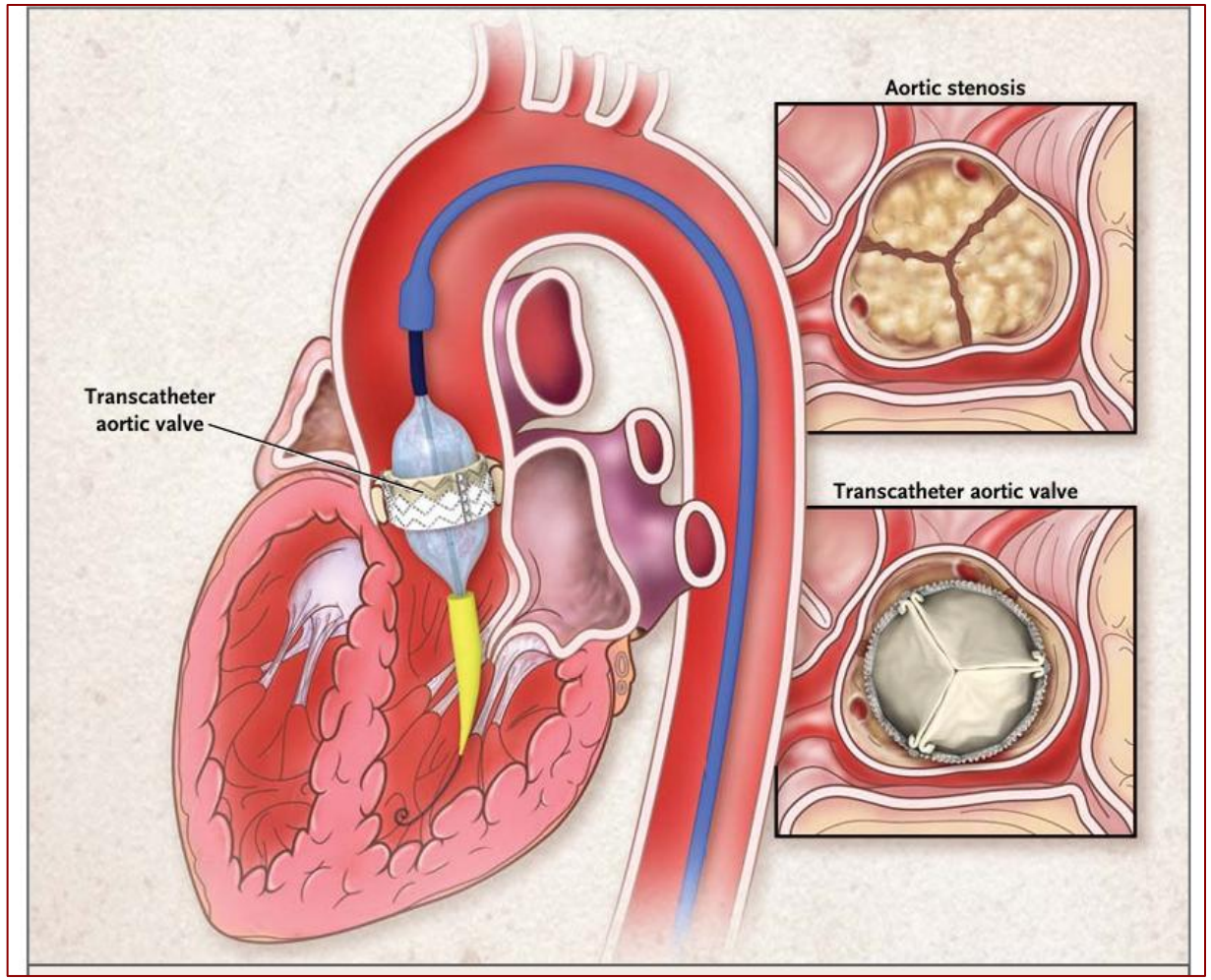
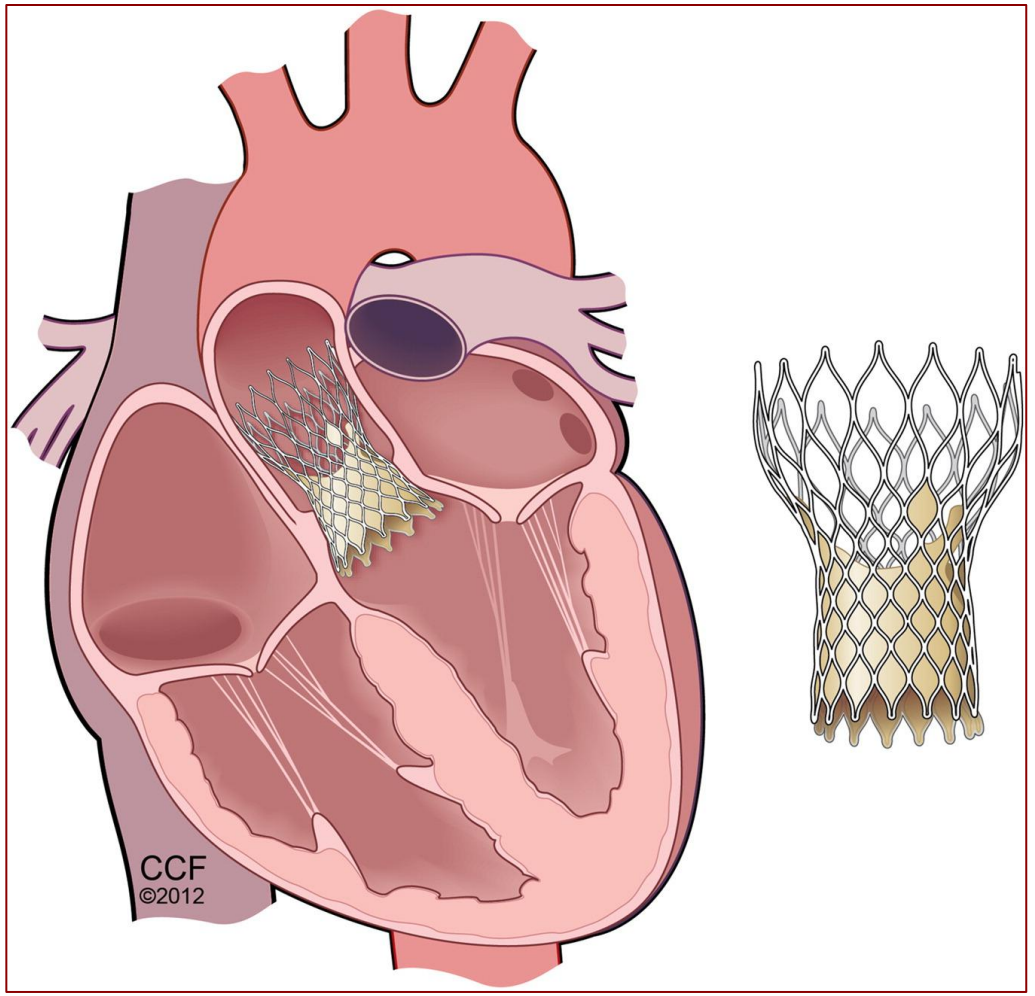
Implantation percutánée de la valve aortique: standard du remplacement valvulaire aortique

Marina Urena

Bichat Hospital, Paris City University, INSERM 1148

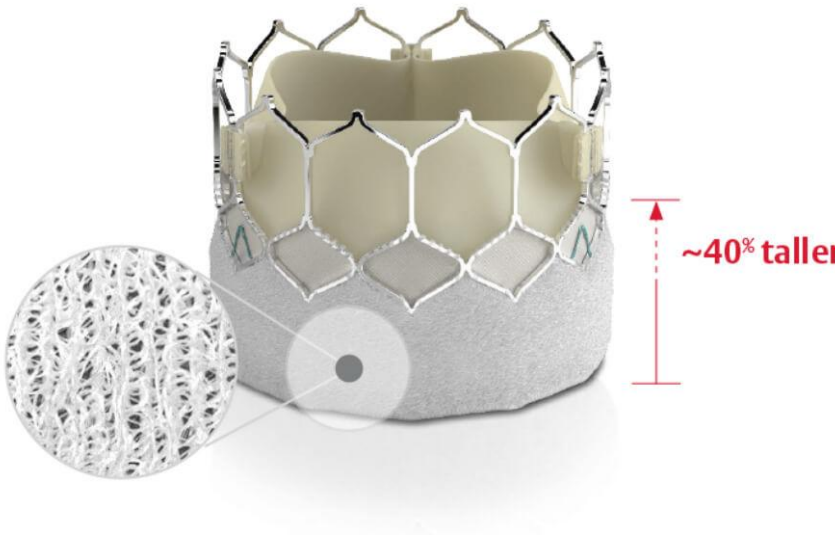
Trascatheter valve implantation:TAVI

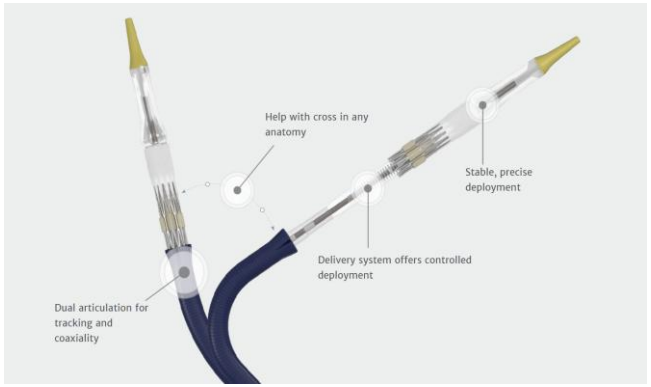




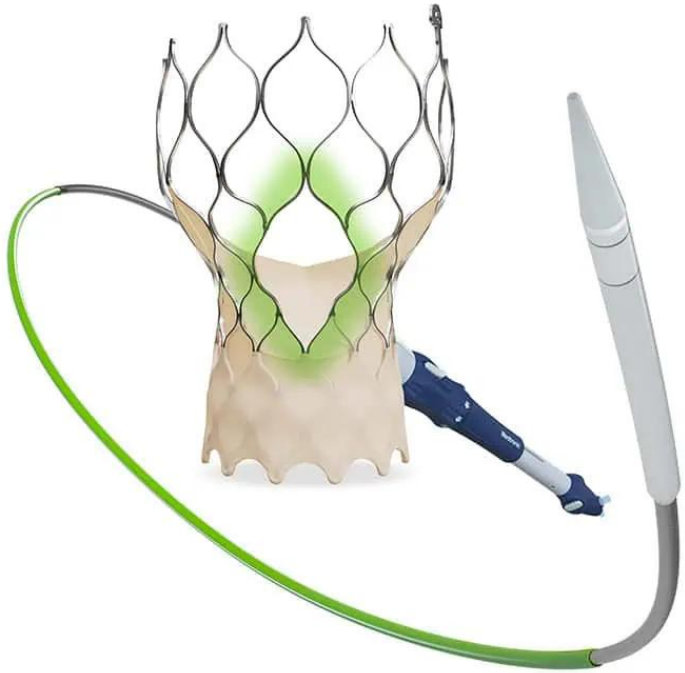
Transcatheter heart valves

Sapien 3 ultra

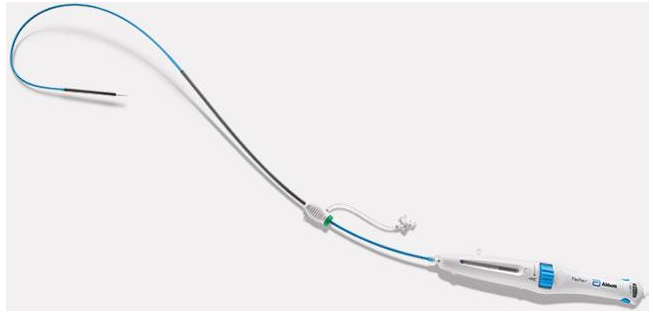




Evolut Fx+

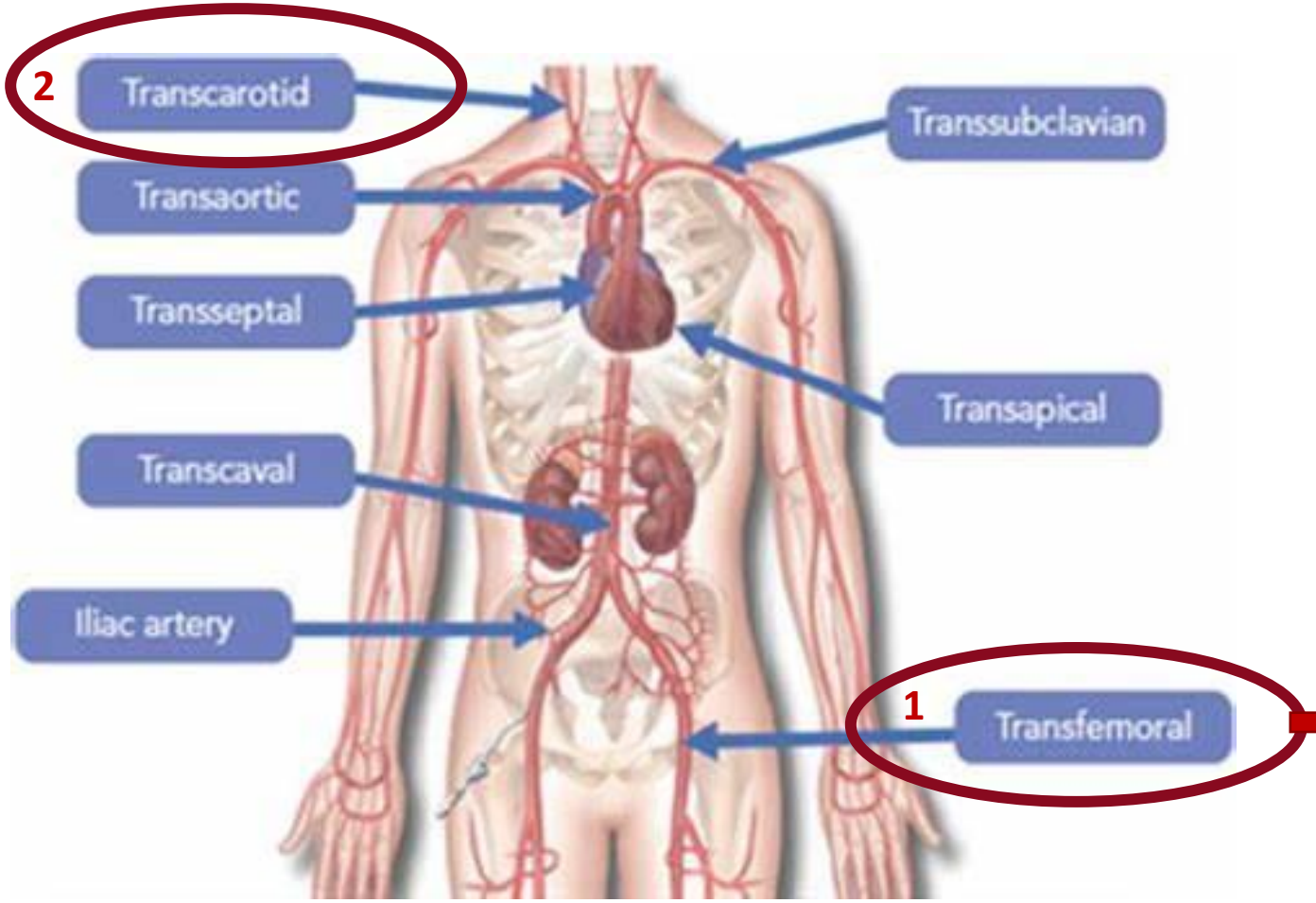


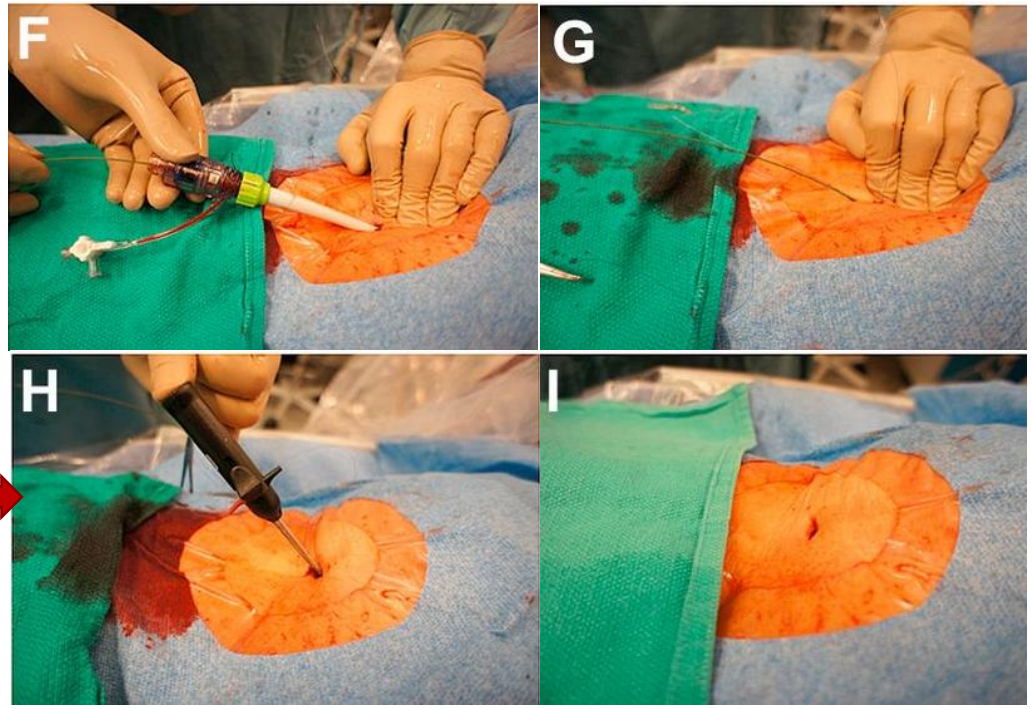
Navitor



Approach

- Local anesthesia (+/-sedation)

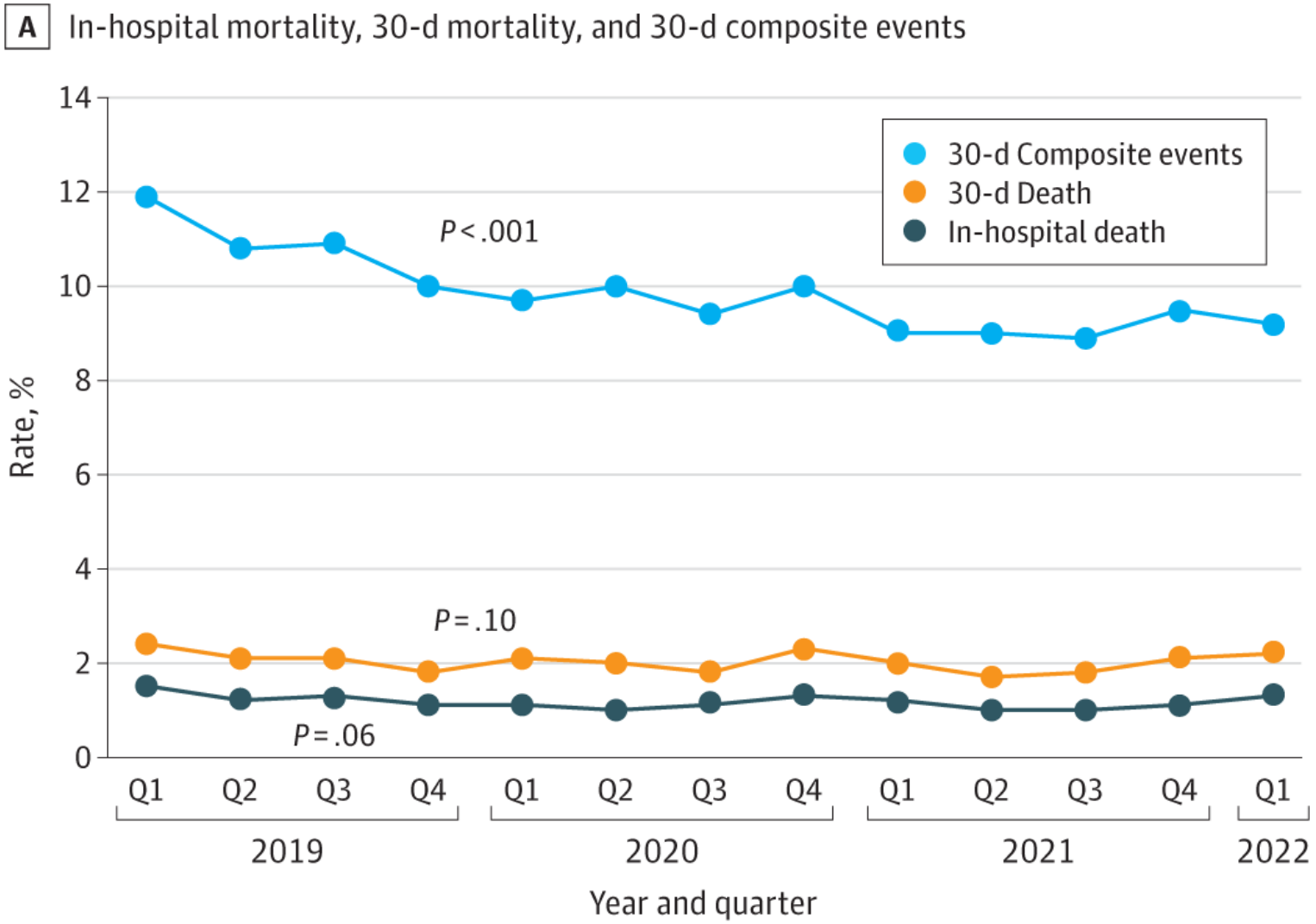




Toggweiler et al. JACC Interv 2013

TAVI Outcomes

n=210 495 pts
median age 79 (73-85) yrs,
43% were female
STS 3.3%



Arnold SV et al. JAMACardiol.2024.

