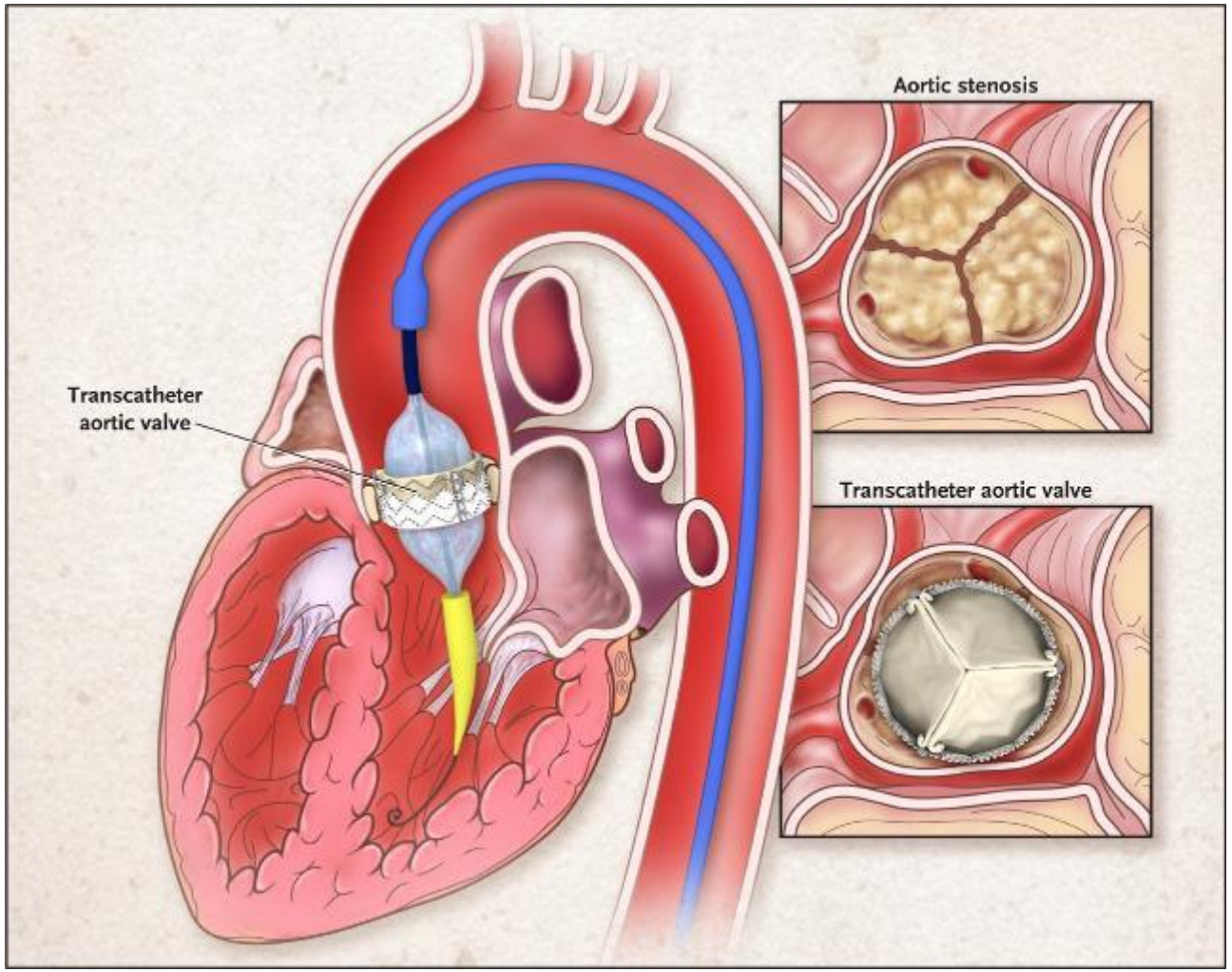
Stadtspital Zürich

Komplikationen bei/nach TAVI Implantationen

Dr. med. David Tüller
Leitender Arzt Kardiologie
Stadtspital Zürich

TAVI: Das Prinzip

Transcatheter Aortic-Valve Replacement (TAVI)

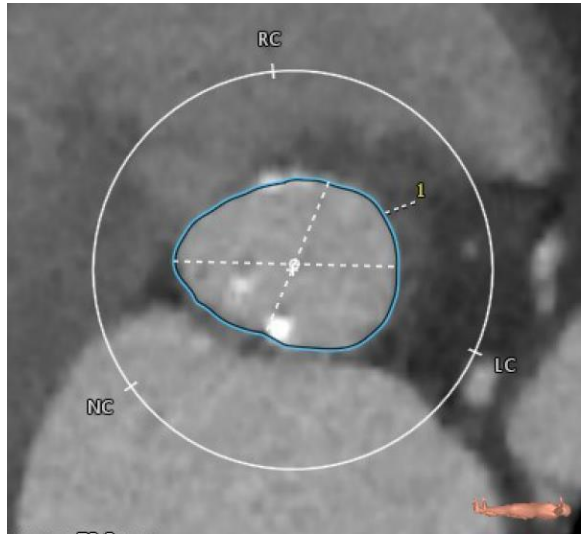


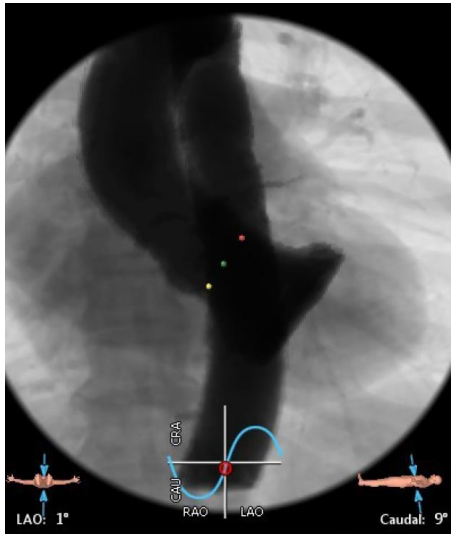
Smith CR et al. N Engl J Med 2011;364:2187-2198

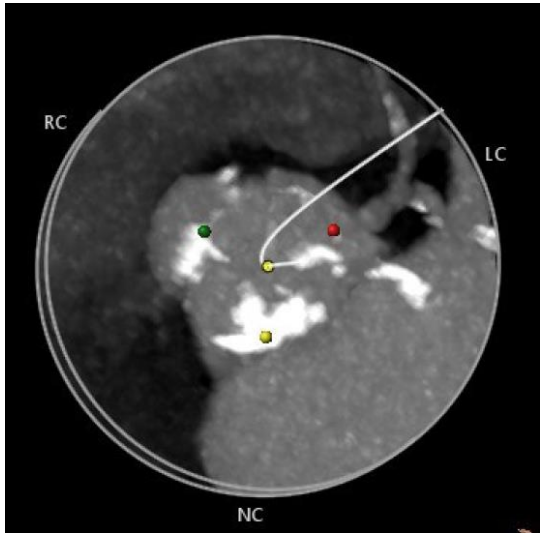
		
	Sapien 3 Ultra	Evolut Pro Plus
Access	all	Transapical not possible
Sheath Size	TF: 14F/16F E-Sheath	14F Sheath
Implantation	**Balloon-expandable**	**Self-expandable, recaptureable**
Sizes	(20),23, 26, 29mm	23, 26, 29mm und 34
	+easy to learn +PVL +pacerrate - Non retriveable -annular ruptur (rare)	+supraannular position +recapturable +valvular area (PPM) - Pacemaker Rate - Learning curve - PVL

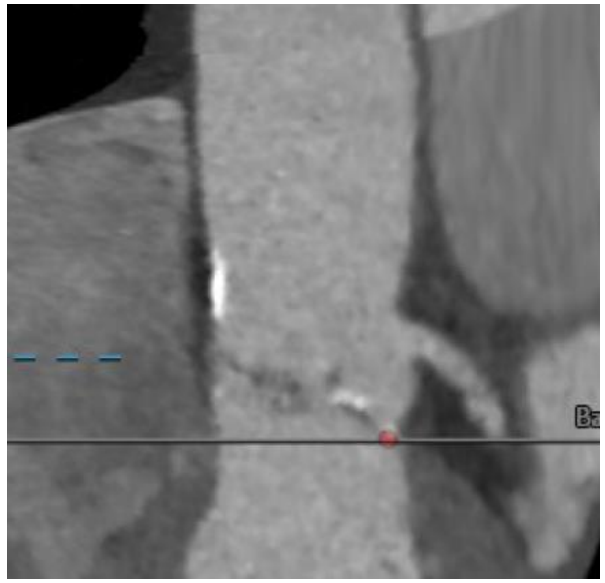
Zeitgemässe Implantationstechnik „minimal touch“

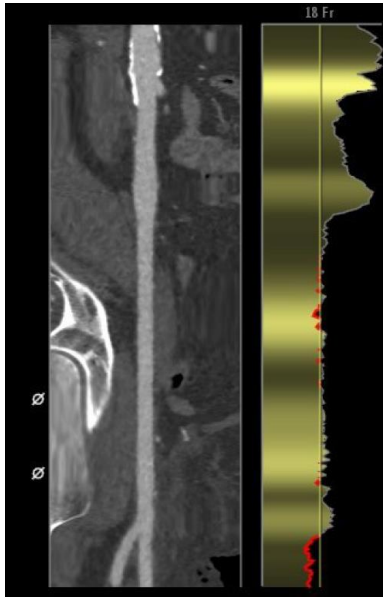
- Transfemoraler Zugang als 1. Wahl wenn immer möglich (>90% der Fälle)
- Lokalanästhesie/Sedation
- Perkutane Verschlusstechnik (Proglide/Prostar/MANTA)
- So wenig Monitoring wie möglich
- Keine Valvuloplastie, hohe Implantation (Evolut)
- Verlegung auf IMC
- Frühe Mobilisation (einige Stunden nach Eingriff)
- Rasche Entlassung/Verlegung Rehabilitation









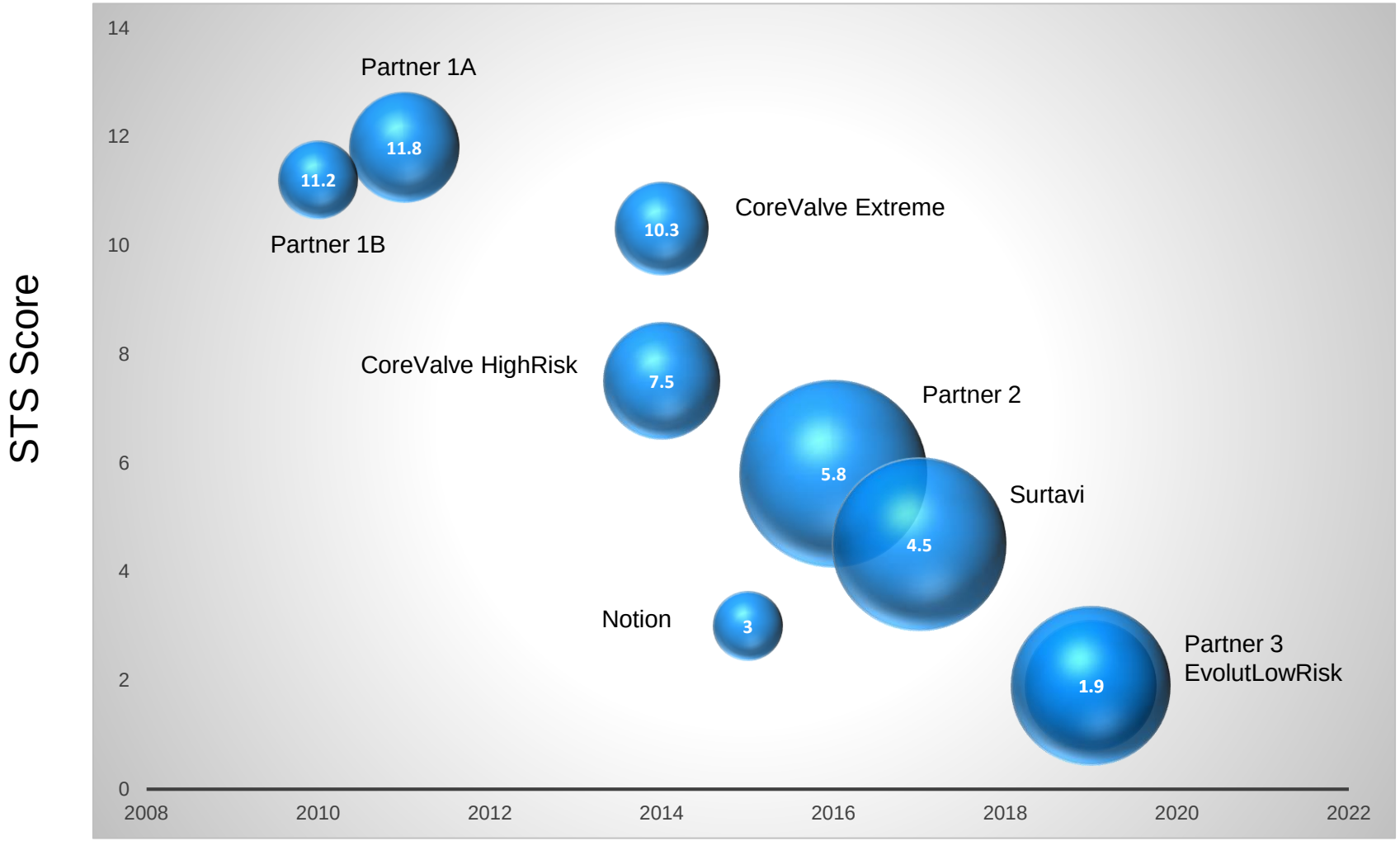


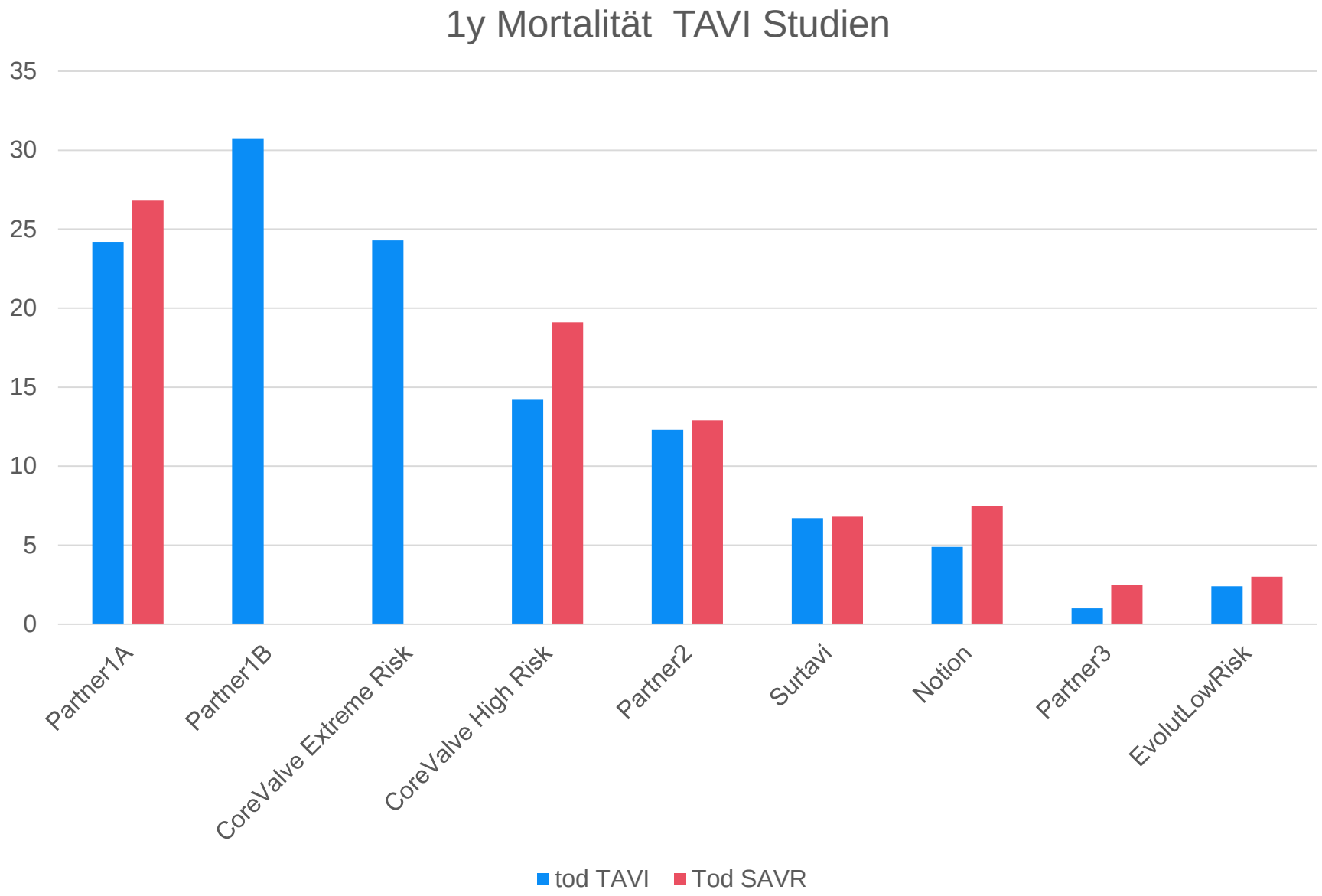
Computertomographie

-> Sizing des Annulus
-> Kuspidie, Verkalkungen
-> Höhe der Koronararterien
-> Dimension des Zugangswegs
-> ideale Implantationsprojektion

