

National Heart Centre Singapore SingHealth

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Outline

- Types & indications of stress tests for VHD
- Updates in Guidelines:
2017 ESC/EACTS, 2017 ACC/AHA



The clinical use of stress echocardiography in non-ischaemic heart disease: recommendations from the European Association of Cardiovascular Imaging and the American Society of Echocardiography

Patricio Luciani^{1,2}, Patricia A. Pellikka³, Werner Raddi⁴, Ramona A. Chiodini⁵, Renukumaran Mani⁶, Theodoros Panagoulas⁷, Melissa-Claudia Sima^{8,9,10}, Suresh C. Kumar¹¹, Jan Knuuti¹², Jani Miettinen¹³, Philippe Bouillon¹⁴, Eugenio Piccini¹⁵, Thomas Haeghe¹⁶, Jochen W. Teiseler¹⁷, and Adam Ungu¹⁸



Outline

- Types and indications of stress tests for VHD
- Updates in Guidelines:
2017 ESC/EACTS, 2017 ACC/AHA


Valve Stress Test

Exercise Pharmacologic


Valve Stress Test

Exercise Pharmacologic


Treadmill



Upright Bicycle Ergometer




Supine/ semi-supine Bicycle Ergometer



Valve Stress Test

Exercise Pharmacologic


Treadmill



Valve

- Δ 18-20 mmHg MFG in AS
- MFG $>$ 15-18 mmHg in MS
- $>$ 10-13 mm² EROA in MR


Upright Bicycle Ergometer



Ventricle

- Δ $<$ 4-5% LVEF (back of CR)
- Δ $<$ 2% QES (back of CR)
- Δ SV $<$ 20% (back of FR)
- Δ WMSI (ischemia)
- LV dyspnoea
- RV dysfunction (TAPSE $<$ 15 mm)

Supine/ semi-supine Bicycle Ergometer



Hemodynamics

- Δ E/a' (LV filling pressure)
- FI (SPAN \geq 10 mmHg)

Lancellotti 2016. EHJ CVI, 17, 1191-1229

Valve Stress Test

indications

Exercise

Pharmacologic

Symptom ≠ Severity

1. Asymptomatic Severe
2. Symptomatic but Non-severe

Flow response to dobutamine
LFLG AS

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Aortic
Stenosis

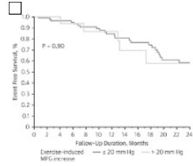
Mitral
Regurgitation

Guideline Updates

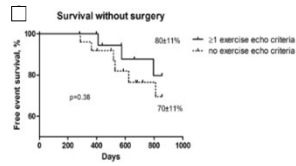
Stress Test Findings	AV Intervention	
	2014 ACC/AHA	2014 ESC/EACTS
Symptoms (during exercise testing)	Class I	Class I
Abnormal hemodynamic <ul style="list-style-type: none"> ▪ Failure of BP rise ▪ Decreased effort tolerance 	Class IIa Class IIa	Class IIa
MPG increase > 20 mmHg		Class IIb

Maréchal et al. EHJ 2010
Lancellotti. Circulation 2005

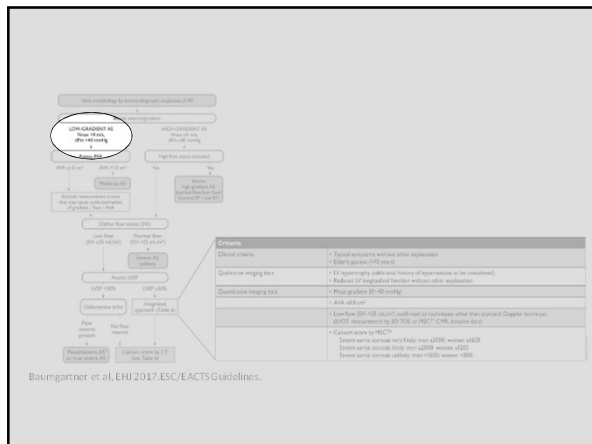
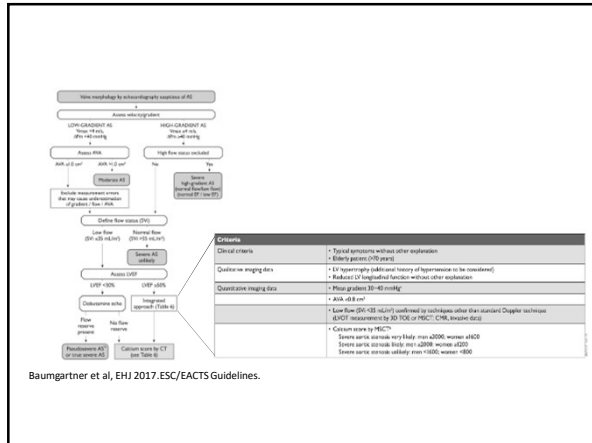
Guideline Updates



Goublaire et al. JACC CVD 2017

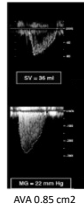
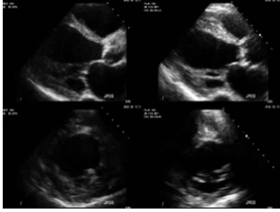


Domanski et al. IJC 2017; 227:908-914



Case 1

83 year-old, NYHA III



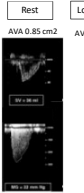
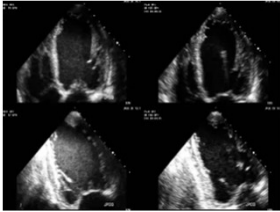
AVA 0.85 cm²

	Mild	Moderate	Severe
MG	< 30	30-40	> 40
AVA	> 1.5	1.0-1.5	< 1.0

Is the AS severe?

