TAVI

Welche Entwicklungen sind zu erwarten?

Univ.-Prof. Dr. med. Oliver Borst
Medizinische Klinik III
Abteilung für Kardiologie, Angiologie & Kreislauferkrankungen
Universitätsklinikum Tübingen

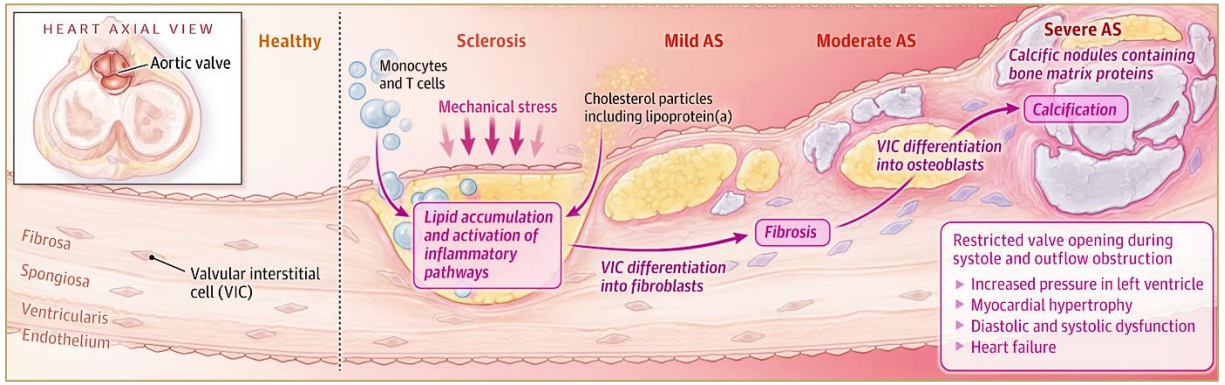
Interessenskonflikte

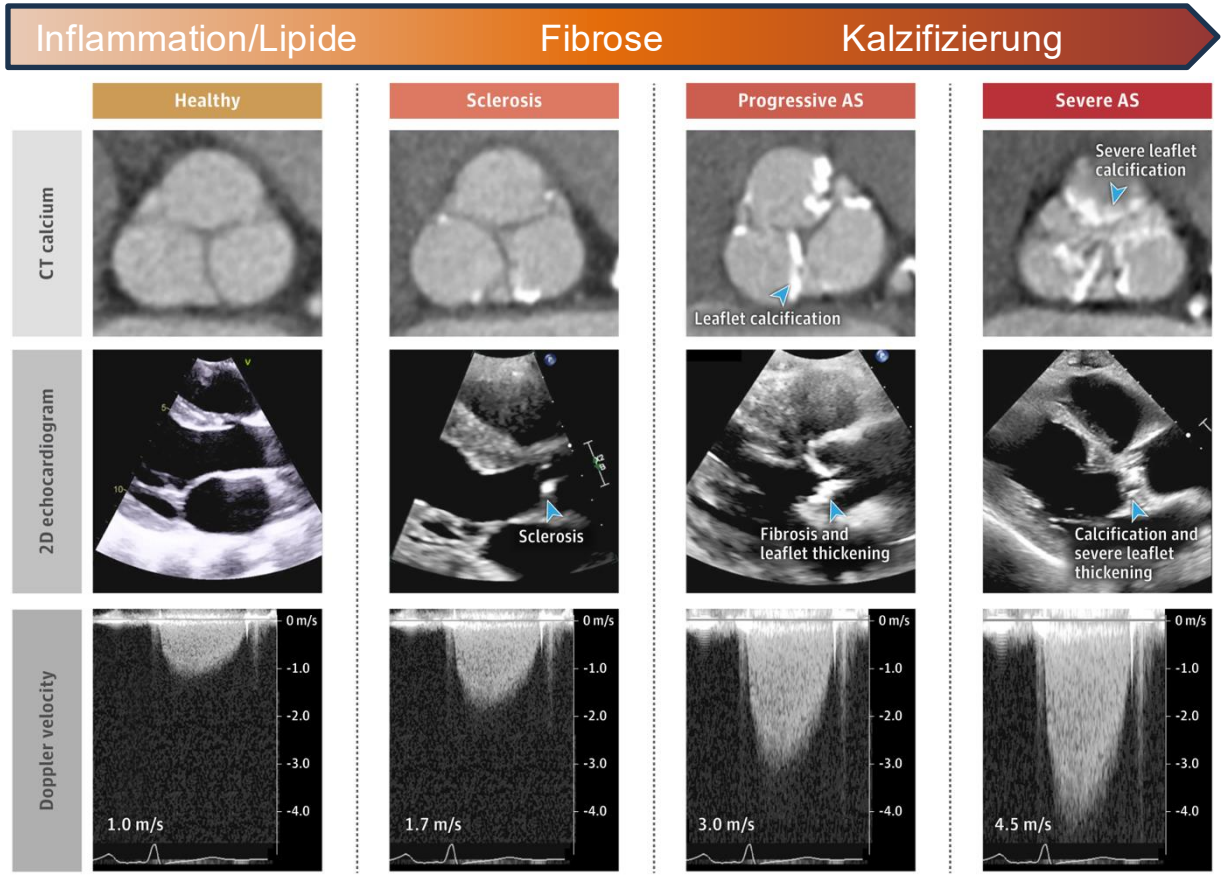
Vortragshonorare: Bayer Vital, Daiichi Sankyo, Pfizer, Amgen, Sanofi, Edwards Lifesciences, Boston Scientific

Beratertätigkeit: Amgen, Bayer Vital, Daiichi Sankyo, Maquet, Medtronic

Studienzuwendung/Forschungsförderung: Edwards Lifesciences, Bayer Vital, Medtronic

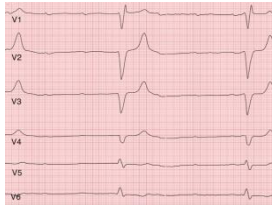
Aortenklappenstenose

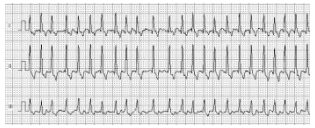




Otto CM, JAMA 2024

Aortenklappenstenose





Aortenstenose

Ventrikelhochdruck
LV-Wandspannung ↑

RR-Entgleisung

LV-Hypertrophie

Transmuraler Koronardruck ↑

TAA/ VHFlim

O2-Verbrauch ↑

ACS/KHK

Koronar-durchblutung ↓

Myokardhypoxie

Diastolische Dysfunktion

Anämie

Systolische Dysfunktion

LV-Füllungsdruck ↑

Bradykardie

Low Output

Mitralklappen-insuffizienz

Pulmonale Hypertonie

RV-Dysfunktion

(Akute) Dekompensation Herzinsuffizienz

Trikuspidalklappen-insuffizienz

Kardiogener Schock

Kamperidis V et al., Eur J Heart Fail 2016

TAVI – Eine Erfolgsgeschichte…

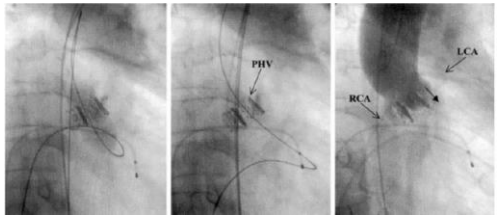
First in man

Circulation — Special Report

Percutaneous Transcatheter Implantation of an Aortic Valve Prosthesis for Calcific Aortic Stenosis

First Human Case Description

Alain Cribier, MD; Helene Eltchaninoff, MD; Assaf Bash, PhD; Nicolas Borenstein, MD; Christophe Tron, MD; Fabrice Bauer, MD; Genevieve Derumeaux, MD; Frederic Anselme, MD; François Laborde, MD; Martin B. Leon, MD



2002

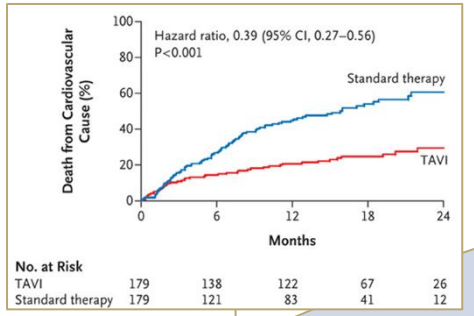
PARTNER

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 — OCTOBER 21, 2010 — VOL. 363 NO. 17

Transcatheter Aortic-Valve Implantation for Aortic Stenosis in Patients Who Cannot Undergo Surgery

Martin B. Leon, M.D., Craig R. Smith, M.D., Michael Mack, M.D., D. Craig Miller, M.D., Jeffrey W. Moses, M.D., Lars G. Svensson, M.D., Ph.D., E. Murat Tuzcu, M.D., John G. Webb, M.D., Gregory P. Fontana, M.D., Raj R. Makkar, M.D., David L. Brown, M.D., Peter C. Block, M.D., Robert A. Guyton, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Pamela S. Douglas, M.D., John L. Petersen, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart Pocock, Ph.D., for the PARTNER Trial Investigators*



2010

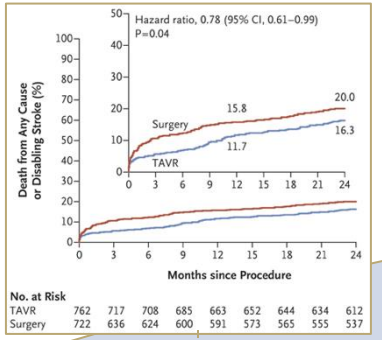
PARTNER-2

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 — APRIL 28, 2016 — VOL. 374 NO. 17

Transcatheter or Surgical Aortic-Valve Replacement in Intermediate-Risk Patients

Martin B. Leon, M.D., Craig R. Smith, M.D., Michael J. Mack, M.D., Raj R. Makkar, M.D., Lars G. Svensson, M.D., Ph.D., Susheel K. Kodali, M.D., Vinod H. Thourani, M.D., E. Murat Tuzcu, M.D., D. Craig Miller, M.D., Howard C. Herrmann, M.D., Darshan Doshi, M.D., David J. Cohen, M.D., Augusto D. Pichard, M.D., Samir Kapadia, M.D., Todd Dewey, M.D., Vasilis Babaliaros, M.D., Wilson Y. Szeto, M.D., Mathew R. Williams, M.D., Dean Kereiakes, M.D., Alan Zajarias, M.D., Kevin L. Greason, M.D., Brian K. Whisenant, M.D., Robert W. Hodson, M.D., Jeffrey W. Moses, M.D., Alfredo Trento, M.D., David L. Brown, M.D., William F. Fearon, M.D., Philippe Pibarot, D.V.M., Ph.D., Rebecca T. Hahn, M.D., Wael A. Jaber, M.D., William N. Anderson, Ph.D., Maria C. Alu, M.M., and John G. Webb, M.D., for the PARTNER 2 Investigators*