TAVI: Studiendaten

Randomisierte TAVI Studien 2009-2019

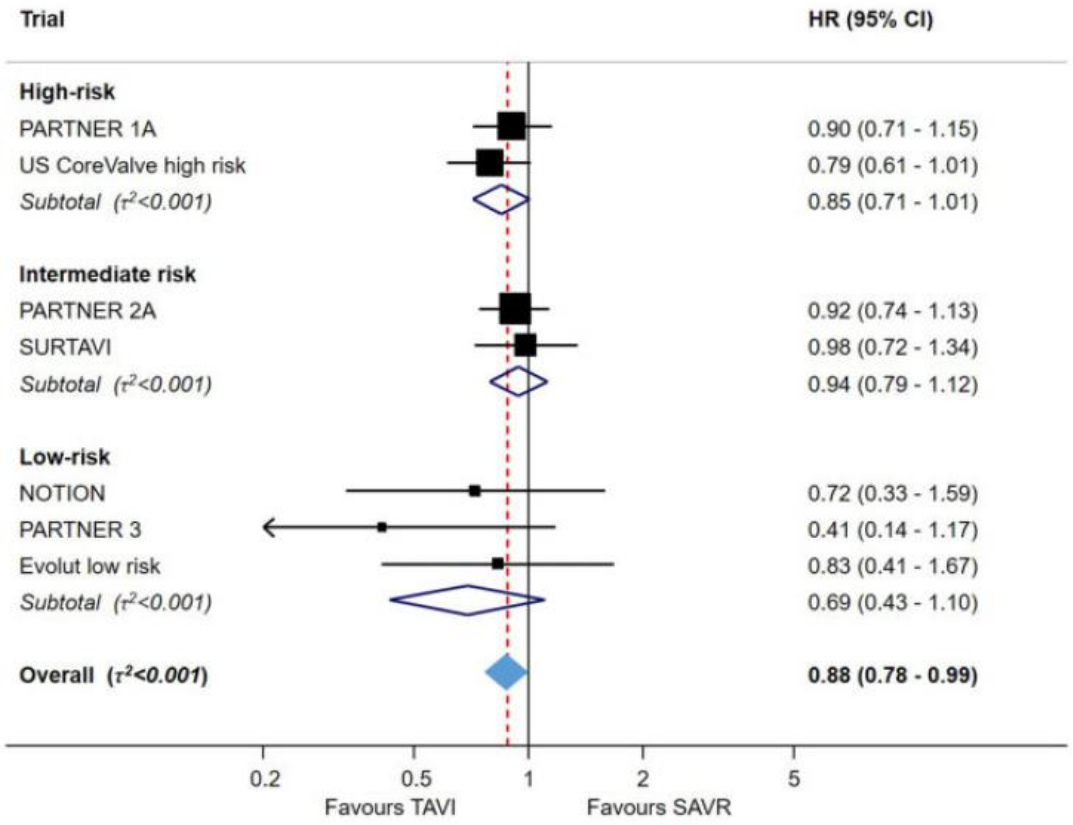



1y Mortalität TAVI Studien
35
30
25
20
15
10
5
0
Partner1A
Partner1B
CoreValve Extreme Risk
CoreValve High Risk
Partner2
Surtavi
Notion
Partner3
EvolutLowRisk
tod TAVI
Tod SAVR

Indikationsstellung TAVI vs Chirurgie

Transcatheter aortic valve implantation vs. surgical aortic valve replacement for treatment of symptomatic severe aortic stenosis: an updated meta-analysis

George C.M. Siontis[1†], Pavel Overtchouk[1†], Thomas J. Cahill[2†], Thomas Modine[3], Bernard Prendergast[4], Fabien Praz[1], Thomas Pilgrim[1], Tatjana Petrinic[5], Adriani Nikolakopoulou[6], Georgia Salanti[6], Lars Søndergaard[7], Subodh Verma[8], Peter Jüni[9], and Stephan Windecker[1*]



All-cause Mortality according to surgical risk

European Heart Journal (2019) **40**, 3143–3153

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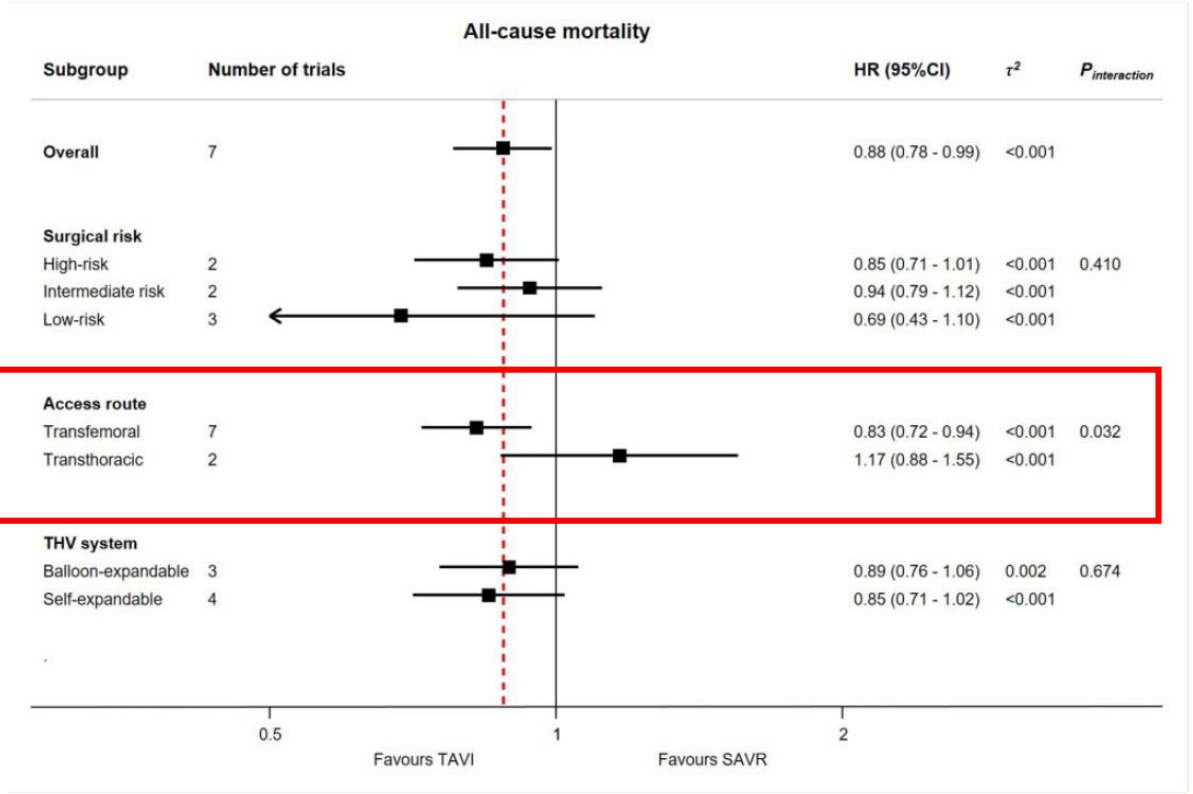


-> Zugangsweg entscheidend, der ganze Vorteil kommt aus den transfemoral behandelten Patienten

Indikationsstellung TAVI vs Chirurgie

Tod

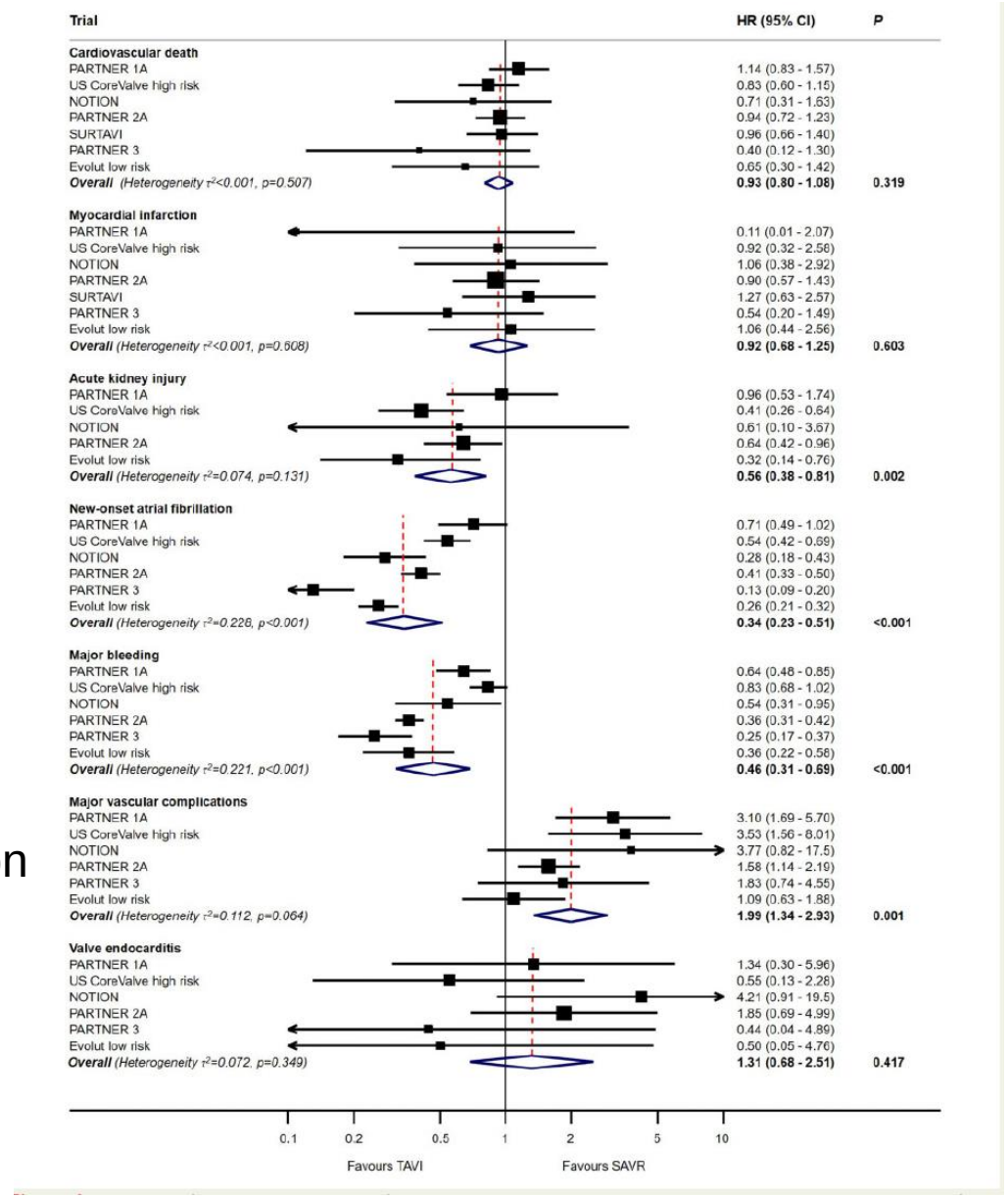
Infarkt

Niereninsuffizienz

Vorhofflimmen

Major Bleeding

Vaskuläre Komplikation



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European Heart Journal (2019) **40**, 3143–3153

TAVI vs. SAVR

- Weniger AKI
- Weniger VHFlimmern
- Weniger Blutungen
- Mehr Schrittmacher
- Mehr vaskuläre Komplikationen

TAVI: Komplikationen

Prozedurale Komplikationen bei TAVI (Sapien)

EXPEDITED REVIEW Heart Valve Disease

Updated Standardized Endpoint Definitions for Transcatheter Aortic Valve Implantation

The Valve Academic Research Consortium-2 Consensus Document†

A. Pieter Kappetein,* Stuart J. Head, Philippe Généreux, Nicolo Piazza, Nicolas M. van Mieghem, Eugene H. Blackstone, Thomas G. Brott, David J. Cohen, Donald E. Cutlip, Gerrit-Anne van Es, Rebecca T. Hahn, Ajay J. Kirtane, Mitchell W. Krucoff, Susheel Kodali, Michael J. Mack, Roxana Mehran, Josep Rodés-Cabau, Pascal Vranckx, John G. Webb, Stephan Windecker, Patrick W. Serruys, Martin B. Leon

Rotterdam, the Netherlands

Prozedurale Komplikationen bei TAVI (Sapien)

Table 2 Mortality

All-cause mortality
Cardiovascular mortality
Any of the following criteria:
Death due to proximate cardiac cause (e.g. myocardial infarction, cardiac tamponade, worsening heart failure)
Death caused by non-coronary vascular conditions such as neurological events, pulmonary embolism, ruptured aortic aneurysm, dissecting aneurysm, or other vascular disease
All procedure-related deaths, including those related to a complication of the procedure or treatment for a complication of the procedure
All valve-related deaths including structural or non-structural valve dysfunction or other valve-related adverse events
Sudden or unwitnessed death
Death of unknown cause
Non-cardiovascular mortality
Any death in which the primary cause of death is clearly related to another condition (e.g. trauma, cancer, suicide)

Table 5 Bleeding

Life-threatening or disabling bleeding
Fatal bleeding *(BARC type 5)* OR
Bleeding in a critical organ, such as intracranial, intraspinal, intraocular, or pericardial necessitating pericardiocentesis, or intramuscular with compartment syndrome *(BARC type 3b and 3c)* OR
Bleeding causing hypovolaemic shock or severe hypotension requiring vasopressors or surgery *(BARC type 3b)* OR
Overt source of bleeding with drop in haemoglobin >5 g/dL or whole blood or packed red blood cells (RBCs) transfusion >4 units* *(BARC type 3b)*
Major bleeding (BARC type 3a)
Overt bleeding either associated with a drop in the hemoglobin level of at least 3.0 g/dl or requiring transfusion of two or three units of whole blood/RBC, or causing hospitalization or permanent injury, or requiring surgery AND
Does not meet criteria of life-threatening or disabling bleeding
Minor bleeding (BARC type 2 or 3a, depending on the severity)
Any bleeding worthy of clinical mention (e.g. access site hematoma) that does not qualify as life-threatening, disabling, or major

Alle relevanten Endpunkte/Komplikationen sind definiert

TAVI: Komplikationen

Komplikation			30d Inzidenz
Tod	Kardiovaskulärer Tod Nicht kardialer Tod		0.4% LR 3.4% High Risk
Stroke	Disabling Stroke Non-disabling Stroke TIA		0.6% LR 5.5% HR
Vaskuläre Komplikationen	Major minor	Punktionsstelle, A-Dissektion, Tamponade, Annulusruptur	2.2% LR 17% HR
Blutung	Life-threatening Major Minor		3.6% LR 9.3% HR
Schrittmacher			3.8%-17%
Myokardinfarkt	Procedural related spontaneous		Ca 1%
AKI	Grad 1-3		0.4% LR 4.1% HR

Prozedurale Komplikationen bei TAVI (Sapien)

Table S4. Procedural Complications

Complication	TAVR n/N (%)	Surgery n/N (%)
Procedural deaths (during index hospitalization)	2/496 (0.4)	4/454 (0.9)
≥2 Transcatheter valves implanted*	1/496 (0.2)	NA
Valve embolization	0 /496(0.0)	NA
Annulus rupture	1/496 (0.2)	NA
Aortic dissection	0/496 (0.0)	0/454 (0.0)
Coronary obstruction	1/496 (0.2)	2/454 (0.4)
Ventricular perforation	1/496 (0.2)	2/454 (0.4)
Access site infections	2/496 (0.4)	6/454 (1.3)

Data are patient counts (%). *Valve in valve or valve with embolization

TAVI: cerebrovaskulärer Insult

TAVI: cerebrovaskulärer Insult

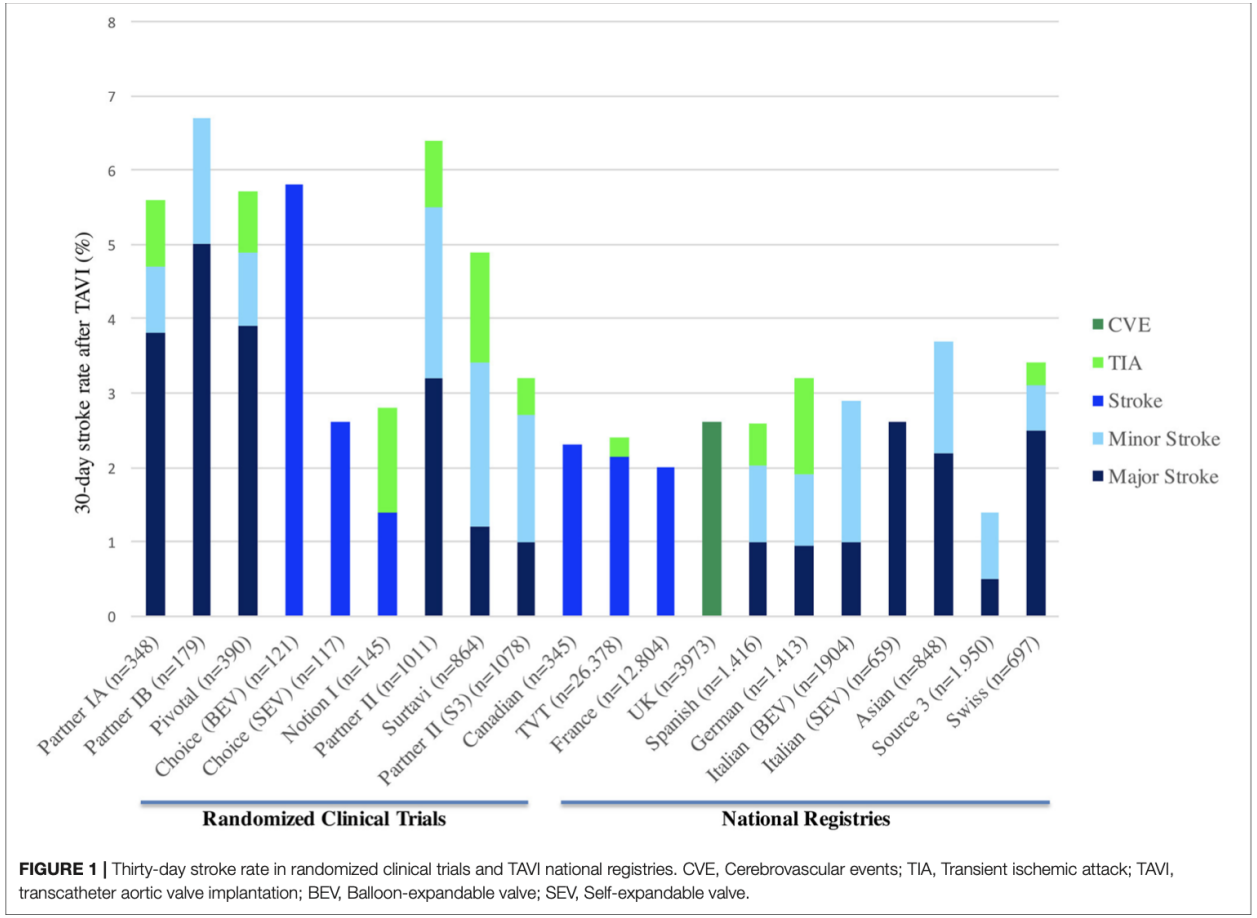
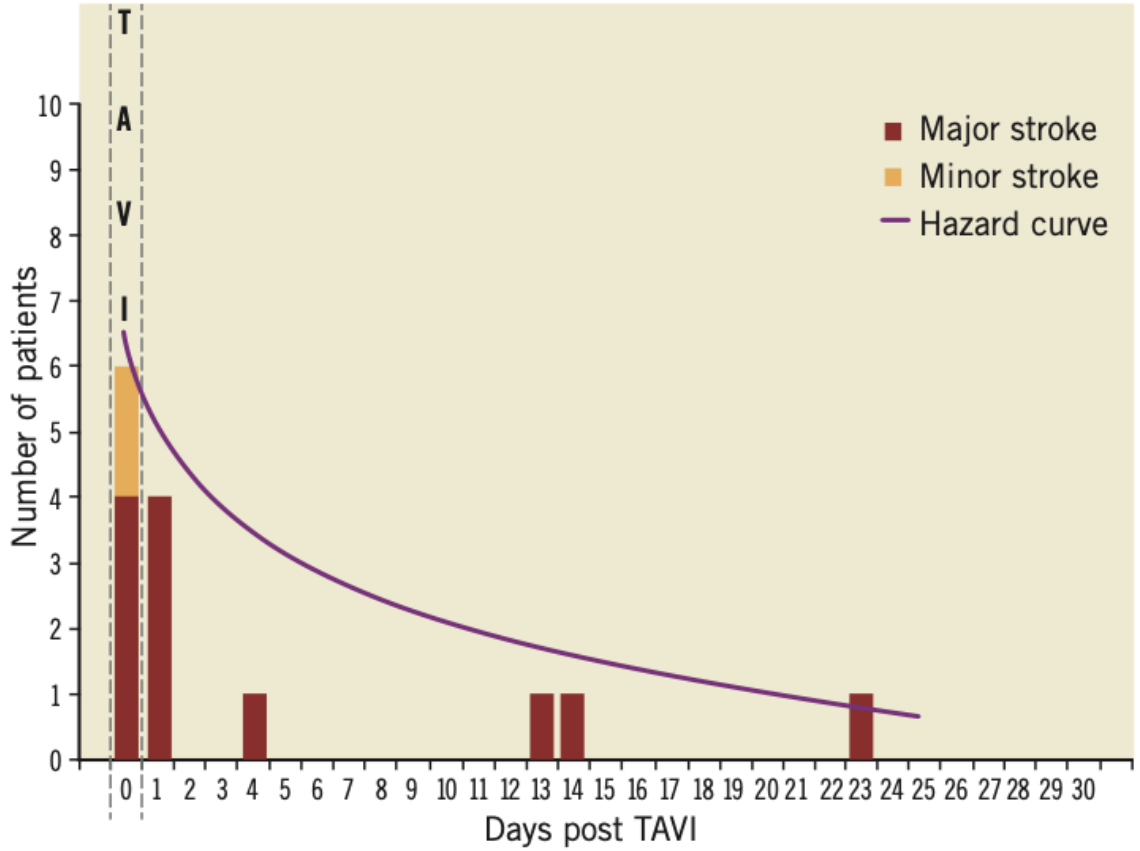


