CARDIO RUN 2025
17ème CONGRÈS DE PATHOLOGIE CARDIO-VASCULAIRE
17-18-19 SEPTEMBRE 2025
Hôtel Saint Alexis ILE DE LA RÉUNION France
CARDIORUN.ORG

TAVI & durabilité des bioprothèses

Cédric Delhaye

CHU Lille

CHU LILLE INSTITUT CŒUR POUMON

DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

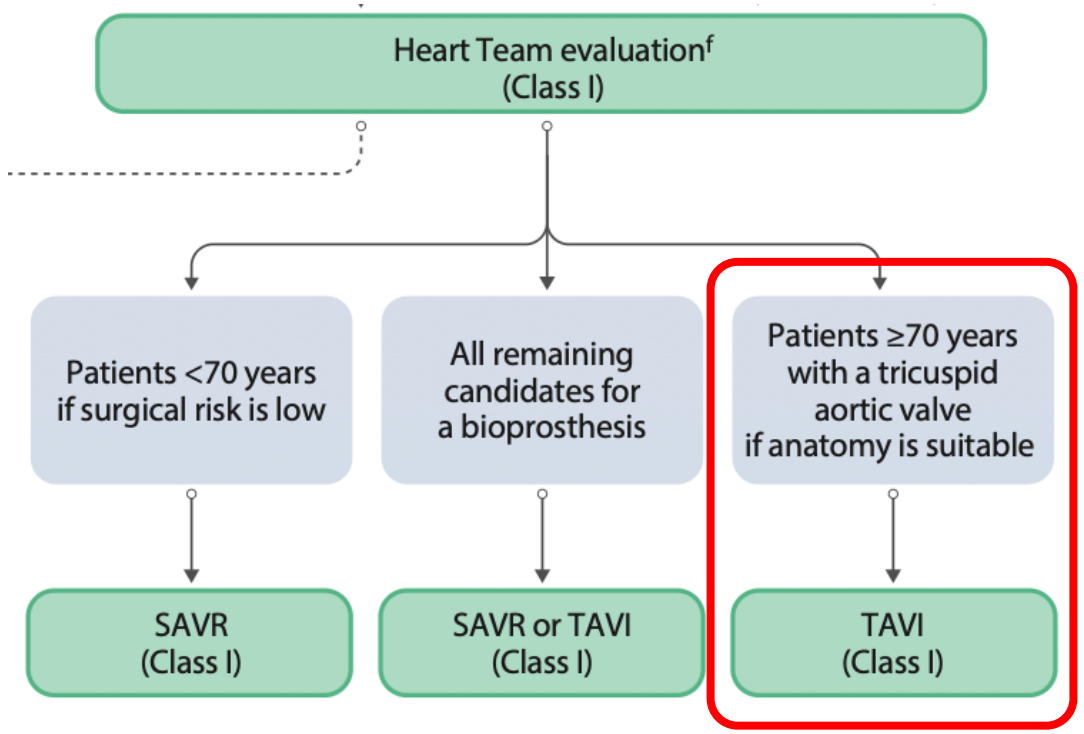
Speaker's name : Cédric DELHAYE, Lille

☑ Je déclare les liens d'intérêt potentiel suivants :

Consultant : Abbott, Asahi, Medtronic

Les patients sont de plus en plus jeunes…

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

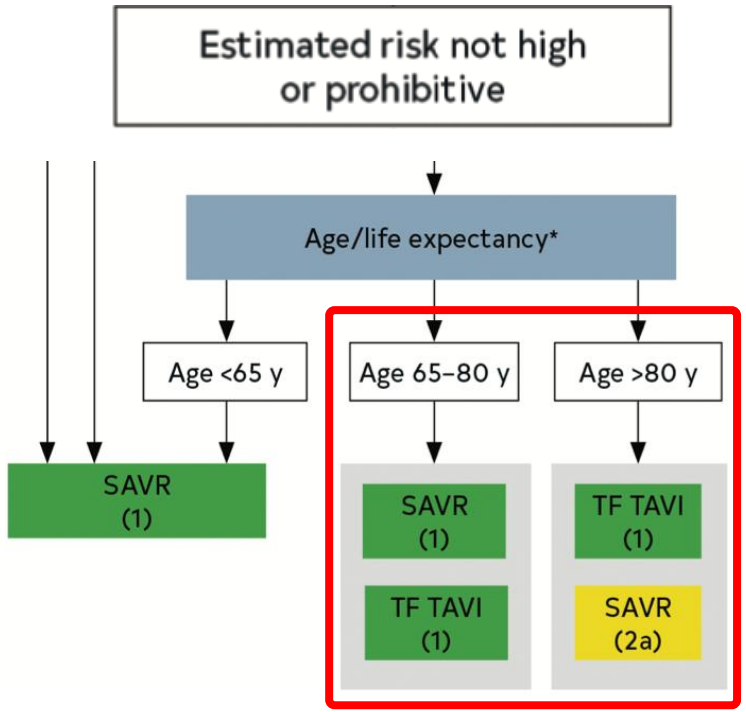


Praz F et al. European Heart Journal (2025) 00, 1–7.

ACC/AHA CLINICAL PRACTICE GUIDELINE

2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease

A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines



Otto C, Circulation. 2021;143:e72–e227.

Médiane de Survie après RVAo

High risk
Median age: 79.3±6.2

Median survival: **5.8 years** (5.4-6.5)

Intermediate risk
Median age: 80±5.8

Median survival: **7.3 years** (7.0-7.9)

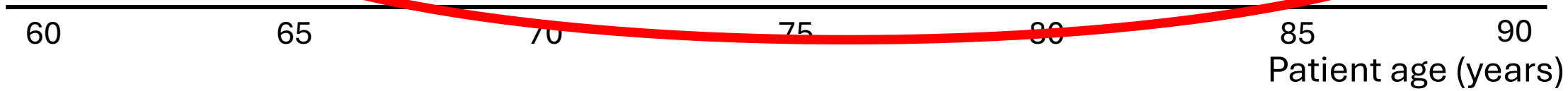
Low risk
Median age: 74.3±6.4

< 80 ans

80-84 years **8.2 years** (7.8-8.8)

75-79 years **10.5 years** (10.1-11.2)

70-74 years **12.5 years** (11.7-13.2)



Martinsson A et al. J Am Coll Cardiol 2021;78:2147–2157

Médiane de Survie après RVAo

High risk
Median age: 79.3±6.2

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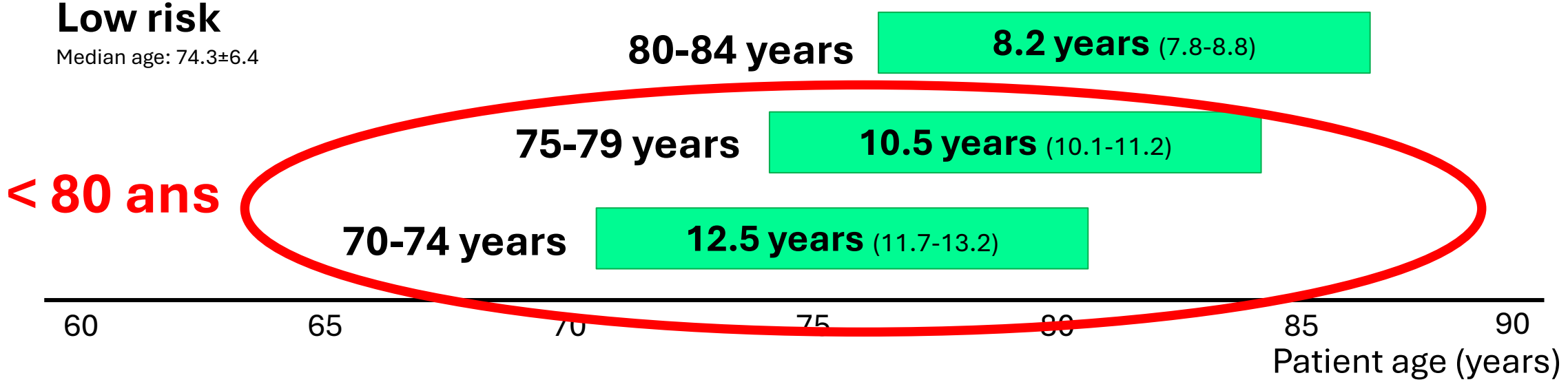
Espérance de vie > durabilité des prothèses ?

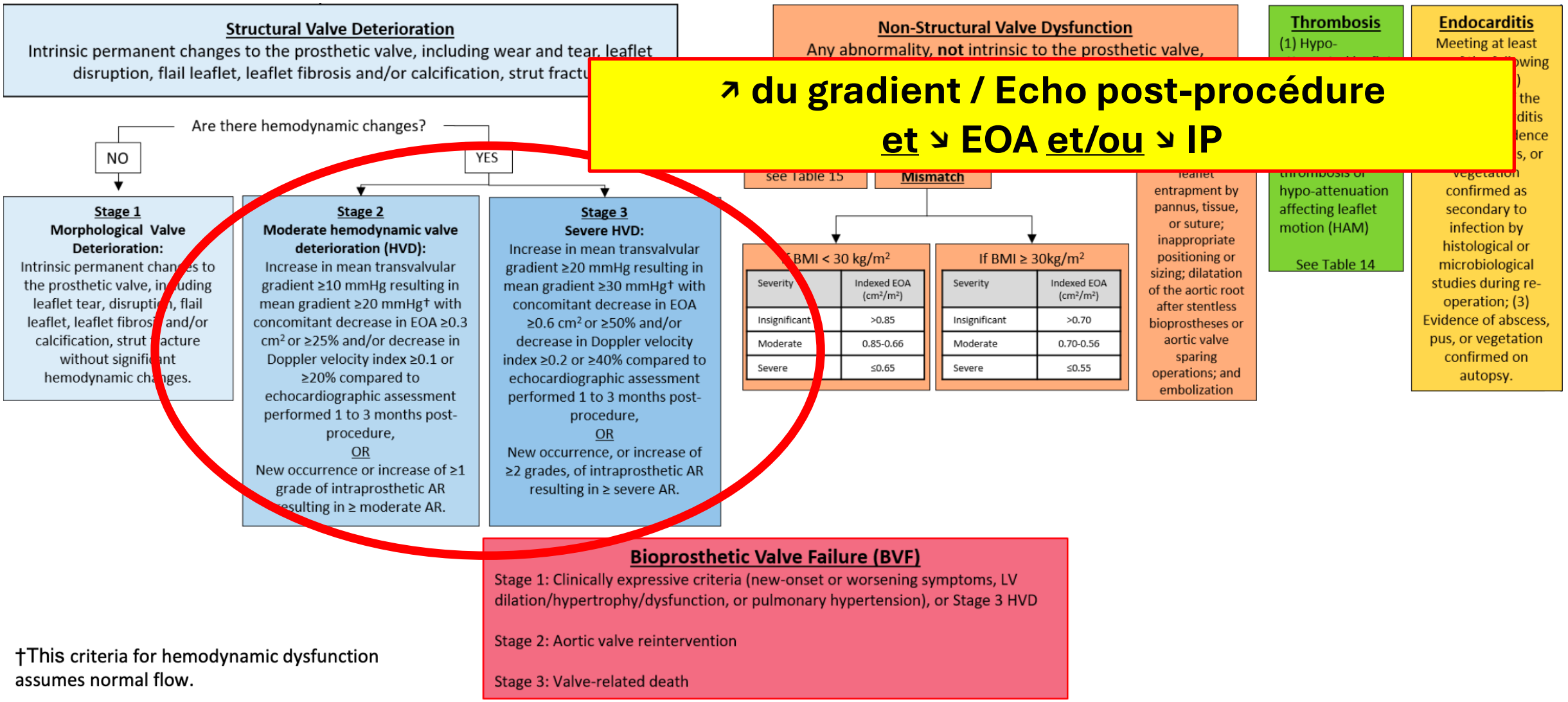
Low risk
Median age: 74.3±6.4



Martinsson A et al. J Am Coll Cardiol 2021;78:2147–2157

Définition de la durabilité ?

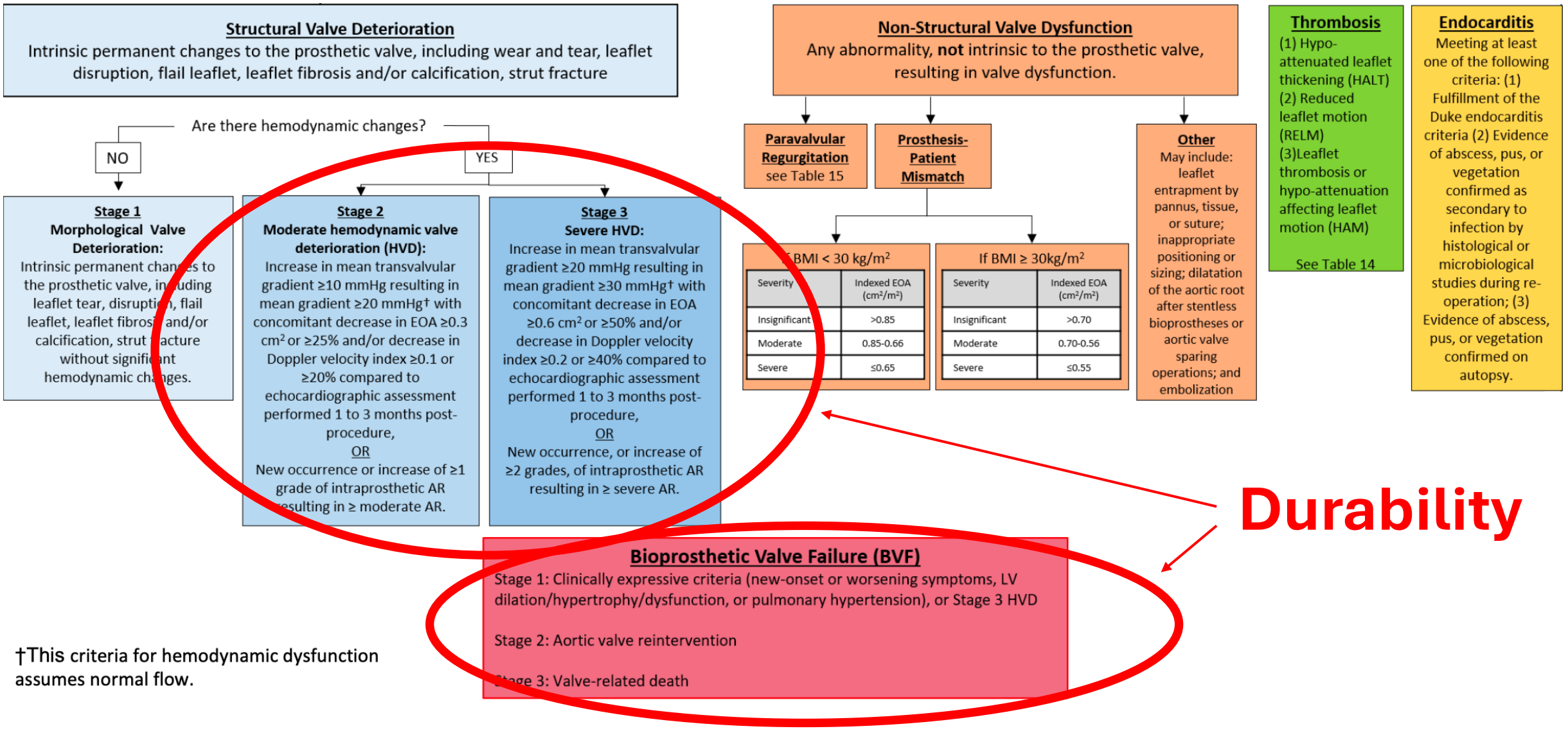
Bioprosthetic Valve Dysfunction (VARC-3)



†This criteria for hemodynamic dysfunction assumes normal flow.