TAVI Outcomes

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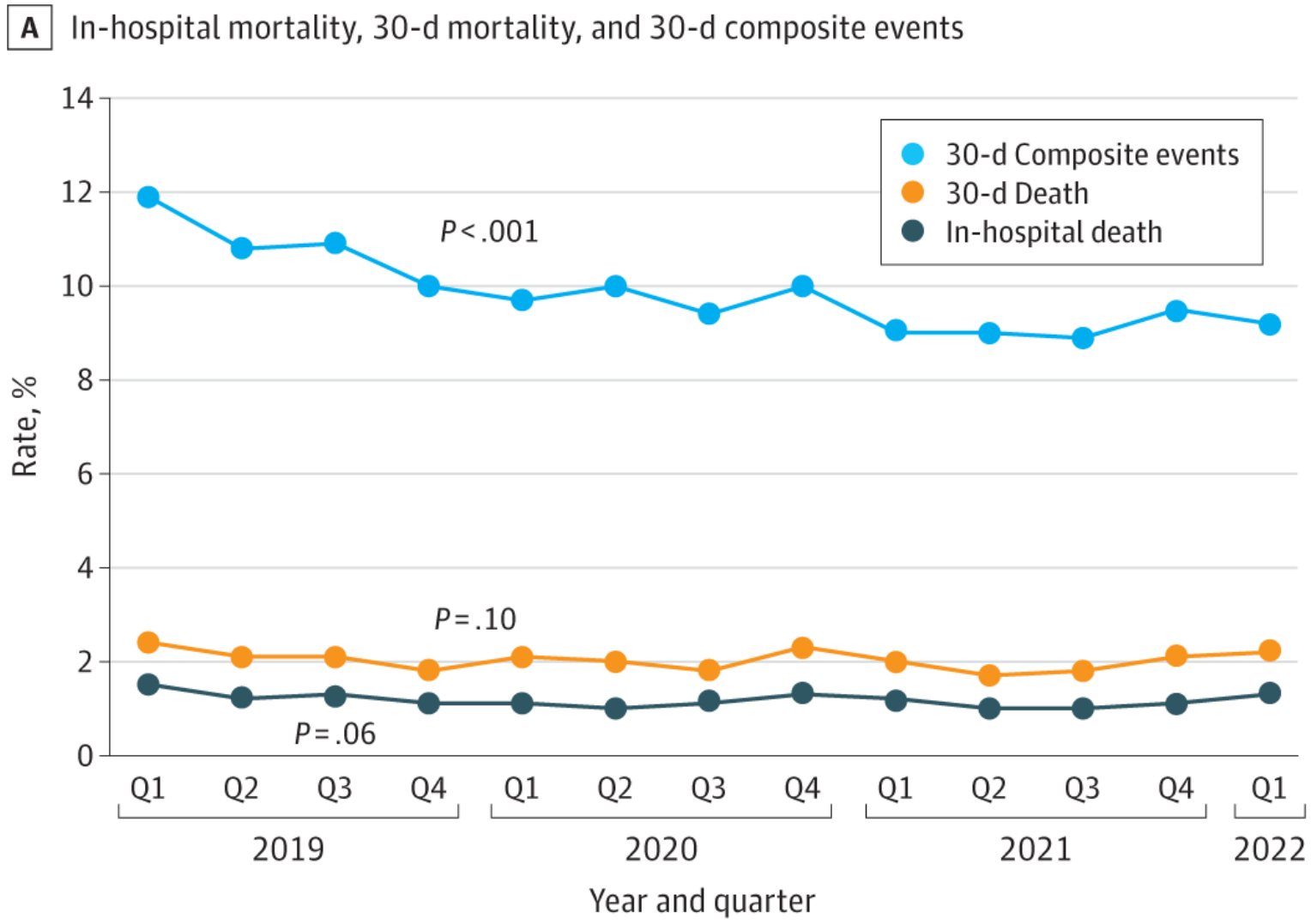


Arnold SV et al. JAMACardiol.2024.

A brief history..

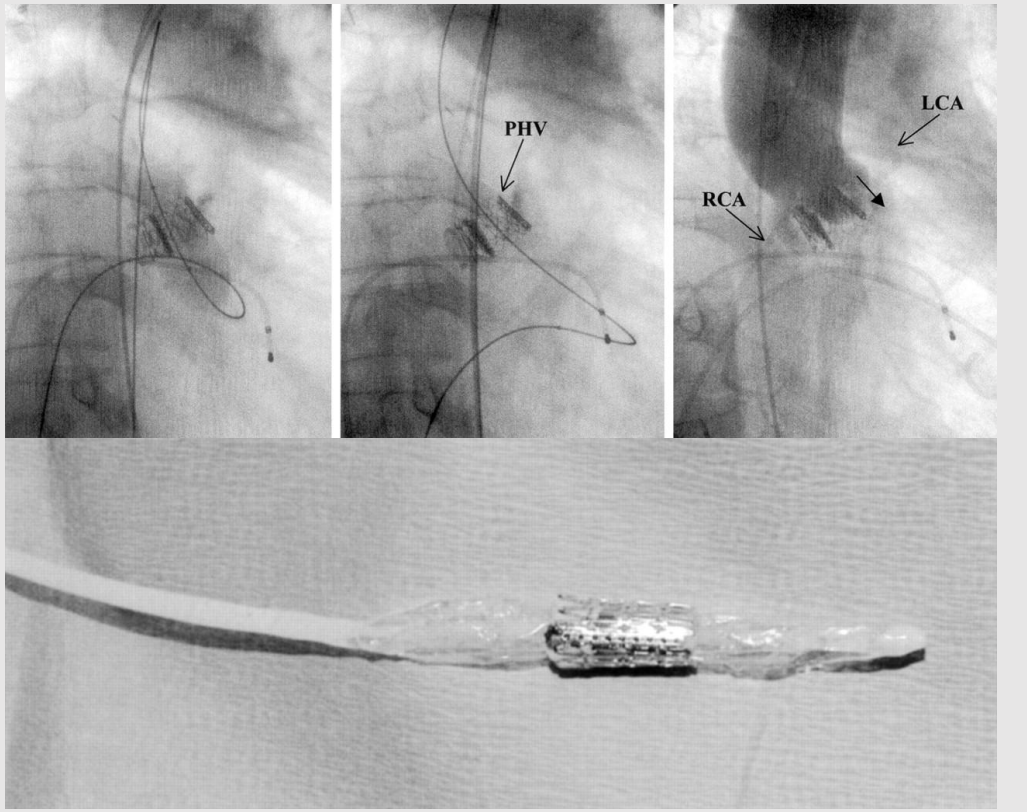
1985. 1st implantation in a pig aorta (Andersen)

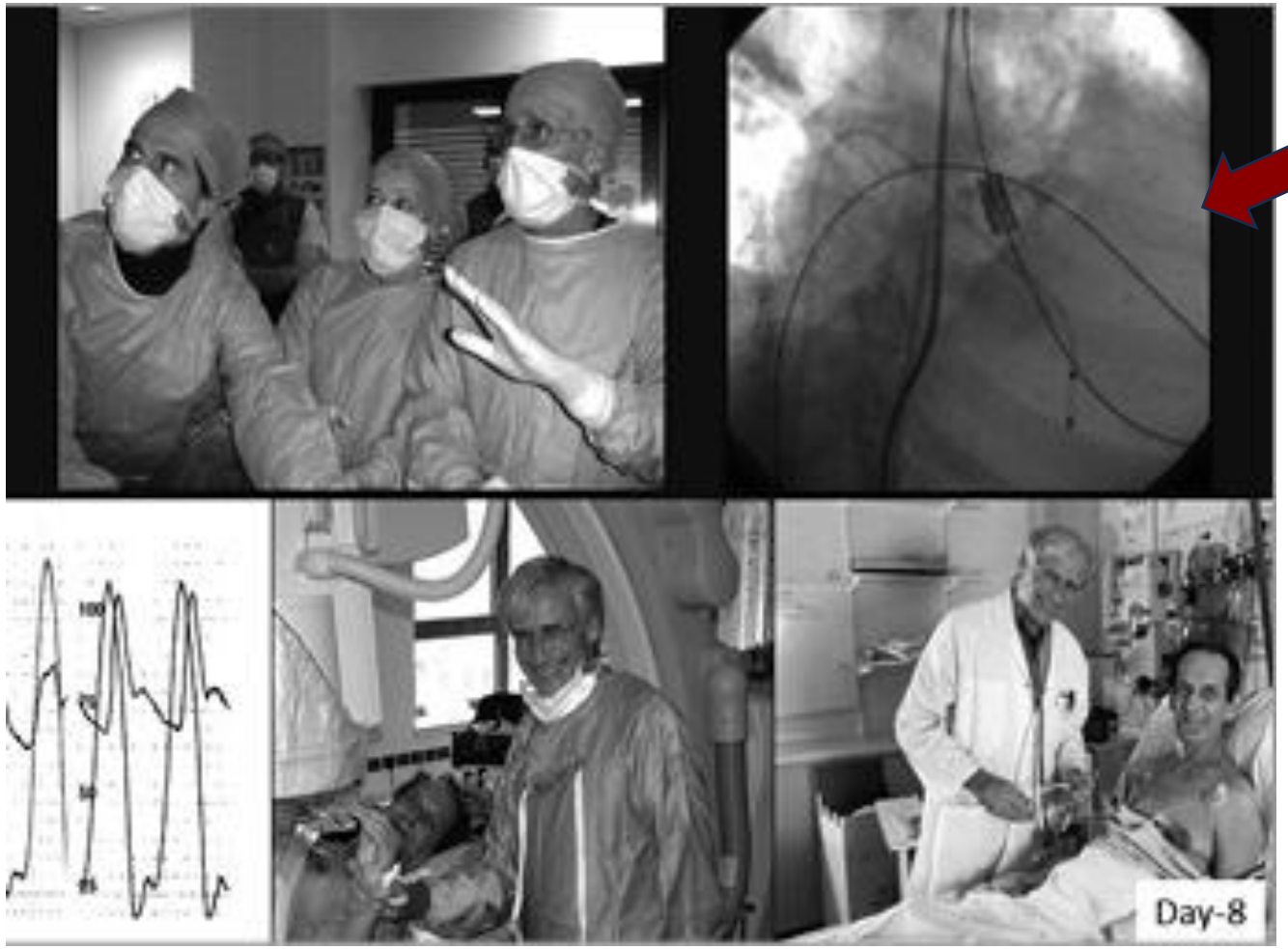
1999. 1erePVT
2000. Animal study

1994. Autopsy study (Cribier)

2002. FIM (Cribier)

TAVI, « proof of concept »

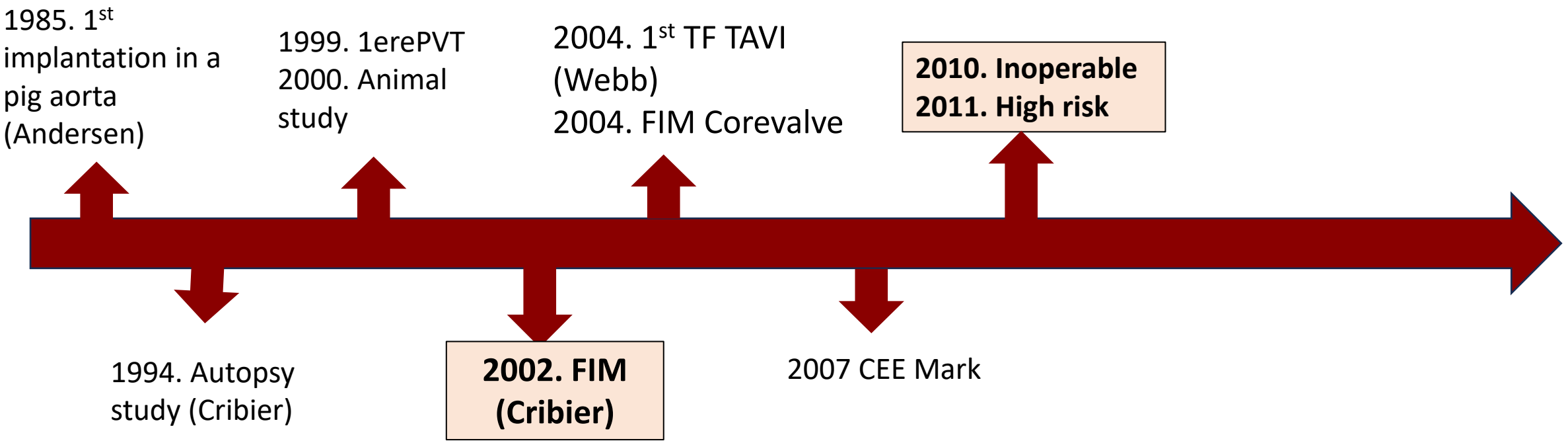




Bicuspid valve
Transseptal approach
Cardiogenic shock

Cribier et al. *Circulation*. 2002

A brief history..

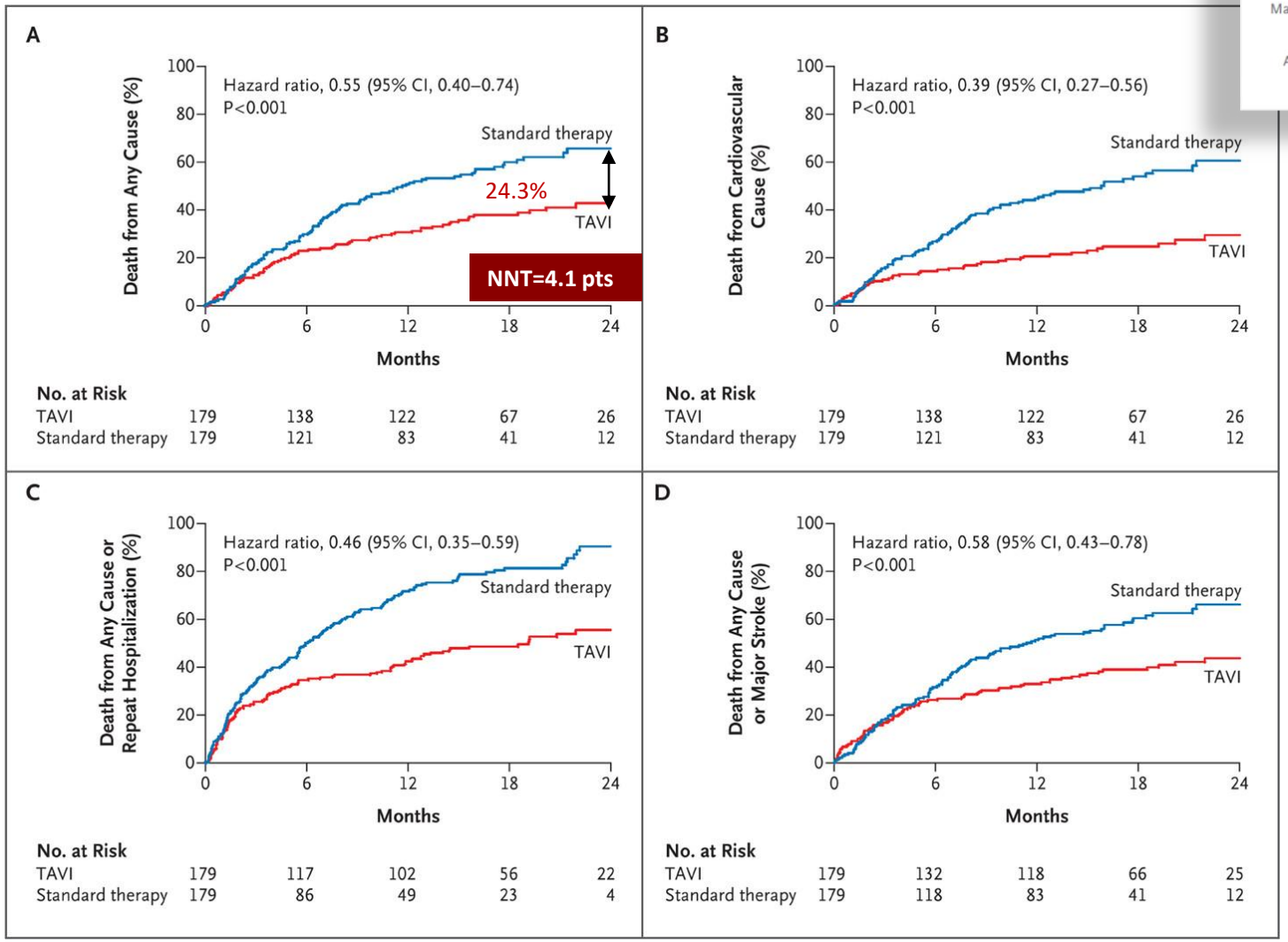


TAVI in inoperable patients

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*



Standard therapy included balloon aortic valvuloplasty

Leon et al. NEJM 2010

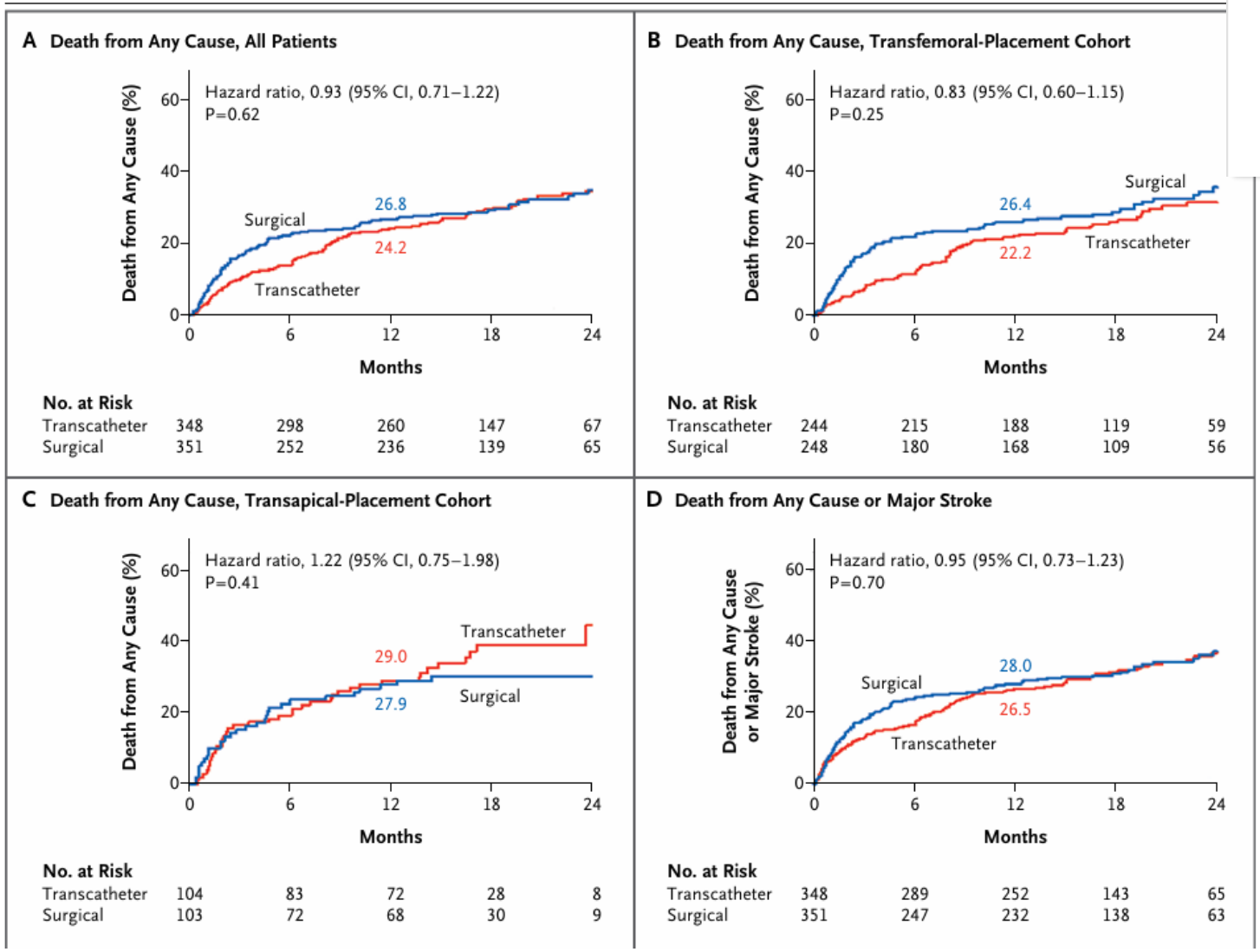
TAVI in high risk patients

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 9, 2011 VOL. 364 NO. 23

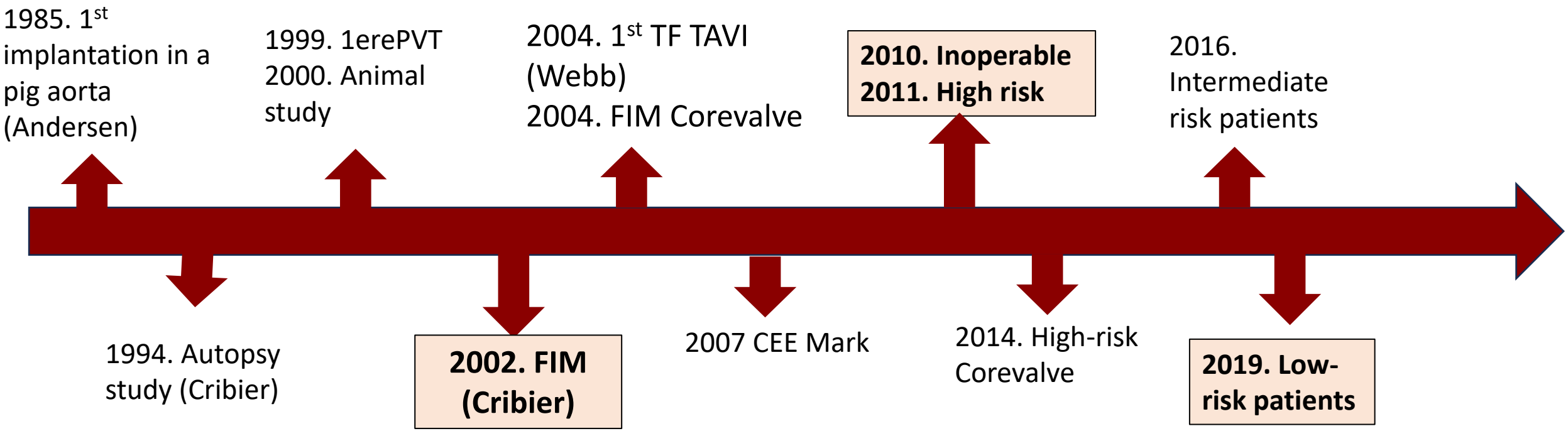
Transcatheter versus Surgical Aortic-Valve Replacement in High-Risk Patients