FIGURE 1 | Thirty-day stroke rate in randomized clinical trials and TAVI national registries. CVE, Cerebrovascular events; TIA, Transient ischemic attack; TAVI, transcatheter aortic valve implantation; BEV, Balloon-expandable valve; SEV, Self-expandable valve.

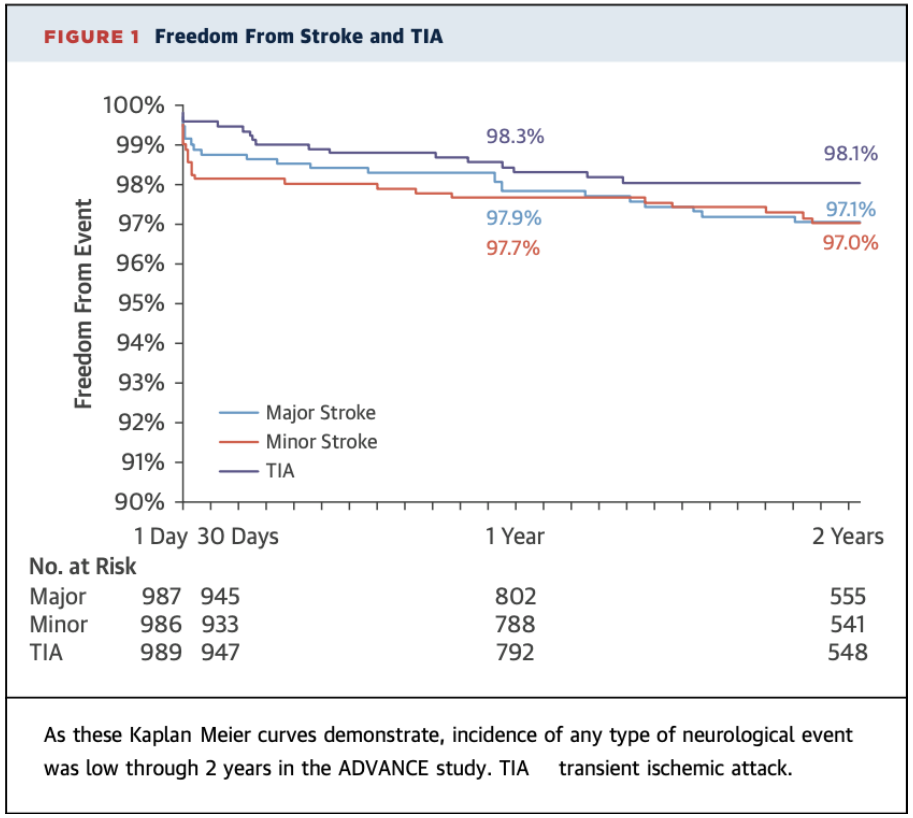


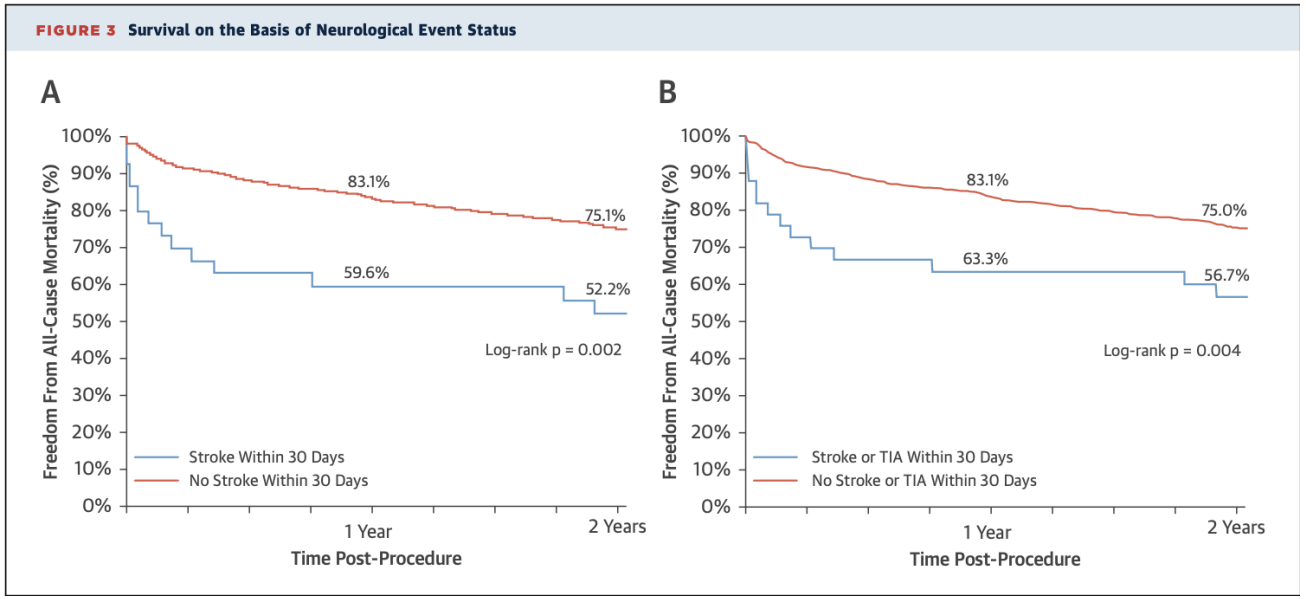
Stortecky S et al.
Eurointervention 2012:8;62-70.

Armijo G, Nombela-Franco L and Tirado-Conte G (2018) Cerebrovascular Events After Transcatheter Aortic Valve Implantation. Front. Cardiovasc. Med. 5:104. doi: 10.3389/fcvm.2018.00104

3-4% CVI in high risk und all comers
Tiefer in low risk patienten
Aetiologie: kardioembolisch

TAVI: cerebrovaskulärer Insult





996 Patienten mit Evolut Klappe behandelt, Beobachtungszeit 2 Jahre

CVI 1.4%

RF für CVI: Frauen, AKI, vaskuläre Komplikation, Vorhofflimmern

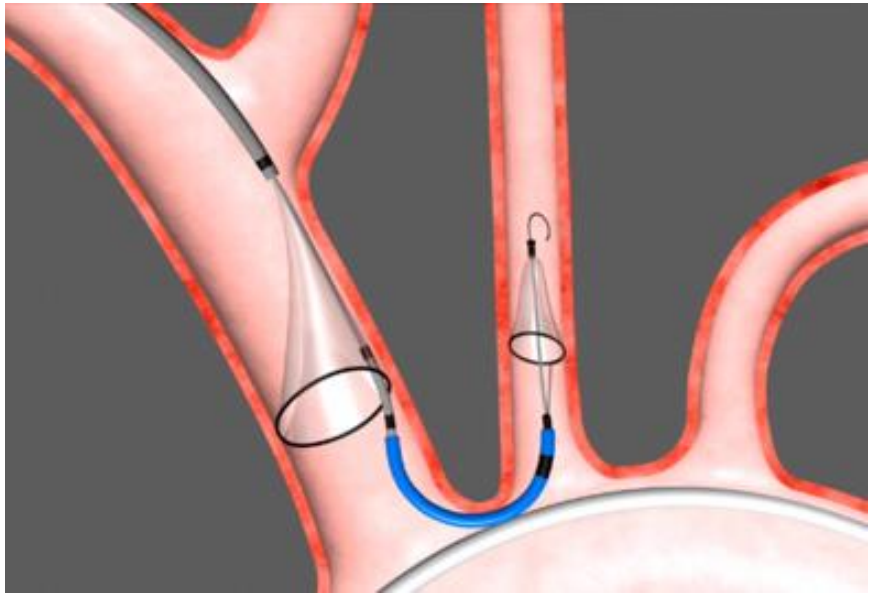
The Incidence and Predictors of Early- and Mid-Term Clinically Relevant Neurological Events After Transcatheter Aortic Valve Replacement in Real-World Patients

Johan Bosmans, MD, PhD,* Sabine Bleiziffer, MD,† Ulrich Gerckens, MD,‡ Peter Wenaweser, MD,§ Stephen Brecker, MD,‖ Corrado Tamburino, MD, PhD,¶ Axel Linke, MD,# for the ADVANCE Study Investigators

JACC VOL. 66, NO. 3, 2015
JULY 21, 2015:209–17

TAVI: cerebrovaskulärer Insult

Embolic Protection Devices



Sentinel Cerebral Protection Device

Effect of a Cerebral Protection Device on Brain Lesions Following Transcatheter Aortic Valve Implantation in Patients With Severe Aortic Stenosis

The CLEAN-TAVI Randomized Clinical Trial

Stephan Haussig, MD; Norman Mangner, MD; Michael G. Dwyer, MD; Lukas Lehmkuhl, MD; Christian Lücke, MD; Felix Woitek, MD; David M. Holzhey, MD; Friedrich W Mohr, MD; Matthias Gutberlet, MD; Robert Zivadinov, MD; Gerhard Schuler, MD; Axel Linke, MD

100 Patienten randomisiert,
MRI Tag 2 und 7
Endpunkt: Anzahl Läsionen im diffusion-weight MRI

Table 3. Brain Lesion Characteristics as Determined by Magnetic Resonance Imaging

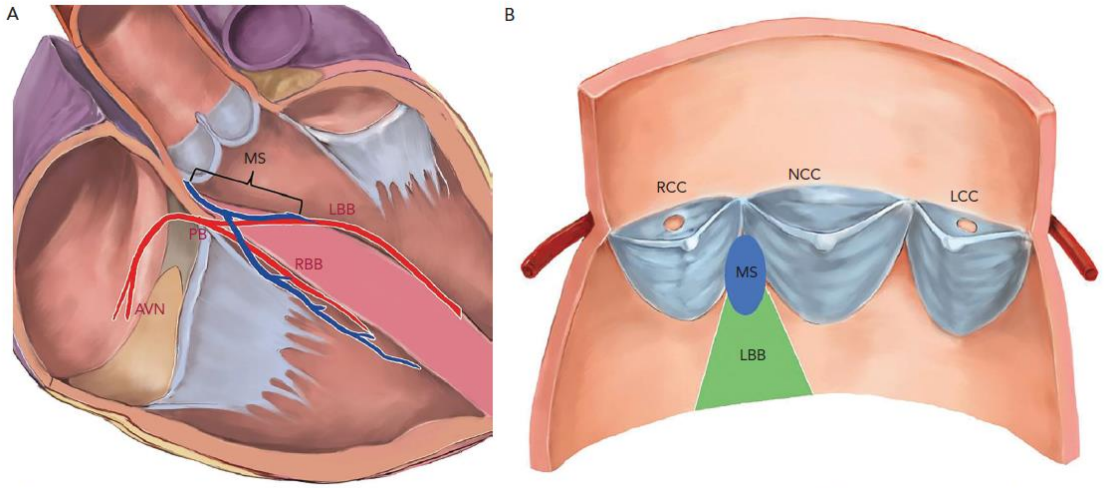
	2 Days				7 Days			
	Filter (n = 49)	Control (n = 45)	Difference (95% CI)[a]	*P* Value	Filter (n = 45)	Control (n = 43)	Difference (95% CI)[a]	*P* Value
Potentially Protected Areas								
No. of new lesions, median (IQR)	4.00 (3.00-7.25)[b]	10.00 (6.75-17.00)[b]	5.00 (2.00-8.00)[b]	<.001	3.00 (1.00-5.25)	7.00 (3.00-13.50)	3.00 (1.00-5.00)	.003
Volume of new lesions, median (95% CI), mm^3	242 (159-353)	527 (364-830)	234 (91-406)	.001	101 (60-174)	292 (181-515)	160 (57-281)	.002
Partially Protected Areas								
No. of new lesions, median (IQR)	2.00 (1.00-3.25)	4.00 (2.00-7.00)	2.00 (0.00-3.00)	.008	1.00 (0.00-3.00)	3.00 (1.00-5.00)	1.00 (0.00-2.00)	.02
Volume of new lesions, median (95% CI), mm^3	113 (72-164)	247 (147-399)	98 (18-194)	.01	37 (11-70)	129 (67-227)	72 (3-129)	.008
Entire Brain								
No. of new lesions, median (IQR)	8.00 (5.00-12.00)	16.00 (9.75-24.25)	6.00 (3.00-10.00)	.002	5.00 (2.75-8.00)	10.00 (3.00-18.00)	4.00 (1.00-8.00)	.009
Volume of new lesions, median (95% CI), mm^3	466 (349-711)	800 (594-1407)	311 (66-580)	.02	205 (115-338)	472 (385-909)	240 (51-393)	.009

Anzahl ischämischer Läsionen im MRI wird durch das Sentinel Device reduziert, Studie zu klein um klinischen Effekt zu bestimmen

TAVI: Schrittmacher

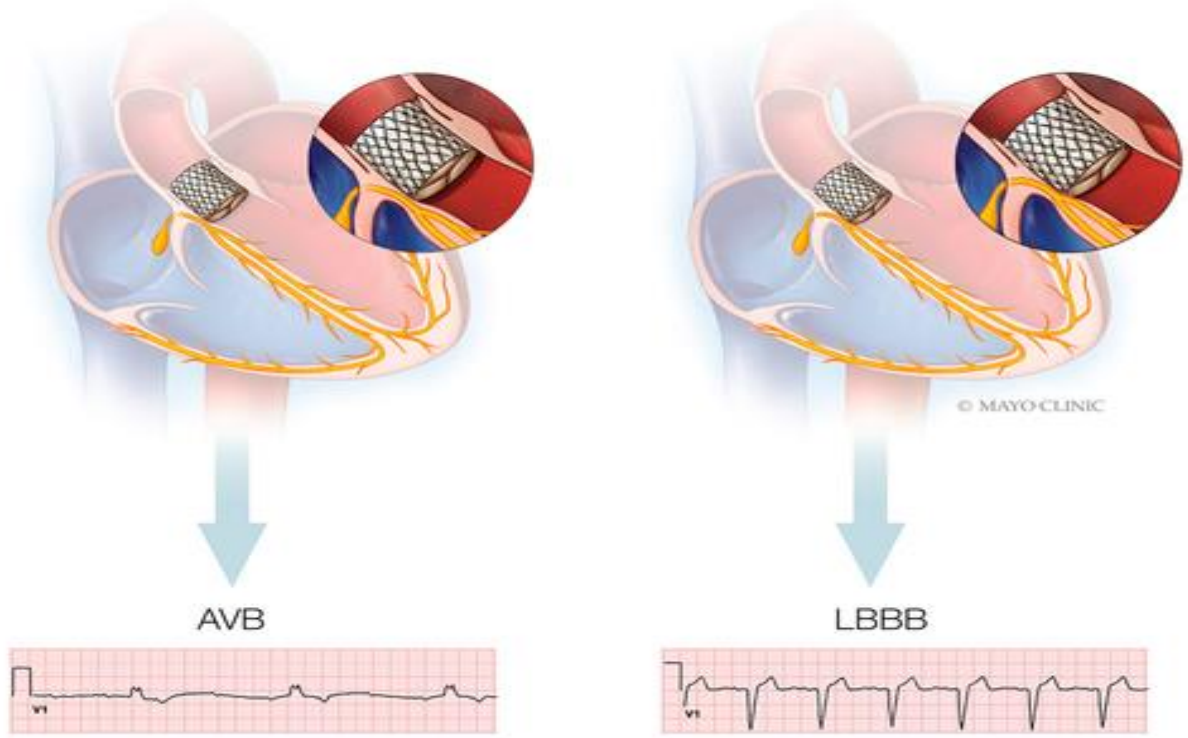
TAVI: Schrittmacher

Figure 1: Anatomical Relationships Between the Aortic Cuspids, Membrane Septum and Conduction System



A: The penetrating bundle of His emerges at the surface of the left ventricular outflow tract beneath the membrane septum (MS). The length of the MS is equal to the distance between the aortic annulus and bundle of His. B: The left bundle branch emerges beneath the MS and is positioned between the right coronary cusp and non-coronary cusp. AVN = atrioventricular node; LBB = left bundle branch; LCC = left coronary cusp; PB = penetrating bundle; MS = membrane septum; NCC = non-coronary cusp; RBB = right bundle branch; RCC = right coronary cusp.