Généreux, P. J Am Coll Cardiol. 2021;77(21):2717–46

Bioprosthetic Valve Dysfunction (VARC-3)



†This criteria for hemodynamic dysfunction assumes normal flow.

Généreux, P. J Am Coll Cardiol. 2021;77(21):2717–46

Durabilité des prothèses TAVI / Chirurgie

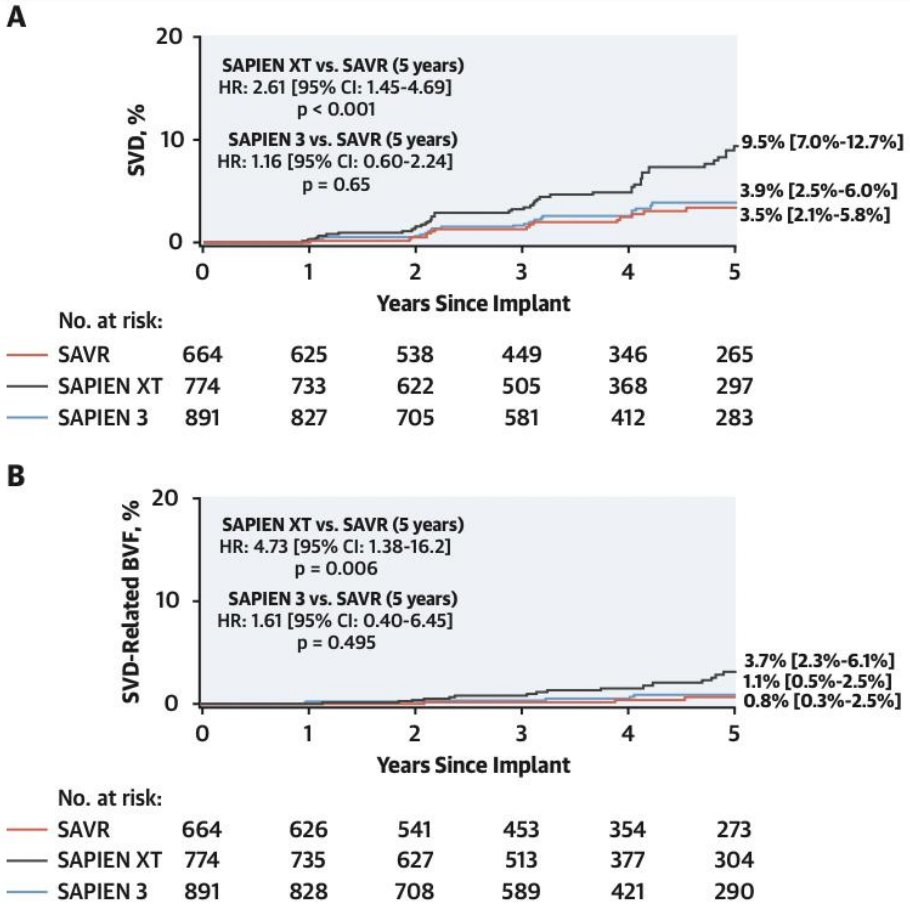
Que disent les études randomisées ?

Intermediate risk patients at 5 years

Plus de SVD et BVF avec la XT vs. SAVR

SVD et BVF similaires avec la S3 vs. SAVR

Structural Deterioration of Transcatheter Versus Surgical Aortic Valve Bioprostheses in the PARTNER-2 Trial

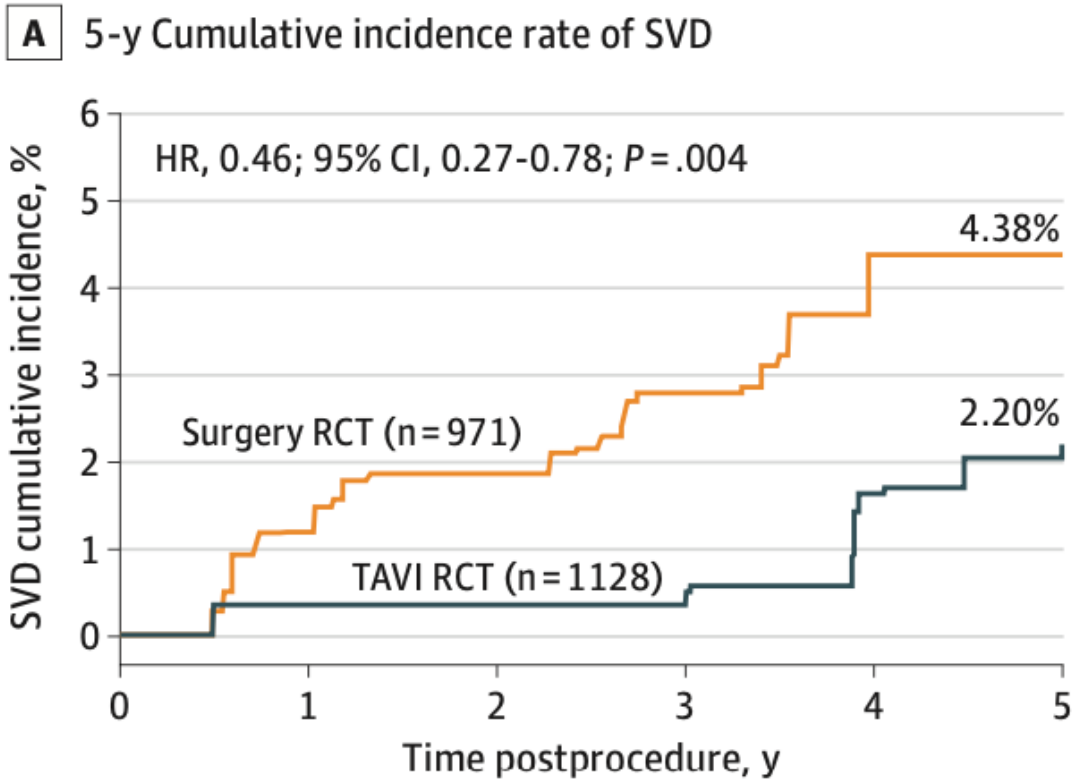


Pibarot P, J Am Coll Cardiol 2020;76:1830–43

Moins de SVD avec la Coreval/Evolut R vs. SAVR

JAMA Cardiology | Original Investigation

Structural Valve Deterioration After Self-Expanding Transcatheter or Surgical Aortic Valve Implantation in Patients at Intermediate or High Risk



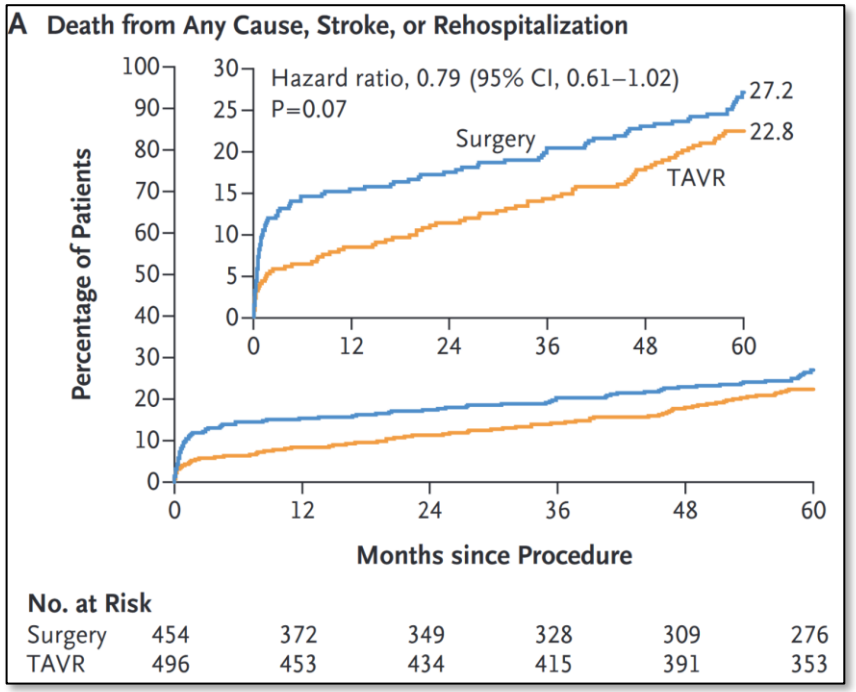
O'Hair D, JAMA Cardiol. 2022

Low risk patients at 5 years

ORIGINAL ARTICLE

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

PARTNER 3

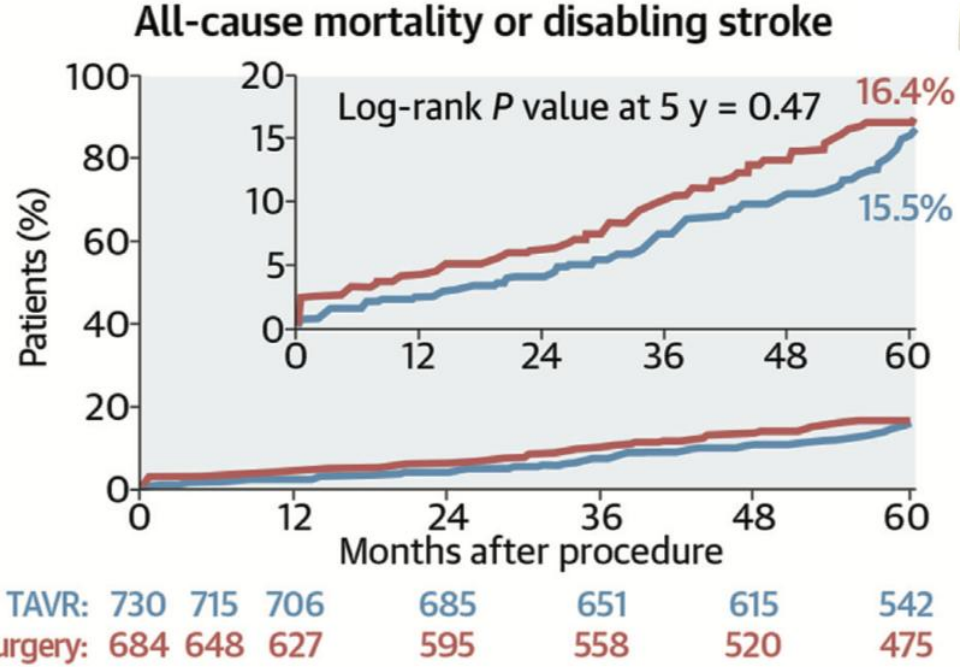


Aortic valve reintervention: 2.6% TAVR vs 3.0% SAVR

Mack MJ et al. NEJM 2023;389:1949-1960

5-Year Outcomes After Transcatheter or Surgical Aortic Valve Replacement in Low-Risk Patients With Aortic Stenosis

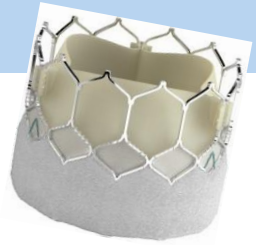
Evolut Low Risk



Aortic valve reintervention: 3.3% TAVR vs 2.5% SAVR

Forrest JK et al. JACC 2025;85:1523-1532

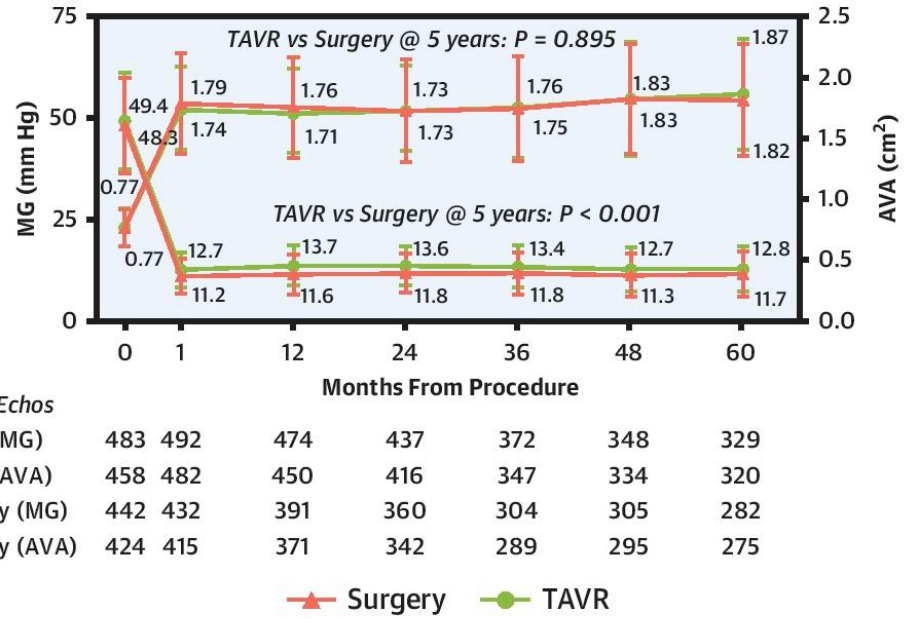
Low risk patients at 5 years



PARTNER 3

Similar hemodynamics with SAPIEN 3 TAVR vs SAVR

MG and AVA Through 5 Years by Treatment



Number of Echos

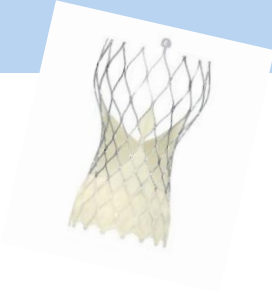
TAVR (MG)	483	492	474	437	372	348	329
TAVR (AVA)	458	482	450	416	347	334	320
Surgery (MG)	442	432	391	360	304	305	282
Surgery (AVA)	424	415	371	342	289	295	275

Surgery TAVR

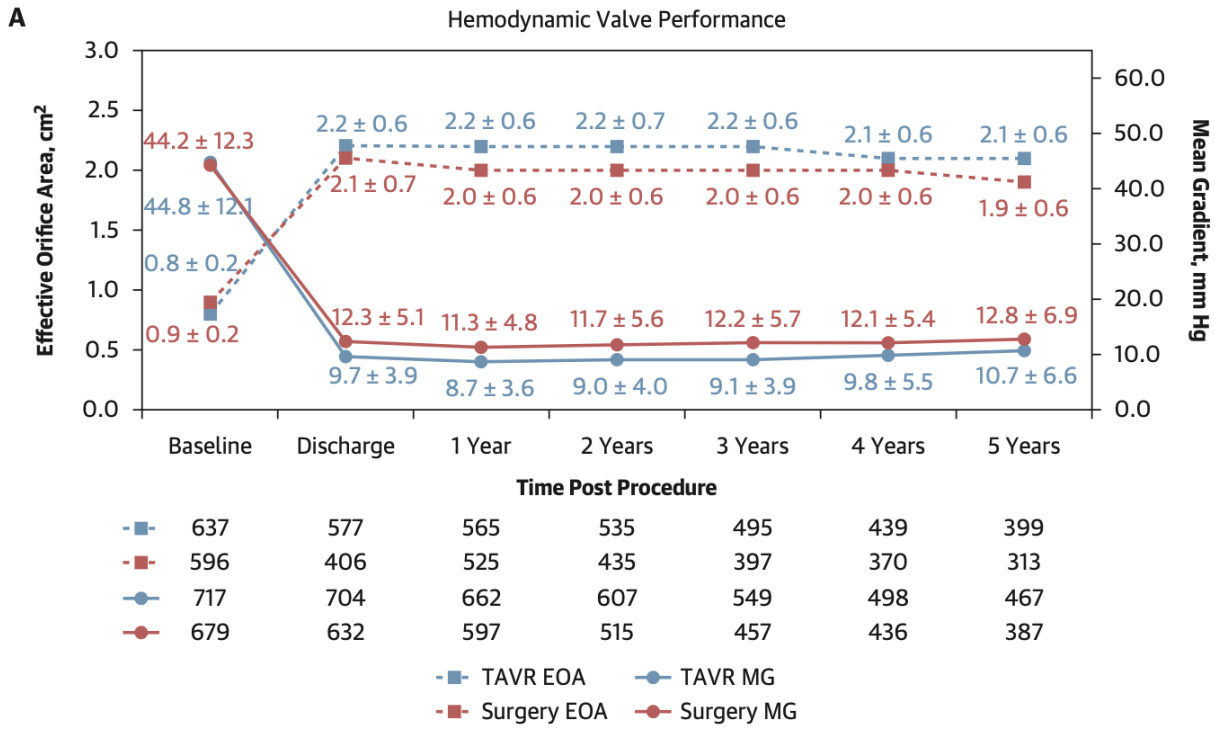
Similar and stable valve hemodynamics were observed for both treatment groups; severe PPM and ≥mild PVR at 30 days were not associated with an increased risk of clinical outcomes

Hahn RT, et al. JACC Cardiovasc Imaging. 2025;18(6):625-640.

