Echokardiografie a aortální vady

Nová doporučení ESC 2025

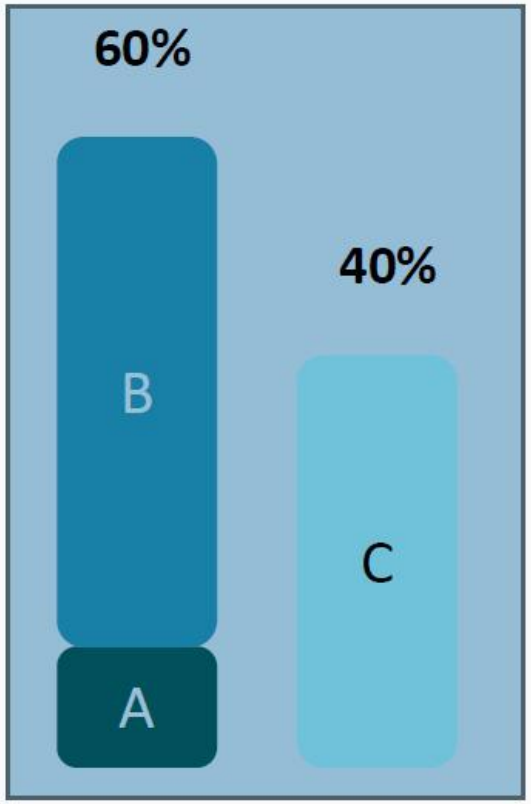
Petr Lupínek

INSTITUT KLINICKÉ A EXPERIMENTÁLNÍ MEDICÍNY
KLINIKA KARDIOLOGIE

Introduction

Increase in the Level of evidence

Level of evidence A	Data derived from multiple randomized clinical trials or meta-analyses.
Level of evidence B	Data derived from a single randomized clinical trial or large non-randomized studies.
Level of evidence C	Consensus of opinion of the experts and/or small studies, retrospective studies, registries.

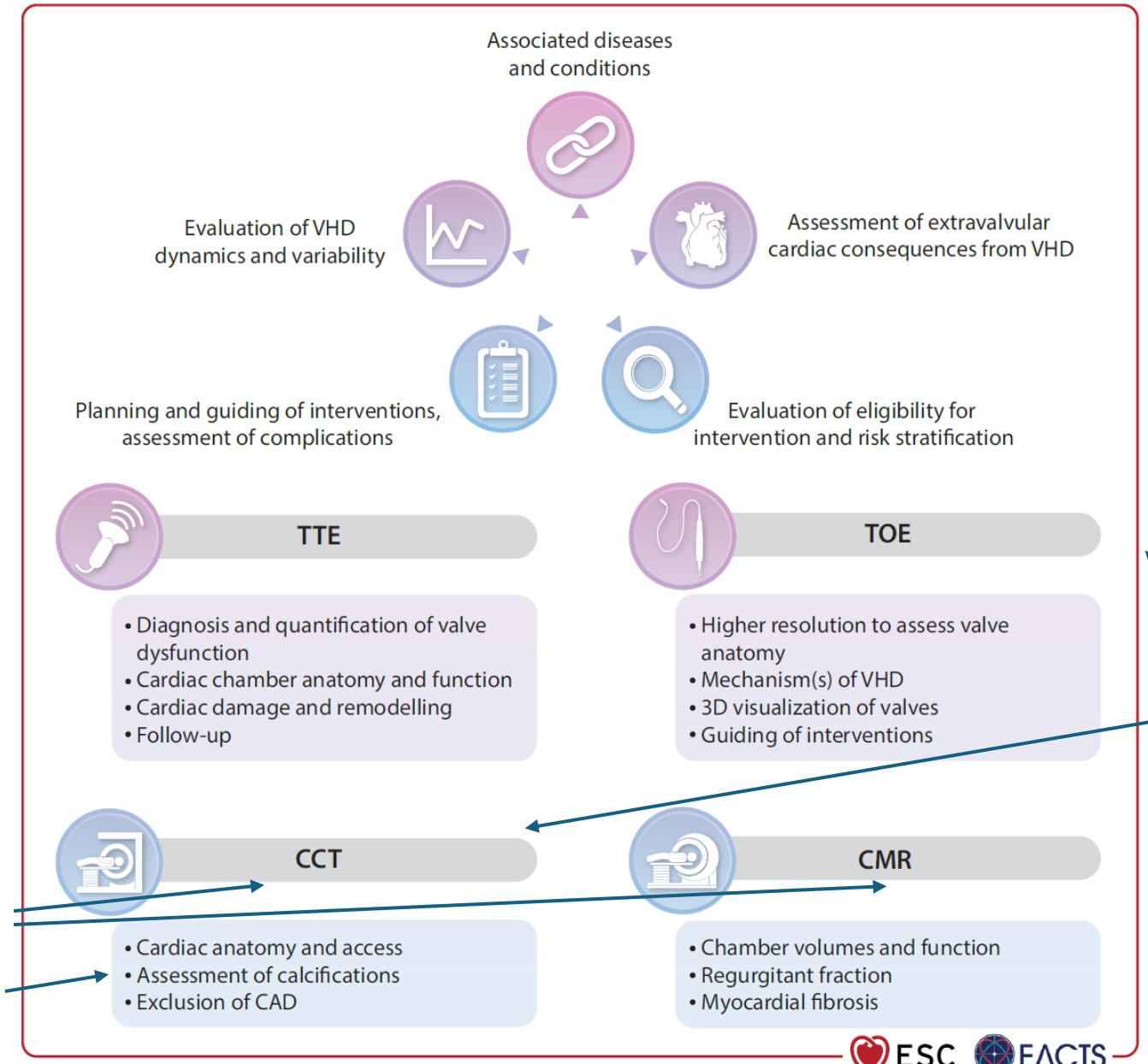


28 new recommendations – 50 revised recommendations

Echokardiografie je vyšetřením první linie u chlopenních vad

- Diagnostika
- Určení etiologie, mechanismu a významnosti vady
- Posouzení anatomie a funkce komor
- Posouzení dopadu na srdeční oddíly a hemodynamiku
- Indikace k intervenci
- Navigace intervencí

Multimodalitní zobrazení



Záchovná operace AoR?

Dysfunkce/komplikace chlopenní náhrady

AoR kvantifikace

Remodelace LK

Dilatace aorty

Low flow
low gradient AoS

- *Kalciové skóre Ao chlopně*
- *Anatomická AVA*
- *Hybridní AVAc*

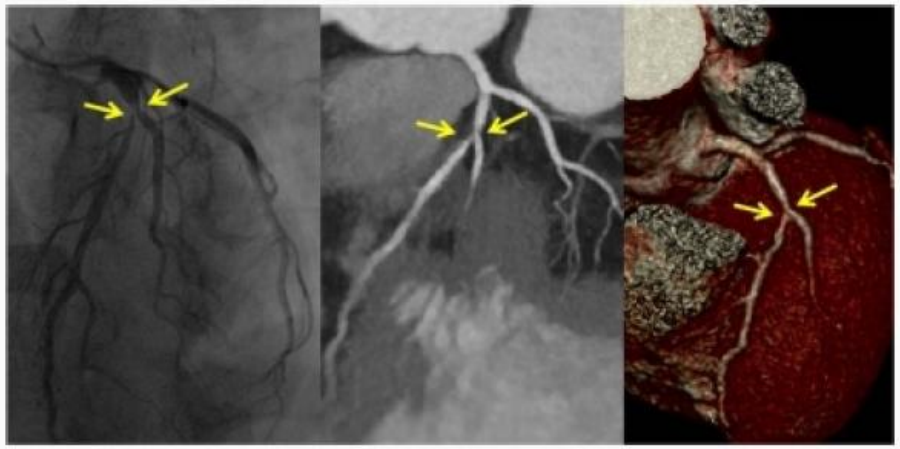
New an revised recommendations

Imaging : Prominent role of CCTA

Recommendations	Class	Level
Diagnosis of coronary artery disease		
Omission of invasive coronary angiography should be considered in TAVI candidates, if procedural planning CCTA is of sufficient quality to rule out significant CAD.	IIa	B

NEW

Management of coronary artery disease in patients with valvular heart disease					
CCTA should be considered as an alternative to coronary angiography before valve surgery in patients with severe VHD and low probability of CAD.	IIa	C	CCTA is recommended before valve intervention in patients with moderate or lower (≤50%) pre-test likelihood of obstructive CAD.	I	B



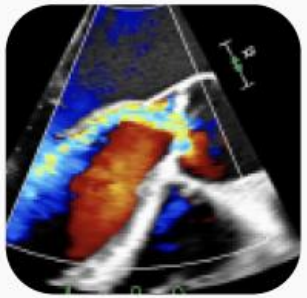
Coronary angiography is recommended before valve surgery in patients with severe VHD and any of the following: • History of cardiovascular disease • Suspected myocardial ischaemia • LV systolic dysfunction • In men >40 years of age and post-menopausal women • One or more cardiovascular risk factors.	I	C	Invasive coronary angiography is recommended before valve intervention in patients with high and very high (>50%) pre-test likelihood of obstructive CAD.	I	C

Imaging assessment of patients with aortic regurgitation

Criteria for severe AR

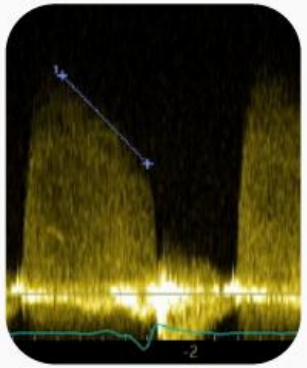
Qualitative

- Abnormal valve morphology
- Flail cusp
- Large coaptation defect



Semi-quantitative

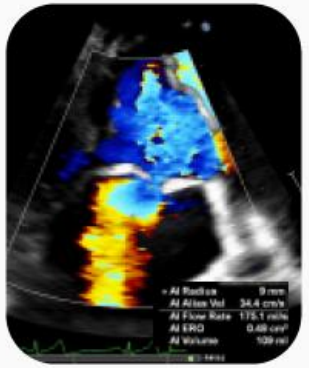
- Vena contracta >6 mm
- PHT <200 ms
- Large central jet (≥65% of LVOT diameter)
- Holodiastolic flow reversal in descending aorta (EDV ≥20 cm/s)