Craig R. Smith, M.D., Martin B. Leon, M.D., Michael J. 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., Mathew Williams, M.D., Todd Dewey, M.D., Samir Kapadia, M.D., Vasilis Babaliaros, M.D., Vinod H. Thourani, M.D., Paul Corso, M.D., Augusto D. Pichard, M.D., Joseph E. Bavaria, M.D., Howard C. Herrmann, M.D., Jodi J. Akin, M.S., William N. Anderson, Ph.D., Duolao Wang, Ph.D., and Stuart J. Pocock, Ph.D., for the PARTNER Trial Investigators*

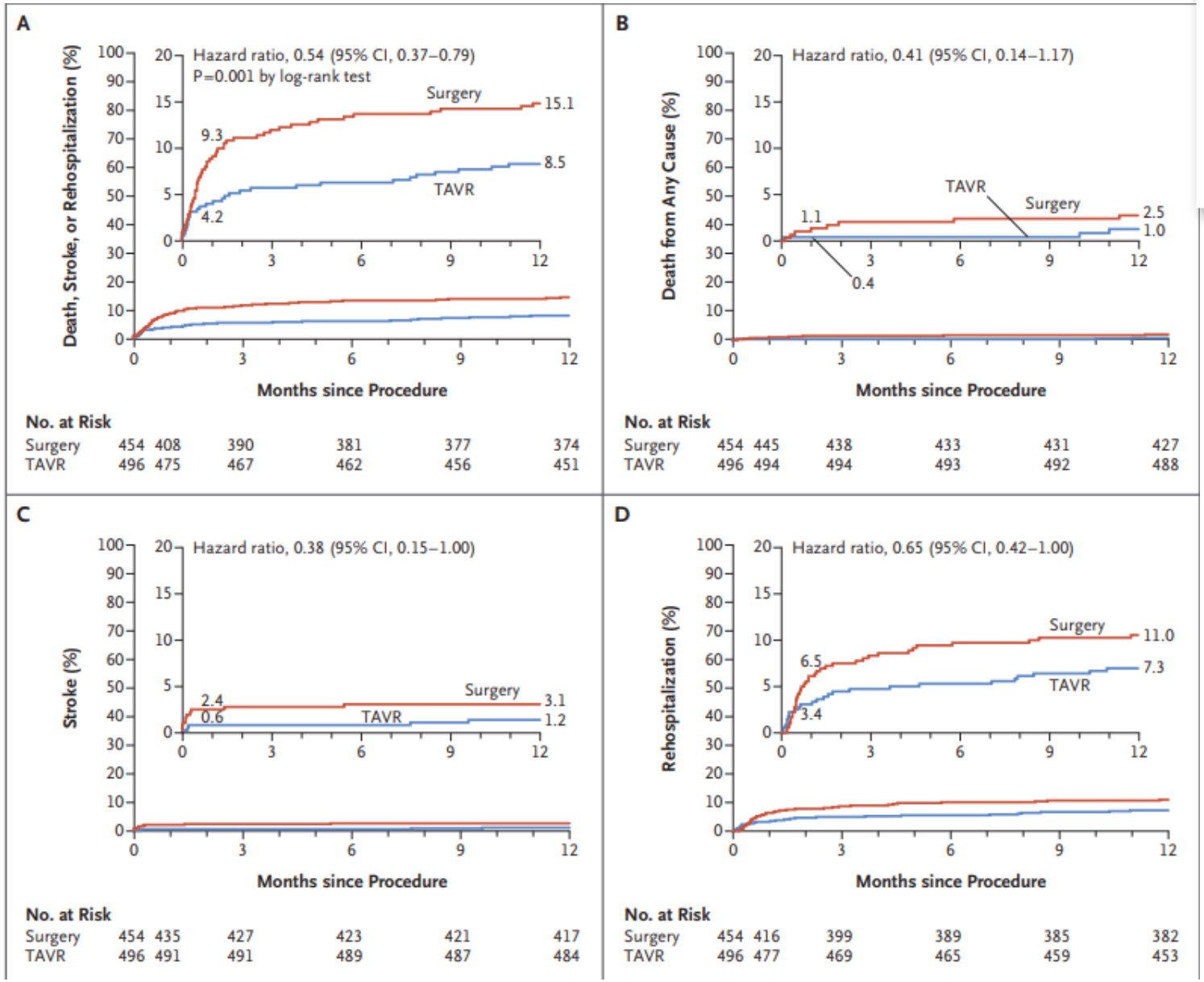


Smith et al. NEJM 2011

A brief history..



Low-risk patients-*BEV*



The NEW ENGLAND JOURNAL of MEDICINE

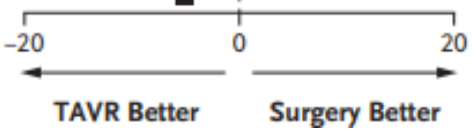
ESTABLISHED IN 1812 MAY 2, 2019 VOL. 380 NO. 18

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*

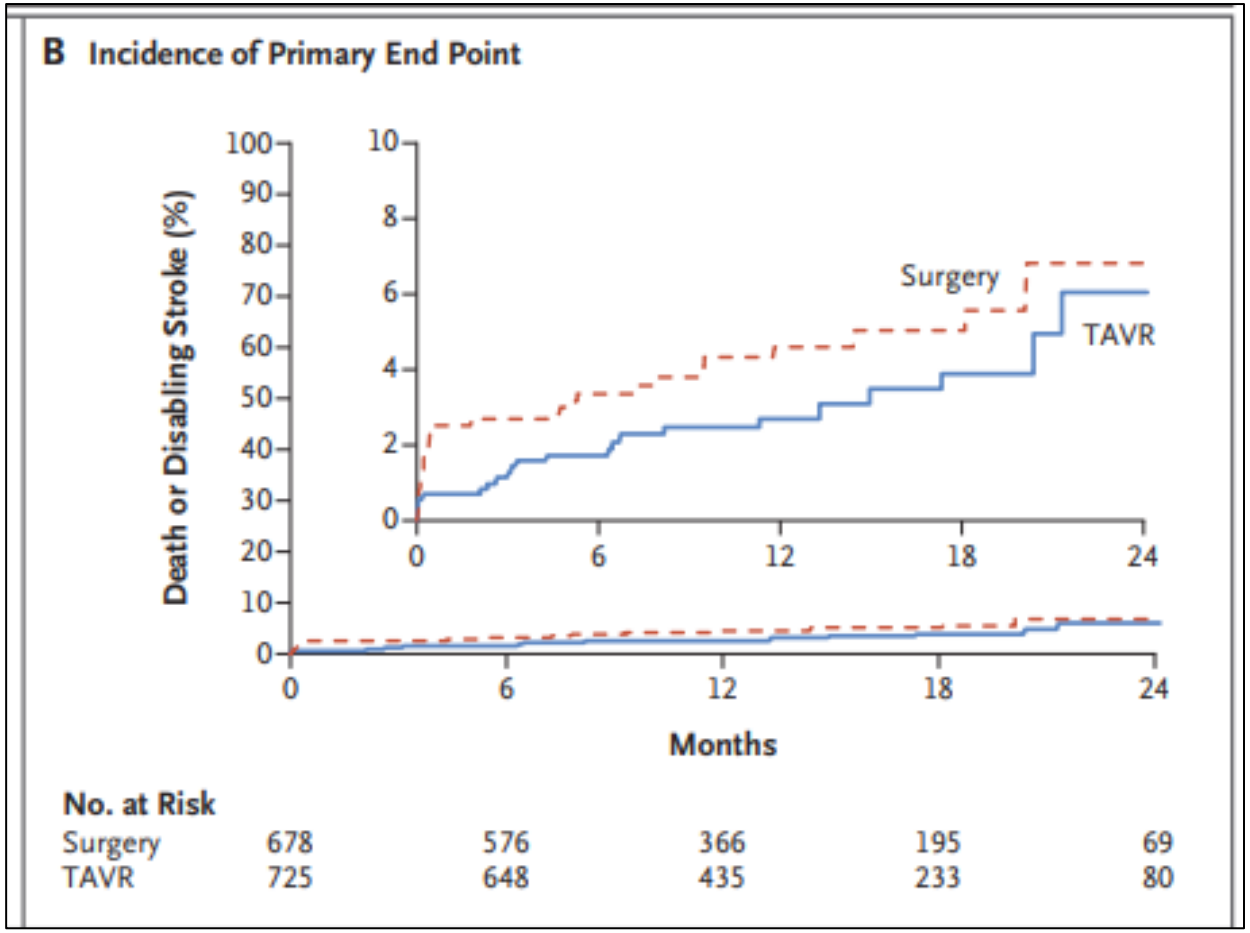
Low-risk patients-*BEV*

Subgroup	No. of Patients	TAVR	Surgery	Difference (95% CI)	P Value for Interaction
		no. of events/total no. (%)		*percentage points*	
Overall	950	42/496 (8.5)	68/454 (15.1)	−6.6 (−10.8 to −2.5)	
Age					0.21
≤74 yr	516	29/273 (10.6)	36/243 (14.9)	−4.3 (−10.1 to 1.5)	
>74 yr	434	13/223 (5.8)	32/211 (15.3)	−9.5 (−15.3 to −3.7)	
Sex					0.27
Female	292	13/161 (8.1)	24/131 (18.5)	−10.4 (−18.3 to −2.5)	
Male	658	29/335 (8.7)	44/323 (13.8)	−5.1 (−9.9 to −0.3)	
STS-PROM score					0.98
≤1.8	464	21/232 (9.1)	36/232 (15.7)	−6.7 (−12.6 to −0.7)	
>1.8	486	21/264 (8.0)	32/222 (14.5)	−6.5 (−12.2 to −0.8)	
Left ventricular ejection fraction					0.48
≤65	384	20/208 (9.6)	30/176 (17.2)	−7.6 (−14.5 to −0.7)	
>65	524	21/264 (8.0)	32/260 (12.4)	−4.4 (−9.6 to 0.7)	
NYHA class					0.54
I or II	687	23/341 (6.8)	50/346 (14.5)	−7.8 (−12.4 to −3.2)	
III or IV	263	19/155 (12.3)	18/108 (16.9)	−4.7 (−13.5 to 4.1)	
Atrial fibrillation					0.67
No	786	33/418 (7.9)	51/368 (14.0)	−6.1 (−10.5 to −1.7)	
Yes	163	9/78 (11.6)	17/85 (20.3)	−8.7 (−19.9 to 2.5)	
KCCQ overall summary score					0.27
≤70	407	23/219 (10.5)	37/188 (19.9)	−9.4 (−16.5 to −2.4)	
>70	536	18/275 (6.5)	29/261 (11.2)	−4.6 (−9.2 to 0.2)	



Mack et al. NEJM 2019

Low-risk patients-*SEV*



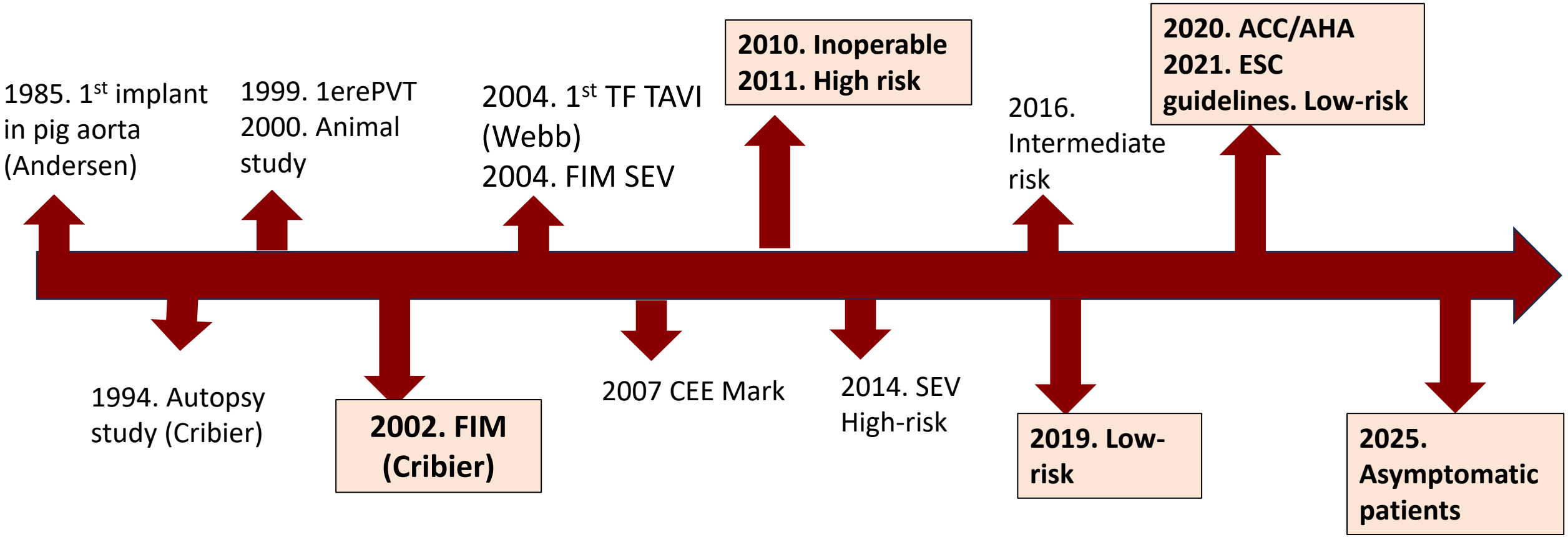
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Transcatheter Aortic-Valve Replacement with a Self-Expanding Valve in Low-Risk Patients

Jeffrey J. Popma, M.D., G. Michael Deeb, M.D., Steven J. Yakubov, M.D., Mubashir Mumtaz, M.D., Hemal Gada, M.D., Daniel O'Hair, M.D., Tanvir Bajwa, M.D., John C. Heiser, M.D., William Merhi, D.O., Neal S. Kleiman, M.D., Judah Askew, M.D., Paul Sorajja, M.D., Joshua Rovin, M.D., Stanley J. Chetcuti, M.D., David H. Adams, M.D., Paul S. Teirstein, M.D., George L. Zorn III, M.D., John K. Forrest, M.D., Didier Tchétché, M.D., Jon Resar, M.D., Antony Walton, M.D., Nicolo Piazza, M.D., Ph.D., Basel Ramlawi, M.D., Newell Robinson, M.D., George Petrossian, M.D., Thomas G. Gleason, M.D., Jae K. Oh, M.D., Michael J. Boulware, Ph.D., Hongyan Qiao, Ph.D., Andrew S. Mugglin, Ph.D., and Michael J. Reardon, M.D., for the Evolut Low Risk Trial Investigators*

A brief history..



TAVI: randomized trials

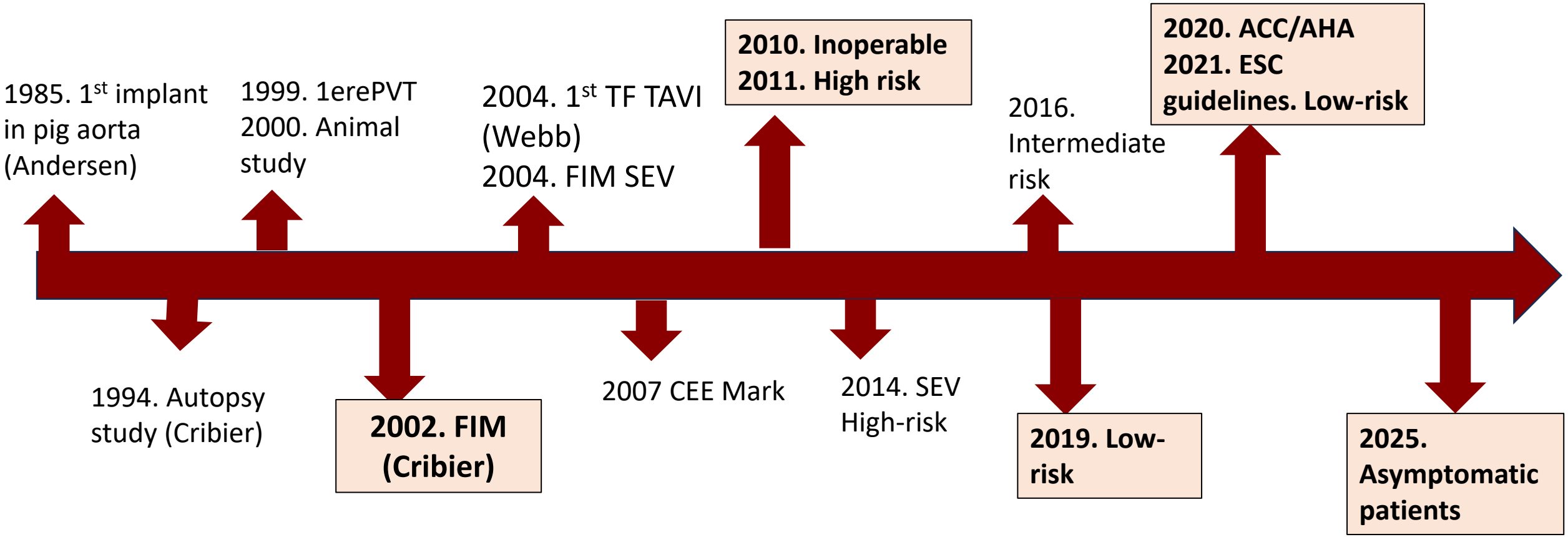
	STS score	Age
Inoperable		
PARTNER IB (2010)	11.6	83
High risk		
PARTNER IA (2011)	11.8	84
CoreValve US Pivotal Trial (2014)	7.4	83
Intermediate risk		
PARTNER II (2016)	5.8	82
SURTAVI (2017)	4.5	80
Low risk		
NOTION (2015)	3.0	79
PARTNER III (2019)	1.9	73
Evolut Low Risk (2019)	1.8	74