2016

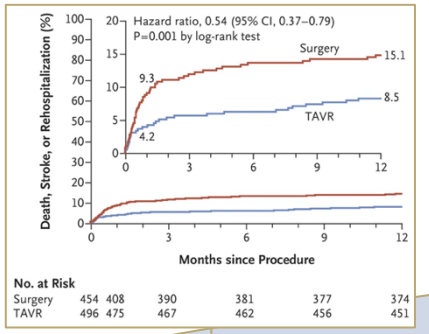
PARTNER-3

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 — MAY 2, 2019 — VOL. 380 NO. 18

Transcatheter Aortic-Valve Replacement with a Balloon-Expandable Valve in Low-Risk Patients

M.J. Mack, M.B. Leon, V.H. Thourani, R. Makkar, S.K. Kodali, M. Russo, S.R. Kapadia, S.C. Malaisrie, D.J. Cohen, P. Pibarot, J. Leipsic, R.T. Hahn, P. Blanke, M.R. Williams, J.M. McCabe, D.L. Brown, V. Babaliaros, S. Goldman, W.Y. Szeto, P. Genereux, A. Pershad, S.J. Pocock, M.C. Alu, J.G. Webb, and C.R. Smith, for the PARTNER 3 Investigators*



2019

Goldstandard

ESC EACTS

Patients ≥70 years with a tricuspid aortic valve if anatomy is suitable

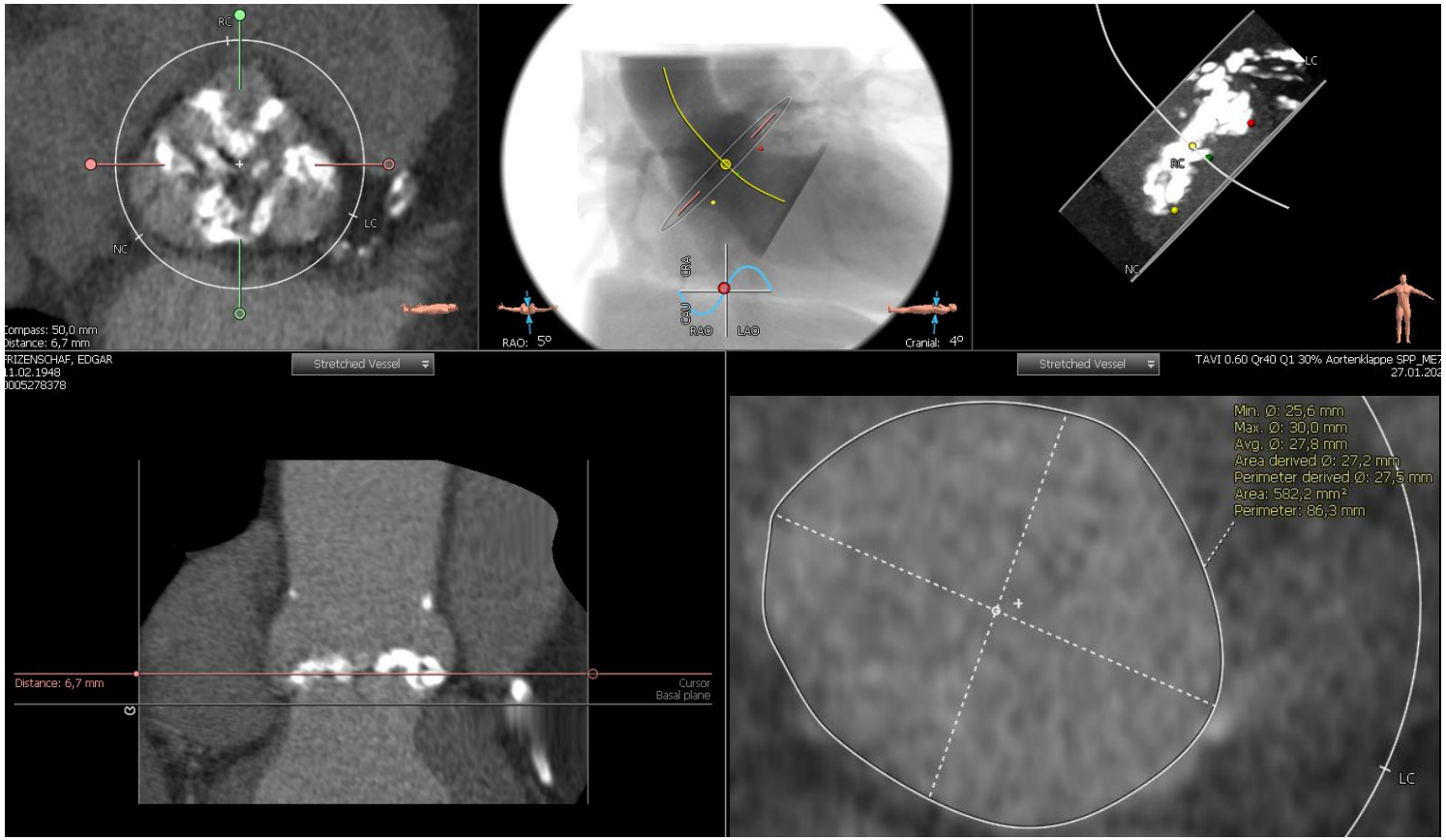
TAVI (Class I)

2025

Goldstandard: Kathetergestützter Aortenklappenersatz (TAVI)

75-jähriger Patient mit symptomatischer hochgradiger Aortenklappenstenose (Dyspnoe NYHA III)

KÖF 0.6 cm² (Pmax/Pmean 96/64 mmHg)



Goldstandard: Kathetergestützter Aortenklappenersatz (TAVI)

75-jähriger Patient mit symptomatischer hochgradiger Aortenklappenstenose (Dyspnoe NYHA III)

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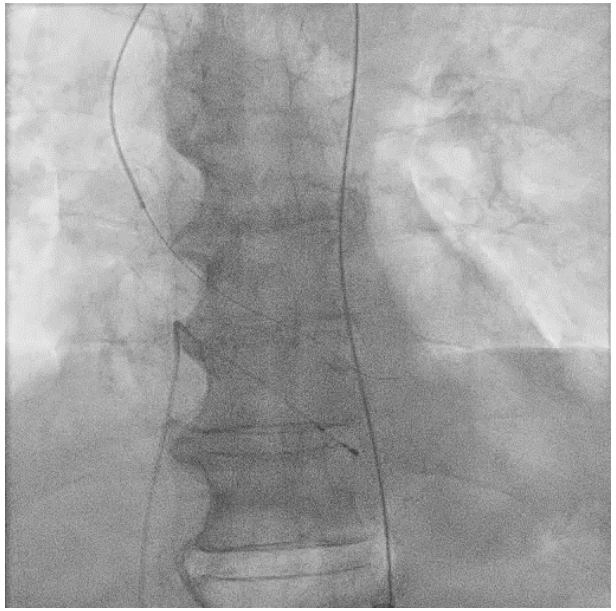
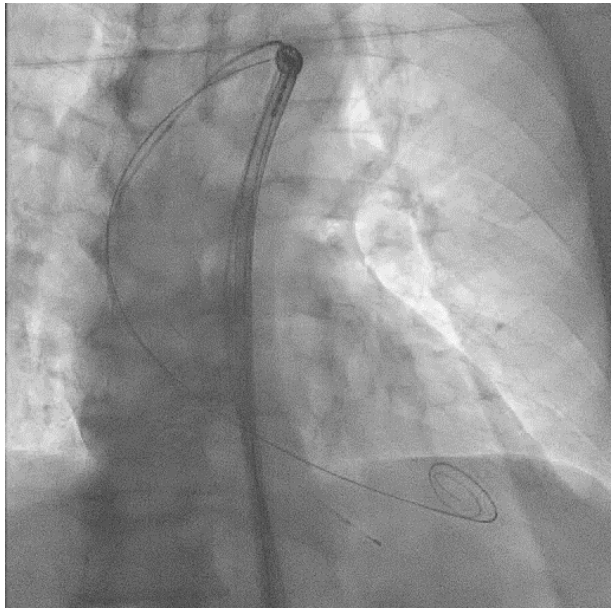
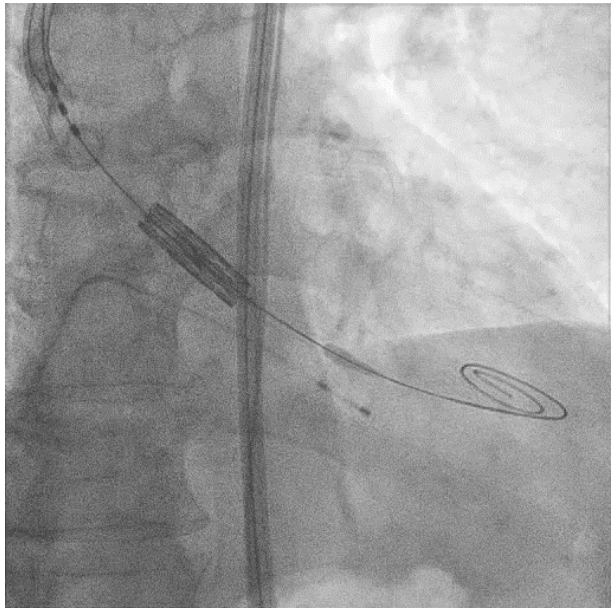
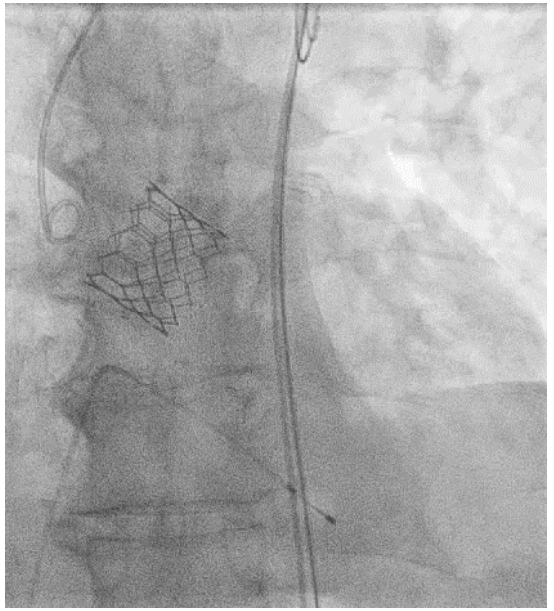





Prozedurzeit 25-35 Minuten
Lokalanästhesie
Klinikaufenthalt 4-6 Tage

Behandlung der Aortenklappenstenose 2026: Offene Fragen

1. Jüngere Patienten/**Lifetime management** – und wen nicht mehr behandeln?
2. Strategien **Valve-in-Valve**
3. **Bikuspide** Aortenklappe
4. Großer Annulus und/oder reine **Aortenklappeninsuffizienz**

Jüngere Patienten („low risk Kollektiv“)

Prozedurerfolg der TAVI ist nachhaltig (5 Jahres Follow up)!