Evolut Low Risk



Better hemodynamics with Evolut TAVR vs SAVR



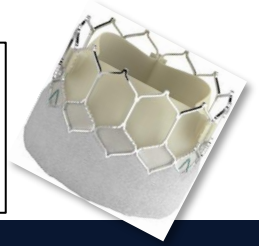
	637	577	565	535	495	439	399
	596	406	525	435	397	370	313
	717	704	662	607	549	498	467
	679	632	597	515	457	436	387

TAVR EOA TAVR MG
Surgery EOA Surgery MG

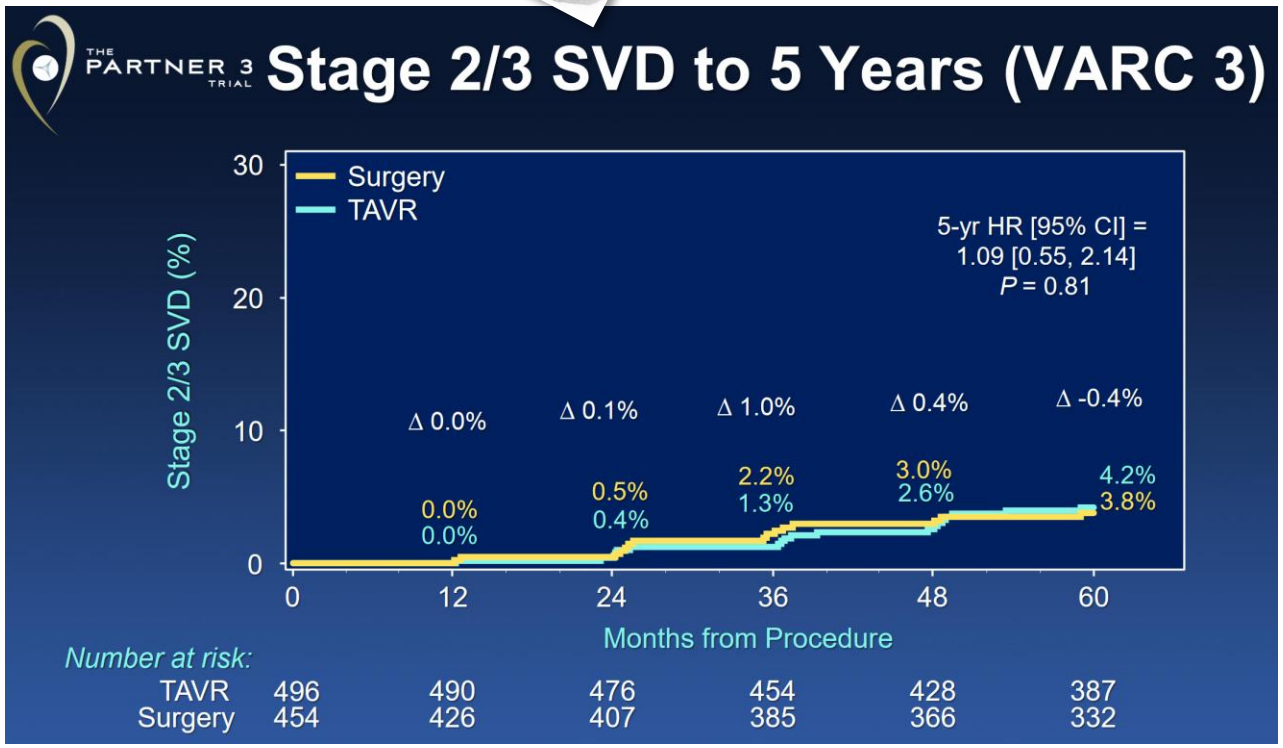
Forrest JK et al. JACC 2025;85:1523-1532

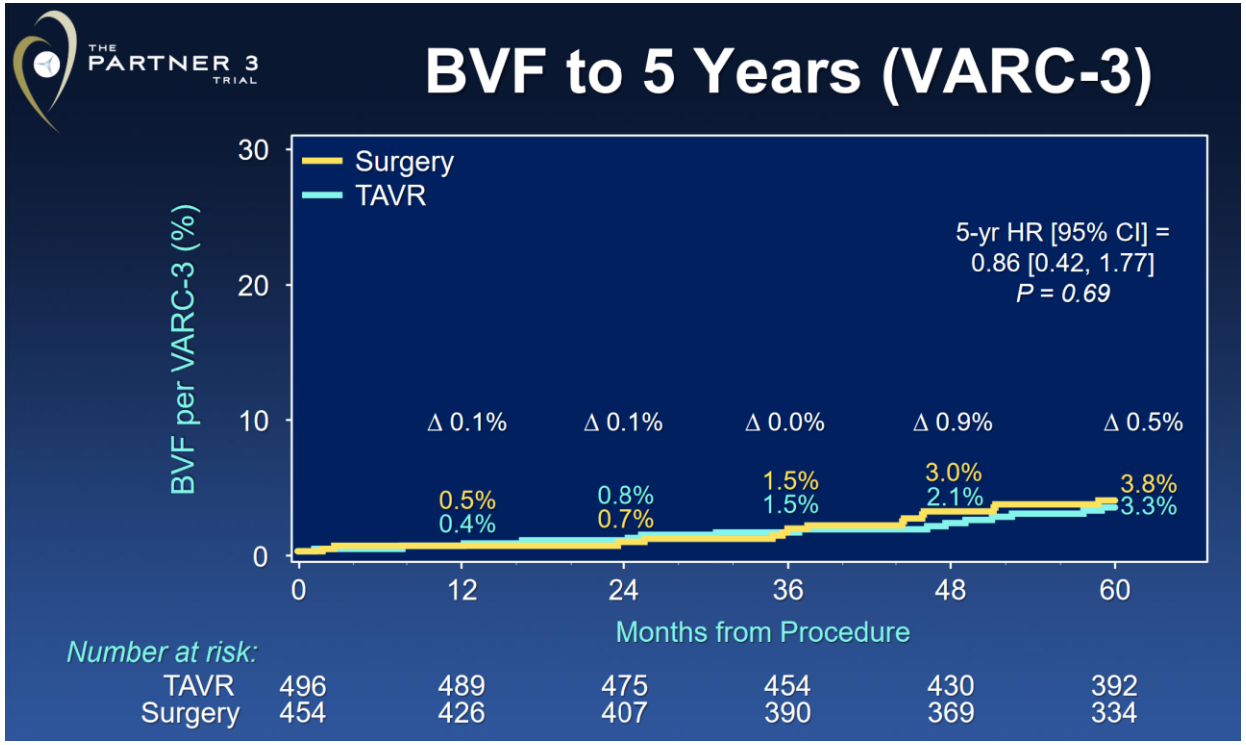
Low risk patients at 5 years

PARTNER 3 low risk



Similar durability at 5 years with Sapien 3 TAVR vs Surgery





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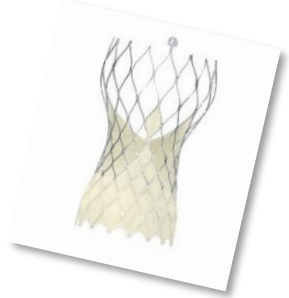
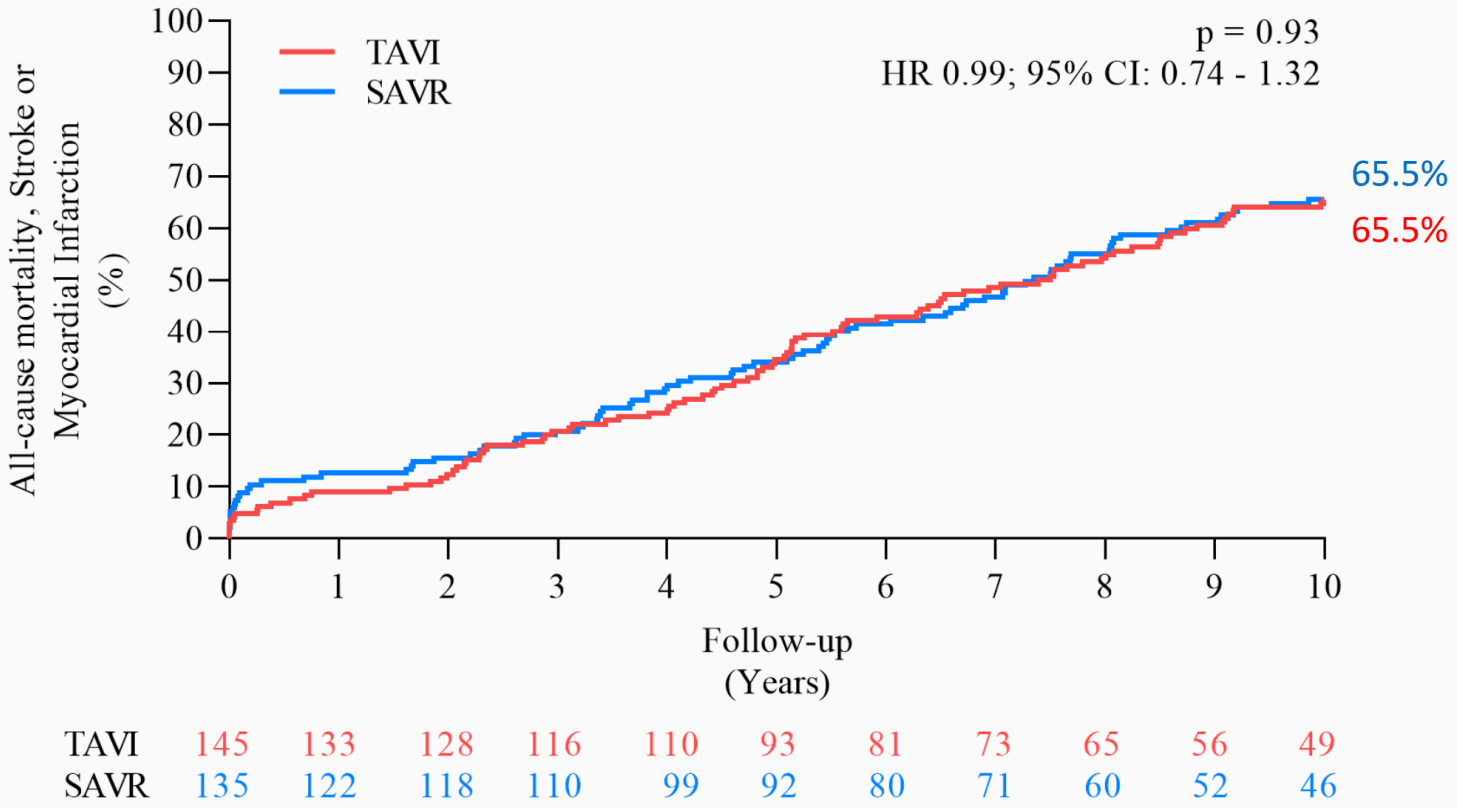


Leon M, TCT 2023

NOTION Trial - 10 years

RCT TAVR (corevalve) vs. SAVR in lower risk patients ≥ 70ans

All-cause mortality, Stroke, Myocardial infarction



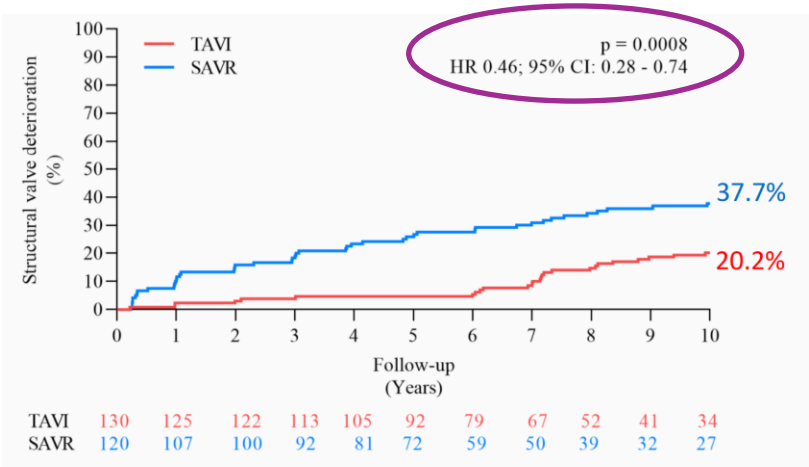
Thyregod et al. EHJ 2024

NOTION Trial - 10 years

RCT TAVR (corevalve) vs. SAVR in lower risk patients ≥ 70ans

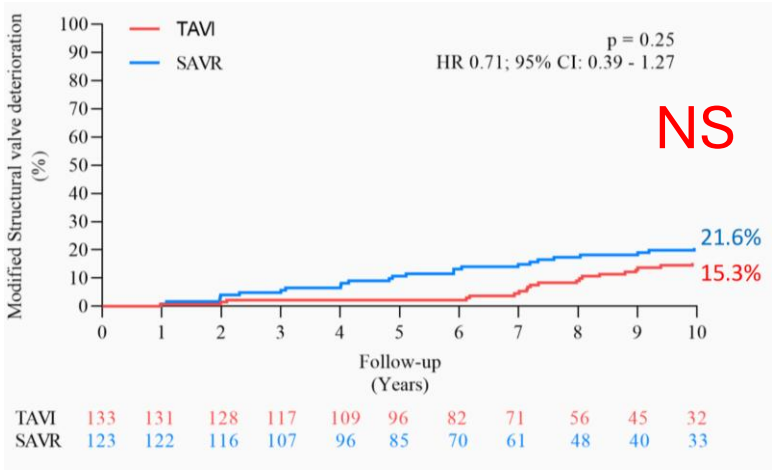
Moins de SVD avec la Corevalve / SAVR

Structural Valve Deterioration



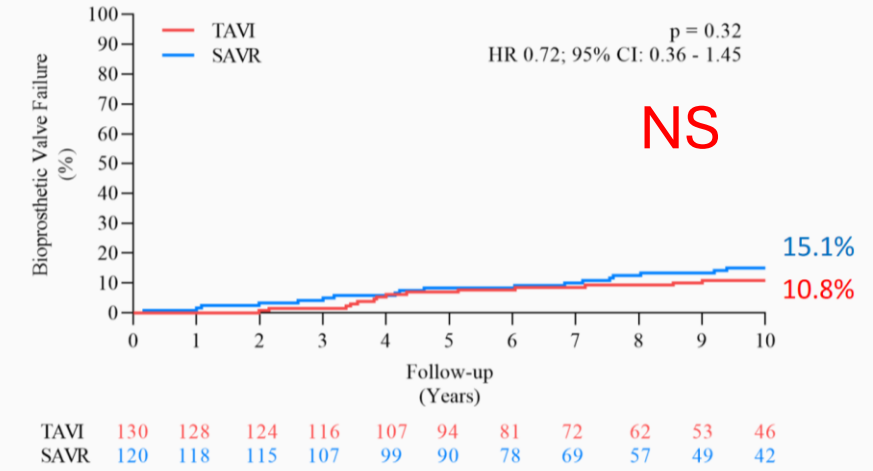
Moderate or severe haemodynamic SVD
- Mean gradient ≥20 mmHg *OR*
- Mean gradient ≥10 mmHg change from baseline *OR*
- Moderate/severe intra-prosthetic aortic regurgitation *(new or worsening from baseline)*