Recommandations 2021

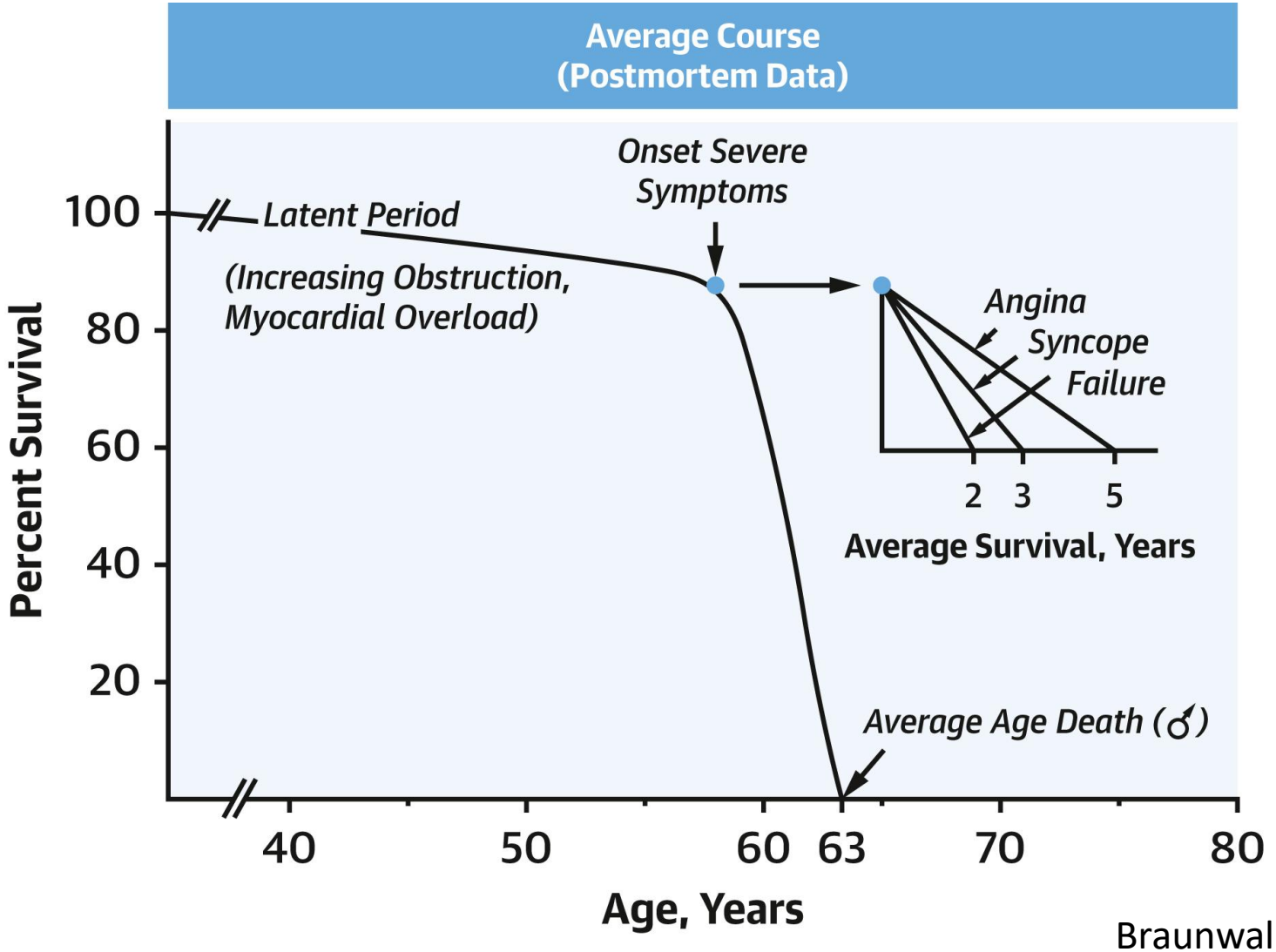
Choix RVA chirurgical vs TAVI		
Classe	**ACC/AHA**	**ESC/EACTS**
I	La chirurgie est recommandée chez les patients symptomatiques ou asymptomatiques ayant un **RA sévère et une indication de RVA < 65 ans ou qui ont une espérance de vie > 20 ans**	La chirurgie est recommandée chez les patients jeunes et à faible risque chirurgical **(<75 ans et STS-PROM/EuroSCORE II <4%) ou opérables et non éligibles au TAVI transfémoral**
I	Chez les patients symptomatiques ayant un RA sévère et âgés **entre 65 et 80 ans, sans contre-indication anatomique à un TAVI transfémoral**, un RVA chirurgical ou un TAVI transfémoral peuvent être recommandés après discussion commune de la balance entre la **longévité attendue du patient et la durabilité de la valve**	Le TAVI est recommandé chez les **patients âgés (≥75 ans) ou à haut risque (STS-PROM /EuroSCORE II >8%) ou inopérables**
I	Le TAVI est recommandé de préférence à la chirurgie pour les patients symptomatiques ayant un RA sévère, > **80 ans** ou plus jeunes mais avec une **espérance de vie < 10 ans et sans contre-indication à un TAVI transfémoral**	La chirurgie ou le TAVI sont recommandés chez les autres patients en fonction des caractéristiques individuelles cliniques, anatomiques et procédurales

Otto et al. , Circulation 2020
Vahanian et al. , EHJ, 2021

A brief history..



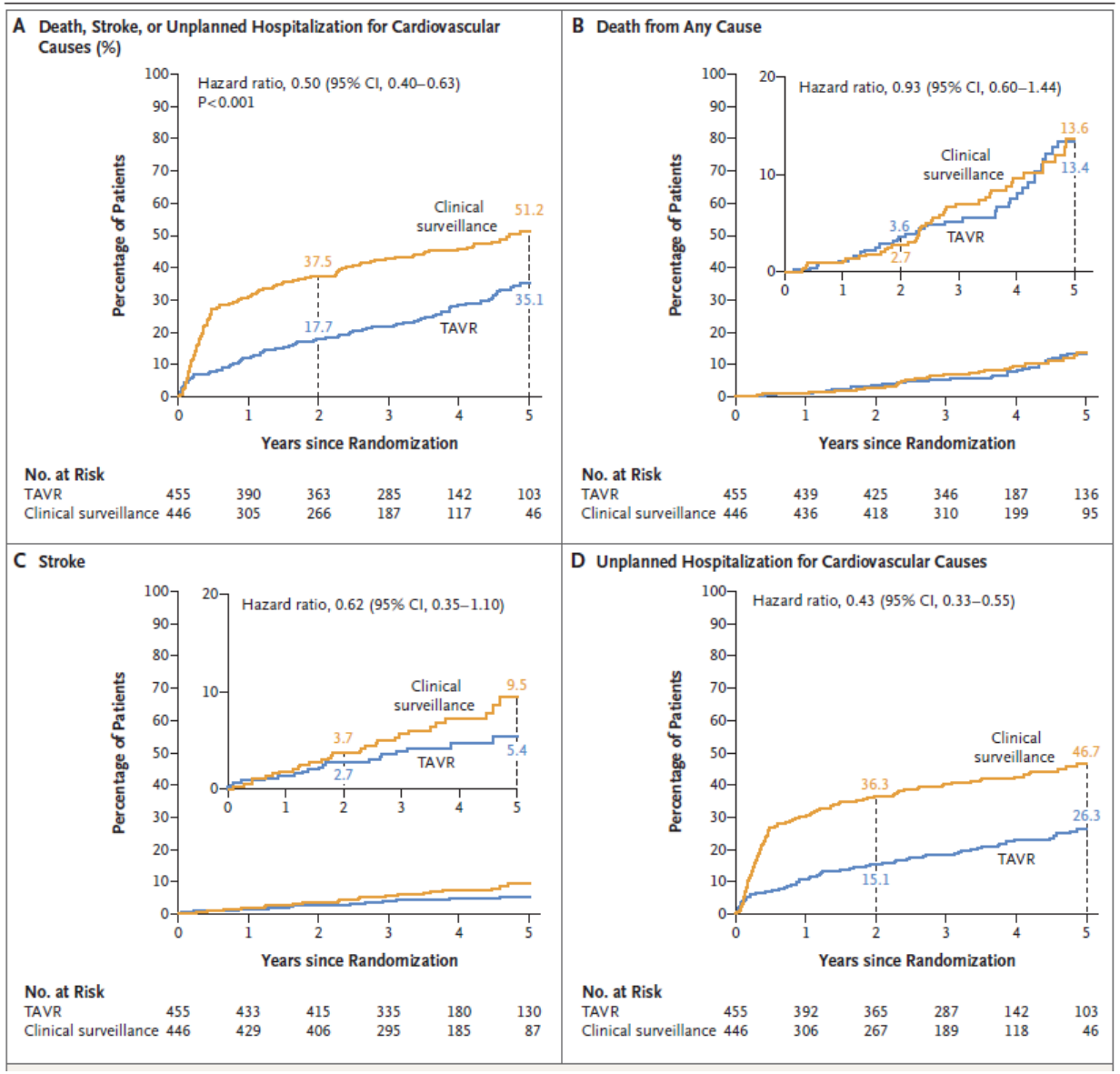
Natural evolution of AS



Braunwald E. J Am Coll Cardiol. 2023

Ross J Jr, Braunwald E. Circulation. 1968

Asymptomatic patients



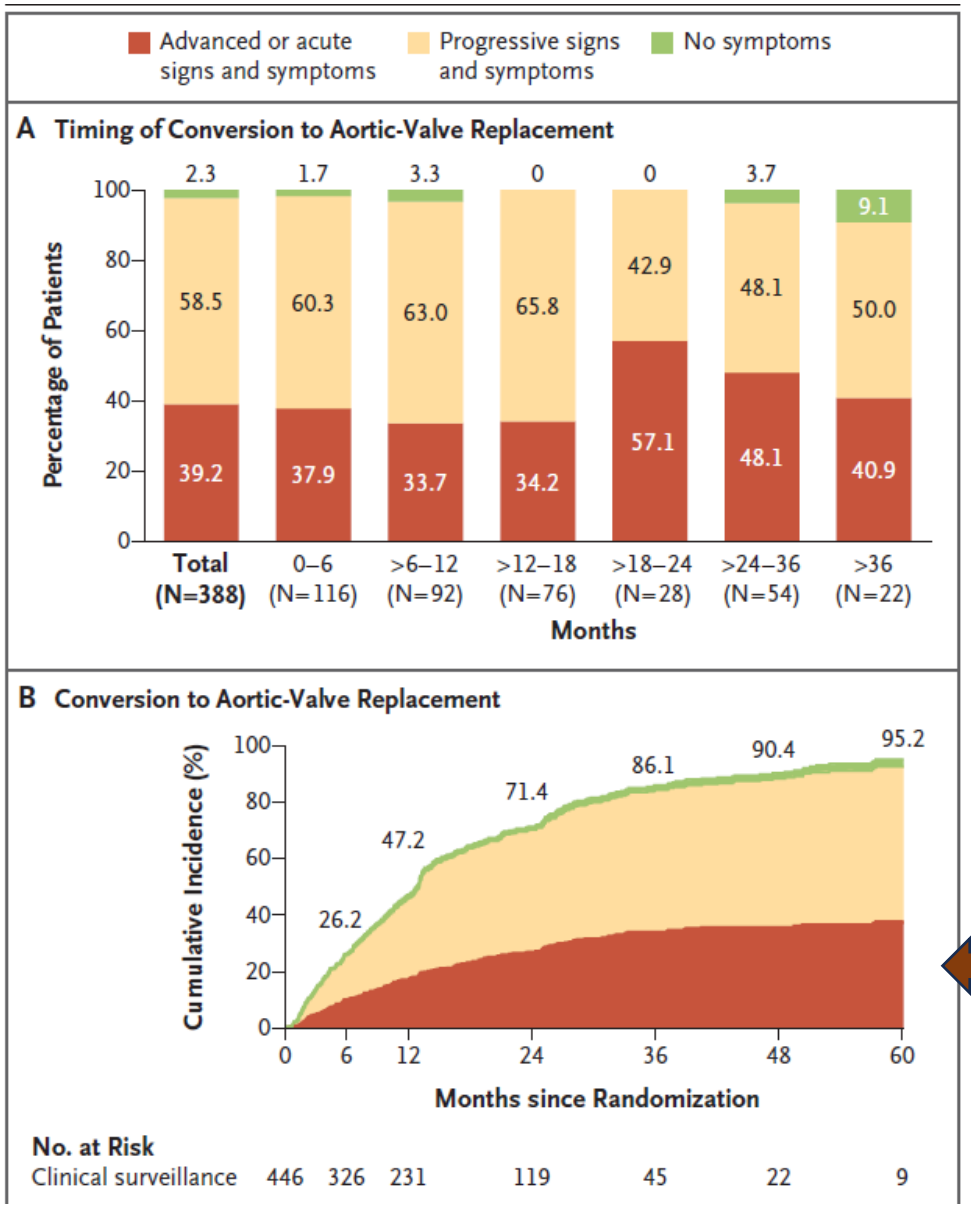
ORIGINAL ARTICLE

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*

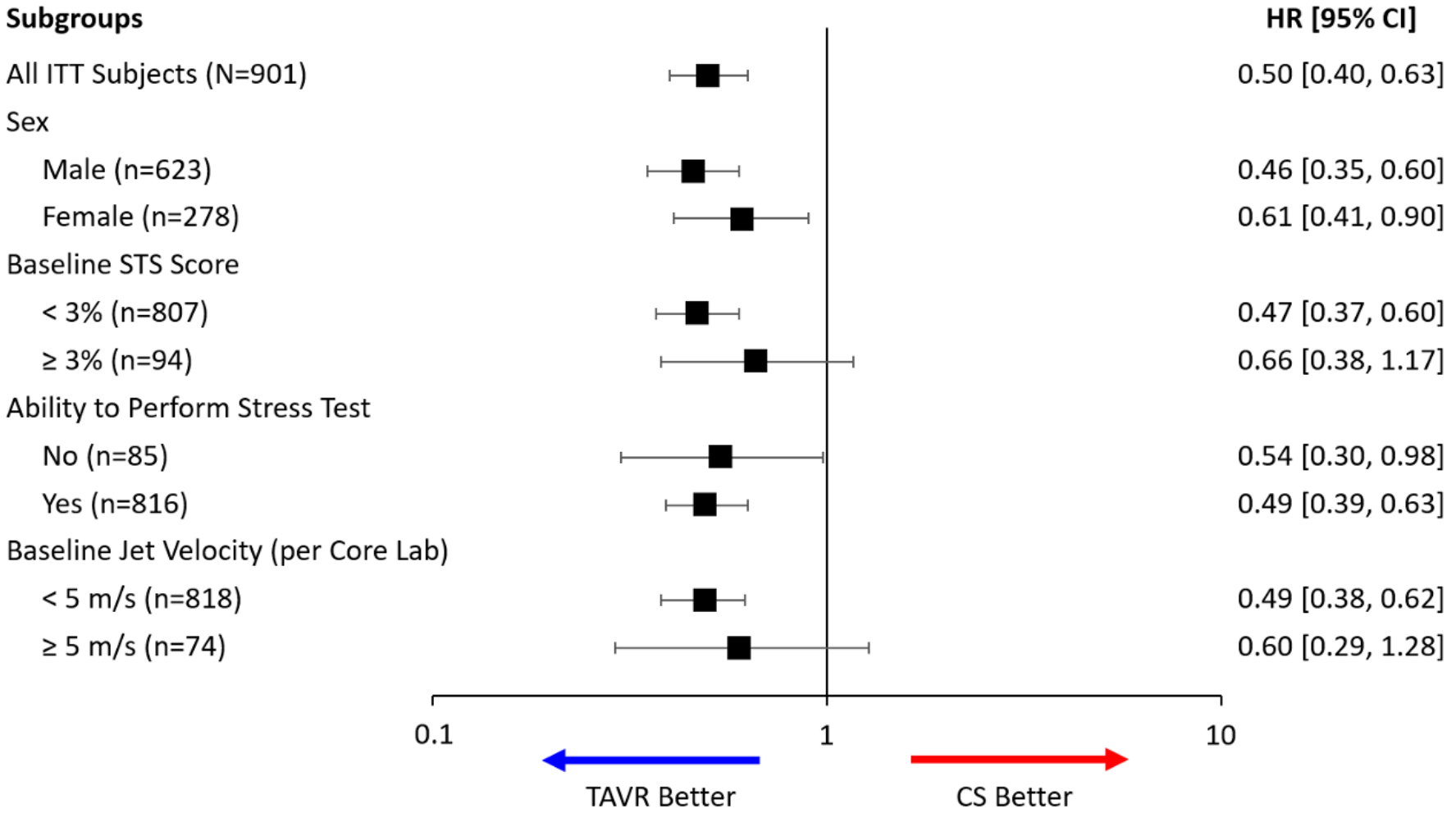
Généreux et al. NEJM 2025

Asymptomatic patients



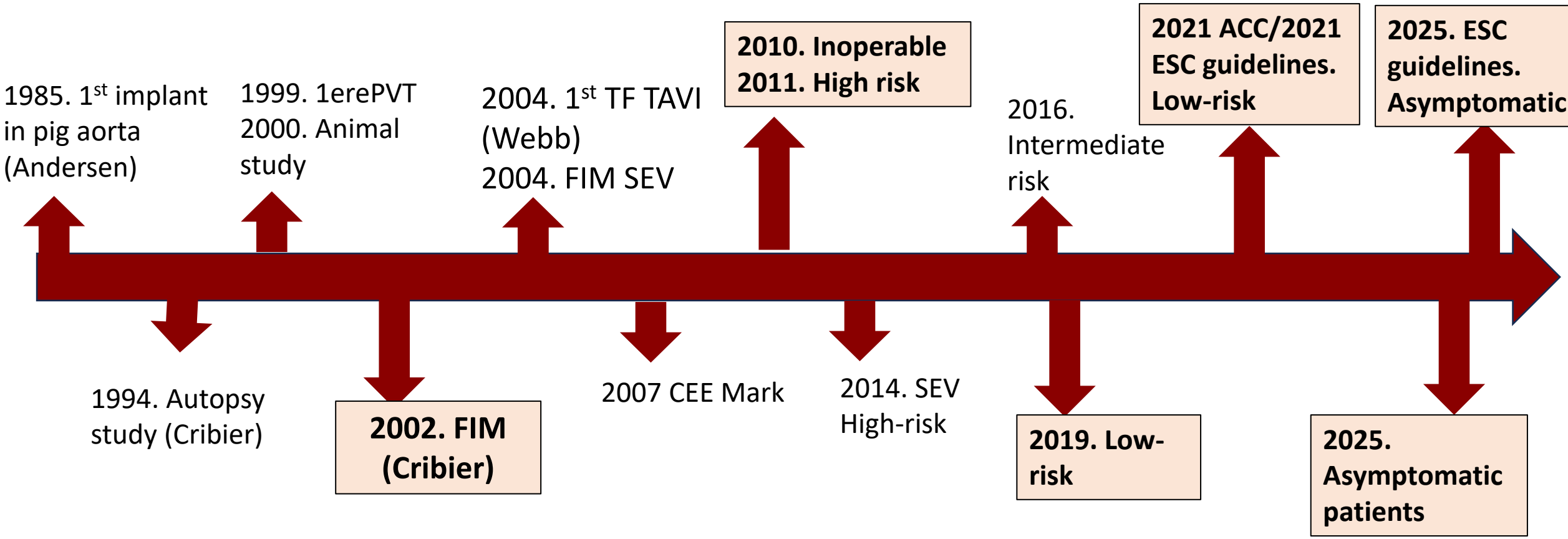
Acute valve syndrome

Asymptomatic patients



CS denotes clinical surveillance, ITT intent-to-treat population, STS Society of Thoracic Surgeons, TAVR transcatheter aortic valve replacement.
There was a median follow-up of 3.8 years; patients had a minimum follow-up of 2 years.
The widths of the confidence intervals have not been adjusted for multiple comparisons and should not be used in place of a hypothesis test.

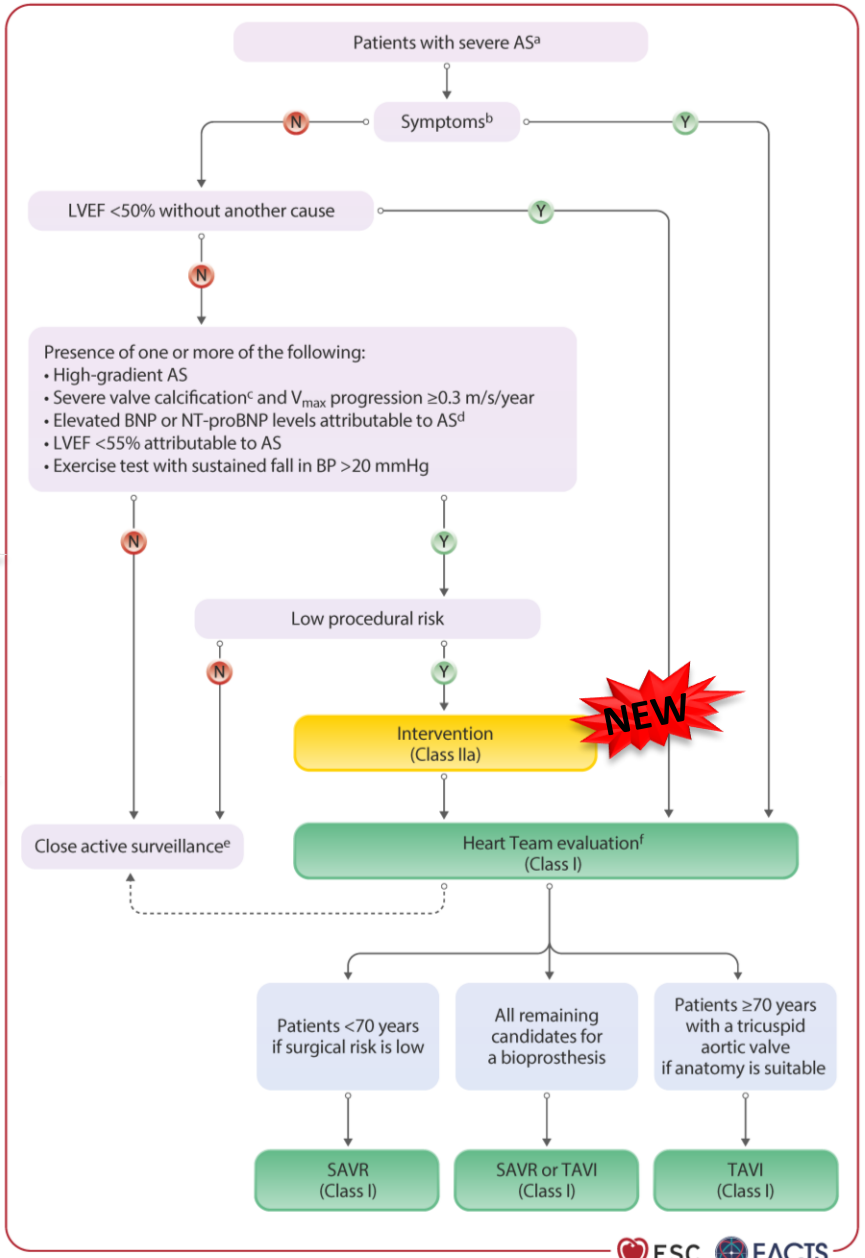
A brief history..