Anatomical Level of Atrioventricular Conduction Block After TAVR



AVB indicates atrioventricular block; LBBB, left bundle branch block, and TAVR, transcather aortic valve replacement.

TAVI: Schrittmacher

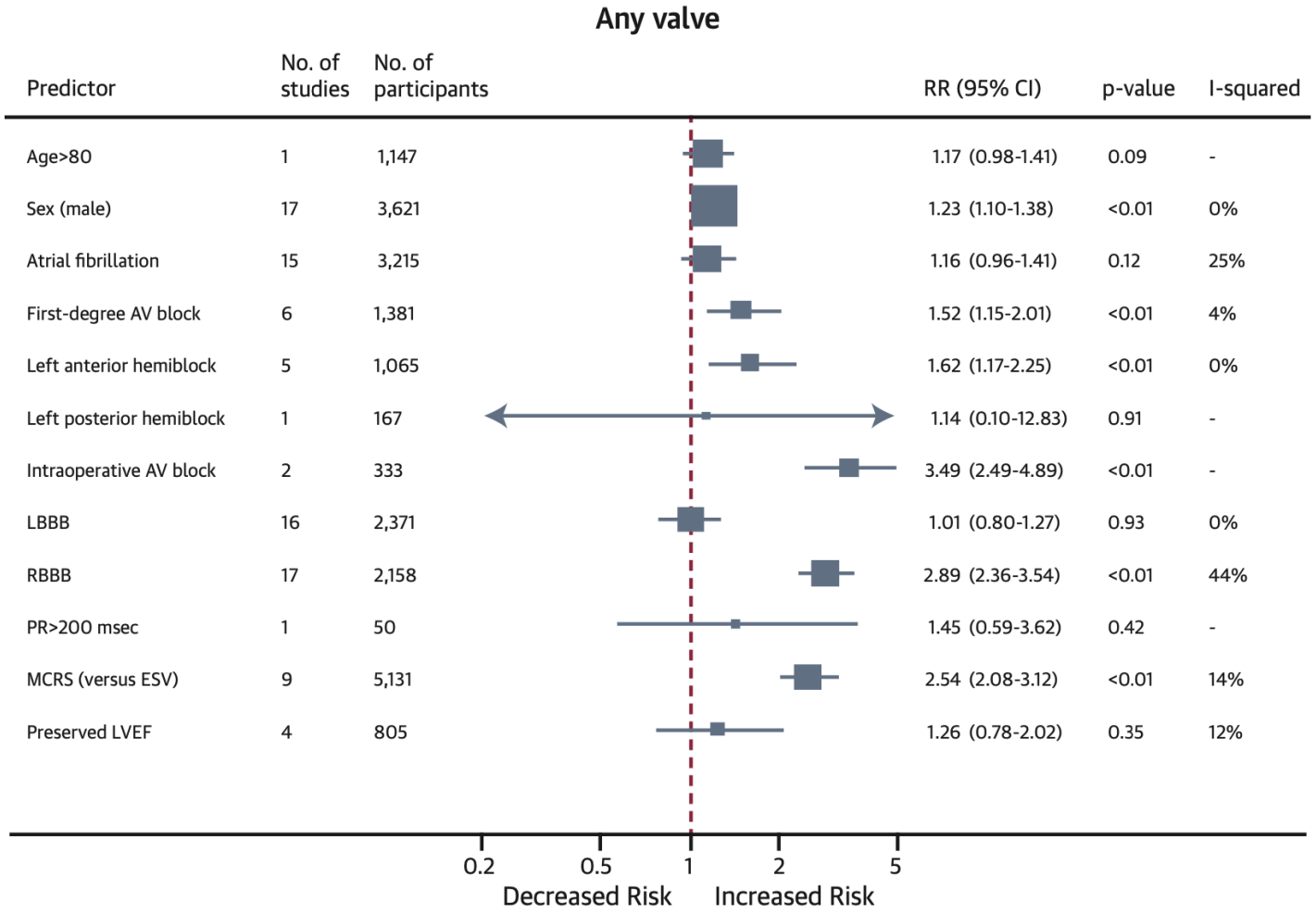


FIGURE 2 **Summary RRs for Each Predictor of PPM Implantation After TAVR (Any Valve)**

Schrittmacher: Risikofaktoren

Table 2. Main Predictors of Permanent Pacemaker Implantation After Transcatheter Aortic Valve Replacement

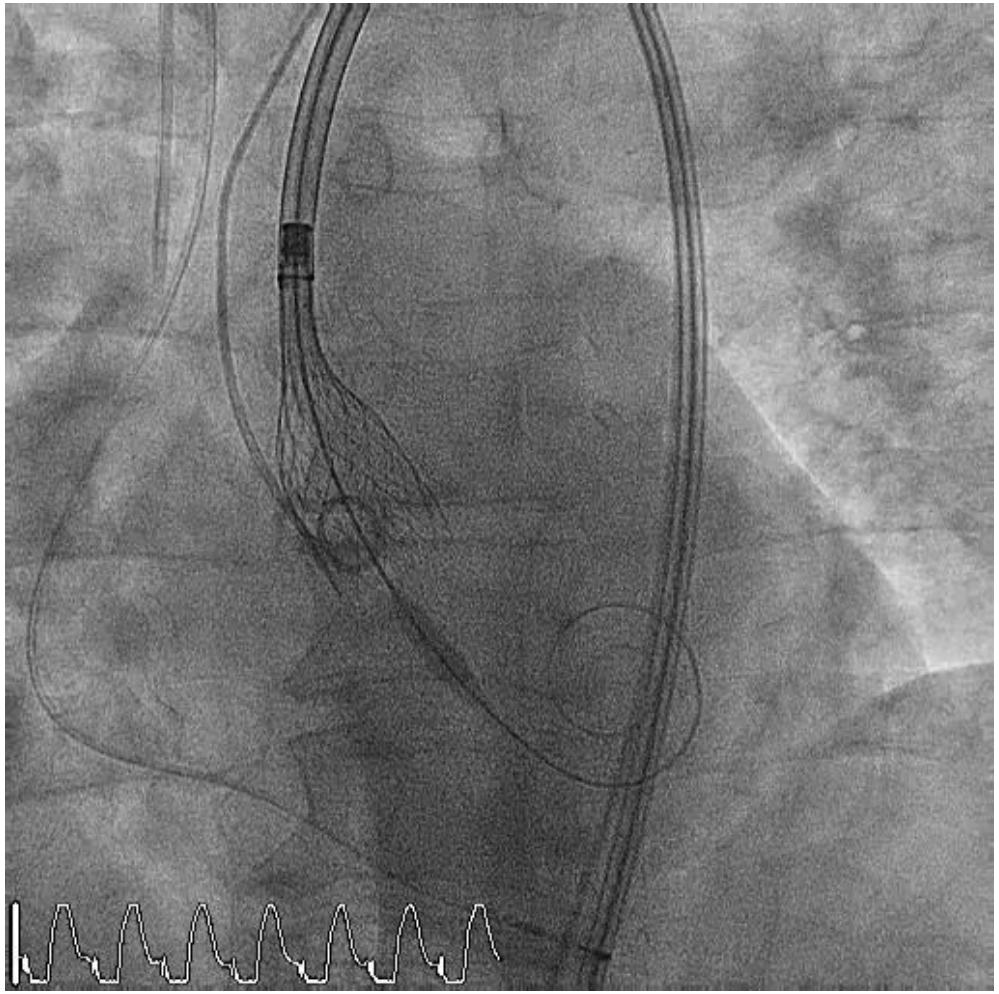
Variable	Multivariable Odds Ratio*	References
Baseline right bundle-branch block	2.8–46.7	10, 34, 45, 51, 55, 61, 68, 69, 111, 122, 145, 146, 148, 156–170
Implantation of a Medtronic CoreValve (vs Edwards SAPIEN/ SAPIEN XT valves)	2.6–25.7	34, 75, 87, 91, 153, 156, 160, 161, 163, 165
Depth of implantation	1.1–1.5/1 mm	10, 44, 51, 61, 111, 146, 157–159, 169, 171–173
Oversizing/stretching of the aortic annulus/ left ventricular outflow tract	1.02–1.5/1%	42, 44, 87, 122, 148, 159, 166, 171, 174
First-degree atrioventricular block	4.0–11.4	157, 164, 175

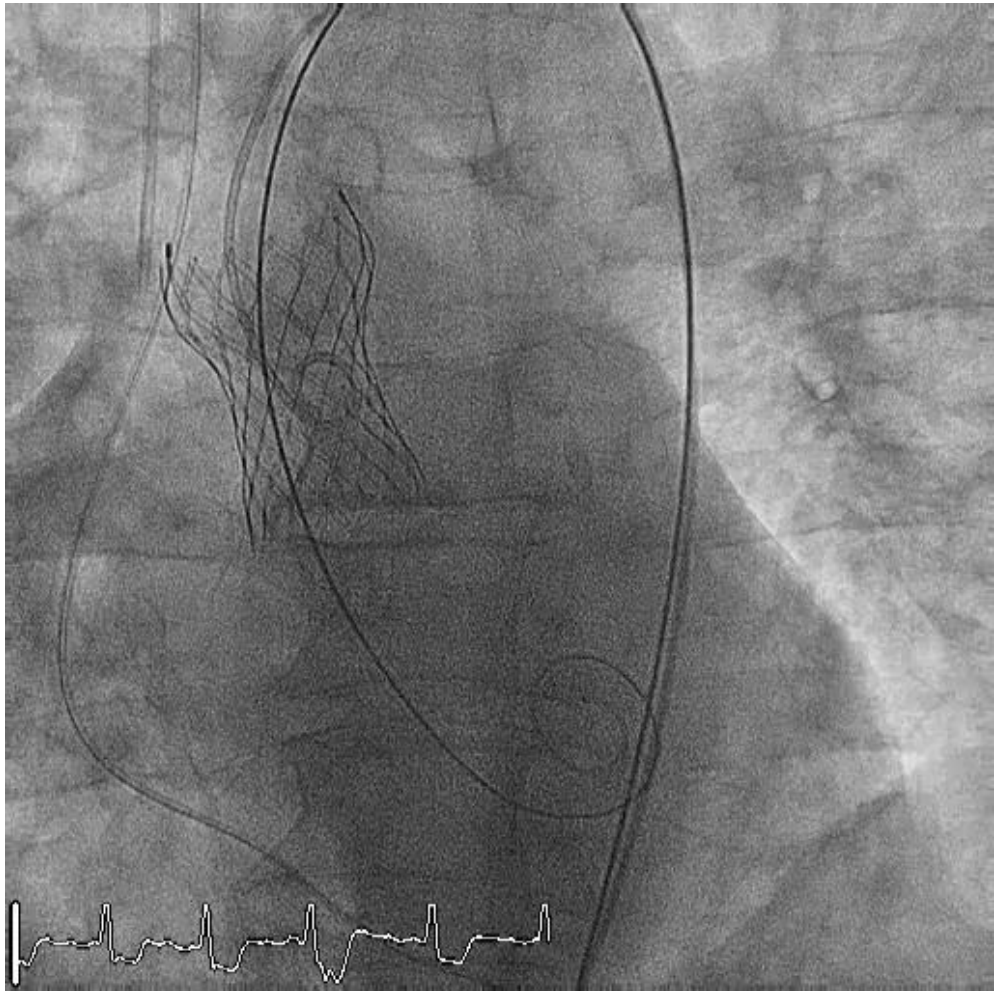
Conduction Disturbances After Transcatheter Aortic Valve Replacement
Current Status and Future Perspectives

Vincent Auffret, MD, MSc
Rishi Puri, MBBS, PhD
Marina Urena, MD, PhD
Chekrallah Chamandi, MD
Tania Rodriguez-Gabella, MD
François Philippon, MD
Josep Rodés-Cabau, MD

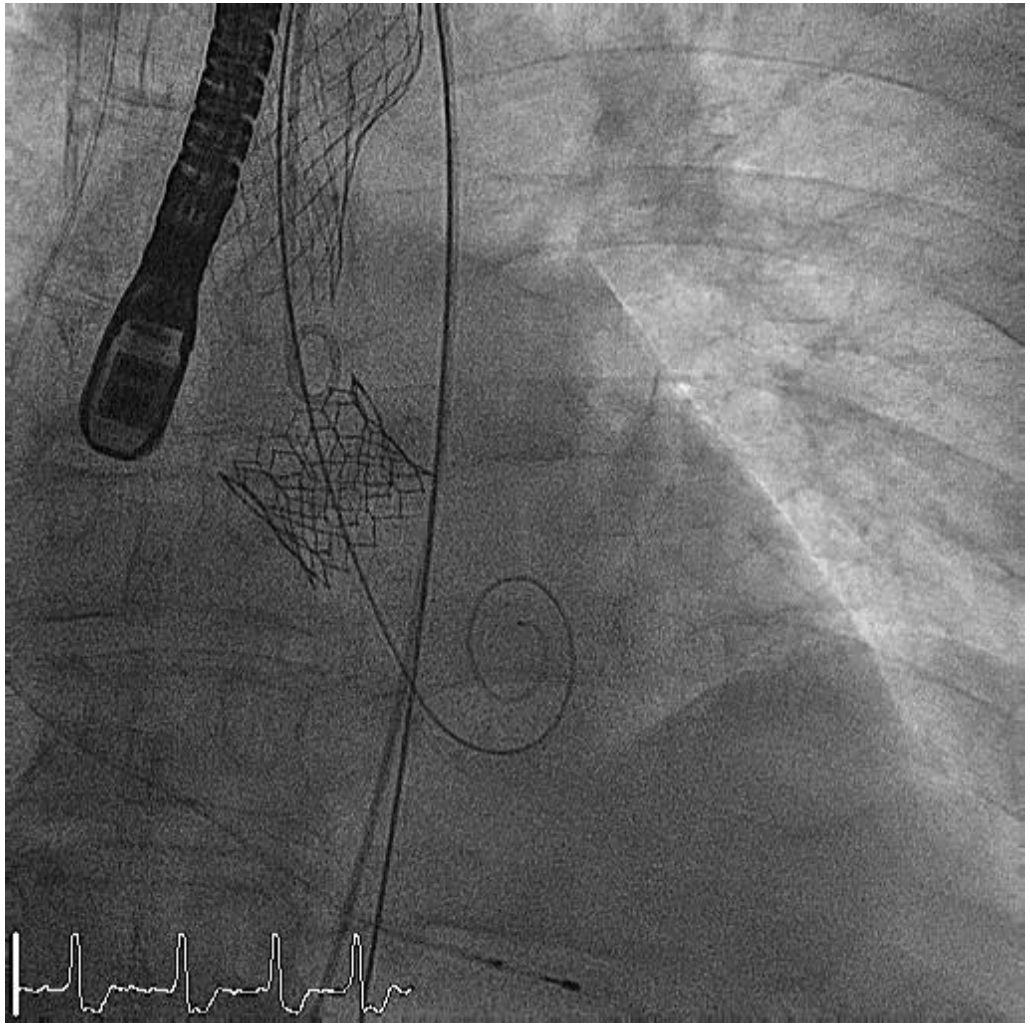
Circulation. 2017;136:1049–1069.