Modified SVD



Mean gradient ≥20 mmHg *AND*
mean gradient ≥10 mmHg change from baseline

Bioprosthesis Valve Failure

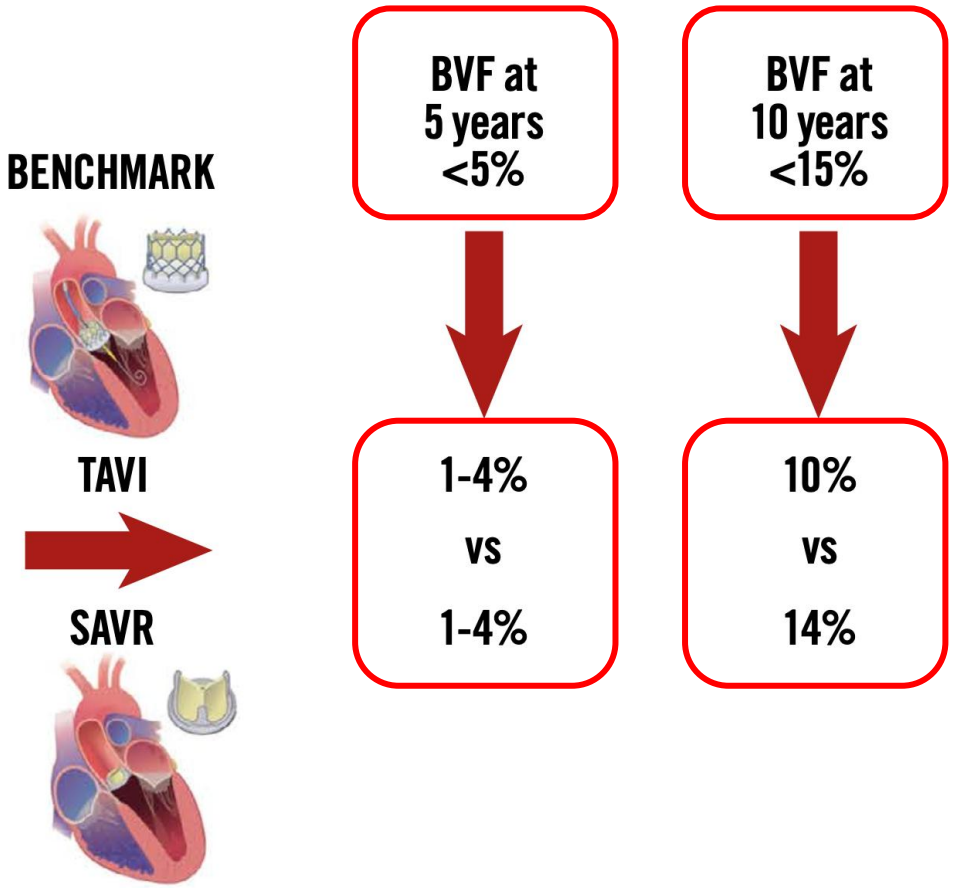


Thyregod et al. EHJ 2024

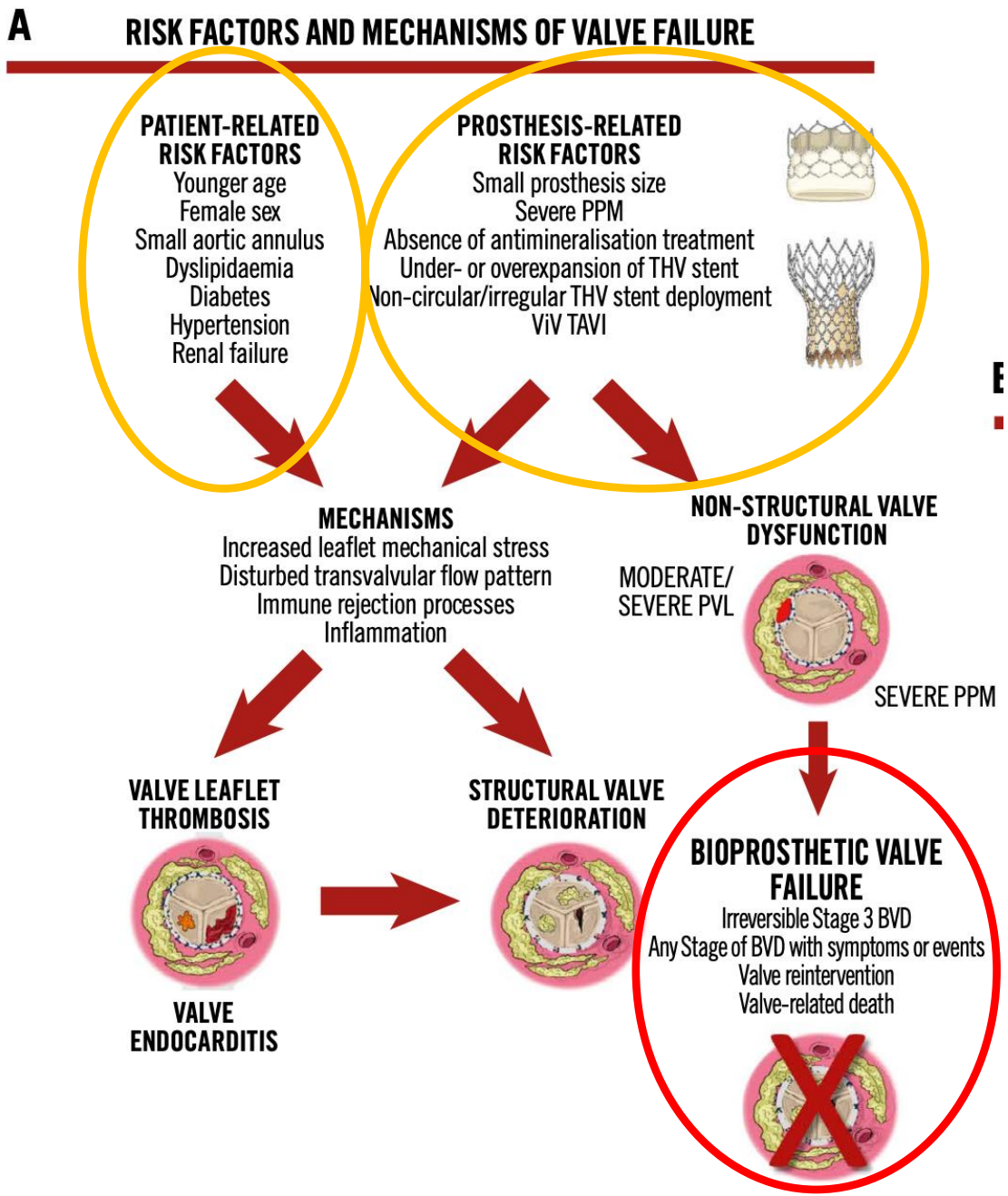
TAVI DURABILITY:
MIDTERM DURABILITY: SIMILAR IN TAVI vs SAVR
LONG-TERM DURABILITY: NEED MORE DATA TO CONFIRM

BIOPROSTHETIC VALVE FAILURE

Irreversible Stage 3 BVD
Any Stage of BVD with symptoms or events
Valve reintervention
Valve-related death



Julien Ternacle et al. EuroIntervention 2024;20:e845-e864



Julien Ternacle et al. EuroIntervention 2024;20:e845-e864

Différence de durabilité des prothèses TAVI entre-elles ?

Très peu de données +++

Sapien 3U

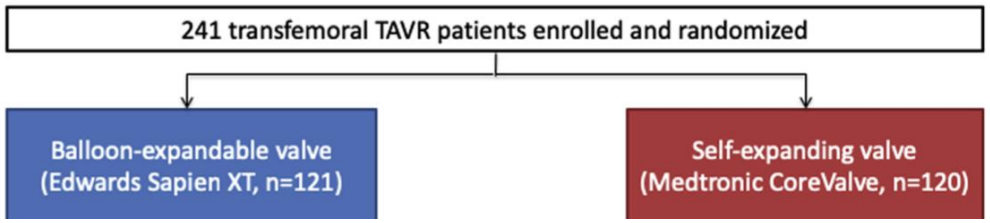
Evolut Fx

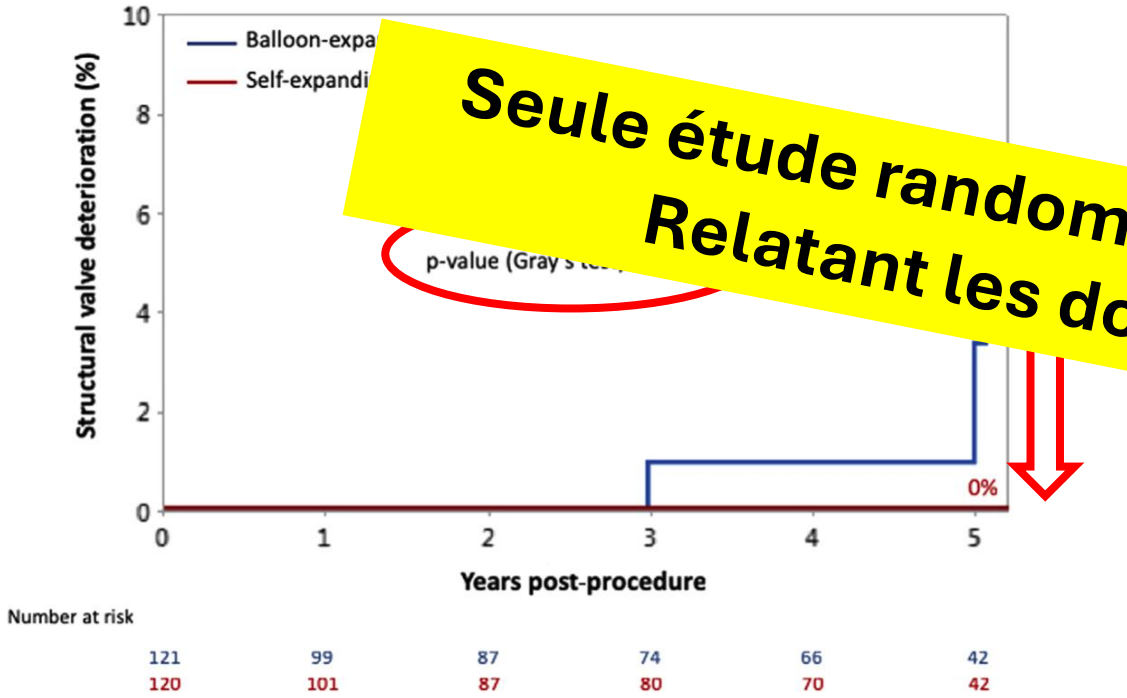
Navitor

Moins de SVD mais pas de BVF entre Corevalve et Sapien XT

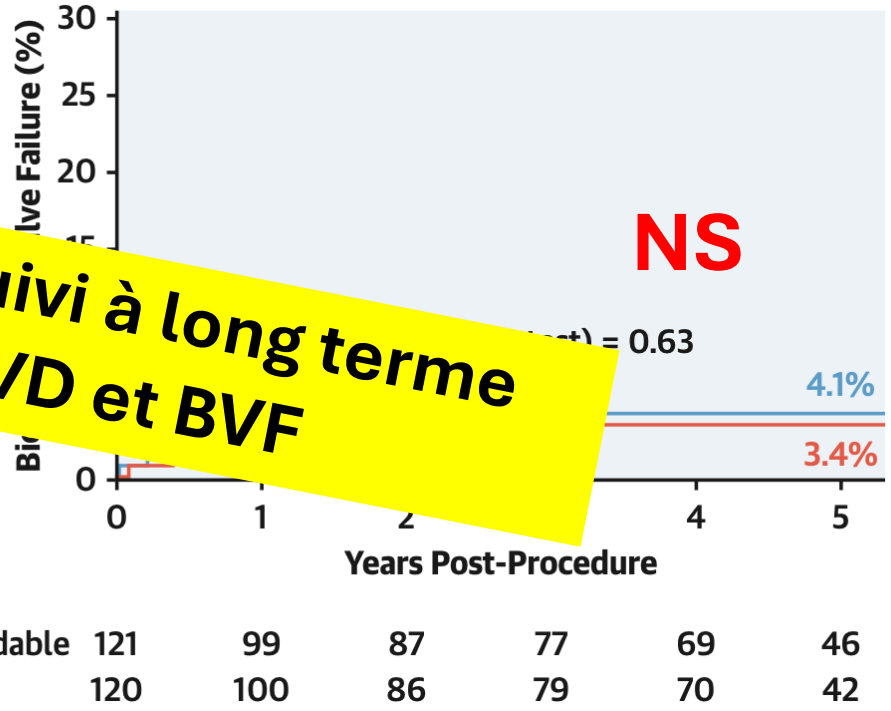
5-Year Outcomes After TAVR With Balloon-Expandable Versus Self-Expanding Valves

Results From the CHOICE Randomized Clinical Trial





Seule étude randomisée avec suivi à long terme
Relatant les données de SVD et BVF

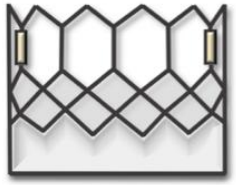


Abdel-Wahab. M. et al. J Am Coll Cardiol Intv. 2020:13(9):1071-82

Moins de SVD et de BVF avec prothèses supra-annulaires

PUREVALVE registry

N=482
88% Sapien
12% Lotus

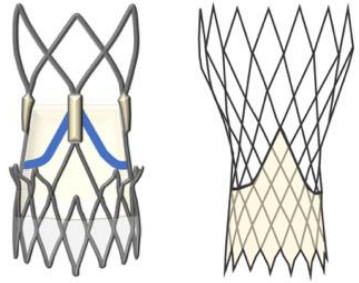


Intra-Annular TAVR

10 years after TAVR

2007 to 2016 | ≥5 year Follow-Up

604



Supra-Annular TAVR

N=122
81% Corevalve/Evolut R
19% Accurate

15%	p = 0.21	**Overall Survival**		**11%**
Hemodynamics				
↑↑ Higher	p < 0.05 (1m - 10y)	*Mean Gradient*		**Lower ↓↓**
Increase	p < 0.05	*Gradient Trend over Time*	p > 0.05	**Stable**
Severe HVD*				
5%	p = 0.05	*Overall*		**1%**
2%	p = 0.40	*Excluding IA TAVR ≤23mm*		**1%**
Bioprosthetic Valve Failure*				
8%	p = 0.02	*Overall*		**1%**
5%	p = 0.11	*Excluding IA TAVR ≤23mm*		**1%**