Scenario 1

83 year-old, NYHA III



AVA 0.85 cm²

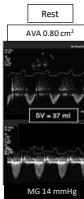
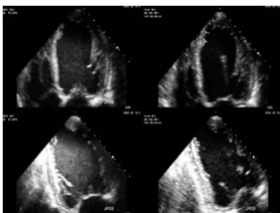
AVA 1.20 cm²

	Mild	Moderate	Severe
MG	< 30	30-40	> 40
AVA	> 1.5	1.0-1.5	< 1.0

Pseudo-severe AS

Scenario 2

83 year-old, NYHA III



AVA 0.80 cm²

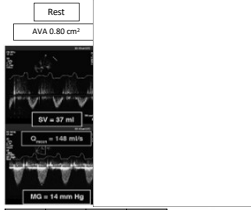
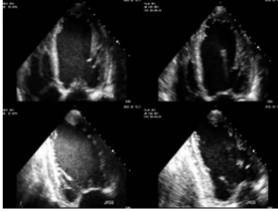
MG 14 mmHg

	Mild	Moderate	Severe
MG	< 30	30-40	> 40
AVA	> 1.5	1.0-1.5	< 1.0

True severe AS

Scenario 3

83 year-old, NYHA III

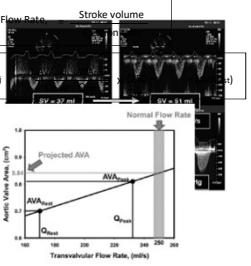
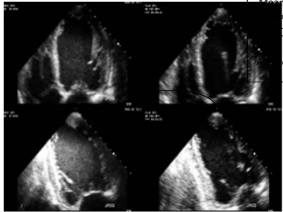


	Mild	Moderate	Severe
MG	< 30	30-40	> 40
AVA	> 1.5	1.0-1.5	< 1.0

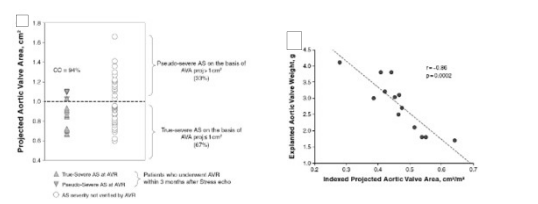
Is the AS severe?

Projected Effective Orifice Area

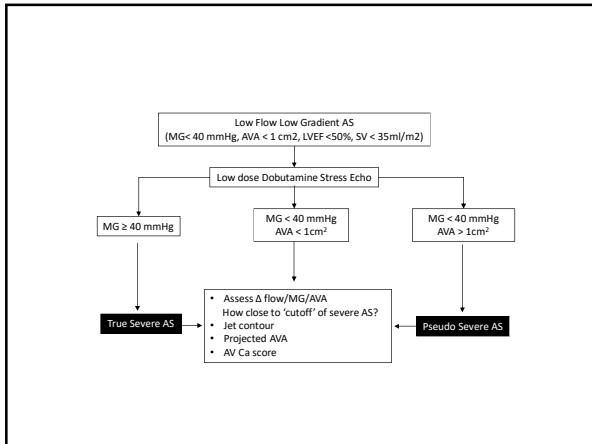
83 year-old, NYHA III



Projected Effective Orifice Area

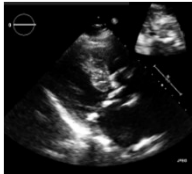
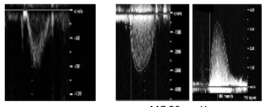


Clavel et al. JACC CVI 2013;6:175-83



Case 2

82 yr-old lady
NYHA III

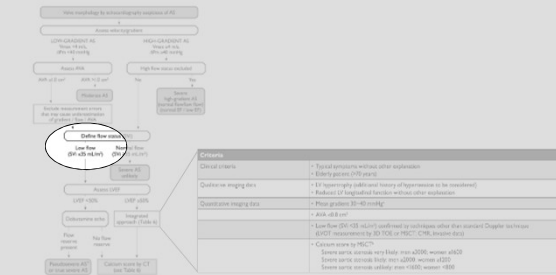
LVOT diameter 2.1 cm
 SV 53 ml
 SVI 29 ml/m²

MG 26 mmHg
 AVA 0.64 cm²
 AVAI 0.36 cm²/m²

Paradoxical LFLG

	Mild	Moderate	Severe
MG	< 30	30-40	> 40
AVA	> 1.5	1.0-1.5	< 1.0

Is the AS severe?

