Impact of Very Severe Aortic Stenosis on Periprocedural Stroke Risk After Transcatheter Aortic Valve Replacement

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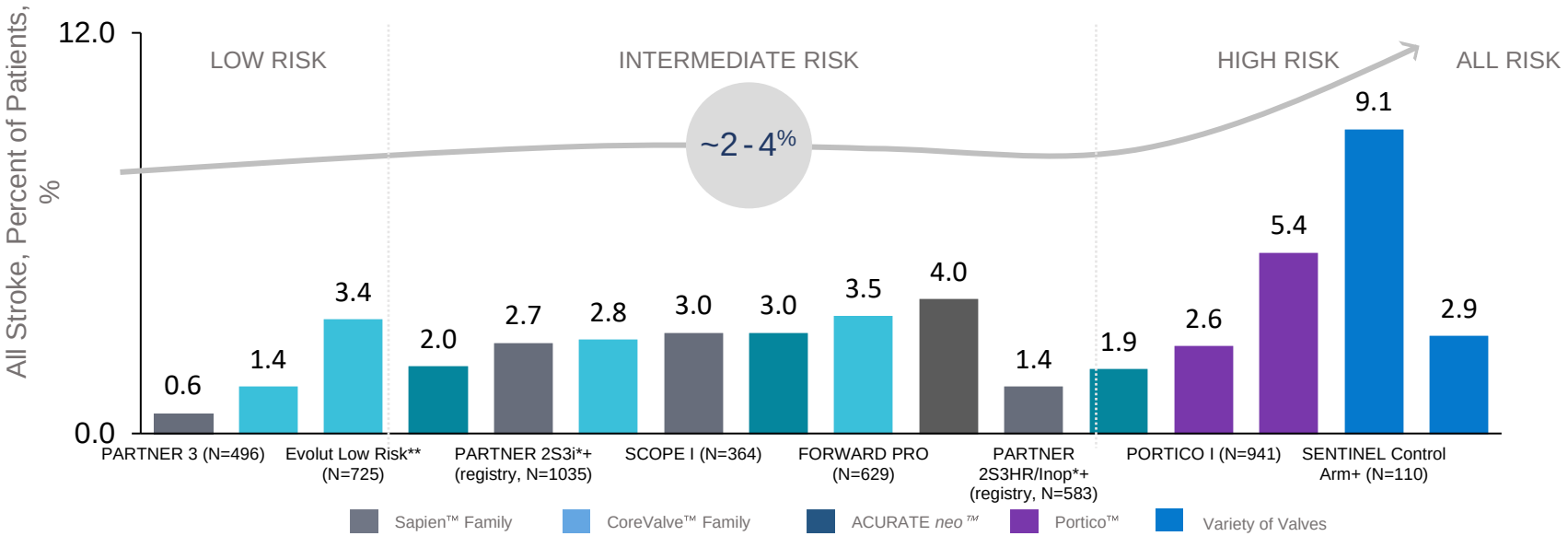
Disclosure of Relevant Financial Relationships

I, Jung-Joon Cha DO NOT have any financial relationships to disclose.

Rate of Stroke at 30 days in Contemporary TAVR Studies

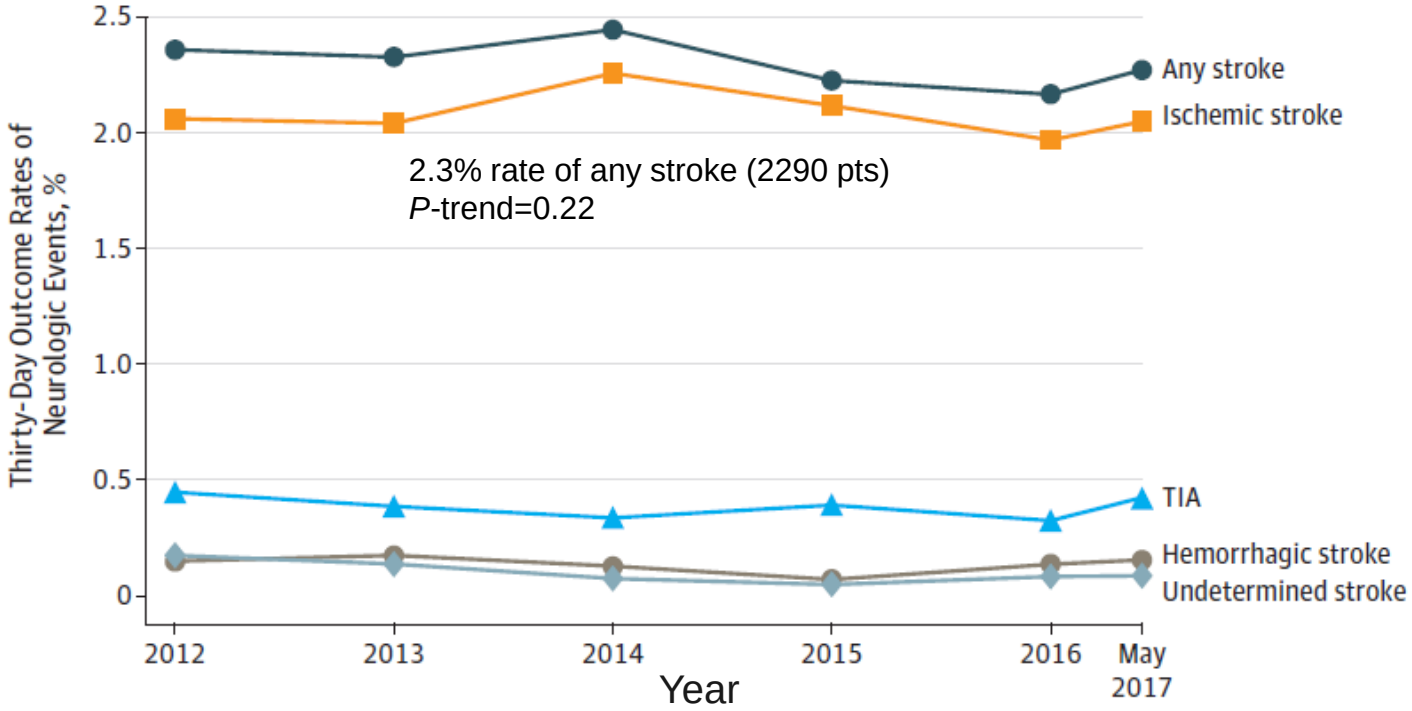
Contemporary studies show consistent rate of stroke