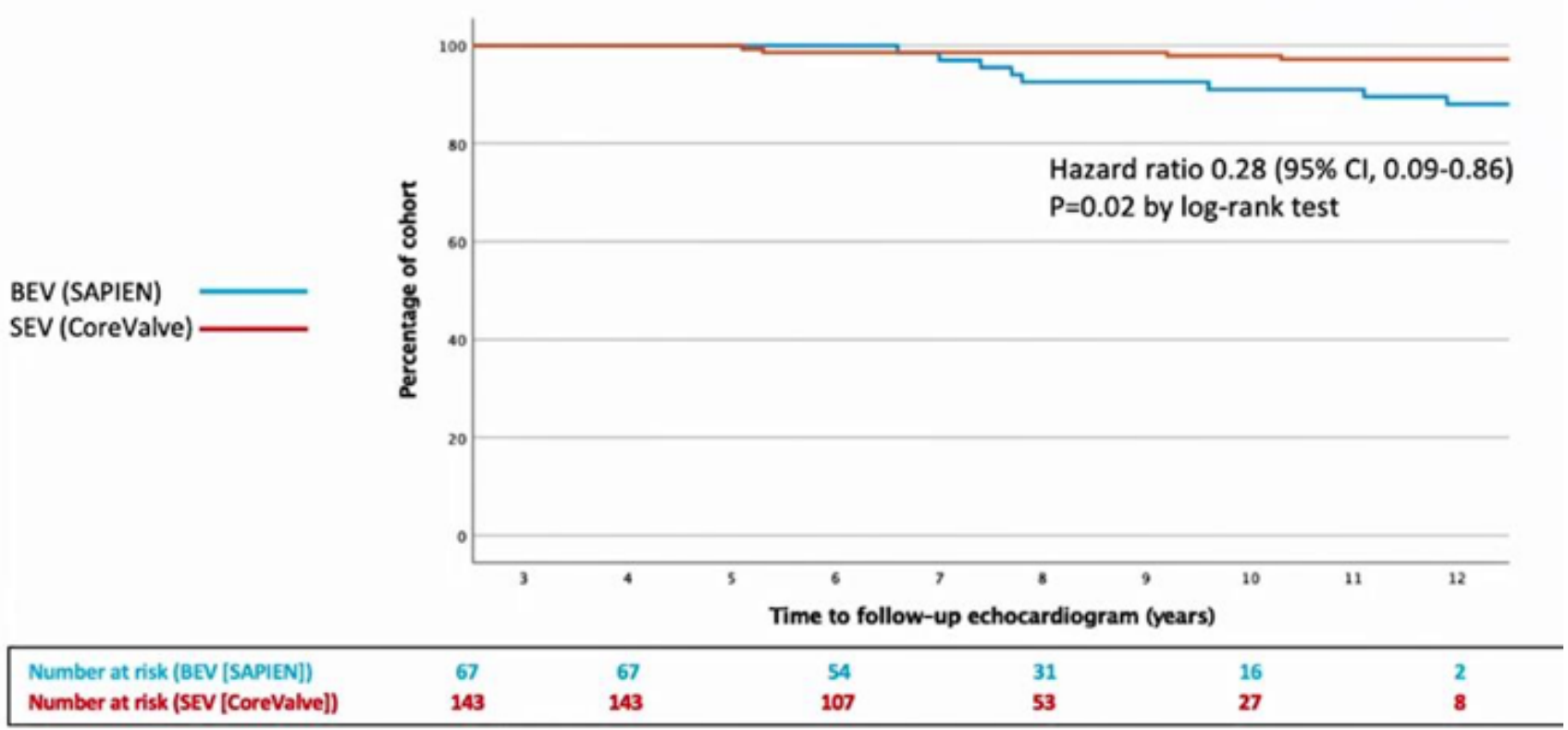
VARC-3

*VARC3

Scotti A, Front. Cardiovasc. Med. 2022

Moins de Severe SVD à 10 ans avec SEV vs. BEV

UK TAVI registry at 10 years



Comparison of valve types

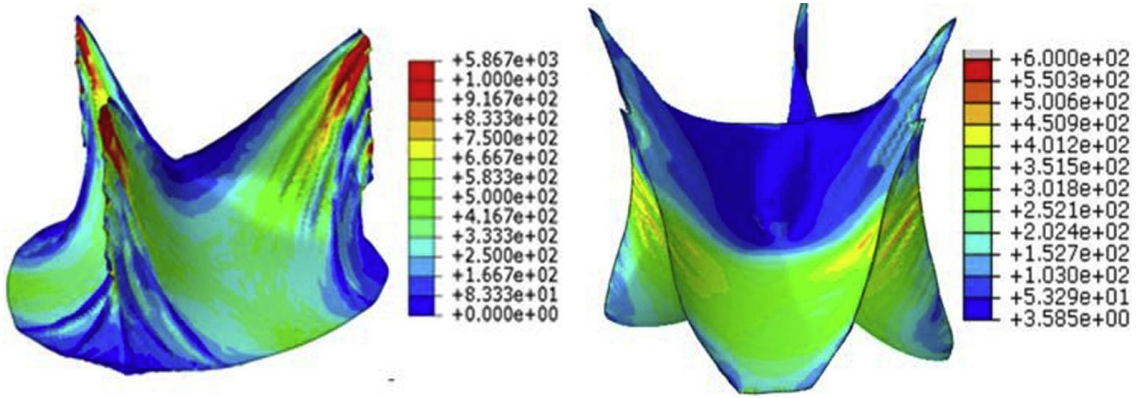
Higher proportion of SAPIEN BEV developed severe SVD compared to CoreValve SEV (8/67 [11.9%] vs. 5/143 [3.5%]; p=0.02)

Ali N. et al., Catheter Cardiovasc Interv. 2023 Apr;101(5):932-942

Les pistes ?

Le design de la prothèse

Stress mécanique plus élevé pour les prothèses balloon-expansible



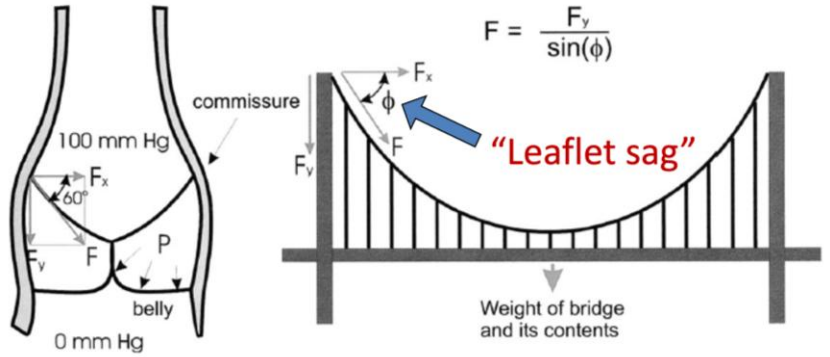
a. Sapien **b. Corevalve**

Figure 1. Maximum principal stress on the leaflets of a) Sapien and b) CoreValve.

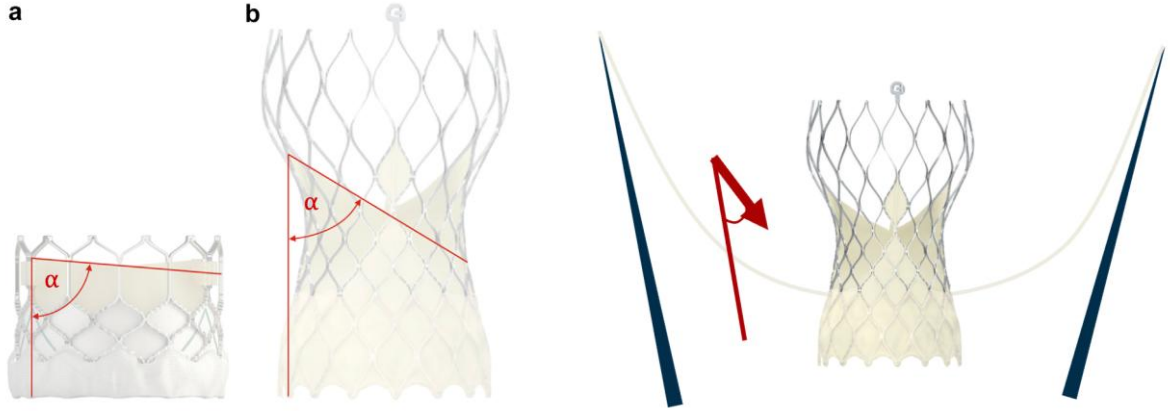
Self-expanding valve had 40% lower peak mechanical stress

Yue Xuan et al. J Am Coll Cardiol 2018; 72:B275
Stanova V et al. Structural Heart 8 (2024) 100262

The greater the "sag" (ϕ), the lower the loaded stress on the leaflets



High and angled take-off optimizes leaflet sag & reduce leaflet stress



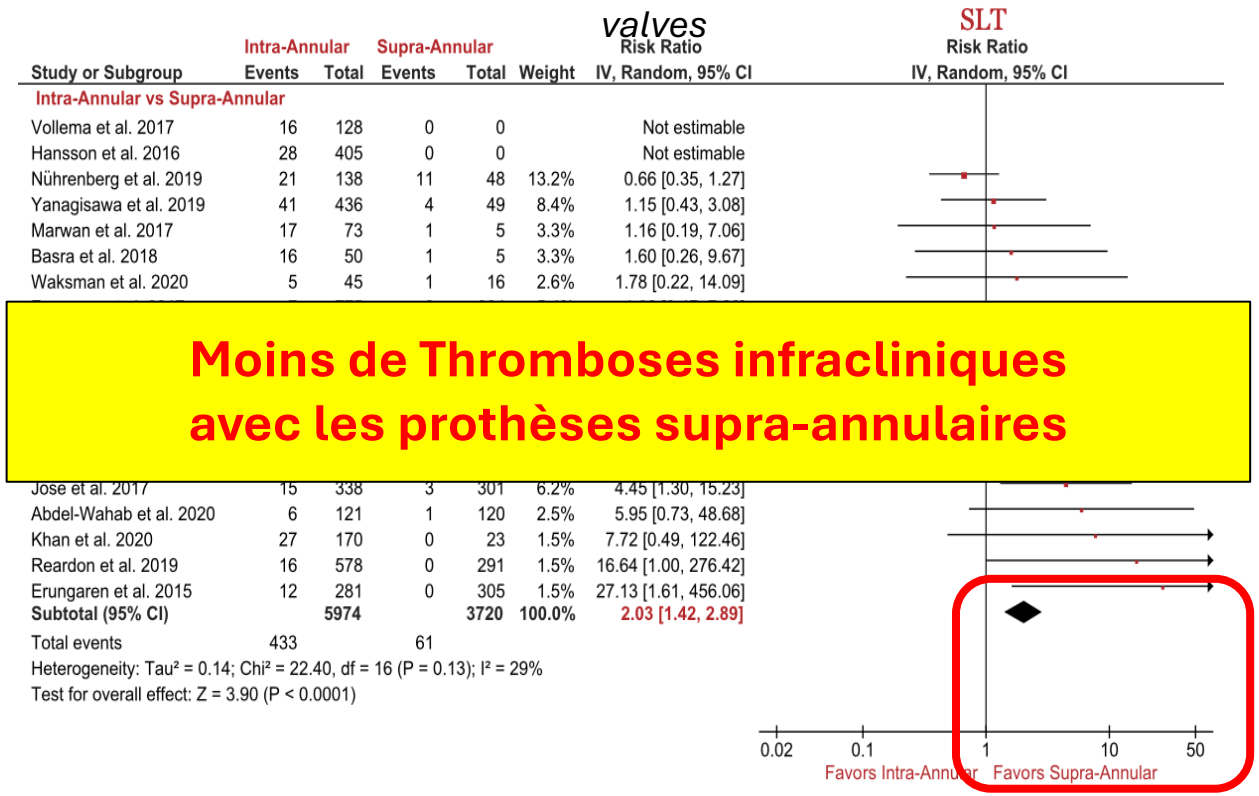
Piazza N, PCR London Valves 2022
Stanova V et al. Structural Heart 8 (2024) 100262

Thromboses de valve infracliniques

Prothèses intra vs. supra-annulaires

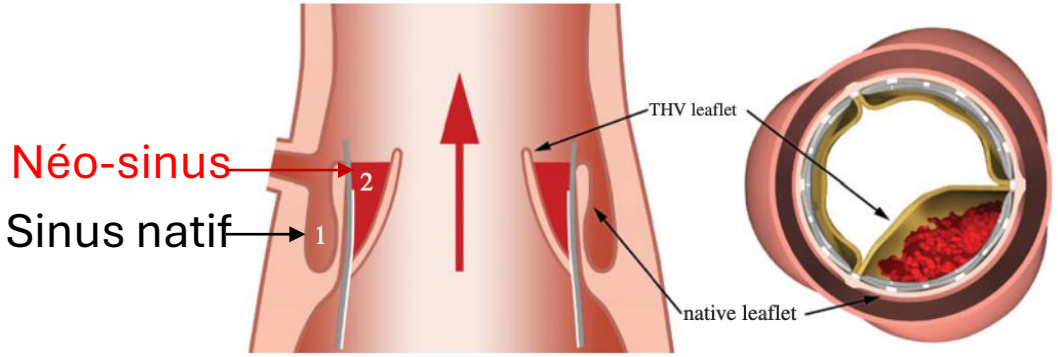
Meta-analysis (19 studies)

*Incidence of SLT in **intra-annular** valves compared with **supra-annular***

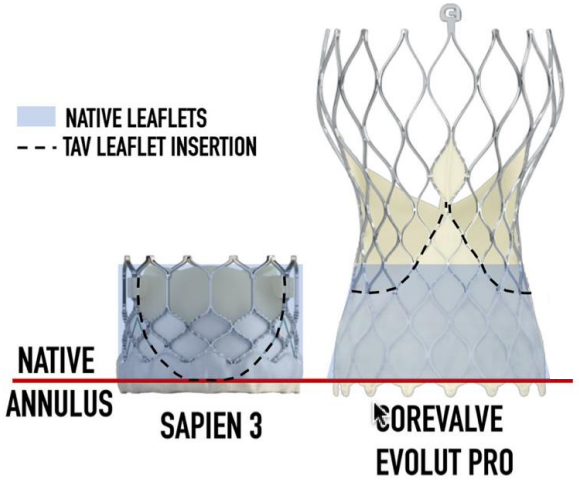


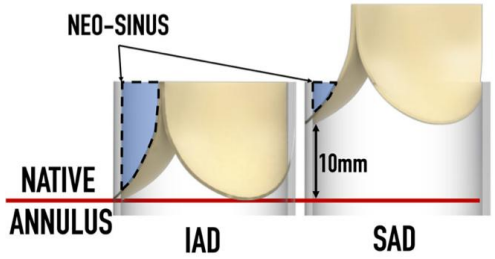
Moins de Thromboses infracliniques avec les prothèses supra-annulaires

Bogyi M et al. J Am Coll Cardiol Intv 2021



Midha et al. Circulation 2017

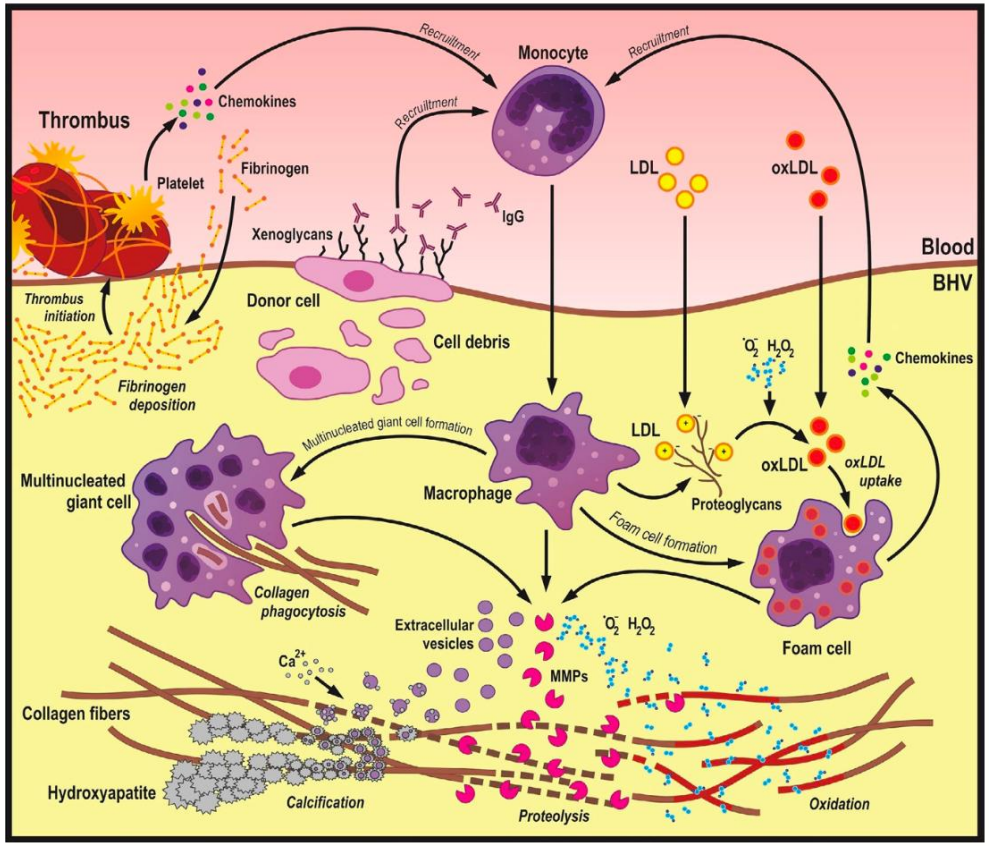




Madukauwa-David et al. Ann. Biomed. Eng. 2020

Thrombose de valve ⟺ dégénérescence ?

