Aortální chlopeň

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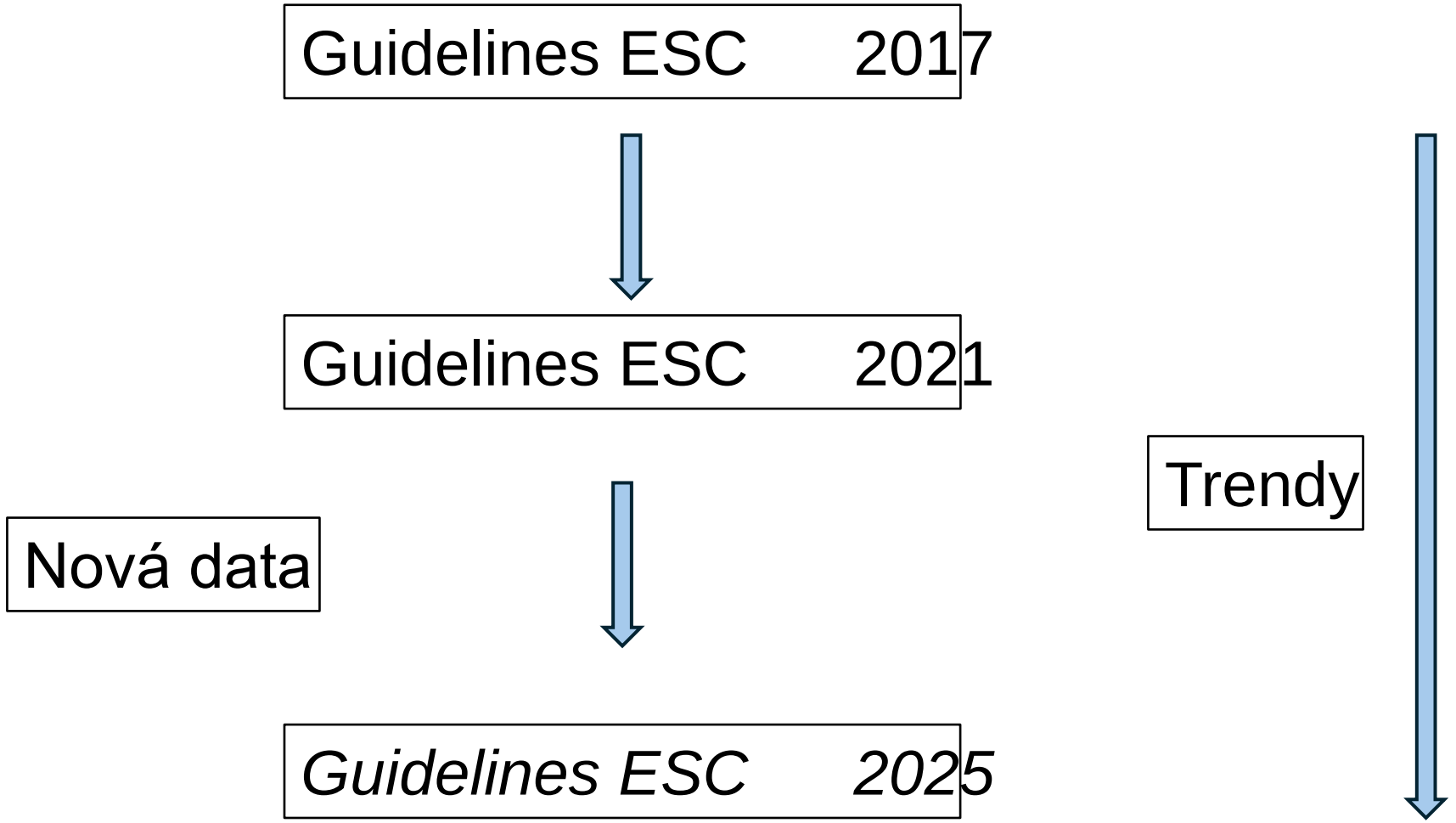
KLINIKA KARDIOLOGIE


Guidelines ESC 2017
Guidelines ESC 2021
Nová data
Guidelines ESC 2025
Trendy

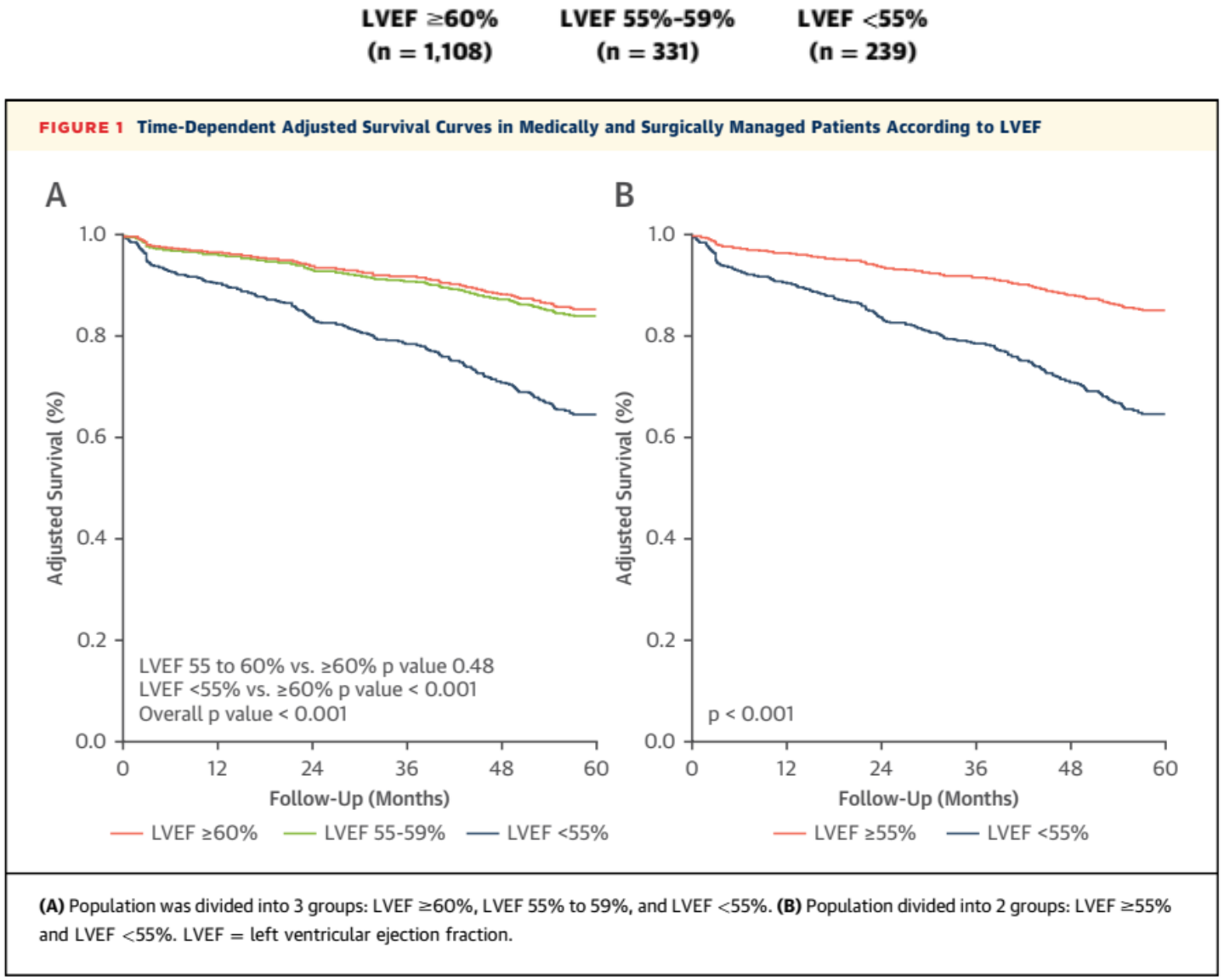
New or Revised	Recommendations in 2017 version	Class	Recommendations in 2021 version	Class
Symptomatic aortic stenosis				
Revised	Intervention is indicated in symptomatic patients with severe, high-gradient aortic stenosis (mean gradient ≥40 mmHg or peak velocity ≥4.0 m/s).	I	Intervention is recommended in symptomatic patients with severe, high-gradient aortic stenosis [mean gradient ≥40 mmHg, peak velocity ≥4.0 m/s and valve area ≤1.0 cm^2 (or ≤0.6 cm^2/m^2)].	I
Asymptomatic patients with severe aortic stenosis				
New			Intervention should be considered in asymptomatic patients with severe aortic stenosis and systolic LV dysfunction (LVEF <55%) without another cause.	IIa
Revised	SAVR should be considered in asymptomatic patients with normal ejection fraction and none of the above-mentioned exercise test abnormalities if the surgical risk is low and one of the following findings is present: • Very severe aortic stenosis defined by a V_{max} >5.5 m/s. • Severe valve calcification and a rate of V_{max} progression ≥0.3 m/s/year. • Markedly elevated BNP levels (>3x age- and sex-corrected normal range) confirmed by repeated measurements without other explanations. • Severe pulmonary hypertension (systolic pulmonary artery pressure at rest >60 mmHg confirmed by invasive measurement) without other explanation.	IIa	Intervention should be considered in asymptomatic patients with LVEF >55% and a normal exercise test if the procedural risk is low and one of the following parameters is present: • Very severe aortic stenosis (mean gradient ≥60 mmHg or V_{max} ≥5 m/s). • Severe valve calcification (ideally assessed by CCT) and V_{max} progression ≥0.3 m/s/year. • Markedly elevated BNP levels (>3× age- and sex-corrected normal range) confirmed by repeated measurements and without other explanation.	IIa

EF
(50) → 55 %

V max
5,5 → 5 m/s

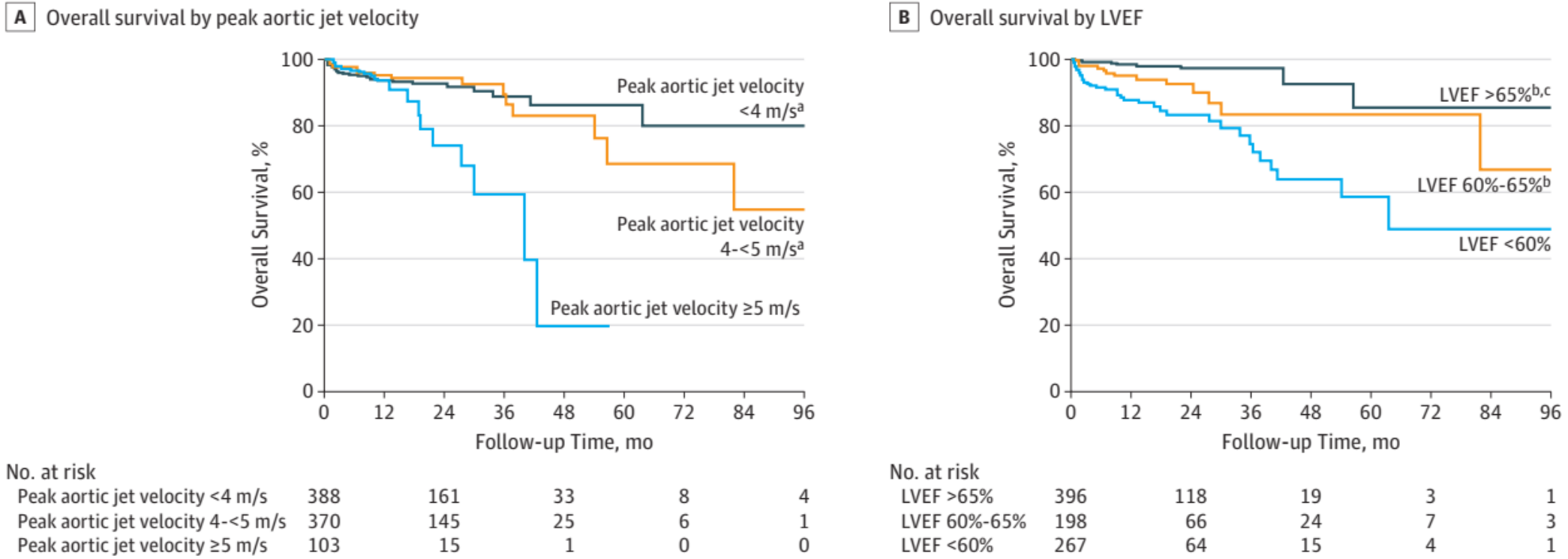
Multicentrická francouzsko-belgická studie: asymptomatická významná AoS s EF > 50 %

Celková mortalita



JACC CV Img 2019;12:38-48

Figure 2. Kaplan-Meier Estimates for Events in Patients With Severe Aortic Stenosis According to Left Ventricular Ejection Fraction (LVEF) and Peak Aortic Jet Velocity



No. at risk

Peak aortic jet velocity <4 m/s	388	161	33	8	4
Peak aortic jet velocity 4-<5 m/s	370	145	25	6	1
Peak aortic jet velocity ≥5 m/s	103	15	1	0	0

No. at risk

LVEF >65%	396	118	19	3	1
LVEF 60%-65%	198	66	24	7	3
LVEF <60%	267	64	15	4	1

Kaplan-Meier analyses of overall survival in patients with severe aortic stenosis at baseline as a function of peak aortic jet velocity (A) and LVEF (B).

