

Reconstruction of the Aortic Valve and Root: A practical approach

Results of Cusp and Root Repair

Christian Giebels

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Overview

Cusp repair

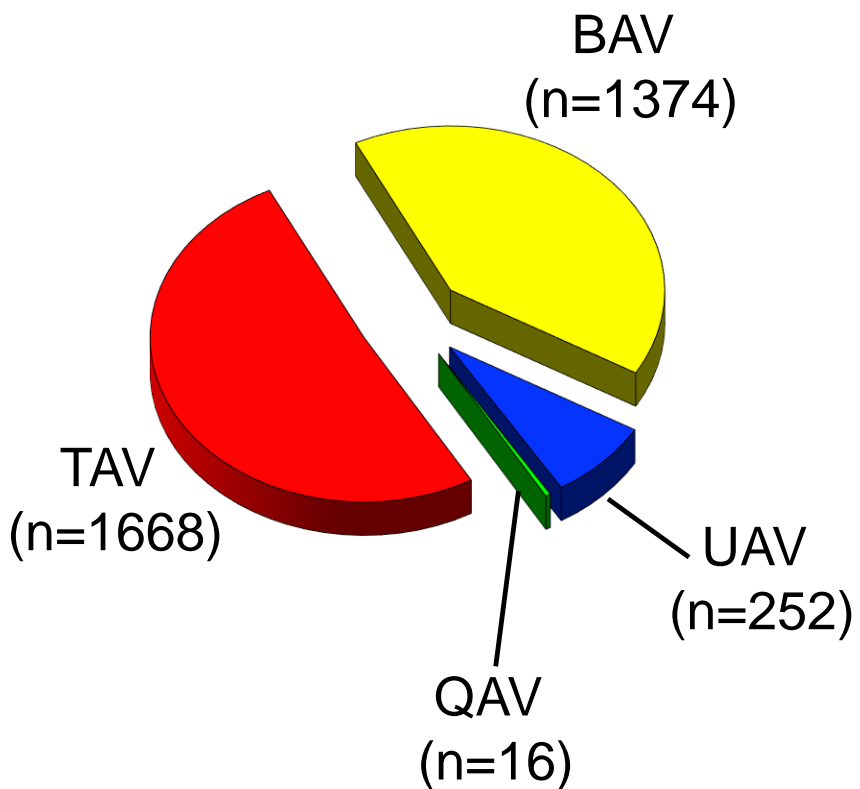
- TAV, BAV, UAV
- Endocarditis
- (Patch cusp repair)

Root repair

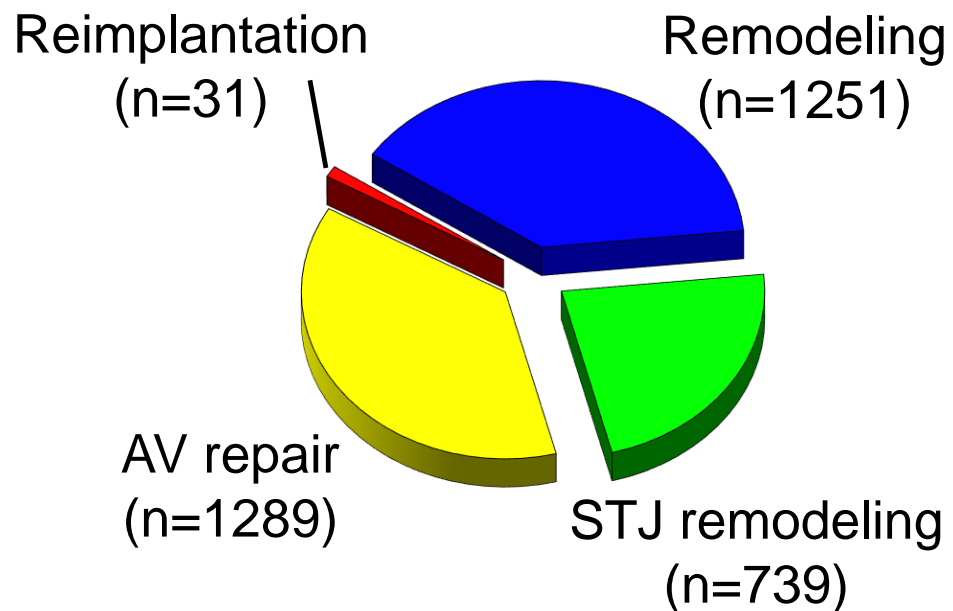
- STJ remodeling
- VPS in TAV and BAV
- VPS in acute dissection
- Failures after VPS

Aortic Valve Repair Homburg (10/1995-08/2022, n=3310)