Chronic inflammation in relation to SVD

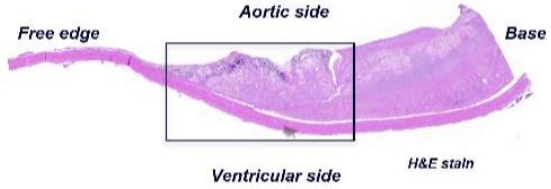


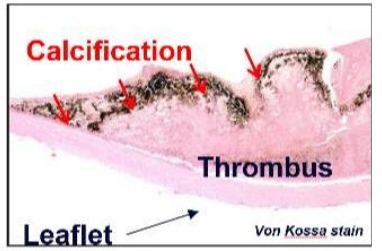
Kostyunin AE et al. J Am Heart Assoc. 2020

Two types of Calcium distribution

Extrinsic calcification

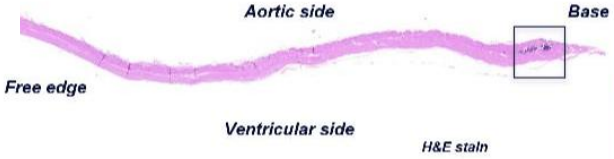
Within thrombus

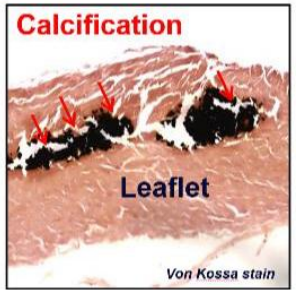




Intrinsic calcification

Within leaflet

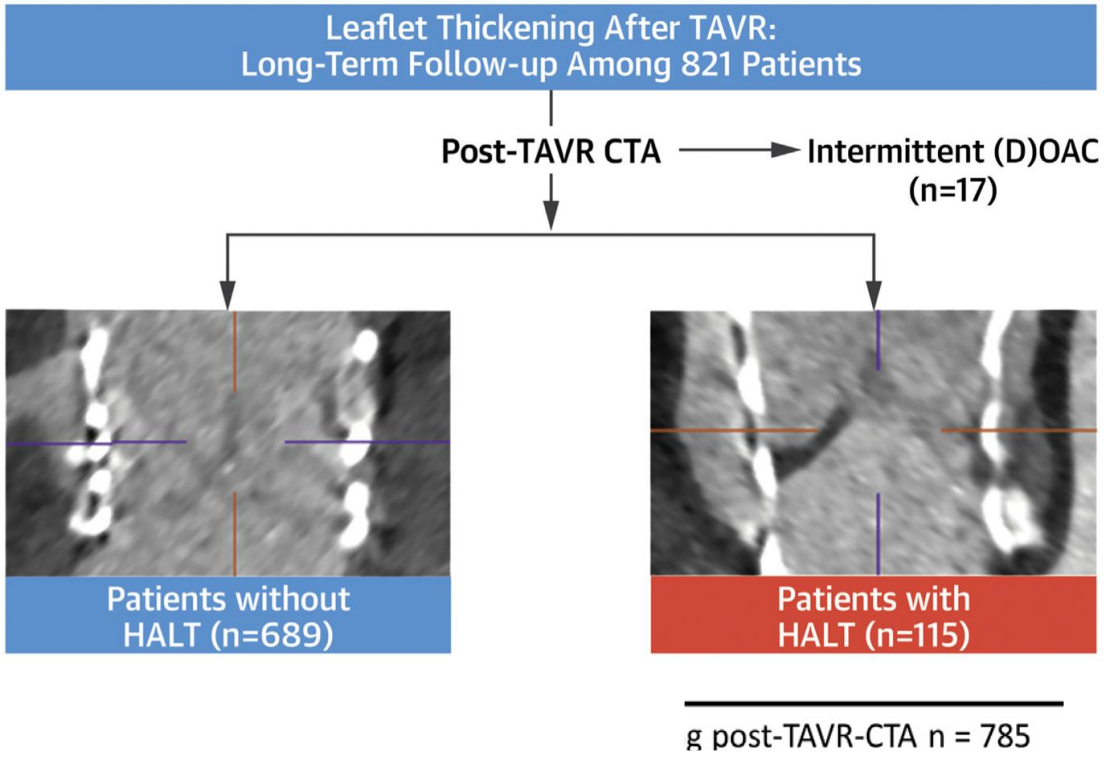


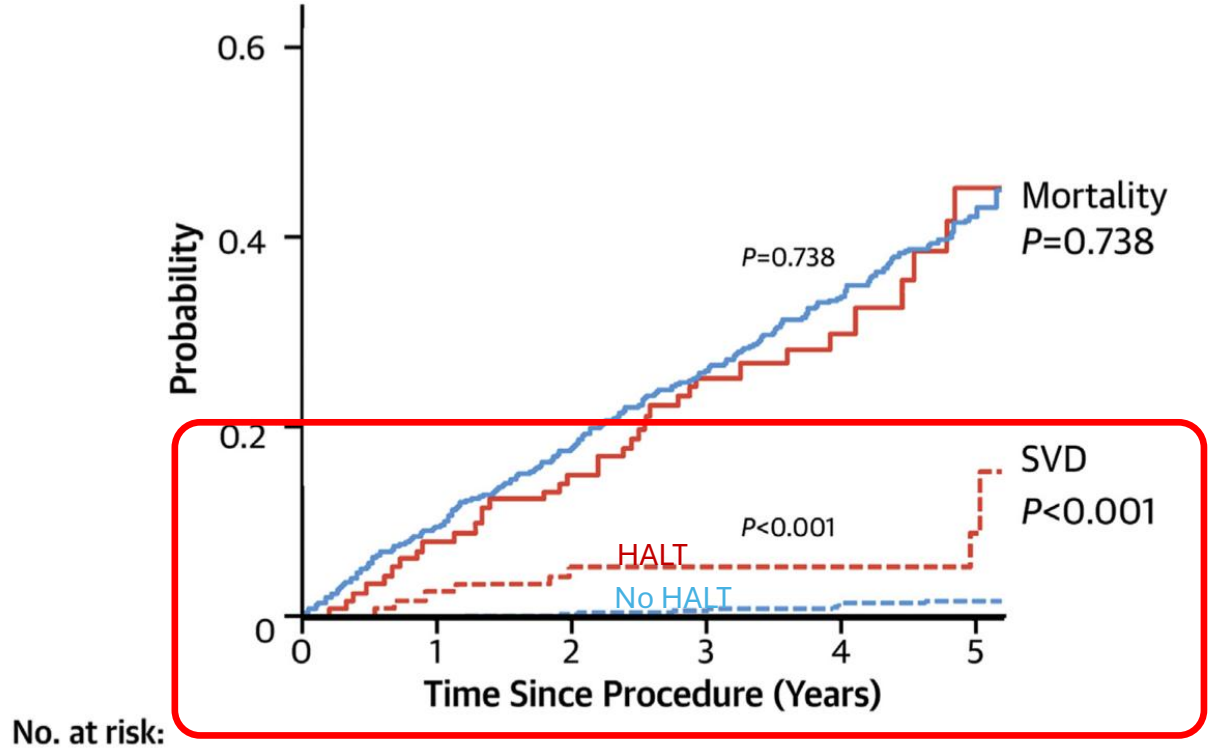


Sato, et al. TCT 2020

Plus de SVD en cas de thromboses infra-cliniques précoces

Long-Term Follow-Up of Hypoattenuated Leaflet Thickening After Transcatheter Aortic Valve Replacement





No. at risk:

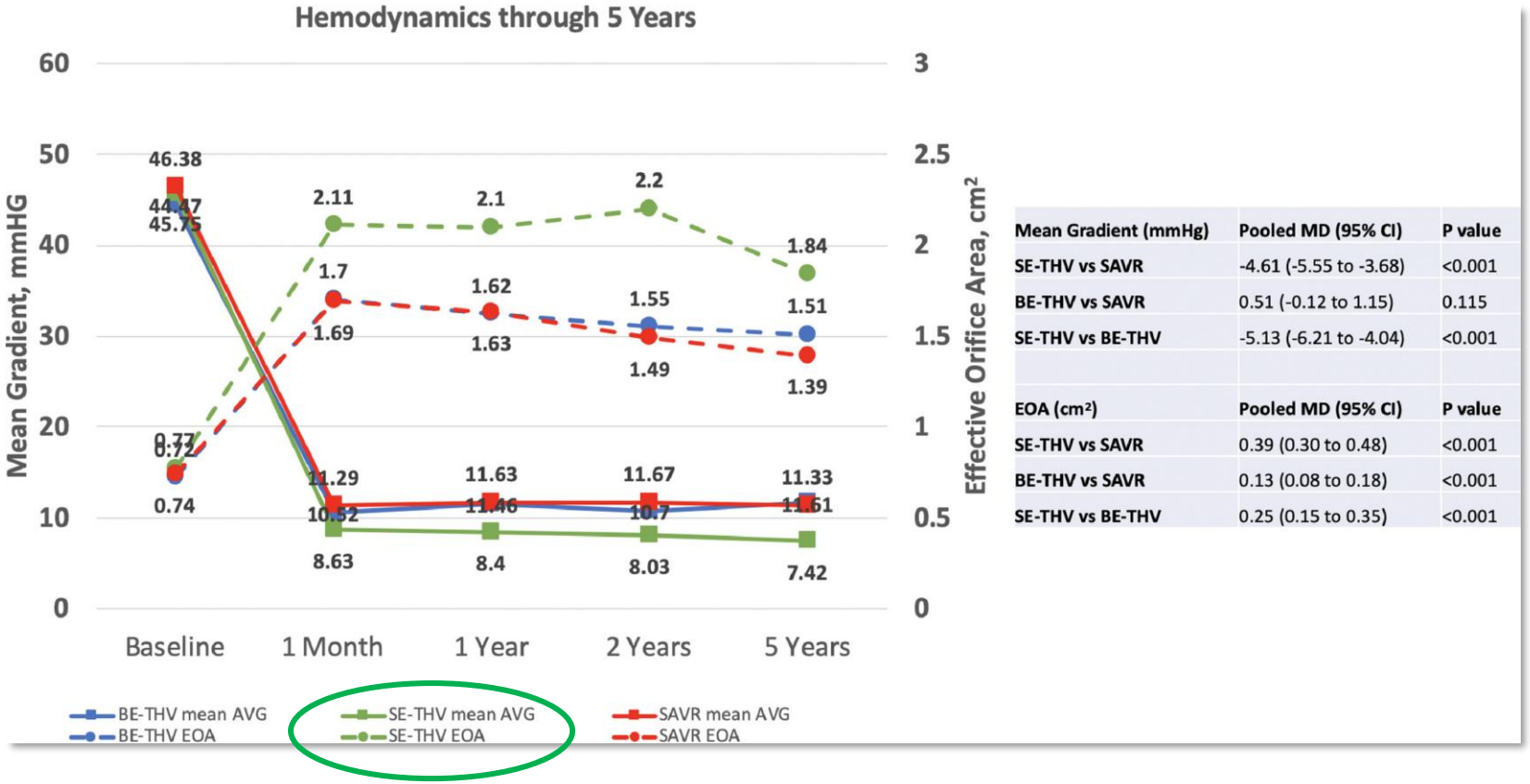
No HALT	689	617	552	461	310	189
HALT	115	101	91	74	42	15
No HALT	689	449	435	378	242	154
HALT	115	76	70	60	29	13

SVD = symptomatic hemodynamic valve deterioration

Hein M, et al. J Am Coll Cardiol Intv. 2022;15(11):1113–1122

L'Hémodynamique

Gradients moins élevés et surfaces plus grandes avec les valves self-expanding



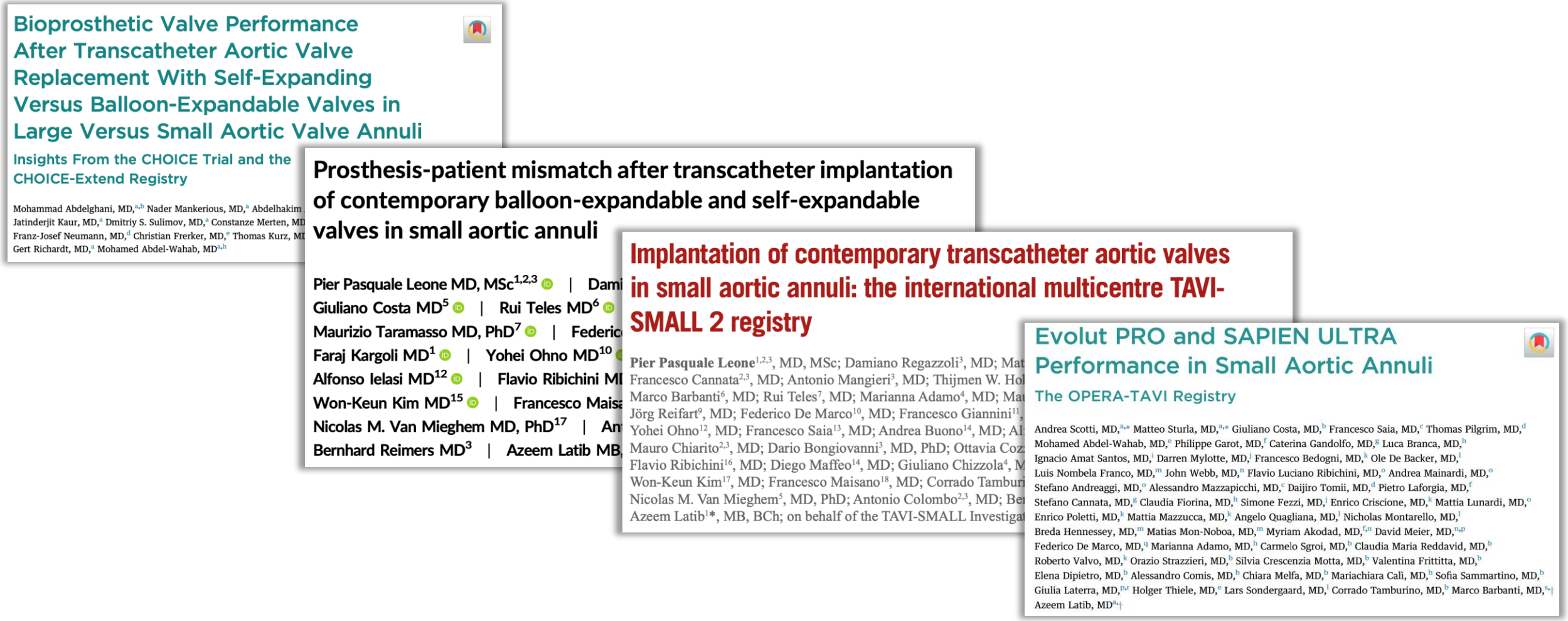
Mean Gradient (mmHg)	Pooled MD (95% CI)	P value
SE-THV vs SAVR	-4.61 (-5.55 to -3.68)	<0.001
BE-THV vs SAVR	0.51 (-0.12 to 1.15)	0.115
SE-THV vs BE-THV	-5.13 (-6.21 to -4.04)	<0.001