[a] Significant difference with peak aortic jet velocity of 5 m/s or greater.

[b] Significant difference with LVEF less than 60%.

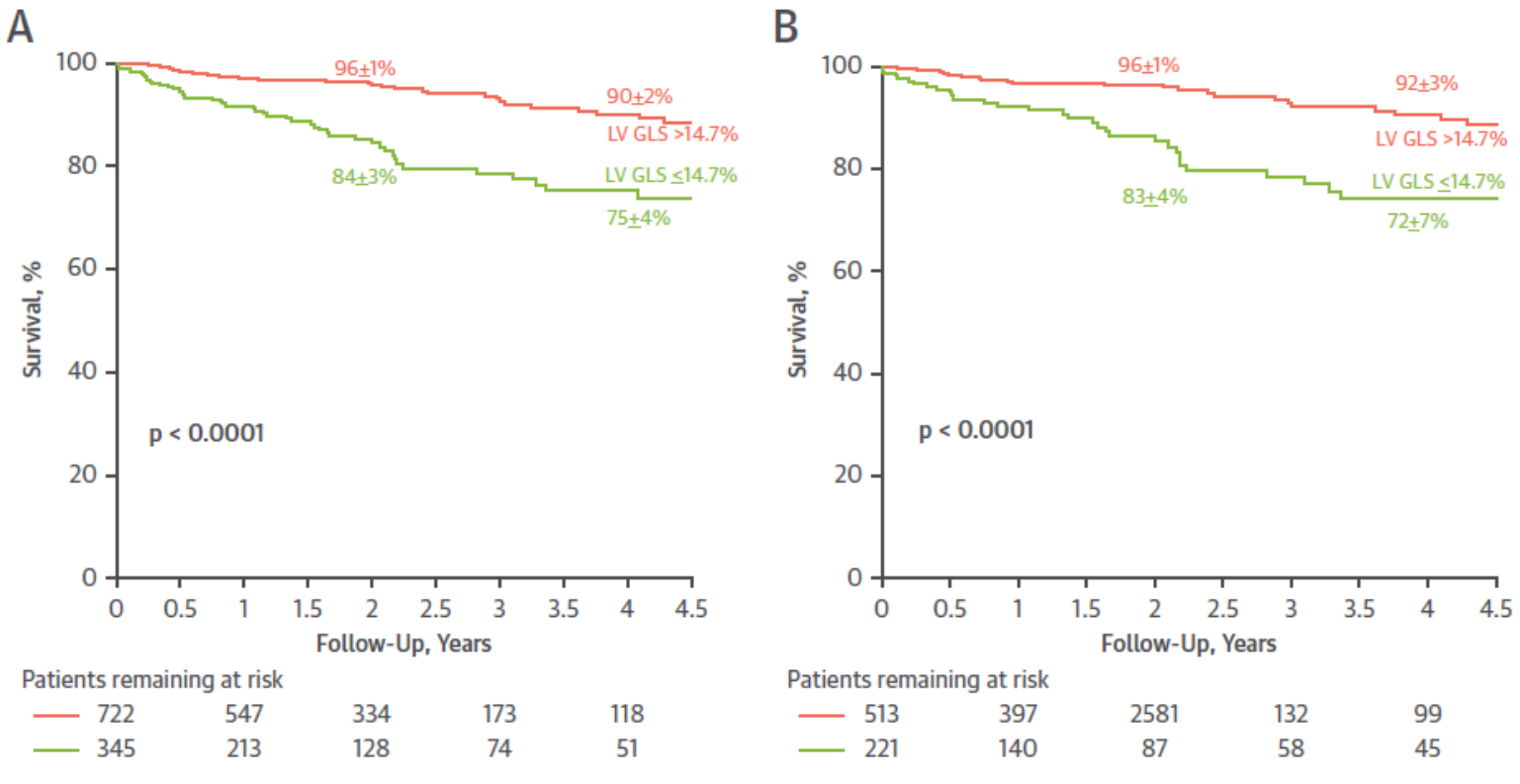
[c] Significant difference with LVEF of 60% to 65%.

Lancellotti et al. JAMA Cardiology 2018;

JAMA Cardiol. doi:10.1001/jamacardio.2018.3152
Published online October 3, 2018.

Metaanalýza studií s GLS u významné asymptomatické **Ao stenózy** s EF> 50 %
s použitím individuálních dat pacientů (10 studií, n = 1067)

FIGURE 4 Kaplan-Meier Survival Curves



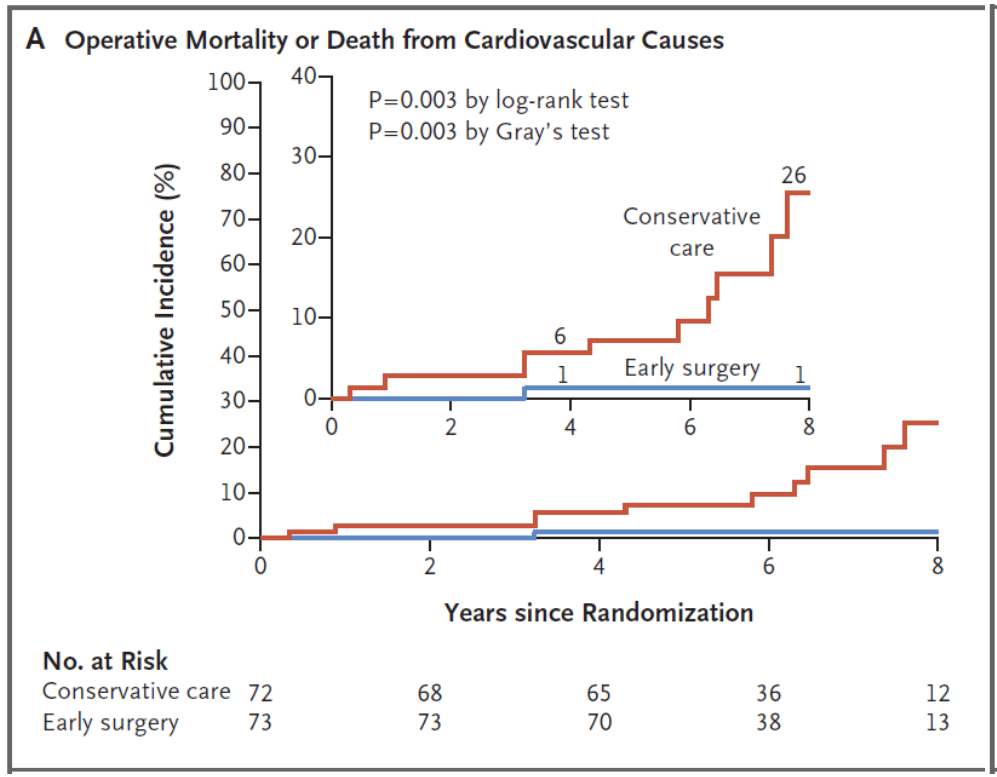
Kaplan-Meier survival curves stratified according to left ventricular global longitudinal strain in the whole cohort **(A)** and in patients with left ventricular ejection fraction ≥60% **(B)**. Percentage in the graphs are survival rate at 2- and 4-year follow-up. LVGLS = left ventricular global longitudinal strain.

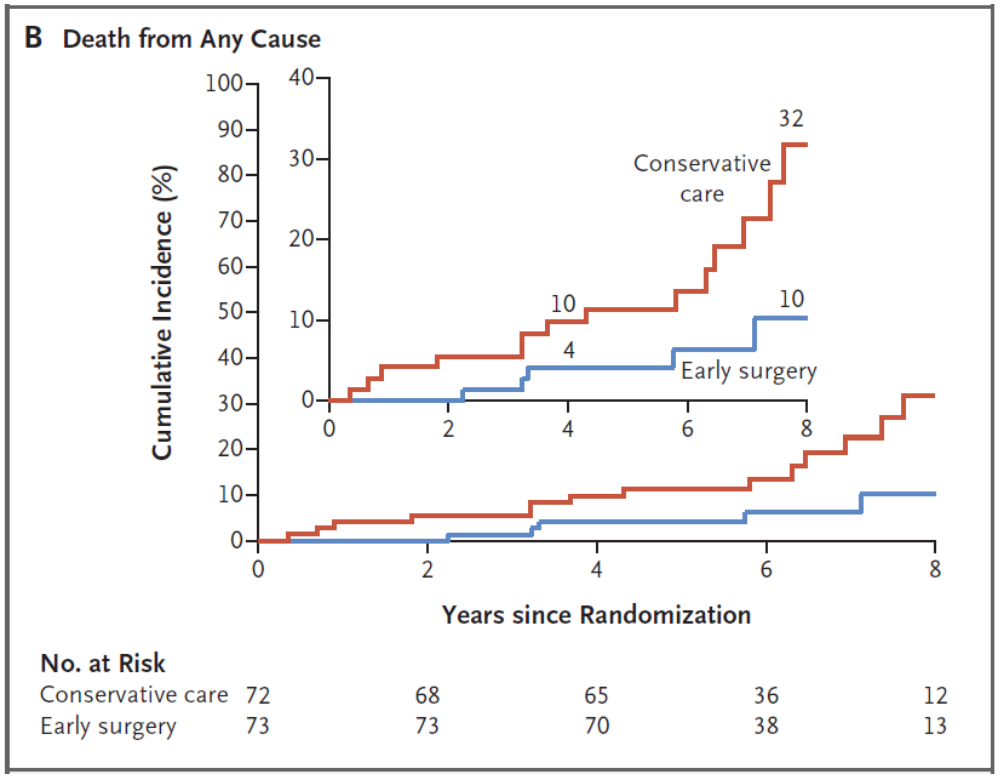
JACC Img 2019;12:84-92

Studie RECOVERY

Asymptomatická AoS
Velmi významná: AVAc ≤ 0,75 cm2 plus Vmax ≥ 4,5 m/s nebo střední gradient ≥ 50 mmHg
Časná SAVR vs konzervativně

145 pac. , věk 64,2 ± 9,4 let, 61 % bikuspidální Ao chlopeň





NEJM 2020;382:111-9.

Velmi významná aortální stenóza

	Severe AS	VSAS
Peak aortic jet velocity	>4 m/s	>5 m/s
MPG	>40 mm Hg	≥60 mm Hg
Aortic valve area	<1 cm^2	<0.6 cm^2
Indexed aortic valve area	<0.6 cm^2/m^2	<0.4 cm^2/m^2 (<0.45 cm^2/m)
Dimensionless index	<0.25	<0.20

J Am Heart Assoc. 2019;8:e011724. DOI: 10.1161/JAHA.118.011724.

