

EAE TEACHING COURSE

Aorta and aortic valve 2012

31th March 2012
Szczecin, Poland EP

EAE TEACHING COURSE: aorta and aortic valve

Szczecin, 31st March 2012

**Prof. Luigi Badano, Italy
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Prof. Gilbert Habib, France**

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STRESS ECHO IN AORTIC VALVE DISEASES

EAE Teaching Course. **Aorta and aortic valve 2012**

Edyta Płońska- Gościńskiak
Szczecin, Poland

EAE stress echo [Sicari, EJE 2008]



European Journal of Echocardiography (2008) 9, 415–437
doi:10.1093/ejechocard/jeu175

EAE GUIDELINES

Stress echocardiography expert consensus statement

European Association of Echocardiography (EAE) (a registered branch of the ESC)

Rosa Sicari^{1*}, Petros Nihoyannopoulos², Arturo Evangelista³, Jaroslav Kasprzak⁴, Patrizio Lancellotti⁵, Don Poldermans⁶, Jen-Uwe Voigt⁷, and Jose Luis Zamorano⁸ on behalf of the European Association of Echocardiography

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STRESS ECHO IN AORTIC VALVE DISEASES

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Rekomendacje 2011 Sekcji Echokardiografii Polskiego Towarzystwa Kardiologicznego dotyczące zastosowania echokardiografii obciążeniowej w praktyce klinicznej

Recommendations of the Echocardiography Working Group of the
Polish Cardiac Society for stress echocardiography use in clinical practice 2011

Edyta Płońska-Gościński¹, Andrzej Gackowski², Zbigniew Gąsior³, Tomasz Kukulski³, Andrzej Szyszka⁴,
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STRESS ECHO IN AORTIC VALVE DISEASES

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Stress echo in valvular diseases

- Evaluation of symptoms
- Exercise capacity
- Hemodynamic consequences of valve diseases

STRESS ECHO IN AORTIC VALVE DISEASES

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Stress echo in aortic stenosis (AS)

Indications:

- Assessment of AS severity and risk stratification in AS/depressed LV/ low-flow/low-grad

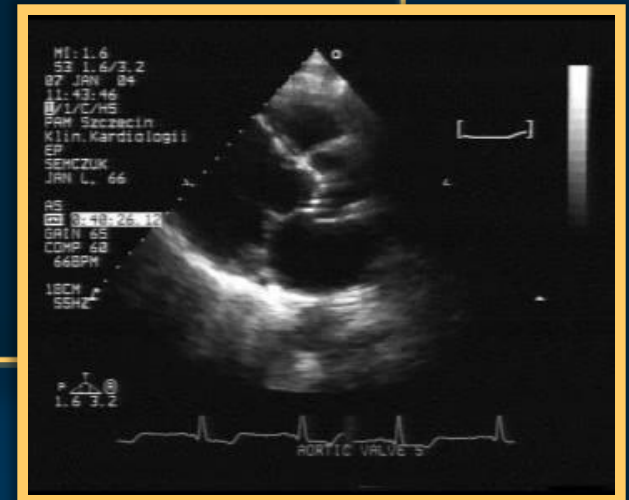
Dob 5 - 20ug/kg/min

- Assessment for functional class and risk stratification in asymptomatic severe AS

Dob 5 - 40ug/kg/min, exercise

Stress ECHO

Low-flow/low-gradient aortic stenosis – role of stress echo



Guidelines of Valvular Heart Disease

ECHO is the only published **stress** imaging technique in patients with low-flow/low-gradient aortic stenosis

$EF < 40\%$, $Mgrad < 30-40 \text{ mmHg}$, $AVA < 1 \text{ cm}^2$

STRESS ECHO IN AORTIC VALVE DISEASES

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Stress echo in low flow/grad aortic stenosis

- To detect the presence of contractile reserve (increase SV > 20%)
- To distinguish truly severe AS from pseudosevere AS (changes in aortic velocity, mean grad, valve area)

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The protocol

The protocol for dobutamine stress echo for evaluation low-flow/ low-grad AS:

- Low dose dob 2,5 or 5 ug/kg/min with an incremental increase in the infusion in every 3-5 min to a maksimum dose 10-20 ug/kg/min
- Test termination: HR more than 10-20bpm over baseline or 100bpm (low dob)

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Doppler data - report

Each stage or at least at baseline and peak dose:

LVOT velocity (VTI)

AS jet velocity, mean gradient

LVOT diameter only in rest

calculation of valve area

SV, EF

SAFETY: ADVERSE EVENTS DURING DOB ECHO IN AS (no death)

(Plonska, n=162 AS pts)

Adverse events in patients with aortic stenosis observed during dobutamine stress echocardiography

Rodzaj objawów niepożądanych Adverse event	Liczba pacjentów (%) Number of cases n=162 (100%)	
Ogółem / Total	75	(46,3%)
Komorowe zaburzenia rytmu / Ventricular arrhythmia	29	(18,0%)
Nadkomorowe zaburzenia rytmu / Supraventricular arrhythmia	4	(2,5%)
Hipotonia / Hypotension	24	(14,8%)
Bóle w klatce piersiowej / Chest pain	20	(12,3%)
Bradykardia / Bradycardia	1	(0,6%)
Parestezje / Parestesia	11	(6,8%)
Duszność / Dyspnoea	3	(1,9%)
Nudności / Nausea	1	(0,6%)
Zawroty głowy / Vertigo	1	(0,6%)
Drżenia / Muscle spasms	1	(0,6%)
Inne objawy niekardiologiczne / Other non-cardiological symptoms	16	(9,9%)
Wzrost gradientu maks. aortalnego >100 mmHg w trakcie testu Max. aortic gradient rise > 100 mmHg	12	(7,4%)

SAFETY: ADVERSE EVENTS AND TEST TERMINATION (Plonska, n=162 AS pts)

Adverse events necessitating termination of dobutamine stress echocardiography in patients with aortic stenosis

Rodzaj objawów niepożądanych Adverse event	Liczba pacjentów (% ogółu) Number of cases n=162	
Ogółem / Total	44	(27,2%)
Komorowe zaburzenia rytmu / Ventricular arrhythmia	15	(9,3%)
Nadkomorowe zaburzenia rytmu / Supraventricular arrhythmia	1	(0,6%)
Hipotonia / Hypotension	16	(9,9%)
Bóle w klatce piersiowej (bez asynergii w ECHO) / Chest pain	9	(5,6%)
Bradykardia / Bradycardia	0	(0%)
Parestezje / Parestesia	7	(4,3%)
Duszność / Dyspnoea	3	(1,8%)
Nudności / Nausea	1	(0,6%)
Zawroty głowy / Vertigo	1	(0,6%)
Drżenia / Muscle spasms	1	(0,6%)
Inne objawy niekardiologiczne / Other non-cardiological symptoms	12	(7,4%)
Wzrost gradientu maks. aortalnego >100 mmHg w trakcie testu Max. aortic gradient rise > 100 mmHg	11	(6,8%)