TAVI: wenn hoch zu hoch ist





TAVI: wenn hoch zu hoch ist

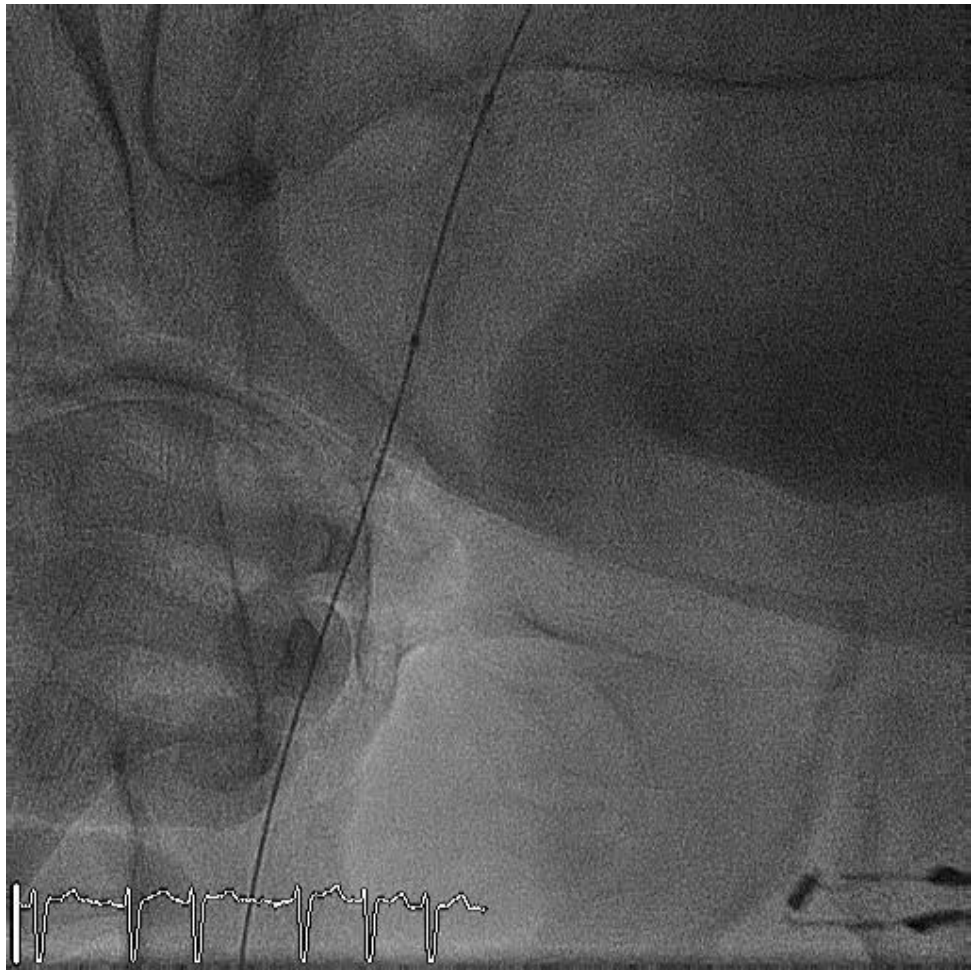


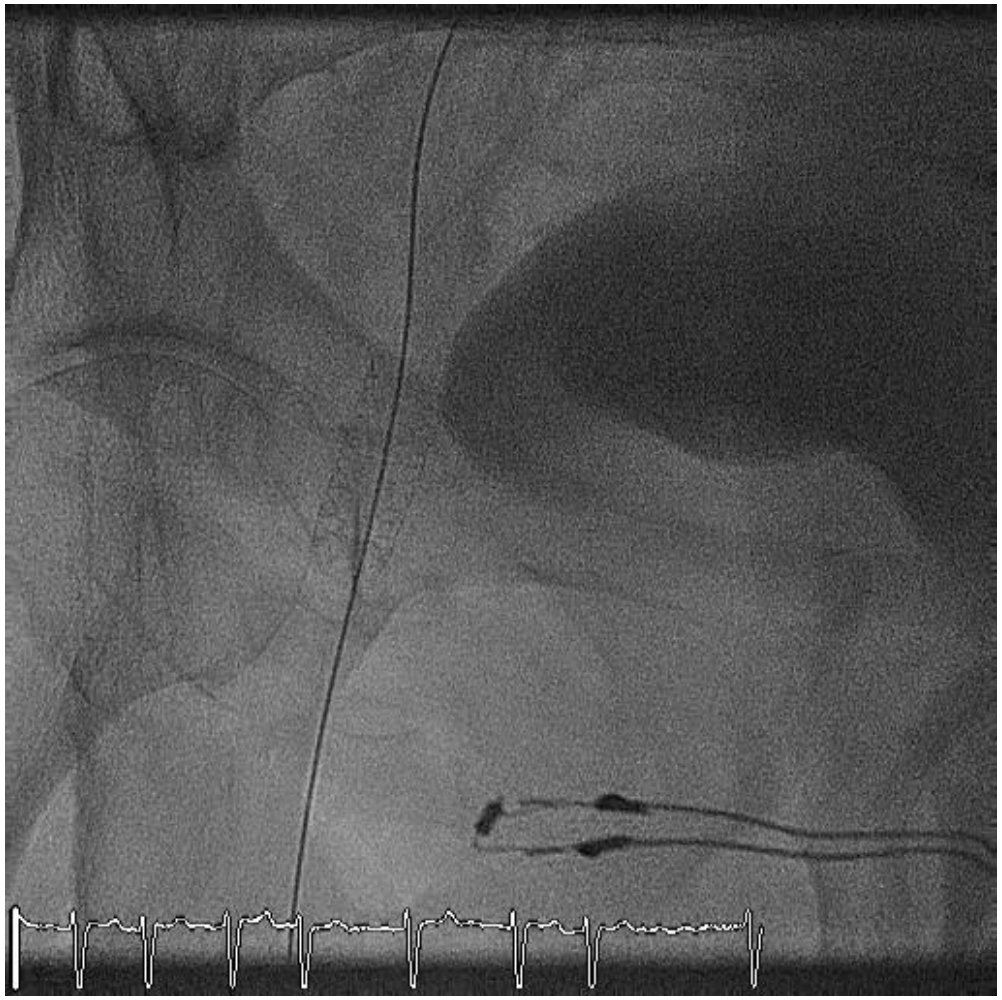
Schrittmacher und TAVI

- Häufigkeit unverändert auch mit neueren Devices (ev. ausser Accurate Neo)
- Häufiger als bei chirurgischem Aortenklappenersatz
- Inzidenz abhängig vom Vorzustand des Reizleitungssystems und der Implantationstiefe, sowie vom Device
- Mortalität scheint nicht beeinflusst
- Indikation schwierig bei LSB und AV-Block I
- Problem bei Versorgung von jüngeren Patienten und low-risk Patienten mittels TAVI (dort aber Schrittmacherinzidenz viel tiefer)

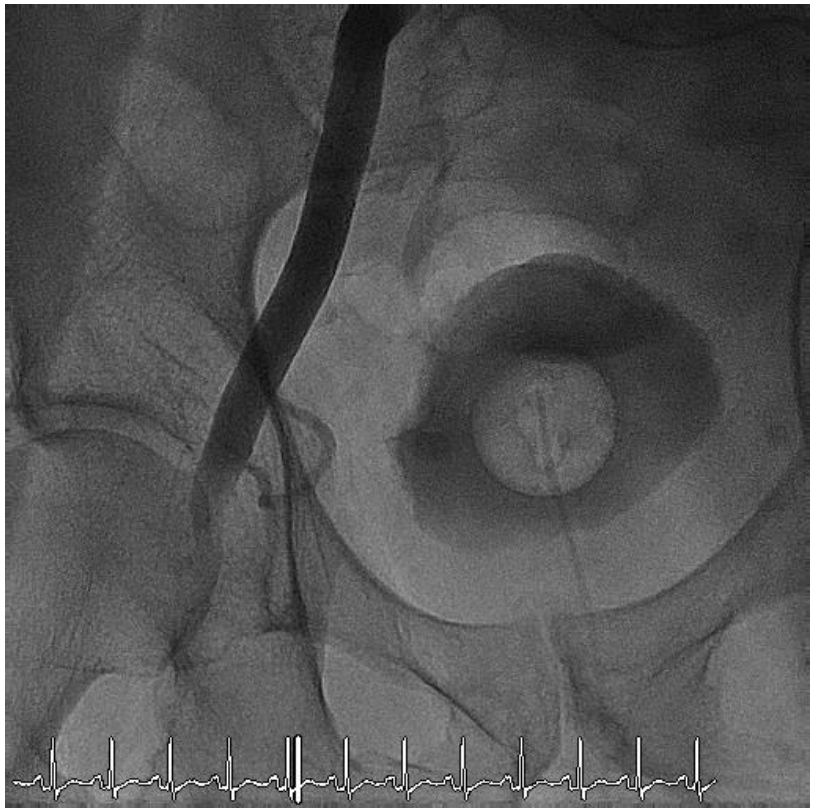
TAVI:
Vaskuläre Komplikationen

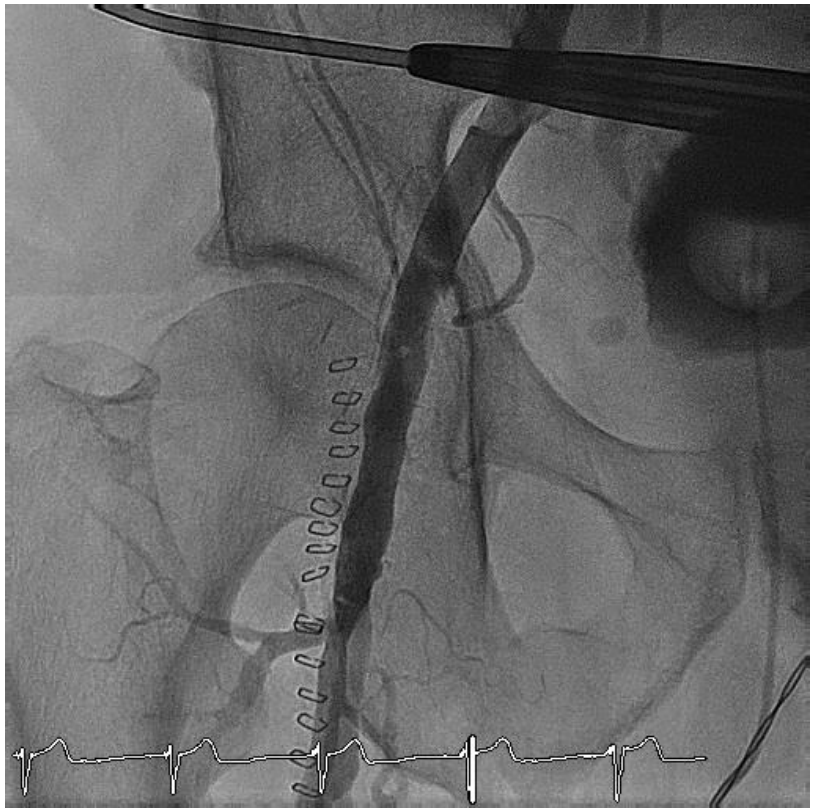
TAVI: Vaskuläre Komplikation

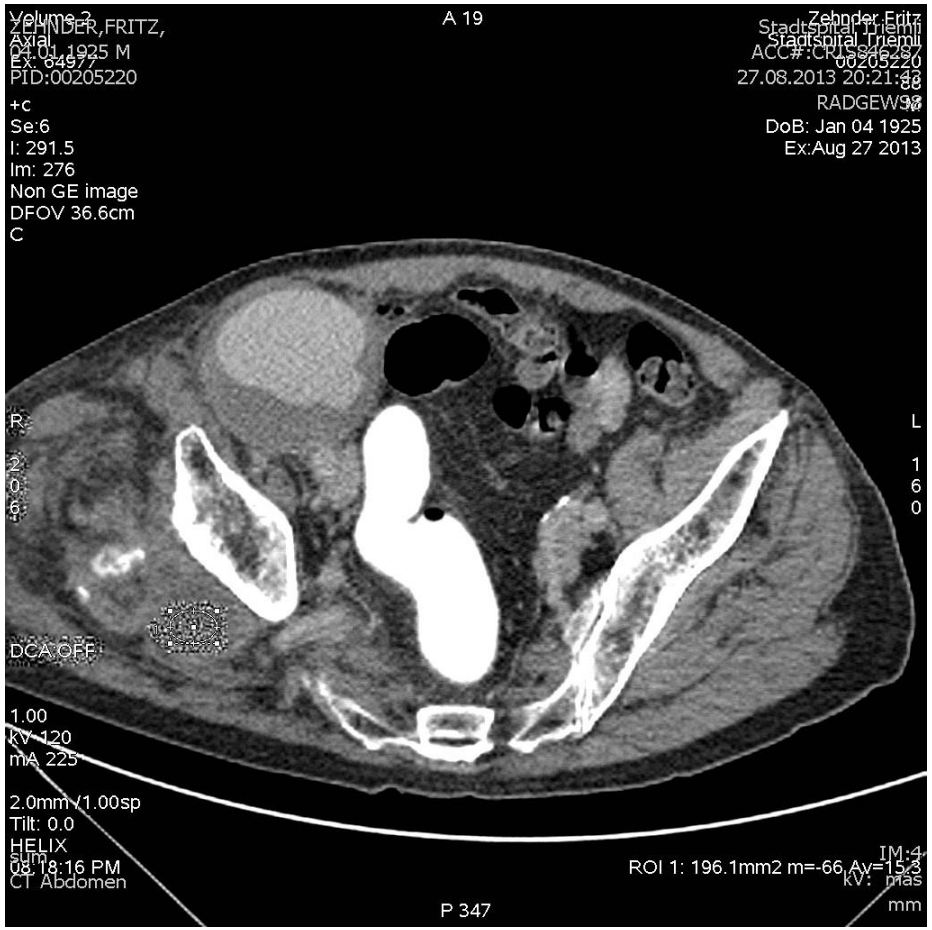




TAVI: Vaskuläre Komplikation

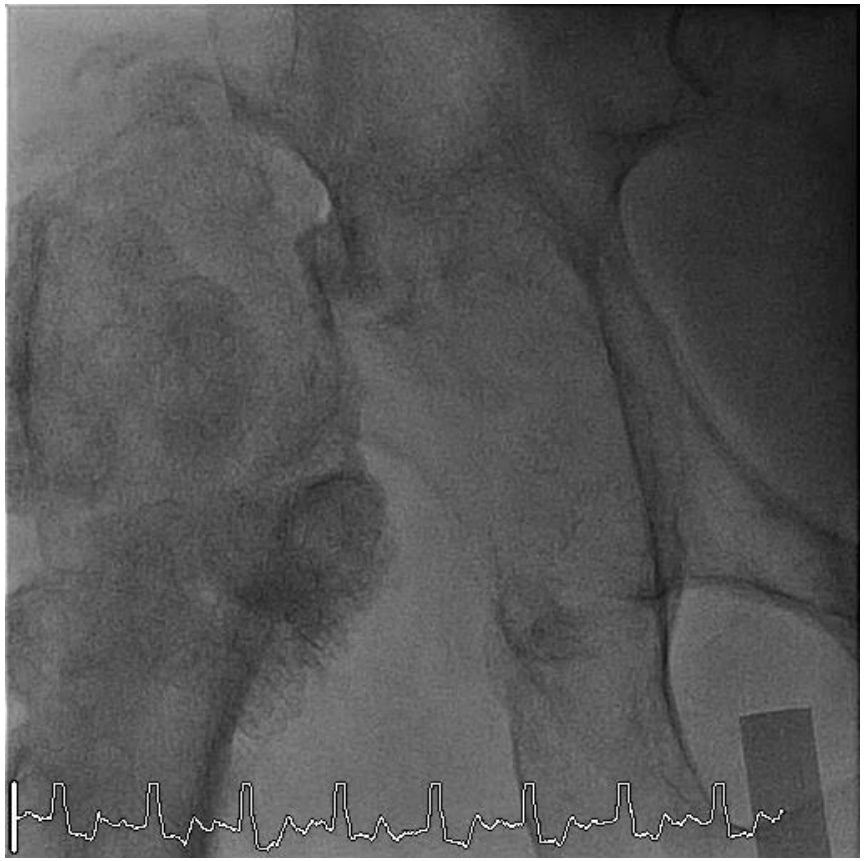






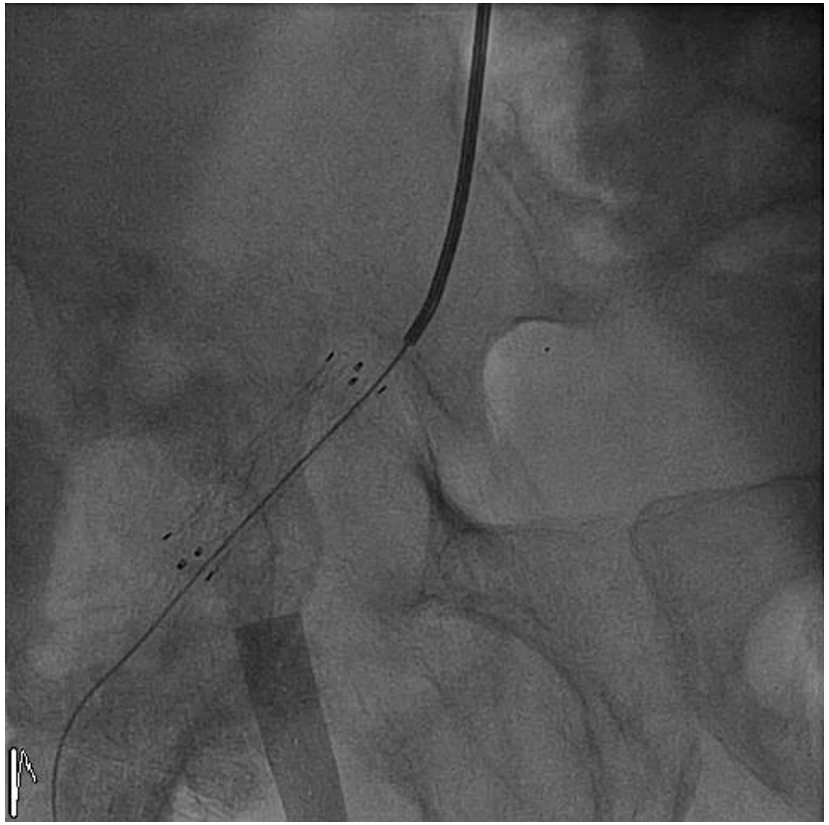
7x6.5 pseudoaneurysm originating in A. iliaca ext.

90-jähriger Pat. 1 Jahr nach TAVI.
Abdomen/Becken CT wegen Infektsuche



a.p.