Section 5. Recommended mode of intervention In patients with aortic stenosis				
Revised	The choice for intervention must be based on careful individual evaluation of technical suitability and weighing of risks and benefits of each modality. In addition, the local expertise and outcomes data for the given intervention must be taken into account.	I	The choice between surgical and transcatheter intervention must be based upon careful evaluation of clinical, anatomical and procedural factors by the Heart Team, weighing the risks and benefits of each approach for an individual patient. The Heart Team recommendation should be discussed with the patient who can then make an informed treatment choice.	I
Revised	SAVR is recommended in patients at low surgical risk (STS or EuroSCORE II <4% or logistic EuroSCORE I <10%, and no other risk factors not included in these scores, such as frailty, porcelain aorta, sequelae of chest radiation).	I	SAVR is recommended in younger patients who are low risk for surgery (<75 years and STS-PROM/ EuroSCORE II <4%) or in patients who are operable and unsuitable for transfemoral TAVI.	I
Revised	TAVI is recommended in patients who are not suitable for SAVR as assessed by the Heart Team.	I	TAVI is recommended in older patients (≥75 years), or in those who are high-risk (STS-PROM/ EuroSCORE II >8%) or unsuitable for surgery.	I
Revised	In patients who are at increased surgical risk (STS or EuroSCORE II ≥4% or logistic EuroSCORE I ≥10%, or other risk factors not included in these scores such as frailty, porcelain aorta, sequelae of chest radiation), the decision between SAVR and TAVI should be made by the Heart Team according to the individual patient characteristics, with TAVI being favoured in elderly patients suitable for transfemoral access.	I	SAVR or TAVI are recommended for remaining patients according to individual clinical, anatomical and procedural characteristics.	I
New			Non-transfemoral TAVI may be considered in patients who are inoperable for SAVR and unsuitable for transfemoral TAVI.	IIb

> 75 let

TAVI – rozšiřování indikací

Noninferiorní prognosticky u nízko rizikových pacientů

(PARTNER 3, Evolut Low Risk,
NOTION, DEDICATE-DZHK6)

⟹ Nízko rizikoví pacienti

Reintervence ne častější než u chirurgických bioprotéz v horizontu 5-10 let

⟹ Mladší věk

⟹ Asymptomatická AoS

⟹ Střední AoS ?

Asymptomatická významná Ao stenóza

Table 1 Trials testing a strategy of early valve replacement versus conservative management with valve replacement if symptoms develop in patients with severe asymptomatic aortic stenosis

Trial acronym	ClinicalTrials registration	Definition of severe AS	Other key inclusion criteria	Other key exclusion criteria*	Method of AVR	Primary outcome	Sample size	Duration of follow-up	Status
✔ RECOVERY	NCT01161732	1. AVA≤0.75 cm^2 and 2. Vmax≥4.5 m/s and/or mean PG≥50 mm Hg	20–80 years	LVEF<50%, prior cardiac surgery, positive exercise test (selective)	Surgical AVR	All-cause death (≤30 days from AVR) and CV death	145 patients	Minimum 4 years. Median 6.1 years	Completed 1-year endpoint: 1% vs 15%, HR 0.09 (0.01–0.67), p=0.003.
✔ AVATAR	NCT02436655	1. Vmax≥4 m/s and/or mean PG≥40 mm Hg and 2. AVA≤1 cm^2 or≤0.6 cm^2/m^2	≥18 years, STS score<8% (30-day mortality)	LVEF<50%, Vmax>5.5 m/s, prior cardiac surgery, atrial fibrillation, need for aortic surgery, CHD requiring revascularisation,† COPD with FEV_1<70%, PASP>50 mmHg, positive exercise test (mandated)	Surgical AVR	All-cause death, myocardial infarction, stroke and/ or unplanned heart failure hospitalisation	157 patients	Median 32 months. Long-term median 63 months	Stopped early. Long-term follow-up: 1-year endpoint 23.1% vs 46.8% HR 0.42 (0.24–0.73), p=0.002.
✔ EARLY-TAVR	NCT03042104	1. AVA≤1 cm^2 or≤0.6 cm^2/m^2 and 2. Vmax≥4 m/s and/or mean PG≥40 mmHg	≥65 years, STS score≤10% (30-day mortality)	LVEF<50%, technical unsuitable for transcatheter AVR, positive exercise test (selective)‡	Transcatheter AVR	All-cause death, stroke and unplanned CV hospitalisation	901 patients§	3.7 years	Completed 1-year endpoint 26.8 vs 45.3% HR: 0.50 (0.40–0.63)
✔ EVOLVED	NCT03094143	1. Vmax≥4 m/s or 2. Vmax≥3.5 m/s with AVA<0.6 cm^2/m^2	≥18 years, mid-wall LV fibrosis on cardiac MRI scan	LVEF<50%, eGFR<30 mL/min/1.73 m^2, contraindication to cardiac MRI scanning	Surgical or transcatheter AVR	All-cause death and unplanned AS-related hospitalisation	224 (of 1700 patients§)	Average 2.8 years	Stopped early. 1-year endpoint 18% vs 23% HR 0.79 (0.4–1.4), p=0.44
DANAVR	NCT03972644	1. AVA≤1 cm^2 and 2. Vmax≥3.5 m/s and 3) Deemed severe by Heart Team	18–85 years, signs of increased LV filling pressure or reduced longitudinal strain	LVEF<50%, Vmax>5 m/s, eGFR<30 mL/min/1.73 m^2	Surgical or transcatheter AVR	All-cause death	1700 patients	Approximately 5 years	Recruiting
EASY-AS	NCT04204915	Vmax≥4 m/s and/or mean PG≥40 mm Hg OR V>3.5 m/s and high CT calcium score¶ AVA≤1 cm^2 or≤0.6 cm^2/m^2	≥18 years	LVEF<50%, previous AVR, planned cardiac surgery	Surgical or transcatheter AVR	CV death and hospitalisation for heart failure	2844 patients§	Median 5 years	Recruiting: >1000 randomised February 2025

*Selected criteria, see ClinicalTrials.gov for full details. In general, all trials exclude patients with any symptoms attributable to aortic stenosis, other significant valvular diseases, other indications for cardiac surgery or significantly reduced life expectancy.
†Requirement removed part-way through study.
‡Mandated if patient can perform stress test, otherwise absence of symptoms based on clinical assessment.
§Anticipated recruitment.
¶>2000IU in men and 1200 in women.
AS, aortic stenosis; AVA, aortic valve area; AVR, aortic valve replacement; CHD, coronary heart disease; COPD, chronic obstructive pulmonary disease; CV, cardiovascular; DM, diabetes mellitus; eGFR, estimated glomerular filtration rate; EuroSCORE, European System for Cardiac Operative Risk Evaluation; LV, left ventricular; LVEF, left ventricular ejection fraction; PASP, pulmonary artery systolic pressure; PG, pressure gradient; STS, Society of Thoracic Surgeons; Vmax, peak transaortic valvular gradient (by Doppler echocardiography).

McCann GP, Heart 2025

RECOVERY

AVATAR

EVOLVED

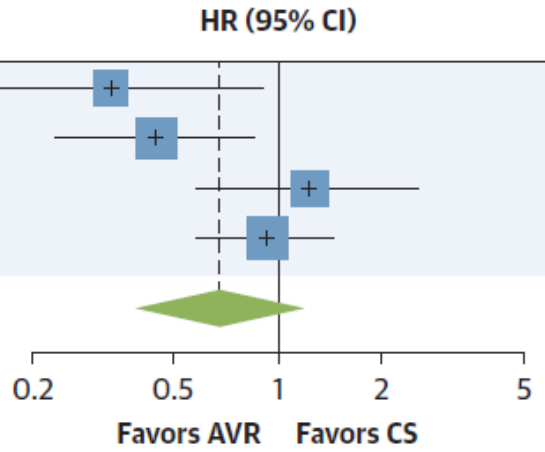
EARLY-TAVR

FIGURE 2 Forest Plots for All-Cause Mortality and Cardiovascular Mortality

A

Study	Log (HR)	SE	Weight	HR (95% CI)
Kang 2020[25]	−1.1,087	0.5,140	17.1%	0.33 (0.12-0.90)
Banovic 2024[26]	−0.8,210	0.3,335	26.0%	0.44 (0.23-0.85)
Loganath 2024[28]	0.1,989	0.3,694	24.0%	1.22 (0.59-2.51)
Genereux 2024[27]	−0.0,726	0.2,233	33.0%	0.93 (0.60-1.44)
Total (95% CI)			**100.0%**	**0.68 (0.40-1.17)**

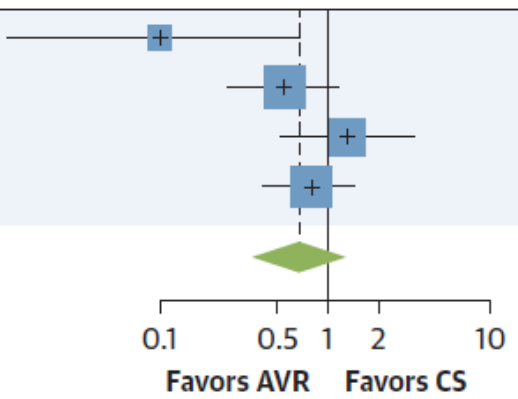
Heterogeneity: τ^2 = 0.1,805; chi-square = 7.77, df = 3 (P = 0.05); I^2 = 61%
Test for overall effect: Z = −1.38 (P = 0.17)



B

Study	Log (HR)	SE	Weight	HR (95% CI)
Kang 2020[25]	−2.4,079	1.0,726	8.2%	0.09 (0.01-0.67)
Banovic 2024[26]	−0.6,162	0.3,959	30.4%	0.54 (0.25-1.18)
Loganath 2024[28]	0.2,852	0.4,760	25.5%	1.33 (0.52-3.36)
Genereux 2024[27]	−0.2,485	0.3,161	35.9%	0.78 (0.42-1.45)
Total (95% CI)			**100.0%**	**0.67 (0.35-1.29)**

Heterogeneity: τ^2 = 0.2,115; chi-square = 6.01, df = 3 (P = 0.11); I^2 = 50%
Test for overall effect: Z = −1.20 (P = 0.23)

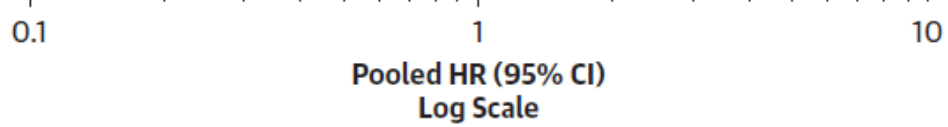


Forest plots of (A) all-cause mortality and (B) cardiovascular mortality comparing AVR vs CS in RCTs. The sizes of the squares correspond to the weight of each trial in the quantitative synthesis. The diamond and its width represent the pooled HR and the 95% CI, respectively. Abbreviations as in Figure 1.