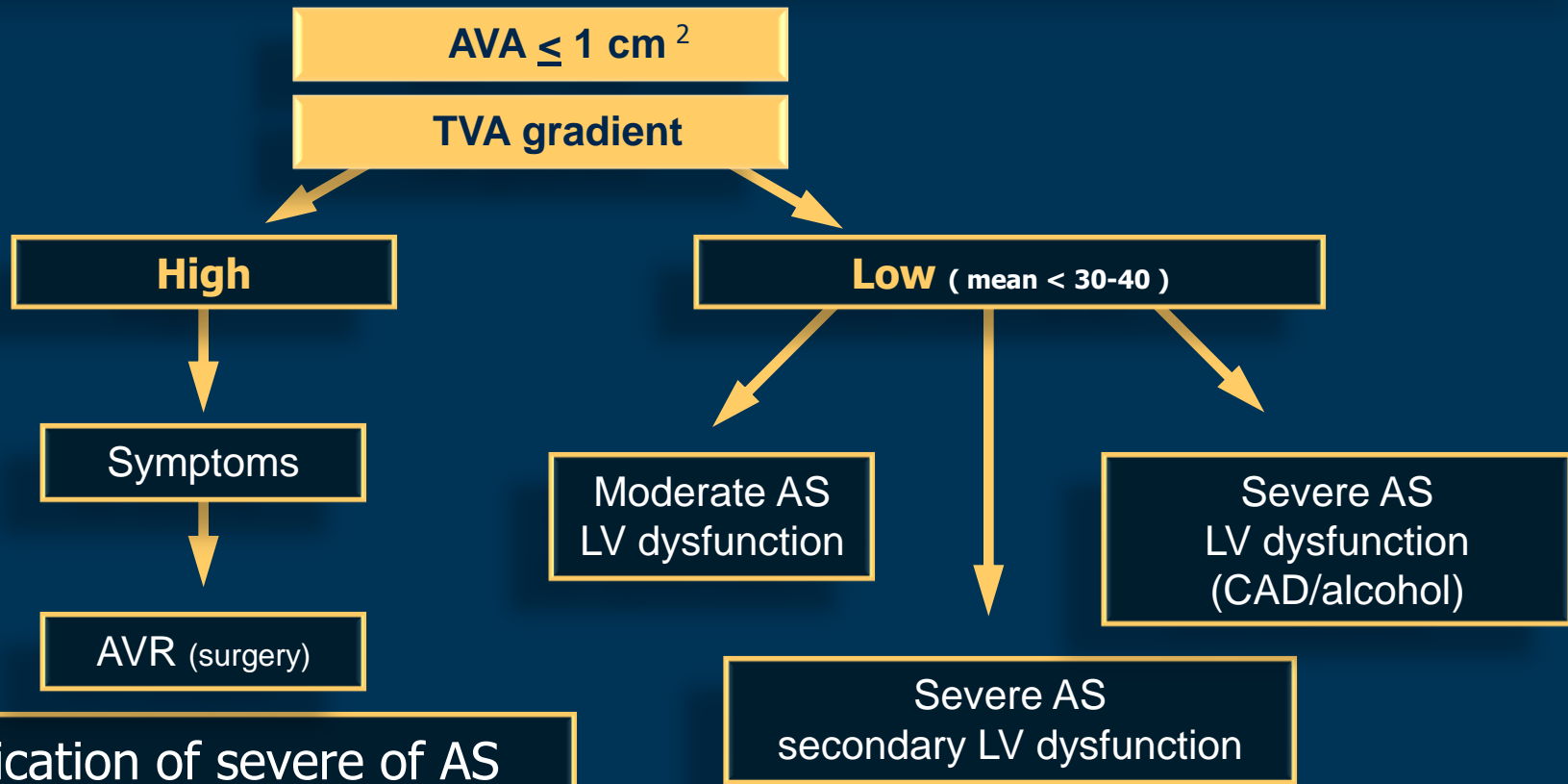
SAFETY: STRESS ECHO ADVERSE EVENTS in Low Flow/Gradient AS

(PLONSKA, group I n=39, low flow/grad vs group II n=123, moderate AS)

Adverse events in group I and II

Objawy niepożądane Adverse event	Grupa I / Group I n=39	Grupa II / Group II n=123	Wartość p p value
Duszność / Dyspnoea	8 (20,5%)	12 (9,8%)	Ns
Hipotonia / Hypotension	4 (10,3%)	20 (16,3%)	Ns
Kołatanie serca / Palpitation	2 (5,1%)	9 (7,3%)	Ns
Nadkomorowe zaburzenia rytmu Supraventricular arrhythmia	3 (7,7%)	1 (0,8%)	0,05
Komorowe zaburzenia rytmu Ventricular arrhythmia	14 (35,9%)	15 (12,2%)	0,001
Bradykardia / Bradycardia	1 (2,6%)	0	Ns

AS: LV dysfunction ($< SV/EF$) due to \uparrow afterload or primary LV dysfunction \longrightarrow limited valve opening

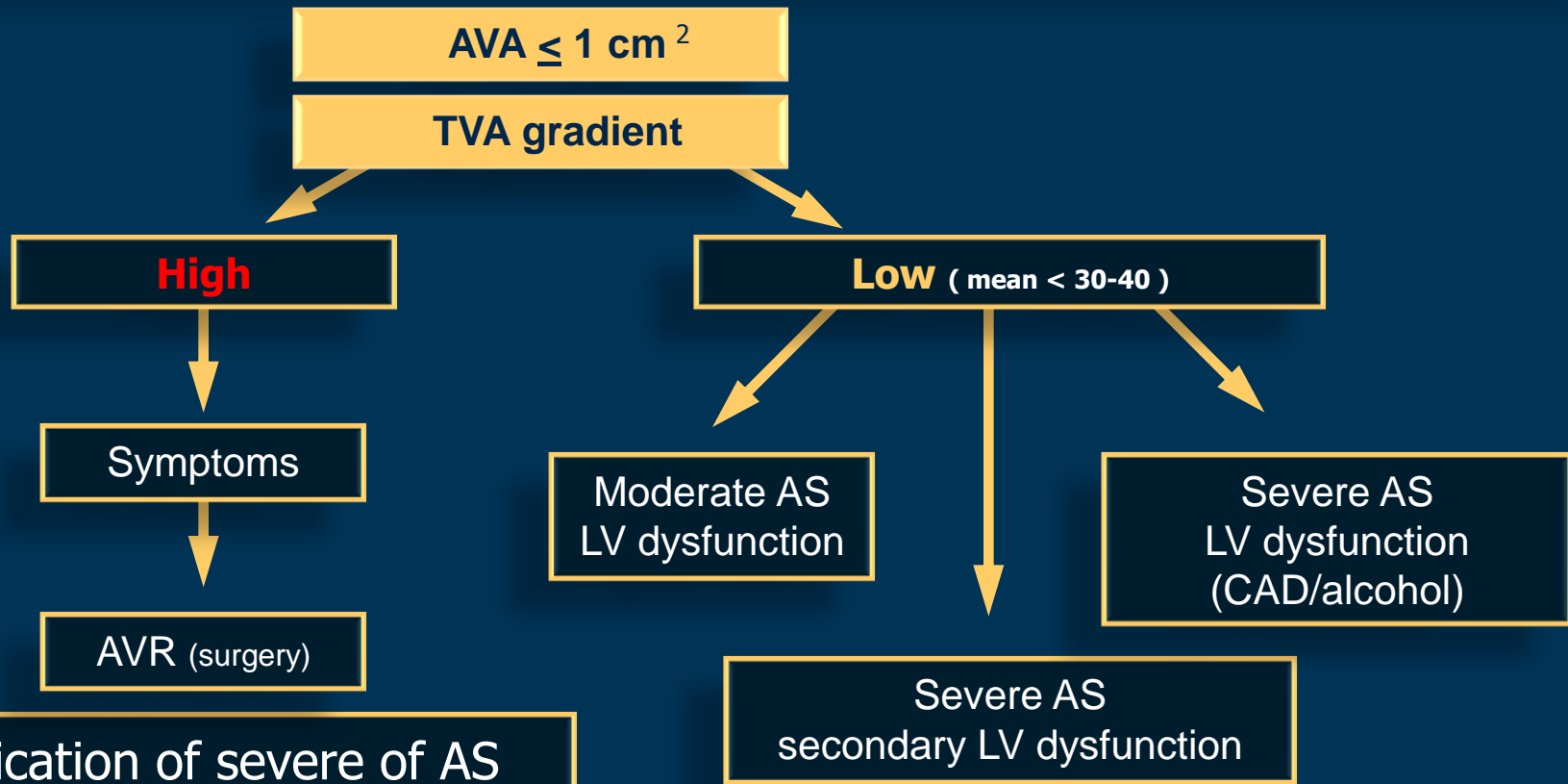


Classification of severe of AS

- Jet velocity (m/s) >4
- Mean grad (mmHg) >50
- Valve area (cm²) <1
- Valve area index <0.6

In case of LV dysfunction, severe AS may be present with a lower grad/velocity - Guidelines, 2007

AS: LV dysfunction ($< SV/EF$) due to \uparrow afterload or primary LV dysfunction \longrightarrow limited valve opening



Classification of severe of AS

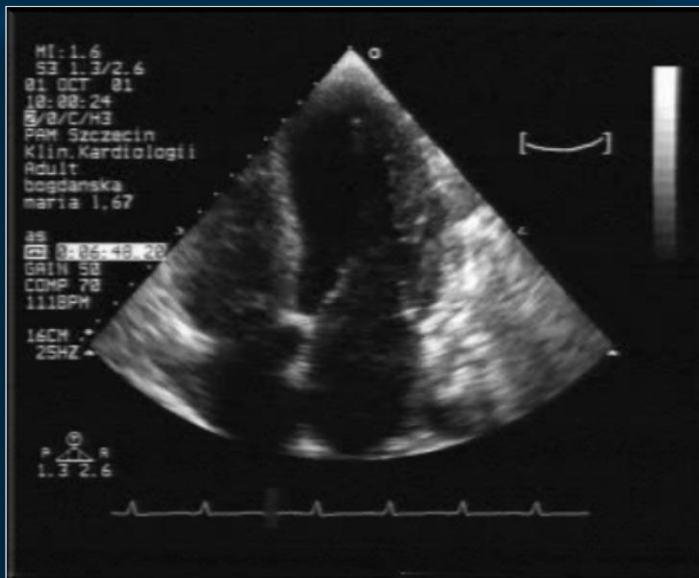
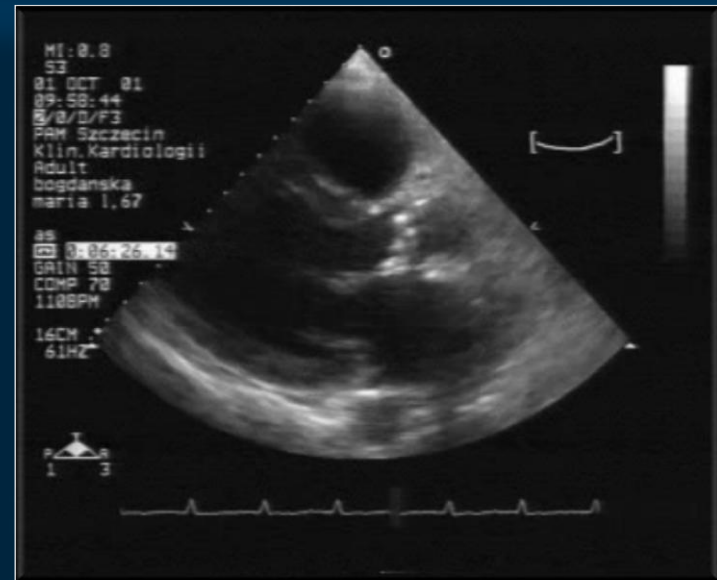
- Jet velocity (m/s) >4
- Mean grad (mmHg) >50
- Valve area (cm²) <1
- Valve area index <0.6