AV Morphology



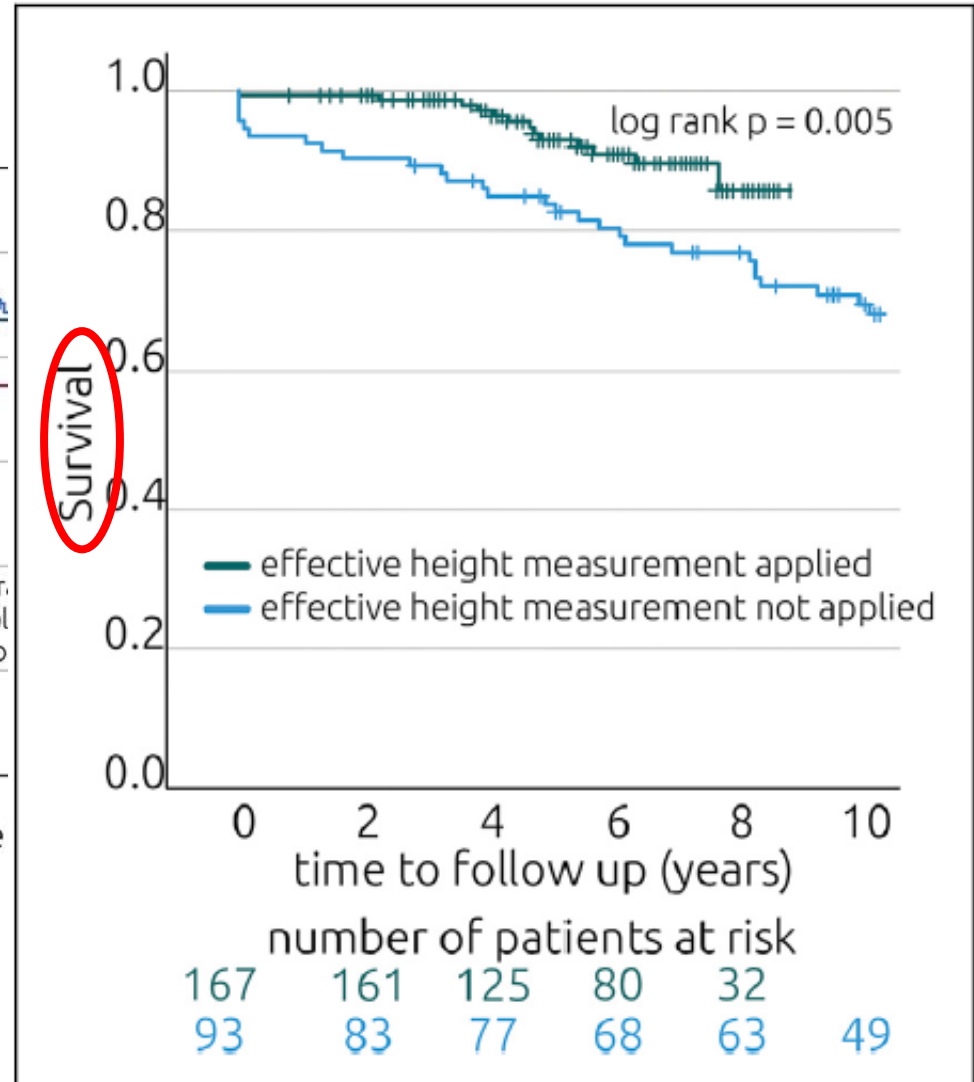
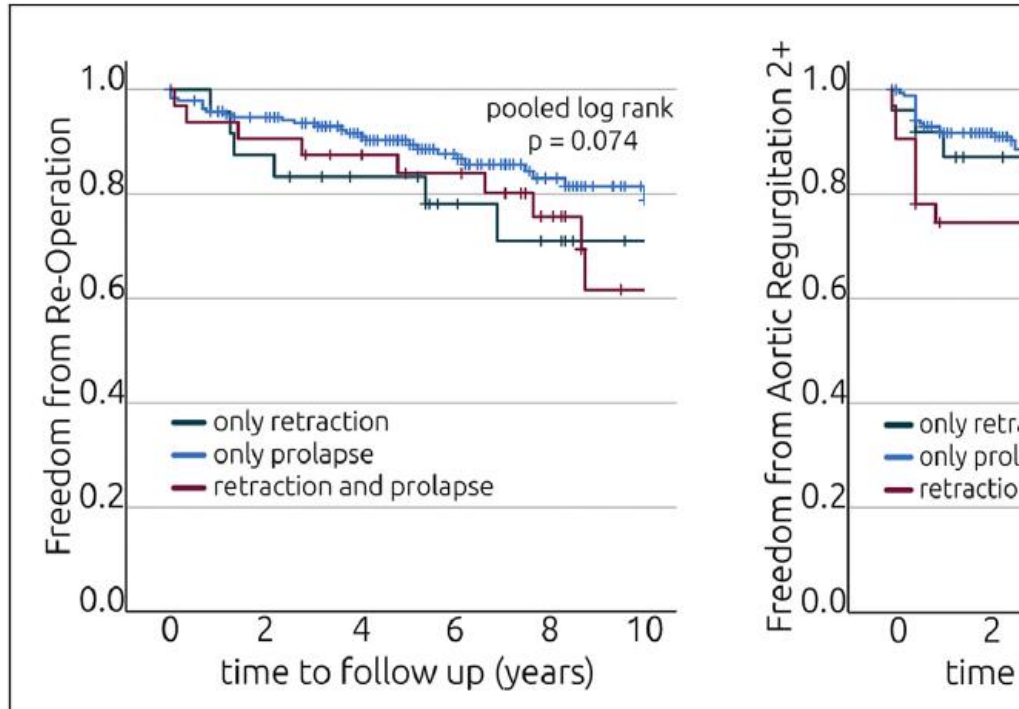
Procedures



Significance of Effective Height and Mechanism of Regurgitation in Tricuspid Aortic Valve Repair

TAV

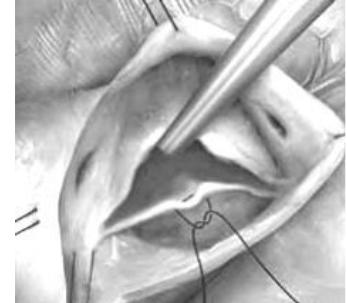
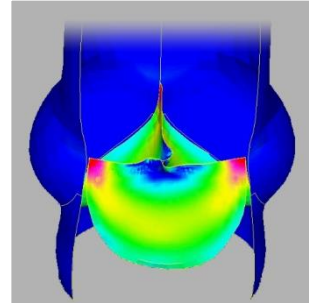
Jeanine Anand, MD,* Marie Schafstedde, MD,* Christian Giebels, MD, and Hans-Joachim Schäfers, MD, PhD



Cusp Repair Techniques

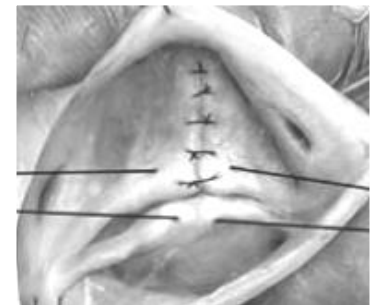
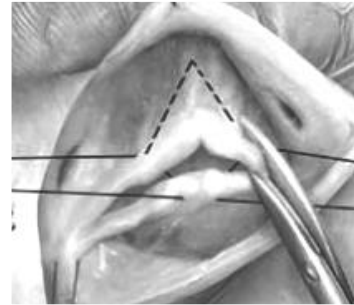
Prolapse

Central Cusp Plication



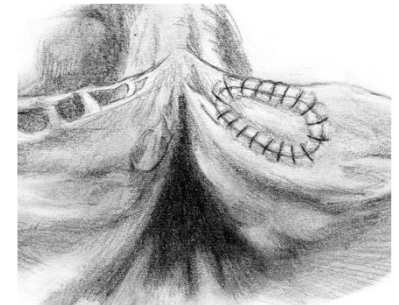
Prolapse +
Redundancy/
Fibrosis

Triangular
Resection



Prolapse +
Calcifications/
Fenestrations

Pericardial
Patch



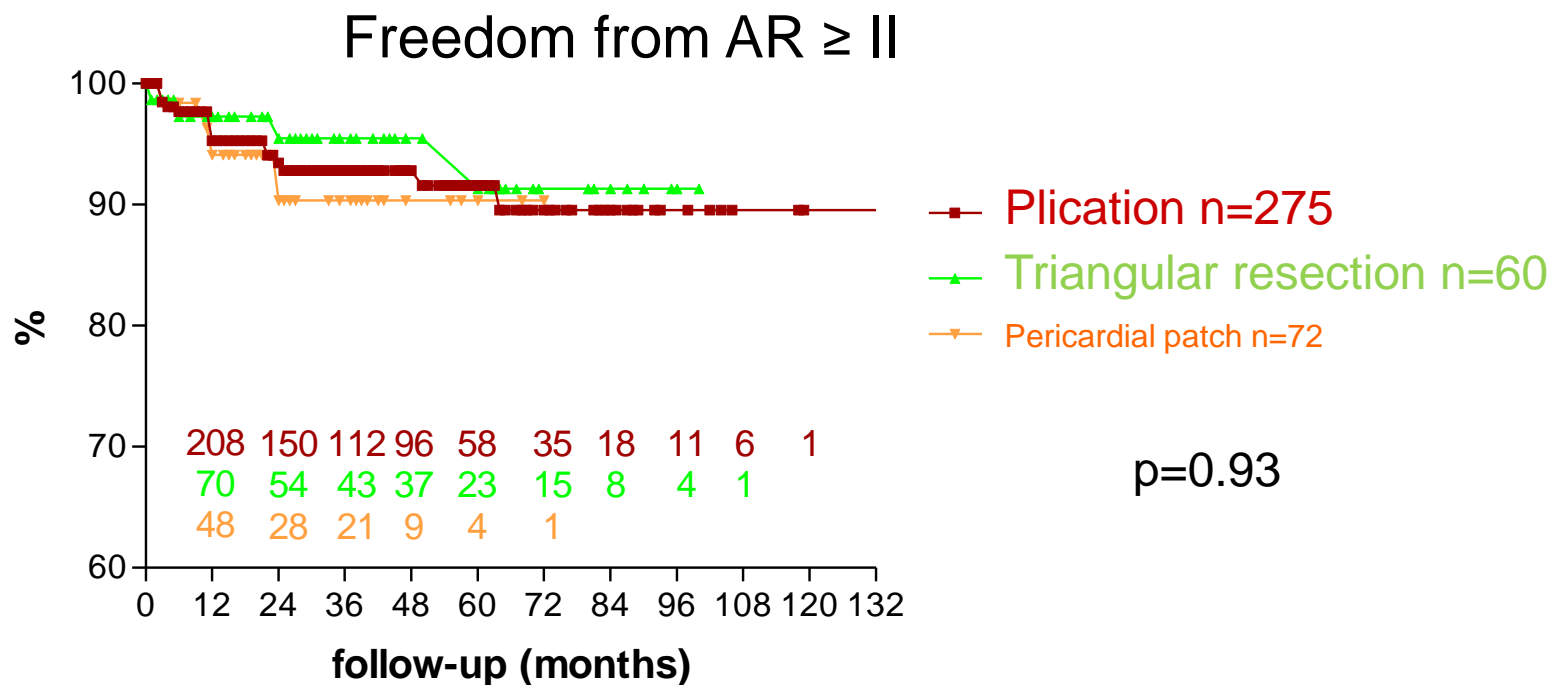
→ Triangular resection as a risk factor for valve stability?