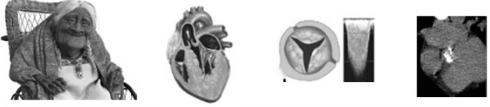


Define low flow

Contents

- Clinical criteria
 - Typical symptoms and/or other explanation
 - ECG pattern (P-R-T axis)
- Diagnostic imaging data
 - E1: Appear only (patient history of hypertension to be considered)
 - Reduced LV hypertrophy burden and/or other explanation
- Dispositive imaging data
 - Phase gradient 35-40 mmHg
 - AVA: 0.6-0.8 cm²
 - Low flow (SV < 35 ml/m²) confirmed by catheter after the current Doppler session (BSC) (assessments by 2D TDI or TDI; CMR, invasive echo)
 - Calcium score by BSC
 - Severe aortic stenosis: very bulky aorta (AS) or aortic aortic
 - Severe aortic stenosis: bulky aorta (AS) or aortic aortic
 - Severe aortic stenosis: bulky aorta (AS) or aortic aortic

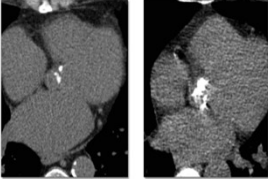
Baumgartner et al. EHU 2017. ESC/EACTS Guidelines.



Criteria	
Clinical criteria	<ul style="list-style-type: none"> • Typical symptoms without other explanation • Elderly patient (>70 years)
Qualitative imaging data	<ul style="list-style-type: none"> • LV hypertrophy (additional history of hypertension to be considered) • Reduced LV longitudinal function without other explanation
Quantitative imaging data	<ul style="list-style-type: none"> • Mean gradient 30–40 mmHg • AVA $\leq 0.8 \text{ cm}^2$
	<ul style="list-style-type: none"> • Low flow (SVI $< 35 \text{ mL/m}^2$) confirmed by techniques other than standard Doppler technique (LVOT measurement by 3D TOE or MSCT, CPM, invasive data)
	<ul style="list-style-type: none"> • Calcium score by MSCT <ul style="list-style-type: none"> Severe aortic stenosis very likely: men ≥ 3000; women ≥ 1600 Severe aortic stenosis likely: men ≥ 2000; women ≥ 1200 Severe aortic stenosis unlikely: men < 1600; women < 800

Baumgartner et al, EHJ 2017.ESC/EACTS Guidelines.

AV Calcium score by MSCT



Likelihood of severe AS		
	Male	Female
Very likely	≥ 3000	≥ 1600
Likely	≥ 2000	≥ 1200
Unlikely	< 1600	< 800

Baumgartner et al, EHJ 2017.ESC/EACTS Guidelines.

Table 4. Accuracy of AVA, AVCL, and AVCL to Identify Severe AS						
Sex	AVA	AVCL	AVCL (reg)	AVCL (reg)	AVA (%)	AVCL (%)
Women	Severe stenosis	0.80 [†]	0.80	0.80	80	80
	Non-severe	0.75 [†]	0.80	0.80	80	75
	Severe stenosis	0.80 [†]	0.80	0.80	80	80
	Non-severe	0.80 [†]	0.80	0.80	80	80
Men	Severe stenosis	0.80 [†]	0.80	0.80	80	80
	Non-severe	0.80 [†]	0.80	0.80	80	80
	Severe stenosis	0.80 [†]	0.80	0.80	80	80
	Non-severe	0.80 [†]	0.80	0.80	80	80

Clavel et al, JACC 2013, 62 (24), 2129-38

- Updates in Guidelines:
2017 ESC/EACTA, ACC/AHA

Aortic
Stenosis

Mitral
Regurgitation
Primary MR

Guideline Updates

Stress Test Findings	MVR	
	2014 ACC/AHA	2017 ESC/EACTA
Asymptomatic + preserved LVEF + high likelihood of durable repair + low surgical risk +: Exercise PHTN (SPAP ≥ 60 mm Hg)	-	Taken Out

- Updates in Guidelines:
2017 ESC/EACTA, ACC/AHA

Aortic Stenosis

Mitral Regurgitation
Secondary MR

Guideline Updates

Stress Test Findings	MVR	
	2014 ACC/AHA	2017 ESC/EACTA
In patients with moderate MR undergoing CABG (The development of dyspnoea , increased severity of MR , PHTN are further incentives to surgery)	-	Taken Out

Chan et al (RIME Trial), Circulation 2012; 126: 2502-10
Pierard L and Lancellotti P. NEJM 2004; 351:1627-1634

Summary

- Updates in Guidelines:
2017 ESC/EACTA, 2017 ACC/AHA

Aortic
Stenosis

Mitral
Regurgitation

1. Asymptomatic severe:
TMX/bike only
2. Classical LFLG AS: DSE

Acknowledgement

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and team



Have a Great Sunday

Questions?
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