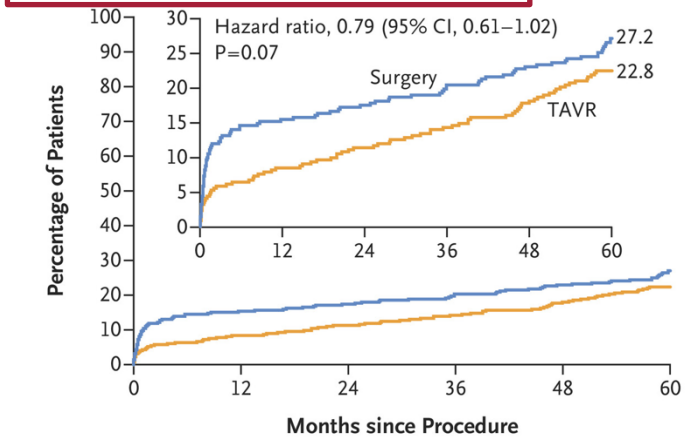
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement in Low-Risk Patients at Five Years

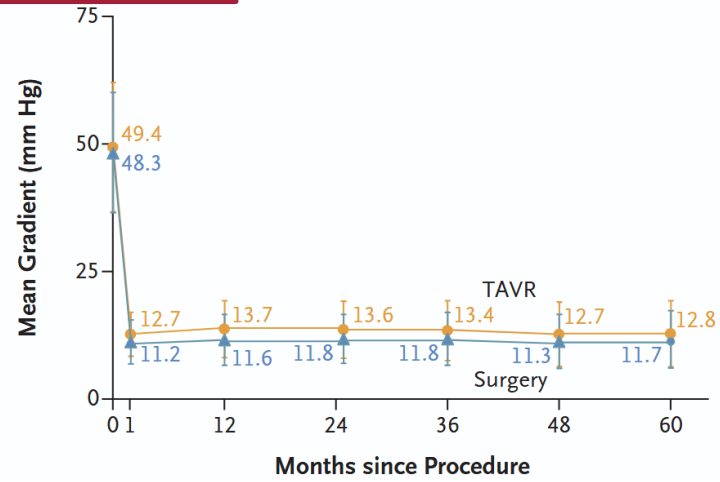
M.J. Mack, M.B. Leon, V.H. Thourani, P. Pibarot, R.T. Hahn, P. Genereux, S.K. Kodali, S.R. Kapadia, D.J. Cohen, S.J. Pocock, M. Lu, R. White, M. Szerlip, J. Ternacle, S.C. Malaisrie, H.C. Herrmann, W.Y. Szeto, M.J. Russo, V. Babaliaros, C.R. Smith, P. Blanke, J.G. Webb, and R. Makkar, for the PARTNER 3 Investigators*

Death from Any Cause, Stroke, or Rehospitalization

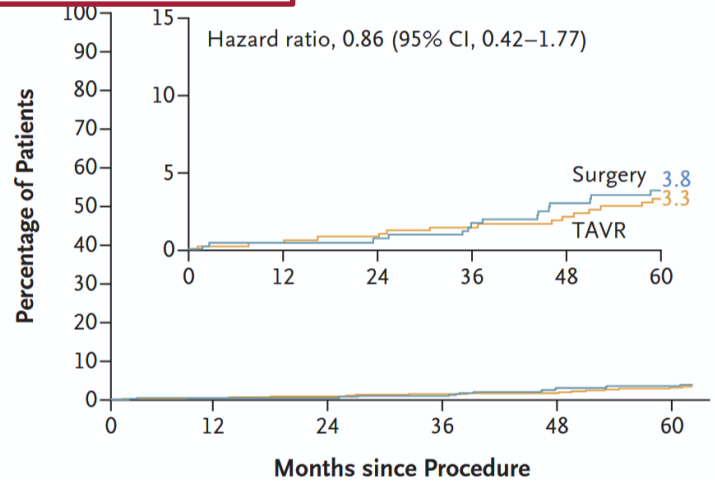


No. at Risk						
Surgery	454	372	349	328	309	276
TAVR	496	453	434	415	391	353

Aortic-Valve Gradient



Bioprosthetic-Valve Failure



Mack MJ et al., N Engl J Med 2023

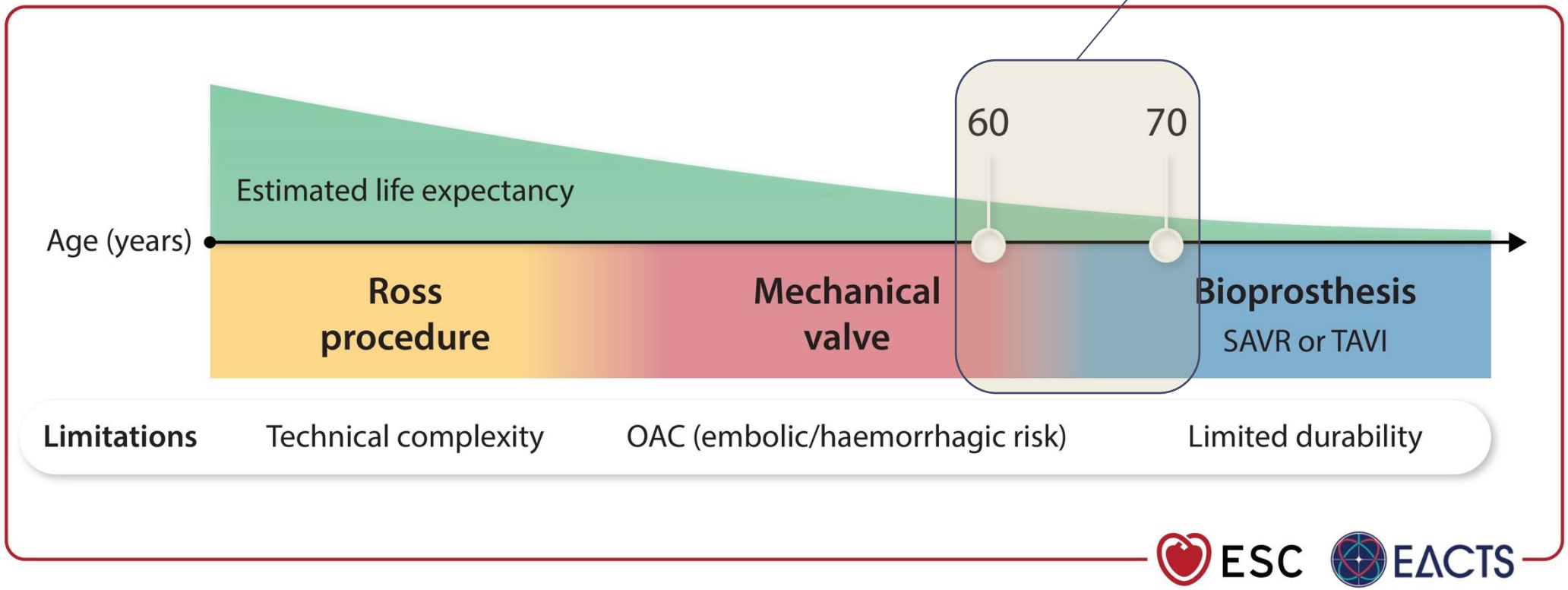
Jüngere Patienten („low risk Kollektiv“)

ESC European Society of Cardiology
European Heart Journal (2025) 46, 4635–4736
https://doi.org/10.1093/eurheartj/ehaf194

ESC GUIDELINES

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

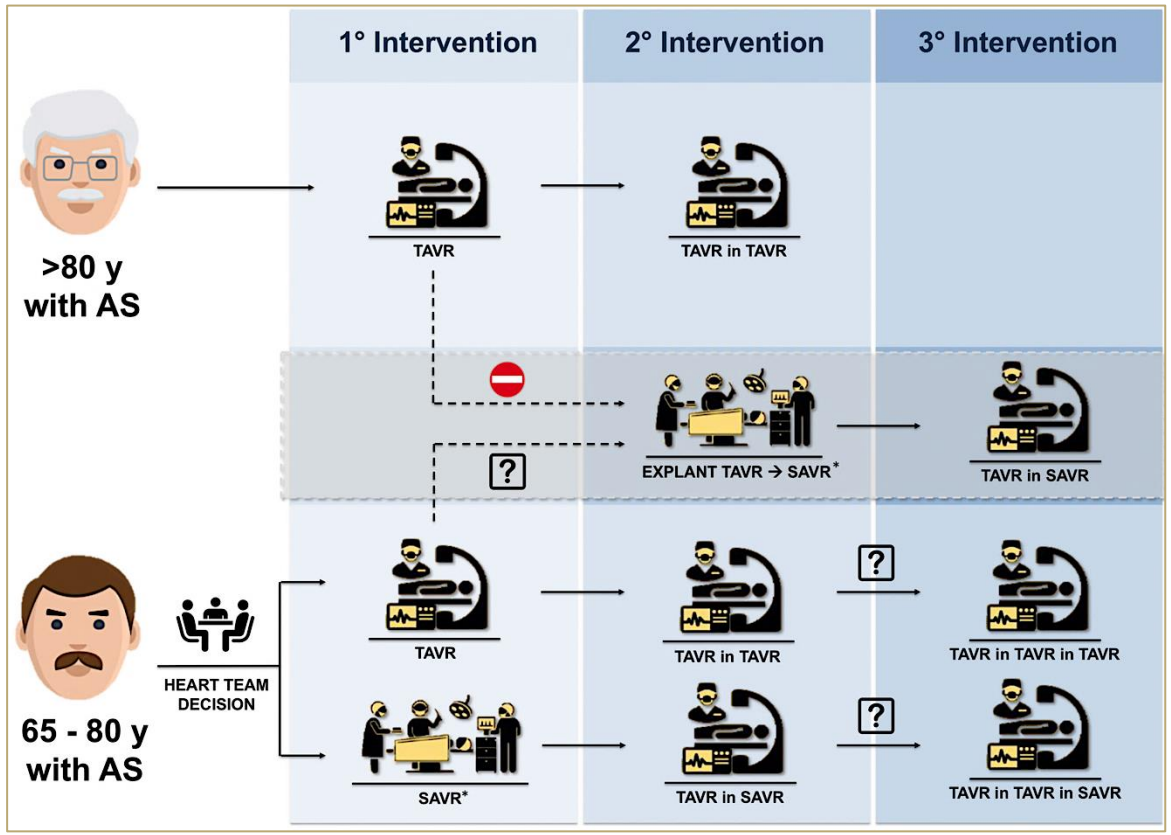
Lifetime Management: Welche Strategie?