(Casselmann et al. EJCTS 1999)

Cusp repair in aortic valve reconstruction: Does the technique affect stability?

Diana Aicher, MD, Frank Langer, MD, Oliver Adam, MD, Dietmar Tscholl, MD, Henning Lausberg, MD, and Hans-Joachim Schäfers, MD

TAV + BAV





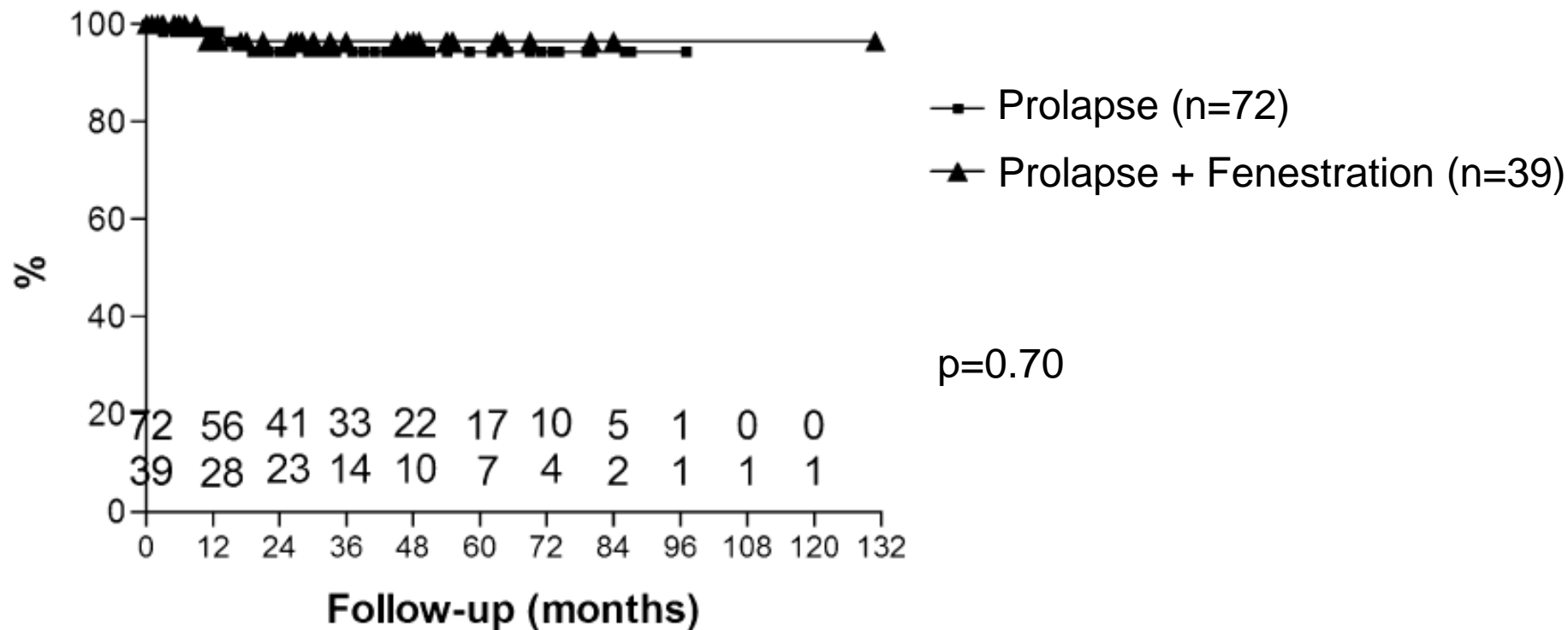
Aortic valve reconstruction in myxomatous degeneration of aortic valves: Are fenestrations a risk factor for repair failure?

2010

TAV

Hans-Joachim Schäfers, MD,^a Frank Langer, MD,^a Petra Glombitza, MD,^a Takashi Kunihara, MD,^a Roland Fries, MD,^b and Diana Aicher, MD^a