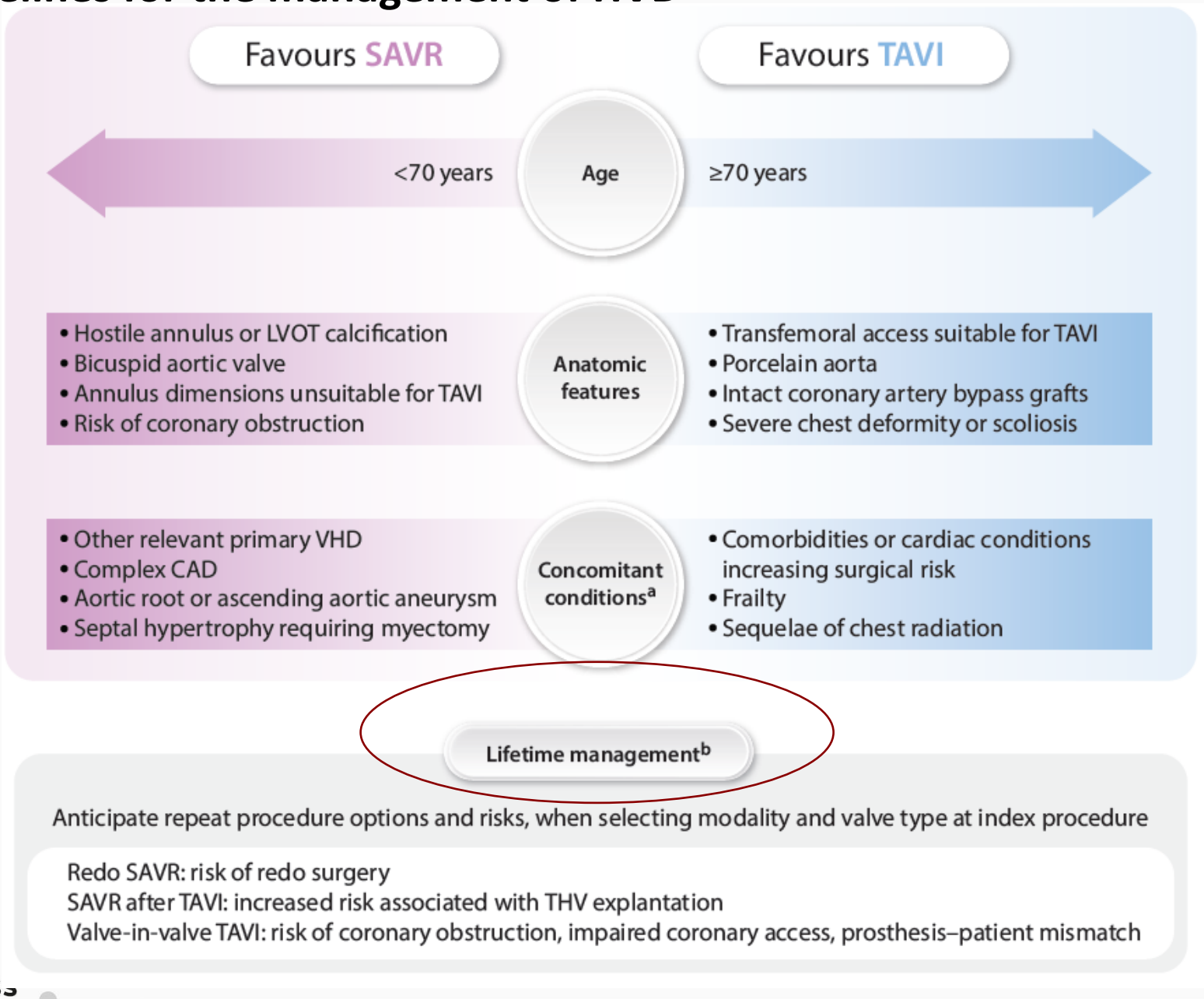
2025 ESC/EACTS Guidelines for the management of HVD

irrespective of the surgical risk score

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



2025 ESC/EACTS Guidelines for the management of HVD

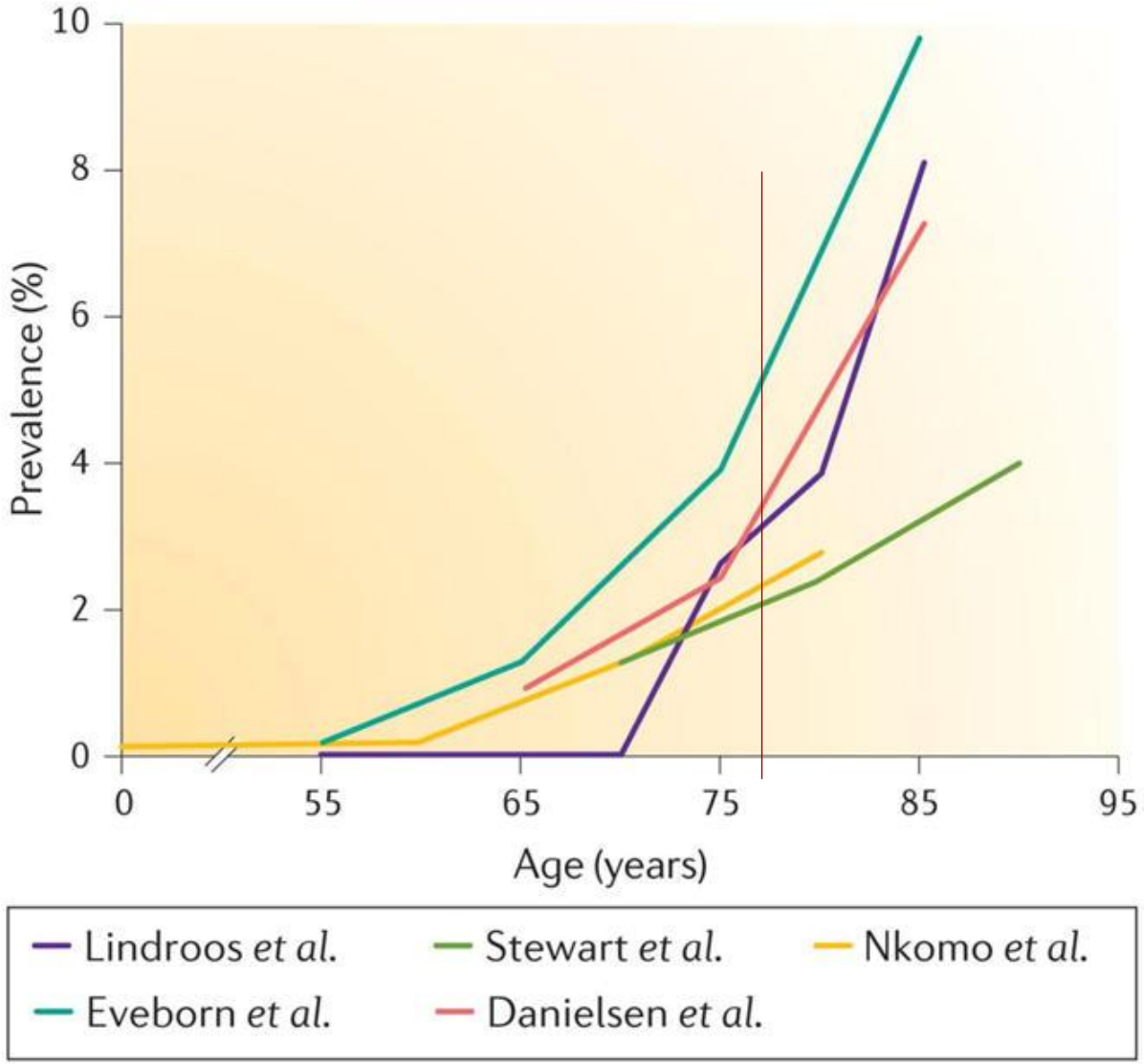


2025 ESC/EACTS Guidelines for the management of HVD

Recommendations	Class	Level
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**

Praz et al. ESC/EACTS 2025 Guidelines for heart valve disease 2025

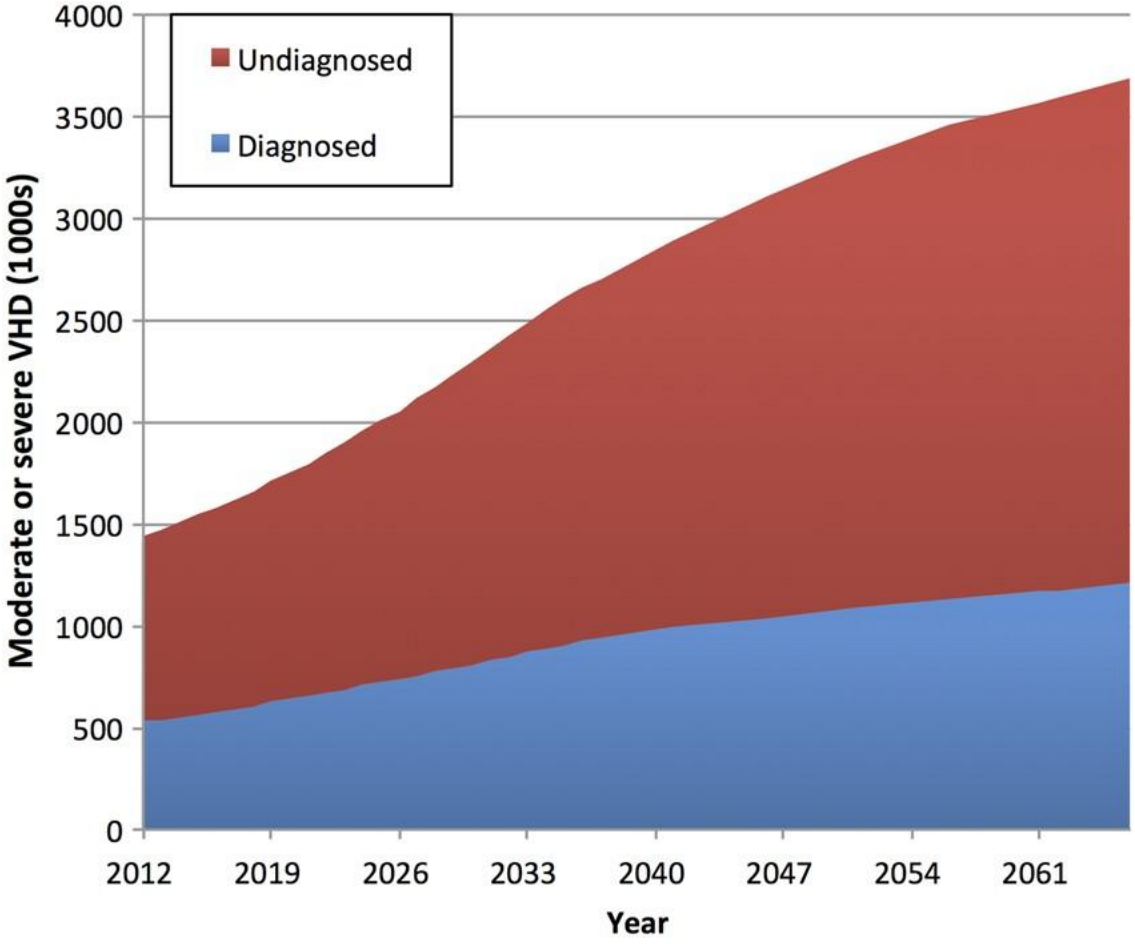
Epidemiology of calcific AS

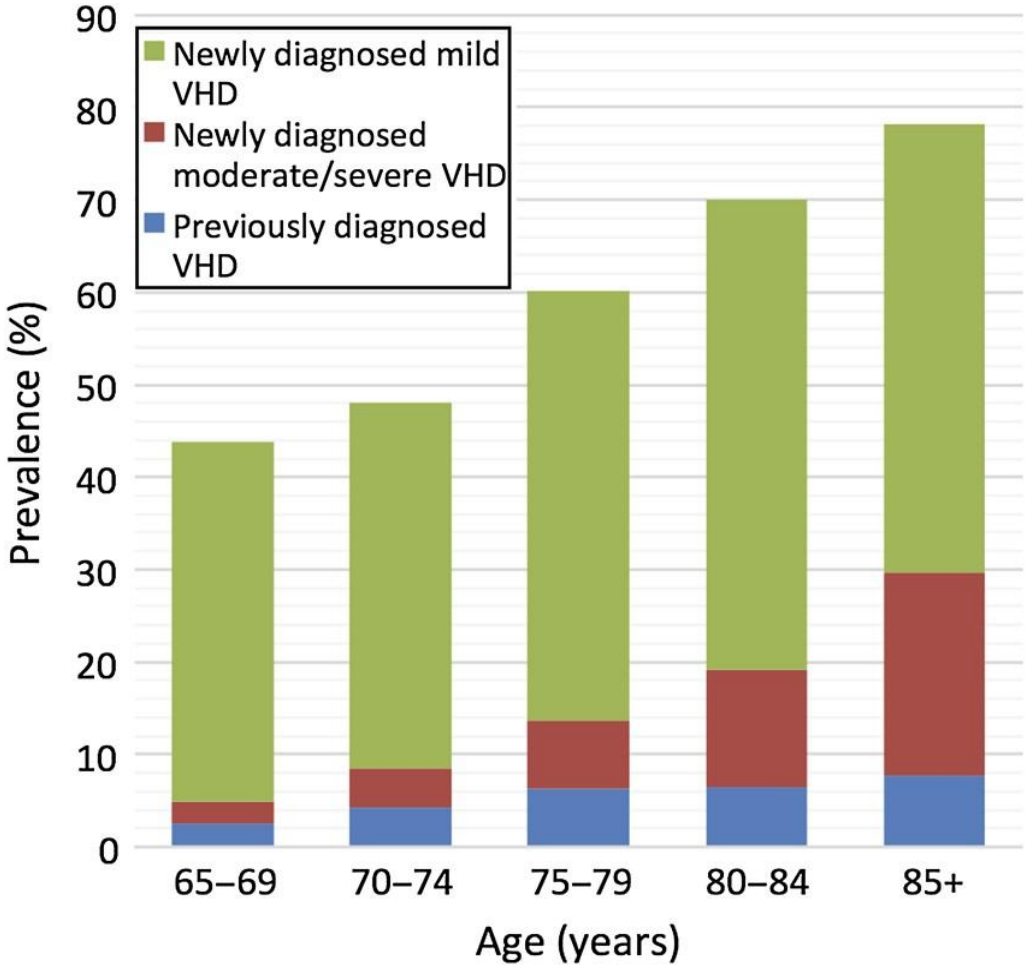


Lindman BR et al. Nat Rev Dis Primers. 2016

Epidemiology of calcific AS

OxVALVE Population Cohort Study

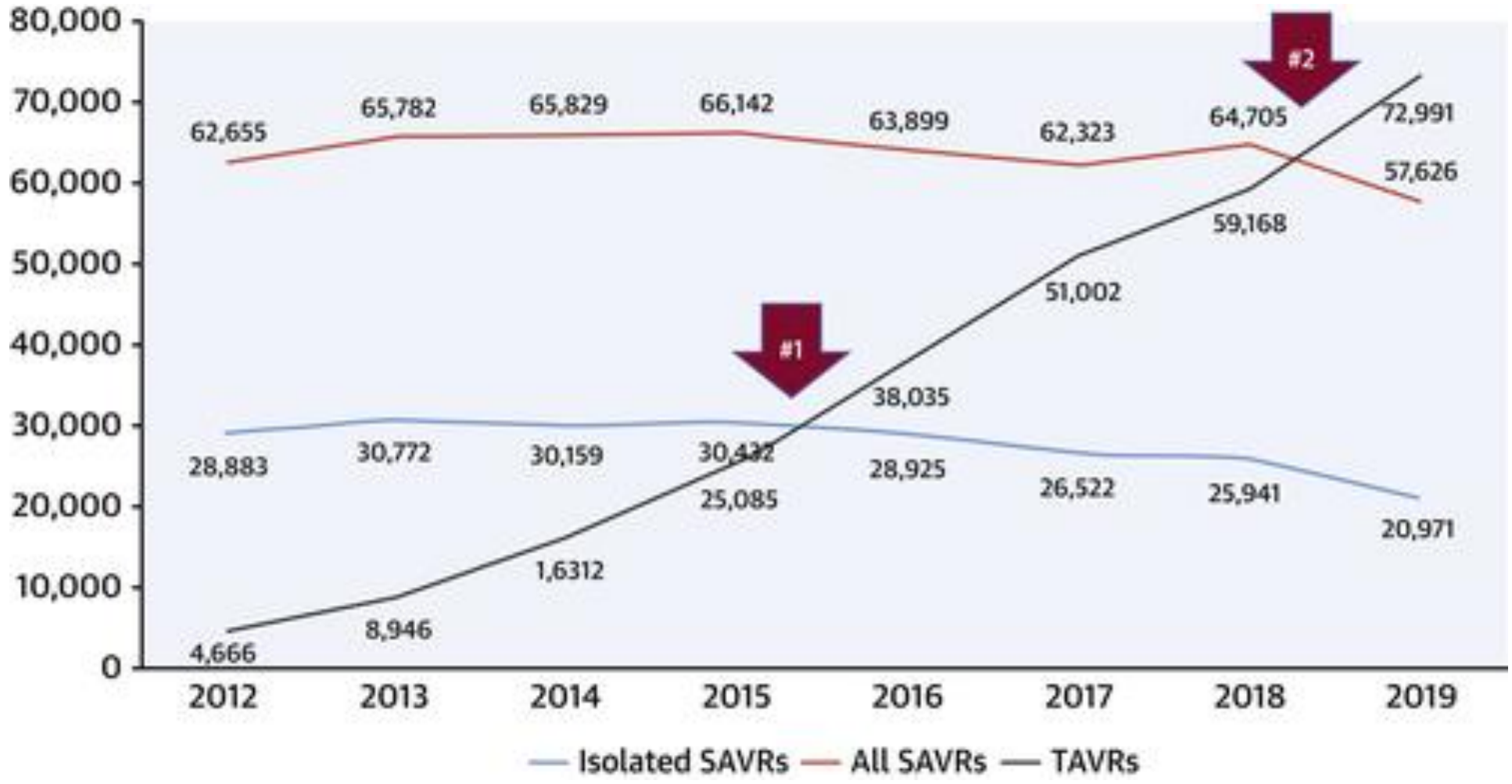




D'Arcy JL et al. European Heart Journal 2016

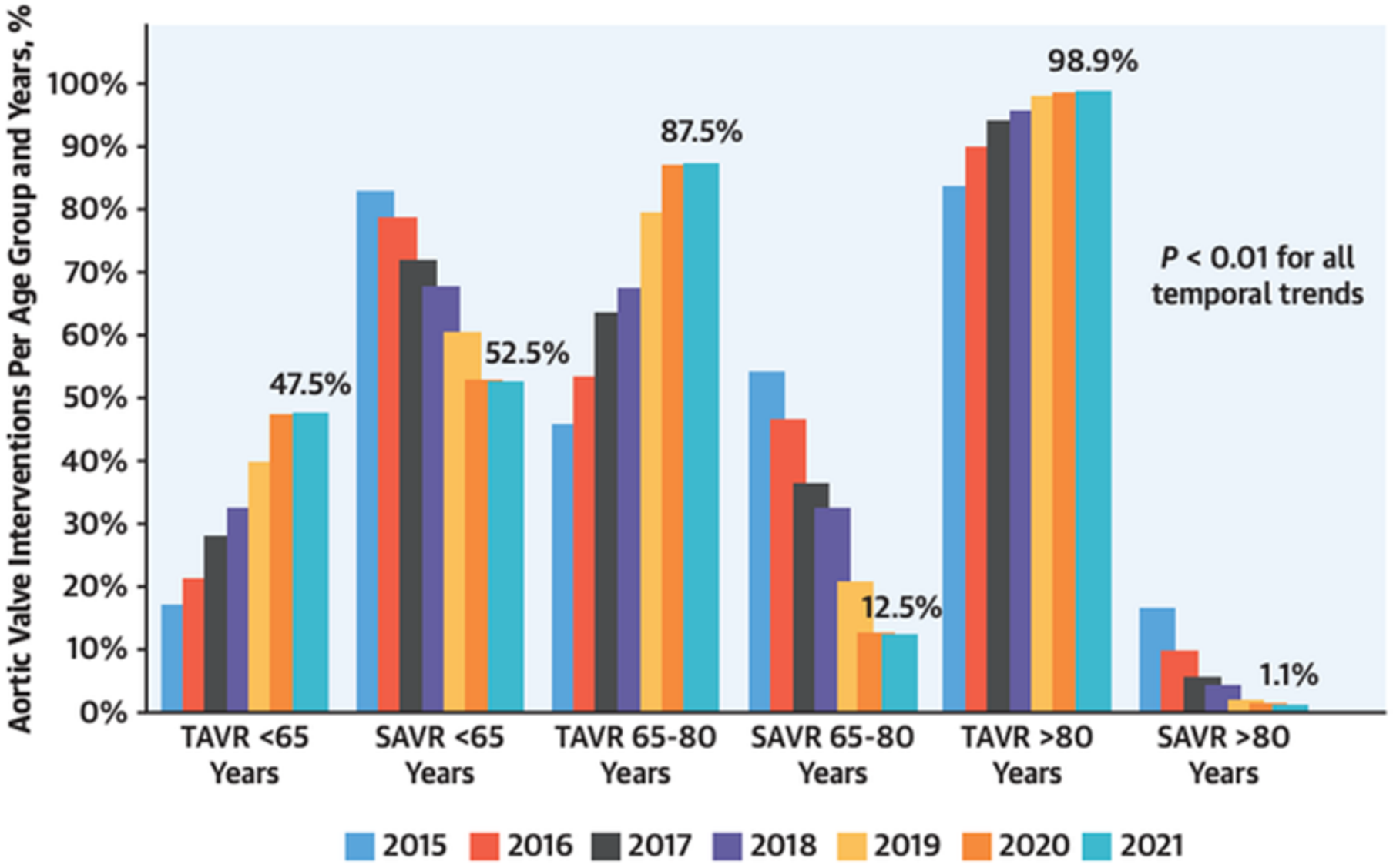
TAVI vs SAVR

TVT registry (US)