*Kaplan Meier estimates; **Bayesian estimate; PA=physician assistant; NP=nurse practitioner; SENTINEL: Kapadia JACC 2017 (95% of patients were evaluated pre- and post-TAVR by neurologists, and stroke neurologists were on the CEC); Evolut Low Risk: Popma NEJM 2019 (<2% of TAVR patients received an embolic protection device); PARTNER 3: Mack NEJM 2019; PORTICO CE Mark: Linke, Circ Cardiovasc Interv 2018 (Supplement); ; PORTICO I: Sondergaard JACC 2018; FORWARD: Grube, JACC 2017 (an embolic protection device was used in 4.1% of patients); FORWARD PRO: Grube, PCR 2019 (an embolic protection device was used in 9.1% of patients); PARTNER 2S3i: Thourani, Lancet 2016; PARTNER 2S3HR/Inop: Kodali Eur Heart J 2016; SCOPE I: Lanz, Lancet 2019; SAVI TF: Möllmann, EuroIntervention 2018; NOTION: Thyregod JACC 2015; Tamburino Circulation 2020
Results from different studies are not directly comparable. + Study protocol included mandated, per-protocol baseline and follow-up evaluation by neurologist, neurology PA, neurology NP or neurology fellow. Information provided for educational purpose only.
For more information on the underdiagnosis of Stroke, click here

Stroke Rate Over Time

2290 strokes at 30-days among N=101,430 patients who underwent TAVR at 521 US sites from 2011-2017.
STS/ACC TVT Registry



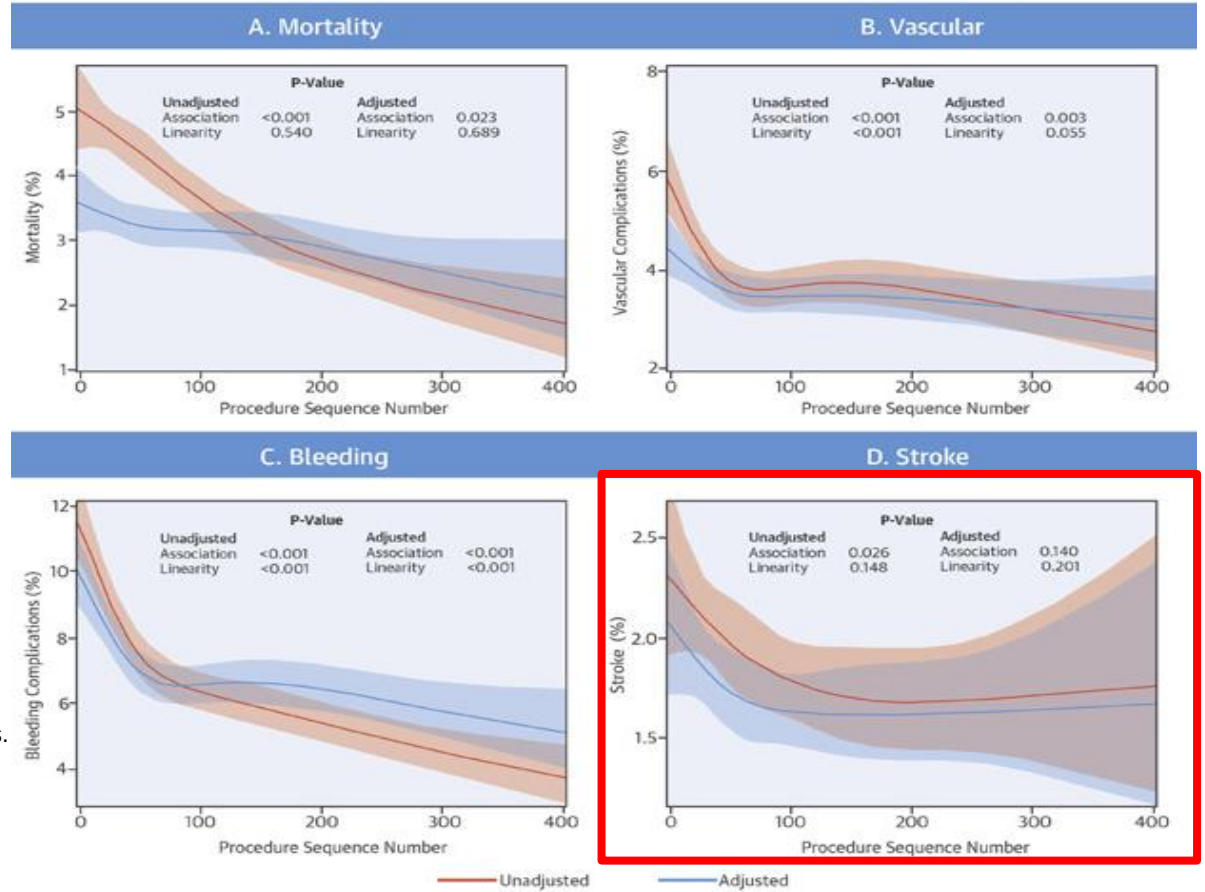
Despite newer-generation valve technology, real-world data demonstrates rate of stroke remains consistent over time.