JACC 2025;85(9):912-922

CENTRAL ILLUSTRATION **Systematic Review and Study-Level Meta-Analysis of AVR vs Clinical Surveillance in Asymptomatic Severe Aortic Stenosis**

	Early AVR n/N (%)	Clinical Surveillance n/N (%)	Pooled HR* (95% CI)	*P* Value
All-Cause Mortality	70/719 (9.7%)	97/708 (13.7%)	0.68 (0.40-1.17)	0.17
Cardiovascular Mortality	37/719 (5.1%)	59/708 (8.3%)	0.67 (0.35-1.29)	0.23
Heart Failure Hospitalization	18/606 (3.0%)	65/597 (10.9%)	0.28 (0.17-0.47)	<0.01
Unplanned CV or HF Hospitalization	105/719 (14.6%)	226/708 (31.9%)	0.40 (0.30-053)	<0.01
Stroke	32/719 (4.5%)	51/708 (7.2%)	0.62 (0.40-0.97)	0.03



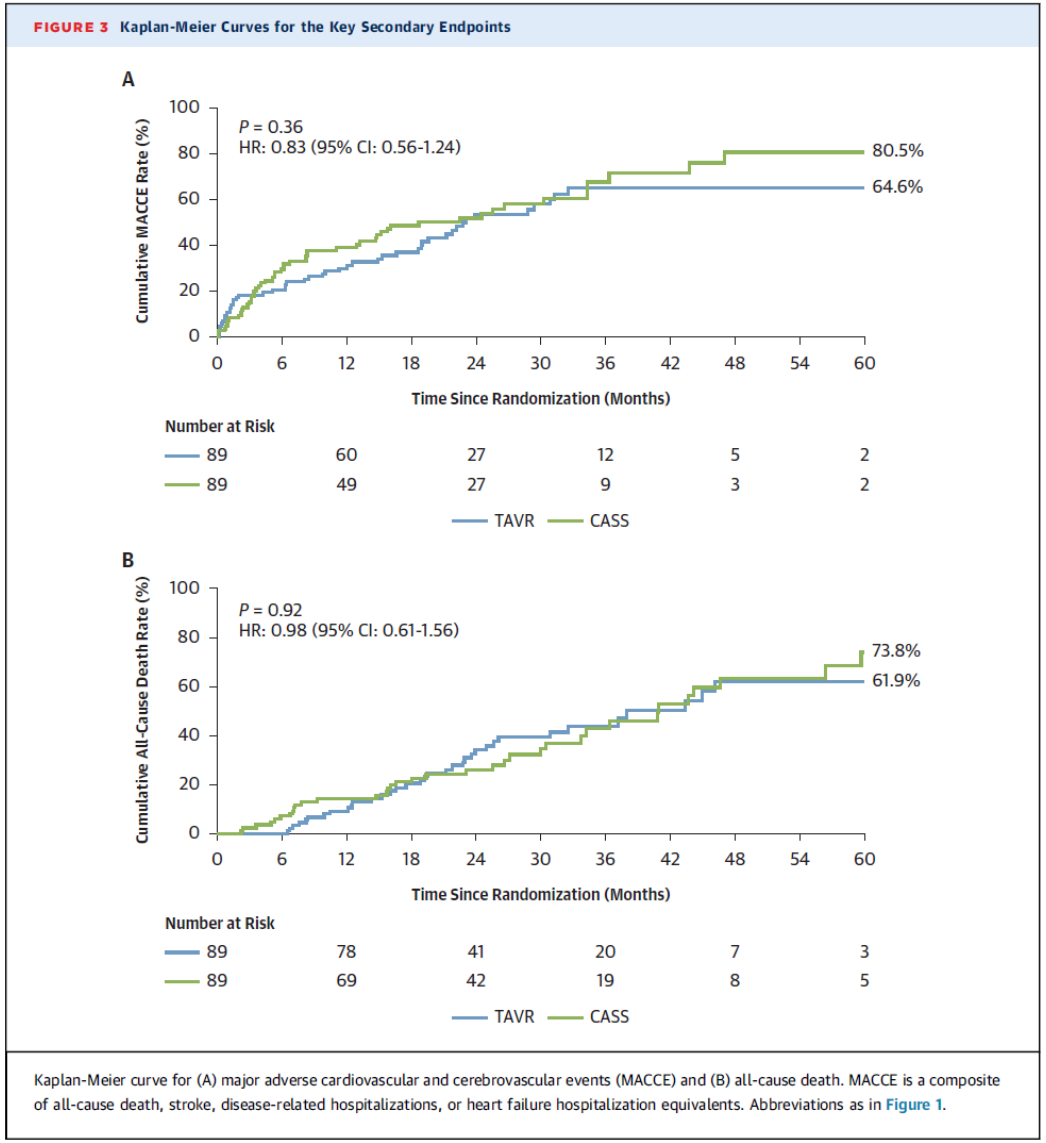
Généreux P, et al. JACC. 2025;85(9):912-922.

Střední aortální stenóza s HFrEF

UNLOAD TAVR

N = 178
Prům. věk 77 let
55,6 % NYHA III-IV
Medián sledování 23 M

38 pac. (43 % konz. skupiny)
konverze k TAVI
-35 pro progresi do významné AoS
-2 pro opakované dekompenzace



JACC 2025;85:878-890

Střední AoS - probíhající studie

Evolut EXPAND TAVR II Pivotal Trial

Medtronic

N = 750
Ukončení 2026 (→ 2034)

PROGRESS

Edwards Lifesciences

N = 2250
Ukončení 2029 (→ 2037)

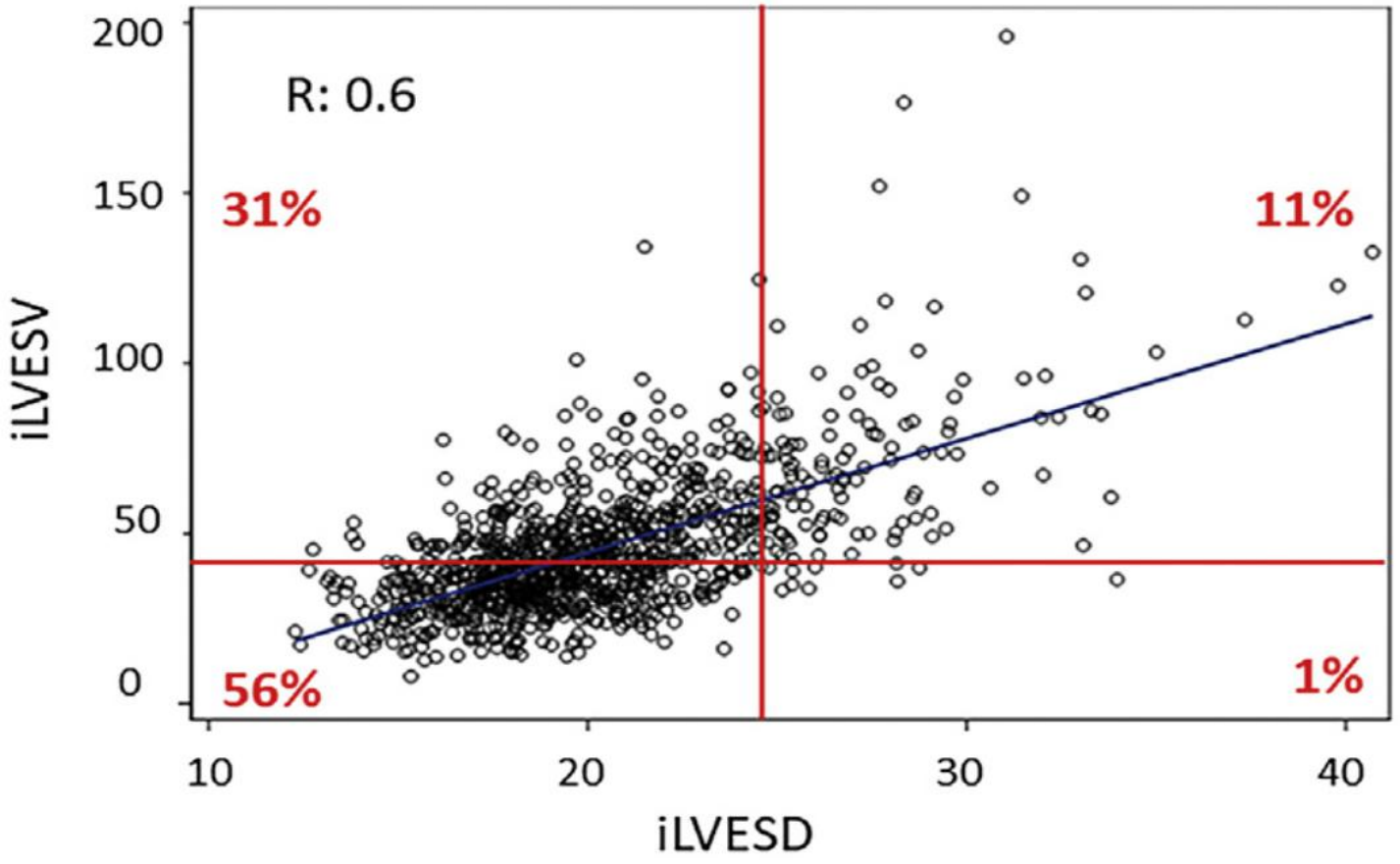
Aortální regurgitace

New or Revised	Recommendations in 2017 version	Class	Recommendations in 2021 version	Class
Section 4. Recommendations on indications for surgery in severe aortic regurgitation				
Revised	Surgery is indicated in asymptomatic patients with resting ejection fraction ≤50%.	I	Surgery is recommended in asymptomatic patients with LVESD >50 mm or LVESD >25 mm/m^2 BSA (in patients with small body size) or resting LVEF ≤50%.	I
	Surgery should be considered in asymptomatic patients with resting ejection fraction >50% with severe LV dilatation: LVEDD >70 mm or LVESD >50 mm (or LVESD >25 mm/m^2 BSA in patients with small body size).	IIa		
New			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 at low-risk.	IIb
Revised	Heart Team discussion is recommended in selected patients in whom aortic valve repair may be a feasible alternative to valve replacement.	I	Aortic valve repair may be considered in selected patients at experienced centres when durable results are expected.	IIb
Section 4. Recommendations on indications for surgery in aortic root or tubular ascending aortic aneurysm (irrespective of the severity of aortic regurgitation)				
Revised	Aortic valve repair, using the reimplantation or remodelling with aortic annuloplasty technique, is recommended in young patients with aortic root dilation and tricuspid aortic valves, when performed by experienced surgeons.	I	Valve-sparing aortic root replacement is recommended in young patients with aortic root dilation, if performed in experienced centres and durable results are expected.	I