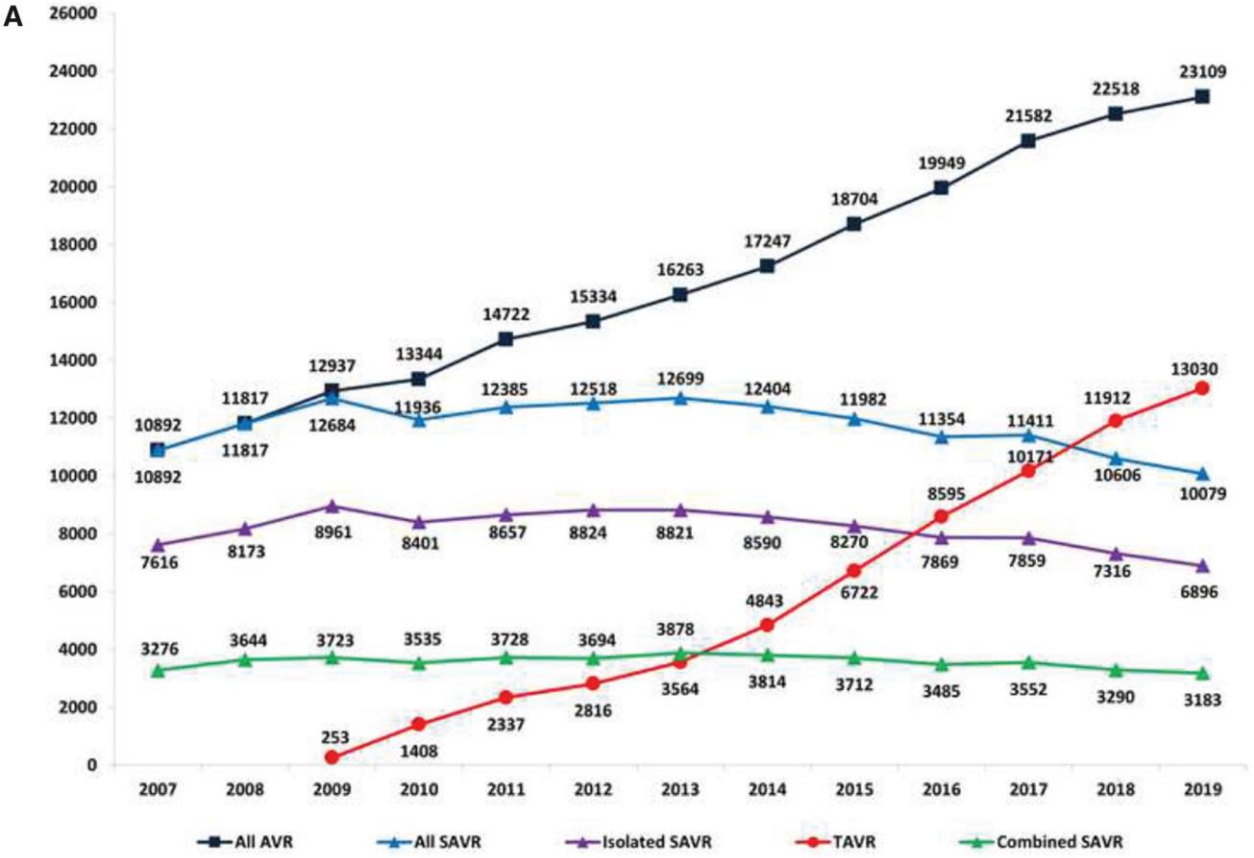
Carroll et al. JACC 2020

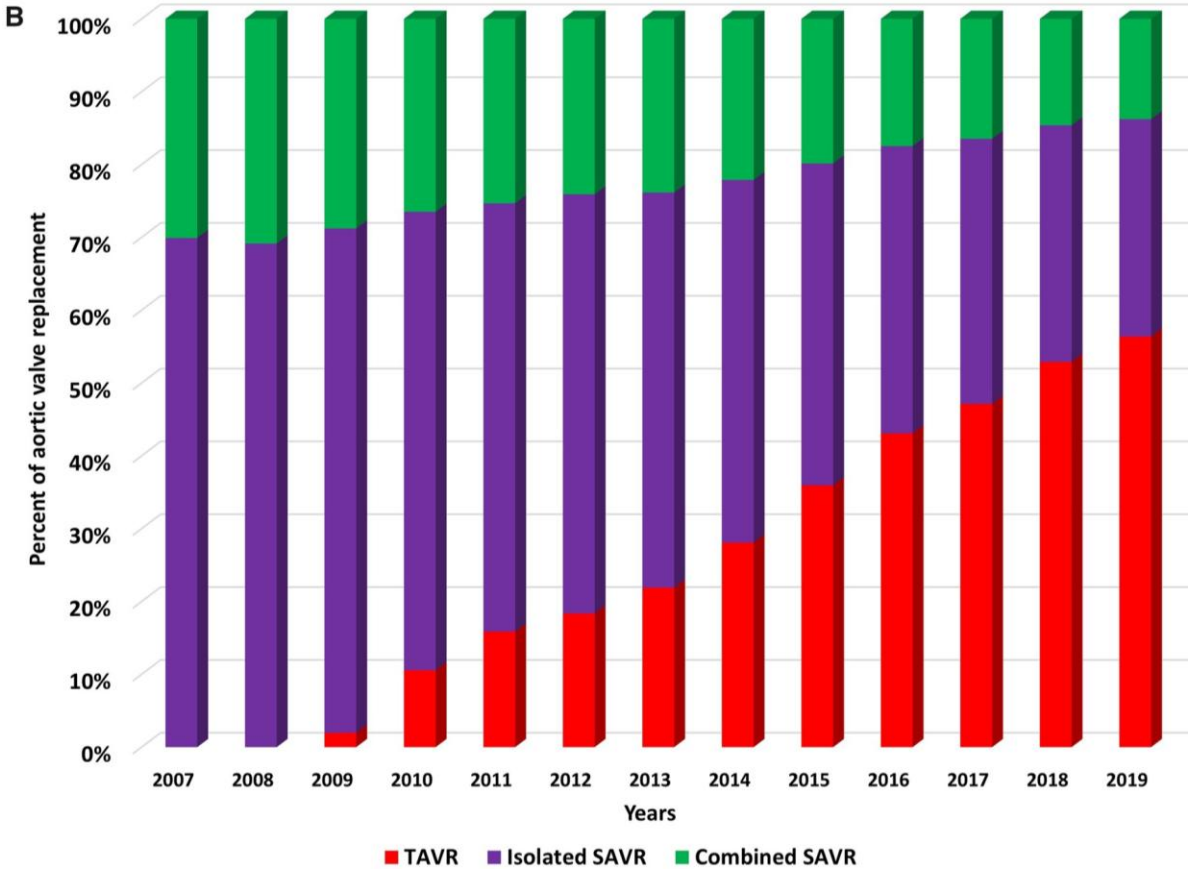
TAVI vs SAVR



Sharma et al. JACC, 2022

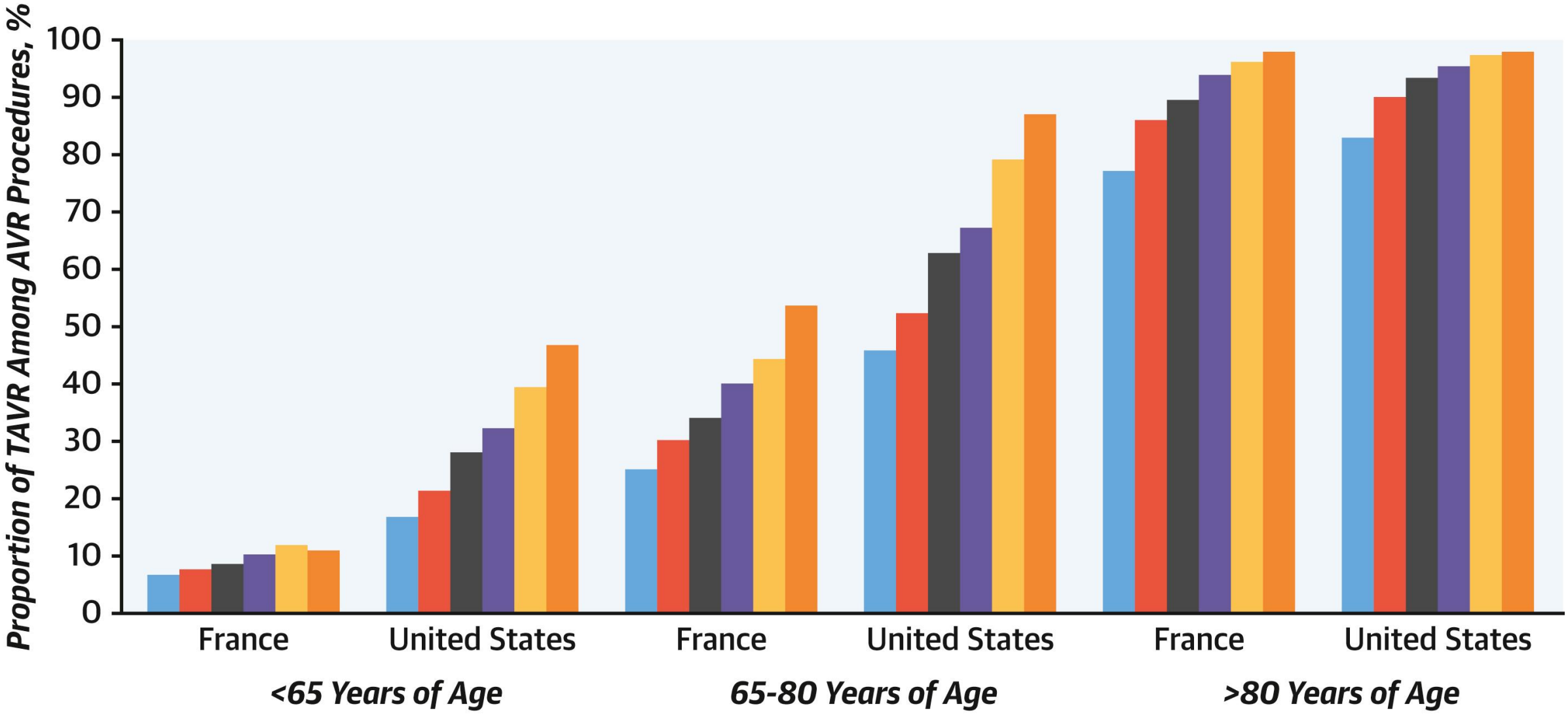
TAVI in France





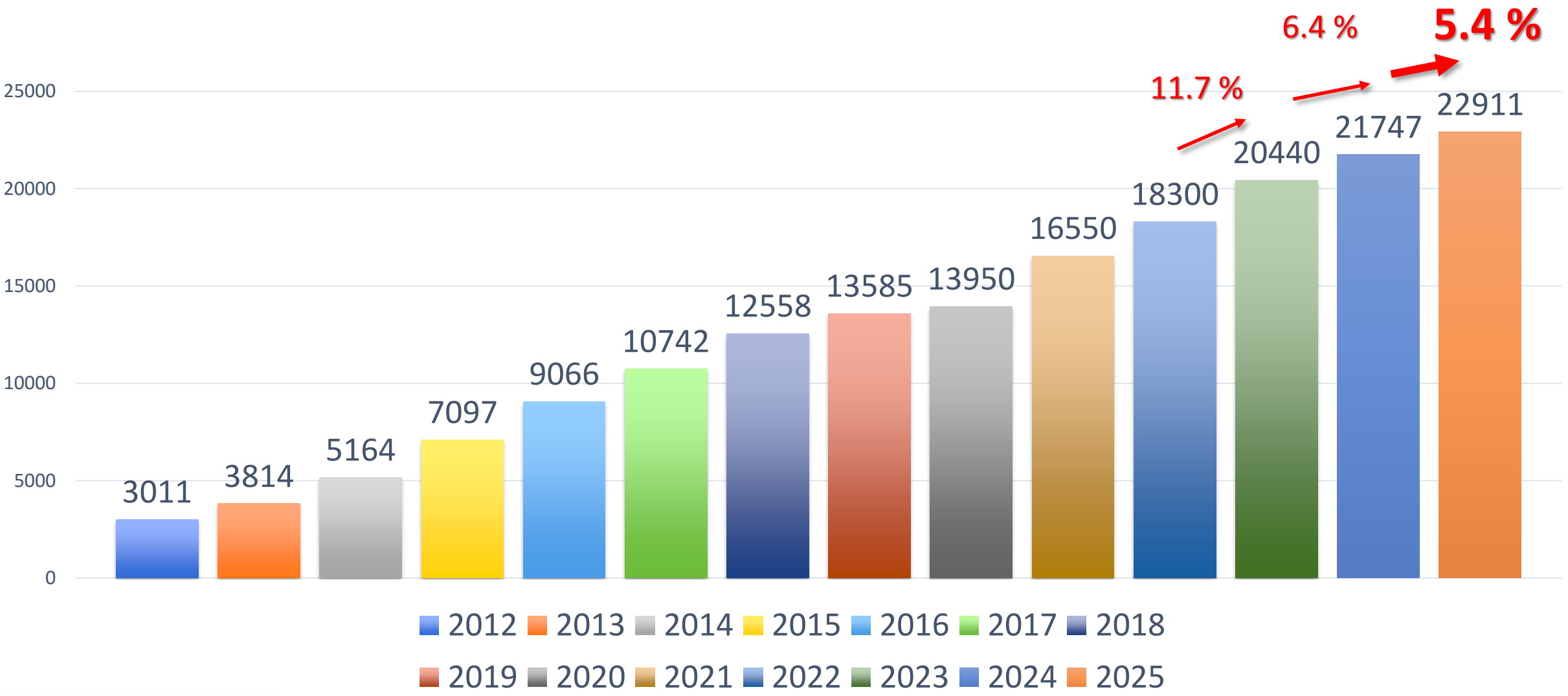
NGuyen V et al. European Heart Journal 2022

TAVI in France compared to US



Colombo, A, Leone, P. . JACC. 2023 Nov, 82 (20) 1903–1905

TAVI in France



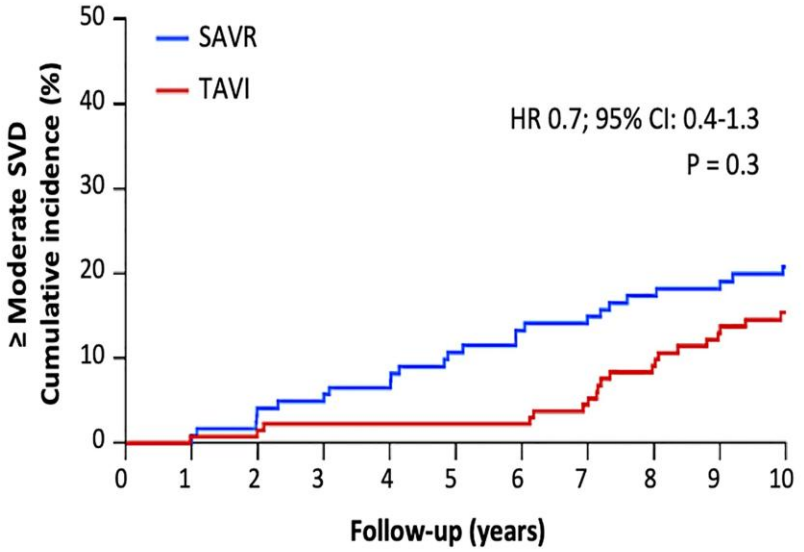
Source: industriels

Challenges

- Valve durability
- Reintervention
- Bicuspid valves
- Valve thrombosis
- Expansion of indications

Valve durability

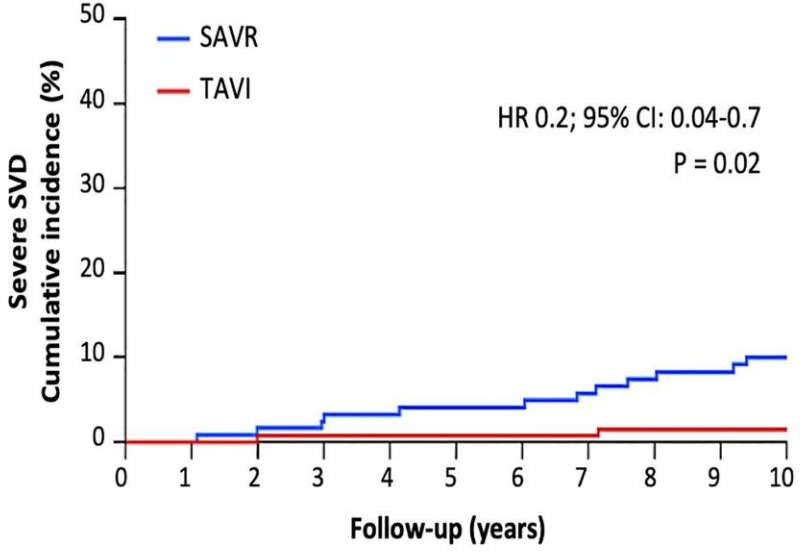
N=280



Patients at risk

TAVI	134	131	128	117	109	96	82	71	56	44	30
SAVR	123	122	116	107	96	84	69	61	48	41	32

	TAVI	SAVR	p value
≥ Moderate SVD	**15.4%**	**20.8%**	**0.2**
Mean gradient ≥ 20 mmHg; AND Increase in mean gradient ≥ 10 mmHg§	12.3%	20.8%	0.05
Moderate/severe intraprosthetic AR	4.6%	0	0.02



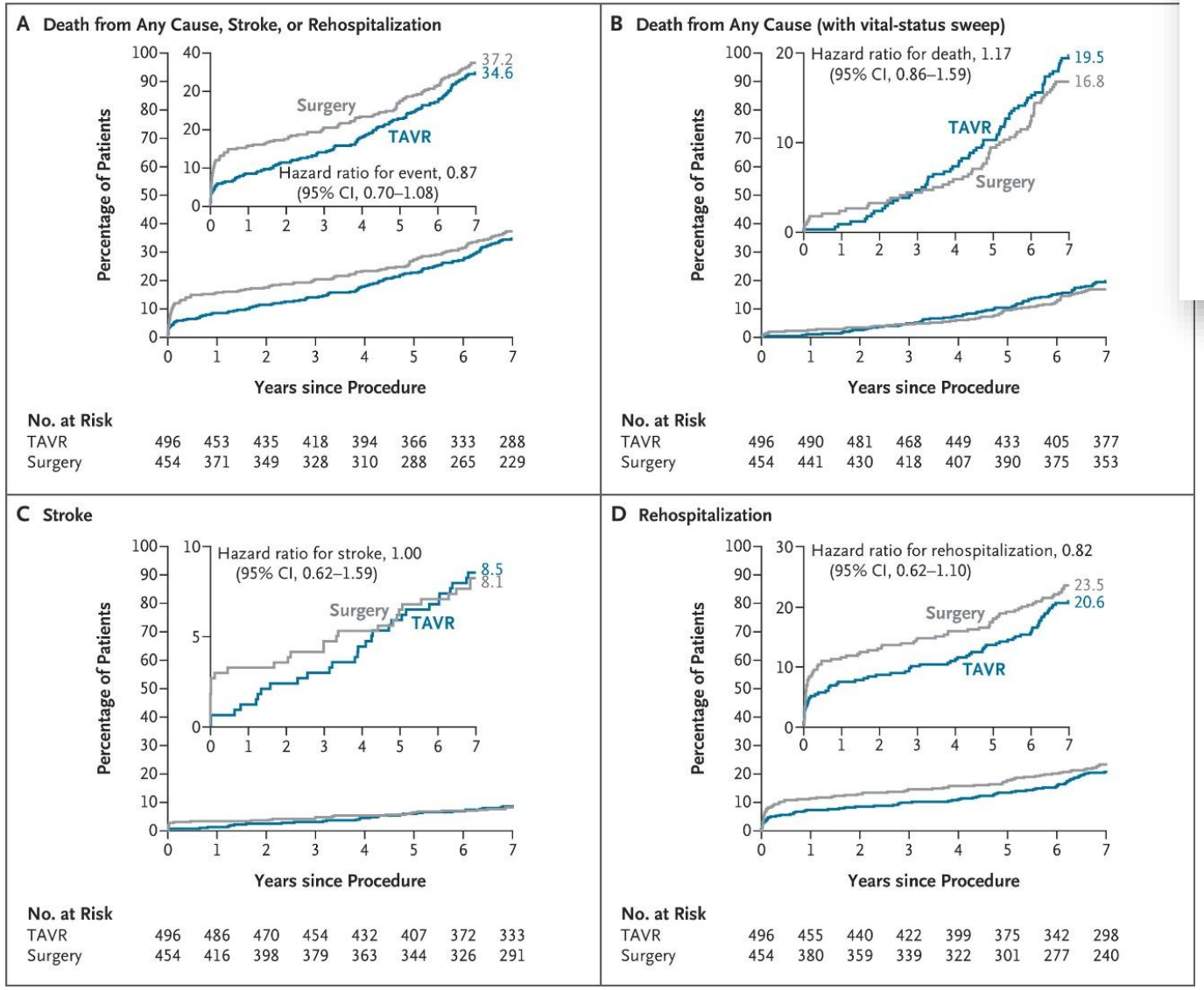
Patients at risk

TAVI	134	132	129	118	109	96	82	73	62	51	40
SAVR	123	122	119	110	100	91	79	70	58	50	39

	TAVI	SAVR	p value
Severe SVD	**1.5%**	**10.0%**	**0.004**
Mean gradient ≥ 30 mmHg; AND Increase in mean gradient ≥ 20 mmHg§	1.5%	10.0%	0.004
Severe intraprosthetic AR	0	0	-