Huded, C. et al. *JAMA*. 2019 Jun 18;321(23):2306-2315. doi: 10.1001/jama.2019.7525

Assessing TAVR Outcomes Based on Site Experience

STS/ACC TVT Registry: N=42,988 TAVR procedures at 395 hospitals (between 2011-2015)

- Increasing site volume was associated with lower in-hospital risk-adjusted outcomes, including mortality, vascular complications, and bleeding **but was not associated with decreased stroke rate.**
- Stroke risk was independent of experience and operator volume.

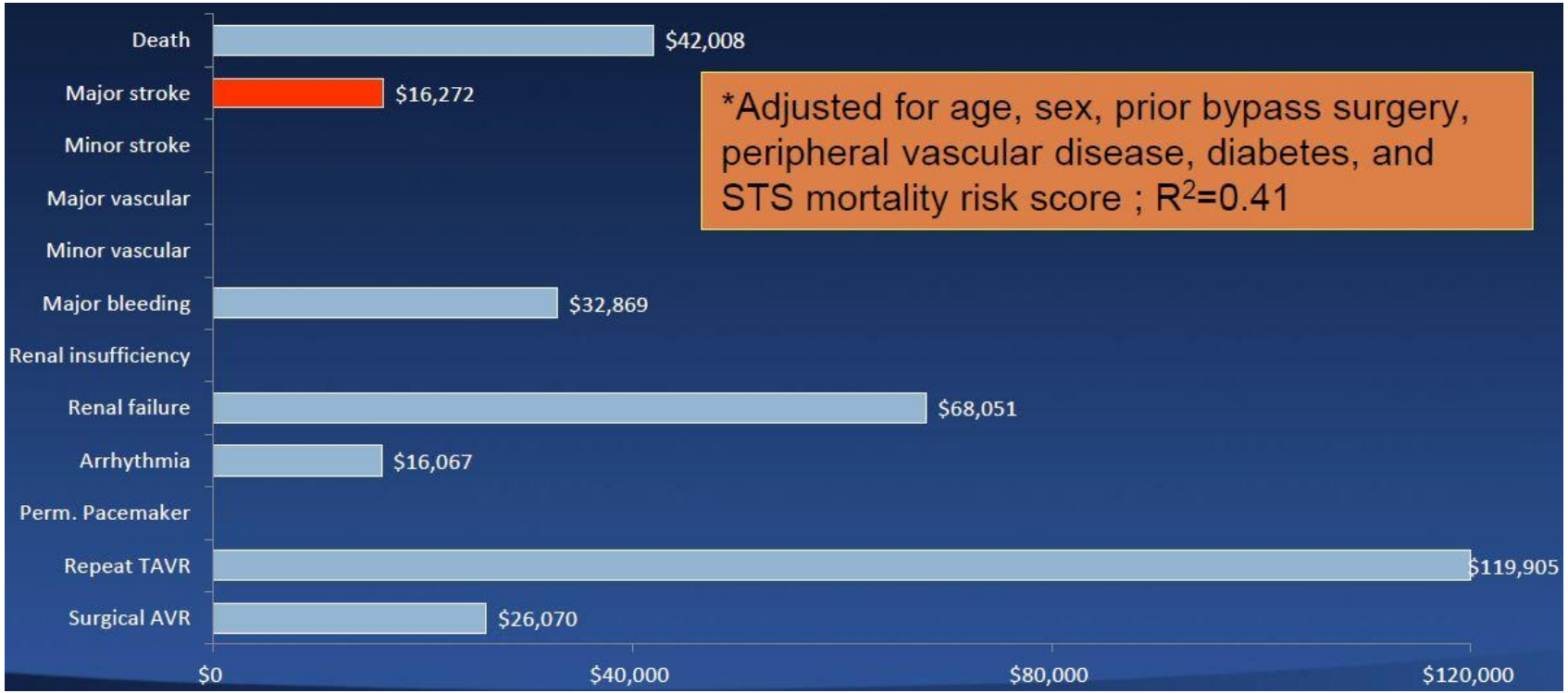


- Unadjusted (orange) and adjusted (blue) frequency of outcomes.
- The orange- and blue-colored bands represent 95% confidence intervals, which are broader for stroke due to low rate of site-reported stroke and the fewer hospital sites contributing cases.