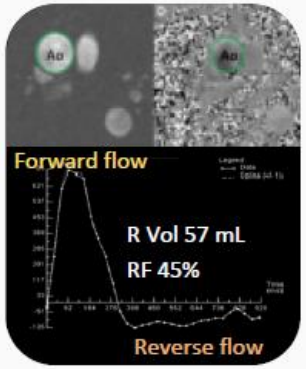


Quantitative

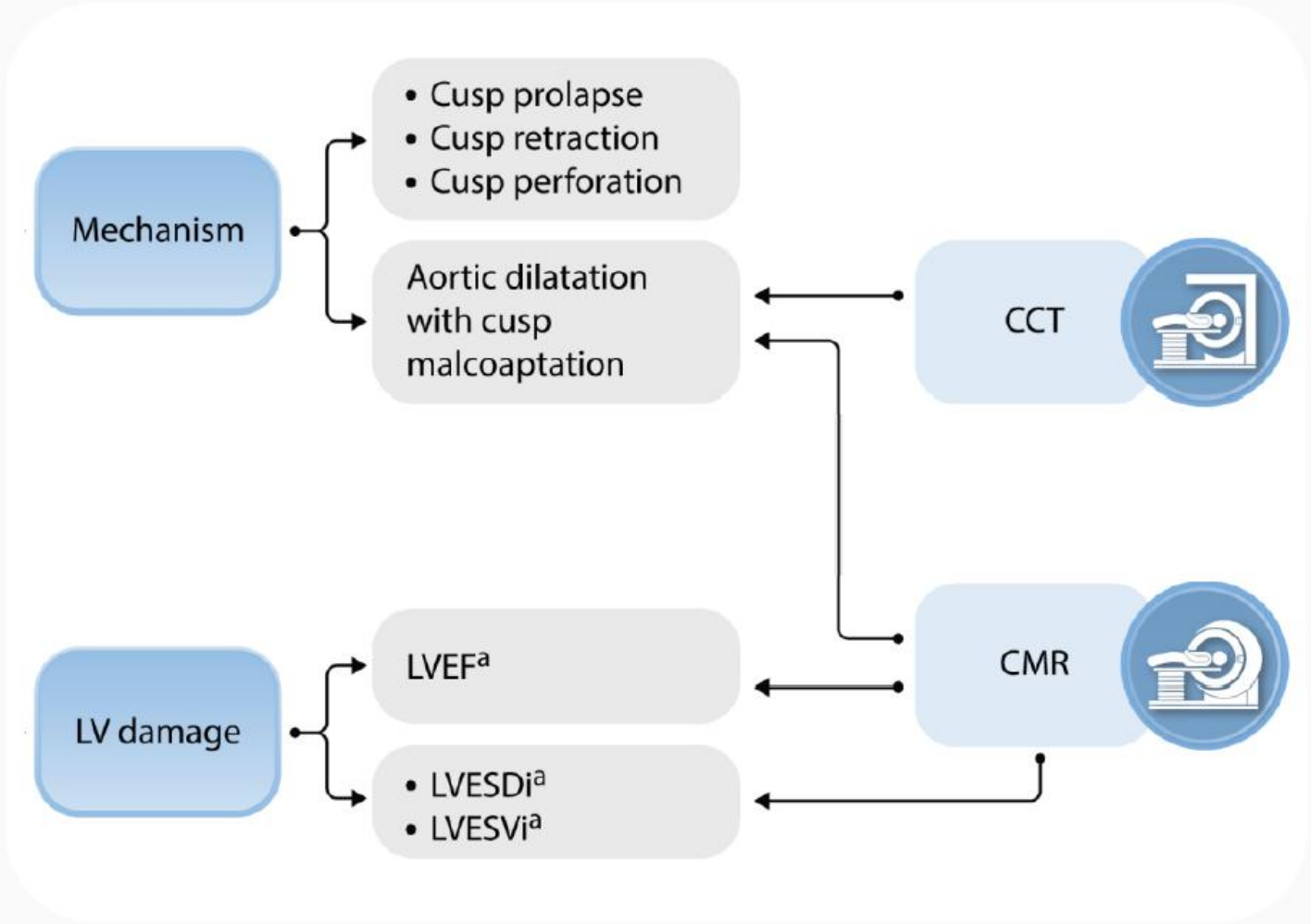
- EROA ≥30 mm^2
- RVol ≥60 mL/beat
- RF >50% (echo)

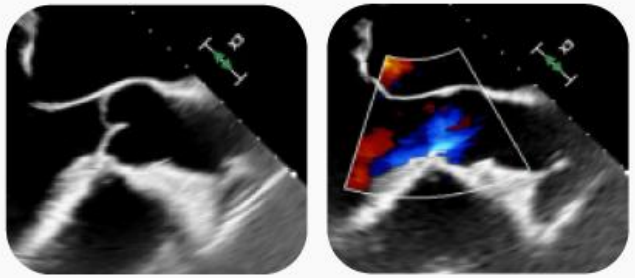
RF >40% (CMR)





Imaging assessment of patients with aortic regurgitation





Indication for intervention

Recommendations	Class	Level
AV surgery is recommended in symptomatic patients with severe AR regardless of LV function.	I	B
AV surgery is recommended in asymptomatic patients with severe AR and LVESD >50 mm or LVESDi >25 mm/m^2 [especially in patients with small body size (BSA <1.68 m^2)] or resting LVEF ≤50%.	I	B
AV surgery may be considered in asymptomatic patients with severe AR and LVESDi >22 mm/m^2, LVESVi >45 mL/m^2 [especially in patients with small body size (BSA <1.68 m^2)], or resting LVEF ≤55%, if the surgical risk is low.	IIb	Revised B

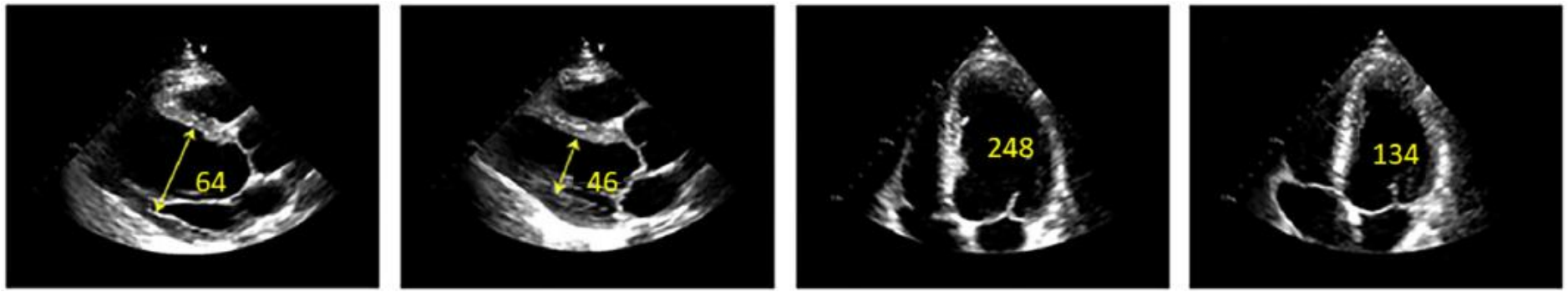
TEE:
Morfologie Ao chlopně

Indications for surgery in severe aortic regurgitation—*Section 7.4*					
AV repair may be considered in selected patients at experienced centres when durable results are expected.	IIb	C	AV repair should be considered in selected patients with severe AR at experienced centres, when durable results are expected.	IIa	B
Surgery may be considered in asymptomatic patients with LVESD >20 mm/m^2 BSA (especially in patients with small body size) or resting LVEF ≤55%, if surgery is at low risk.	IIb	C	AV surgery may be considered in asymptomatic patients with severe AR and LVESDi >22 mm/m^2 or LVESVi >45 mL/m^2 [especially in patients with small body size (BSA <1.68 m^2)], or resting LVEF ≤55%, if surgical risk is low.	IIb	B

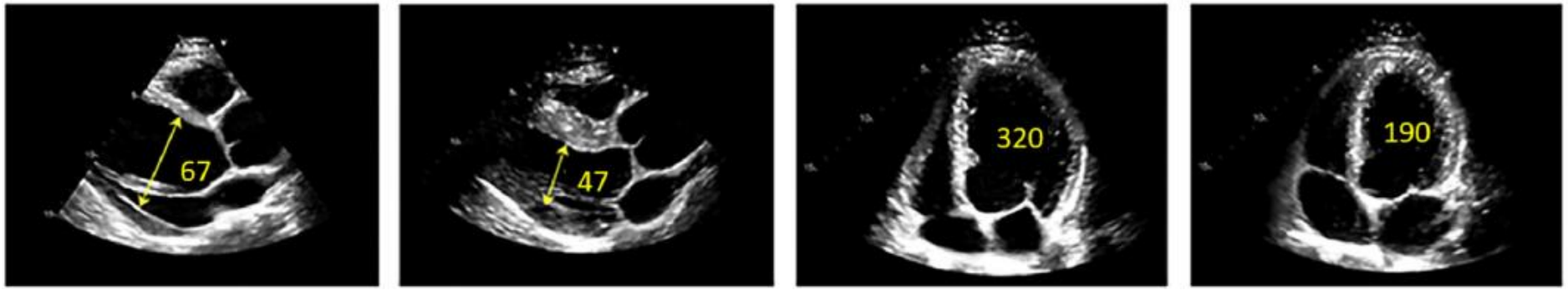
Význam volumetrie
Role 3D echa a CMR

Rozměry versus objemy LK

EDD ESD EDV ESV



Po 3 letech ⇩



JASE 2021;34:352-9

Globální longitudinální strain (GLS)

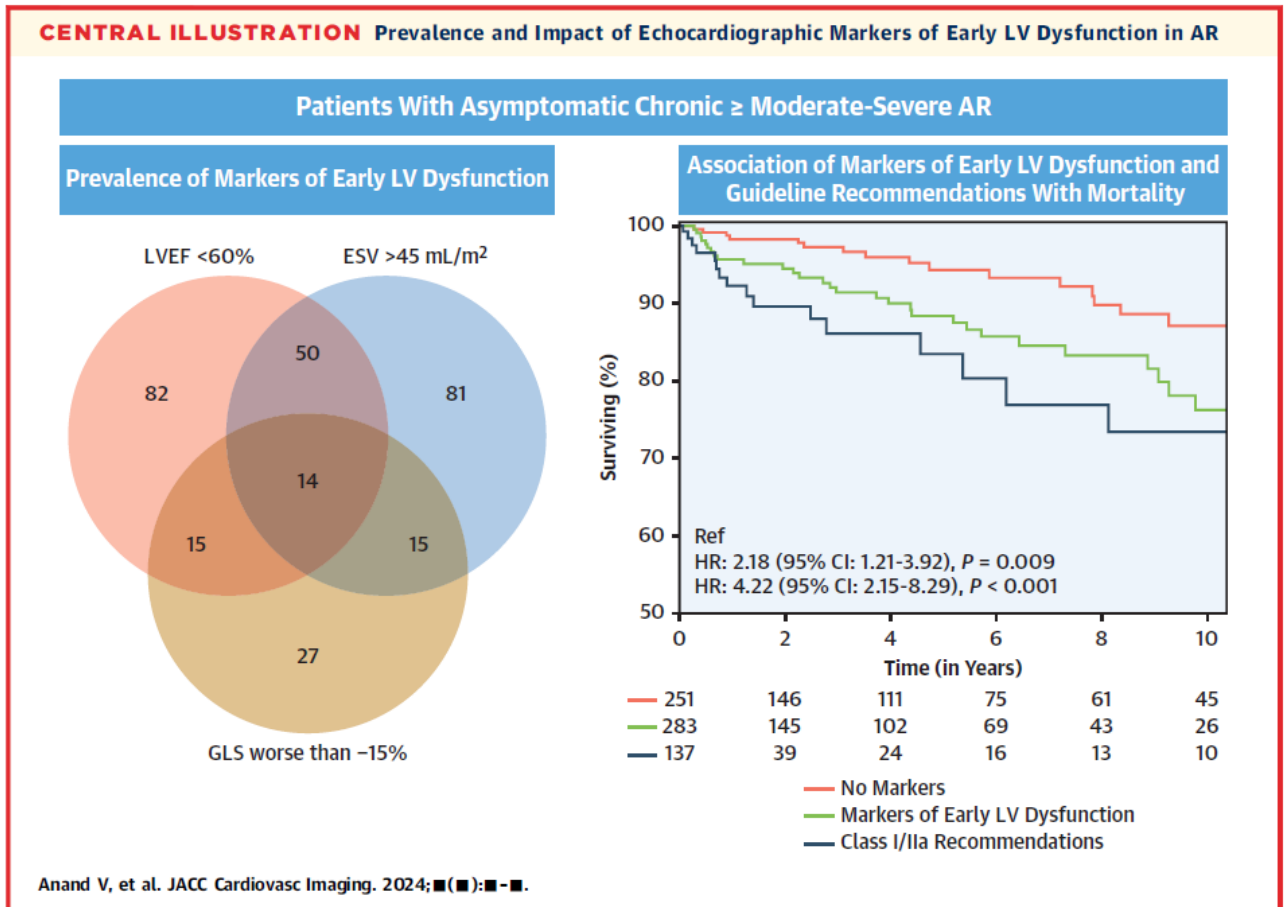
useful in borderline cases (*Figure 4*).[45,209] Strain imaging can be helpful in identifying subclinical LV dysfunction[209–211] and can therefore influence the optimal timing of intervention. Reduced longitudinal strain and contractile reserve at stress echocardiography,[212] elevated biomarkers (BNP),[213,214] and the presence of myocardial fibrosis detected by CMR need to be integrated in the decision-making process, even if not entirely validated yet.[209]