Thyregod et al. European Heart Journal, 2024

Durability of BEVs



The NEW ENGLAND JOURNAL of MEDICINE

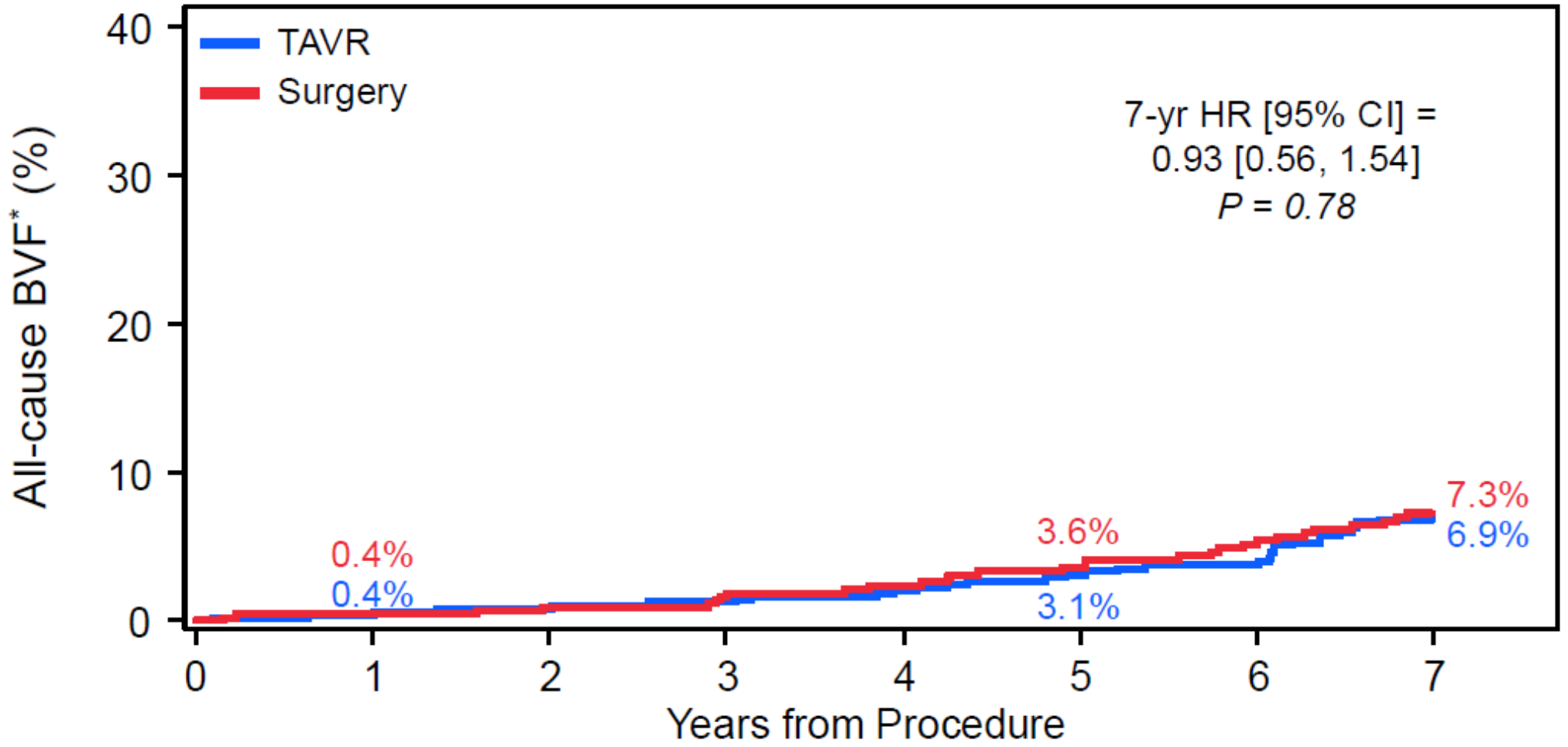
ORIGINAL ARTICLE

Transcatheter or Surgical Aortic-Valve Replacement in Low-Risk Patients at 7 Years

Martin B. Leon, M.D.,[1,2] Michael J. Mack, M.D.,[3] Philippe Pibarot, D.V.M., Ph.D.,[4] Rebecca T. Hahn, M.D.,[1,2] Vinod H. Thourani, M.D.,[5] S.H. Kodali, M.D.,[1,2] Philippe Généreux, M.D.,[6] Samir R. Kapadia, M.D.,[7] David J. Cohen, M.D.,[2,8] Stuart J. Pocock, Ph.D.,[2,9] Yiran Zhang, M.S.,[10] Molly Szerlip, M.D.,[3] Julien Ternacle, M.D., Ph.D.,[11] S. Chris Malaisrie, M.D.,[12] Howard C. Herrmann, M.D.,[13] Wilson Y. Szeto, M.D.,[13] Mark J. Russo, M.D.,[14] Vasilis Babaliaros, M.D.,[15] Tamim Nazif, M.D.,[1,2] John G. Webb, M.D.,[16] and Raj R. Makkar, M.D.,[17] for the PARTNER 3 Investigators*

Leon et al NEJM 2025

All-cause BVF (VARC-3)



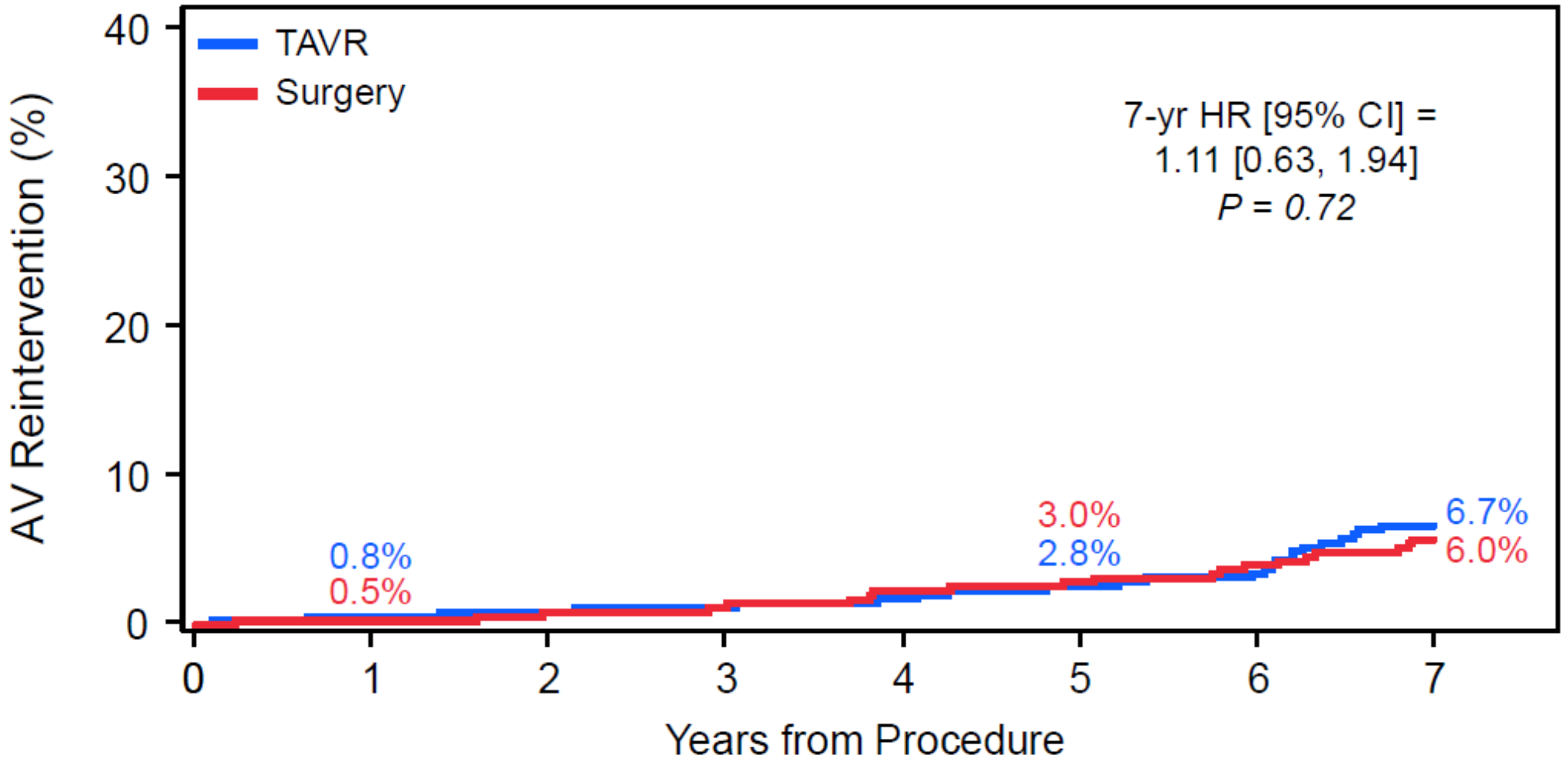
Number at risk:

TAVR	496	488	476	459	433	408	374	330
Surgery	454	426	407	390	372	348	327	288

**Cumulative incidence with death as a competing risk; HR estimated using the Fine and Gray method*

Mack JM., Seven-year Outcomes of the PARTNER 3 Low-risk Trial, Presented on October 27, 2025, 2at TCT. San Francisco, CA.

Aortic Valve Reintervention

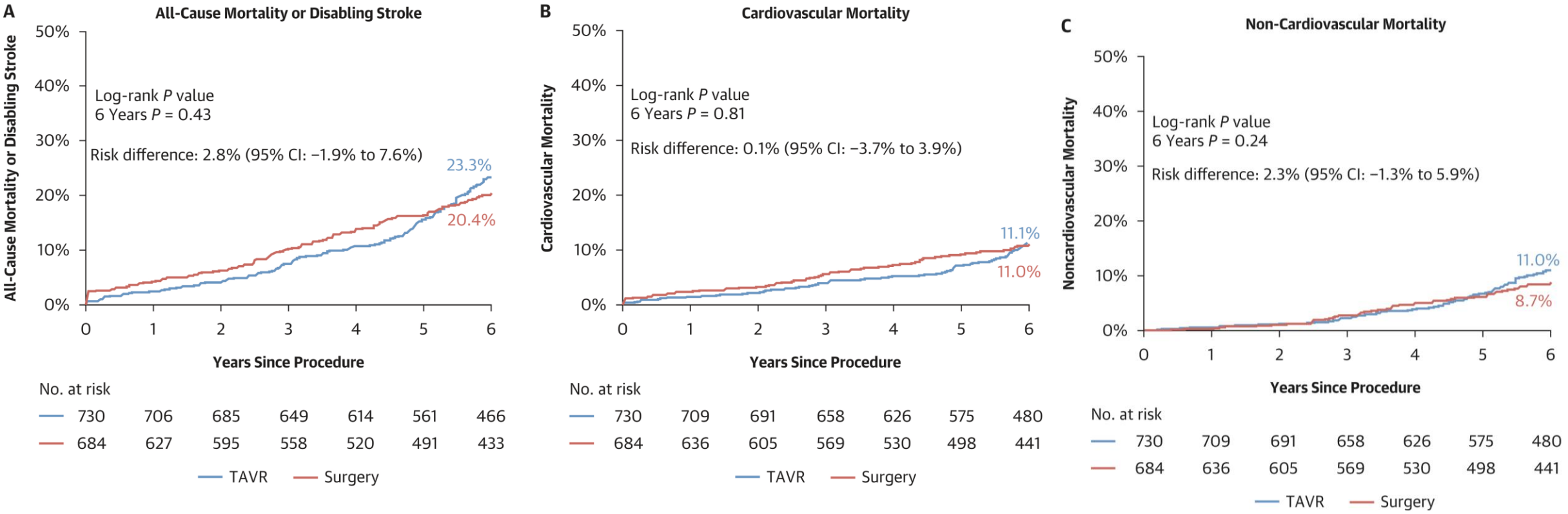


Number at risk:

TAVR	496	488	477	461	437	413	378	333
Surgery	454	426	407	391	373	352	332	294

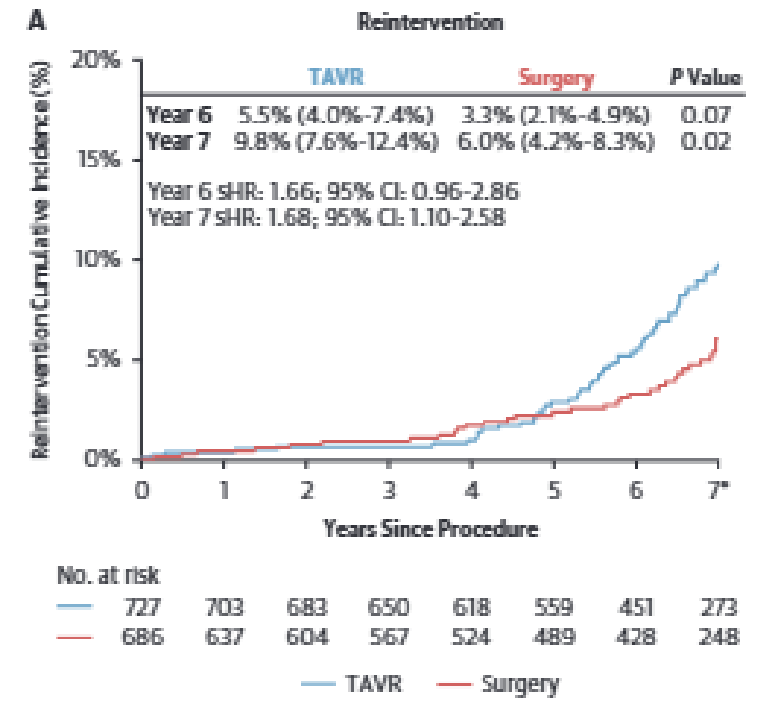
Mack JM., Seven-year Outcomes of the PARTNER 3 Low-risk Trial, Presented on October 27, 2025, 2at TCT. San Francisco, CA.

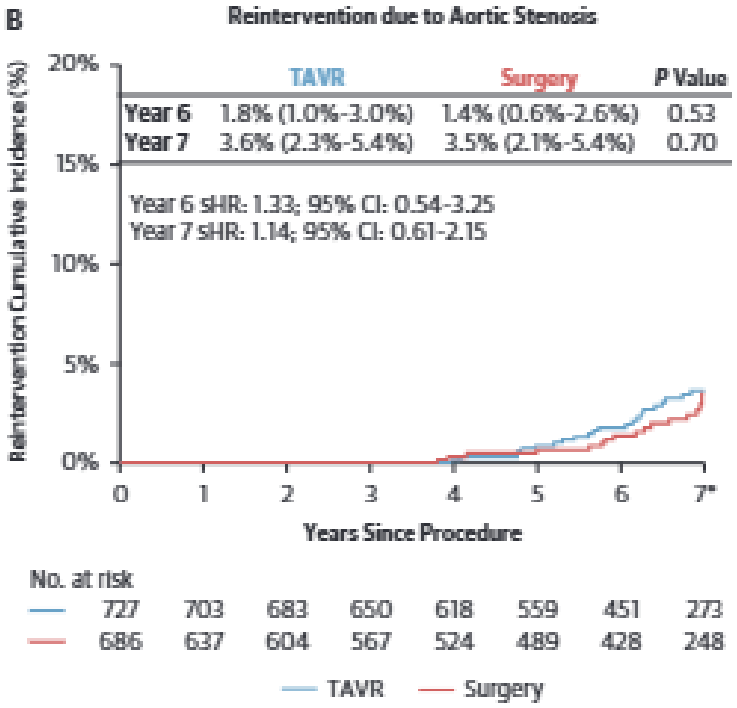
Durability of SEVs

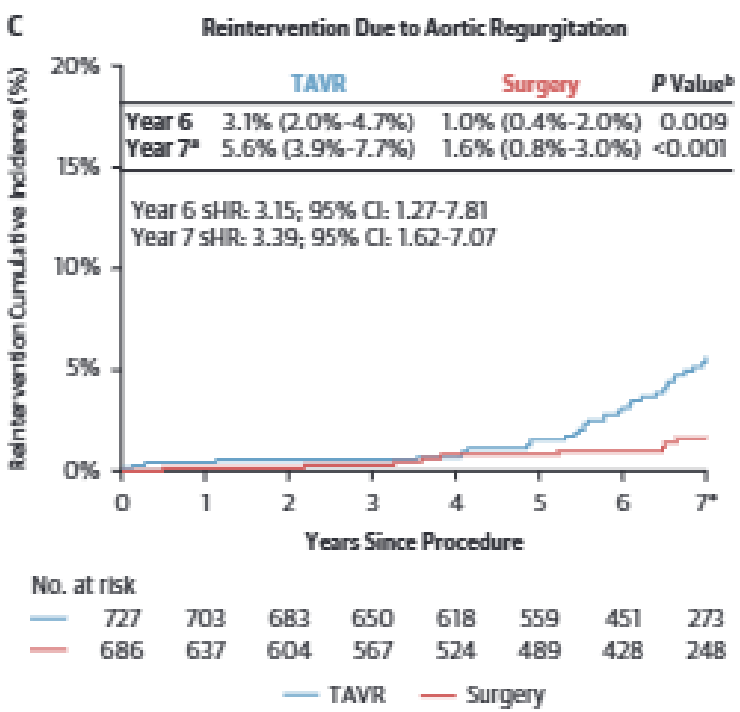


Forrest, J, Yakubov, S, Deeb, G. et al. JACC.2026

Durability of SEVs

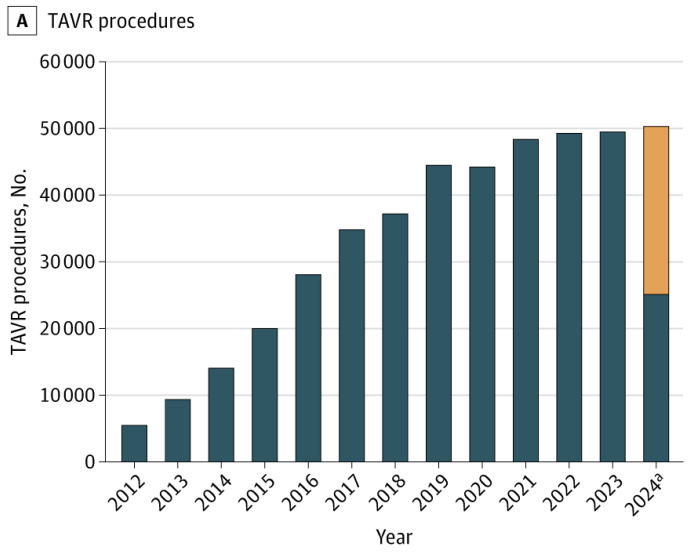


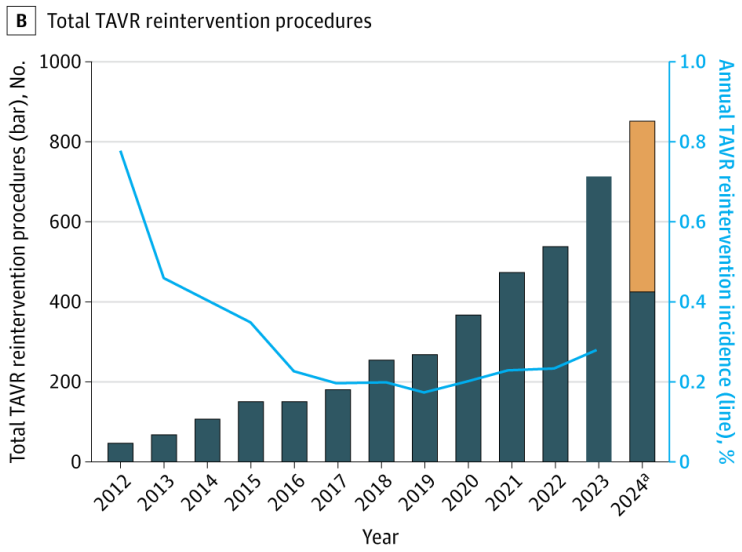


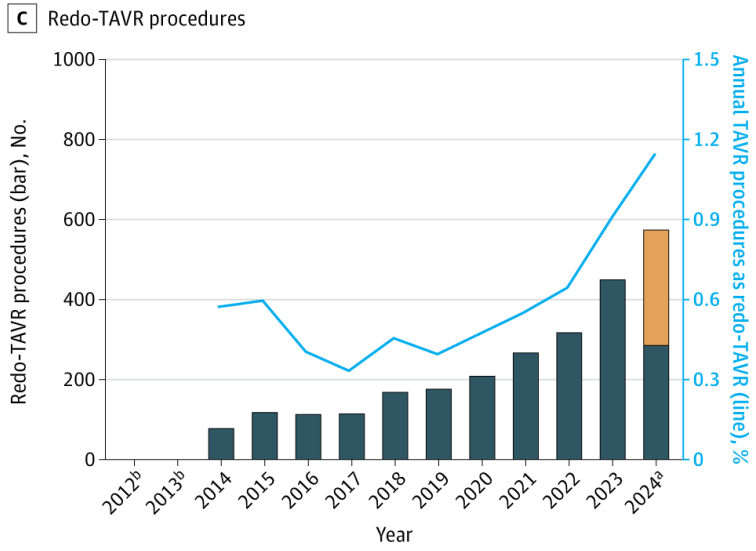


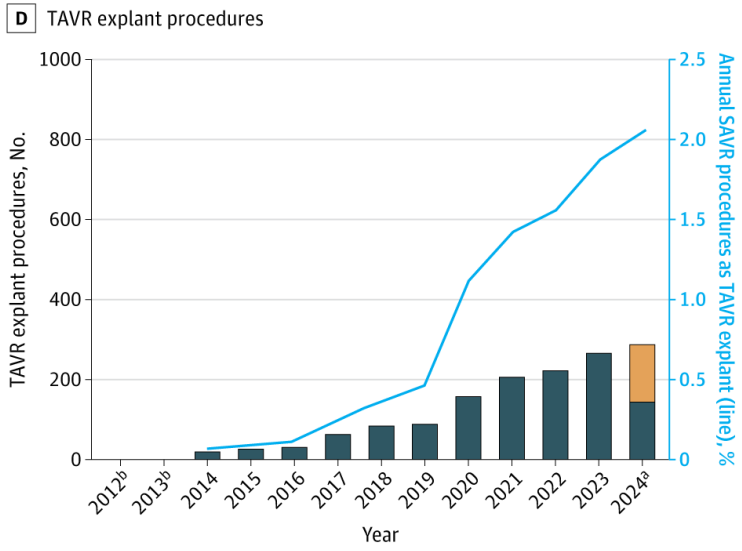
Forrest, J, Yakubov, S, Deeb, G. et al. JACC.2026