Carroll JD, et al. Procedural Experience for Transcatheter Aortic Valve Replacement and Relation to Outcomes: The STS/ACC TVT Registry. J Am Coll Cardiol. 2017 Jul 4;70(1):29-

Effect of Stroke on Economics of TAVR

PARTNER Trial – major stroke was a contributor to cost related to TAVR



Gada H, presented at TVT 2018

Post-TAVR Strokes Associated with Substantial Mortality, Non-Home Discharges, and Cost

Post-TAVR strokes are related to:

- **~3-fold increase** in in-hospital mortality
- **32% increase** in cost of index hospitalization
- **121% increase** in nursing home and intermediate care facility utilization
- **132% increase** in cost of rehospitalizations

Table 1. Outcomes of patients with and without acute ischemic stroke following transcatheter aortic valve replacement.

	Unmatched cohorts			Matched cohorts		
	TAVR non-stroke (N = 30,054)	TAVR-stroke (N = 776)	*p*-value	TAVR non-stroke (N = 763)	TAVR-stroke (N = 763)	*p*-value
In-hospital outcomes						
Death	4%	11.2%	<0.001	4.1%	11.3%	<0.001
Non-home discharge	28.6%	66.8%	<0.001	29.8%	66.1%	<0.001
Gastrostomy	1%	11%	<0.001	0.7%	10.8%	<0.001
Mechanical ventilation	1.2%	5.8%	<0.001	2.4%	13.3%	<0.001
Tracheostomy	2.7%	13.9%	<0.001	1.7%	5.1%	0.043
LOS, mean (SD), d	8 (8)	15 (12)	<0.001	9 (9)	15 (12)	<0.001
Admission cost*, US$	58,995 (32,723)	80,724 (45,926)	<0.001	59,584 (32,647)	79,242 (43,751)	<0.001
30-day outcomes						
Readmission	18.3%	23.2%	0.026	15.6%	20.5%	0.020
Death	0.9%	2.1 %	<0.001	1.3%	3.1%	0.034
LOS of readmission	6 (7)	10 (24)	<0.001	7 (7)	10 (22)	<0.001
Readmission cost*, US$	15,532 (39,442)	33,258 (132,317)	<0.001	14,471 (15,264)	33,578 (120,085)	<0.001

Notes. *Mean (SD).

NE, national estimate; TAVR, transcatheter aortic valve replacement; SD, standard deviation; Y, year; N, number; TIA, transient ischemic attack; LOS, length of stay; US, United States.

Data collected from the National Readmission Database, Jan 1, 2013- Dec 31, 2014

Alqahtani F, et al. *Structural Heart J*. 2018. DOI: 10.1080/24748706.2018.1539281

The Short-Term Clinical Costs of TAVR-Related Stroke are High

23%

increase (+$12,737) in average TAVR index hospitalization costs[1]

4.2 days

average increase in index hospitalization length-of-stay (LOS)[1]

3x

increase in hospital mortality[2]

TAVR-Related Stroke and Neuro-cognitive Decline Also Significantly Increase Long-term Costs

30-day

31% higher 30-day readmission rates for TAVR-related stroke (20.5% vs. 15.6%)[1]

One Year

TAVR-related stroke can increase cumulative 1 year healthcare costs by **70%** (and additional **$59,646**)[2]

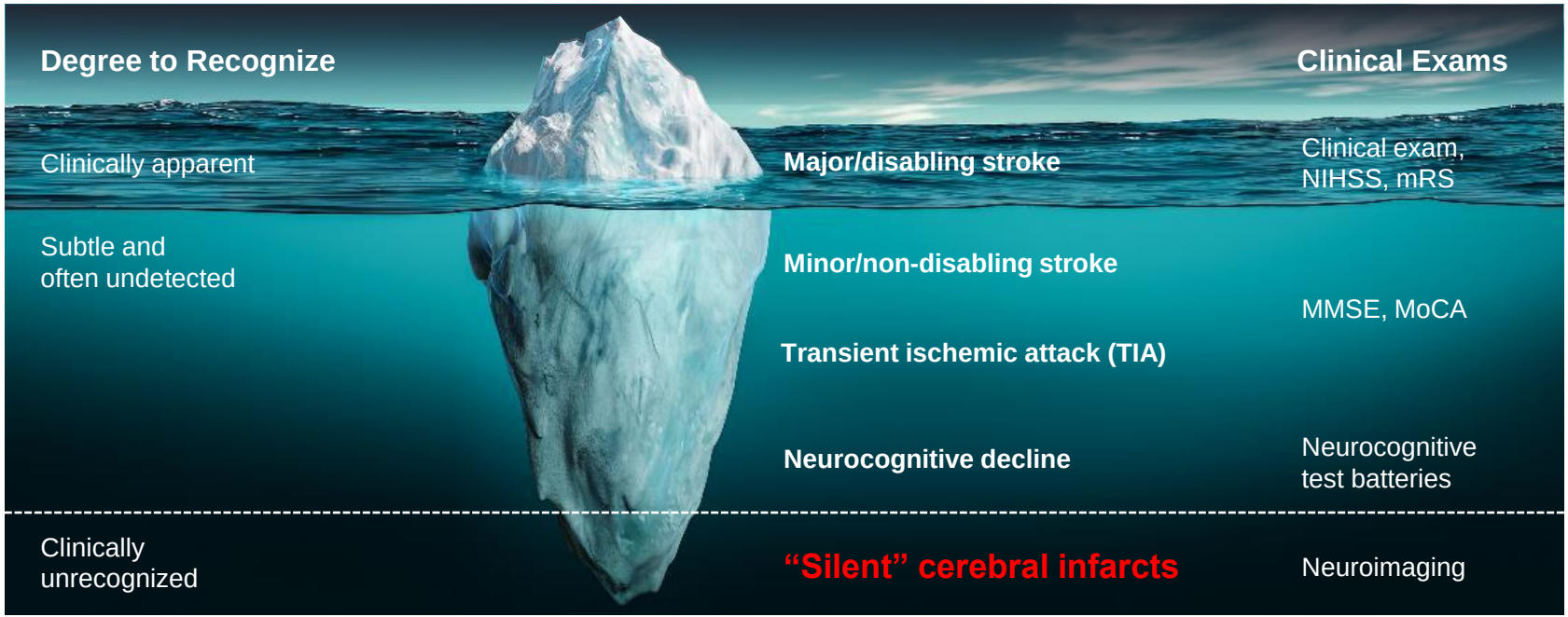
Post-procedural neurocognitive decline can lead to a **$17,275** increase in post-acute care costs[3]