ESD > 20 mm/m^2

EF ≤ 55 %

Rozměry a objemy LK

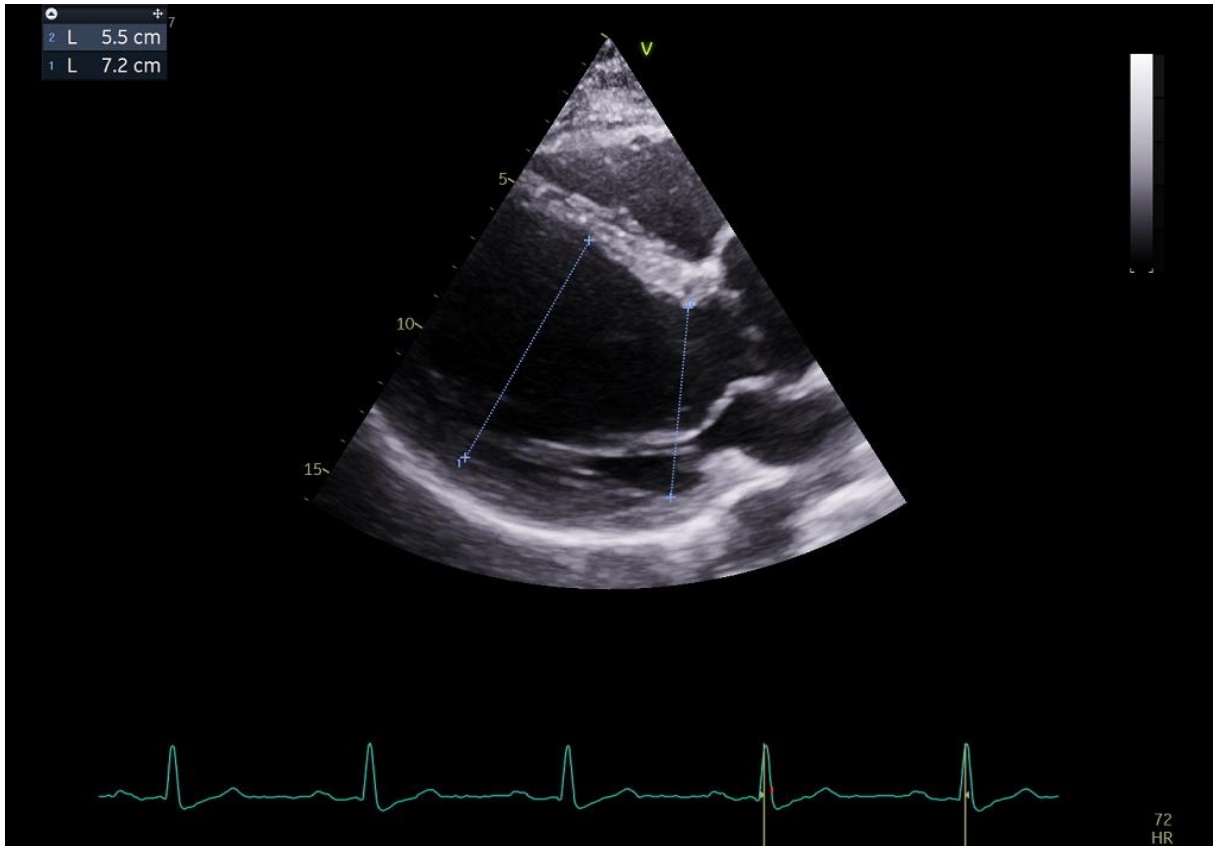


ESVi > 45 ml/m2
-cut-off pro mortalitu

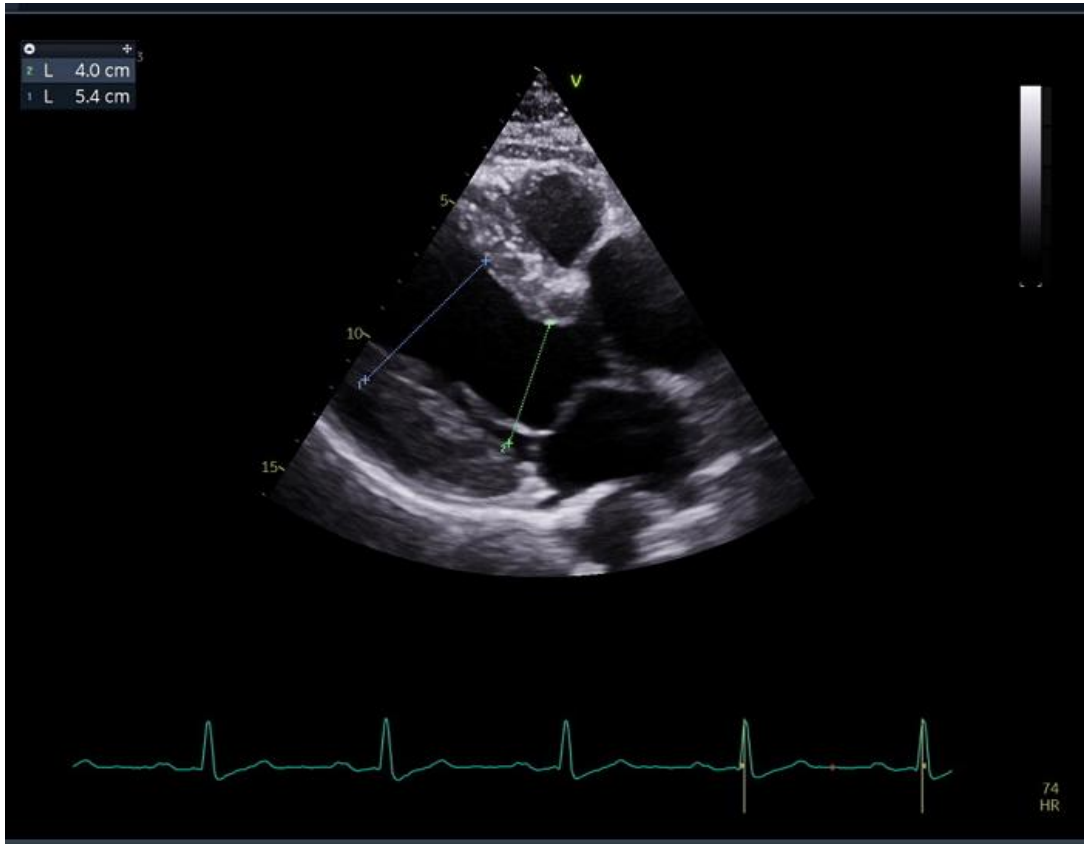
JASE 2021;34:352-9

Velikost LK

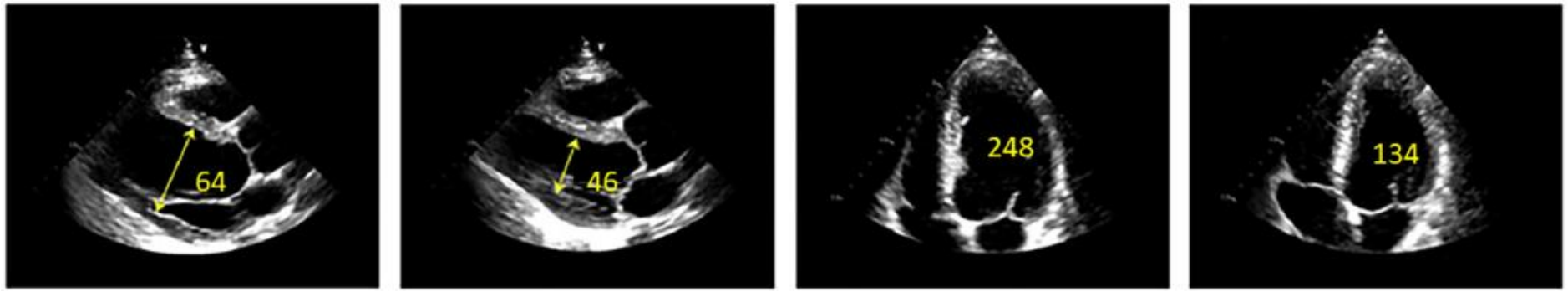
EDD



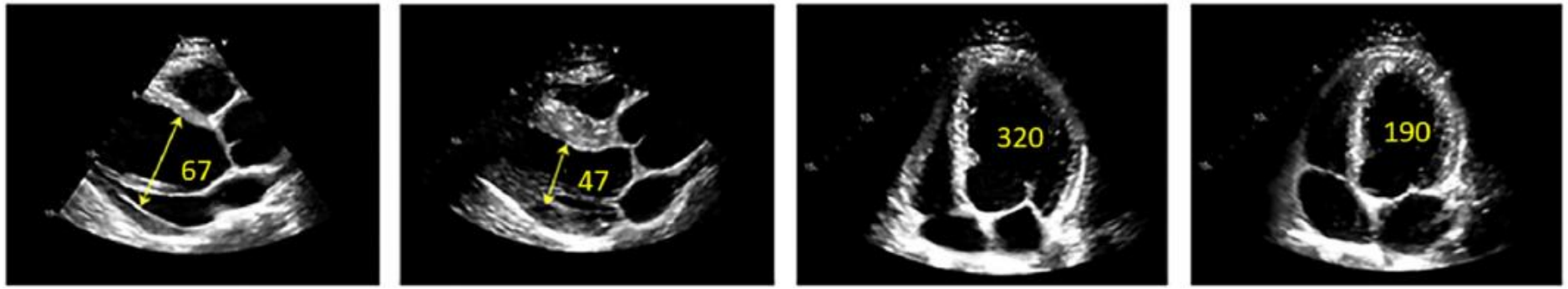
ESD



EDD ESD EDV ESV

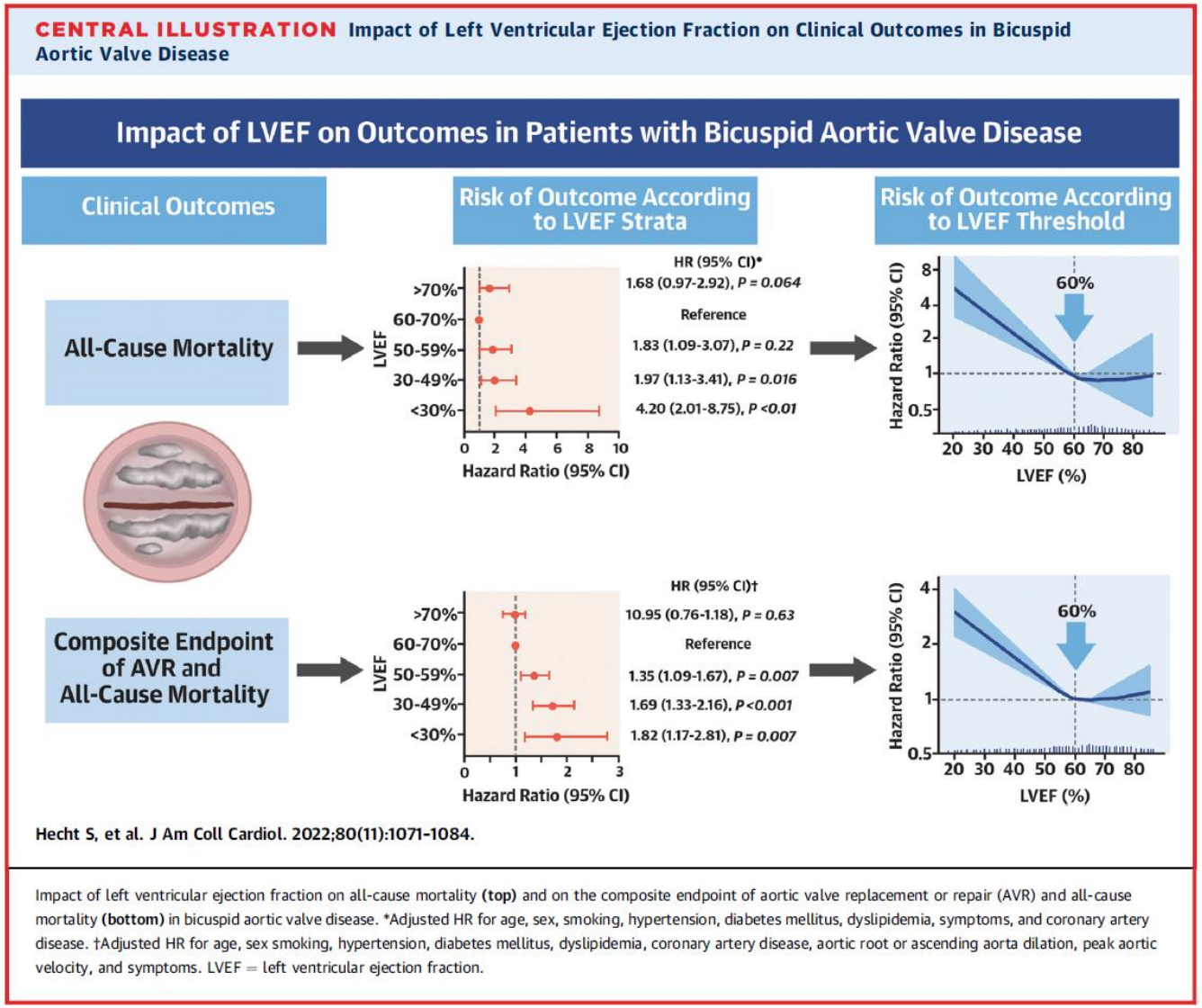


Po 3 letech



JASE 2021;34:352-9

Hranice pro EF



Cut-off pro mortalitu EF 60 %

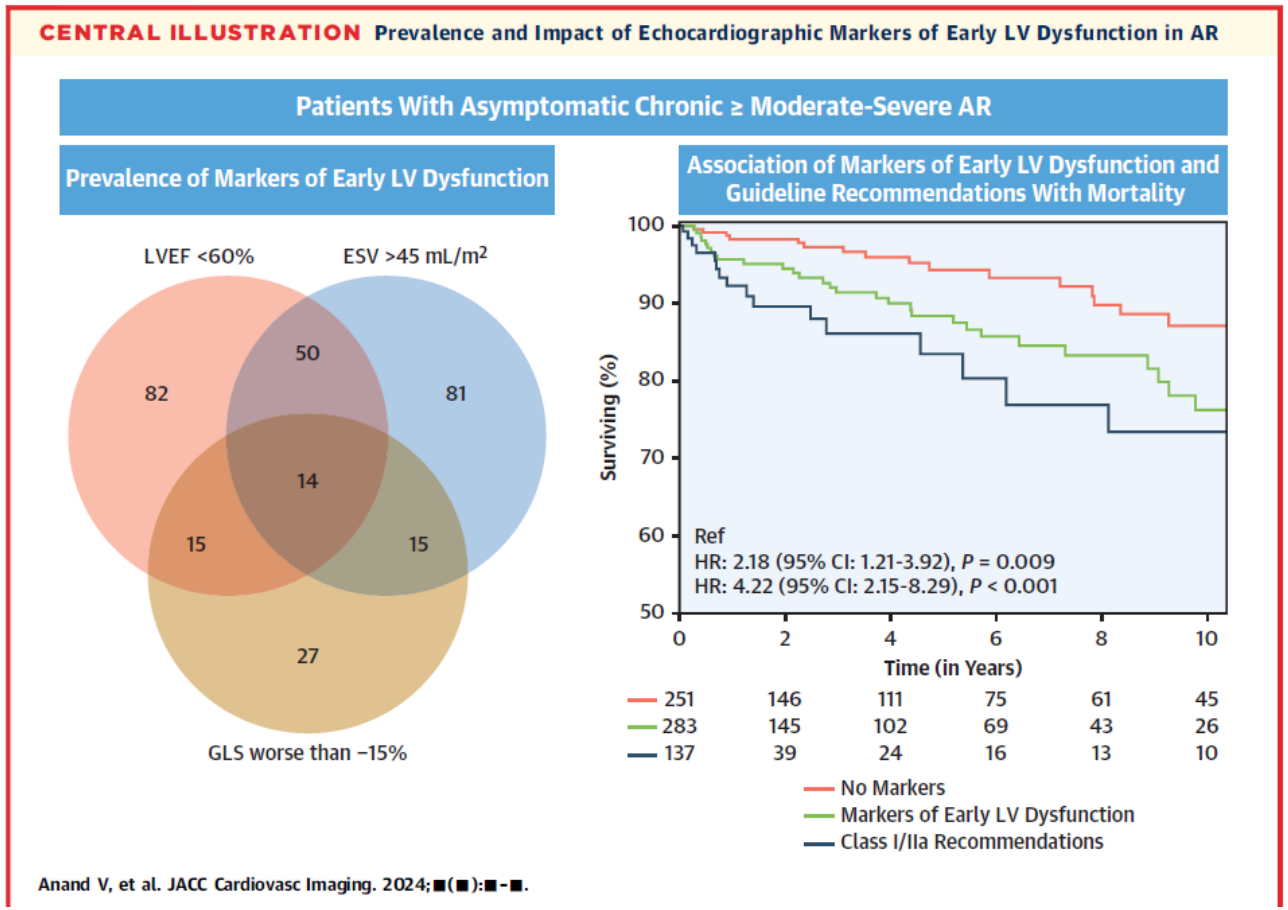
Hecht JACC 2022;80:1071-1084

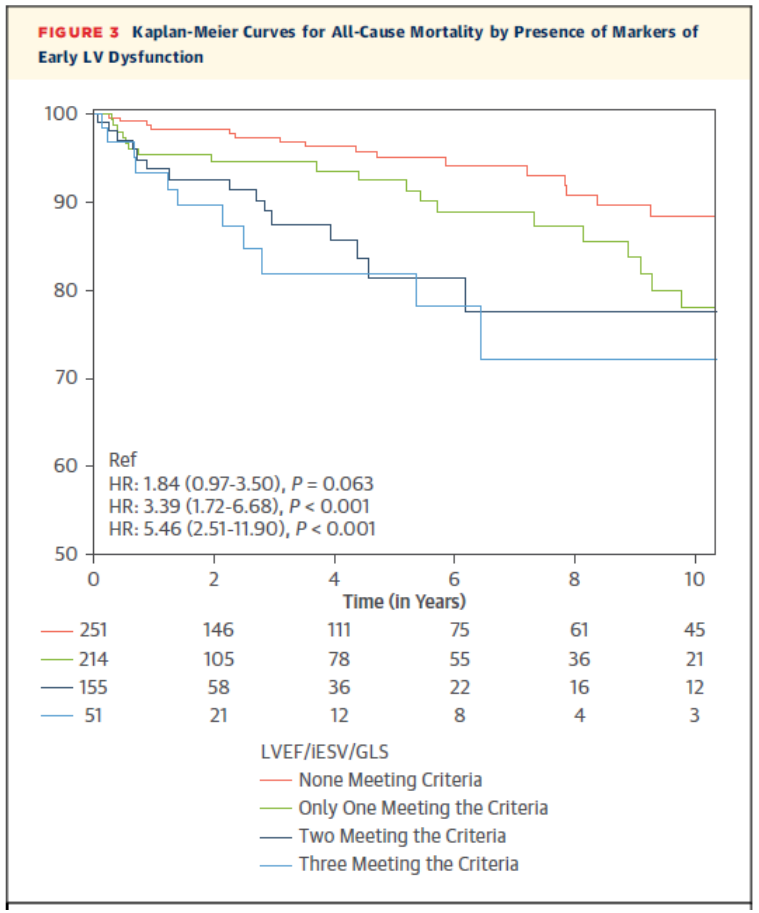
Časné markery počínající dysfunkce LK

ESVi > 45 ml/m2

EF < 60 %

Snížený GLS





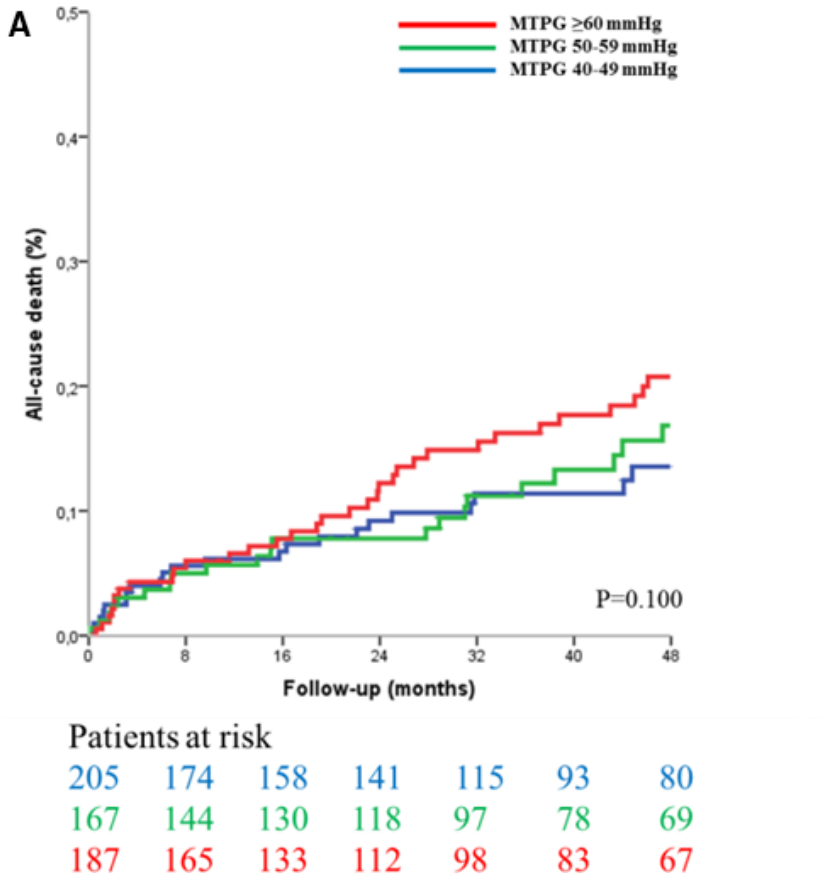
Anand JACC CV Imaging 2024
https://doi.org/10.1016/j.jcmg.2024.09.005

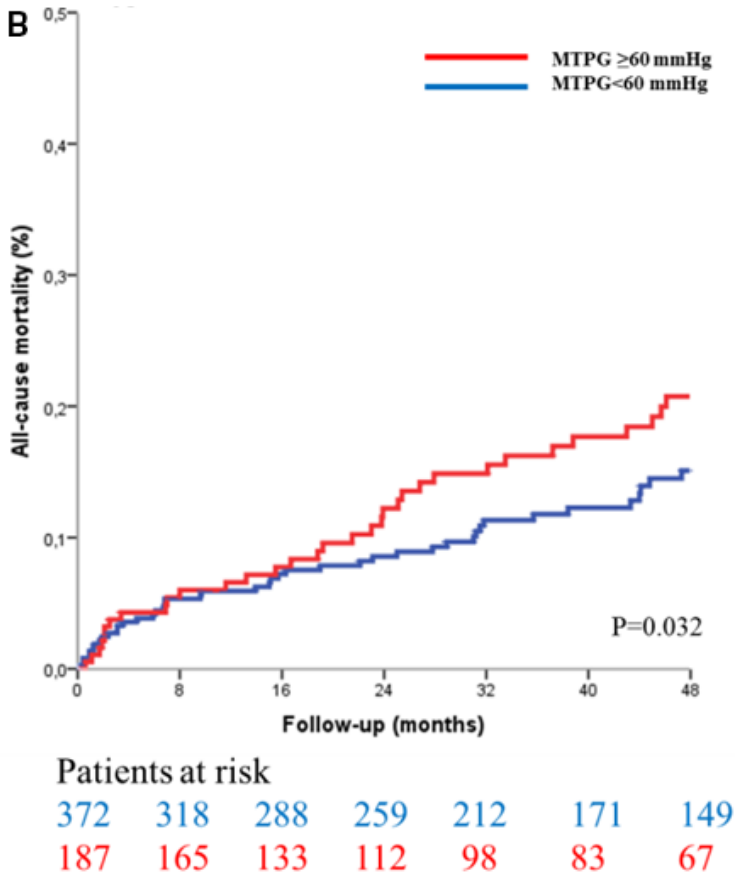
Závěr