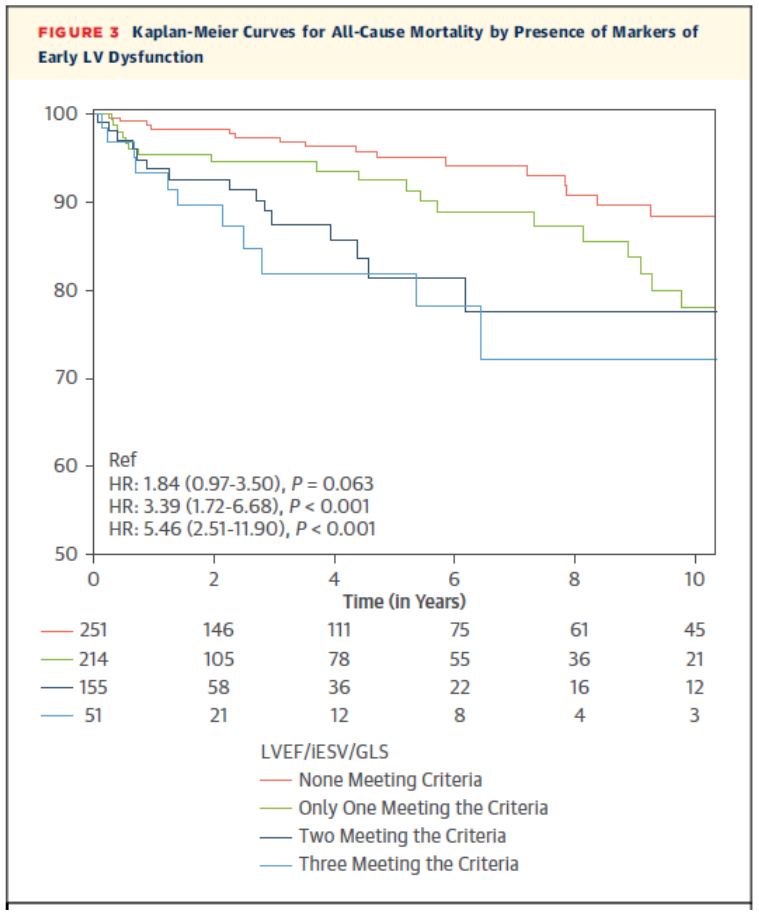
Časné markery počínající dysfunkce LK u AoR

ESVi > 45 ml/m2

EF < 60 %

Snížený GLS





Anand JACC CV Imaging 2024
https://doi.org/10.1016/j.jcmg.2024.09.005

Management of patients with significant root enlargement

2024 ESC Guidelines for the management of peripheral arterial and aortic diseases

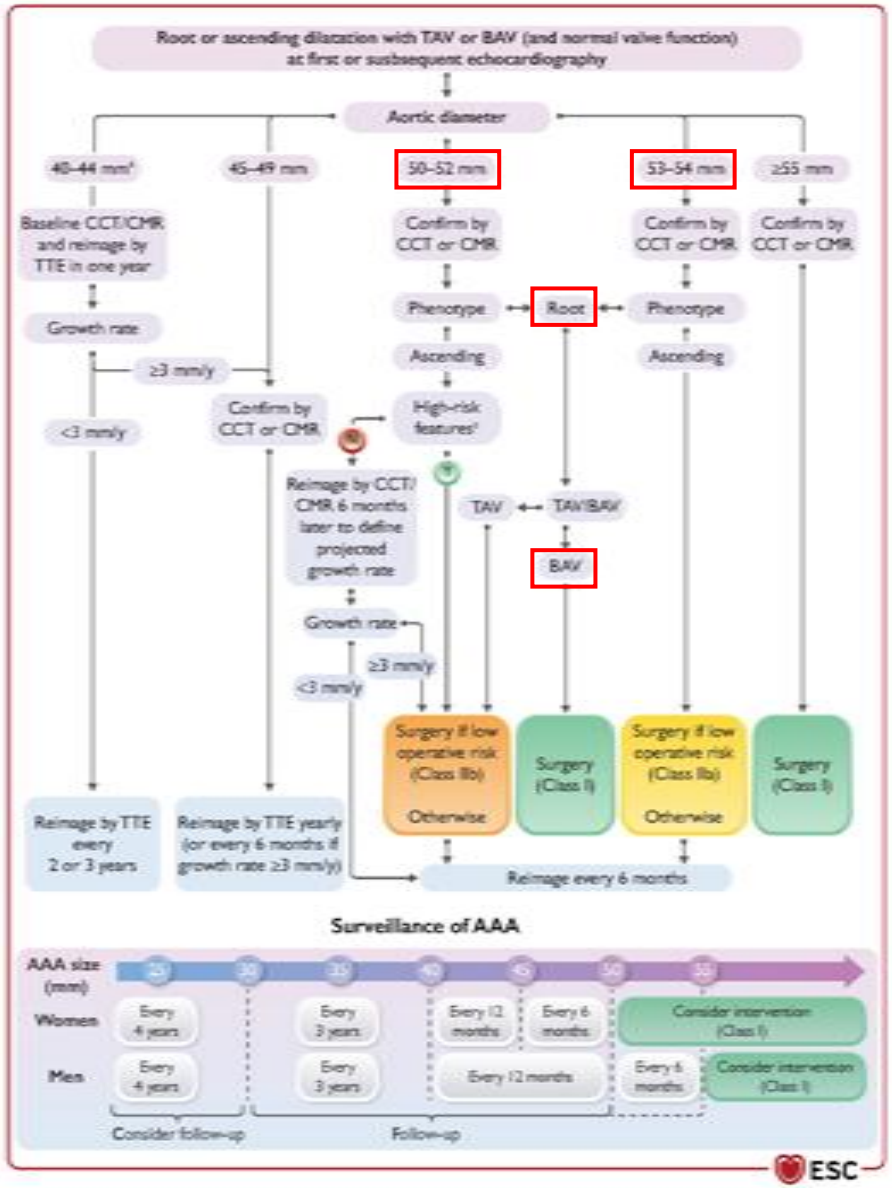
Recommendation	Class	Level
Valve-sparing aortic root replacement is recommended in young patients with aortic root dilatation at experienced centres, when durable results are expected.	I	B

(již i 2021)

When AV surgery is indicated and the predicted surgical risk is low, replacement of the aortic root or ascending aorta should be considered if the maximal diameter is ≥45 mm.	IIa	C

Figure 24

Surveillance of patients with non-heritable thoracic aortic disease and abdominal aortic aneurysms



Root vs ascending phenotype

2024 ESC Guidelines for the management peripheral arterial and aortic diseases (European Heart Journal; 2024 – doi: 10.1093/eurheartj/ehae179)

Management of patients with symptomatic severe aortic stenosis

Recommendations	Class	Level
Intervention is recommended in symptomatic patients with severe, high-gradient AS [mean gradient ≥40 mmHg, V_{max} ≥4.0 m/s, AVA ≤1.0 cm^2 (or ≤0.6 cm^2/m^2 BSA)].	I	B
Intervention is recommended in symptomatic patients with low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with reduced LVEF (<50%) after careful confirmation that AS is severe. irrespective of evidence of flow (contractile) reserve	I	Revised B
Intervention should be considered in symptomatic patients with low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with normal LVEF (≥50%) after careful confirmation that AS is severe.	IIa	Revised B

2021 IIa C

Low flow low gradient AoS

Indications for intervention in symptomatic severe aortic stenosis—*Section 8.4.1*					
Intervention is recommended in symptomatic patients with severe low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with reduced LVEF (<50%), and evidence of flow (contractile) reserve.	I	B	Intervention is recommended in symptomatic patients with low-flow (SVi ≤35 mL/m^2), low-gradient (<40 mmHg) AS with reduced LVEF (<50%) after careful confirmation that AS is severe.	I	B
Intervention should be considered in symptomatic patients with low-flow, low-gradient severe aortic stenosis and reduced ejection fraction without flow (contractile) reserve, particularly when CCT calcium scoring confirms severe aortic stenosis.	IIa	C			

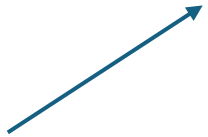


Figure 6

Integrative imaging assessment of patients with aortic stenosis.

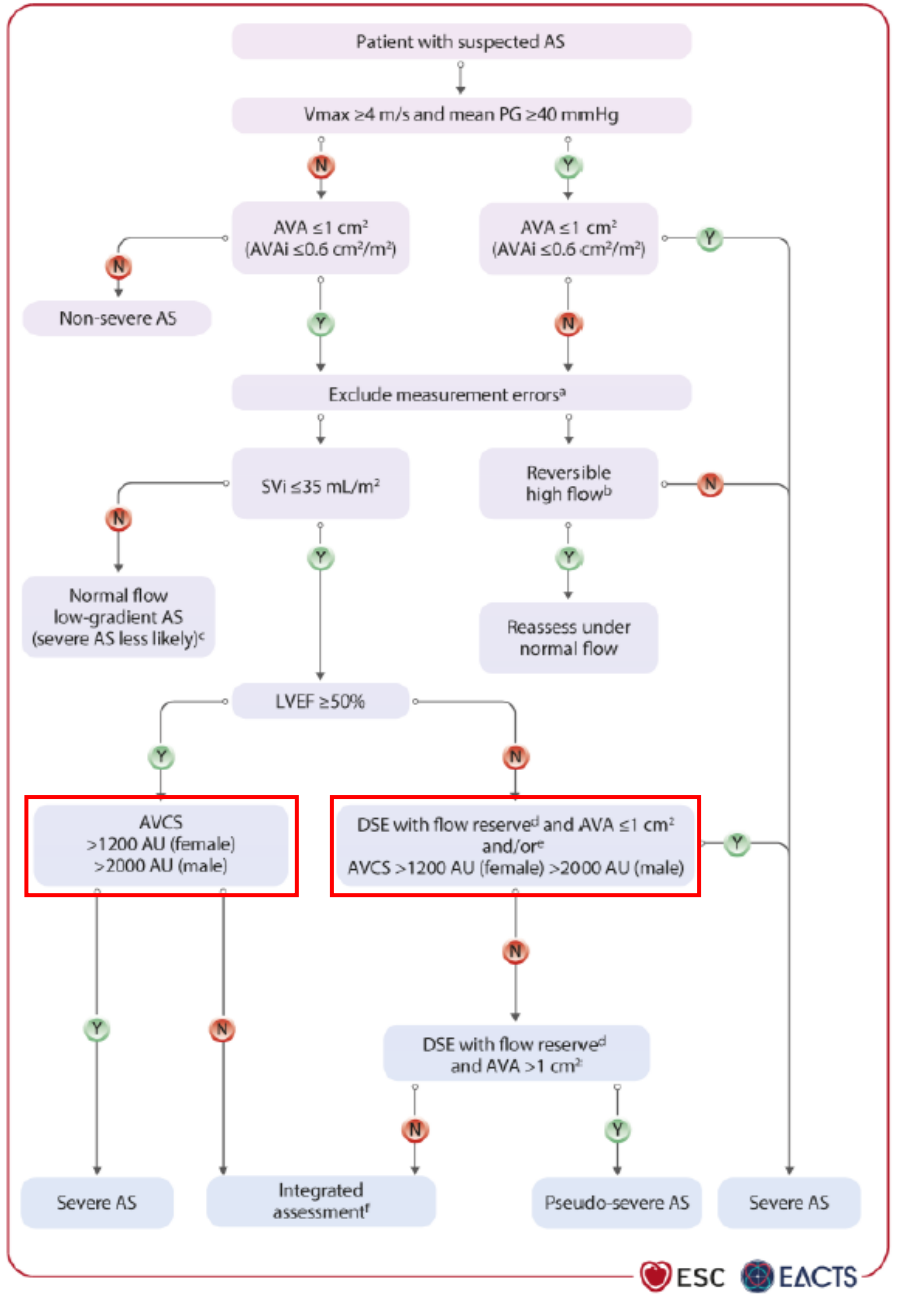
Kalciové skóre Ao chlopně (AVCS)

> 2000 AU (M) a >1200 (Ž) – senz a spec 85%

> 3000 AU (M) a >1600 AU (Ž) – vysoce specifické pro významnou AoS

< 1200 AU (M) a < 800 AU (Ž) – významná AoS nepravděpodobná

CAVE:
- Bikuspidální Ao chlopeň
- Amyloidóza
- Postiradiační AoS
- Postrevmatická AoS
- Zánětlivá onemocnění