Freedom from Reoperation



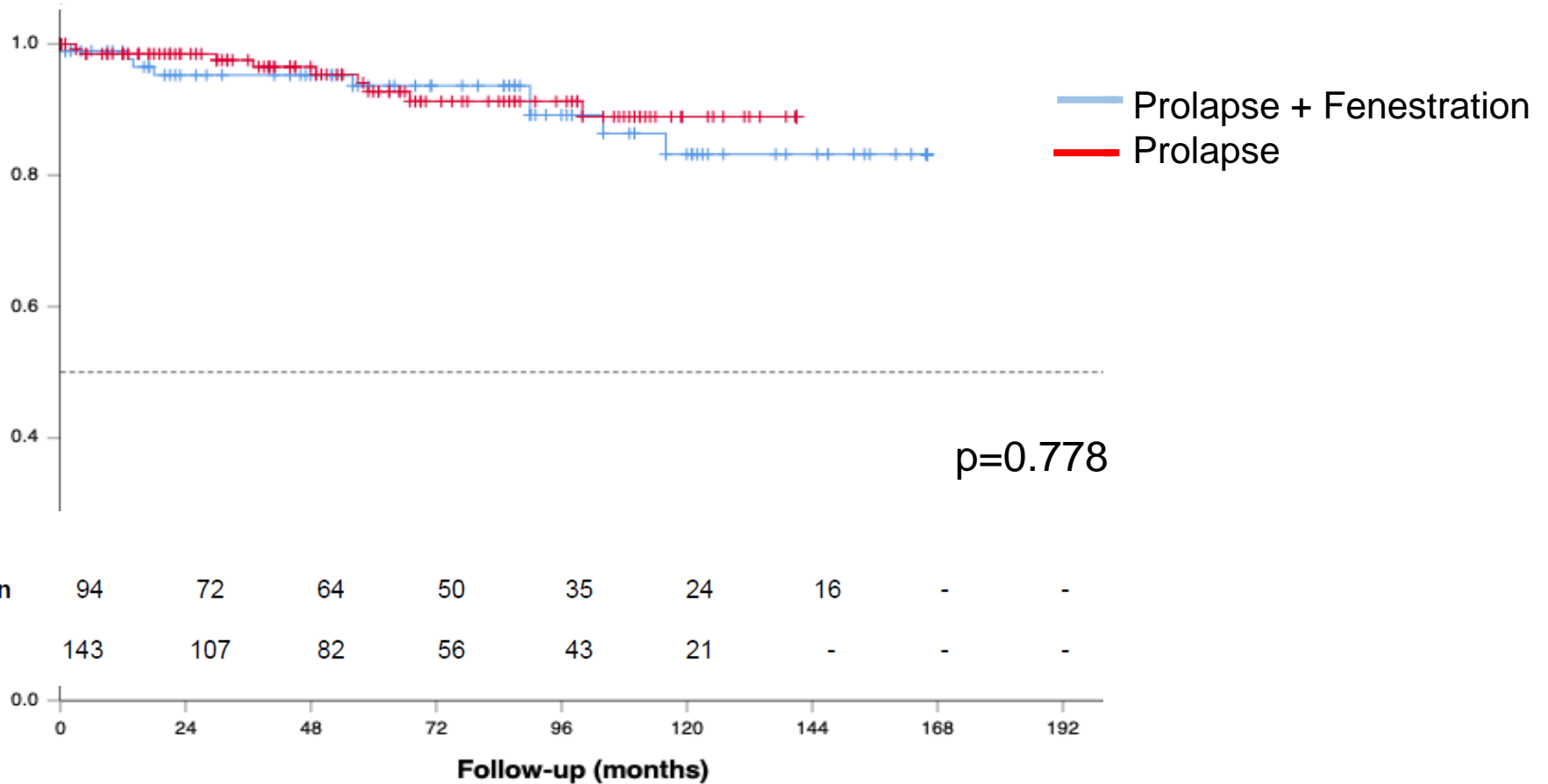


Aortic valve reconstruction in myxomatous degeneration of aortic valves: Are fenestrations a risk factor for repair failure?

2022

TAV

Freedom from Reoperation



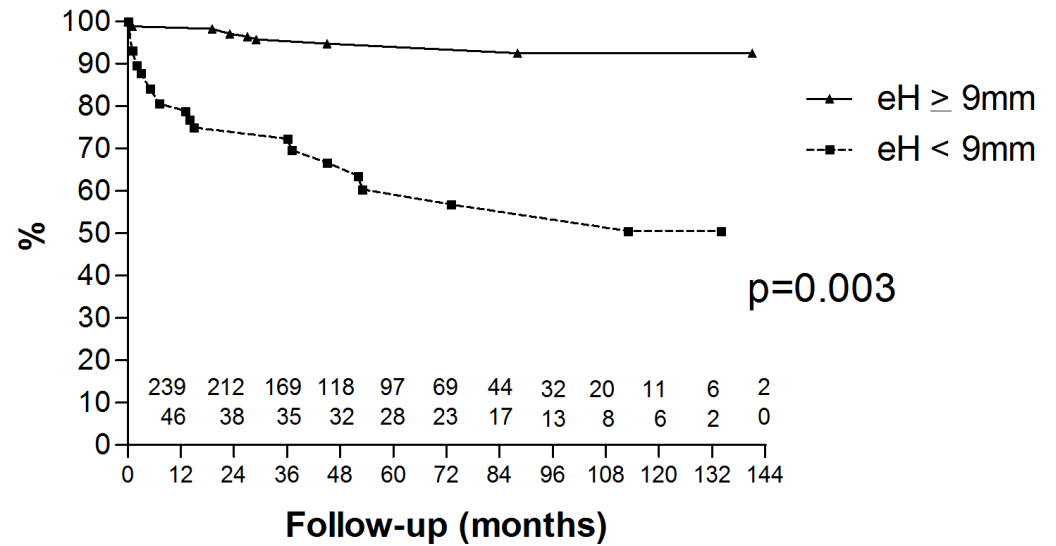
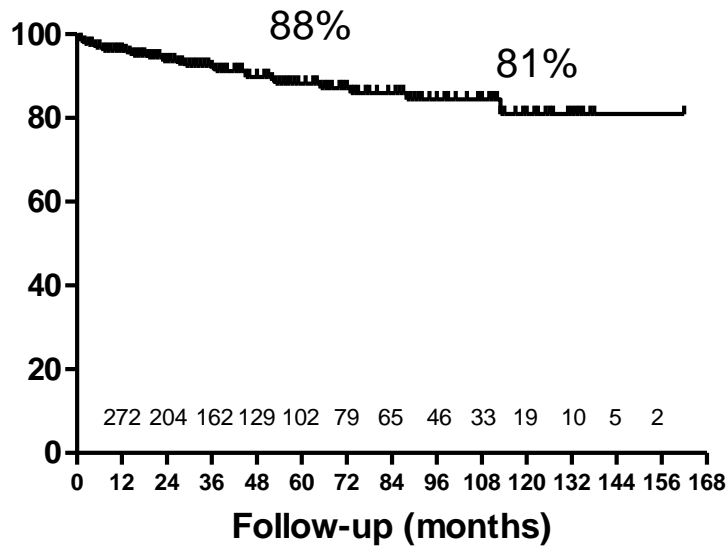
Valve Configuration Determines Long-Term Results After Repair of the Bicuspid Aortic Valve



Diana Aicher, MD; Takashi Kuniyama, MD; Omar Abou Issa, MD; Brigitte Brittner, MD; Stefan Gräber, MD; Hans-Joachim Schäfers, MD

Freedom from Reoperation

Overall

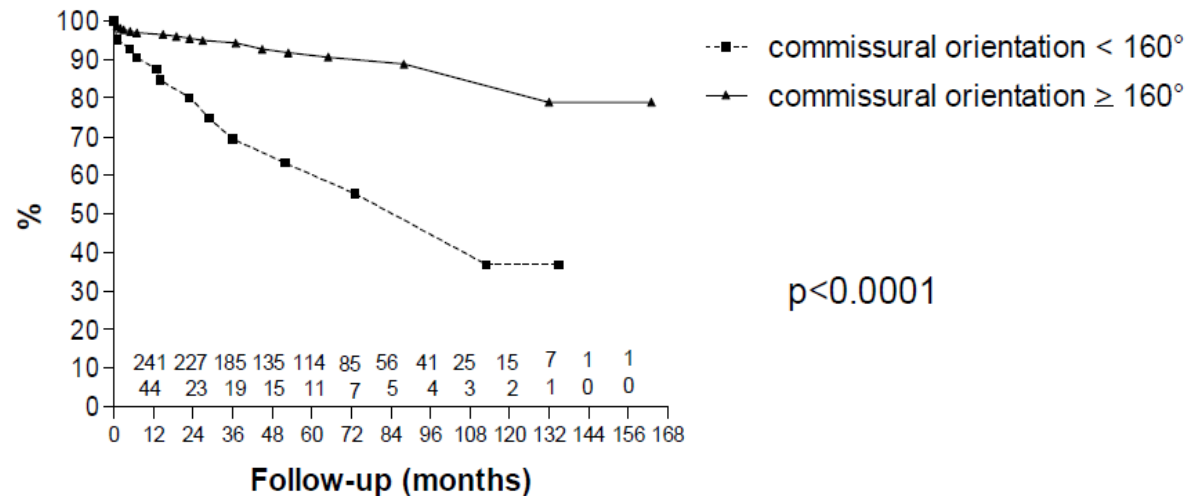
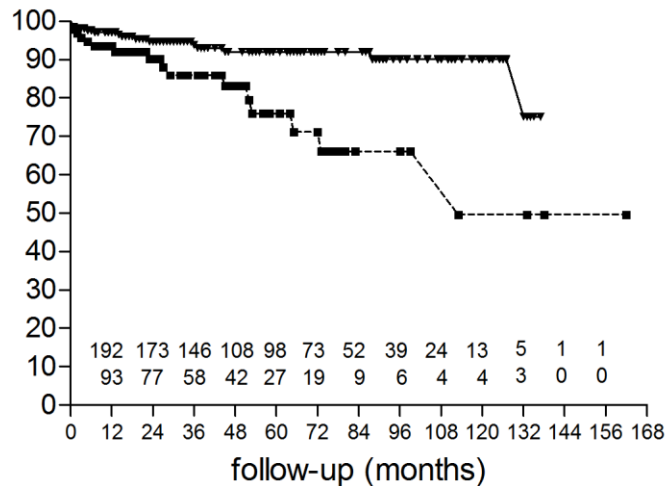