Patient Lifetime

Life cost of ischemic stroke is estimated to be $140,048 on average, including inpatient care, rehabilitation, and follow-up care[4]

1. Alkhouli, M, et al. "Cost of procedural stroke in TAVR in a US Medicare population" Valve20A-POS01; PCR London Valves 2020
2. Alqahtani F, et al. Clinical and Economic Burden of Acute Ischemic Stroke Following Transcatheter Aortic Valve Replacement SHJ online 16 Nov 2018
3. Boone, M. et all. "Economic Burden of Postoperative Neurocognitive Disorders Among US Medicare Patients" JAMA Network Open.2020;3(7):e208931. 31July2020
4. Rosamund, W. et al. "Heart Disease and Stroke Statistics – 2008 Update" AHA DOI: 10/1161/CIRCULATIONAHA.108/1879998

Post-TAVR Stroke and Other Neurological Events May Not Be Acutely Apparent



Risk factors for stroke with TAVI according to strength of evidence for association

Very severe AS (VSAS), defined as a peak aortic velocity of ≥5 m/s, represents an advanced disease stage.

However, its association with stroke risk after TAVR has not been well-studied.

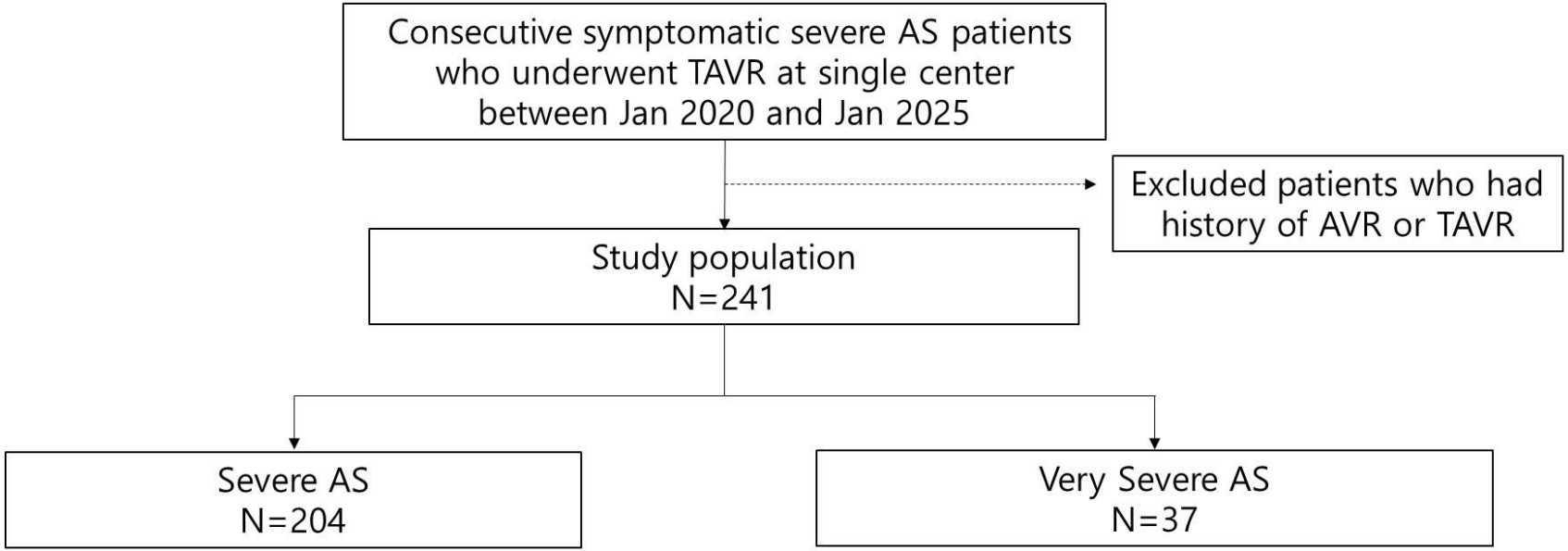
EuroIntervention 2024;20:e793-e805

Aim of the study

- Assess the impact of very severe aortic stenosis on periprocedural stroke risk

- Evaluate the potential protective role of cerebral embolic protection

Method



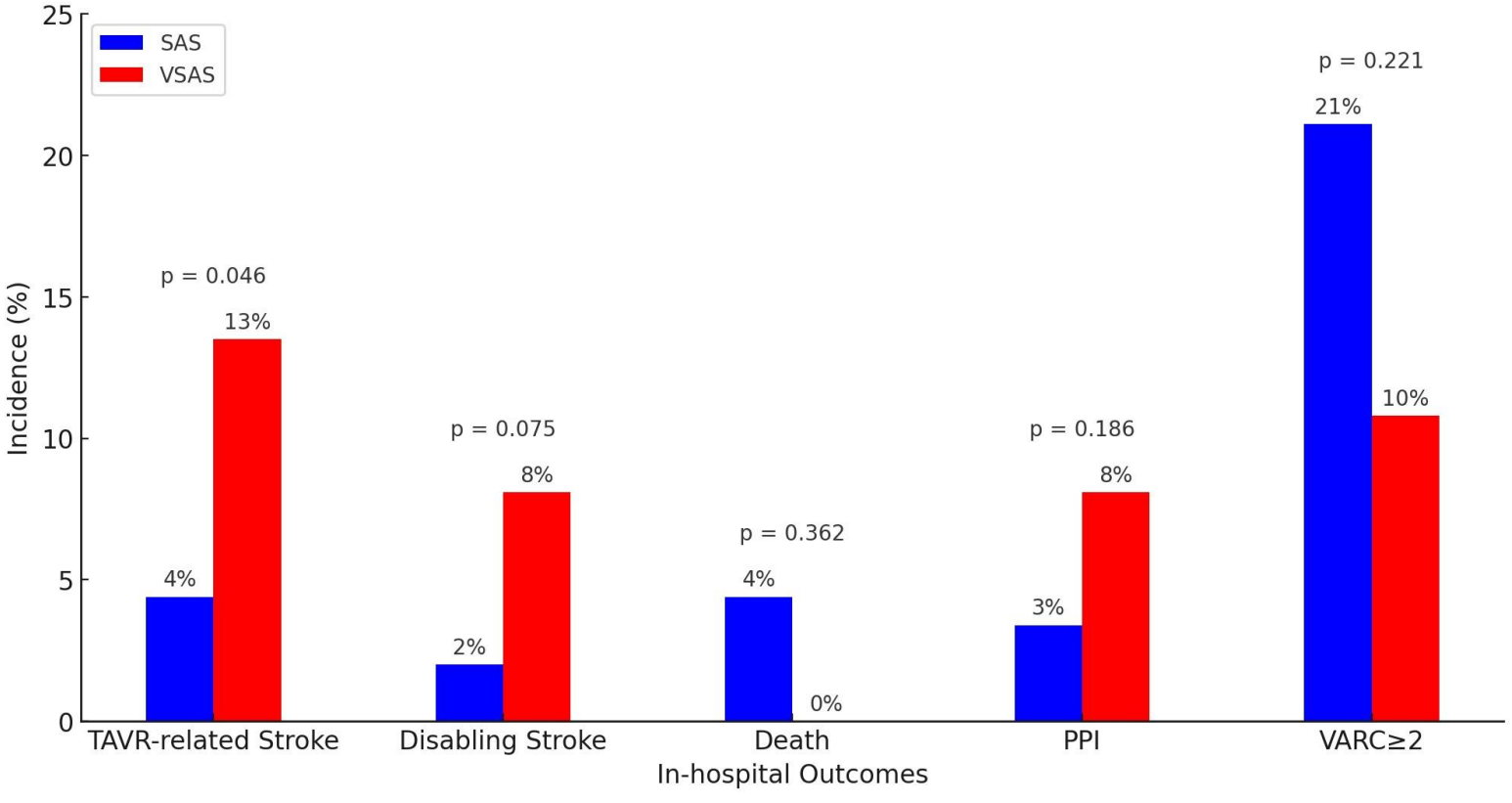
The primary endpoint : the incidence of TAVR-related stroke

The secondary outcomes: procedural success, complications, and 1-year clinical outcomes