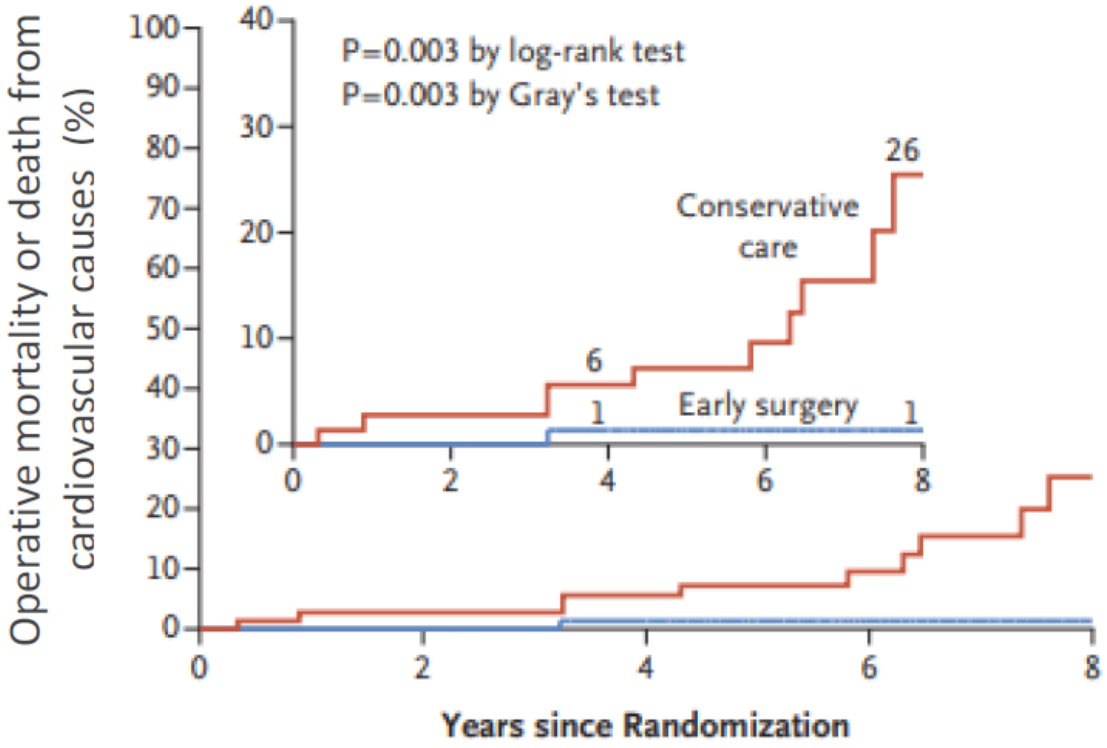
ESC Guidelines for the management of valvular heart disease
(European Heart Journal; 2025 – doi: 10.1093/eurheartj/ehaf194)

Management of patients with asymptomatic severe aortic stenosis

Recommendations	Class	Level
Intervention is recommended in asymptomatic patients with severe AS and LVEF <50% without another cause.	I	B
Intervention should be considered in asymptomatic patients (confirmed by a normal exercise test, if feasible) with severe, high-gradient AS and LVEF ≥50% as an alternative to close active surveillance, if the procedural risk is low.	IIa	A (New)
Intervention should be considered in asymptomatic patients with severe AS and LVEF ≥ 50% if the procedural risk is low and one of the following parameters is present: • Very severe AS (mean gradient ≥60 mmHg or V_{max} >5.0 m/s) • Severe valve calcification (ideally assessed by CCT) and V_{max} progression ≥0.3 m/s/year. • Markedly elevated BNP/NT-proBNP levels (more than three times age- and sex-corrected normal range, confirmed on repeated measurement without other explanation). • LVEF <55% without another cause.	IIa	B
Intervention should be considered in asymptomatic patients with severe AS and a sustained fall in BP (>20 mmHg) during exercise testing.	IIa	C

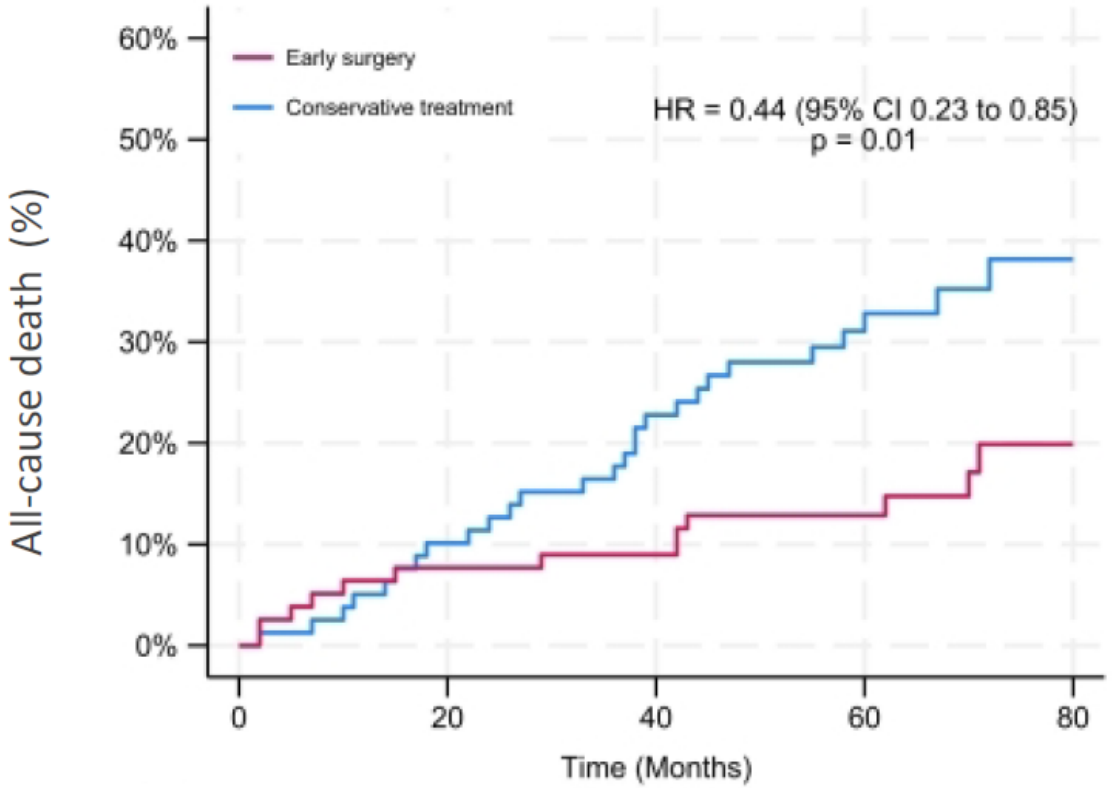
RCTs in patients with asymptomatic severe aortic stenosis

RECOVERY
145 patients, mean age 64 years



Kang et al. N Engl J Med 2020;382:111-9.

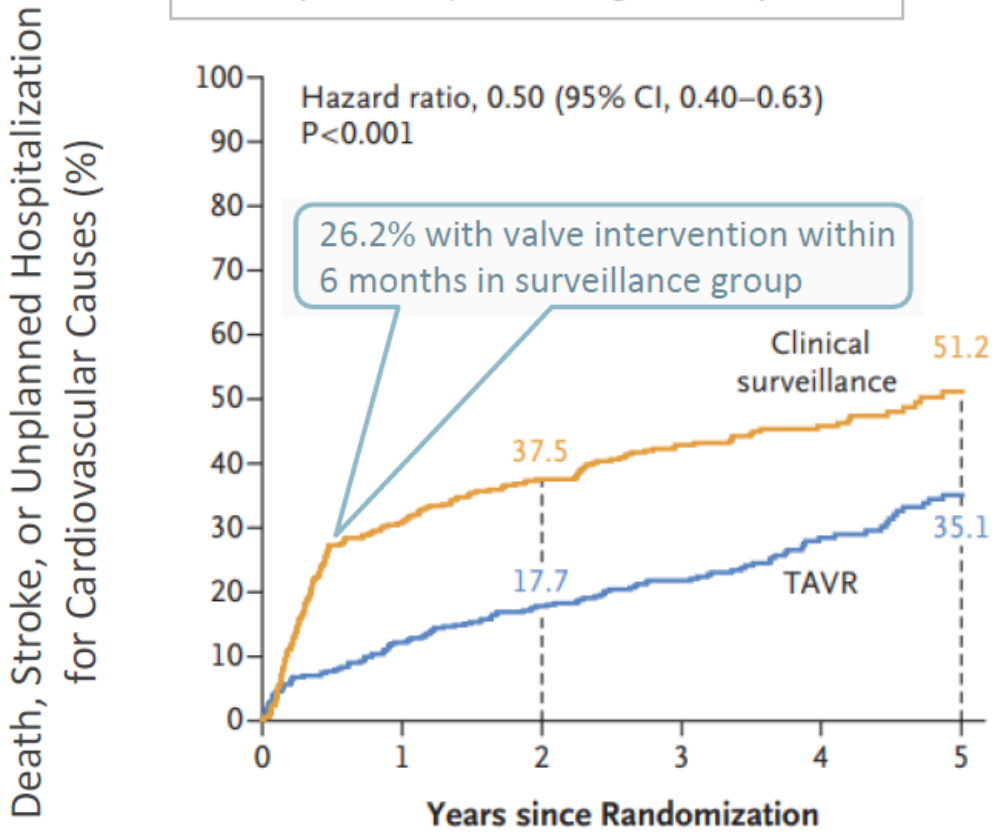
AVATAR long-term follow-up
157 patients, mean age 67 years



Banovic et al. EHJ 2024;45:4526:4535.

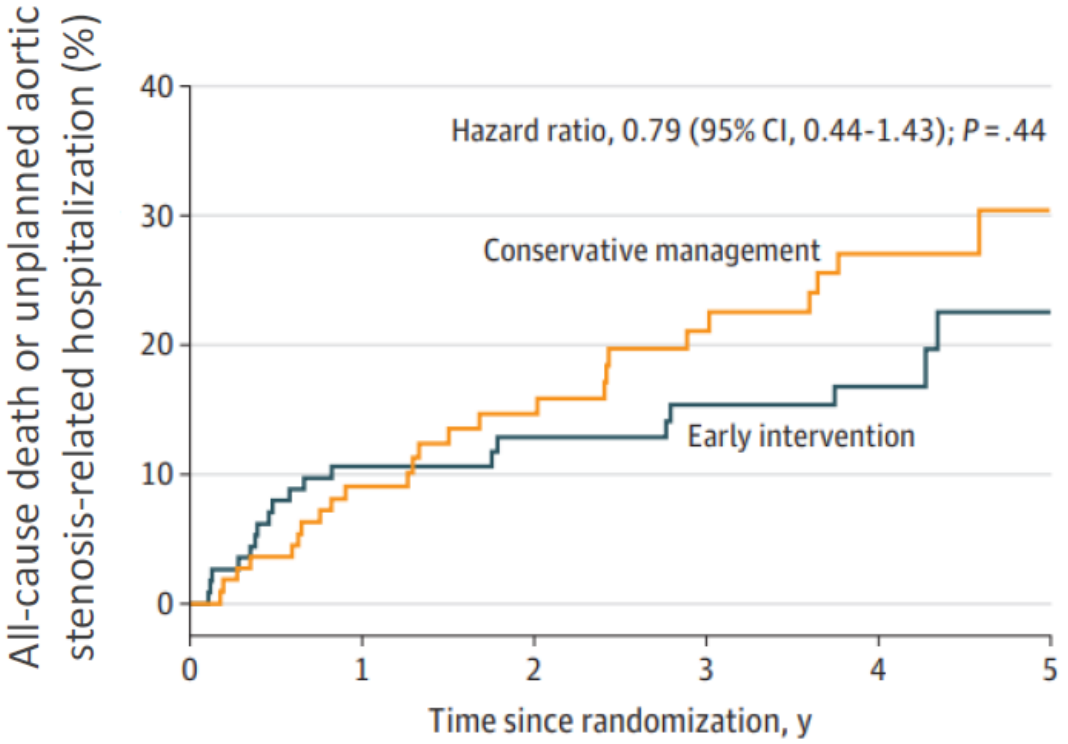
RCTs in patients with asymptomatic severe aortic stenosis

EARLY TAVR
901 patients, mean age 75.8 years



Généreux et al. N Engl J Med 2025;392:217-27

EVOLVED
224 patients, mean age 73 years



Loganathan et al. JAMA 2025;333(3):213-221

Globální longitudinální strain (GLS)

Assessment of GLS can be useful for risk stratification[310] and evaluation of extravalvular cardiac damage.[311,312] It provides additional information regarding LV function and a threshold of −15% may contribute to identifying patients with severe asymptomatic AS at increased risk of clinical deterioration or premature mortality.[59]

Kombinovaná aortální vada

Recommendations	Class[a]	Level[b]
Intervention is recommended in symptomatic patients with mixed moderate AV stenosis[c] and moderate regurgitation, and a mean gradient ≥40 mmHg or V_{max} ≥4.0 m/s.[790–793]	I	B
Intervention is recommended in asymptomatic patients with mixed moderate AV stenosis[c] and moderate regurgitation with V_{max} ≥4.0 m/s, and LVEF <50% not attributable to other cardiac disease.[791]	I	C

Table 12). Patients presenting with mixed AV disease, but with gradients below thresholds for intervention, should undergo careful multimodality diagnostics including assessment of cardiac damage to inform individual treatment strategies. Global longitudinal strain and natriuretic peptides have shown incremental prognostic value beyond symptom status and single lesion severity in patients with preserved LVEF.[762,794–796]

Často chybí dilatace LK!