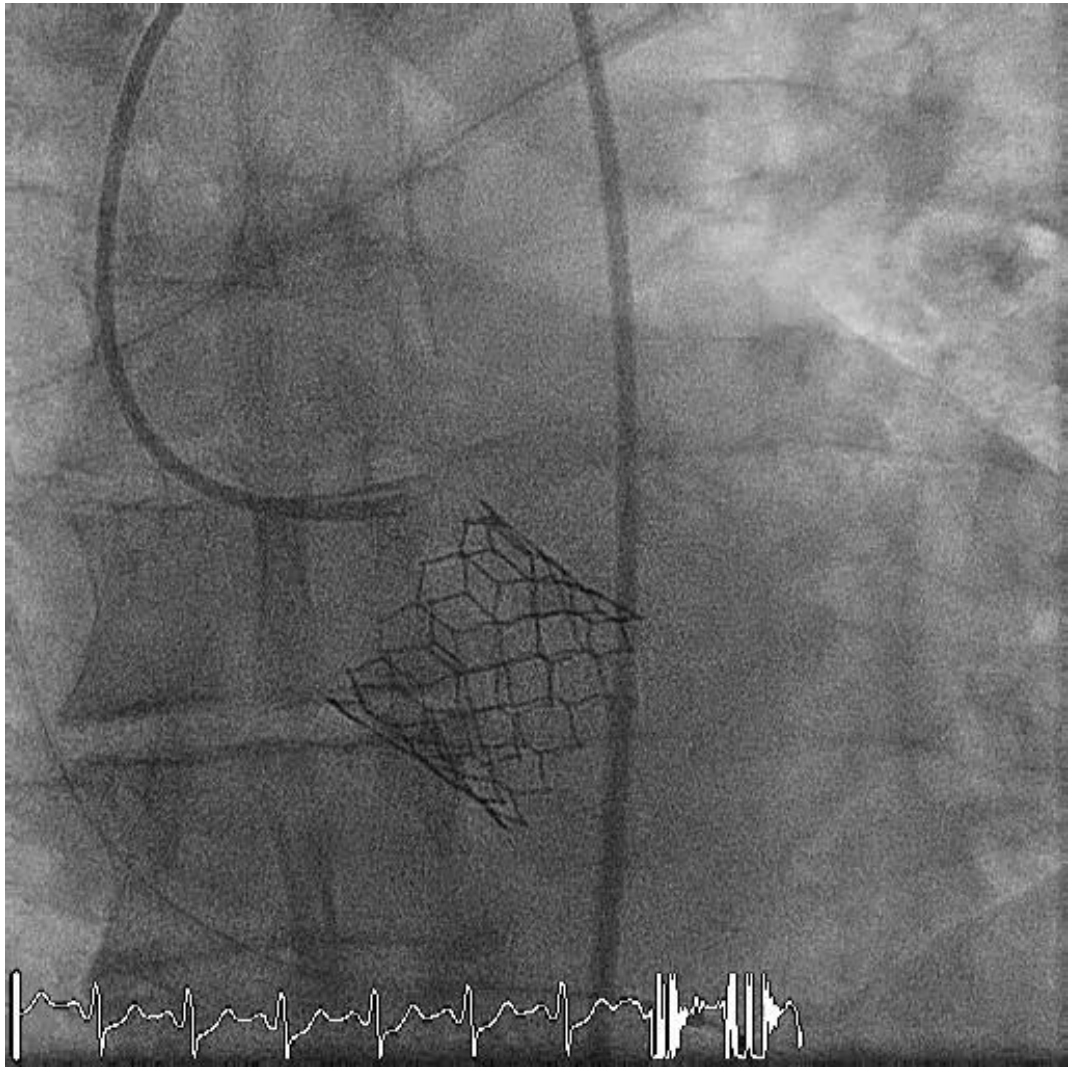
RAO caud



Implantation of Fluency 10x40mm Covered Stent

10 F Sheath A. fem comm left

TAVI: Vaskuläre Komplikation



Annulusruptur:

<0.2% bei Ballon-expandierender Klappe

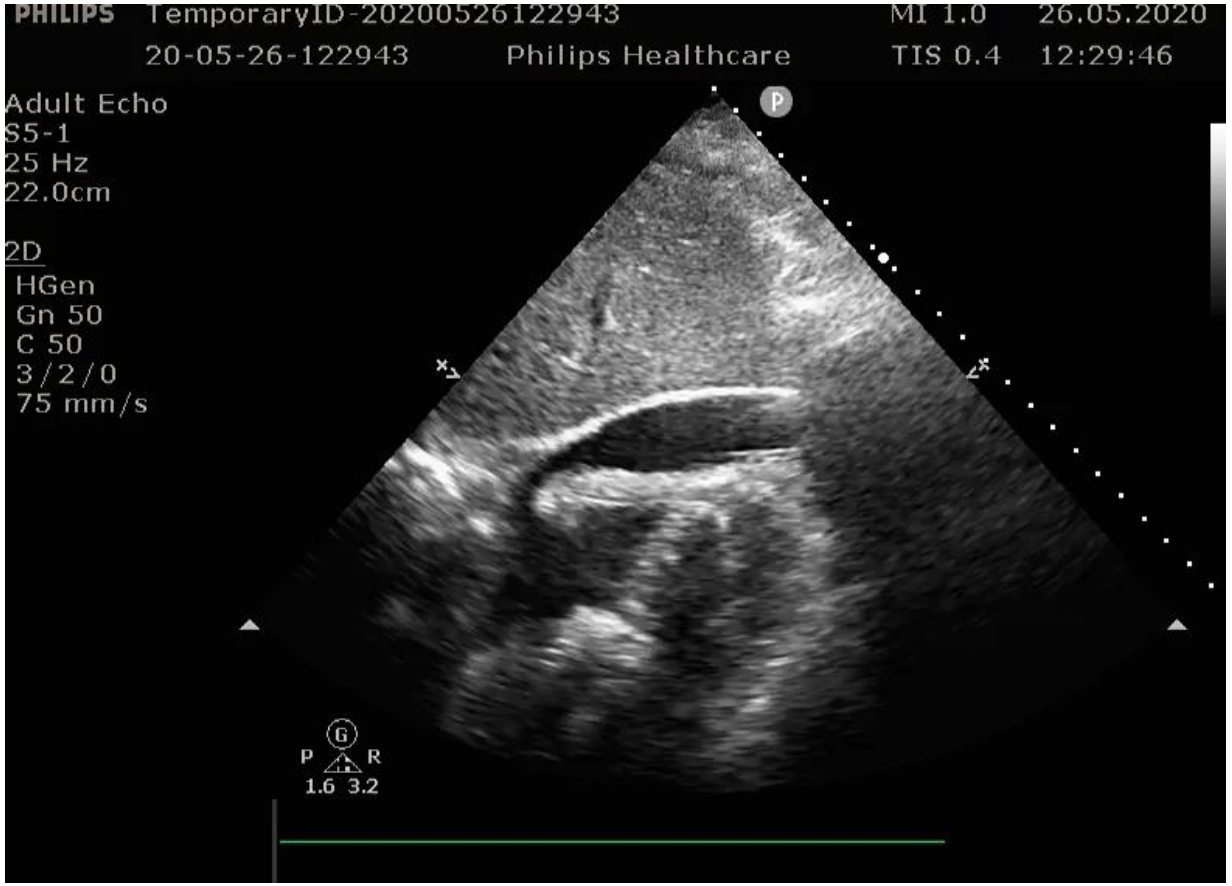
RF: viel Kalk, kleine Annuli, „zu grosse Klappe“ implantiert

Unbehandelt meist tödlich

Notfallmässige chirurgische Revision mit durchzogenen Ergebnissen (abh. Vom Grundrisiko)

-> Nutzen/Risiken einer Thorakotomie vorbesprechen, insb. Bei älteren und hochrisiko Patienten

TAVI: Vaskuläre Komplikation



Tamponade

(zählt auch als life-threatening bleeding)

Meist bereits während Intervention

DD Drahtperforation, Annulusruptur, A-Diss, prov. Schrittmacher

Drainage (fast) immer notwendig

Nicht selten nach Punktion erledigt

TAVI: Paravalvuläres Leck

Case Summary

88y old Patient with severe aortic insufficiency due to degeneration of an Carpentier Edwards Perimount Bioprosthesis (27mm)

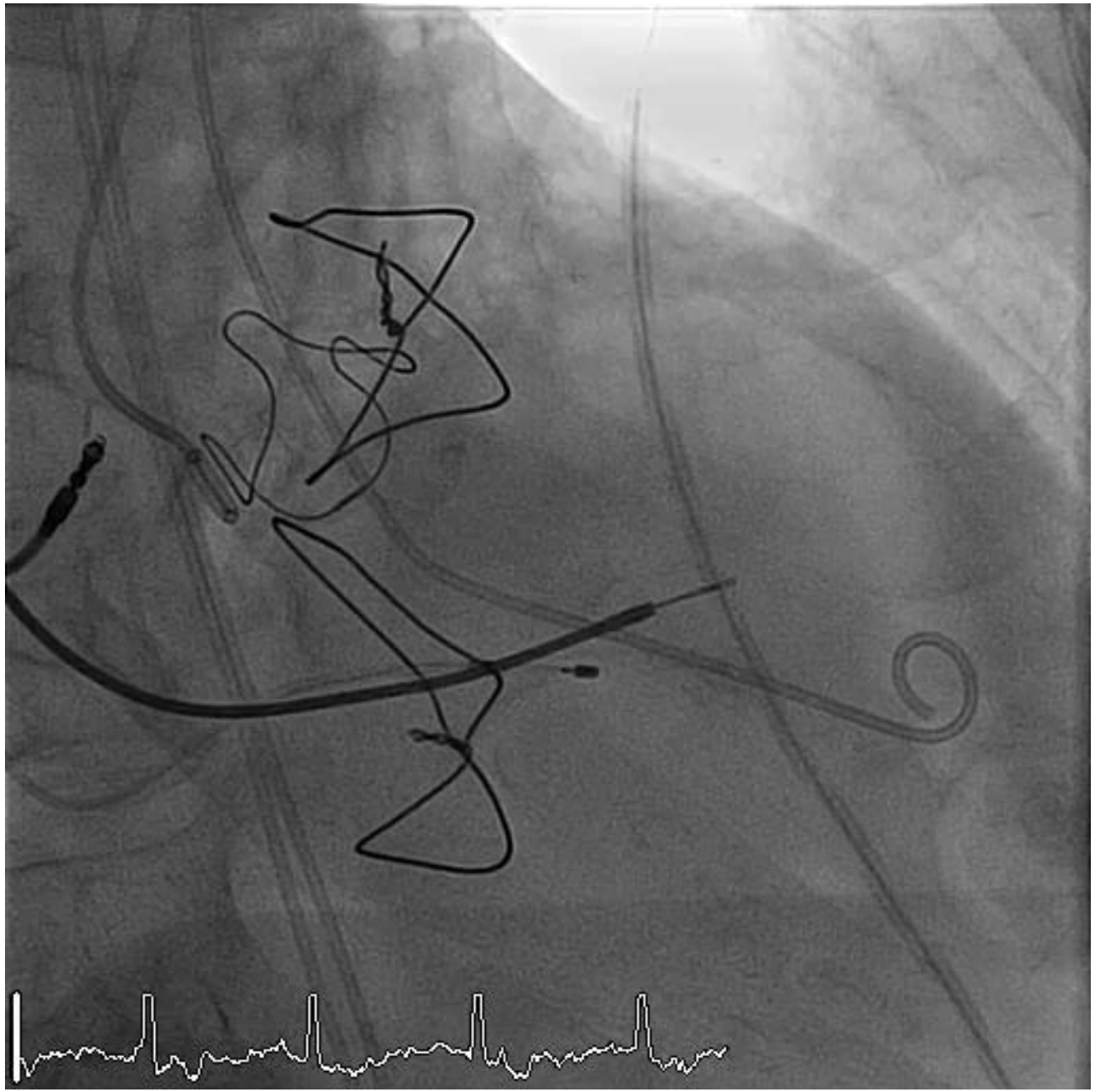
CHF NYHA IV

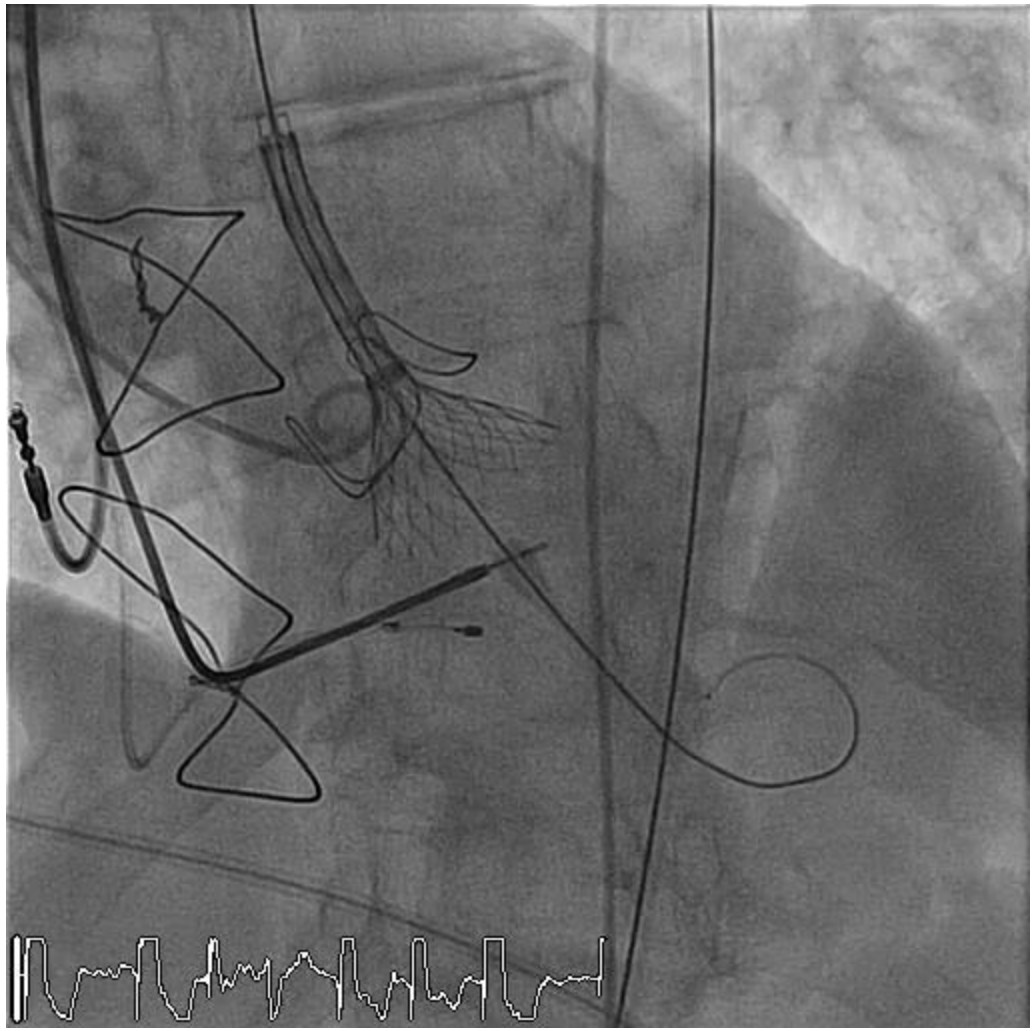
LVEF 52%, LVEDP 39mmHg, PAPm 33mmHg, CI 2.7 l/min*m2