In case of LV dysfunction, severe AS may be present with a lower grad/velocity - Guidelines, 2007

AS with depressed LV, low flow / high gradient

Patient

F, 67yr,
Symptoms
Grad 80/48, AVA < 1
EF ↓
No need stres echo



STRESS ECHO IN AORTIC VALVE DISEASES

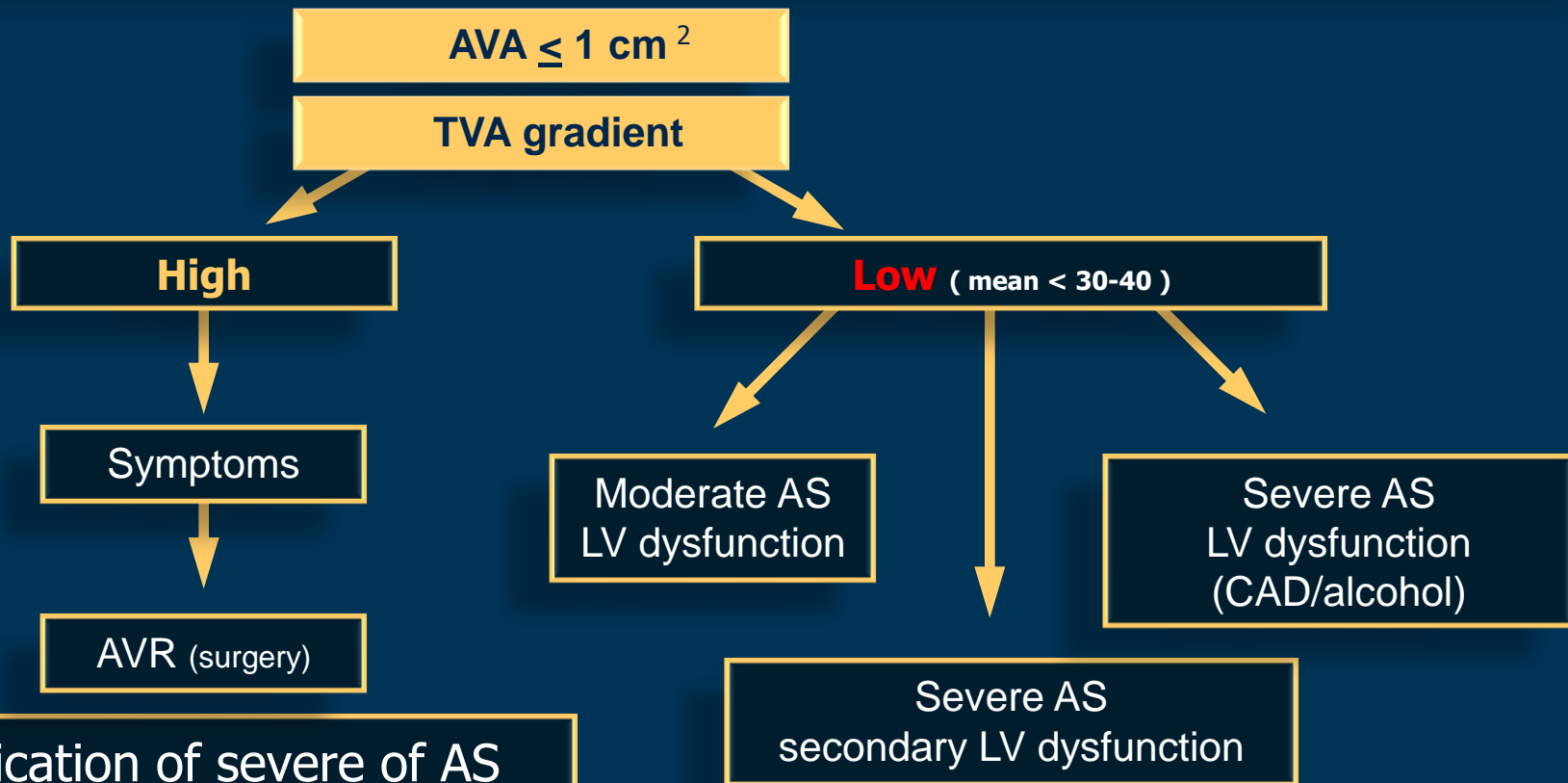
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Stress echo in aortic stenosis

Left ventricular systolic dysfunction AS: low flow / high gradient AS (mean grad >40, AVA <1, EF<40%)

Does not need stress echo

AS: LV dysfunction ($< SV/EF$) due to \uparrow afterload or primary LV dysfunction \longrightarrow limited valve opening



Classification of severe of AS

- Jet velocity (m/s) >4
- Mean grad (mmHg) >50
- Valve area (cm²) <1
- Valve area index <0.6

In case of LV dysfunction, severe AS may be present with a lower grad/velocity - Guidelines, 2007

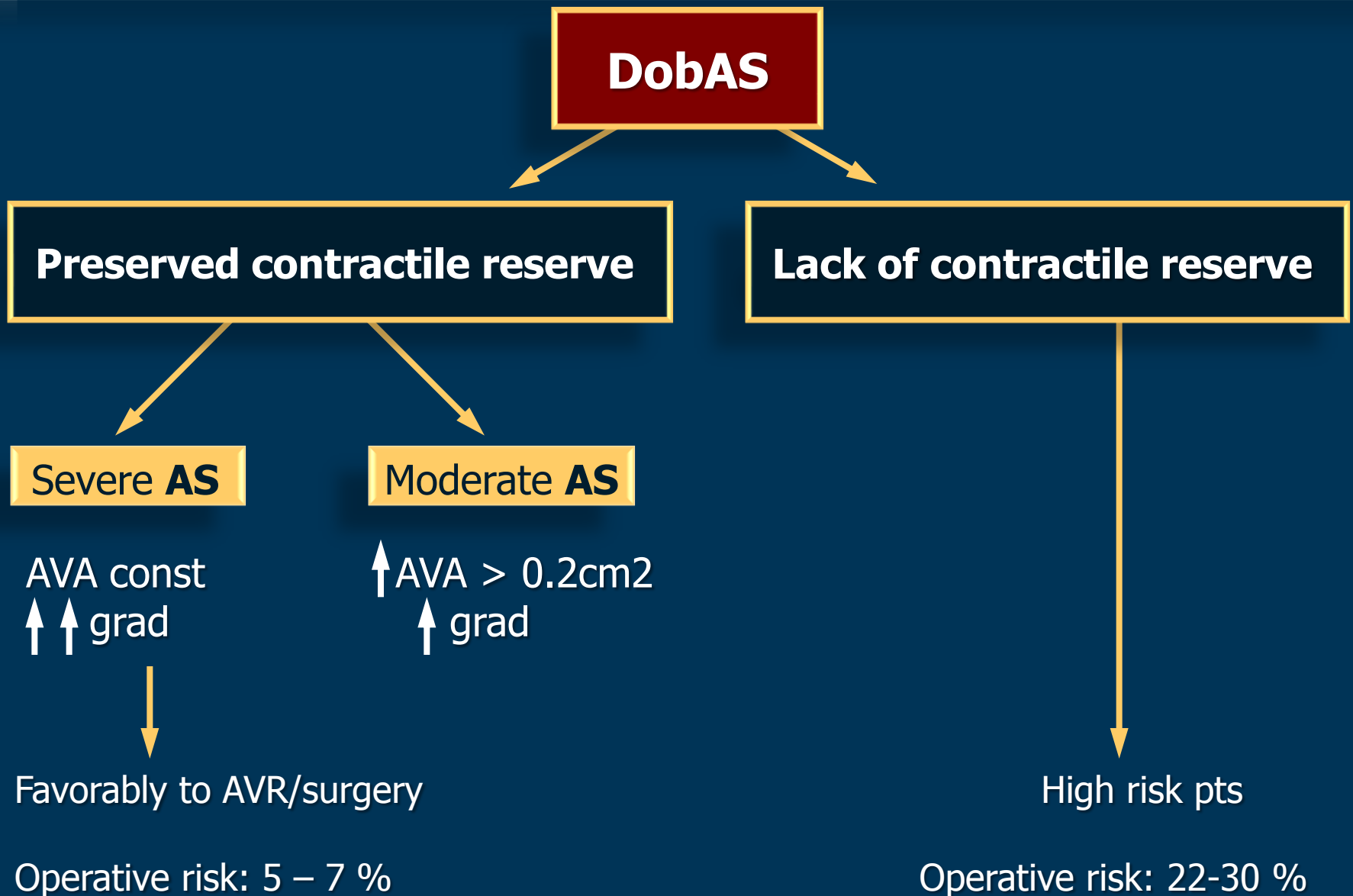
Dobutamine echo in low-grad/low flow AS and LV dysfunction provides:

Assessment of real severity of AS and contractile reserve

- 5 – 20 $\mu\text{g/kg/min}$
- R+: **>SV by 20%** (WMSI,EF) (4 segments=0,25 WMSI)
- AS severity: R+ and AVA <1 cm^2 (Δ 0,2)

DE	Severe AS	Moderate AS	Undetectable AS
SV, EF	↑	↑	↔
Pressure grad	↑	↔	↔
AVA	↔	↑	↔

DEAS in low-flow/low-grad AS and LV dysfunction



Low-flow/low - grad AS and LV dysfunction

Dobutamine stress echo determines:

```
graph TD; A[Dobutamine stress echo determines:] --> B[True severe AS]; A --> C[Moderate AS]; B --> D["Acceptable operative mortality<br/>Improved long-term survival<br/>Increase in EF"]; C --> E[Less surgical benefit];
```

True severe AS

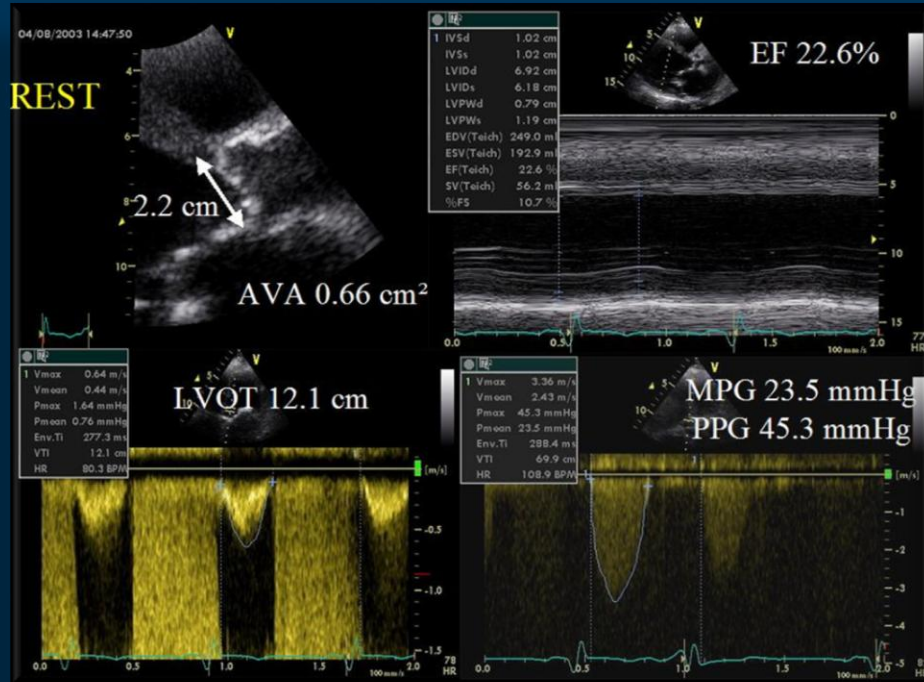
**Acceptable operative mortality
Improved long-term survival
Increase in EF**