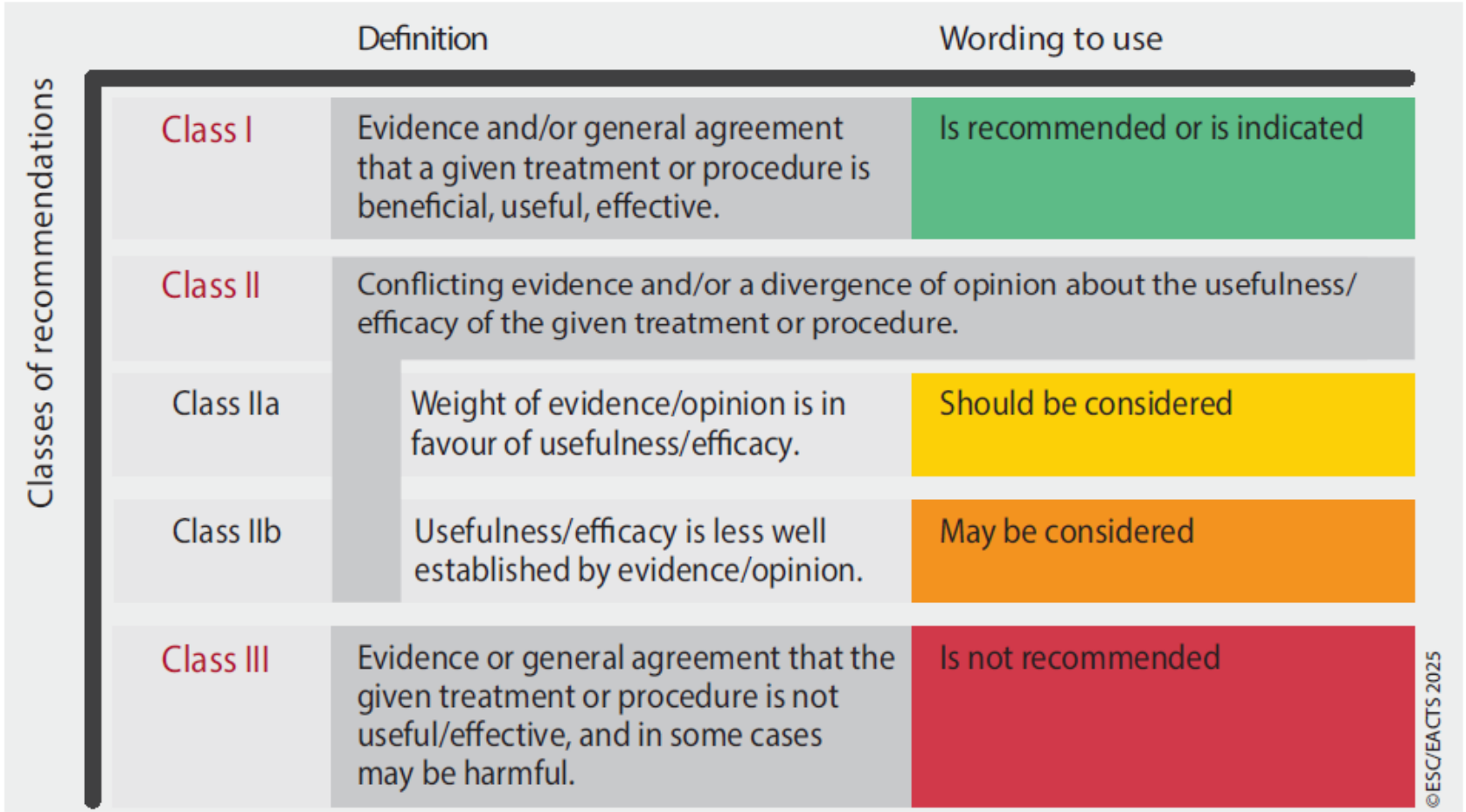
Dysfunkce chlopenní náhrady - kriteria

Table 12 **Criteria for the diagnosis of moderate or severe aortic and mitral haemodynamic valve deterioration**

	Moderate	Severe
Aortic BHV SVD or non-structural valve dysfunction (except PVL or PPM),[a] thrombosis, or endocarditis	Increase in mean transvalvular gradient ≥10 mmHg resulting in mean gradient ≥20 mmHg	Increase in mean transvalvular gradient ≥20 mmHg resulting in mean gradient ≥30 mmHg
	AND	**AND**
	Decrease in EOA ≥0.3 cm^2 or ≥25%, and/or decrease in DVI ≥0.1 or ≥20%, compared with echocardiographic assessment performed 1–3 months post-procedure	Decrease in EOA ≥0.6 cm^2 or ≥50%, and/or decrease in DVI ≥0.2 or ≥40%, compared with echocardiographic assessment performed 1–3 months post-procedure
	OR	***OR***
	New occurrence or increase of ≥1 grade of intraprosthetic AR resulting in ≥ moderate AR	New occurrence or increase of ≥2 grades of intraprosthetic AR resulting in ≥ moderate-to-severe AR

Co je nového

- V narůstající míře se uplatňuje **multimodální zobrazení** (echo/CT/MR) v posouzení Ao vad i koronárního řečiště
- U asymptomatické významné **AoR** doporučeno při rozhodování o dalším postupu vzít v úvahu i **LV ESVI** a **GLS.**
- **AoS se sníženou EF a nízkým gradientem:**
  Přítomnost kontraktilní rezervy neovlivňuje indikaci + role CT/AVC.
- **Asymptomatická významná AoS s vysokým gradientem:**
  Má být zvážena SAVR/TAVR jako alternativní postup.
- **Kombinovaná aortální vada:**
  Indikace k AVR i když AoS i AoR jsou středně významné
  - při V max ≥ 4 m/s a/nebo středním gradientu ≥ 40 mmHg
  - případně i při nižších gradientech dle individuálního posouzení


Classes of recommendations
Definition
Wording to use
Class I
Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.
Is recommended or is indicated
Class II
Conflicting evidence and/or a divergence of opinion about the usefulness/ efficacy of the given treatment or procedure.
Class IIa
Weight of evidence/opinion is in favour of usefulness/efficacy.
Should be considered
Class IIb
Usefulness/efficacy is less well established by evidence/opinion.
May be considered
Class III
Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.
Is not recommended
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New concepts

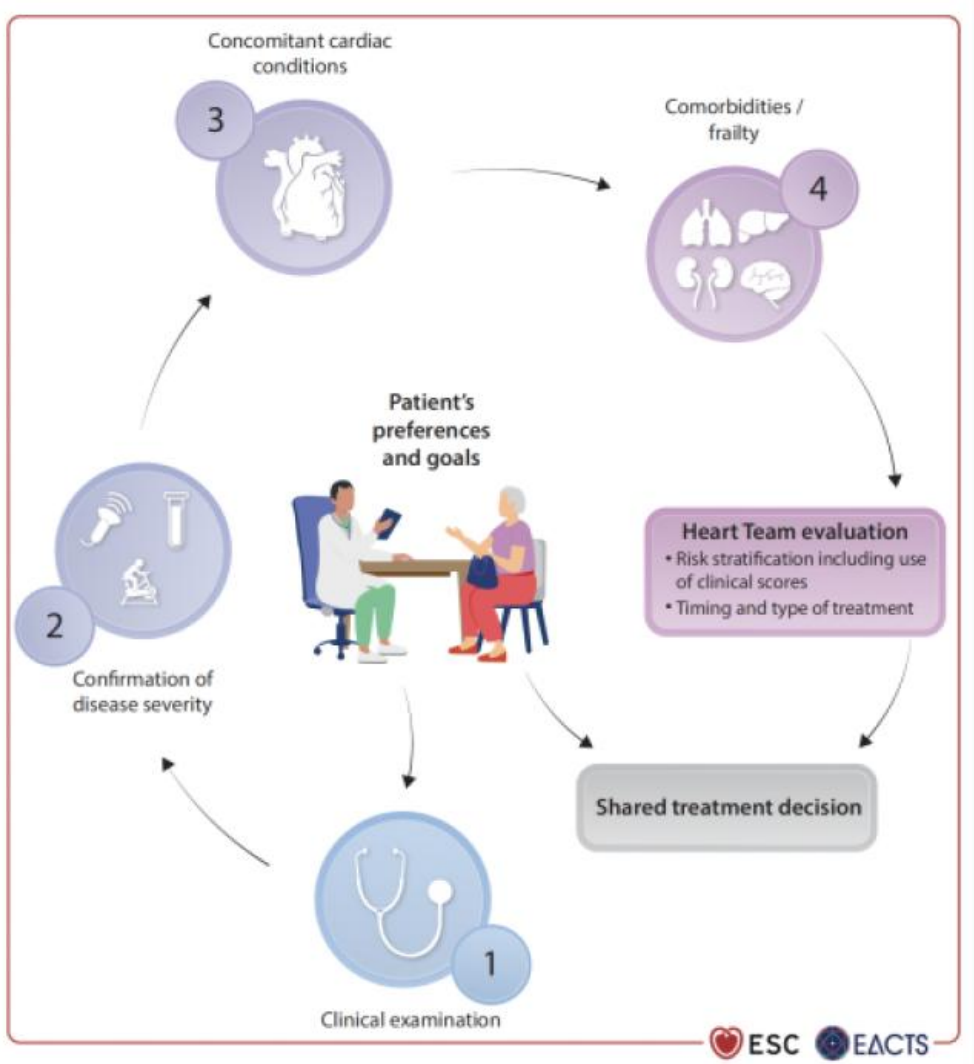
The patient centered care and shared DM

2025 ESC/EACTS Guidelines for the management of valvular heart disease

Developed by the task force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Authors/Task Force Members:

Fabien Praz (ESC Chairperson) (Switzerland), Michael A. Borger (EACTS Chairperson) (Germany), Jonas Lanz (ESC Task Force Co-ordinator) (Switzerland), Mateo Marin-Cuartas (EACTS Task Force Co-ordinator) (Germany), Ana Abreu (Portugal), Marianna Adamo (Italy), Nina Ajmone Marsan (Netherlands); Fabio Barili (Italy), Nikolaos Bonaros (Austria), Bernard Cosyns (Belgium), Ruggero De Paulis (Italy),Habib Gamra (Tunisia), Marian Jahangiri (United Kingdom), Anders Jeppsson (Sweden),Robert J.M. Klautz (Netherlands), Benoit Mores (Belgium), Esther Pérez-David (Spain), Janine Pöss (Germany), Bernard D. Prendergast (United Kingdom), Bianca Rocca (Italy), Xavier Rossello (Spain), Mikio Suzuki (Serbia), Holger Thiele (Germany), Christophe Michel Tribouilloy (France), Wojtek Wojakowski (Poland).