60-75 Jahre: Lebenserwartung? Prothese für Ersteingriff immer unter Berücksichtigung für Zweiteingriff?!

Russo G et al., Circulation 2022

Jüngere Patienten („low risk Kollektiv“)

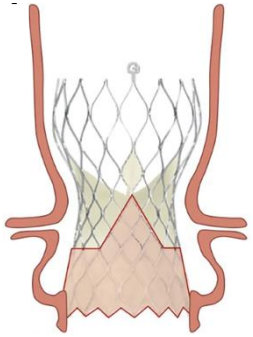


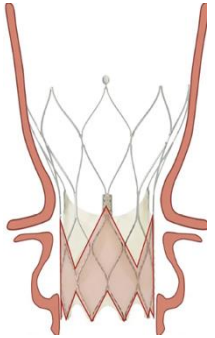
- Anatomie (Annulusgröße, LVOT, A. ascendens)
- Paravalvuläres Leck/AI
- Prothesenhaltbarkeit
- Koronarzugänglichkeit
- Risiko für Schrittmacherpflichtigkeit

Selbstexpandier-/Repositionierbar

CV Evolut FX+

Navitor

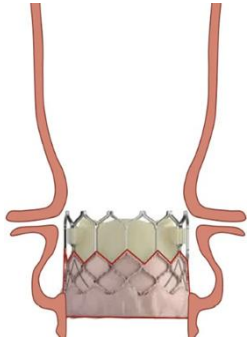


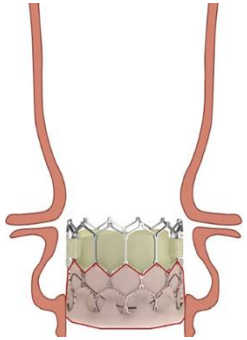


Ballonexpandierbar

ESIII Ultra (Resilia)

Octapro





Valve in Valve

Russo G et al., Circulation 2022

Valve-in-Valve

- **Ursache Degeneration?** Prothesenmismatch? Thrombose? Degeneration?

  TEE und CT-Gefäße, ggf. OAK oder Cracking der Prothese

- **Supraanuläre oder intraanuläre Prothese?**

  Rigidiät und true ID des biologischen AKE?

- **Koronarzugänglichkeit?**

  Prothesentyp mit hohem Koronarobstruktionsrisiko?

  Bspw. BASILICA Device oder Protektion des Koronargefäßes? Re-OP?

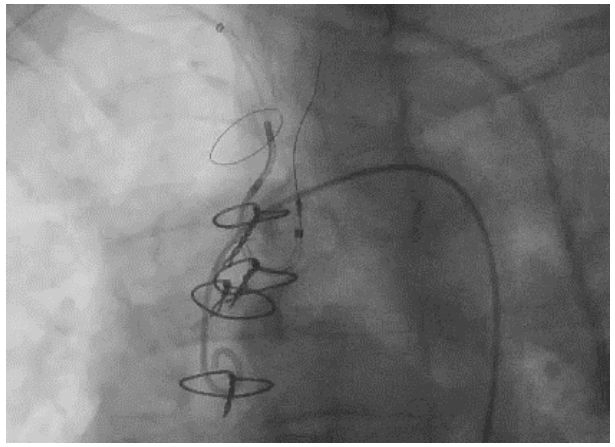
- **Embolierisiko?**

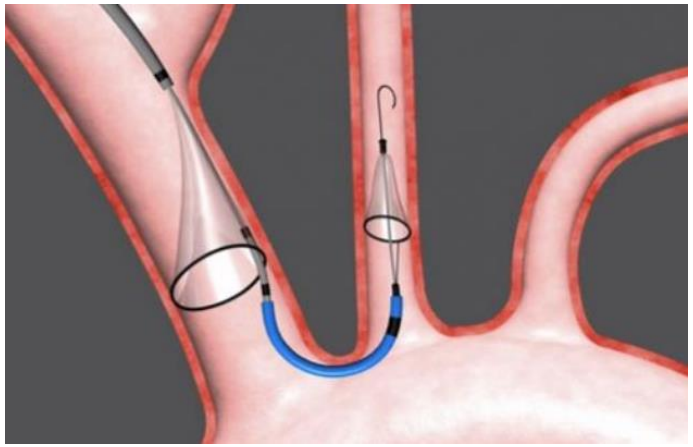
  Cerebrale Protektionssysteme (Sentinel oder Triguard)

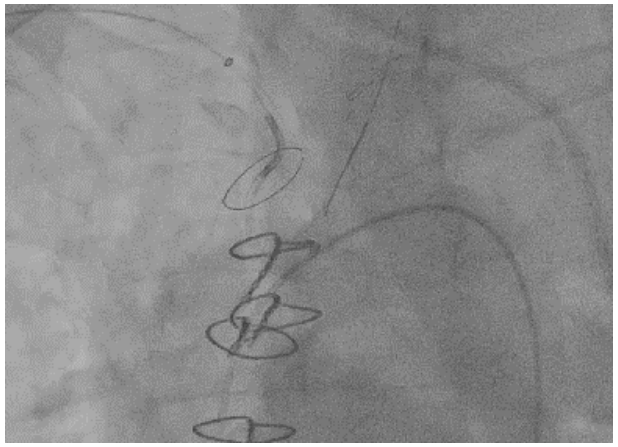
Valve-in-Valve: TAVI in AKE

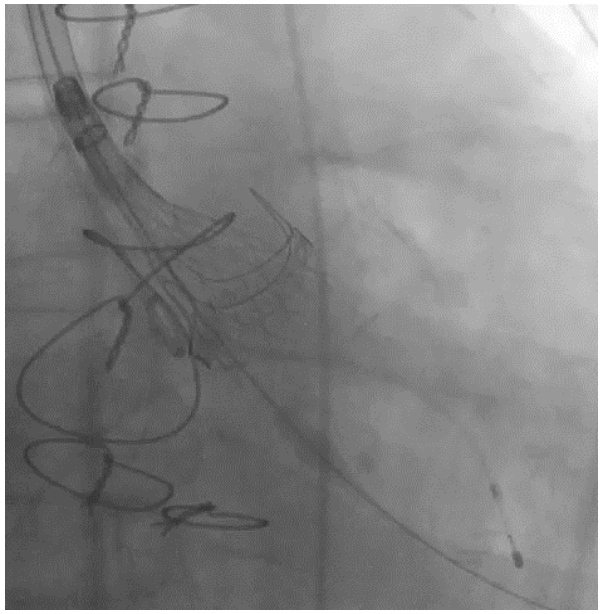
Valve-in-Valve TAVI (Supravalvuläre CoreValve Prothese 29 mm in Perimount 25 mm Bioprothese)

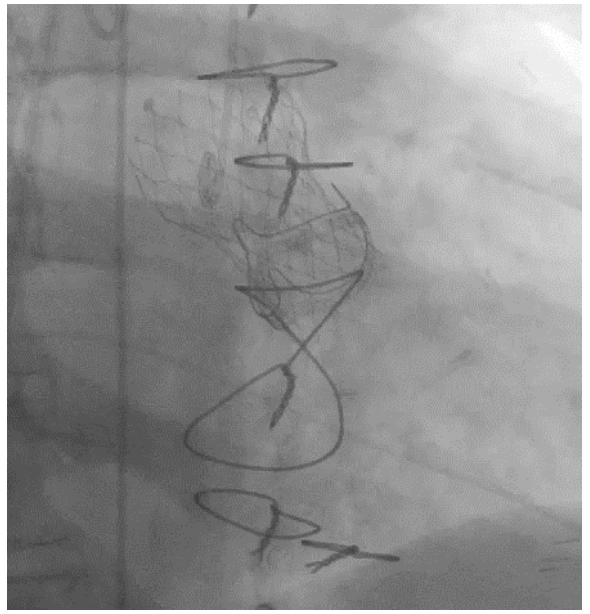
+ Cerebrale Protektion (Sentinel)





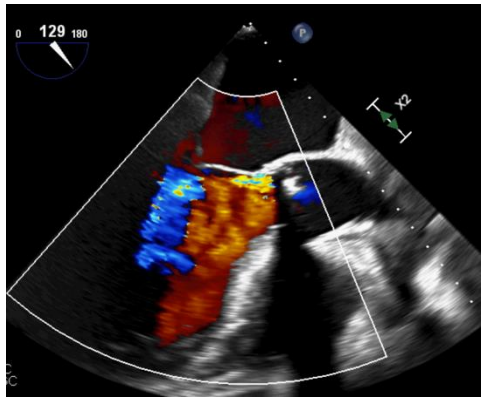


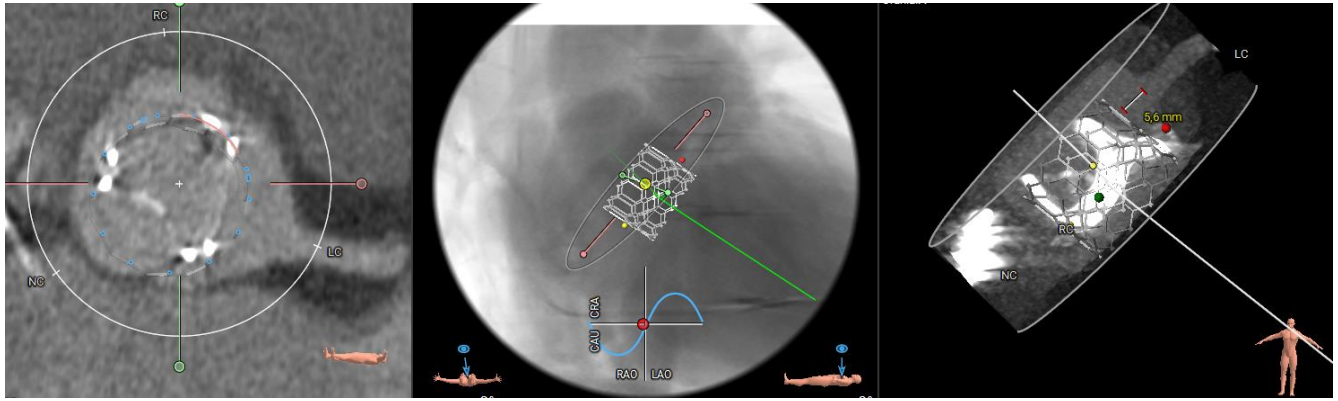


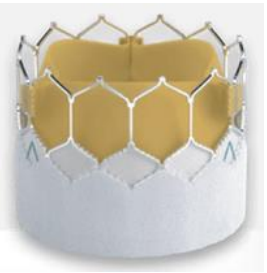


Jüngere Patienten: Redo after SAVR

65 jähriger Patient, Z.n. zweimaligem AKE (AS 2017, dann Endokarditis 2019), aktuell schwere **transvalvuläre AI** der 25 mm Magna Ease Prothese mit LV-Dilatation (EF 45%) und Dyspnoe NYHA III