	Total (N=241)	SAS (N=204)	VSAS (N=37)	p
Female	146 (60.6%)	123 (60.3%)	23 (62.2%)	0.975
Age	81.1 ± 6.6	81.0 ± 6.6	81.6 ± 6.7	0.608
Body mass index	24.2 ± 3.9	24.0 ± 3.8	25.4 ± 4.3	0.038
Hypertension	215 (89.2%)	182 (89.2%)	33 (89.2%)	1.000
Diabetes mellitus	106 (44.0%)	92 (45.1%)	14 (37.8%)	0.523
Dyslipidemia	157 (65.1%)	133 (65.2%)	24 (64.9%)	1.000
eGFR	61.1 ± 24.5	60.0 ± 25.1	67.6 ± 19.7	0.080
CKD (eGFR <30)	33 (13.7%)	31 (15.2%)	2 (5.4%)	0.182
History of CAD	118 (49.0%)	108 (52.9%)	10 (27.0%)	0.006
History of Stroke	33 (13.7%)	31 (15.2%)	2 (5.4%)	0.182
History of Syncope	22 (9.1%)	21 (10.3%)	1 (2.7%)	0.244
History of recent MI	6 (2.5%)	6 (2.9%)	0 (0.0%)	0.629
History of PCI	49 (20.3%)	48 (23.5%)	1 (2.7%)	0.007
History of CABG	5 (2.1%)	5 (2.5%)	0 (0.0%)	0.737
History of BAV	4 (1.7%)	1 (0.5%)	3 (8.1%)	0.008
History of PPM or ICD	8 (3.3%)	8 (3.9%)	0 (0.0%)	0.468
History of hospitalization for AS	42 (17.4%)	37 (18.1%)	5 (13.5%)	0.655
Dementia	12 (5.0%)	9 (4.4%)	3 (8.1%)	0.589
Cancer	44 (18.3%)	34 (16.7%)	10 (27.0%)	0.204
Liver cirrhosis	6 (2.5%)	4 (2.0%)	2 (5.4%)	0.507
COPD	10 (4.1%)	10 (4.9%)	0 (0.0%)	0.354

	Total (N=241)	SAS (N=204)	VSAS (N=37)	p
Frailty score ≥ 5	106 (44.0%)	96 (47.1%)	10 (27.0%)	0.038
STS score	7.0 ± 5.1	7.1 ± 5.1	6.2 ± 5.4	0.318
STS ≥ 8	74 (30.7%)	65 (31.9%)	9 (24.3%)	0.471
Reduced ejection fraction (LVEF≤40%)	33 (13.7%)	29 (14.2%)	4 (10.8%)	0.768
Use of oral anticoagulant	48 (19.9%)	41 (20.1%)	7 (18.9%)	1.000
Small annulus (aortic annular area ≤430 mm²)	140 (58.1%)	120 (58.8%)	20 (54.1%)	0.719
Pre ballooning	100 (41.5%)	76 (37.3%)	24 (64.9%)	0.003
Post ballooning	25 (10.4%)	18 (8.8%)	7 (18.9%)	0.119
Cerebral embolic protection	63 (26.1%)	53 (26.0%)	10 (27.0%)	1.000
Device				0.060
- SAPIEN series	116 (48.1%)	102 (50.0%)	14 (37.8%)	
- EVOLUT series	79 (32.8%)	65 (31.9%)	14 (37.8%)	
- ACURATE neo2	43 (17.8%)	36 (17.6%)	7 (18.9%)	
- NAVITOR	3 (1.2%)	1 (0.5%)	2 (5.4%)	