Valve Configuration Determines Long-Term Results After Repair of the Bicuspid Aortic Valve



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Freedom from Reoperation

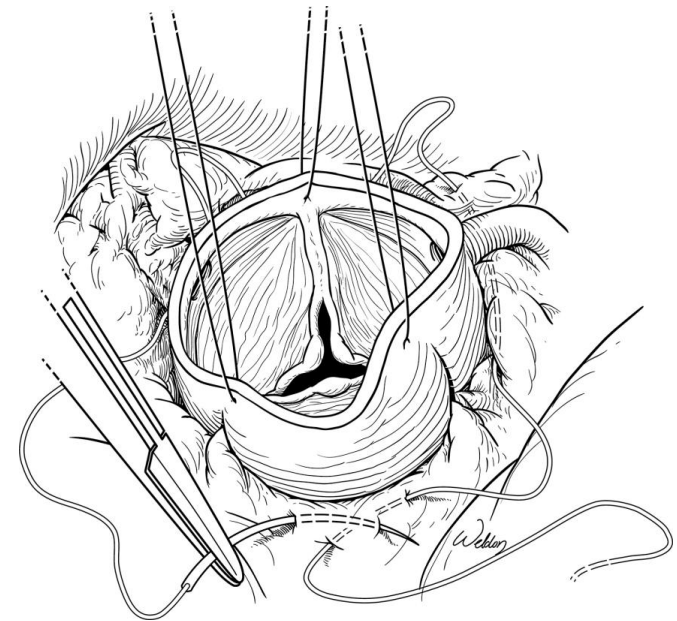
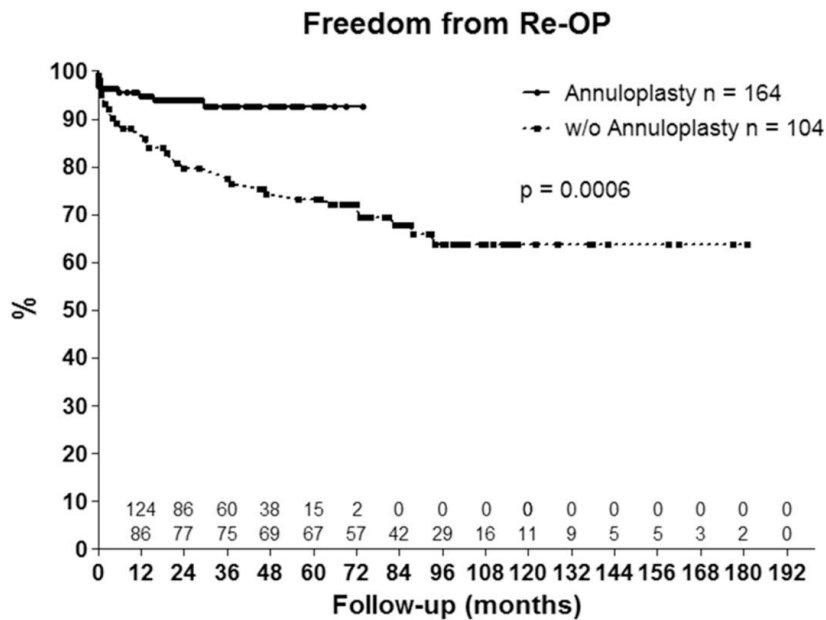


Suture Annuloplasty Significantly Improves the Durability of Bicuspid Aortic Valve Repair



Ulrich Schneider, MD, Christopher Hofmann, Diana Aicher, MD, Hiroaki Takahashi, MD, Yujiro Miura, MD, and Hans-Joachim Schäfers, MD

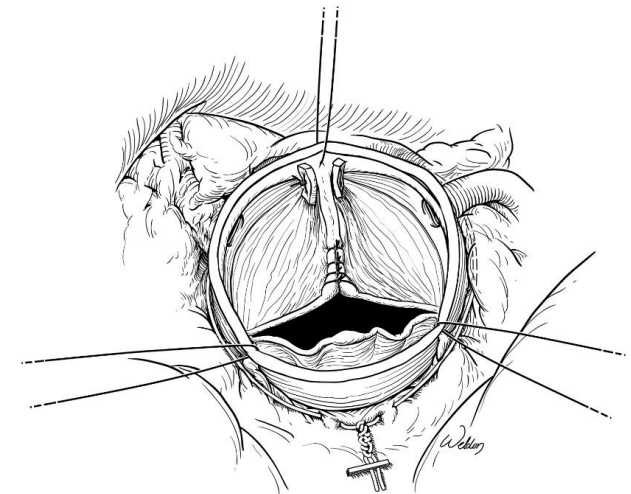
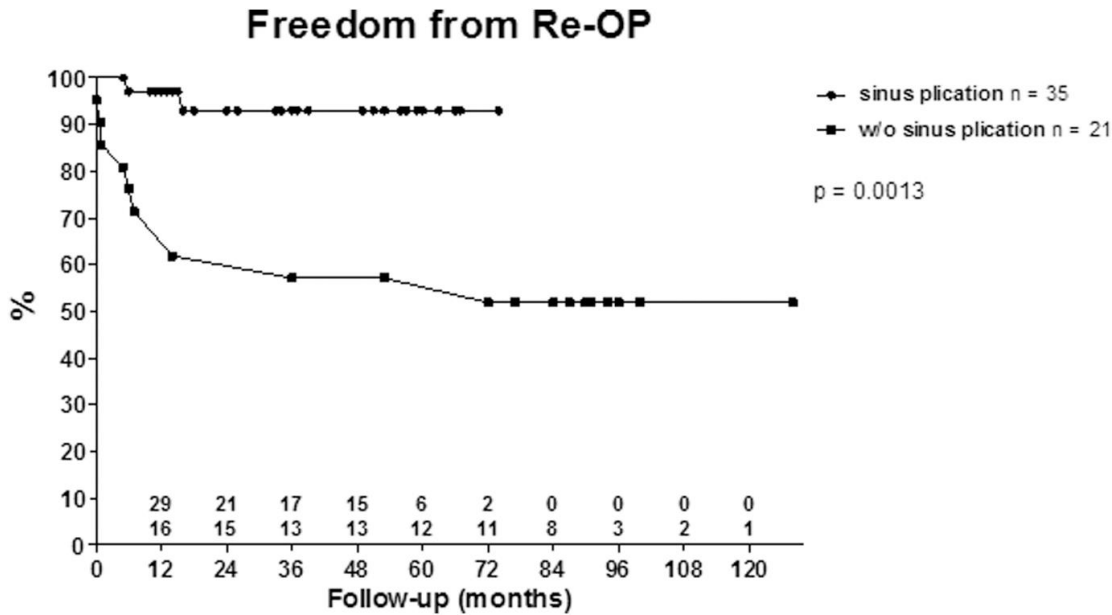
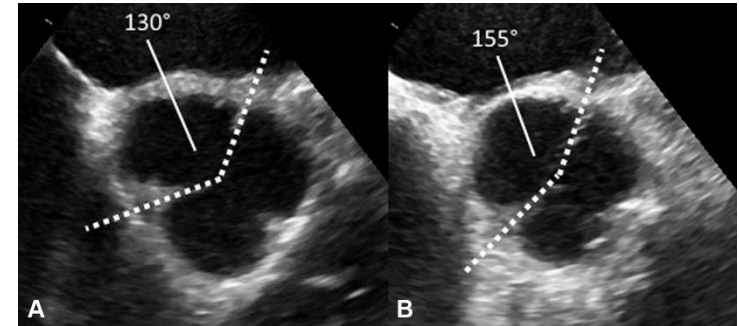
Department of Thoracic and Cardiovascular Surgery, Saarland University Medical Center, Homburg/Saar, Germany