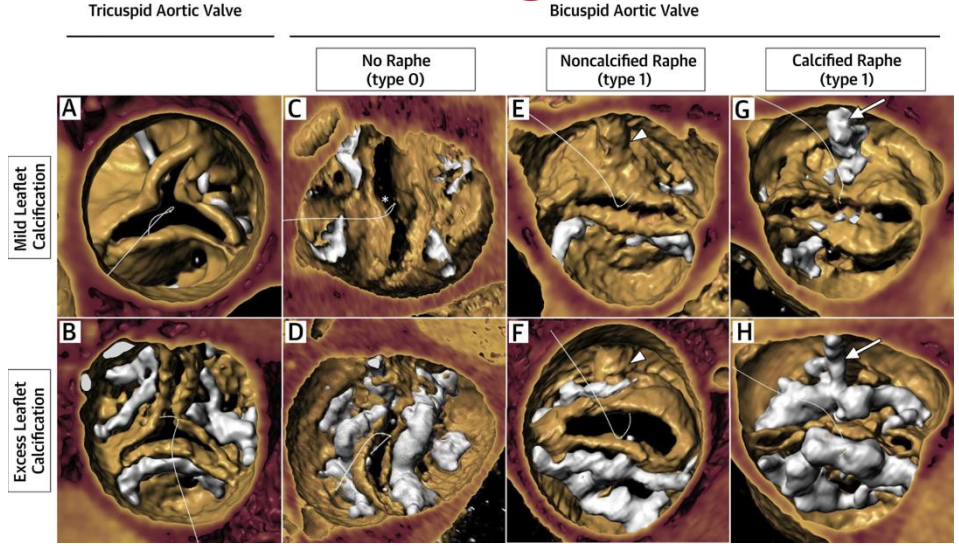


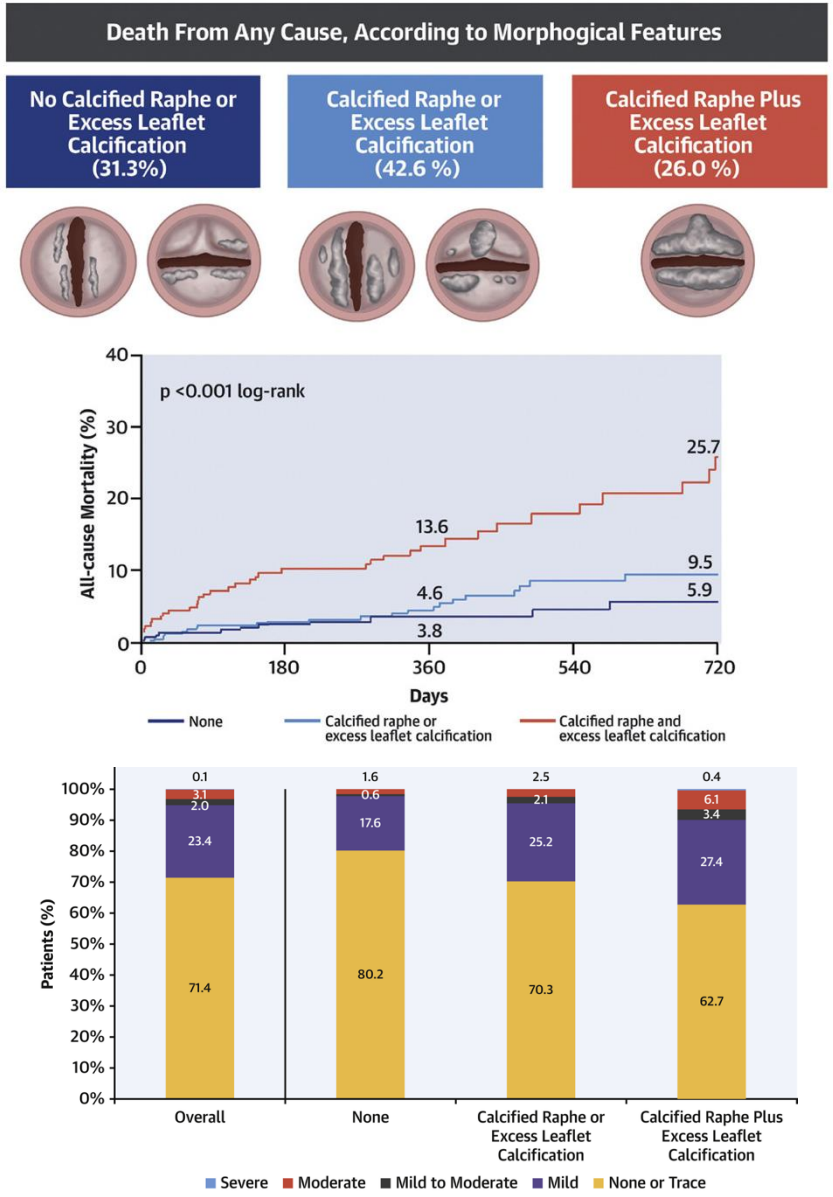




Bikuspide Aortenklappe

	Type 0	Type 1				Type 2
Main Category Number of raphes	0 raphe		1 raphe			2 raphe
	21(7)		269(88)			14(5)
Subcategory 1 Spatial position of: • Cusps in type 0 • Raphes in types 1 and 2	Lat.	AP	L-R	R-N	N-L	L-R / R-N
	13(4)	7(2)	216(71)	45(15)	8(3)	14(5)

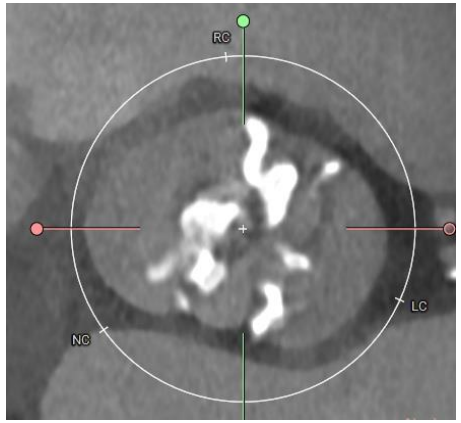


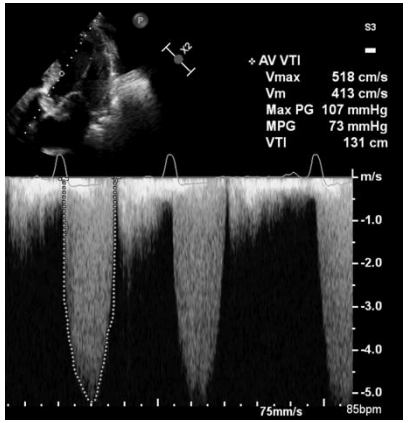


Yoon SH et al., J Am Coll Cardiol 2020
Loftus PD et al., STS Cardiothoracic Surgery 2025

Bikuspide Aortenklappe

70 jähriger Patient, Dyspnoe NYHA III, bikuspide Aortenklappe (Sievers Typ 0) mit high gradient Aortenklappenstenose



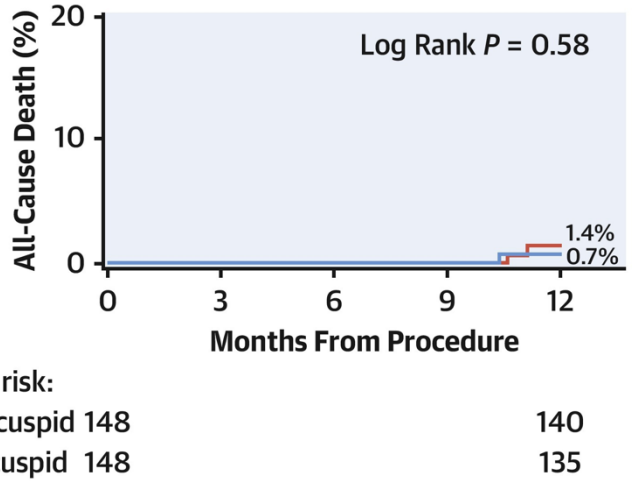


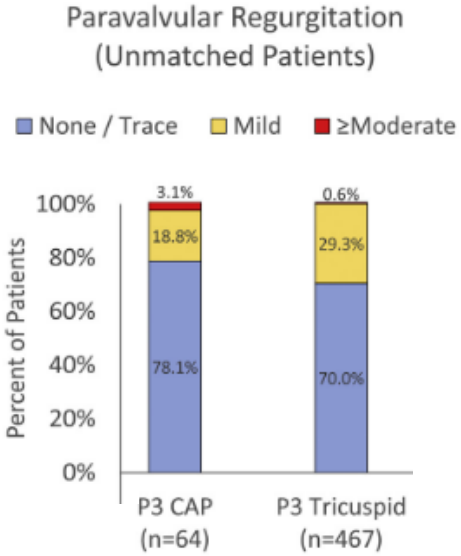
JACC: CARDIOVASCULAR INTERVENTIONS VOL. 15, NO. 5, 2022

PUBLISHED BY ELSEVIER

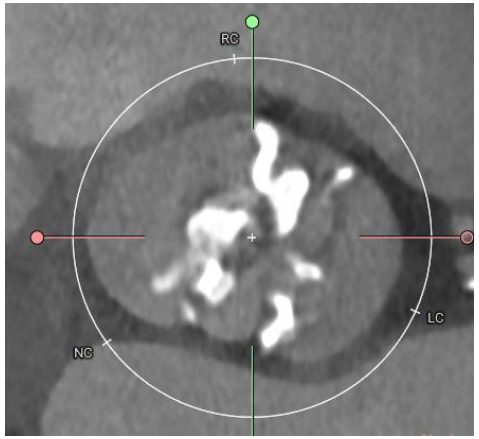
The PARTNER 3 Bicuspid Registry for Transcatheter Aortic Valve Replacement in Low-Surgical-Risk Patients

Mathew R. Williams, MD,[a,*] Hasan Jilaihawi, MD,[a,*] Raj Makkar, MD,[b] William W. O'Neill, MD,[c] Robert Guyton, MD,[d] S. Chris Malaisrie, MD,[e] David L. Brown, MD,[f] Philipp Blanke, MD,[g] Jonathon A. Leipsic, MD,[g] Philippe Pibarot, DVM, PhD,[h] Rebecca T. Hahn, MD,[i,j] Martin B. Leon, MD,[i,j] David J. Cohen, MD,[j,k] Jeroen J. Bax, MD, PhD,[l] Susheel K. Kodali, MD,[i] Michael J. Mack, MD,[f] Michael Lu, PhD,[m] John G. Webb, MD[g]