EOA (cm²)	Pooled MD (95% CI)	P value
SE-THV vs SAVR	0.39 (0.30 to 0.48)	<0.001
BE-THV vs SAVR	0.13 (0.08 to 0.18)	<0.001
SE-THV vs BE-THV	0.25 (0.15 to 0.35)	<0.001

Ueyama H et al., Am J Cardiol 2021;00:1–8

Gradients moins élevés et surfaces plus grandes avec les valves self-expanding

Encore plus marqué pour les petits anneaux



Bioprosthetic Valve Performance After Transcatheter Aortic Valve Replacement With Self-Expanding Versus Balloon-Expandable Valves in Large Versus Small Aortic Valve Annuli

Insights From the CHOICE Trial and the CHOICE-Extend Registry

Mohammad Abdelghani, MD,[a,b] Nader Mankerious, MD,[a] Abdelhakim
Jatinderjit Kaur, MD,[a] Dmitriy S. Sulimov, MD,[a] Constanze Merten, MD
Franz-Josef Neumann, MD,[d] Christian Frerker, MD,[e] Thomas Kurz, MD
Gert Richardt, MD,[a] Mohamed Abdel-Wahab, MD[a,h]

Prosthesis-patient mismatch after transcatheter implantation of contemporary balloon-expandable and self-expandable valves in small aortic annuli

Pier Pasquale Leone MD, MSc[1,2,3] | Dami
Giuliano Costa MD[5] | Rui Teles MD[6]
Maurizio Taramasso MD, PhD[7] | Federic
Faraj Kargoli MD[1] | Yohei Ohno MD[10]
Alfonso Ielasi MD[12] | Flavio Ribichini MD
Won-Keun Kim MD[15] | Francesco Maisa
Nicolas M. Van Mieghem MD, PhD[17] | An
Bernhard Reimers MD[3] | Azeem Latib MB,

Implantation of contemporary transcatheter aortic valves in small aortic annuli: the international multicentre TAVI-SMALL 2 registry

Pier Pasquale Leone[1,2,3], MD, MSc; Damiano Regazzoli[3], MD; Mat
Francesco Cannata[2,3], MD; Antonio Mangieri[3], MD; Thijmen W. Hol
Marco Barbanti[6], MD; Rui Teles[7], MD; Marianna Adamo[4], MD; Ma
Jörg Reifart[9], MD; Federico De Marco[10], MD; Francesco Giannini[11],
Yohei Ohno[12], MD; Francesco Saia[13], MD; Andrea Buono[14], MD; Al
Mauro Chiarito[2,3], MD; Dario Bongiovanni[3], MD, PhD; Ottavia Coz
Flavio Ribichini[16], MD; Diego Maffeo[14], MD; Giuliano Chizzola[4], M
Won-Keun Kim[17], MD; Francesco Maisano[18], MD; Corrado Tamburi
Nicolas M. Van Mieghem[5], MD, PhD; Antonio Colombo[2,3], MD; Be
Azeem Latib[1]*, MB, BCh; on behalf of the TAVI-SMALL Investigat

Evolut PRO and SAPIEN ULTRA Performance in Small Aortic Annuli

The OPERA-TAVI Registry

Andrea Scotti, MD,[a,*] Matteo Sturla, MD,[a,*] Giuliano Costa, MD,[b] Francesco Saia, MD,[c] Thomas Pilgrim, MD,[d]
Mohamed Abdel-Wahab, MD,[e] Philippe Garot, MD,[f] Caterina Gandolfo, MD,[g] Luca Branca, MD,[h]
Ignacio Amat Santos, MD,[i] Darren Mylotte, MD,[j] Francesco Bedogni, MD,[k] Ole De Backer, MD,[l]
Luis Nombela Franco, MD,[m] John Webb, MD,[n] Flavio Luciano Ribichini, MD,[o] Andrea Mainardi, MD,[o]
Stefano Andreaggi, MD,[o] Alessandro Mazzapicchi, MD,[c] Daijiro Tomii, MD,[d] Pietro Laforgia, MD,[f]
Stefano Cannata, MD,[g] Claudia Fiorina, MD,[h] Simone Fezzi, MD,[i] Enrico Criscione, MD,[k] Mattia Lunardi, MD,[o]
Enrico Poletti, MD,[k] Mattia Mazzucca, MD,[k] Angelo Quagliana, MD,[l] Nicholas Montarello, MD,[l]
Breda Hennessey, MD,[m] Matias Mon-Noboa, MD,[m] Myriam Akodad, MD,[f,n] David Meier, MD,[n,p]
Federico De Marco, MD,[q] Marianna Adamo, MD,[b] Carmelo Sgroi, MD,[b] Claudia Maria Reddavid, MD,[b]
Roberto Valvo, MD,[k] Orazio Strazzieri, MD,[b] Silvia Crescenzia Motta, MD,[b] Valentina Frittitta, MD,[b]
Elena Dipietro, MD,[b] Alessandro Comis, MD,[b] Chiara Melfa, MD,[b] Mariachiara Calì, MD,[b] Sofia Sammartino, MD,[b]
Giulia Laterra, MD,[p,r] Holger Thiele, MD,[e] Lars Sondergaard, MD,[l] Corrado Tamburino, MD,[b] Marco Barbanti, MD,[s,†]
Azeem Latib, MD[a,†]

Abdelghani M, et al, JACC Cardiol Intv 2018

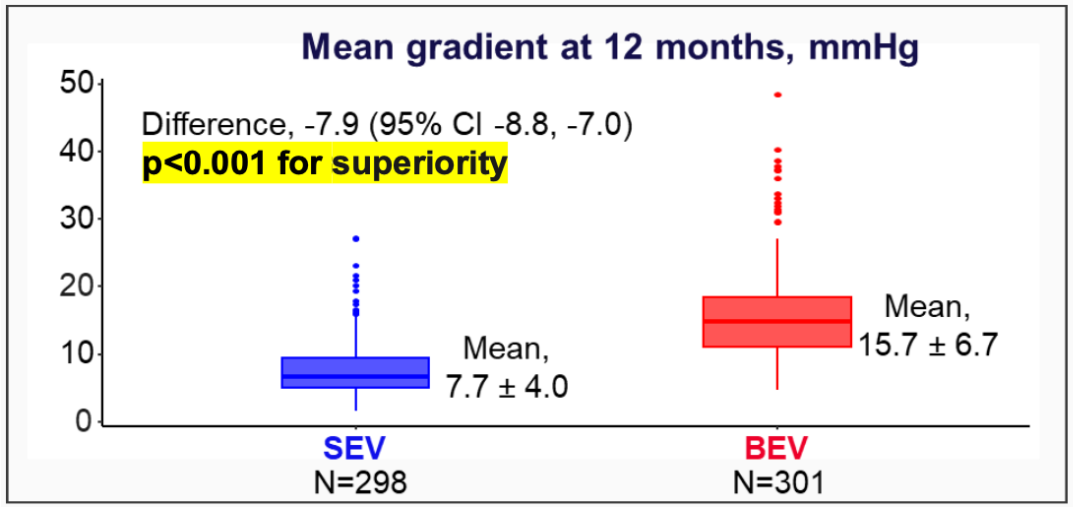
Scotti et al. JACC 2024

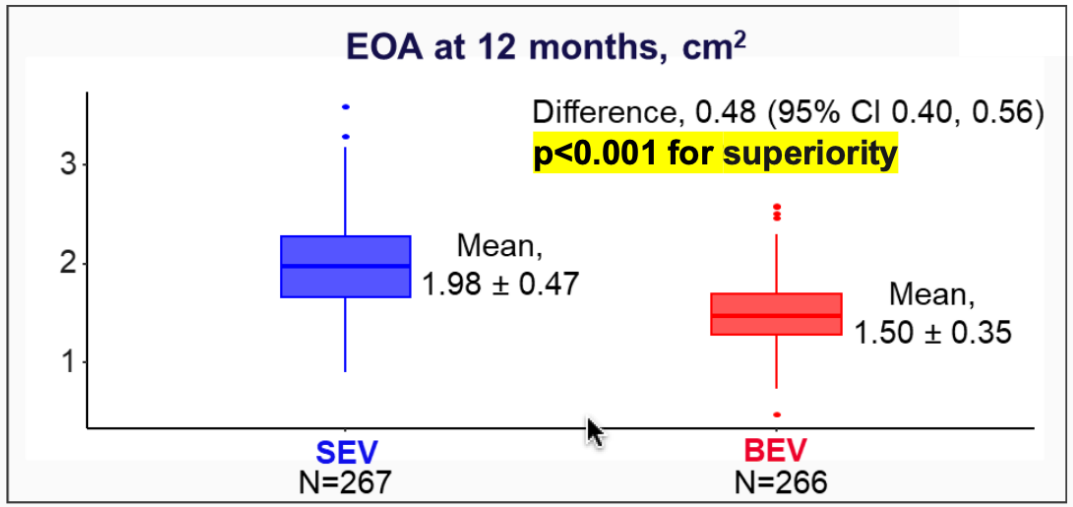
Leone P et al. EuroIntervention 2023;19:256-266.

Leone P et al. Catheter Cardiovasc Interv. 2023;102:931–943.

SMART Trial results - a landmark head-to-head randomized controlled TAVI trial

SMall **A**nnuli **R**andomized **T**o **E**volut or **S**APIEN = SMART Trial



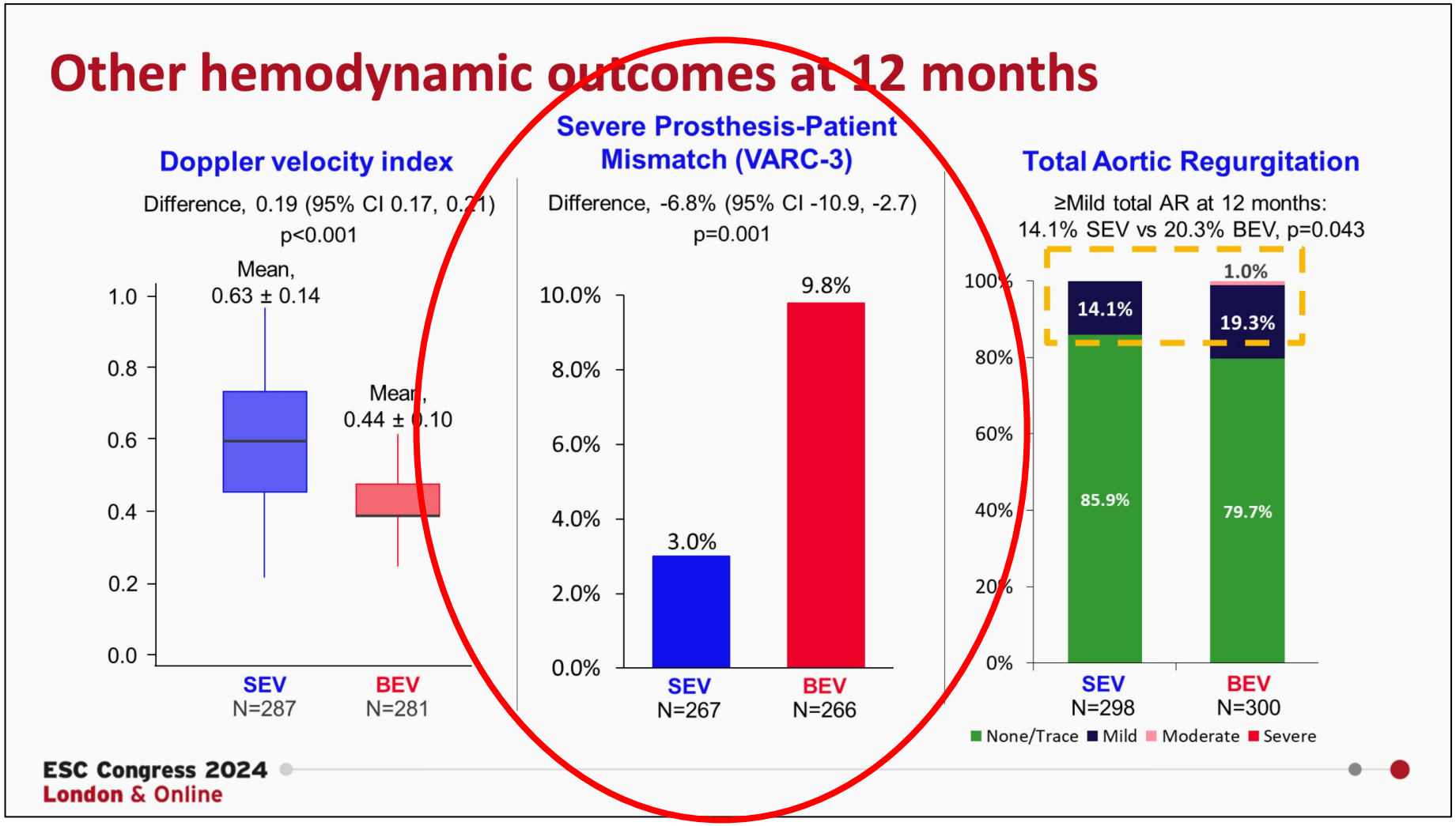


Tchetche D, ESC 2024

Herrmann HC et al. N Engl J Med 2024;390:1959-1971

Moins de mismatch sévère avec les prothèses self-expanding

SMART

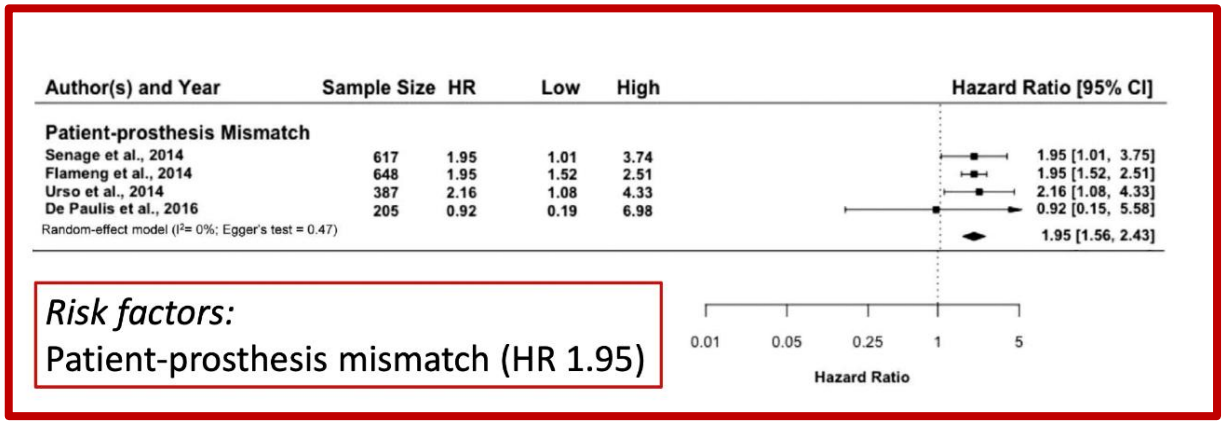


Tchetche D, ESC 2024

Herrmann HC et al. N Engl J Med2024;390:1959-1971

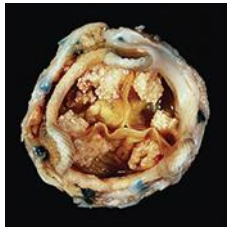
Patient-prosthesis mismatch in SAVR patients

Mismatch in SAVR pts promotes SVD



Risk factors:
Patient-prosthesis mismatch (HR 1.95)

PPM

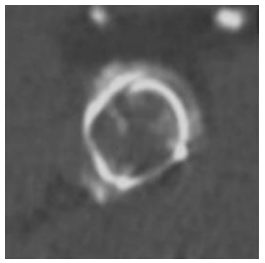


SVD

Ochi et al. Heart, Lung and Circulation 2020.