- Pokrok kardiochirurgie (↘ *mortalita a morbidita, miniinvazívní operace, lepší protézy, záchovné operace, Ross*) a intervenční kardiologie (TAVI) má za následek tendenci k časnějším intervencím.
- Časnější indikace u vybraných pacientů by měly vést ke zlepšení dlouhodobé prognózy.
- Pokrok ve zobrazovacích metodách umožňuje lépe stratifikovat asymptomatické pacienty, zpřesnit a zjemnit indikační kritéria.
- Dochází k posunům při volbě konkrétních intervencí (↑ *TAVI, možnost a perspektiva ViV TAVI*…)

Souhrn

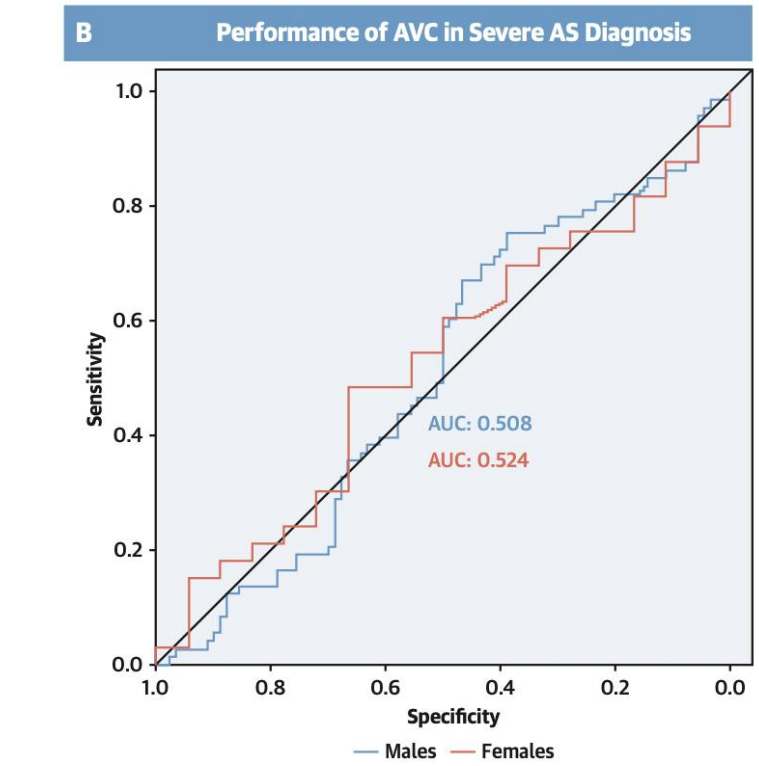
- Asymptomatická AoS:
  - obecně liberálnější přístup k indikaci intervence
  - vytipování rizikovějších pacientů: EF při dolní hranici normy
    snížený GLS
    těsnější stenóza
- Srdeční selhání + střední AoS:
  - lze zvážit individuálně TAVI (refrakterní SS)

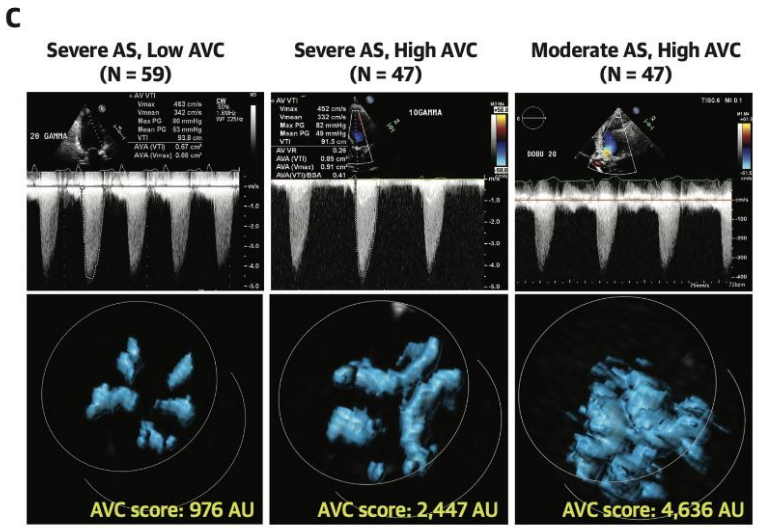




J Am Heart Assoc. 2017;6:e005850. DOI: 10.1161/JAHA.117.005850.)