Valve reintervention after TAVR

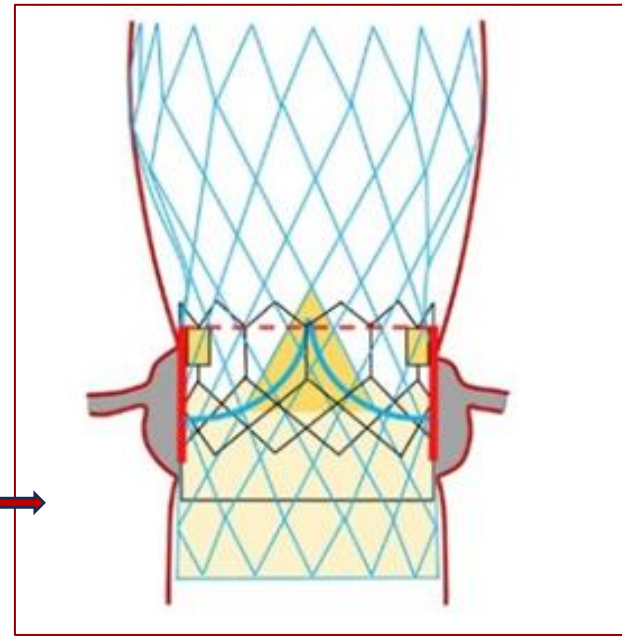








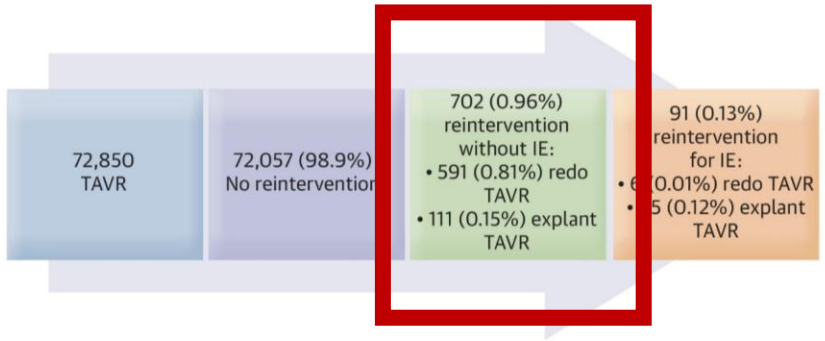
N=410 726 patients



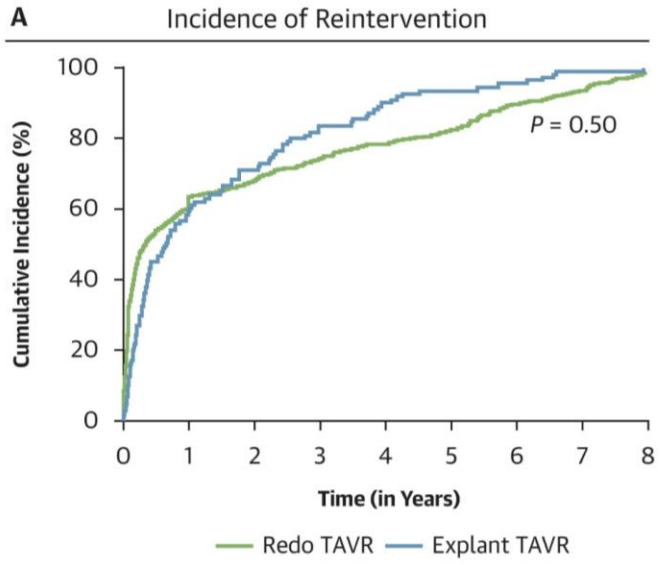
Braasch et al JAMA Cardiol 2025

Valve reintervention in France

Reintervention After TAVR: Data From French National Registries



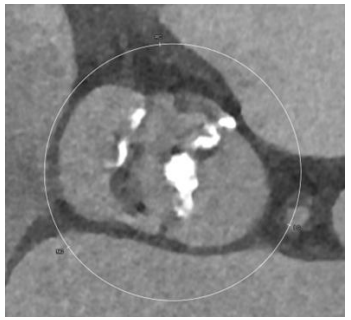
Predictive Factors of Reintervention			
	OR	95% CI	*P* Value
Age	0.95	0.94-0.97	<0.001
Dialysis	1.95	0.98-3.91	0.06
Mean Aortic Gradient Preimplantation	0.99	0.98-1.00	0.03
Mean Aortic Gradient >20 mm Hg After Implantation	2.70	1.82-4.00	<0.001
Aortic Regurgitation ≥ Grade 2	3.30	2.36-4.62	<0.001
PCI Post TAVR	2.56	1.04-6.30	0.04

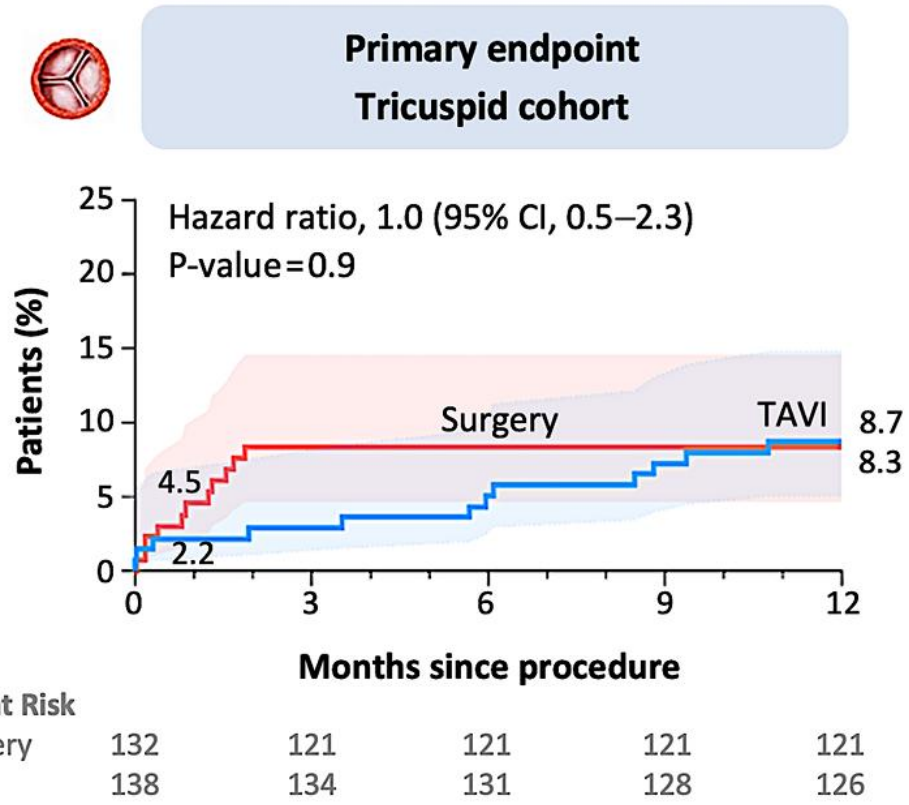


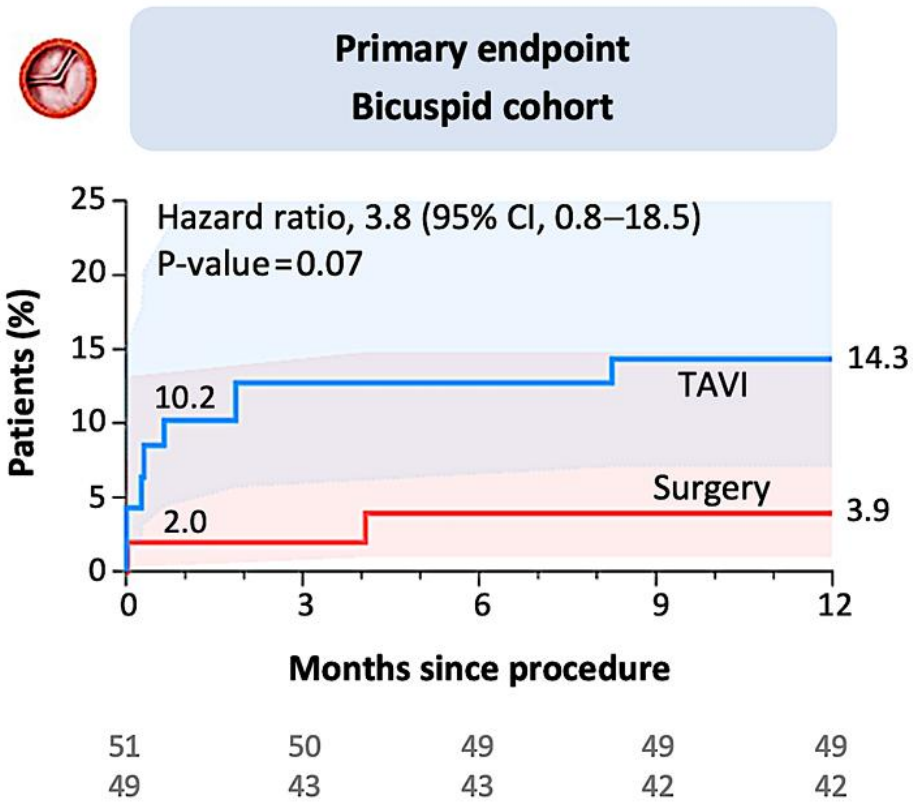
Durand et al, JACC 2025

Bicuspid valves

NOTION II trial, N= 370, 100 bicuspid valves



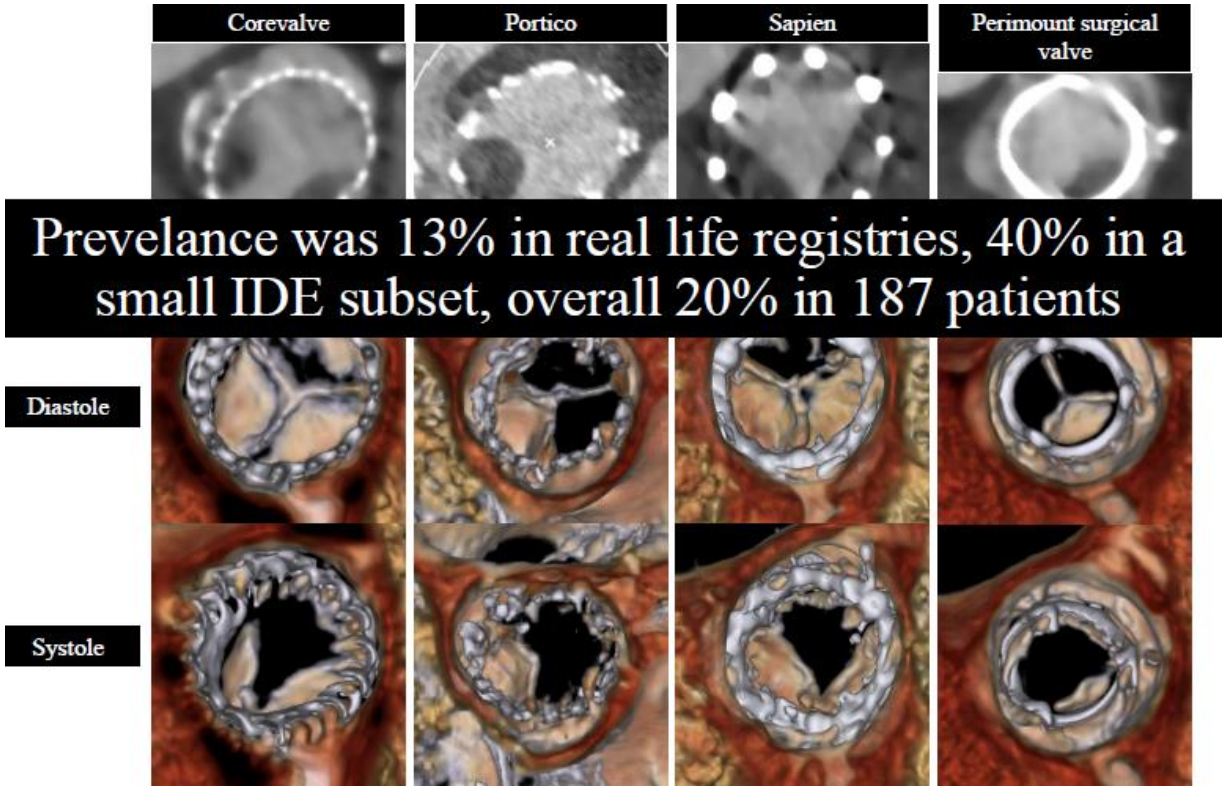




art

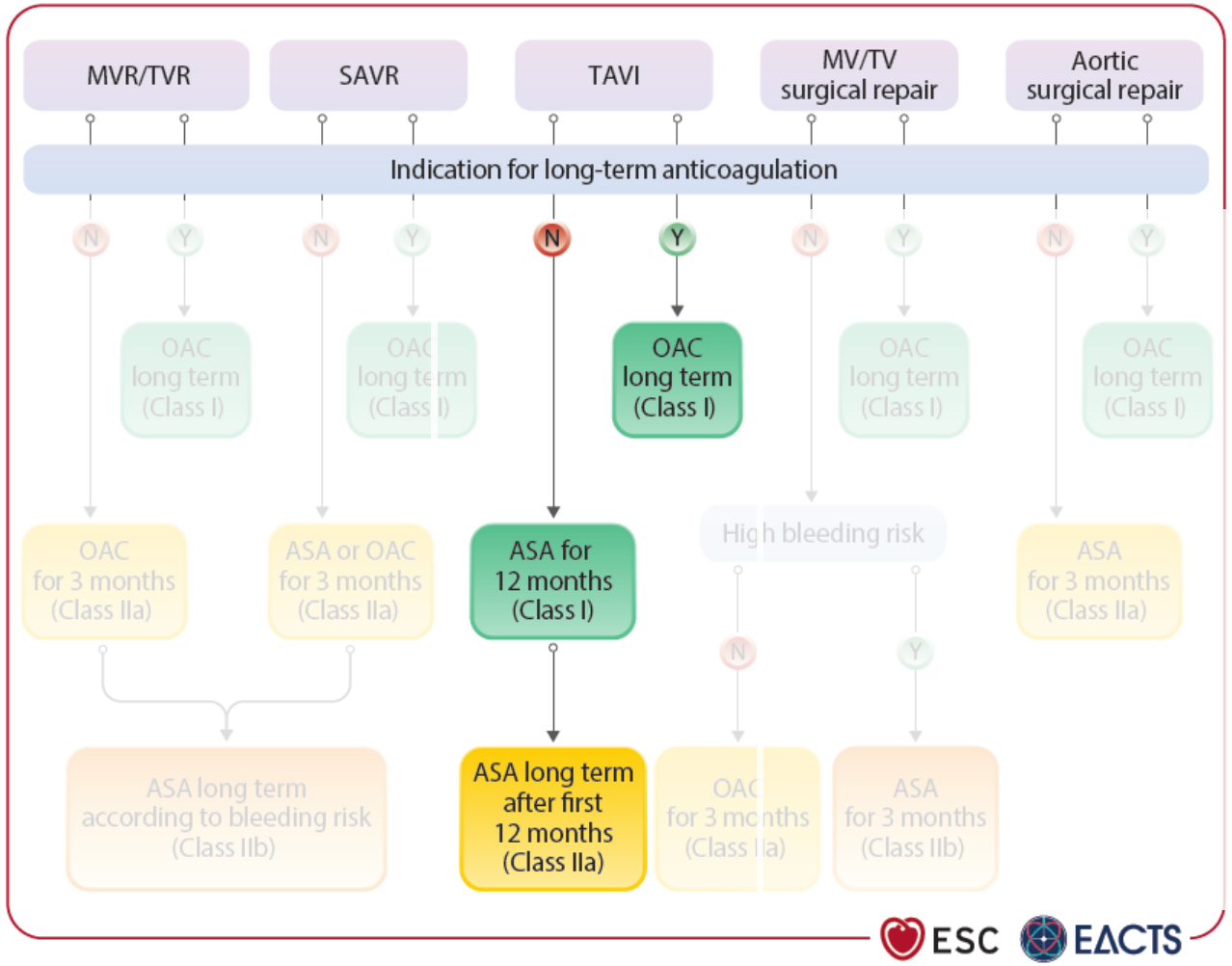
Journal, 2024

Valve thrombosis



Makkar et al. NEJM, 2015

2025 ESC/EACTS Guidelines for the management of HVD



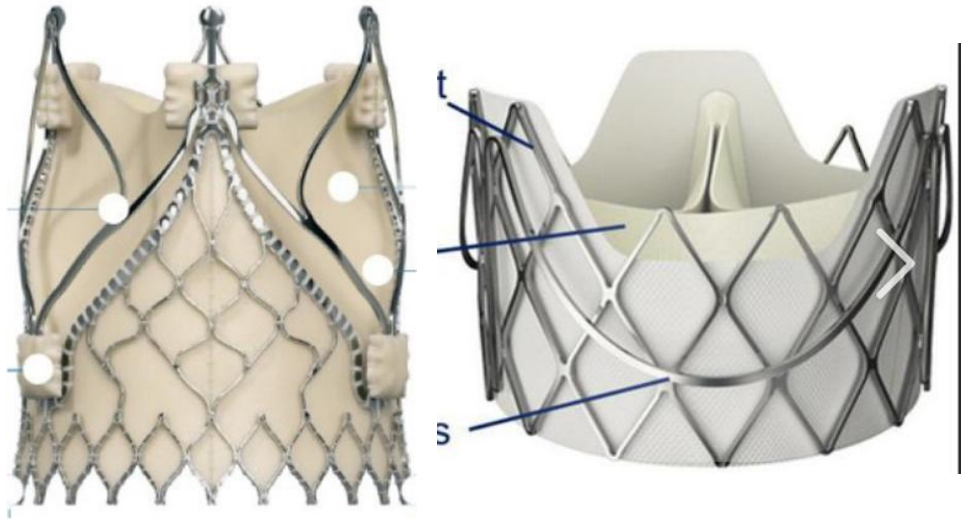
Praz et al. EHJ 2025

Expansion of indications

- **Bicuspid AS**
  - NAVIGATE trial
  - BELIEVERS trial
  - Bicuspid TAVR vs Surgery Pilot Trial

- **Moderate AS**
  - The PROGRESS trial
  - EXPAND TAVR II
  - TAVR UNLOAD

- **Aortic regurgitation**
  - The JOURNEY trial
  - JenaValve AR pivotal trial



Conclusions

- TAVI est une révolution thérapeutique à l'échelle mondiale avec niveau de preuves élevé, plébiscité par les patients
  - Technologie rapidement évolutive
  - Elargissement des indications
- C'est aujourd'hui la thérapie de 1ere intention pour la majorité des patients avec un RAC
- Néanmoins, la durabilité des bioprothèses et les stratégies de réintervention restent des enjeux majeurs
- L'anticipation des options thérapeutiques futures dès la première intervention (lifetime management) est essentielle, en particulier chez les patients jeunes
- La place du TAVI dans la bicuspidie, l'insuffisance aortique et le RAC modéré reste à définir