Moderate AS

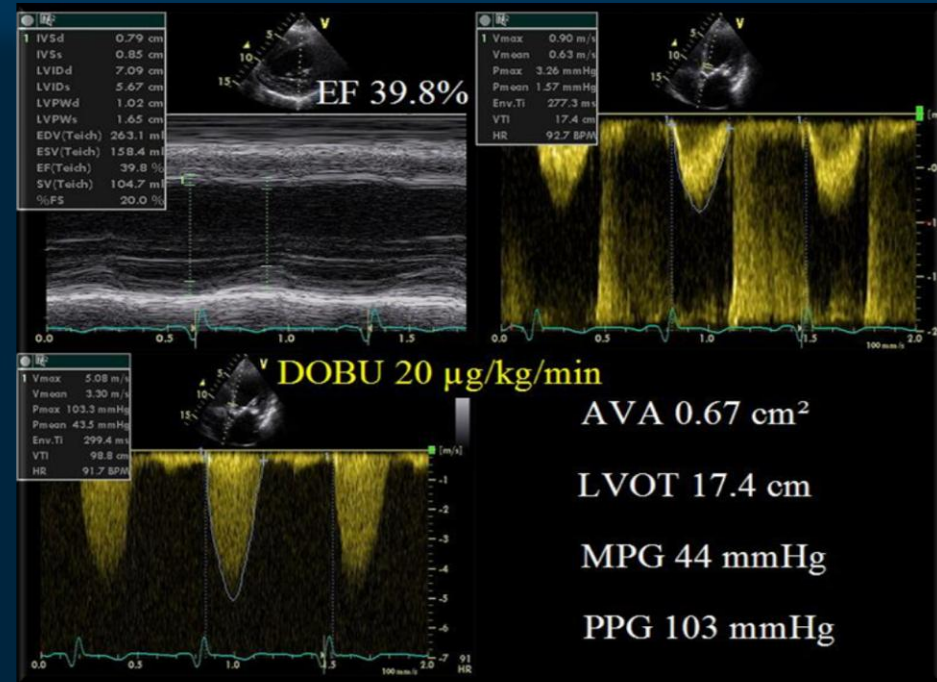
Less surgical benefit

DE in low-flow/low-grad. AS

Rest



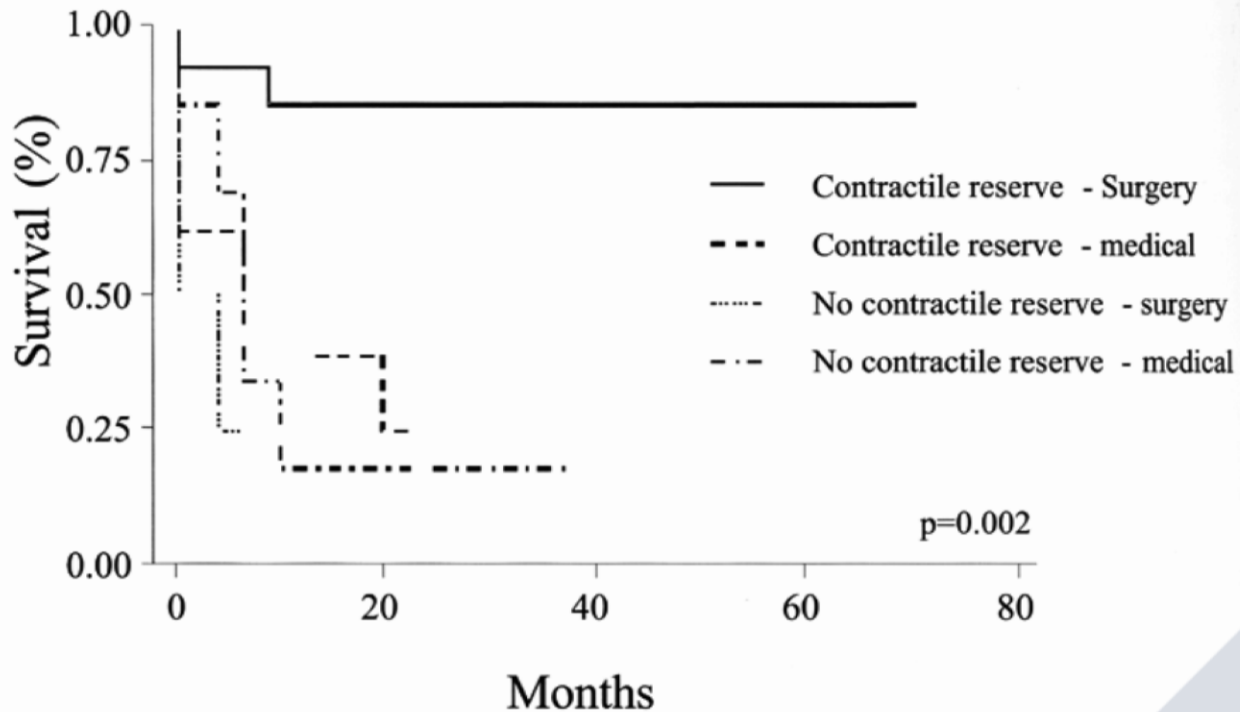
Stress



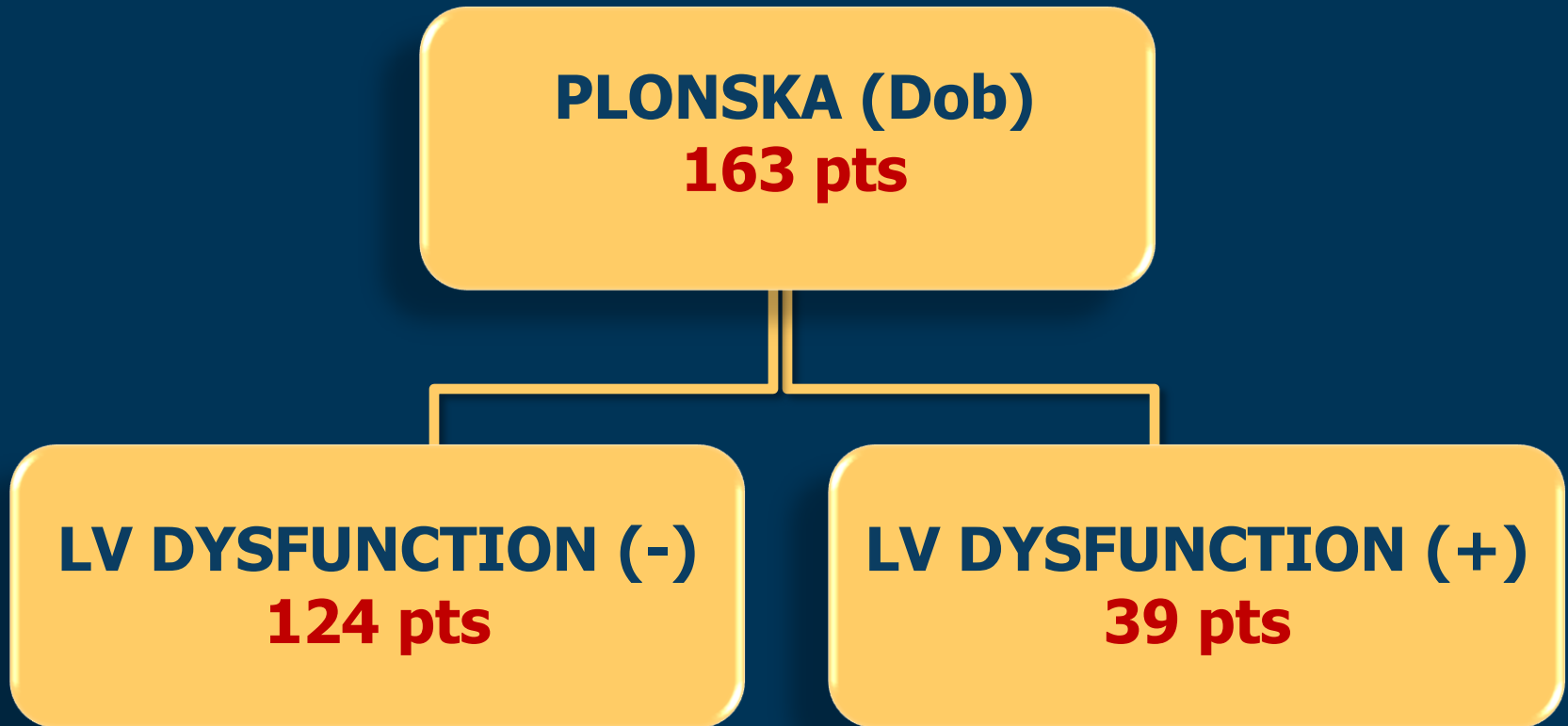
DE	EF	MGrad	AVA
Rest	22	23	0,66
Stress	39	44	0,67

Plonska, Lancellotti

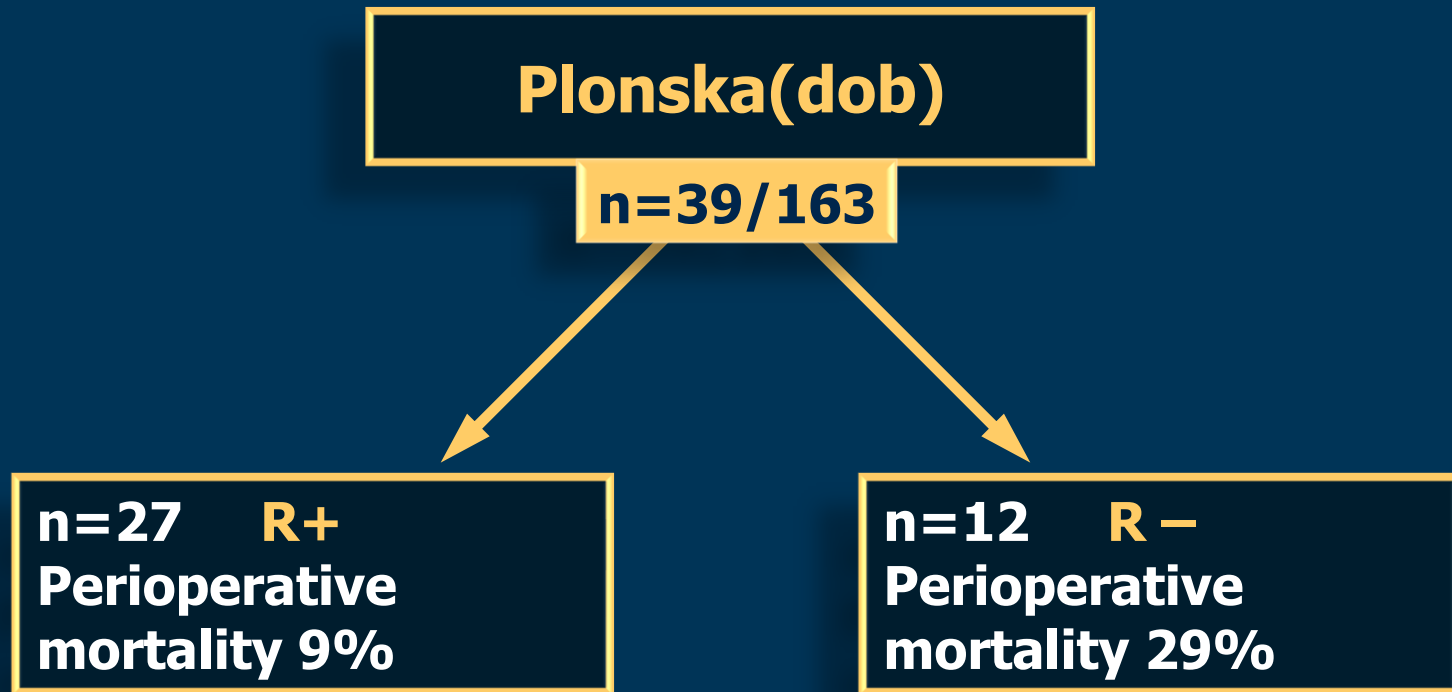
Dobutamine stress echo in low-grad AS (Monin)