Sinus Plication to Improve Valve Configuration in Bicuspid Aortic Valve Repair—Early Results

BAV

Ulrich Schneider, MD, Wolfram Schmied, Dipl-Psych, Diana Aicher, MD, Christian Giebels, MD, Lena Winter, MD, and Hans-Joachim Schäfers, MD
 Department of Thoracic and Cardiovascular Surgery, Saarland University Medical Center, Homburg/Saar, Germany

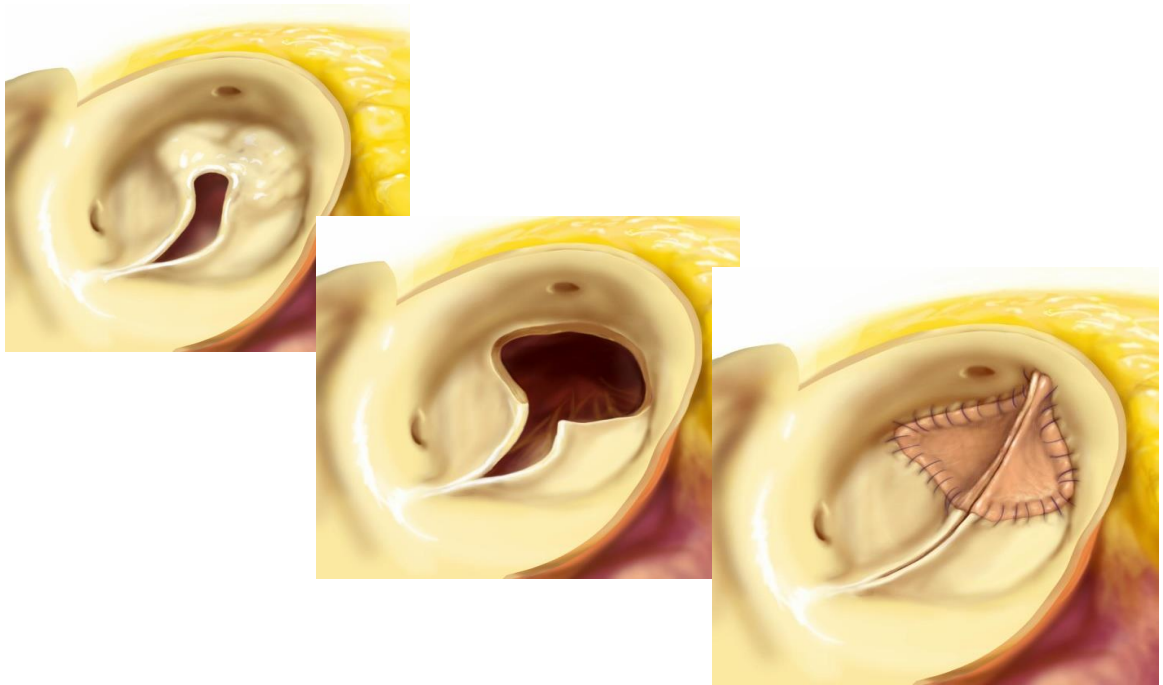


Bicuspidization of the Unicuspid Aortic Valve: A New Reconstructive Approach

UAV

Hans-Joachim Schäfers, MD, Diana Aicher, MD, Svetlana Riodionychewa, MD, Angelika Lindinger, MD, Tanja Rädle-Hurst, MD, Frank Langer, MD, and Hashim Abdul-Khaliq, MD

Departments of Thoracic and Cardiovascular Surgery and Pediatric Cardiology, University Hospitals of Saarland, Homburg/Saar, Germany

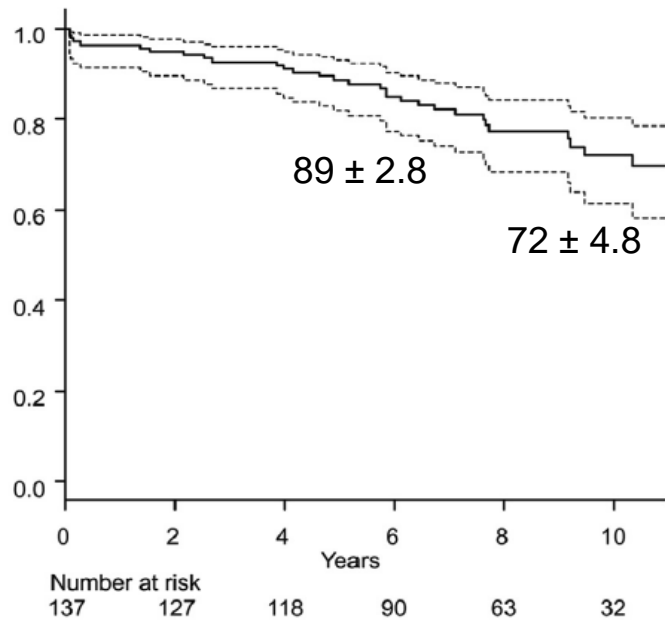


Bicuspidization and Annuloplasty Provide a Functioning Configuration to the Unicuspid Aortic Valve