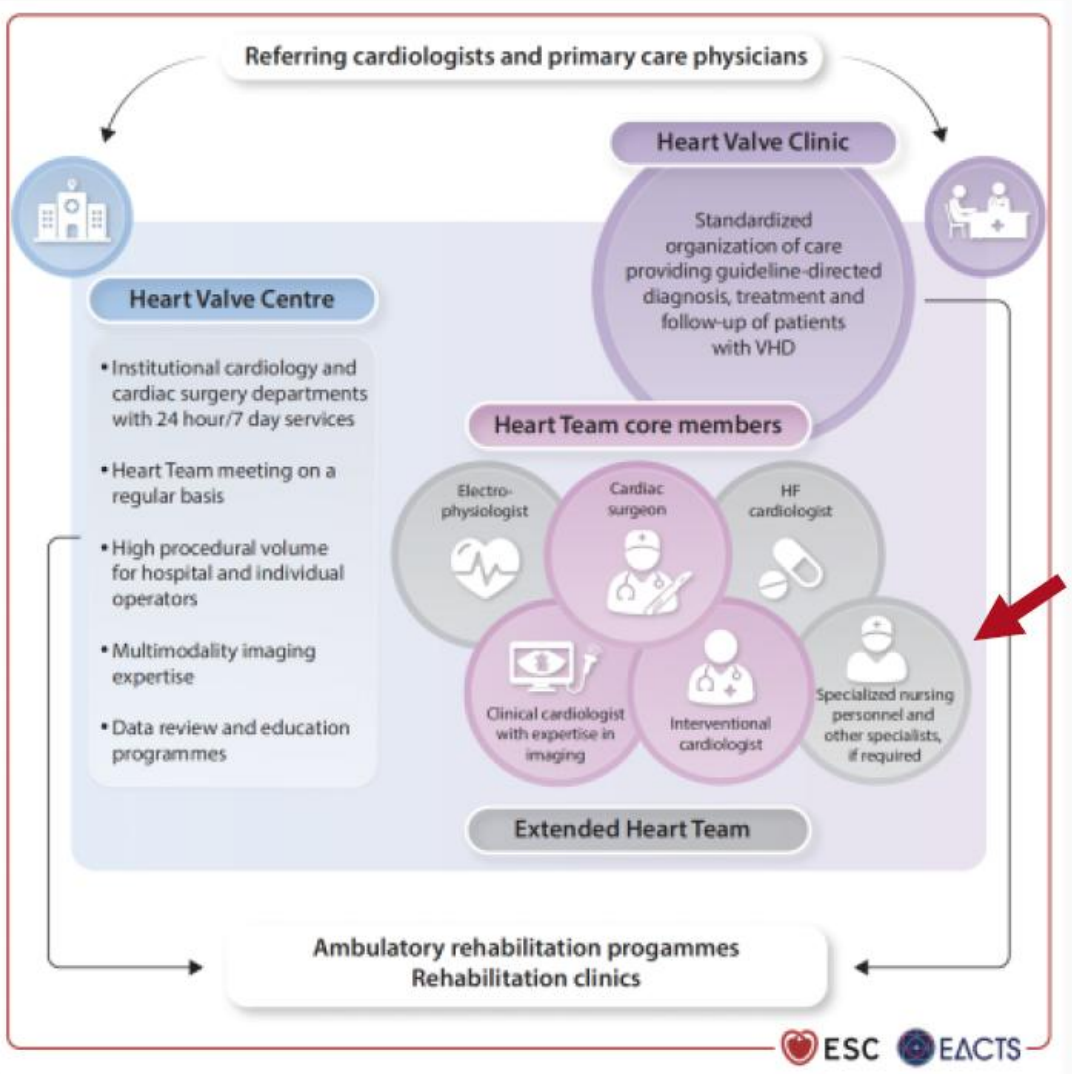


New concepts

Heart Valve Centre and Clinic

Heart Valve Centre

- Institutional cardiology and cardiac surgery departments with 24 hour/7 day services
- Heart Team meeting on a regular basis
- High procedural volume for hospital and individual operators
- Multimodality imaging expertise
- Data review and education programmes



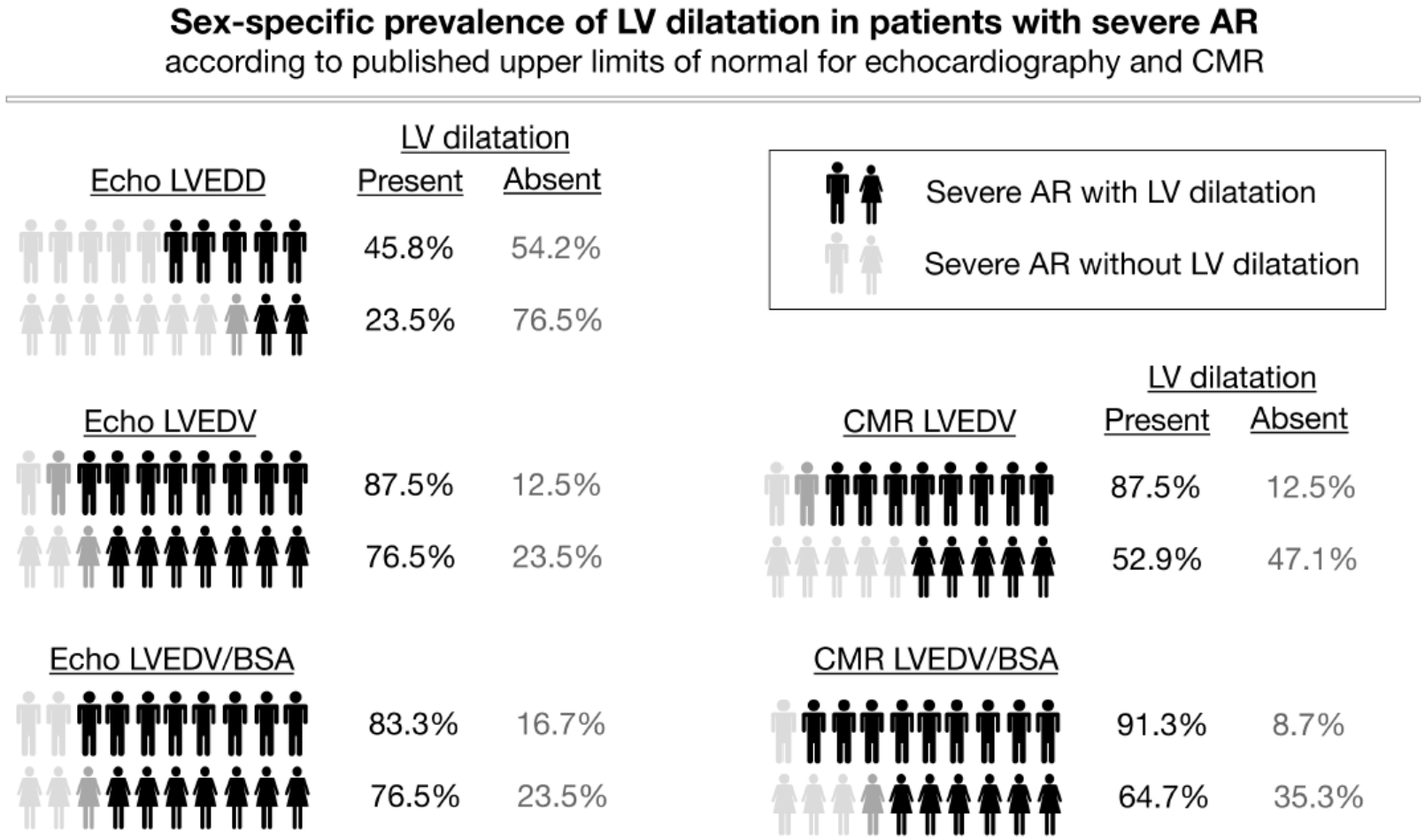
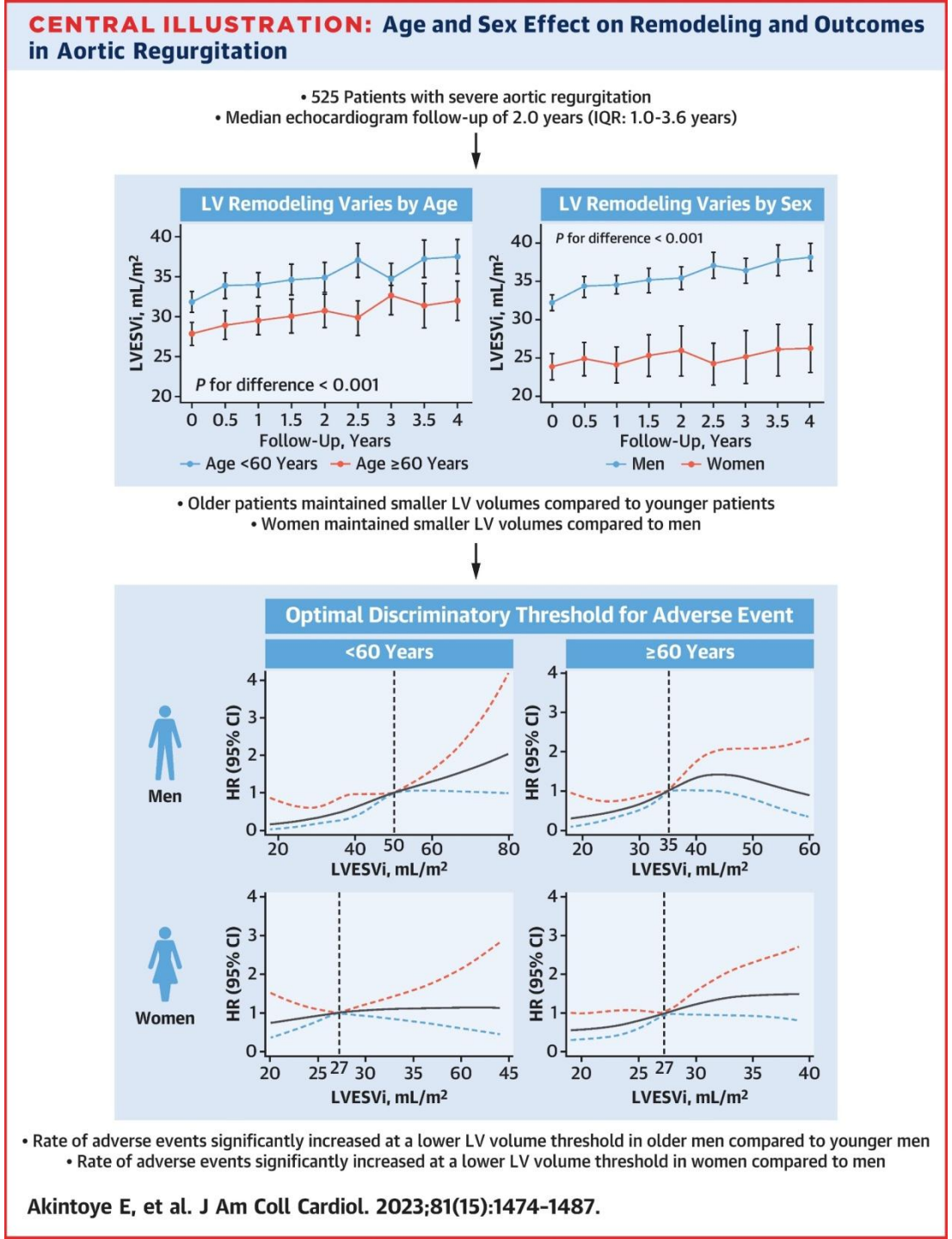


Figure 4. Sex-specific prevalence of left ventricular (LV) dilatation, according to published upper limits of normal, on echocardiography and CMR in patients with severe aortic regurgitation. LV dilatation is a key finding in men but often absent in women.