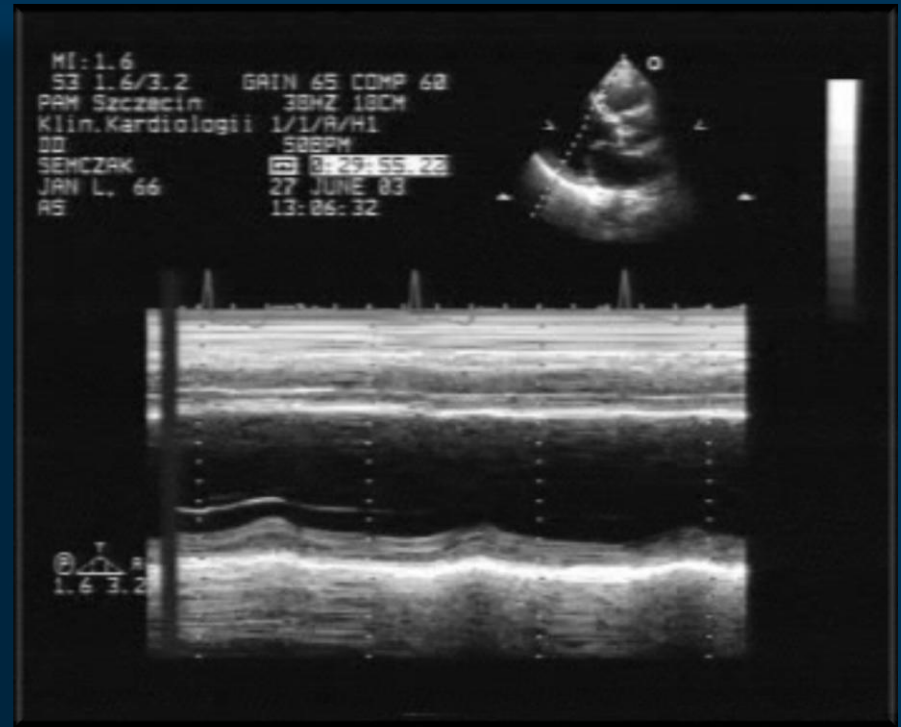
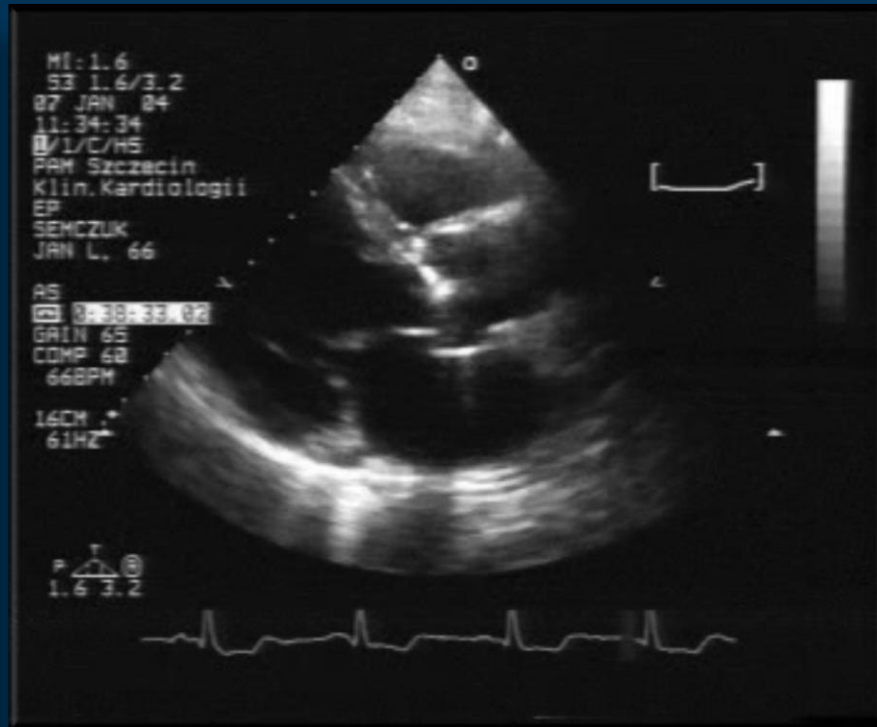
RESULTS AS-STUDY



Dobutamine echo in low-flow/low-grad AS



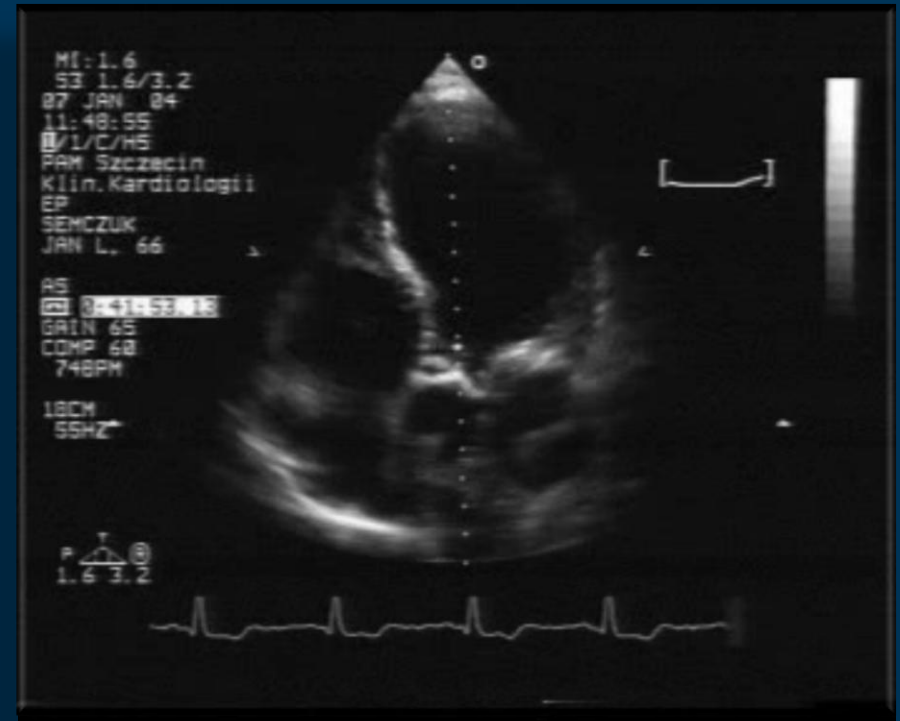
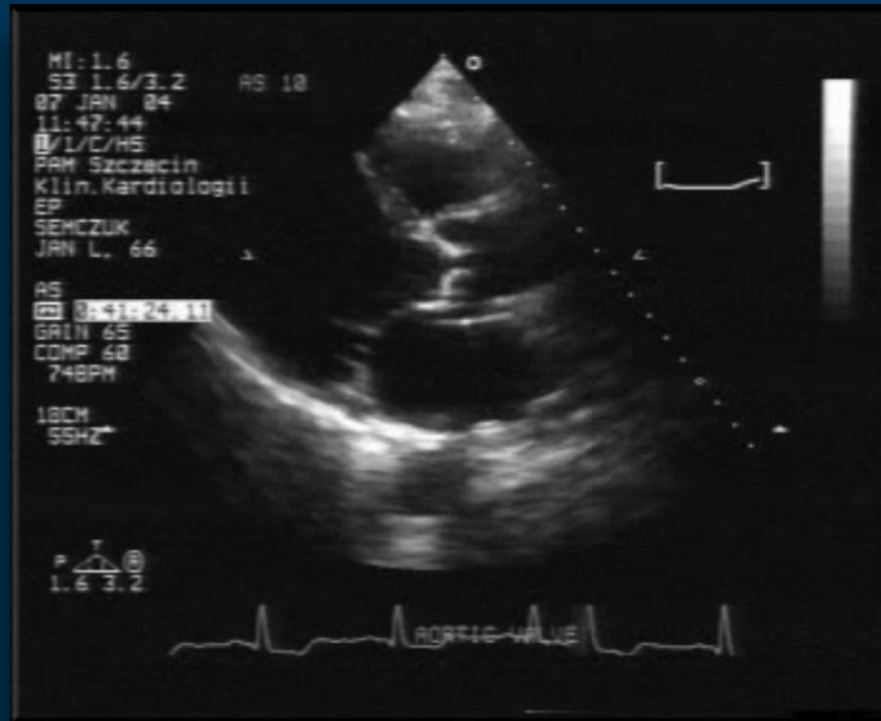
Patient 1: at rest



66 year old man with HF symptoms (III NYHA), LV dysfunction and calcified aortic valve, but mean grad only 29 and valve area 0.7. Significant LV dilatation and systolic dysfunction are present, so low gradient may underestimate AS severity.