Normal coronary arteries

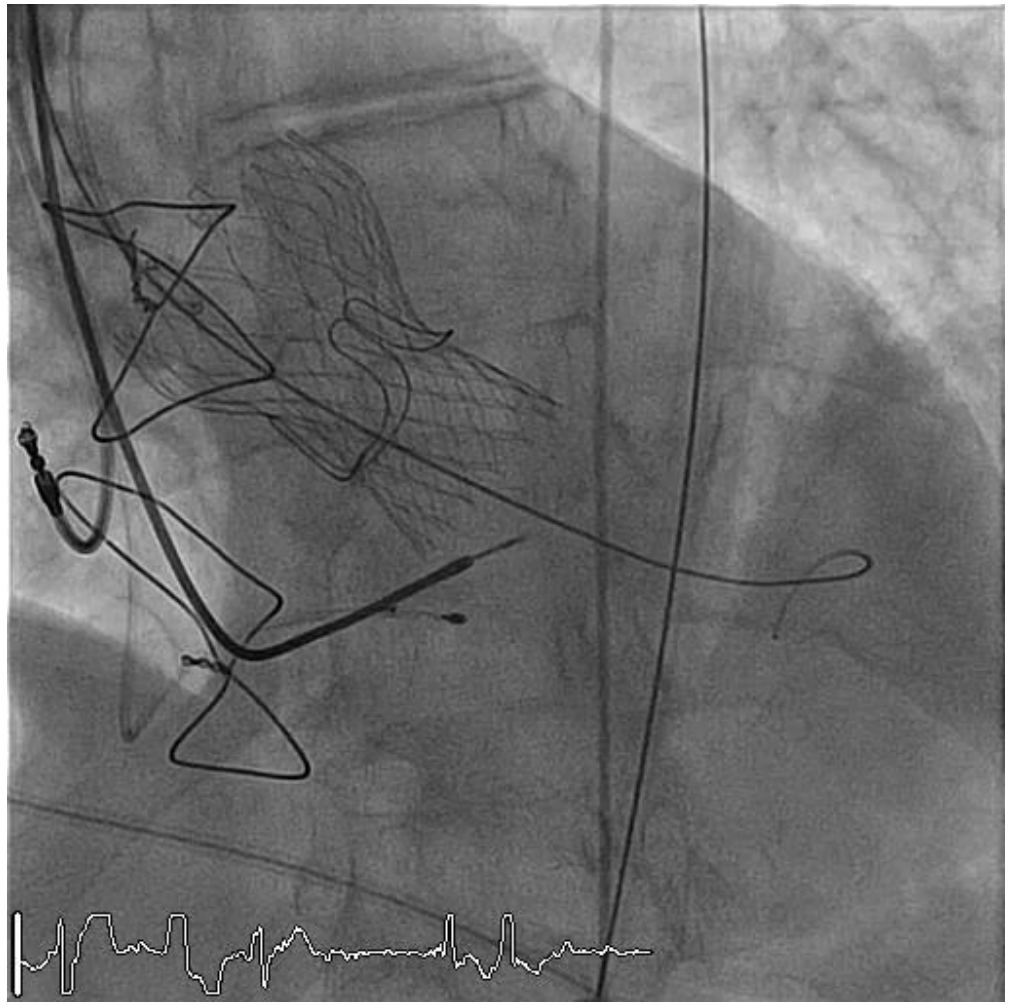
A. fem. comm. right 10mm, left 8mm

Log Euroscore 18%, Euroscore II 6.6%, STS Score 5.1%, MMSE 30/30

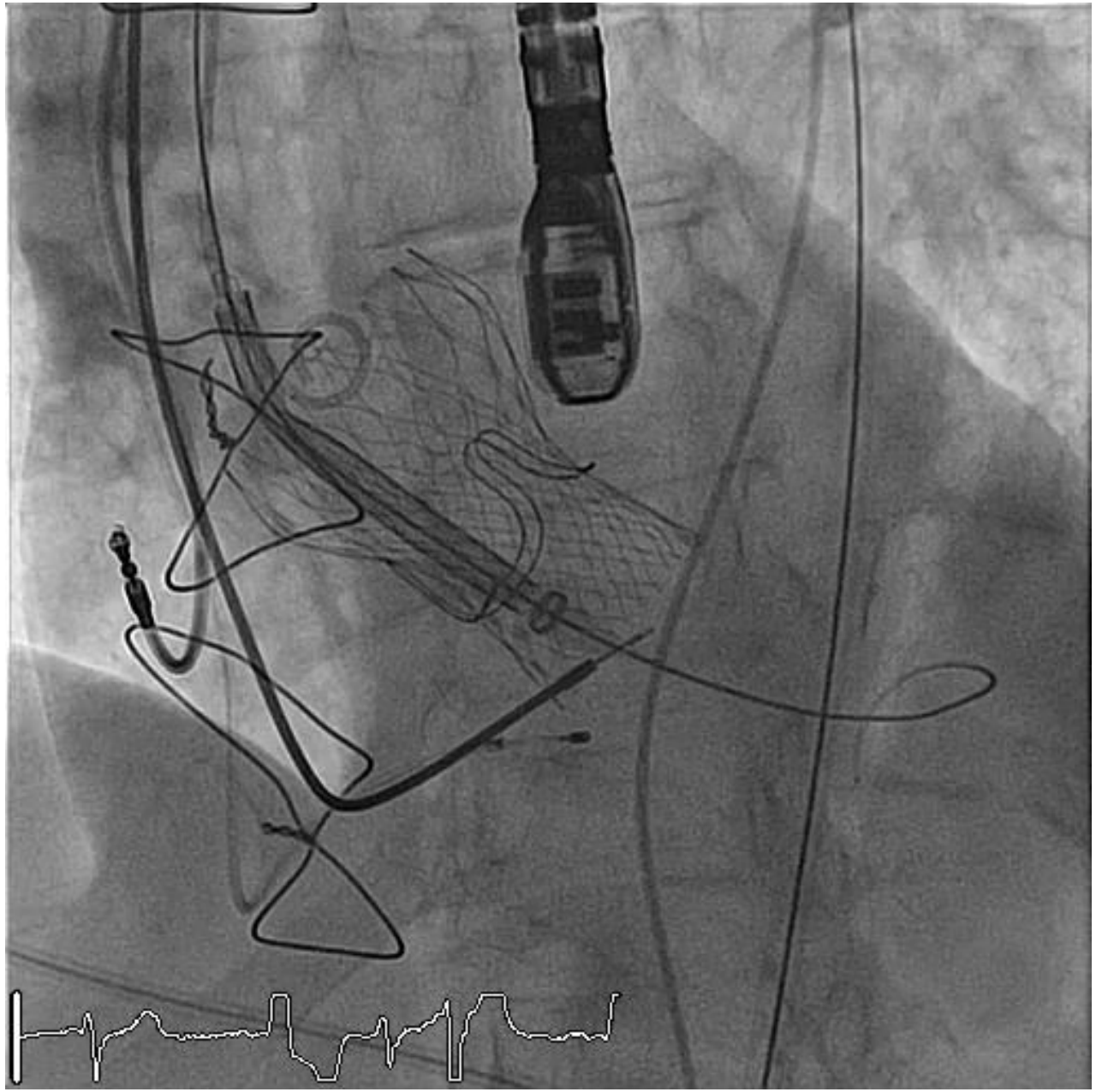


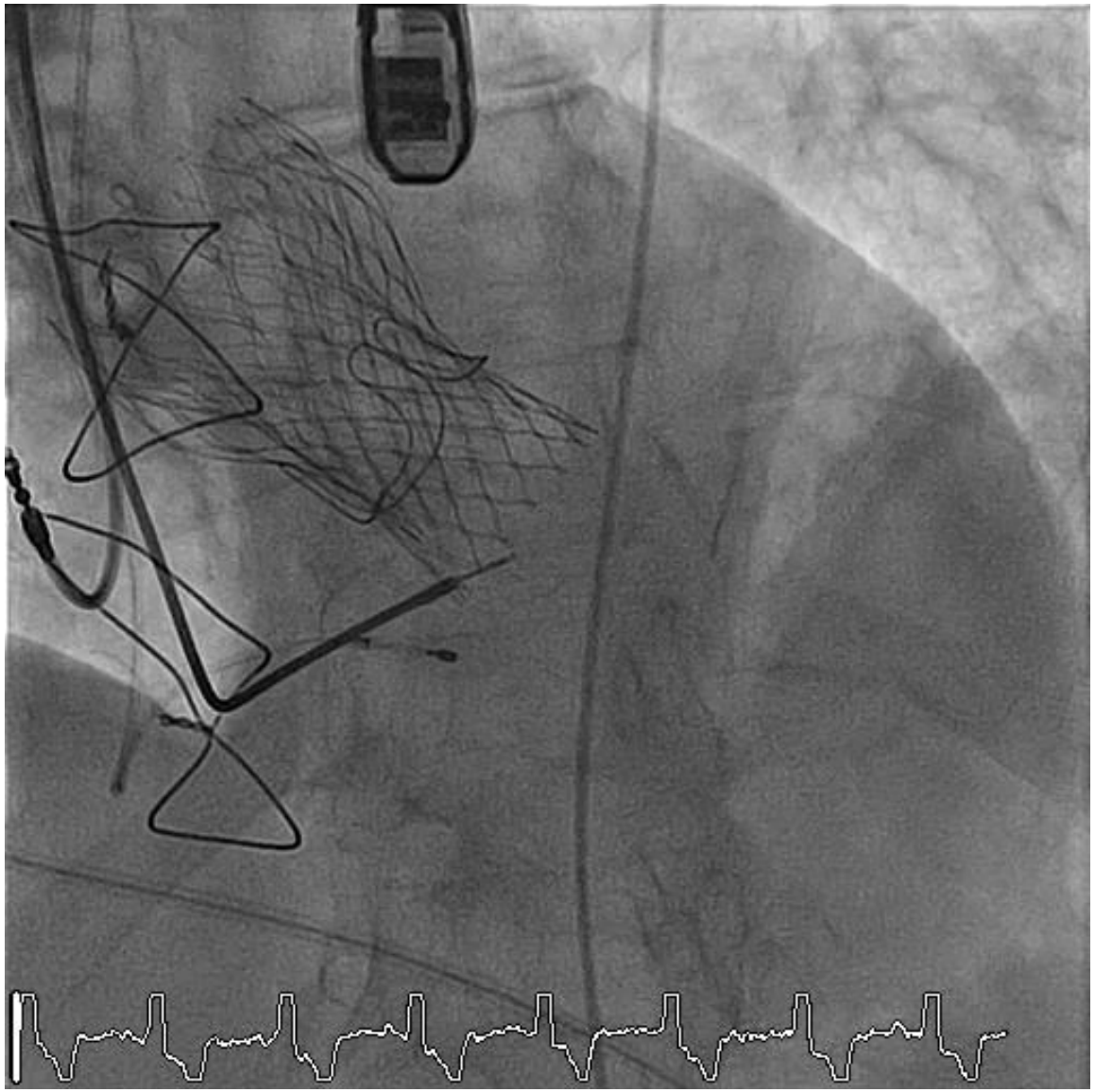


Valve not repositionable at that time




mmHg
200 200
160 160
120 120
80 80
40 40
P1 P2
HR:57
II
Empf.: 10 mm/mV
09:27:43
44
45
46
47
48
49
50
51
52
53
54
16.04.13 10:27:53 BB04EQ00 CL 4.2.2 (B 22) W






mmHg
200 200
160 160
120 120
80 80
40 40
P1 P2
HR:55
II
Empf.: 10 mm/mV
10:05:29
31
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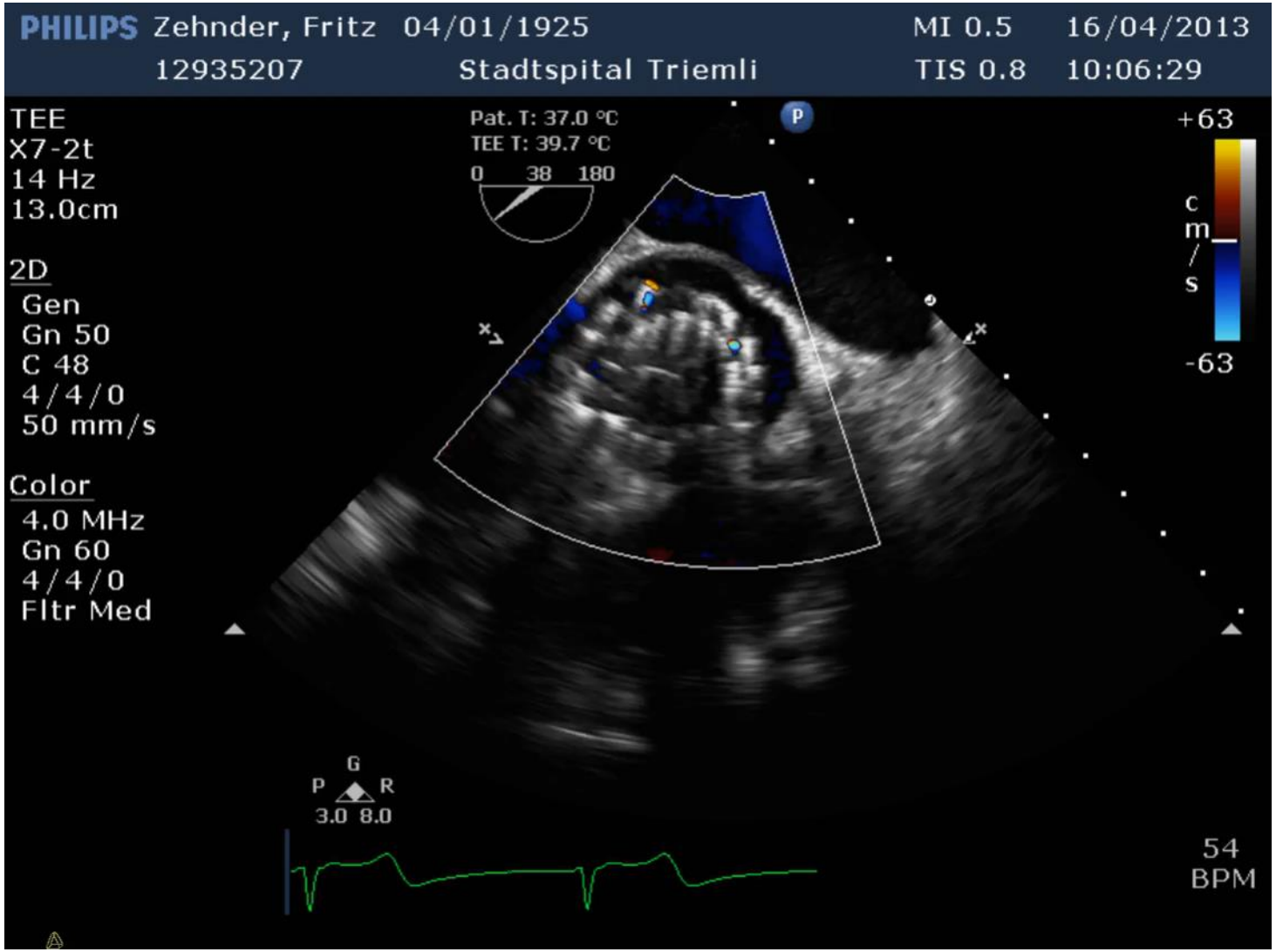
16.04.13 10:27:04 BB04EQ00 CL 4.2.2 (B 22) W


PHILIPS Zehnder, Fritz 04/01/1925
12935207 Stadtspital Triemli
MI 0.5 16/04/2013
TIS 0.8 10:06:29
TEE
X7-2t
14 Hz
13.0cm
2D
Gen
Gn 50
C 48
4/4/0
50 mm/s
Color
4.0 MHz
Gn 60
4/4/0
Fltr Med
Pat. T: 37.0 °C
TEE T: 39.7 °C
0 38 180
P
+63
cm/s
-63
G
P R
3.0 8.0
54
BPM

Paravalvuläres Leck nach TAVI

Echodaten aus der Evolut Low Risk Studien

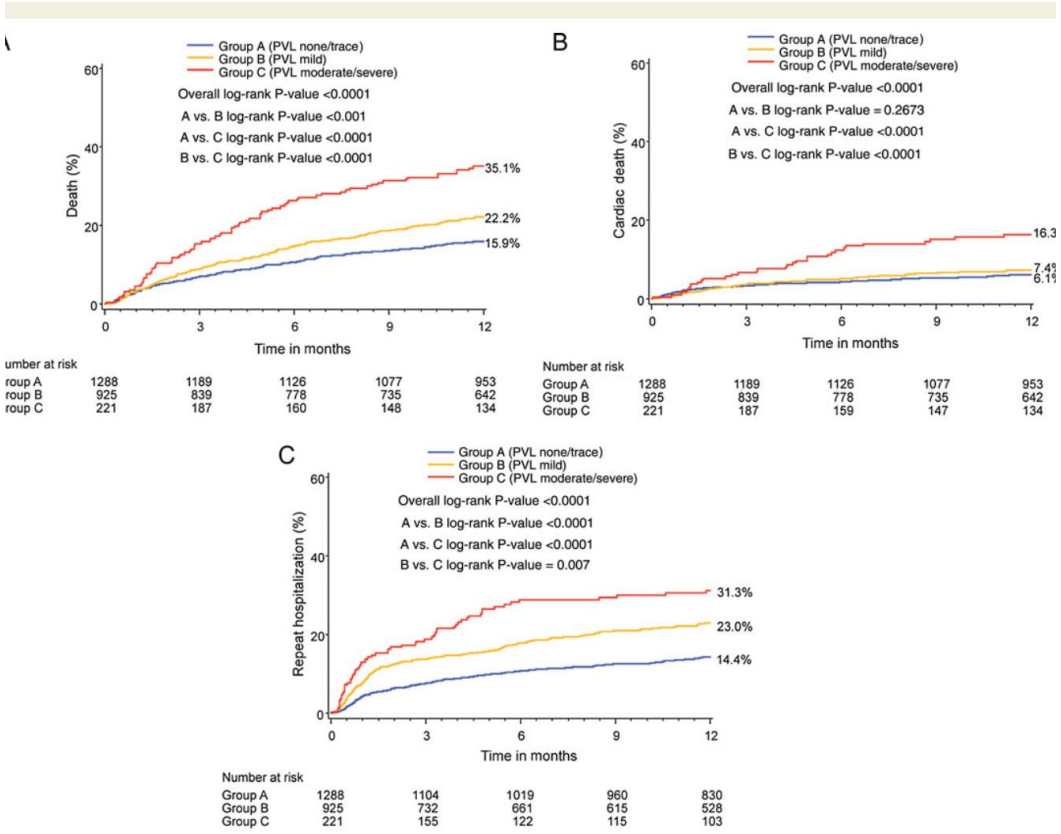
Table S11. Serial Echocardiography by Treatment Group

	30 Days			1 Year			2 Year		
	TAVR	Surgery	95% BCI for difference	TAVR	Surgery	95% BCI for difference	TAVR	Surgery	95% BCI for difference
Aortic-valve area, cm^2	2.2 ± 0.6 (610)	2.0 ± 0.6 (541)	(0.1, 0.2)	2.3 ± 0.7 (341)	2.0 ± 0.6 (293)	(0.2, 0.4)	2.2 ± 0.5 (59)	2.0 ± 0.5 (53)	(0.0, 0.4)
Aortic-valve gradient, mm Hg	8.4 ± 3.5 (699)	10.5 ± 4.0 (634)	(-2.5, -1.7)	8.6 ± 3.7 (409)	11.2 ± 4.9 (339)	(-3.2, -2.0)	9.0 ± 3.3 (71)	12.3 ± 5.7 (62)	(-4.9 -1.6)
Total aortic regurgitation	N=709	N=626		N=415	N=340		N=69	N=63	
None – no. (%)	140 (19.7)	461 (73.6)	(-57.9, -48.9)	157 (37.8)	243 (71.5)	(-39.7, -26.4)	36 (52.2)	49 (77.8)	(-38.6, -7.9)
Trace – no. (%)	288 (40.6)	131 (20.9)	(14.7, 24.3)	102 (24.5)	66 (19.4)	(-0.8, 10.9)	9 (13.0)	7 (11.1)	(-9.2, 12.6)
Mild – no. (%)	256 (36.1)	31 (5.0)	(27.0, 34.8)	138 (33.3)	26 (7.6)	(20.0, 30.6)	20 (29.0)	7 (11.1)	(3.9, 29.4)
Moderate – no. (%)	23 (3.2)	2 (0.3)	(1.5, 4.4)	17 (4.1)	5 (1.5)	(0.2, 5.0)	4 (5.8)	0 (0.0)	(-0.5, 12.3)
Severe– no. (%)	2 (0.3)	1 (0.2)	(-0.6, 0.8)	1 (0.2)	0 (0.0)	(-0.7, 1.1)	0 (0.0)	0 (0.0)	(-4.4, 3.9)
Paravalvular leak	N=703	N=608		N=407	N=326		N=70	N=61	
None – no. (%)	146 (20.8)	544 (89.5)	(-71.9, -64.2)	168 (41.3)	299 (91.7)	(-55.2, 43.8)	39 (55.7)	59 (96.7)	(-50.5, -24.2)
Trace – no. (%)	280 (39.8)	44 (7.2)	(28.2, 36.5)	86 (21.1)	17 (5.2)	(11.1, 20.4)	9 (12.9)	1 (1.6)	(2.0, 19.4)
Mild – no. (%)	253 (36.0)	18 (3.0)	(29.0, 36.6)	138 (33.9)	8 (2.5)	(26.2, 35.9)	18 (25.7)	1 (1.6)	(12.1, 33.3)
Moderate – no. (%)	22 (3.1)	1 (0.2)	(1.6, 4.4)	14 (3.4)	2 (0.6)	(0.7, 4.9)	4 (5.7)	0 (0.0)	(-0.7, 12.1)
Severe – no. (%)	2 (0.3)	1 (0.2)	(-0.6, 0.8)	1 (0.2)	0 (0.0)	(-0.8, 1.1)	0 (0.0)	0 (0.0)	(-4.6, 3.9)
Transvalvular regurgitation	N=695	N=609		N=405	N=327		N=69	N=61	
None – no. (%)	668 (96.1)	506 (83.1)	(9.7, 16.4)	378 (93.3)	263 (80.4)	(8.0, 18.0)	66 (95.7)	51 (83.6)	(0.1, 23.9)
Trace – no. (%)	25 (3.6)	90 (14.8)	(-14.3, -8.0)	20 (4.9)	48 (14.7)	(-14.1, -5.4)	1 (1.4)	5 (8.2)	(-14.9, 0.9)
Mild – no. (%)	2 (0.3)	12 (2.0)	(-3.0, -0.6)	7 (1.7)	16 (4.9)	(-6.0, -0.6)	2 (2.9)	5 (8.2)	(-13.8, 2.8)
Moderate – no. (%)	0 (0.0)	1 (0.2)	(-0.8, 0.3)	0 (0.0)	0 (0.0)	(-0.9, 0.7)	0 (0.0)	0 (0.0)	(-4.6, 3.9)
Severe– no. (%)	0 (0.0)	0 (0.0)	(-0.5, 0.4)	0 (0.0)	0 (0.0)	(-0.9, 0.7)	0 (0.0)	0 (0.0)	(-4.6, 3.9)
Patient-prosthesis mismatch	N = 609	N=541		N = 341	N = 293		N = 59	N = 53	
None – no. (%)	542 (89.0)	433 (80.0)		318 (93.3)	223 (76.1)		56 (94.9)	45 (84.9)	
Moderate – no. (%)	60 (9.9)	84 (15.5)		17 (5.0)	46 (15.7)		1 (1.7)	7 (13.2)	