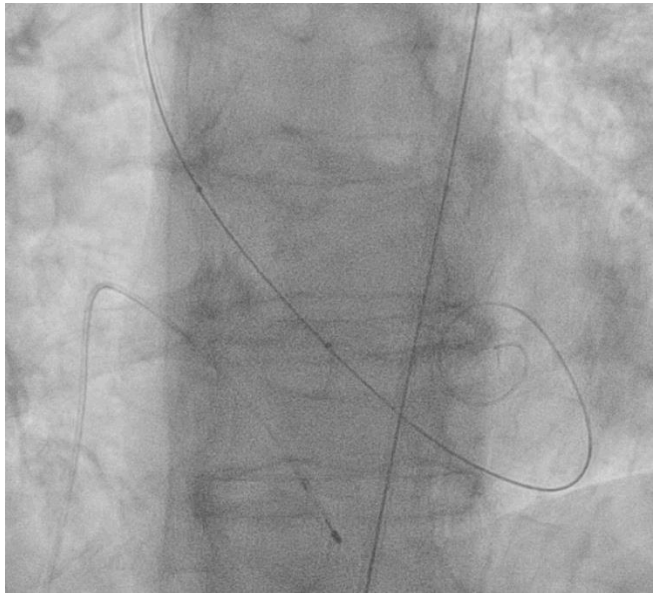


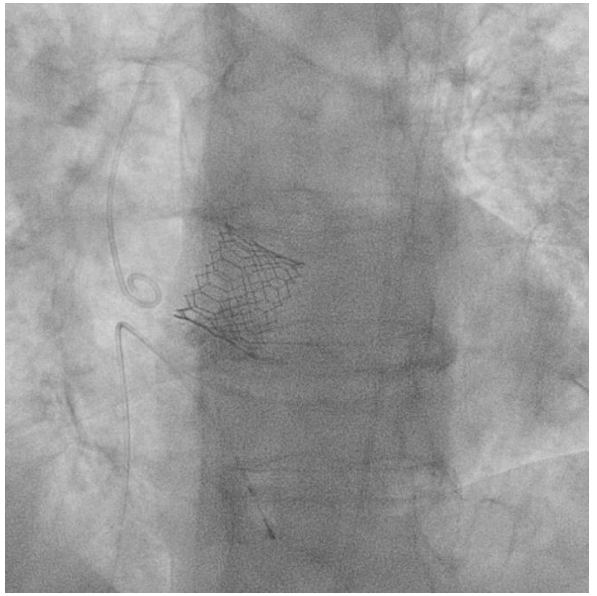
Bikuspide Aortenklappe

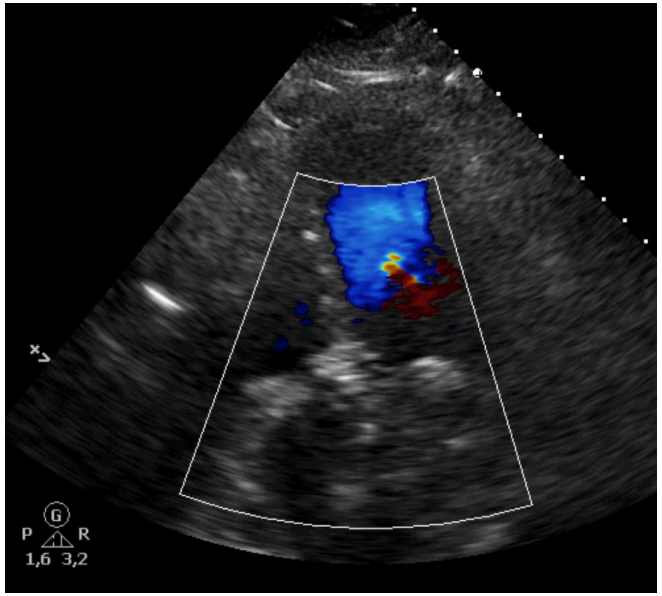


Ist die TAVI sicher in dieser bikuspiden Anatomie?

- Annulus diameter passend (für 29 mm Prothese)
- A. ascendens nicht signifikant erweitert (43 mm)
- Keine verkalkte Raphe
- Keine extreme Verkalkung der Segel







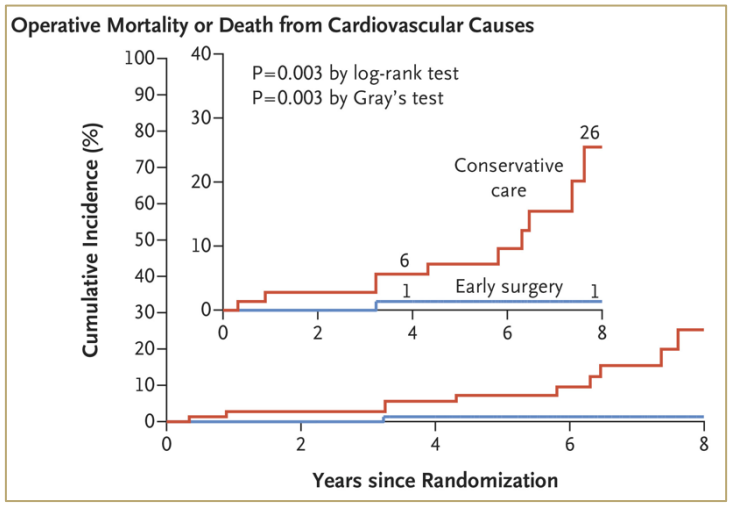
Lifetime Management: AKE/TAVI aus prognostischer Indikation

The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 JANUARY 9, 2020 VOL. 382 NO. 2

Early Surgery or Conservative Care for Asymptomatic Aortic Stenosis

Duk-Hyun Kang, M.D., Ph.D., Sung-Ji Park, M.D., Ph.D., Seung-Ah Lee, M.D., Sahmin Lee, M.D., Ph.D., Dae-Hee Kim, M.D., Ph.D., Hyung-Kwan Kim, M.D., Ph.D., Sung-Cheol Yun, Ph.D., Geu-Ru Hong, M.D., Ph.D., Jong-Min Song, M.D., Ph.D., Cheol-Hyun Chung, M.D., Ph.D., Jae-Kwan Song, M.D., Ph.D., Jae-Won Lee, M.D., Ph.D., and Seung-Woo Park, M.D., Ph.D.

Mittleres Alter 65 Jahre
>50% bikuspide AK
Pmean AK >60 mmHg
Normale LVEF

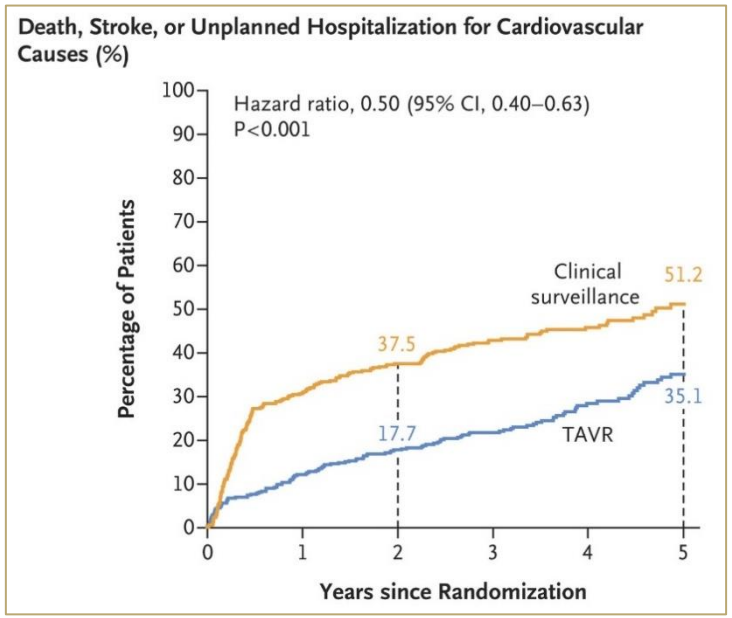


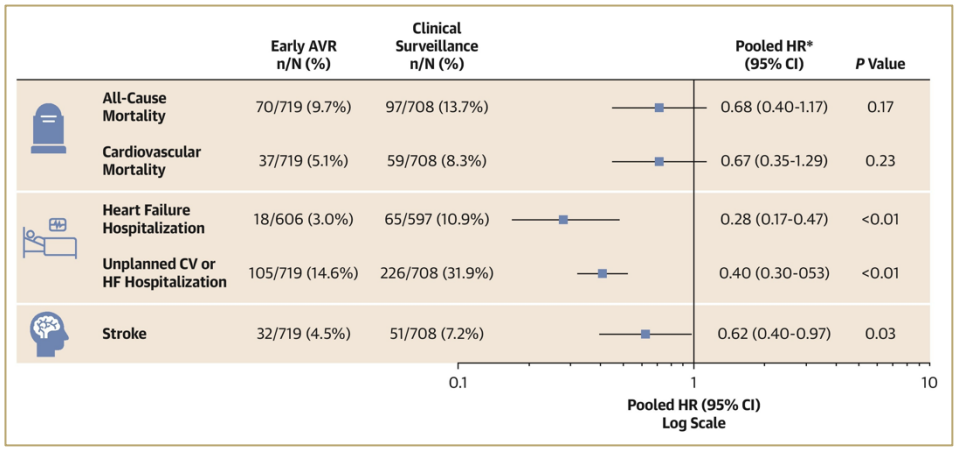
The NEW ENGLAND JOURNAL of MEDICINE
ESTABLISHED IN 1812 JANUARY 16, 2025 VOL. 392 NO. 3

Transcatheter Aortic-Valve Replacement for Asymptomatic Severe Aortic Stenosis

P. Généreux, A. Schwartz, J.B. Oldemeyer, P. Pibarot, D.J. Cohen, P. Blanke, B.R. Lindman, V. Babaliaros, W.F. Fearon, D.V. Daniels, A.K. Chhatriwalla, C. Kavinsky, H. Gada, P. Shah, M. Szerlip, T. Dahle, K. Goel, W. O'Neill, T. Sheth, C.J. Davidson, R.R. Makkar, H. Prince, Y. Zhao, R.T. Hahn, J. Leipsic, B. Redfors, S.J. Pocock, M. Mack, and M.B. Leon, for the EARLY TAVR Trial Investigators*

Mittleres Alter 76 Jahre
8% bikuspide AK
Pmean AK 47 mmHg
Normale LVEF
NT-proBNP <300 pg/ml