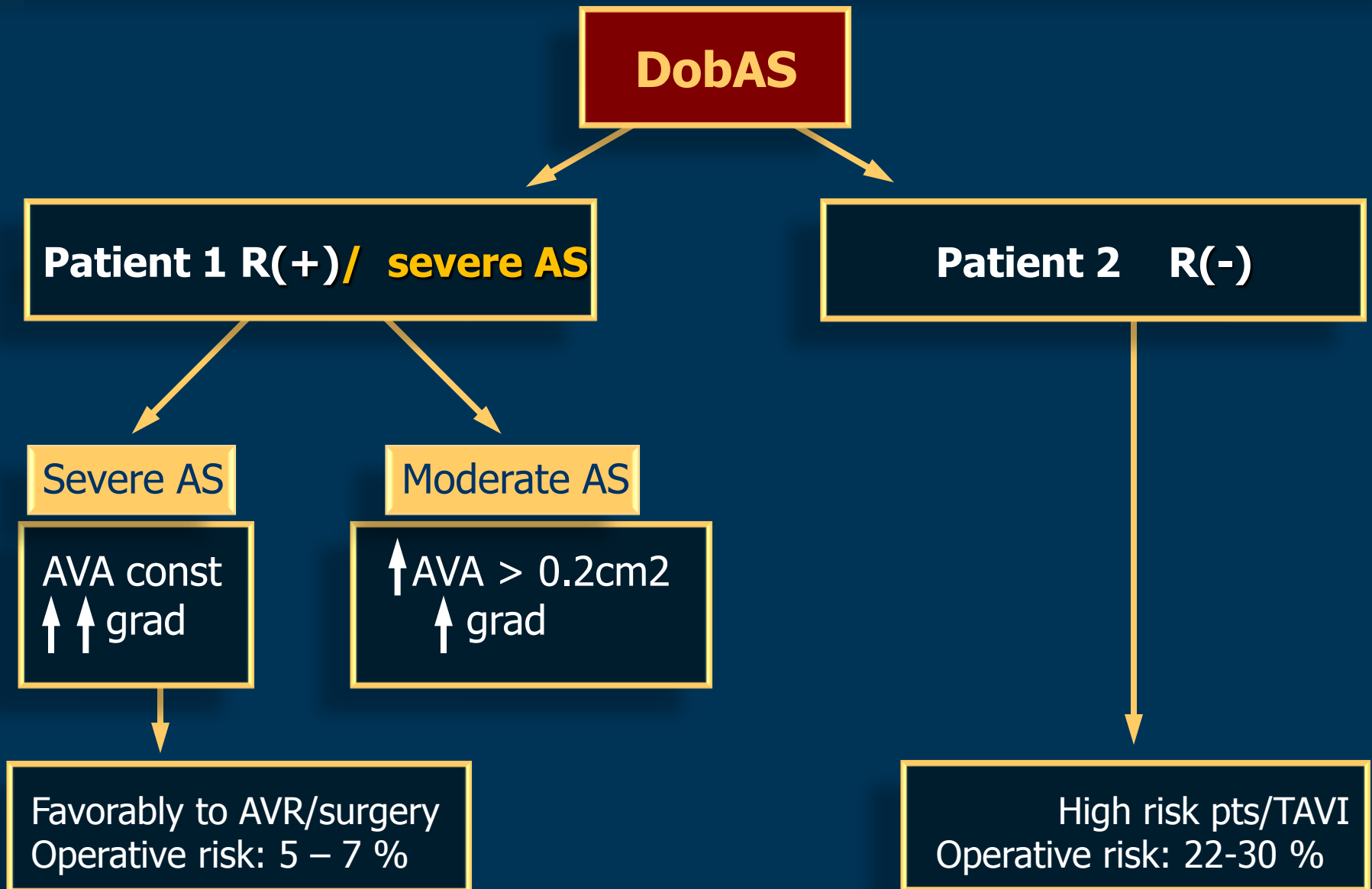
DE can be performed to evaluate contractile reserve and determine severity of AS

Patient 1 stress: with contractile reserve and severe AS



DE	EF	MGrad	AVA
Rest	30	29	0,7
Stress	46	43	0,7

DEAS in low-flow/low-grad AS and LV dysfunction



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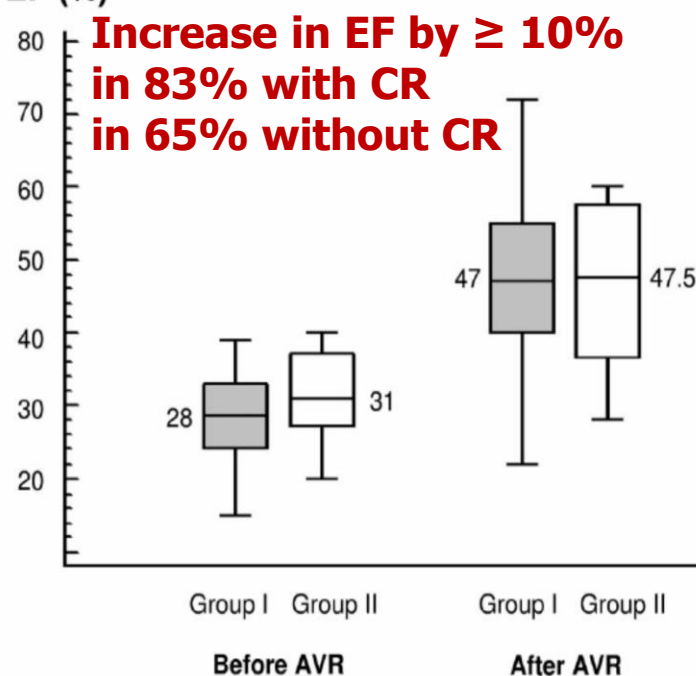
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TABLE 5. Predictors for LVEF Increase After AVR by Multivariable Analysis

Predictors for LVEF Increase	Unstandardized Coefficients		Standardized Coefficients	<i>t</i> Statistics	<i>P</i>
	B	SE	β		
MPG ≤ 30 mm Hg	-0.062	0.02	-0.304	-2.617	0.011
Multivessel CAD	-0.062	0.03	-0.238	-2.049	0.045

Perioper. mortality
R + 6%, R - 33%

LVEF (%)



STRESS ECHO IN AORTIC VALVE DISEASES

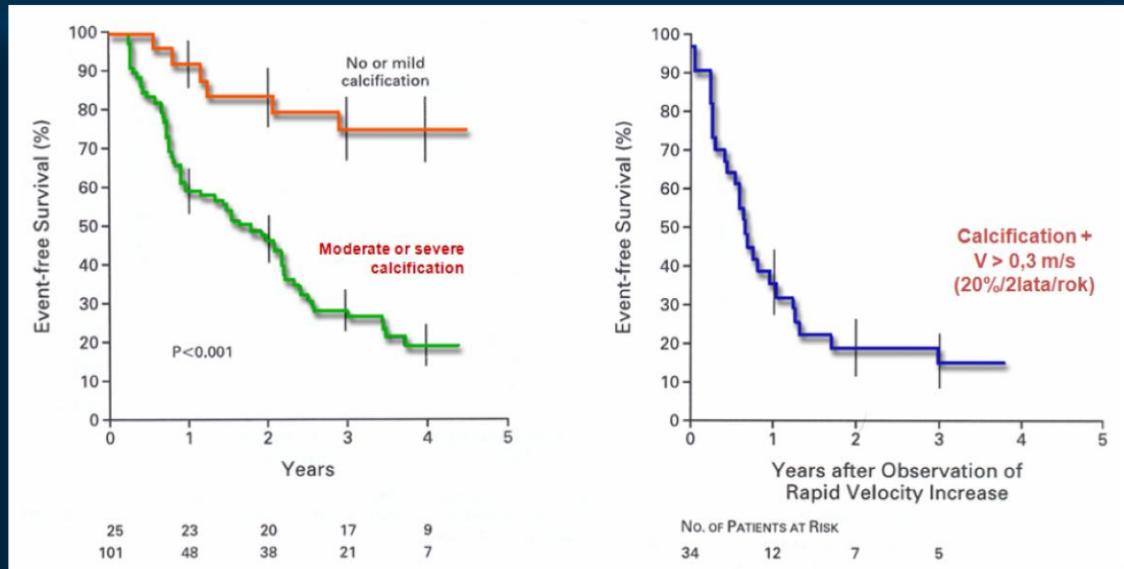
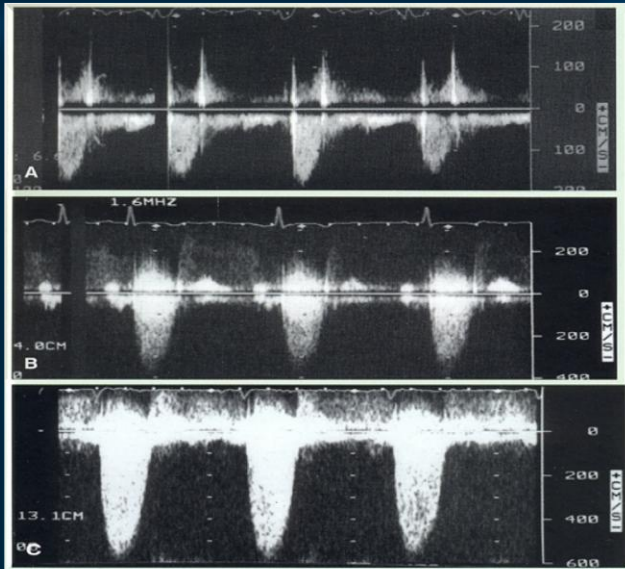
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The test abnormal response

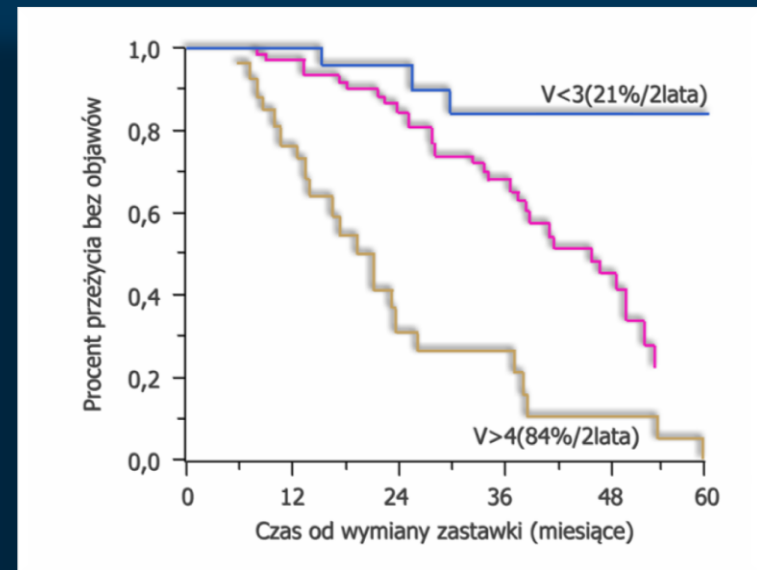
- Symptoms (dyspnoea, syncope, near syncope, angina pectoris)
- Blood pressure fall (≥ 20 mmHg)
- Significant ventricular arrhythmias, ECG- ST