CENTRAL ILLUSTRATION Continued

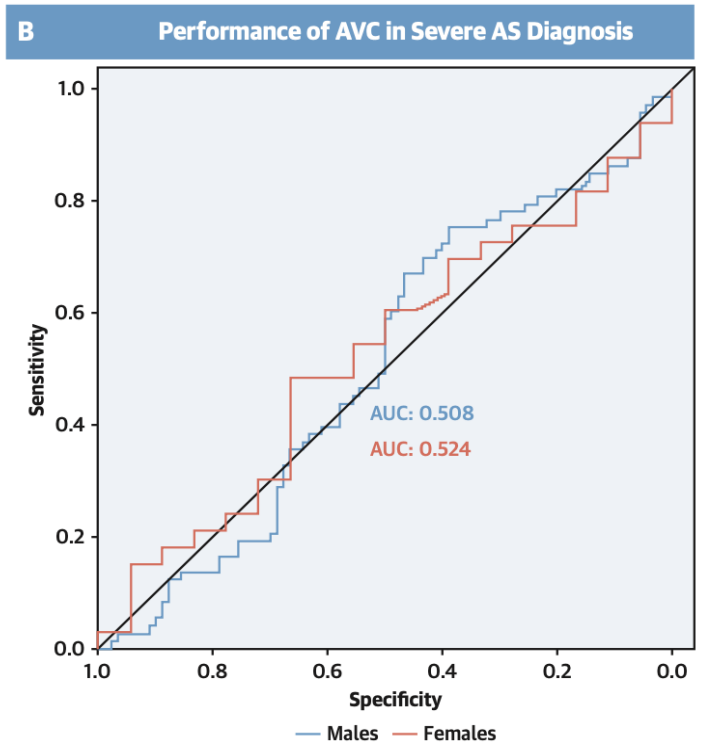


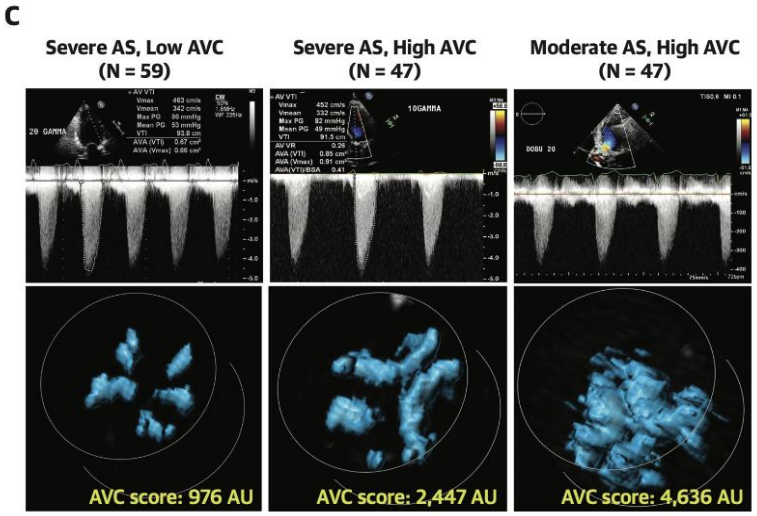


Adrichem R, et al. JACC Cardiovasc Imaging. 2024;17(8):847-860.

Kalciové skóre aortální chlopně

CENTRAL ILLUSTRATION Continued

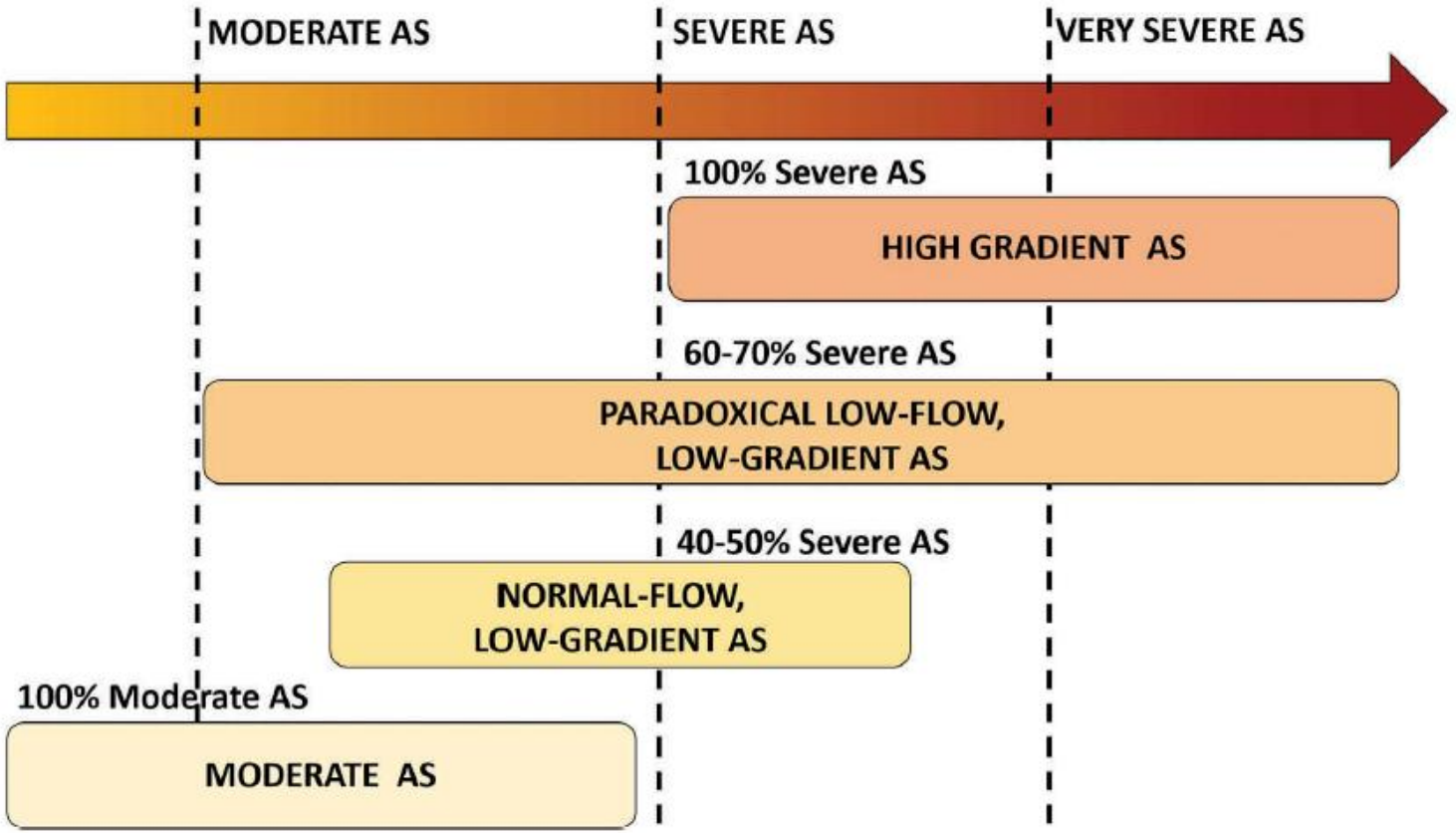




Adrichem R, et al. JACC Cardiovasc Imaging. 2024;17(8):847-860.

Diskrepantní parametry AoS

~ 40 %

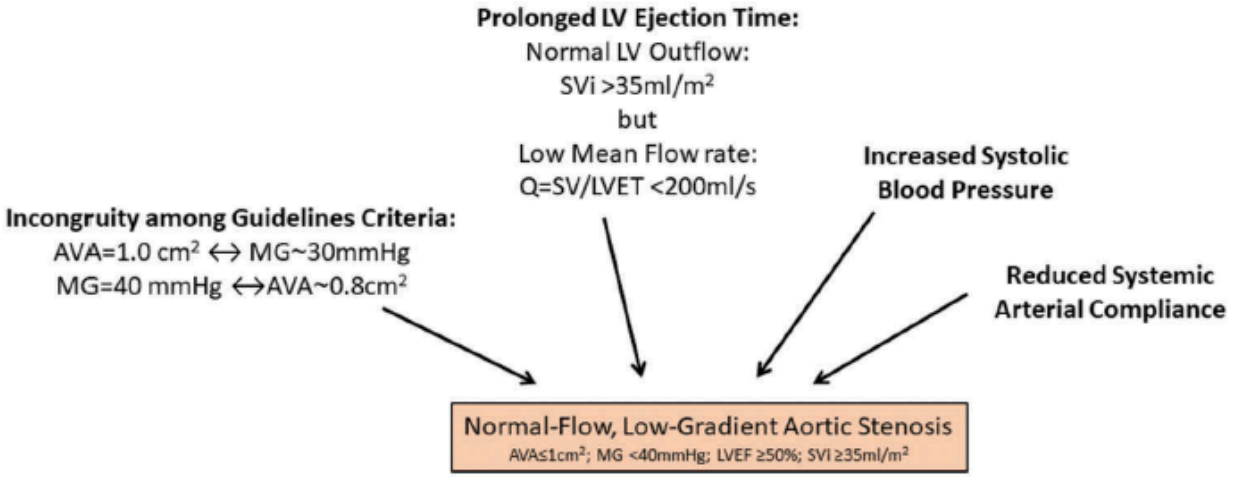


	MPG	AVAc	SVI
	≥40	<1,0	
	<40	<1,0	< 35
	<40	<1,0	≥ 35

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

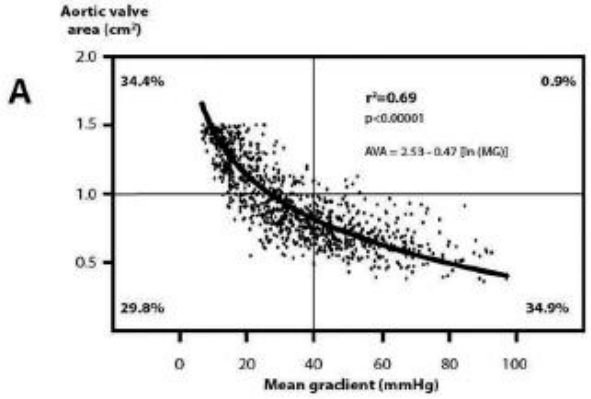
Normal flow low gradient AoS

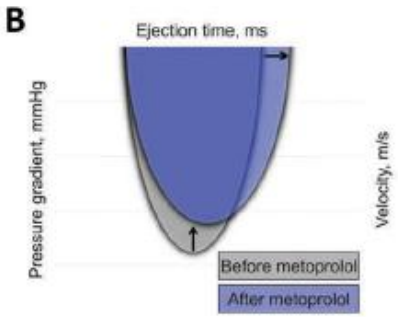
AVAc < 1,0 cm² a MG < 40 mmHg ***ALE*** **SVI > 35 ml/m²** ~ 20 %