Kammerlander AA J Clin Med 2020;9:4100

Vliv pohlaví a věku na ESVI u AoR



Střední AoS - probíhající studie

Evolut EXPAND TAVR II Pivotal Trial

Medtronic

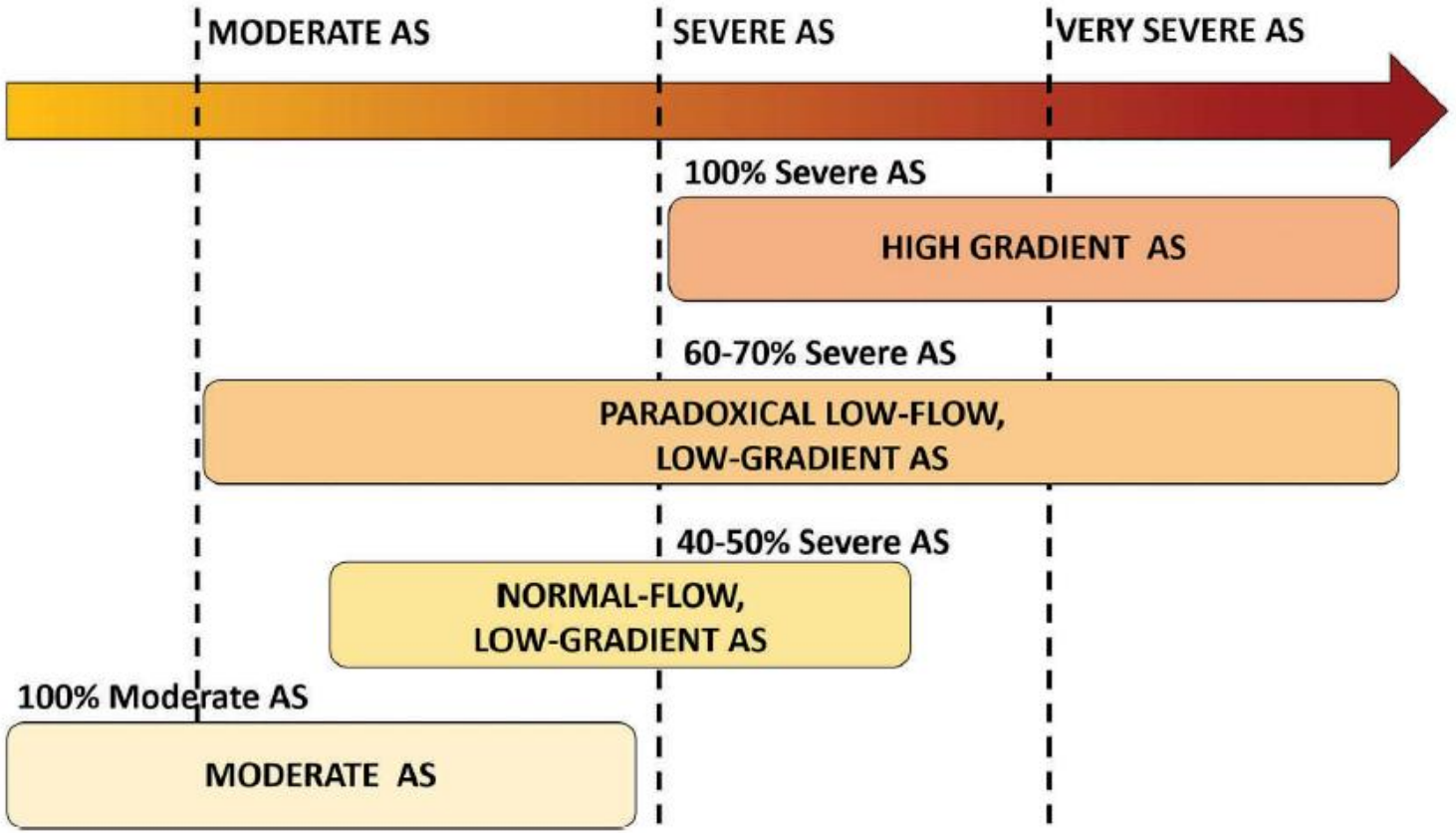
N = 750
Ukončení 2026 (→ 2034)

PROGRESS

Edwards Lifesciences

N = 2250
Ukončení 2029 (→ 2037)

Diskrepantní parametry AoS s norm.EF (≥ 50 %)

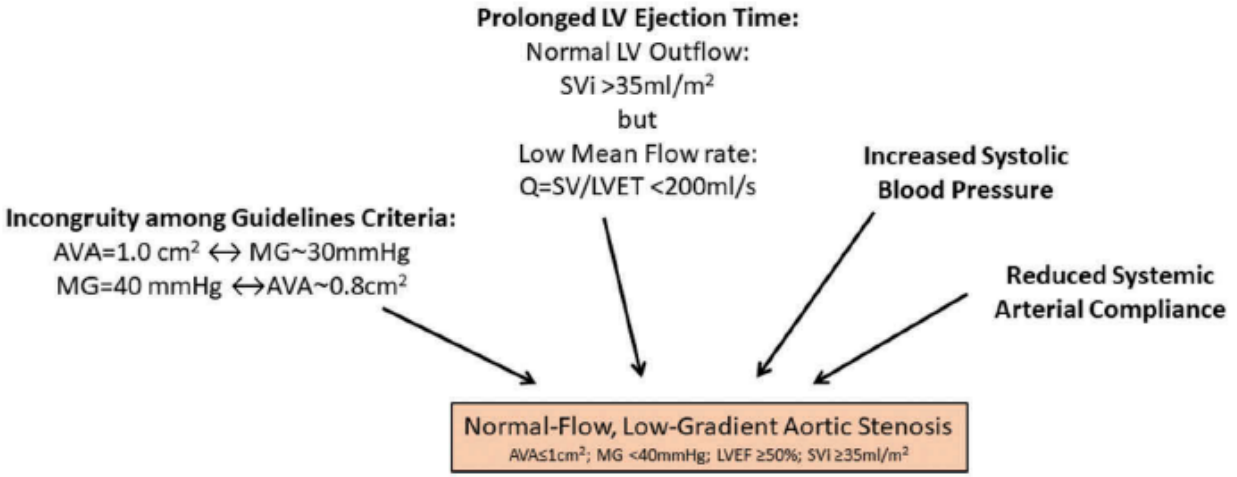


	MPG	AVAc	SVI
HIGH GRADIENT AS	≥40	<1,0	
PARADOXICAL LOW-FLOW, LOW-GRADIENT AS	<40	<1,0	< 35
NORMAL-FLOW, LOW-GRADIENT AS	<40	<1,0	≥ 35

Clavel MA et al. Structural Heart 2018;2:180-187

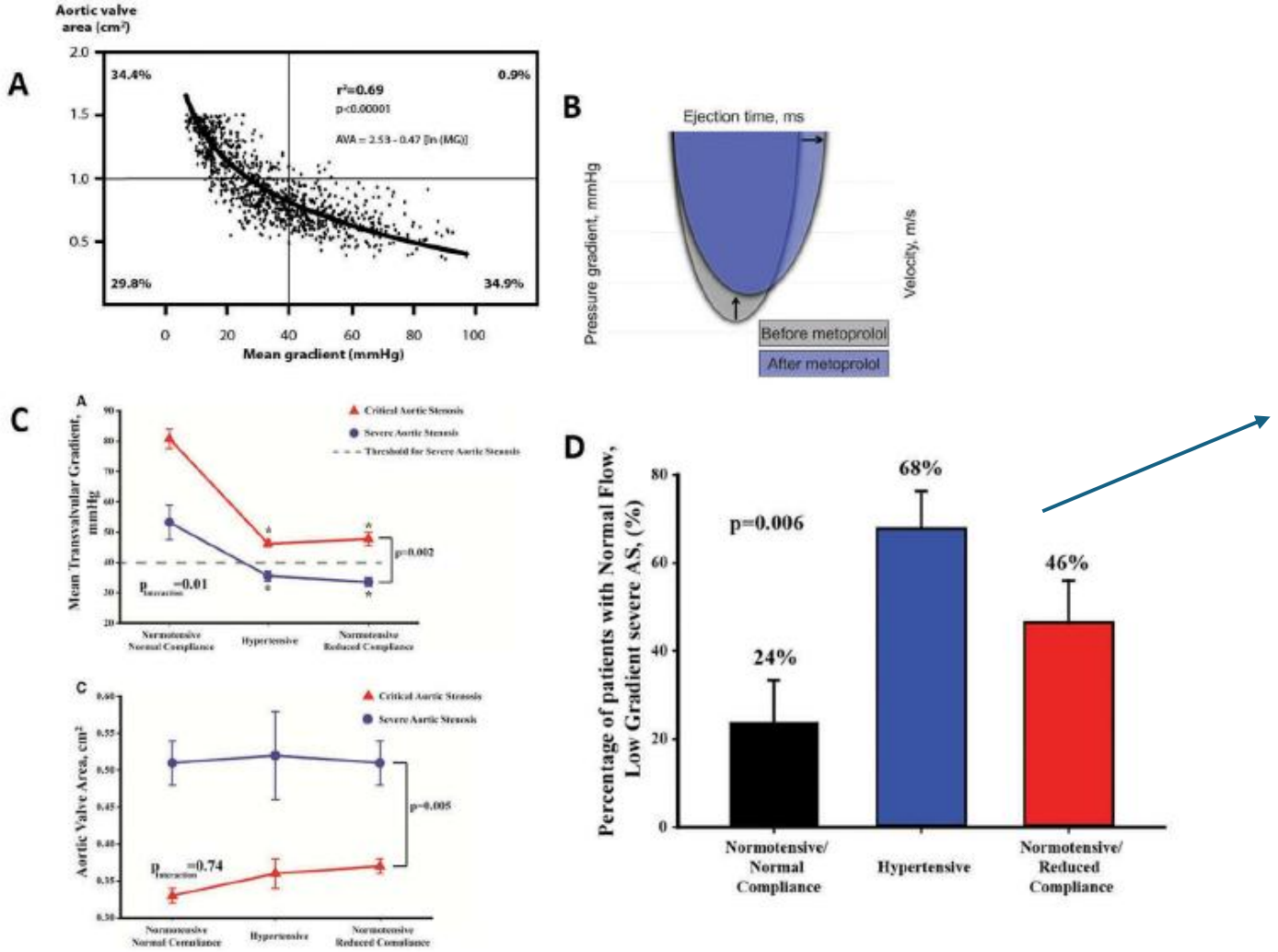
Normal flow low gradient AoS

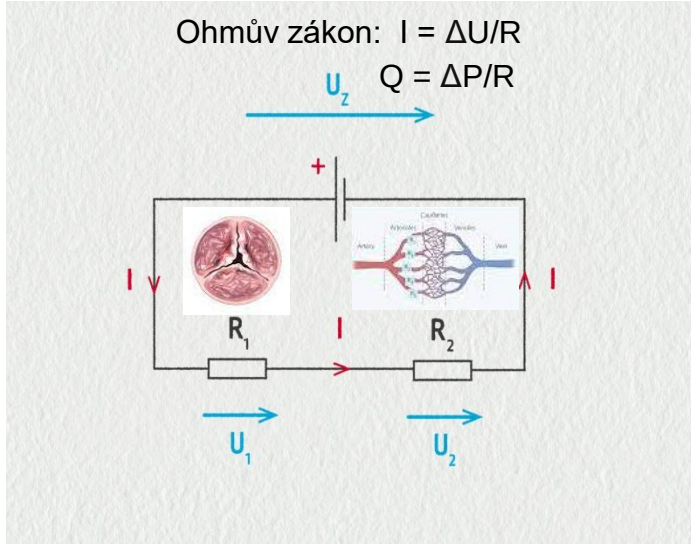
AVAc < 1,0 cm² a MG < 40 mmHg ***ALE*** **SVI > 35 ml/m²** ~ 20 %



Systemic arterial compliance = SVI/(SBP-DBP)
< 0,6 ml/m²/mmHg

Clavel MA et al. Structural Heart 2018;2:180-187





Systemic arterial compliance = SVI/(SBP-DBP)
< 0,6 ml/m²/mmHg

Clavel MA et al. Structural Heart 2018;2:180-187

Poměr **VTI LVOT / VTI Ao (bezrozměrný index)** nebo poměr rychlostí

může pomoci v hodnocení, když ostatní parametry jsou nejednoznačné.

Při hodnotě < 0,25 je významná aortální stenóza vysoce pravděpodobná.