Determinants of aortic bioprosthetic valve calcification assessed by multidetector CT

Haïfa Mahjoub, Patrick Mathieu, Eric Larose, Abdelaziz Dahou, Mario Sénéchal, Jean-Gaston Dumesnil, Jean-Pierre Després, Philippe Pibarot



194 pts with bioprosthetic SAVR, FU= 7.9±3 yrs
24% developed calcification on CT.

PPM = strongest predictor of valve calcification (OR =3.67; 95% CI: 1.25–10.6; P=0.01).

Table 3 Multivariable predictors of bioprosthetic valve calcification

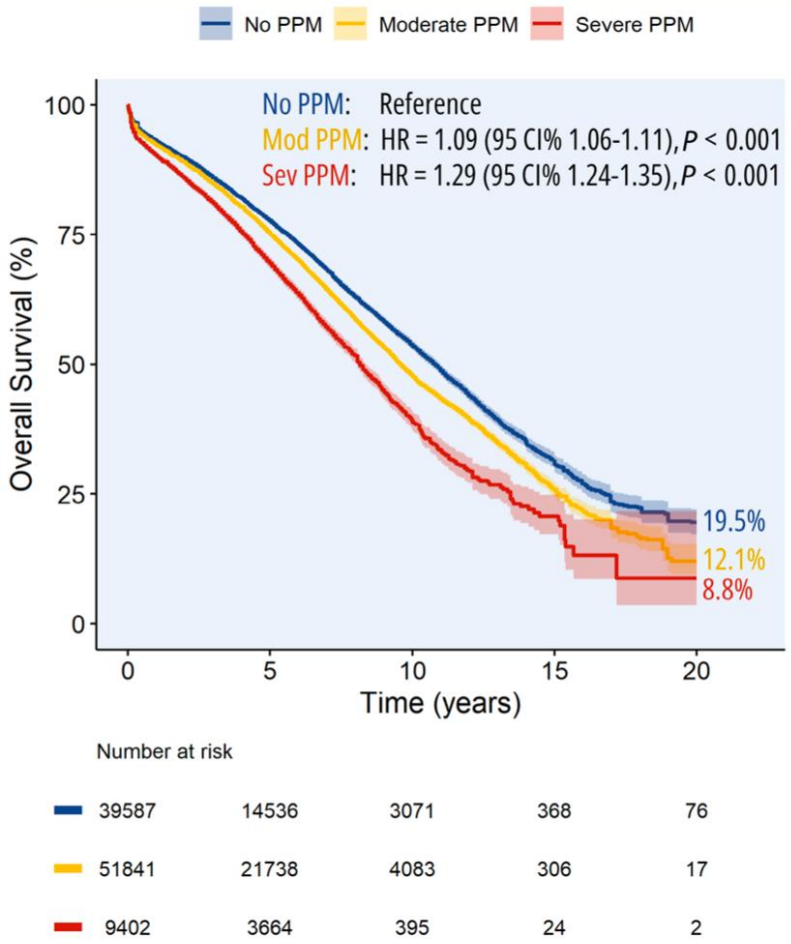
	OR	95% CI	p Value
Age (per 1 year increment)	0.96	0.92 to 1.01	0.1
Time interval since BPV implantation (per 1 year increment)	1.16	1.05 to 1.29	0.003
Calcium–phosphorus product (per 0.1 increment)	1.11	1.01 to 1.23	0.02
Prosthesis–patient mismatch	3.67	1.25 to 10.6	0.01

BPV, bioprosthetic valve.

Mahjoub H, et al. Heart 2015;101:472-7.

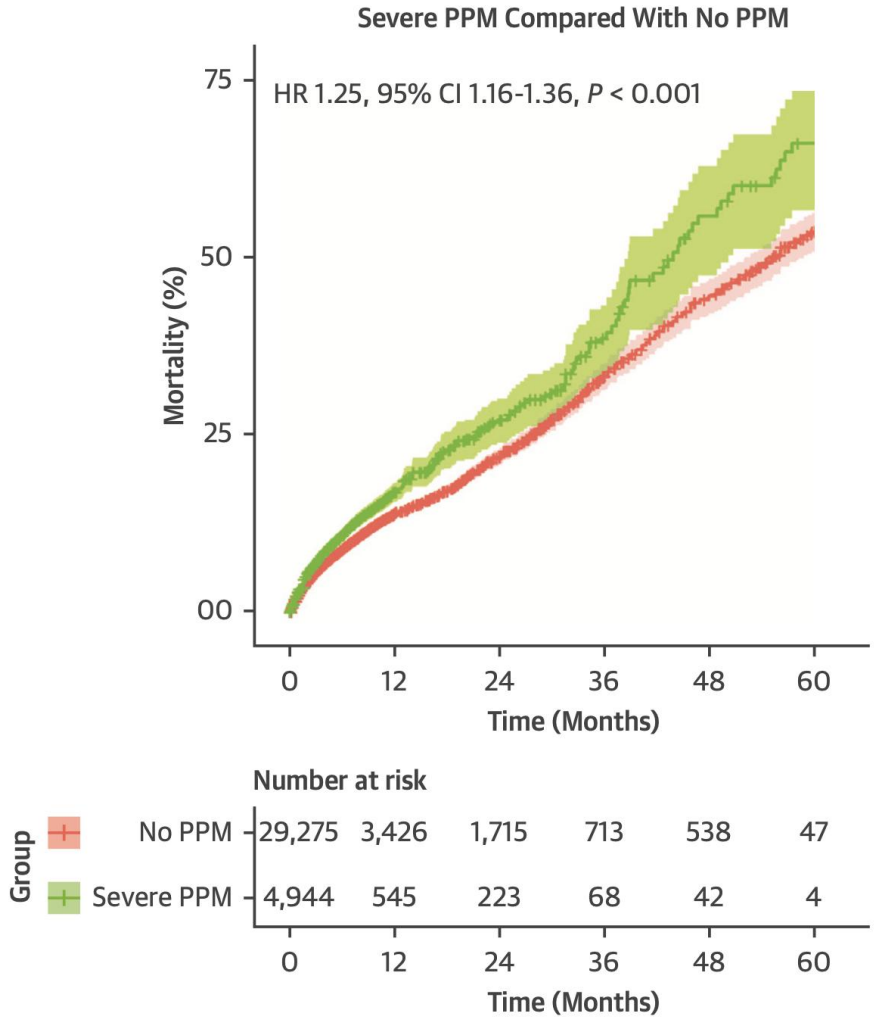
Impact du mismatch sévère sur la mortalité

Meta-analysis - SAVR



Sá M et al. J Am Heart Assoc. 2024;13:e033176.

Meta-analysis - TAVR



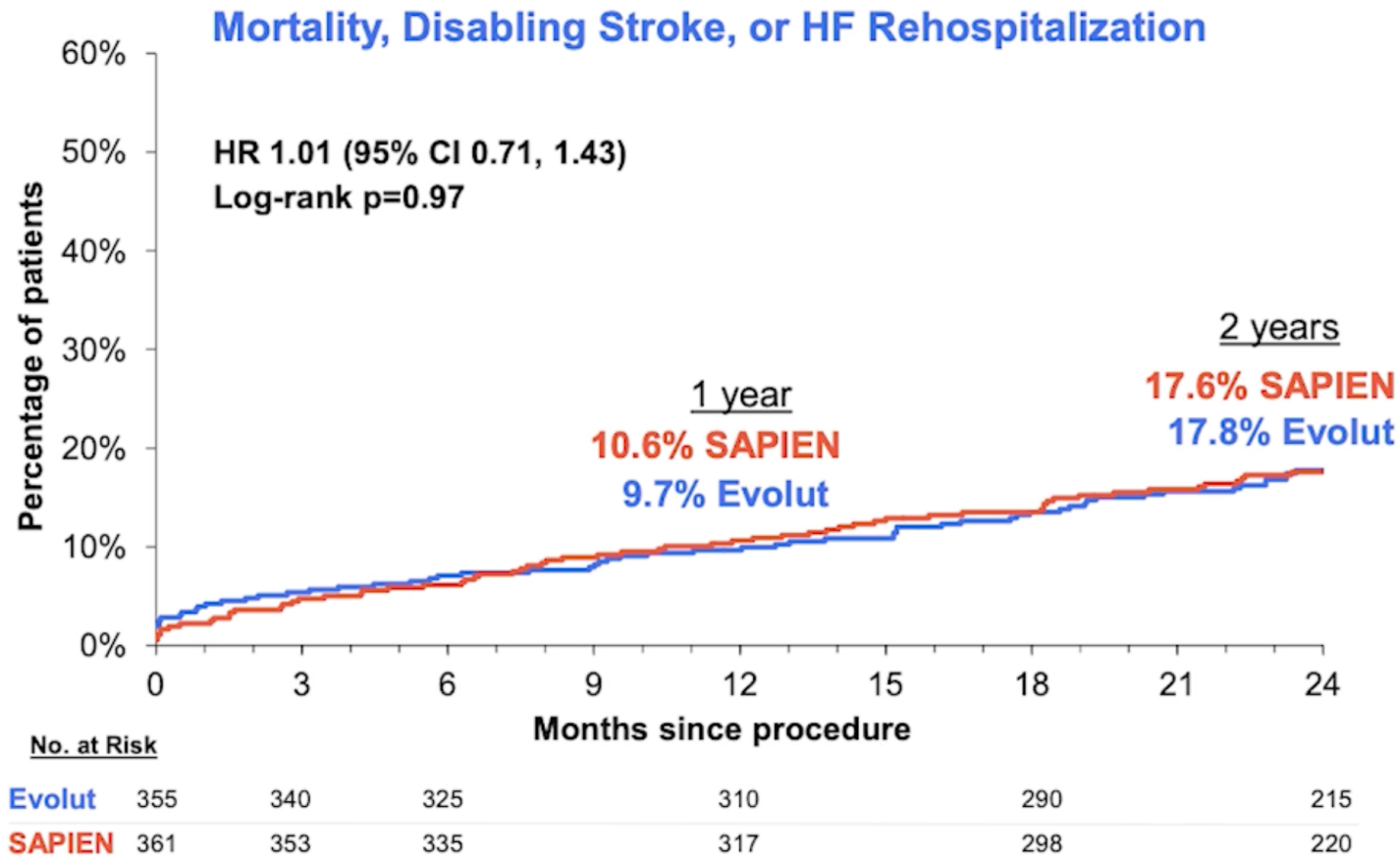
Sá M et al. J Am Coll Cardiol Img 2023;16:298–310.

Auto-expansible vs. Ballon-expansible dans les petits anneaux

Pas d'impact clinique à 2 ans

SMART trial

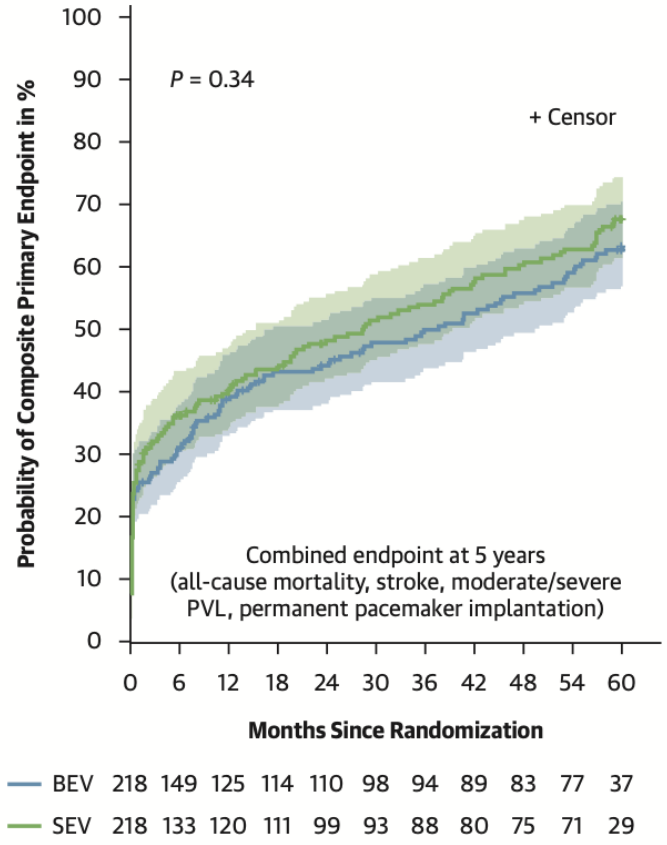
Clinical outcome composite & components through 2 years



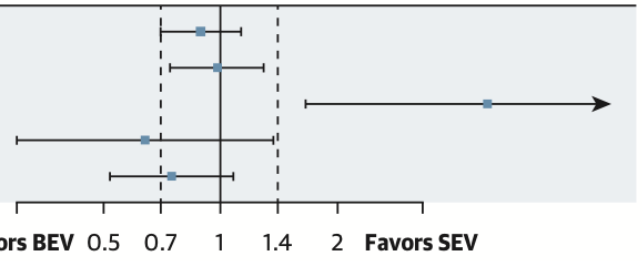
Herrmann HC, CRT 2025

5-Year Results of the Randomized SOLVE-TAVI Trial

447 intermediate- to high-risk pts with symptomatic artic stenosis



Endpoint	HR (95% CI)
Composite Primary Endpoint	0.89 (0.70-1.13)
All-Cause Mortality	0.98 (0.74-1.29)
Stroke	4.84 (1.65-14.18)
Moderate/Severe PVL	0.64 (0.30-1.37)
Permanent Pacemaker	0.75 (0.52-1.08)



Feistritzer H-J, et al. JACC. 2025;85(1):74–82.

CIHR IRSC
Canadian Institutes of Health Research | Instituts de recherche en santé du Canada

MINISTÈRE DES SOLIDARITÉS ET DE LA SANTÉ
Liberté
Égalité
Fraternité

PHRC-N 2020

Centre Hospitalier Régional Universitaire de Lille

UNIVERSITÉ LAVAL

BEST Study

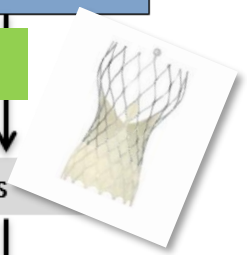
Patients eligible to percutaneous transfemoral TAVI either with BE-valve or SE-valve

1862 Patients 1:1 R...

n=1989; completed enrollment Oct 2024

BE-Valve N=931	*Versus*	SE-Valve N=931

Stratification sur anatomie (BAV vs TAV)



Primary endpoint : all-cause death at 90 days

Secondary endpoints including all-cause death at 12 months

Suivi à 10 ans

Screening Consent

Randomization

TAVI

Follow-up

Take Home Message

- **La durabilité des prothèses TAVI est une question essentielle au moment ou l'espérance de vie des patients implantés augmentent.**
- **Plus de 20 après l'implantation du premier TAVI, la durabilité de ces prothèses est éprouvée et semble au moins similaire aux prothèses chirurgicales.**
- **Des études comparant les prothèses TAVI de nouvelles générations et utilisant les définitions standardisées VARC-3 (SVD & BVF) sont en cours avec des suivis prévus à très long-terme (SMART, BEST).**

Merci !

cedric.delhaye@chru-lille.fr