TAVI: paravalvuläres Leck

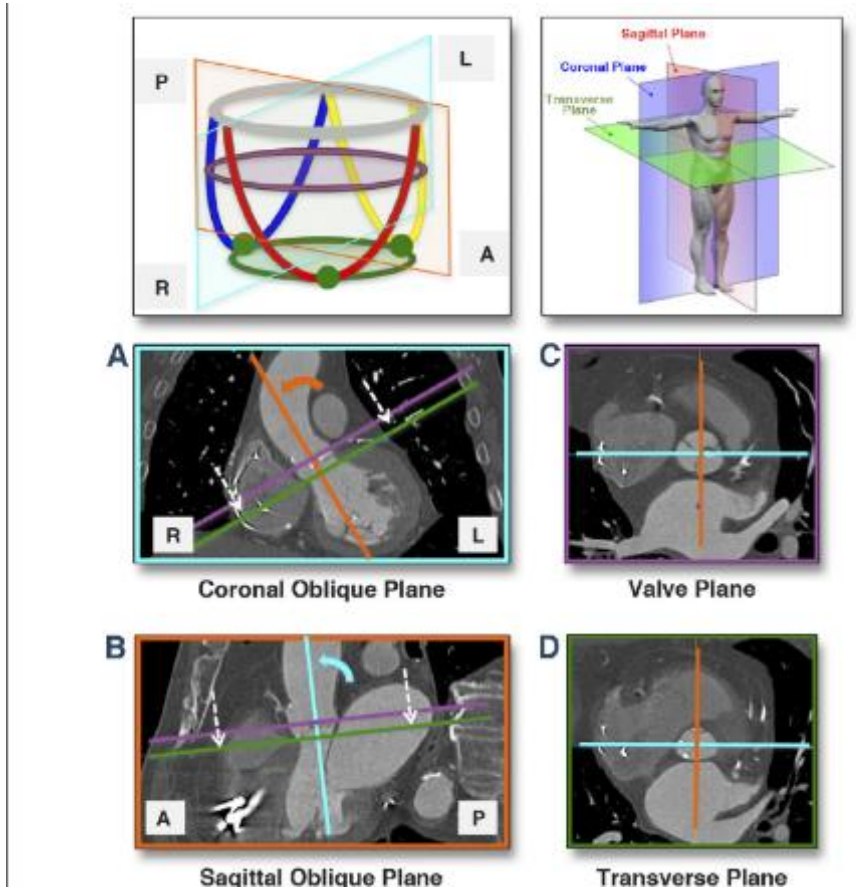
Schweres PVL ist verbunden mit einer schlechteren Prognose

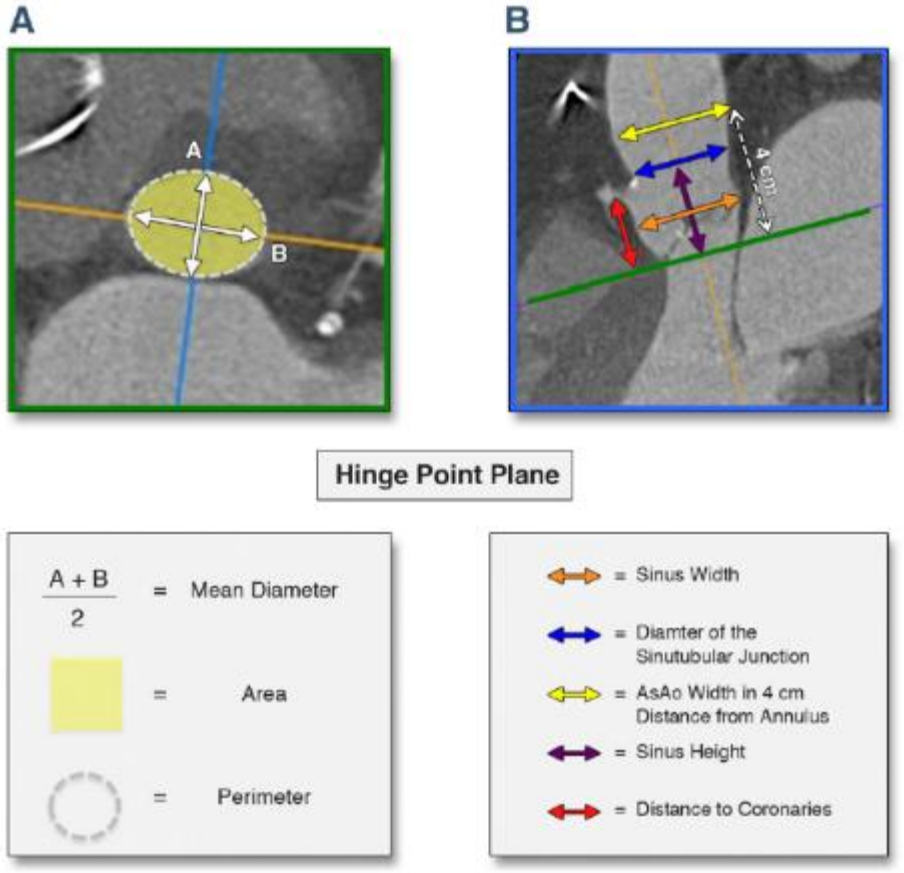
RF: Männer, schlechte EF, schlechte LV Funktion, deutliche Verkalkung, Undersizing der Prothese, LVOT Verkalkungen, ovaläre Annuli, bicuspide Klappe



Differences in all-cause mortality (*A*), cardiac mortality (*B*) and repeat hospitalization (*C*) in patients following transcatheter aorti
ement stratified by severity of post-implant paravalvular regurgitation: none/trace (group *A*), mild (group *B*), and moderate/severe (gr

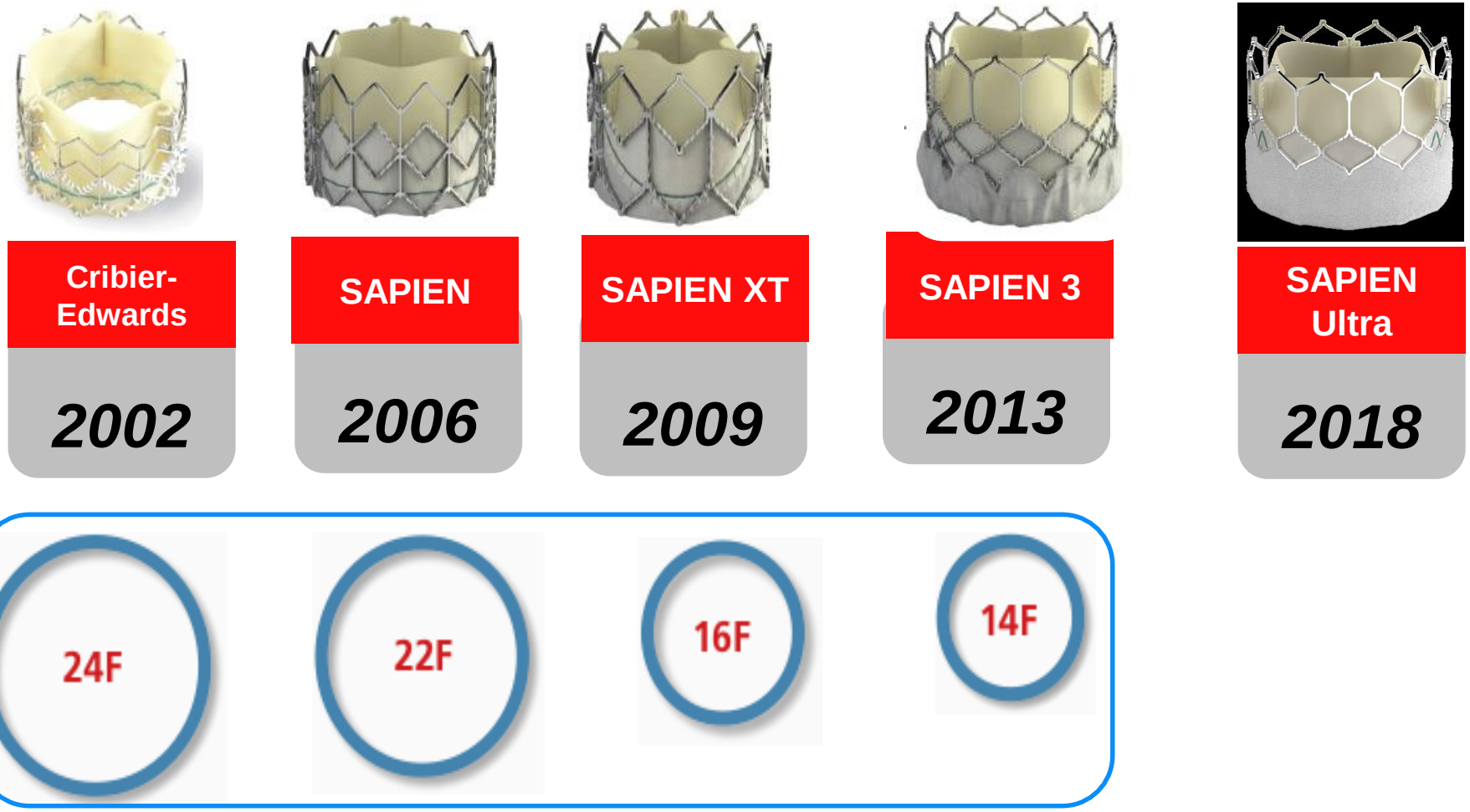
Multislice CT





Kasel AM et. al. JACC Img 2013: 6:240-62

Evolution of the Edwards Balloon-Expandable Transcatheter Valves



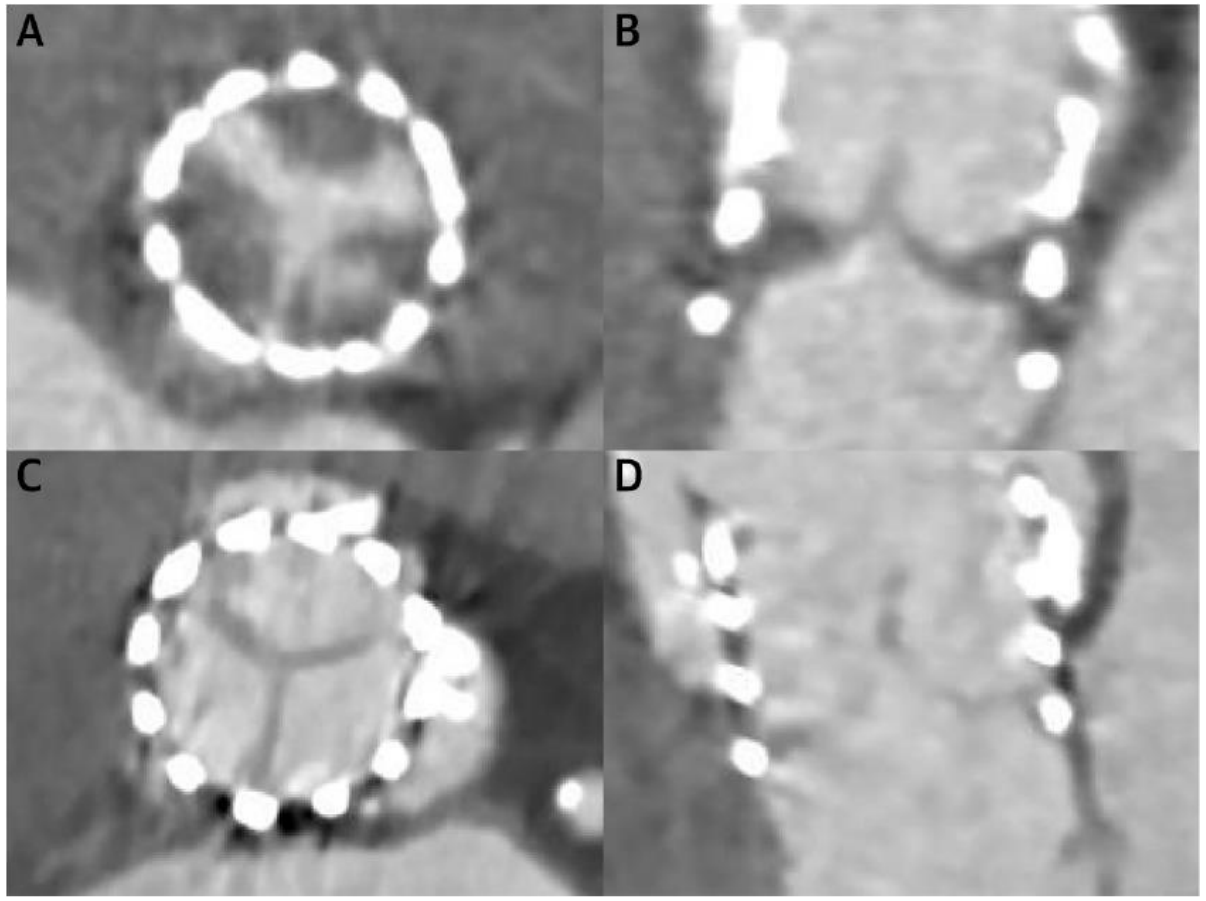
Kodali S et al. TCT 2014

TAVI: paravalvuläres Leck

- schwere paravalvuläre Lecks sind mit einer schlechten Prognose verbunden
- Schwere Lecks werden hämodynamisch oft schlecht toleriert (insb bei kleinen, „steifen“ Ventrikeln)
- Leichte paravalvuläre Lecks haben keinen Einfluss auf die Prognose
- Paravalvuläre Lecks sind etwas häufiger mit den selbstexpandierenden Prothesen
- Schwere paravalvuläre Lecks sind sehr selten geworden
  -> besseres Sizing
  -> optimierte Implantationstechnik
  -> Design der modernen Prothesen („skirt“)
  -> Folge von “Implantationsfehlern“ (hoch oder tiefe Implantation, zu kleine Prothese)
- Patienten mit schweren Lecks sollten im Labor behandelt werden (Nachdilatation, 2. Klappe, Leckverschluss)
- Leicht-mittelschwere Lecks müssen z.T. akzeptiert werden (LVOT Verkalkungen), insb in älteren oder Hochrisikopatienten

TAVI: Subklinische Klappenthrombosen

Subklinische Klappenthrombose



Gradient 23mm
Herzinsuffizienz

Nach OAK
-> vollständige Resolution

Hypoattenuated leaflet thickening with motion abnormalities (HALM)

Subclinical leaflet thrombosis in surgical and transcatheter bioprosthetic aortic valves: an observational study

*Tarun Chakravarty, Lars Søndergaard, John Friedman, Ole De Backer, Daniel Berman, Klaus F Kofoed, Hasan Jilaihawi, Takahiro Shiota, Yigal Abramowitz, Troels H Jørgensen, Tanya Rami, Sharjeel Israr, Gregory Fontana, Martina de Knegt, Andreas Fuchs, Patrick Lyden, Alfredo Trento, Deepak L Bhatt, Martin B Leon, Raj R Makkar, on behalf of the RESOLVE and SAVORY Investigators**

931 Patienten aus zwei Registern wurden mittels CT untersucht, 890 CT Untersuchungen konnten ausgewertet werden

106 Patienten (12%) der 890 hatten eine subklinische Klappenthrombose
5 von 138 chirurgischen Bioprothesen (4%) versus 101 von 752 TAVI Prothesen (13%)

Mediane Zeit bis zum diagnostischen CT 83 Tage

Subklinische Thrombose war selten unter OAK (4%) als unter DAPT (15%)

Unter OAK (Warfarin oder NOAK) ist die Veränderung in praktisch allen Fällen komplett reversibel, aber nicht unter DAPT

Pat. mit subklinischer Klappenthrombose haben häufiger TIA's aber nicht CVI

Subclinical leaflet thrombosis in surgical and transcatheter bioprosthetic aortic valves: an observational study

Lancet 2017; 389: 2383–92

*Tarun Chakravarty, Lars Søndergaard, John Friedman, Ole De Backer, Daniel Berman, Klaus F Kofoed, Hasan Jilaihawi, Takahiro Shiota, Yigal Abramowitz, Troels H Jørgensen, Tanya Rami, Sharjeel Israr, Gregory Fontana, Martina de Knegt, Andreas Fuchs, Patrick Lyden, Alfredo Trento, Deepak L Bhatt, Martin B Leon, Raj R Makkar, on behalf of the RESOLVE and SAVORY Investigators**

	Normal leaflet motion (n=784)	Reduced leaflet motion (n=106)	p value
Post-AVR			
Ejection fraction (%)	60·4 (13·5)	58·5 (13·1)	0·14
Mean aortic valve gradient (mm Hg)	10·9 (5·7)	9·8 (4·0)	0·20
Peak aortic valve gradient (mm Hg)	20·1 (9·6)	18·6 (7·3)	0·36
VTI ratio	0·57 (0·20)	0·56 (0·21)	0·21
At the time of the CT scan			
Ejection fraction (%)	59·3 (10·8)	56·4 (11·9)	0·03
Mean aortic valve gradient (mm Hg)	10·4 (6·3)	13·8 (10·0)	0·0004
Peak aortic valve gradient (mm Hg)	19·9 (10·4)	25·3 (15·5)	0·001
VTI ratio	0·52 (0·16)	0·43 (0·17)	<0·0001
Aortic valve gradient			
>20 mm Hg	40/714 (6%)	15/96 (16%)	0·0002
>30 mm Hg	13/714 (2%)	6/96 (6%)	0·007
>40 mm Hg	5/714 (1%)	4/96 (4%)	0·02
Change in aortic valve gradient			
>10 mm Hg	9/632 (1%)	13/88 (15%)	<0·0001
>20 mm Hg	5/632 (1%)	5/88 (6%)	0·004
>30 mm Hg	2/632 (<1%)	3/88 (3%)	0·02
Aortic valve gradient >20 mm Hg and increase in gradient >10 mm Hg	7/632 (1%)	12/88 (14%)	<0·0001
Absolute change in aortic valve gradient	−0·25 (5·0)	4·3 (9·2)	<0·0001
Relative change in aortic valve gradient	0·06 (0·61)	0·50 (0·89)	<0·0001
Absolute change in VTI ratio	−0·06 (0·22)	−0·14 (0·20)	0·001
Relative change in VTI ratio	−0·04 (0·38)	−0·21 (0·26)	0·0001

Data are mean (SD) or n/N (%). AVR=aortic valve replacement. VTI=velocity time integral.

Table 4: **Echocardiographic characteristics**

Subklinische Klappenthrombose

Subklinische Klappenthrombose tritt in den ersten 3-6 Monaten nach Klappenimplantation auf, klinisch oft asymptomatisch

Assoziation mit TIA aber nicht mit CVI

Chirurgische Klappe (4%) und TAVI Klappen (12%)

Vorwiegend CT Diagnose, kann ohne Gradientenanstieg auftreten

Vollständig reversibel auf OAK (mit Warfarin oder NOAK)

Vielen Dank.