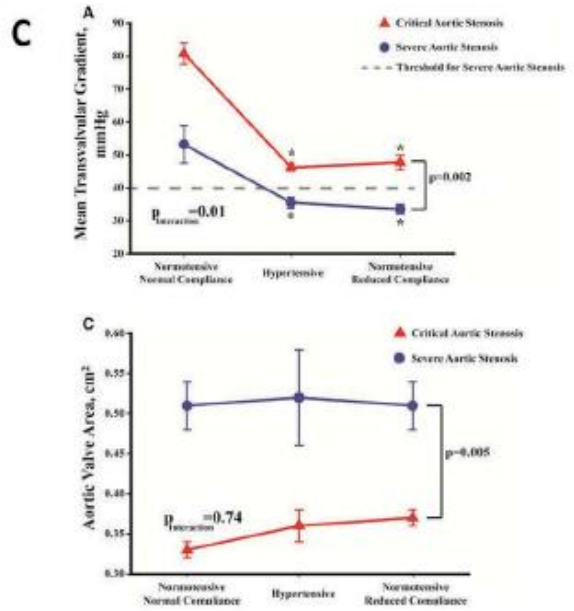


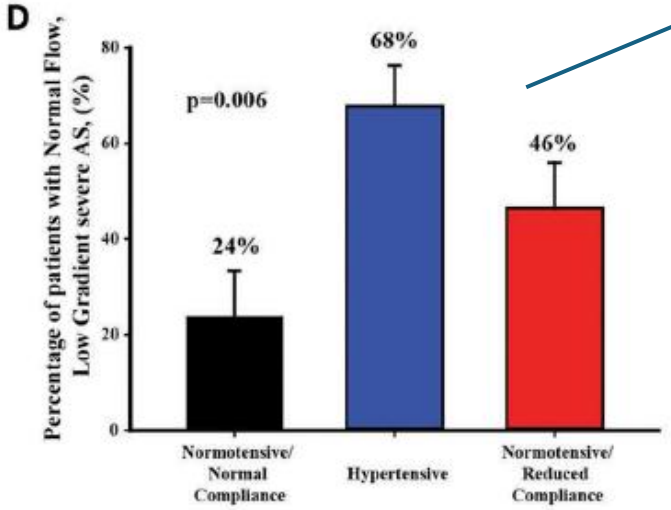
Systemic arterial compliance = SVI/(SBP-DBP)
< 0,6 ml/m²/mmHg

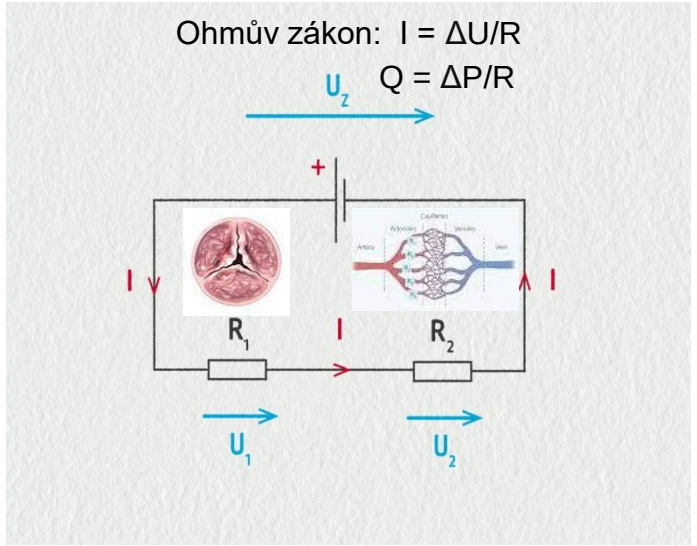
Clavel MA et al. Structural Heart 2018;2:180-187







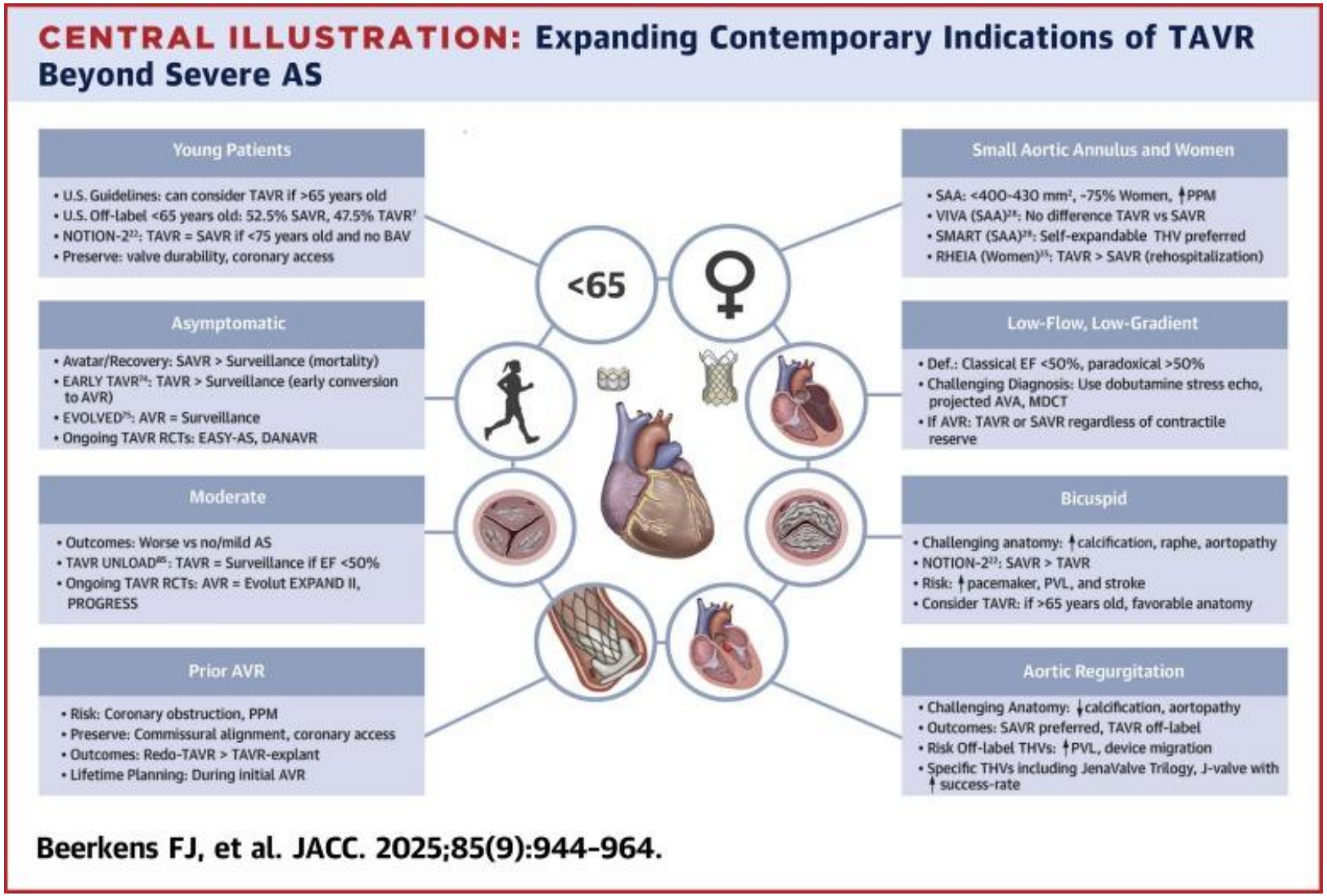




Systemic arterial compliance = SVI/(SBP-DBP)
< 0,6 ml/m²/mmHg

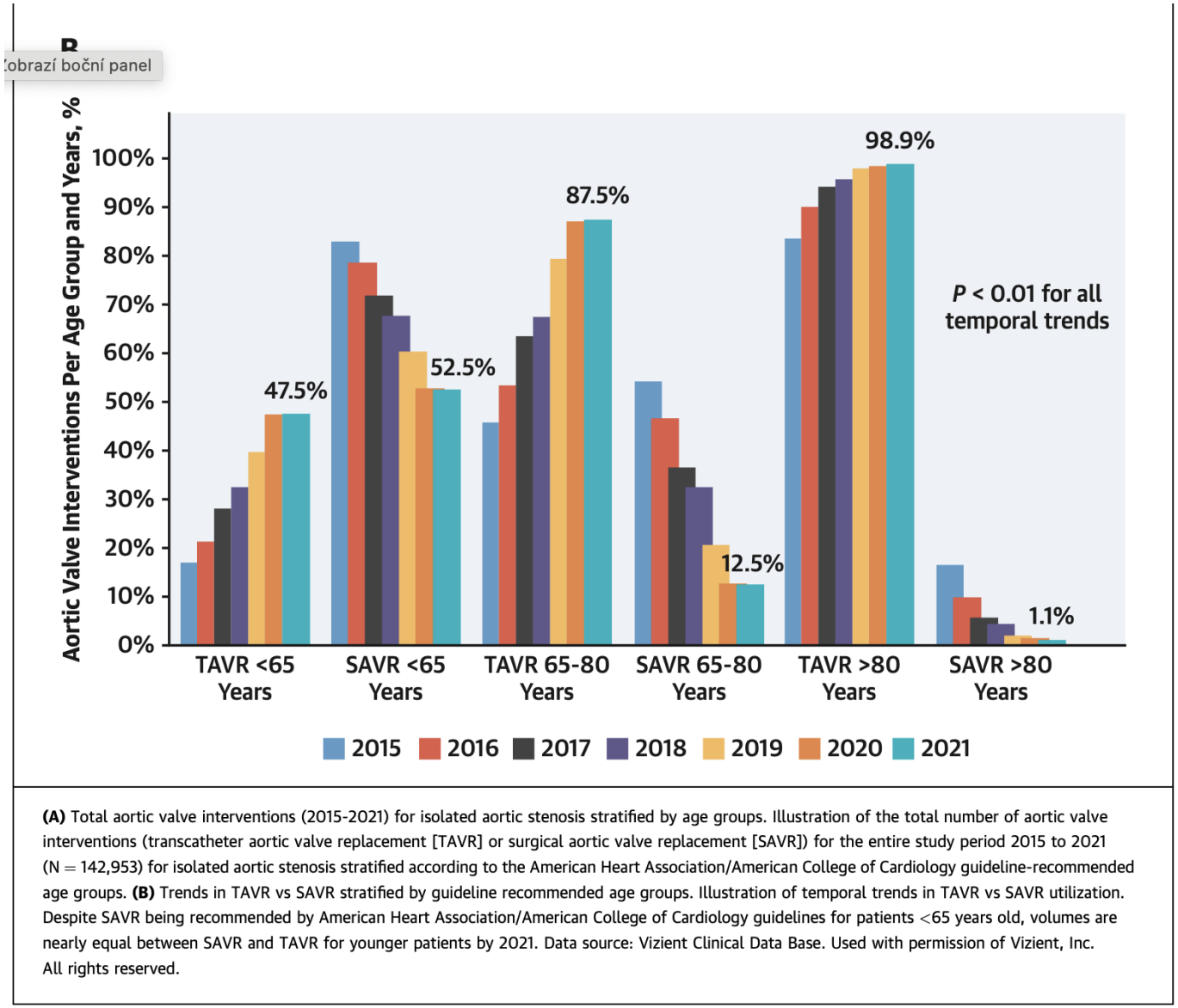
Clavel MA et al. Structural Heart 2018;2:180-187

Expanze TAVI, vč. nízce rizikových skupin



Vývoj TAVI v USA 2015-2021

Vizient Clinical Data Base
800 akademických center
z toho 250 TAVR i SAVR



(A) Total aortic valve interventions (2015-2021) for isolated aortic stenosis stratified by age groups. Illustration of the total number of aortic valve interventions (transcatheter aortic valve replacement [TAVR] or surgical aortic valve replacement [SAVR]) for the entire study period 2015 to 2021 (N = 142,953) for isolated aortic stenosis stratified according to the American Heart Association/American College of Cardiology guideline-recommended age groups. **(B)** Trends in TAVR vs SAVR stratified by guideline recommended age groups. Illustration of temporal trends in TAVR vs SAVR utilization. Despite SAVR being recommended by American Heart Association/American College of Cardiology guidelines for patients <65 years old, volumes are nearly equal between SAVR and TAVR for younger patients by 2021. Data source: Vizient Clinical Data Base. Used with permission of Vizient, Inc.

JACC 2022;80:2054-2056