Clinical Outcomes

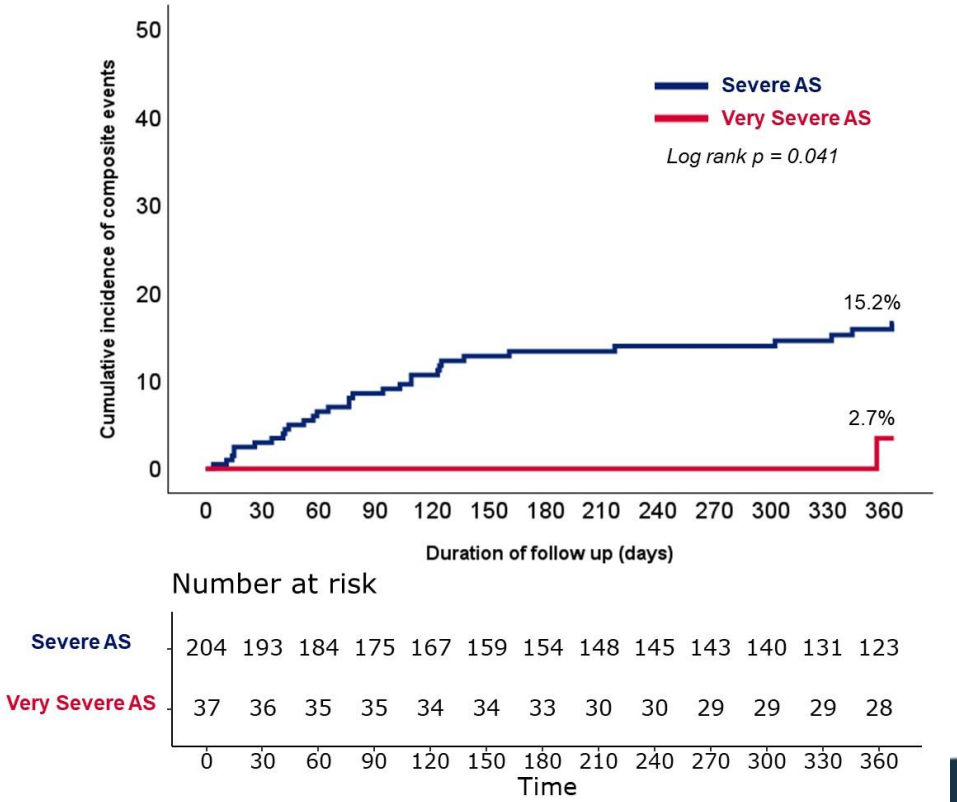


Independent predictors of TAVR-related stroke

All patients underwent TAVR (N=241)	Crude OR	Adjusted OR (95% CI)	P-value
Female	1.67	-	-
Body mass index	1.05	-	-
History of coronary artery disease	1.42	-	-
History of stroke	1.79	-	-
History of PCI	0.64	-	-
Chronic kidney disease (eGFR <30)	0.47	-	-
Very severe AS (V_{max}≥5m/s)	3.39	4.46 (1.32–15.05)	0.016
Reduced ejection fraction (LVEF≤40%)	1.05	-	-
STS Score ≥ 8	1.27	-	-
Frailty score ≥ 5	2.41	3.14 (0.96–10.23)	0.058
Use of oral anticoagulant	1.66	-	-
Small annulus (aortic annular area ≤430 mm^2)	1.87	-	-
Procedural time (min)	1.00	-	-
Pre ballooning	1.44	-	-
Post ballooning	1.48	-	-
Cerebral embolic protection	0.76	-	-

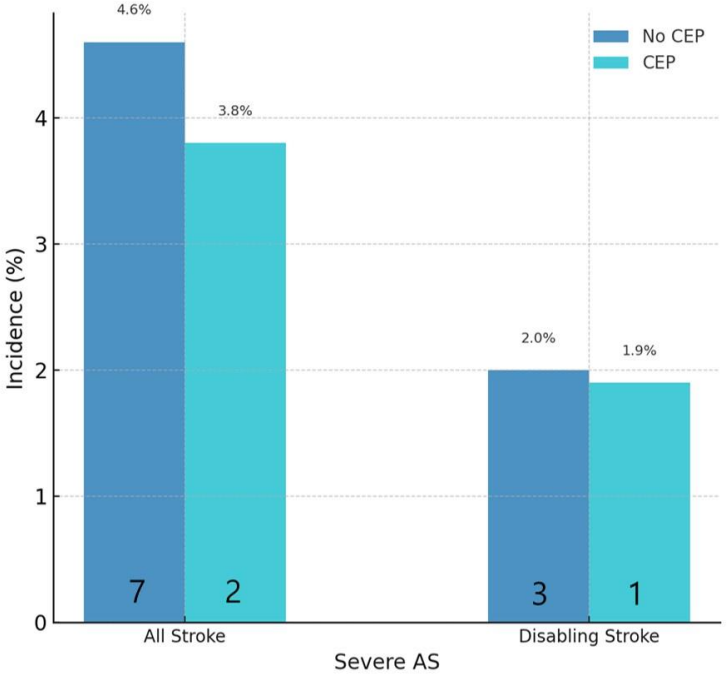
1-year composite event

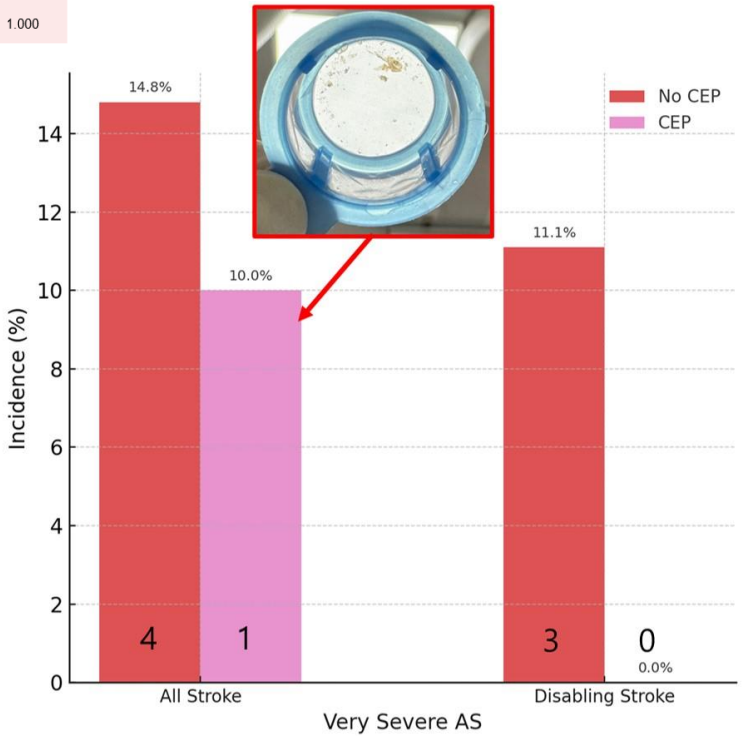
Composite of death, stroke, or hospitalization for heart failure



Impact of cerebral embolic protection device

	Total	SAS	VSAS	p
	(N=241)	(N=204)	(N=37)	
Cerebral embolic protection	63 (26.1%)	53 (26.0%)	10 (27.0%)	1.000





Conclusion

- Stroke is a critical complication post-TAVR, and prevention is crucial for improving patient outcomes as well as cost.
- VSAS showed a strong association with TAVR-related stroke.
- Given the improved long-term outcomes in patients with VSAS, further exploration of stroke mitigation strategies, such as CEP, is warranted to optimize clinical outcomes.

Thanks your kind attention

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