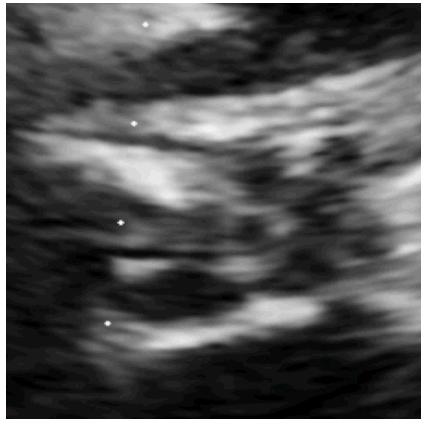


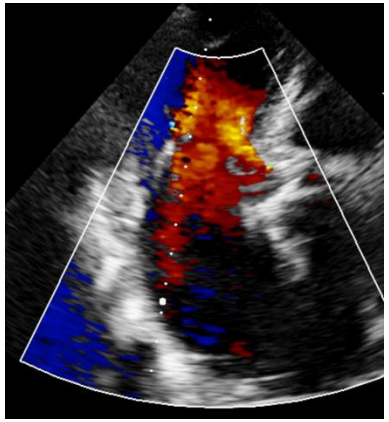
Kang DH et al., N Engl J Med 2020
Généreux P et al., N Engl J Med 2025
Généreux P et al., J Am Coll Cardiol 2025

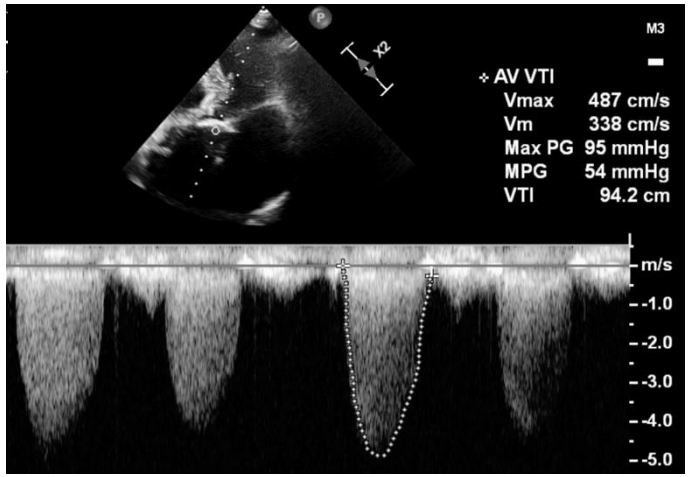
Lifetime Mangement/Therapie der AS: Wann ist es noch sinnvoll?

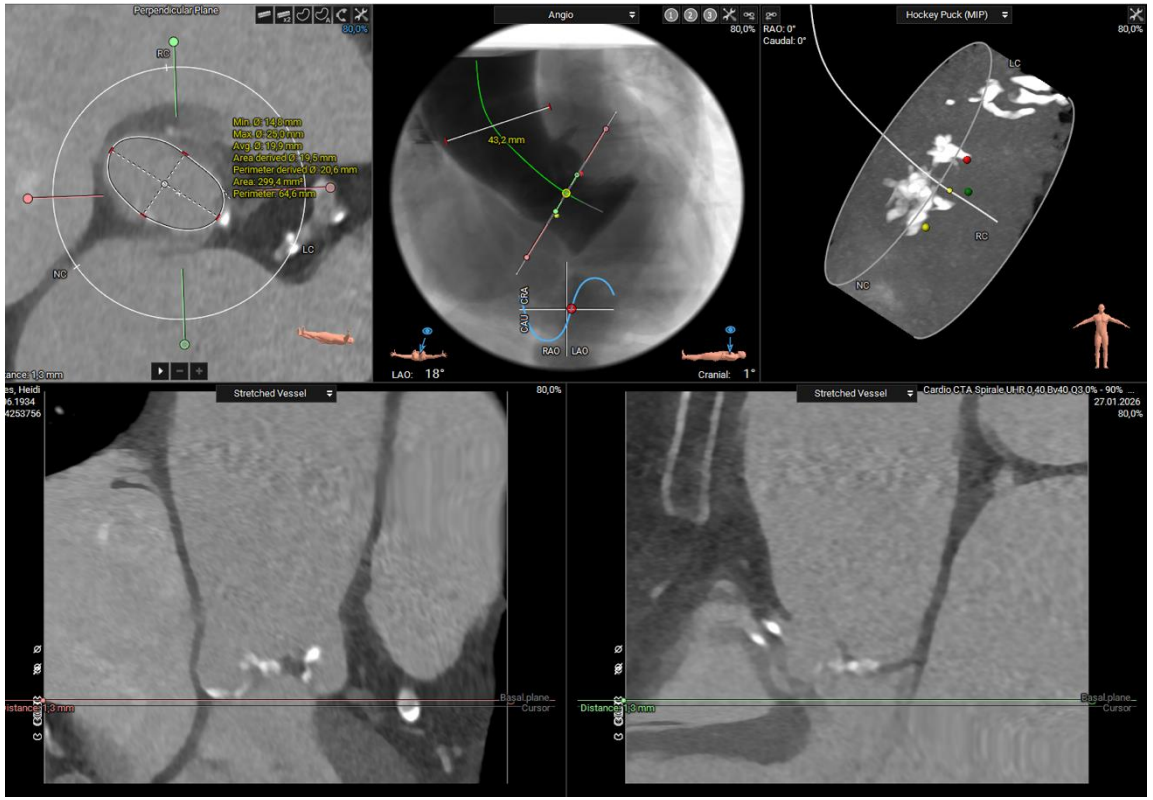
91 jährige sehr rüstige selbstversorgende Patientin, Dyspnoe NYHA IV bei high gradient Aortenklappenstenose und sekundären AV-Vitien bei normaler LVEF

Vor 5 Jahren kein Therapiewunsch aufgrund des nach eigener Auffassung hohen Alters, jetzt dringender Therapiewunsch bei Erstickungsangst





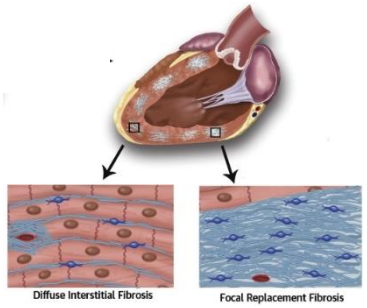


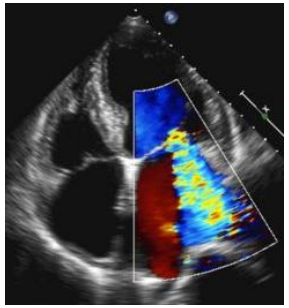


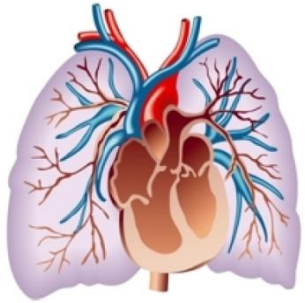
Komplexe Anatomie mit kleinem schwer kalzifizierten Annulus und Ascendensaneurysma

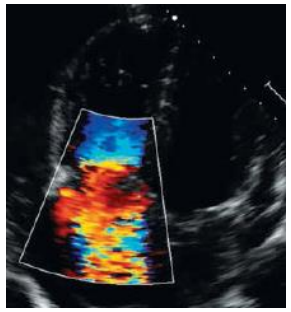
Lifetime Mangement/Therapie der AS: Wann ist es noch sinnvoll?

Rechtzeitige Versorgung der AS (vor struktureller Schädigung) entscheidend für Prognose!

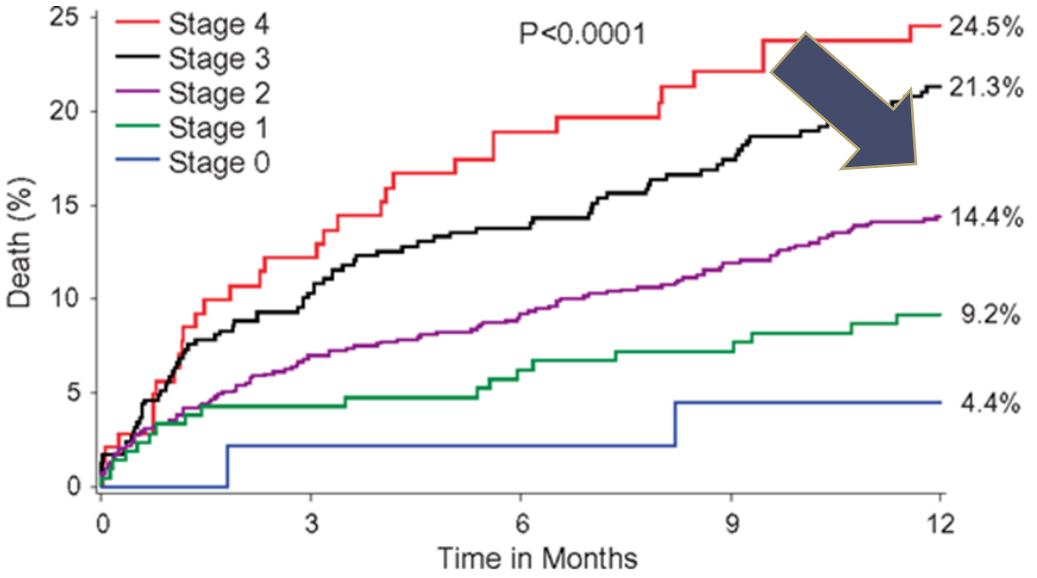








Stage 1	Stage 2	Stage 3	Stage 4
LV Damage	**LA or Mitral Damage**	**Pulmonary Vasculature or Tricuspid Damage**	**RV Damage**
Increased LV Mass Index >115 g/m² (Male) >95 g/m² (Female)	Indexed left atrial volume >34mL/m²	Systolic Pulmonary hypertension ≥60 mmhg	Moderate-Severe right ventricular dysfunction
E/e' >14	Moderate-Severe mitral regurgitation	Moderate-Severe tricuspid regurgitation	
LV Ejection Fraction <50%	Atrial Fibrillation		



Généreux P et al., Eur Heart J 2017

Lifetime Mangement/Therapie der AS: Wann ist es noch sinnvoll?