ESC indications for AVR in AS/symptoms (-)

$V > 4 \text{ m/s}$ i $\geq 0,3 \text{ m/s/rok}$



Asymptomatic severe AS, $n = 126$, $V > 4 \text{ m/s}$, endpoint: death/AVR (Rosenhek)

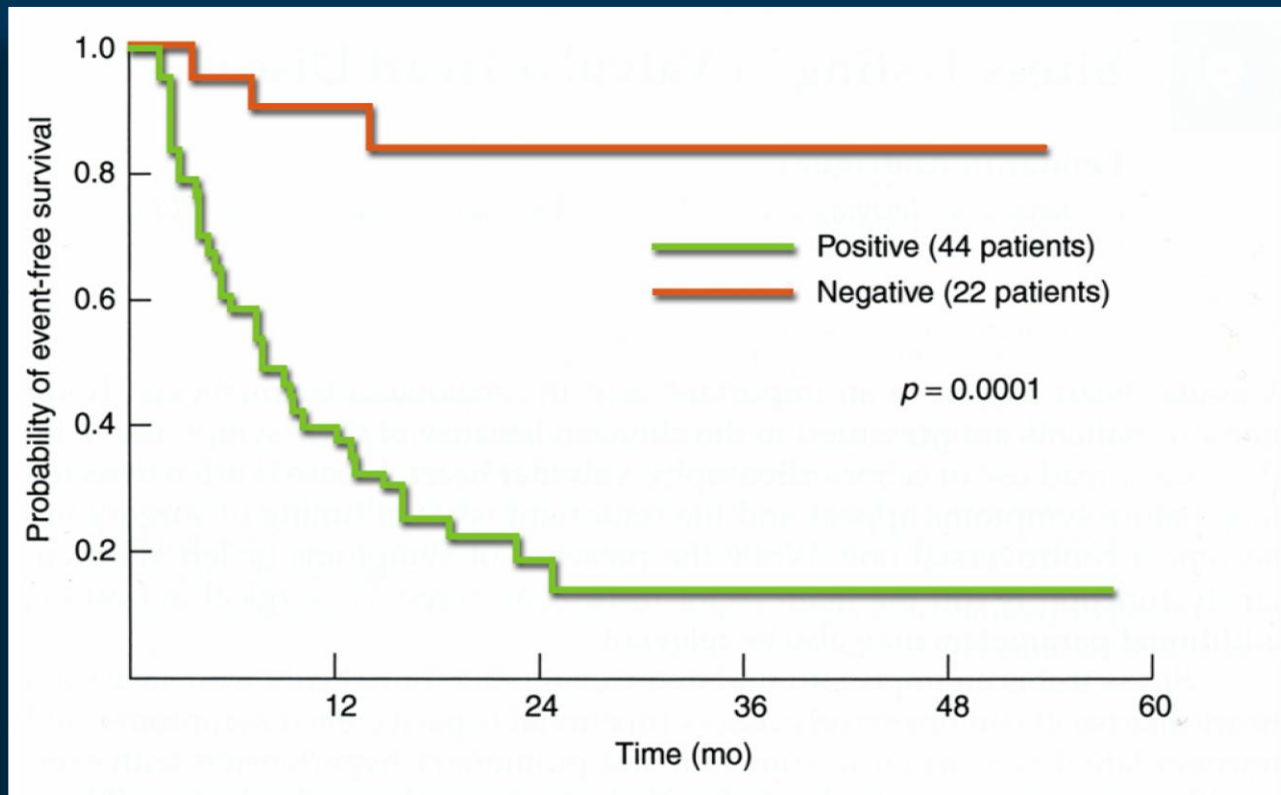


Asymptomatic, $n = 123$, end point: death/AVR (Otto)

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Aortic stenosis: **asymptomatic**



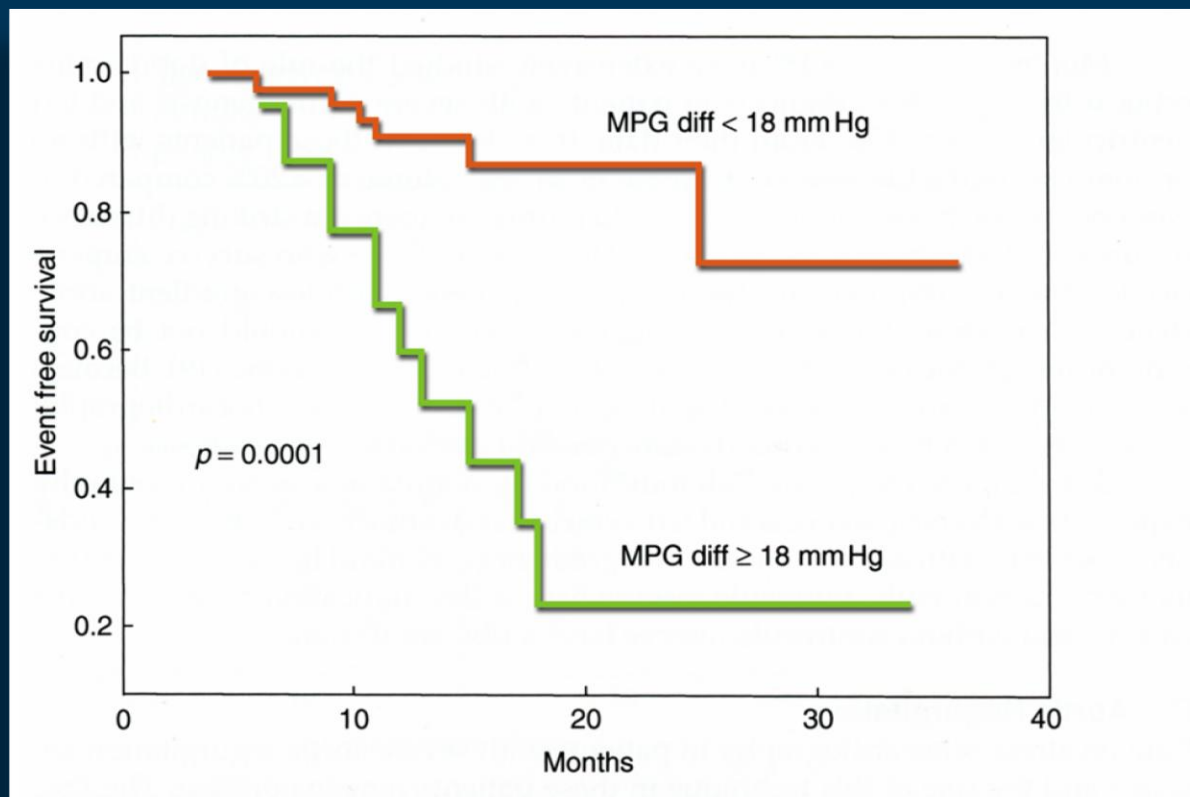
K-M: pts with severe asymptomatic AS f-up 60 month (exercise echo).

Amato (2001): prognosis (death or symptoms). Criteria (+) test: symptoms, ST/arrhythmias, BP fall.

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Aortic stenosis: asymptomatic



KM: pts with severe asymptomatic AS.
Difference in mean gradient rest- stress

Lancellotti (2005): prognosis (death or symptoms). Criteria (+) test: symptoms, ST/arrhythmias, BP fall, increase in mean grad > 18mmHg

STRESS ECHO IN AORTIC VALVE DISEASES

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Stress echo in asymptomatic AS

- To unmask symptoms (30-40% pts)
- For risk stratification

Increase in mean grad ≥ 18 mmHg, abnormal test and AVA $< 0,75\text{cm}^2$ predicts a worse prognosis in severe AS (Lancellotti); stress increase mean grad $> 20\text{mmHg}$ in pts with normal test (Pibarot)

SUMMARY: STRESS ECHO IN AORTIC VALVE DISEASES

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ESC indications for AVR Class I: severe AS

Symptom

CABG/Ao/valve

Asymptomatic

EF<50%

**„+“
stress echo**

STRESS ECHO IN AORTIC VALVE DISEASES

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SUMMARY

ESC indications for asymptomatic severe AS

- Class I test (+): symptoms
- Class IIa test (+): BP fall
- Class IIb test (+): arrhythmias

STRESS ECHO IN AORTIC VALVE DISEASES EAE

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SUMMARY: stress echo in asymptomatic severe AS

- It is accepted for risk stratification and assessment of functional class in asymptomatic pts

Szczec