(Cave: extrémní rozměry LVOT)

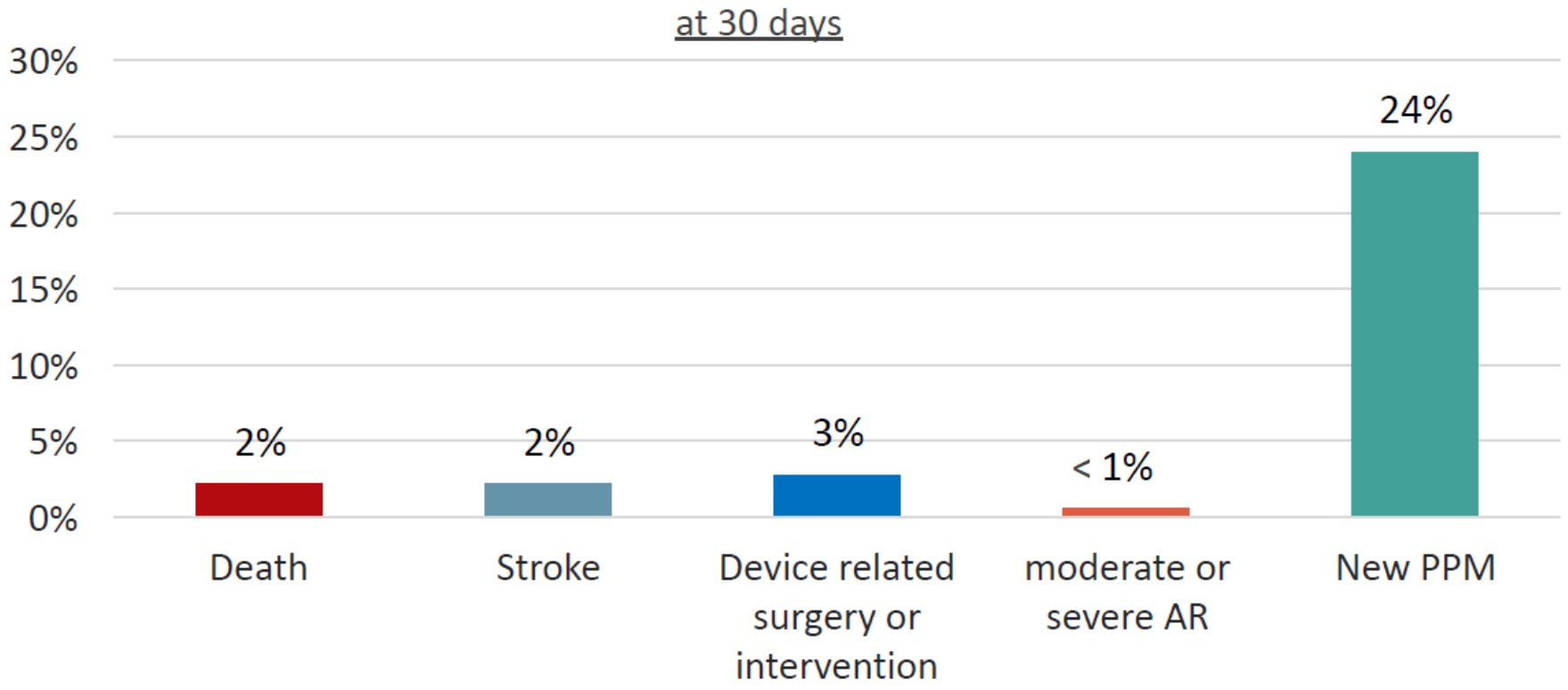
Mode of treatment

Recommendations	Class	Level
AV repair should be considered in selected patients with severe AR at experienced centres, when durable results are expected.	IIa	Revised B
TAVI may be considered for the treatment of severe AR in symptomatic patients ineligible for surgery according to the Heart Team, if the anatomy is suitable.	IIb	New B

V r. 2021 jen v textu, ne v tabulce

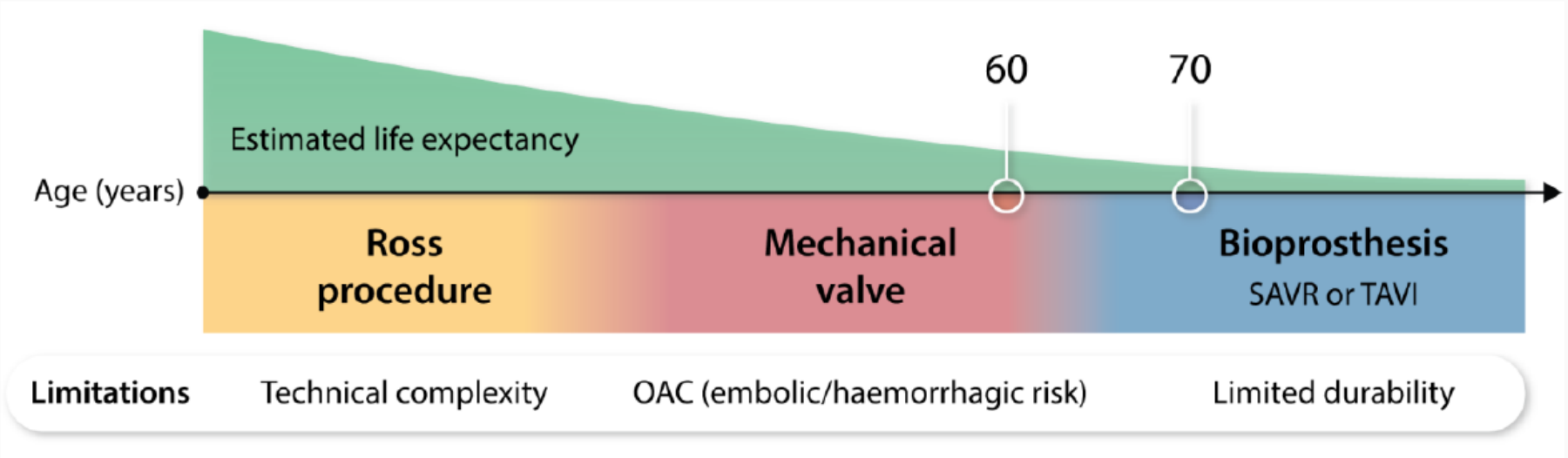
TAVI in patients with severe AR not eligible for surgery

ALIGN-AR
single-arm study, TAVI device dedicated for AR
180 patients, mean age 75.5 years



Vahl et al. Lancet 2024;403: 1451-59

Mode of intervention in patients with severe aortic stenosis



Recommendations	Class	Level
It is recommended that AV interventions are performed in Heart Valve Centres that report their local expertise and outcome data, have on-site interventional cardiology and cardiac surgical programmes, and a structured collaborative Heart Team.	I	C
It is recommended that the mode of intervention is based on Heart Team assessment of individual clinical, anatomical, and procedural characteristics, incorporating lifetime management considerations and estimated life expectancy.	I	C (Revised)

Mode of intervention in patients with severe aortic stenosis

Recommendations	Class	Level
TAVI is recommended in patients ≥70 years of age with tricuspid AV stenosis, if the anatomy is suitable. (irrespective of surgical risk score)	I	A (Revised)
SAVR is recommended in patients <70 years of age, if the surgical risk is low.	I	B (Revised)
SAVR or TAVI are recommended for all remaining candidates for an aortic BHV according to Heart Team assessment.	I	B (Revised)

Heart Team evaluation (Class I)

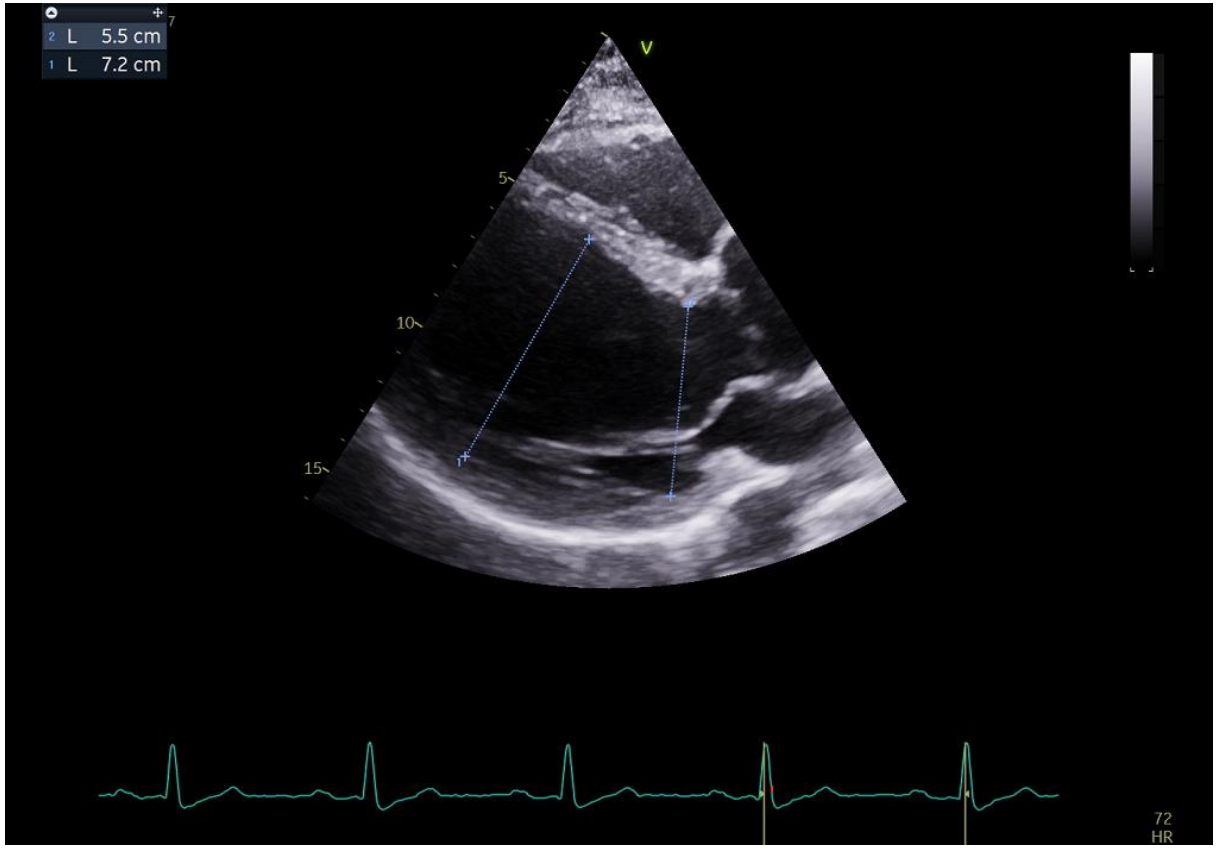
Patients <70 years if surgical risk is low	All remaining candidates for a bioprosthesis	Patients ≥70 years with a tricuspid aortic valve if anatomy is suitable
SAVR (Class I)	SAVR or TAVI (Class I)	TAVI (Class I)

Table 3 New recommendations

Recommendations	Class[a]	Level[b]
Diagnosis of coronary artery disease—*Section 6.1*		
Omission of invasive coronary angiography should be considered in TAVI candidates, if procedural planning CT angiography is of sufficient quality to rule out significant CAD.	IIa	B
PCI should be considered in patients with a primary indication to undergo TAVI and ≥90% coronary artery stenosis in segments with a reference diameter ≥2.5 mm.	IIa	B
Indications for intervention in severe aortic regurgitation—*Section 7.4*		
TAVI may be considered for the treatment of severe AR in symptomatic patients ineligible for surgery according to the Heart Team, if the anatomy is suitable.	IIb	B
Indications for intervention in symptomatic and asymptomatic severe aortic stenosis, and recommended mode of intervention—*Section 8.5*		
Intervention should be considered in asymptomatic patients (confirmed by a normal exercise test, if feasible) with severe, high-gradient AS and LVEF ≥50%, as an alternative to close active surveillance, if the procedural risk is low.	IIa	A
TAVI may be considered for the treatment of severe BAV stenosis in patients at increased surgical risk, if the anatomy is suitable.	IIb	B
Indications for intervention in patients with mixed moderate aortic stenosis and moderate aortic regurgitation—*Section 13.3*		
Intervention is recommended in symptomatic patients with mixed moderate AV stenosis and moderate regurgitation, and a mean gradient ≥40 mmHg or V_{max} ≥4.0 m/s.	I	B
Intervention is recommended in asymptomatic patients with mixed moderate AV stenosis and moderate regurgitation, with V_{max} ≥4.0 m/s and LVEF <50% not attributable to other cardiac disease.	I	C

Rozměry versus objemy LK

EDD



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