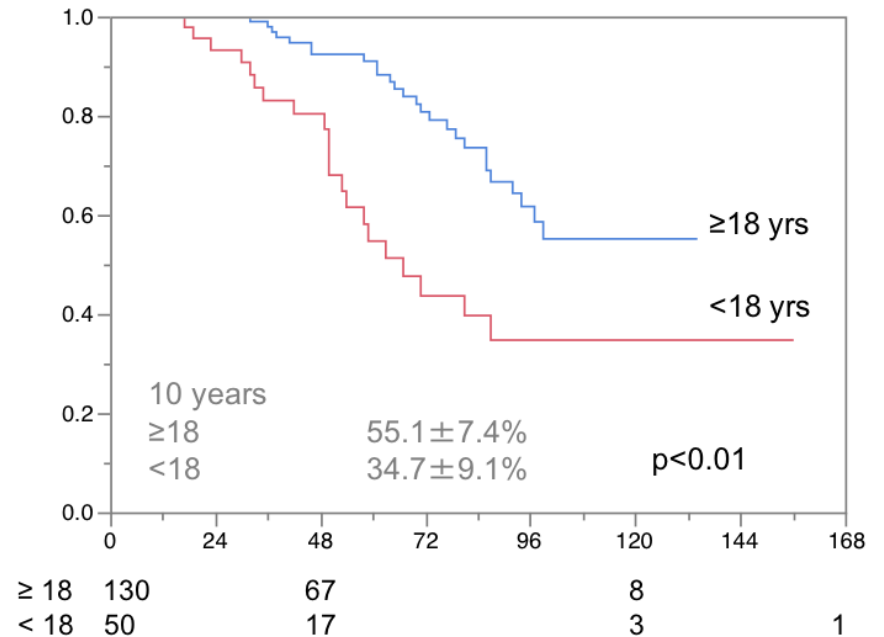


Takashi Igarashi, MD, PhD,* Shunsuke Matsushima, MD,* Atsushi Shimizu, MD, Tristan Ehrlich, MD, Irem Karliova, MD, and Hans-Joachim Schäfers, MD, PhD

Freedom from AV Replacement



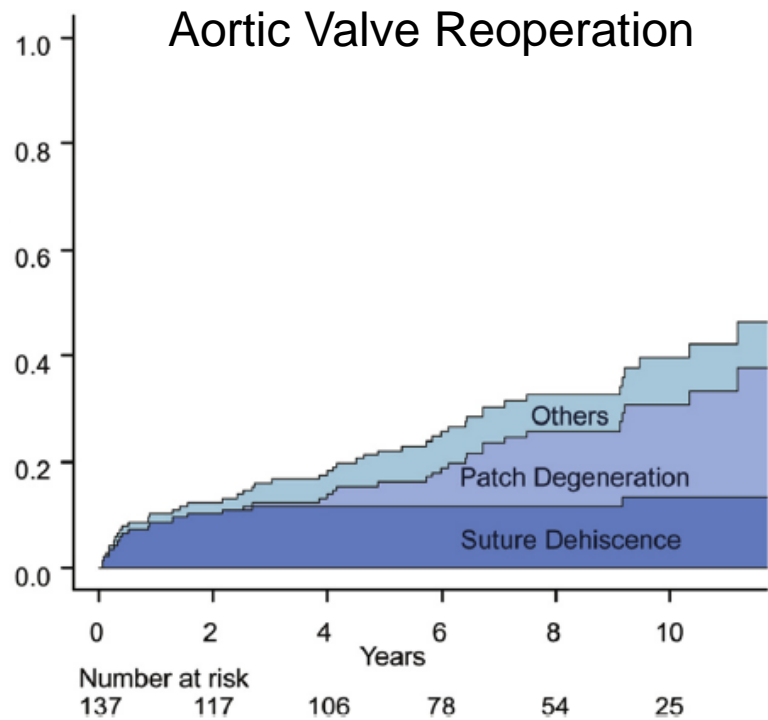
Freedom from Patch Calcification



Bicuspidization and Annuloplasty Provide a Functioning Configuration to the Unicuspid Aortic Valve



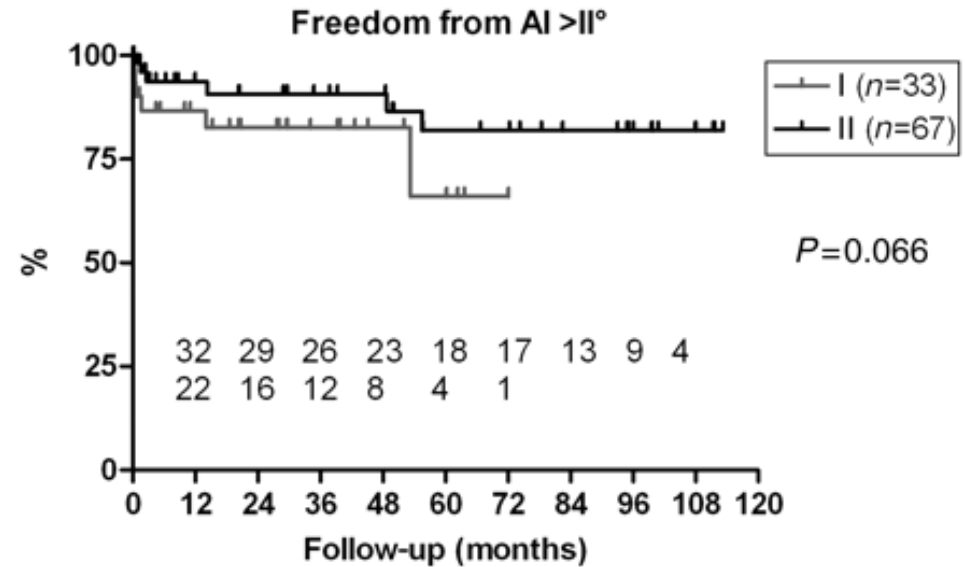
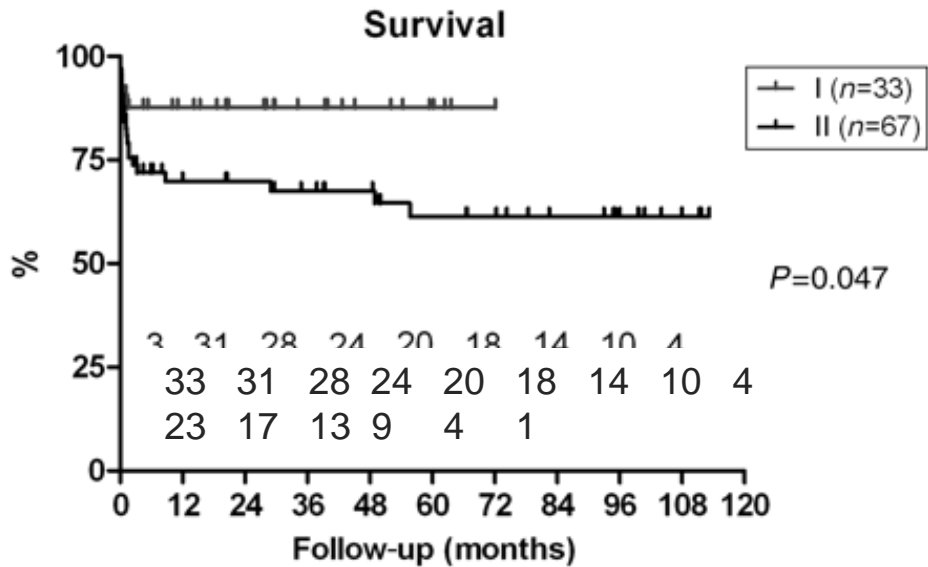
Takashi Igarashi, MD, PhD,* Shunsuke Matsushima, MD,* Atsushi Shimizu, MD, Tristan Ehrlich, MD, Irem Karliova, MD, and Hans-Joachim Schäfers, MD, PhD