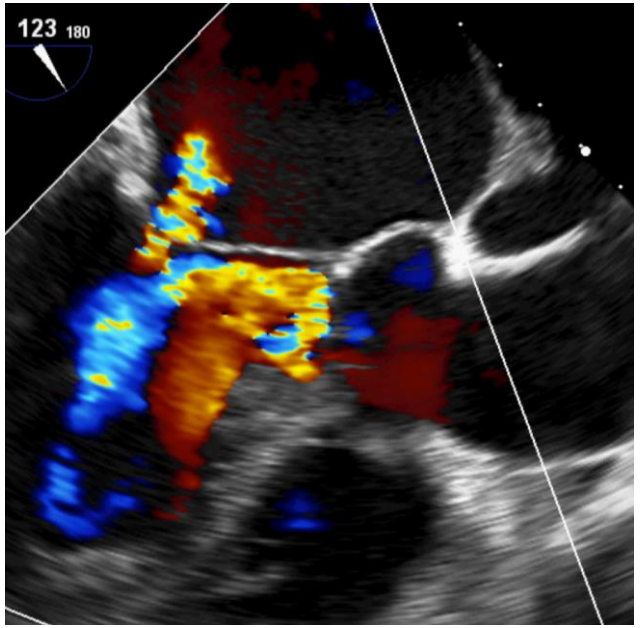
Octapro

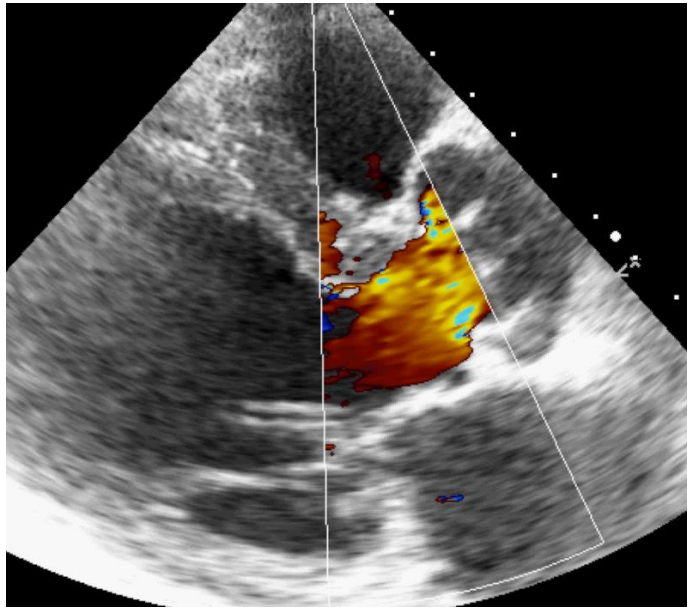
Myval Octapro Size Matrix & Technical Specs.	Area [illegible]	Area 363 mm²	Area 415 mm²	Area 471 mm²	Area 531 mm²	Area 594 mm²	Area 661 mm²	Area 731 mm²	Area 804 mm²
	19.50 mm 20 mm	20.50 mm 21.5 mm	19.50 mm 23 mm	20.70 mm 24.5 mm	20.80 mm 26 mm	21.40 mm 27.5 mm	22.50 mm 29 mm	[illegible] mm 30.5 mm	23.50 mm 32 mm
Perimeter	62.83 mm	67.54 mm	72.26 mm	76.97 mm	81.68 mm	86.39 mm	91.11 mm	95.82 mm	100.53 mm
Python Expandable Introducer Sheath	14 Fr	14 Fr	14 Fr	14 Fr	14 Fr	14 Fr	14 Fr	14 Fr	14 Fr
Native Annulus Area (CT Derived)	270 – 330 mm²	314 – 380 mm²	360 – 440 mm²	410 – 500 mm²	460 – 560 mm²	510 – 630 mm²	570 – 700 mm²	630 – 770 mm²	700 – 840 mm²

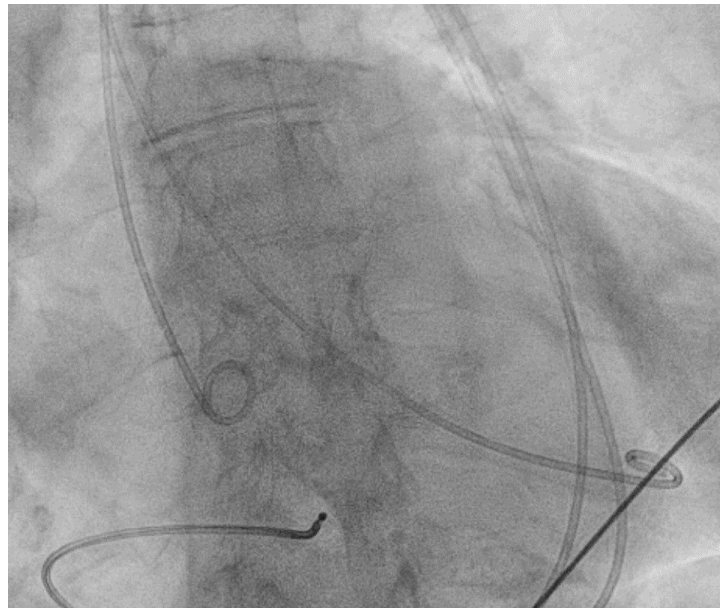
Aortenklappeninsuffizienz

84 jährige Patientin, Dyspnoe NYHA III bei schwerer Aortenklappeninsuffizienz (pure AR) und LV-Dilatation, Ascendensaneurysma

„Lasse mich auf keinen Fall aufschneiden – gibt’s denn da nichts anderes?“

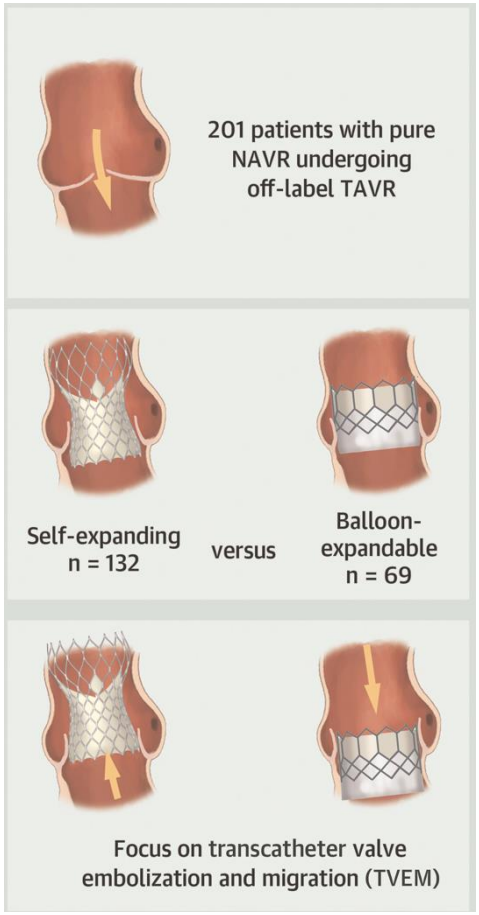


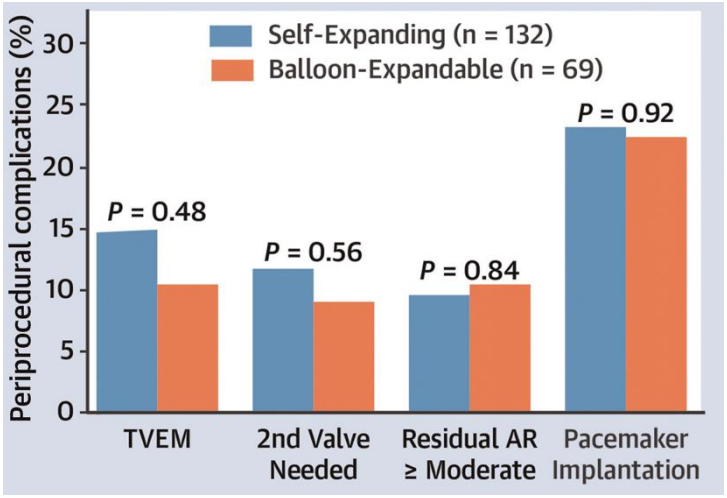




Aortenklappeninsuffizienz

Welche Optionen gibt es bislang?





Poletti E et al., J Am Coll Cardiol Intv 2023

Aortenklappeninsuffizienz

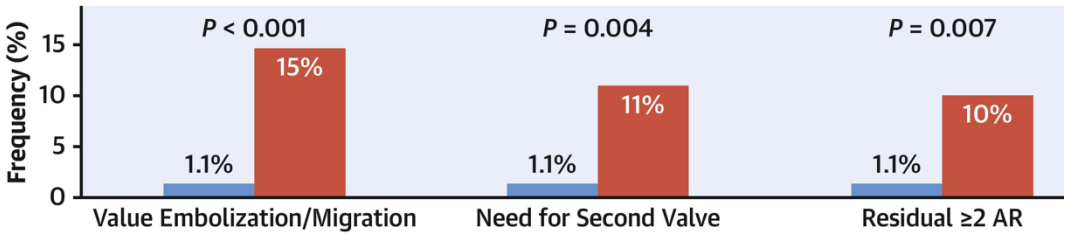
JenaValve Trilogy ein Gamechanger für die versorgung der pure AR?

Procedural and Clinical Outcomes With Dedicated THV Versus Off-Label Devices for Aortic Regurgitation, N = 256

JenaValve Trilogy

Off-Label THVs

Periprocedural Complications



34 Studies

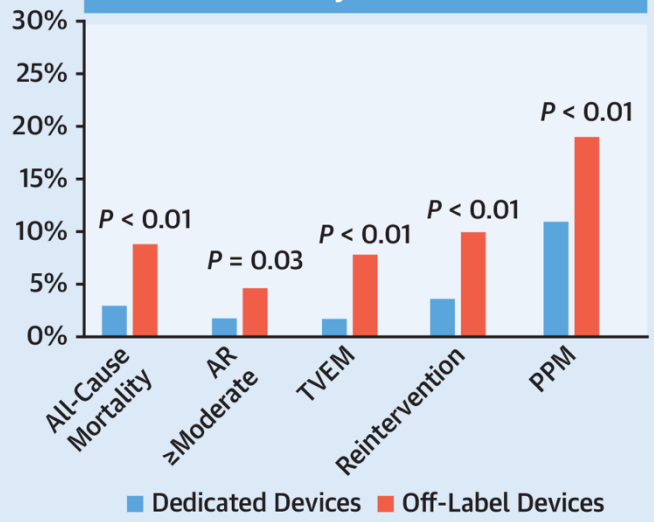
2,162 Patients

1,193 Dedicated Devices

969 Off-label Devices

Mean age = 75.4 ± 0.2 years
STS score = 5.6% ± 0.1%
Log EuroSCORE = 24.2% ± 0.3%

30-Day Outcomes



Device Success
93% vs 82%

Similar Risk of:
Stroke
Vascular Complications

Mortality at 1 Year
6% vs 24%

Poletti E et al., J Am Coll Cardiol Intv 2024
Samimi S et al., J Am Coll Cardiol Intv 2025

Zusammenfassung

- ✓ TAVI bei AS ab 70 Jahren ist der Goldstandard (ESC Leitlinie 2025)
- ✓ Versorgung AS frühzeitig (auch aus prognostischer Indikation
- ✓ Lifetime Strategie bei jüngeren Patienten interdisziplinär antizipieren
- ✓ Breites Portfolio an hochwertigen TAVI Prothesen – Adaption and Anatomie!
- ✓ Valve in Valve Prozeduren sicher durchführbar
- ✓ Bikuspide Aortenklappen subtil CT-morphologisch charakterisieren und hiervon Indikationsstellung für TAVI abwägen, häufig sicher möglich
- ✓ Reine Aorteninsuffizienz noch Domäne der Herzchirurgie, jedoch neue Generation Prothesen am Horizont (bspw. Jena Valve Trilogy)

Vielen Dank für Ihre Aufmerksamkeit

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