	B
• or LV dysfunction (LVEF < 50%) is present.	I	C
Asymptomatic patients with severe AS should undergo intervention pre-pregnancy when they develop symptoms during exercice testing.	I	C
Asymptomatic patients with severe AS should be considered for intervention pre-pregnancy when a fall in blood pressure below baseline during exercice testing occurs.	IIa	C

European Heart Journal 2011, doi: 10.1093/eurheartj/ehr218

Timing and Mode of Delivery

- Favour spontaneous onset of labour and vaginal delivery in most cases of stable heart disease.
- Wide use of lumbar epidural analgesia.
- Indications for Caesarean section:
  - pre-term labour in patients on oral anticoagulants,
  - Marfan and other ascending aortic aneurysms (IIaC if > 45 mm, IIbC if 40-45 mm),
  - aortic dissection (IIaC),
  - severe aortic stenosis (IIaC),
  - Eisenmenger syndrome (IIaC).
- Multidisciplinary care for high-risk patients.

European Heart Journal 2011, doi: 10.1093/eurheartj/ehr218

Indications for transcatheter aortic valve implantation

	Class	Level
TAVI should only be undertaken with a multidisciplinary “heart team” including cardiologists and cardiac surgeons and other specialists if necessary.	I	C
TAVI should only be performed in hospitals with cardiac surgery on-site.	I	C
TAVI is indicated in patients with severe symptomatic AS who are not suitable for AVR as assessed by a “ heart team” and who are likely to gain improvement in their quality of life and to have a life expectancy of more than 1 year after consideration of their comorbidities.	I	B
TAVI should be considered in high risk patients with severe symptomatic AS who may still be suitable for surgery, but in whom TAVI is favoured by a “heart team” based on the individual risk profile and anatomic suitability.	IIa	B

European Heart Journal 2012 - doi:10.1093/eurheartj/ehs109 &
European Journal of Cardio-Thoracic Surgery 2012 -
doi:10.1093/ejcts/ezs455).

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Comparison between Sapien 3 and surgery

	30 days		1 Year	
	TAVI (963pts)	**Surgery (747pts)**	**TAVI**	**Surgery**
Death (%)	1.1	4	7.4	13
Any stroke(%)	2.7	6.1	4.6	8.2
Major vascular complication (%)	**6.1**	**5.4**		
AKI (%)				
New AF(%)				2
New PM(%)	**10.2**	**7.3**	**12.4**	**9.4**
Valve area(cm^2)	1.7±0.4	1.5±0.4	1.7±0.4	1.4±0.4
Moderate and severe AR (%)	**3.8**	**0.5**	**1.5**	**0.4**

TAVI is superior to AVR :
Death,strokes,and moderate to severe AR
H.R. -9.2%, 95%CI (-13—5.4); p<0.0001

(Thourani ,Lancet 2016)

More evidence to come on TAVI

- **SURTAVI**
- **UK-TAVI**
- **PARTNER 3**
- **Evolut R Low risk**
- ***EARLY TAVR***
- **UNLOAD**
- **ACTIVATION**
- **POPULAR TAVI; GALILEO; ATLANTIS**
- **PORTICO IDE; SALUS; REPRISE III**
- **SOLVE TAVI; DIRECT; EASY TAVI**
- **…**

Conclusions

- Thanks to recent studies the prognosis of patients with asymptomatic AS can be better individualised.
- Exercise testing and the analysis of Vmax. are the main components of risk stratification.
- Guidelines are consistent for recommending surgery in selected patients with asymptomatic AS.
- Challenges remain:
  - Low level of evidence
  - Specific problems in the elderly
  - Need for well designed randomized trials
  - Evaluation of the role of TAVI

Thank you