Repair versus replacement of the aortic valve in active infective endocarditis

TAV + BAV

Katharina Mayer, Diana Aicher, Susanne Feldner, Takashi Kuniyara and Hans-Joachim Schäfers*

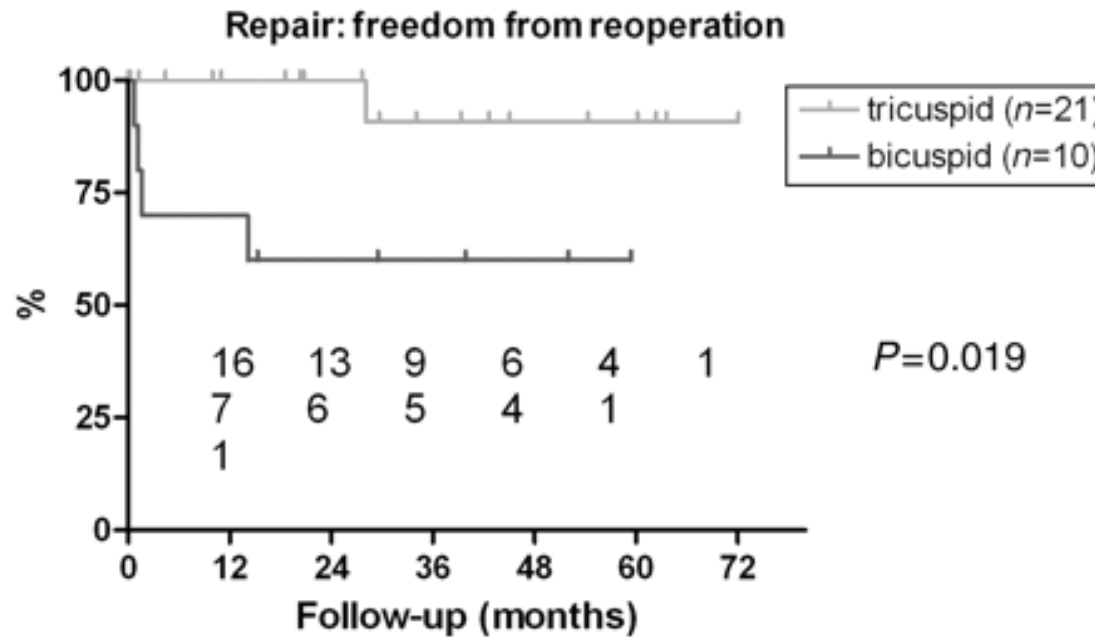


I Aortic valve repair
II Aortic valve replacement

Repair versus replacement of the aortic valve in active infective endocarditis

TAV + BAV

Katharina Mayer, Diana Aicher, Susanne Feldner, Takashi Kuniyama and Hans-Joachim Schäfers*

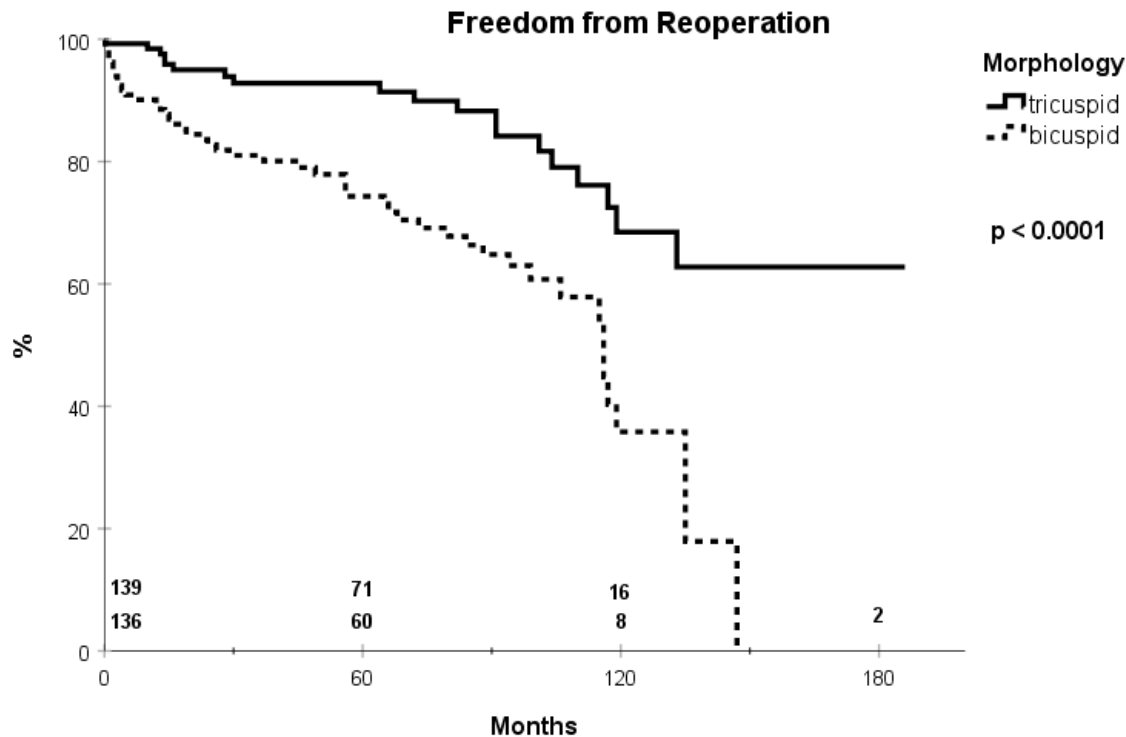


Risk factor for reoperation: size of the pericardial patch (>1cm)

Results of Pericardial Patches in Tricuspid and Bicuspid Aortic Cusp Repair

TAV + BAV

Irem Karliova, MD, Ulrich Schneider, MD, Tristan Ehrlich, MD, and Hans-Joachim Schäfers, MD



Conclusions

Aortic cusp repair: free margin plication, triangular resection, patch repair („weaving of GT“ into margin).

Aortic cusp repair:

- good long-term results in TAV.
- Good results in BAV if anatomical features considered.
- Acceptable durability in UAV.

Suture annuloplasty improves long-term results in (isolated) BAV repair

Active infective endocarditis: less predictable, poor results in BAV (patch!).

Patch repair only good long-term results in TAV.

Overview

Cusp repair

- TAV, BAV, UAV
- Endocarditis
- (Patch cusp repair)

Root repair

- STJ remodeling
- VPS in TAV and BAV
- VPS in acute dissection
- Failures after VPS

Mid-term results after sinutubular junction remodelling with aortic cusp repair[†]

Mitsuru Asano, Takashi Kuniyara, Diana Aicher, Hazem El Beyrouiti, Svetlana Rodionycheva, and Hans-Joachim Schäfers*

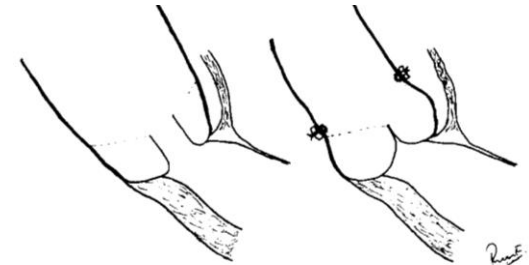
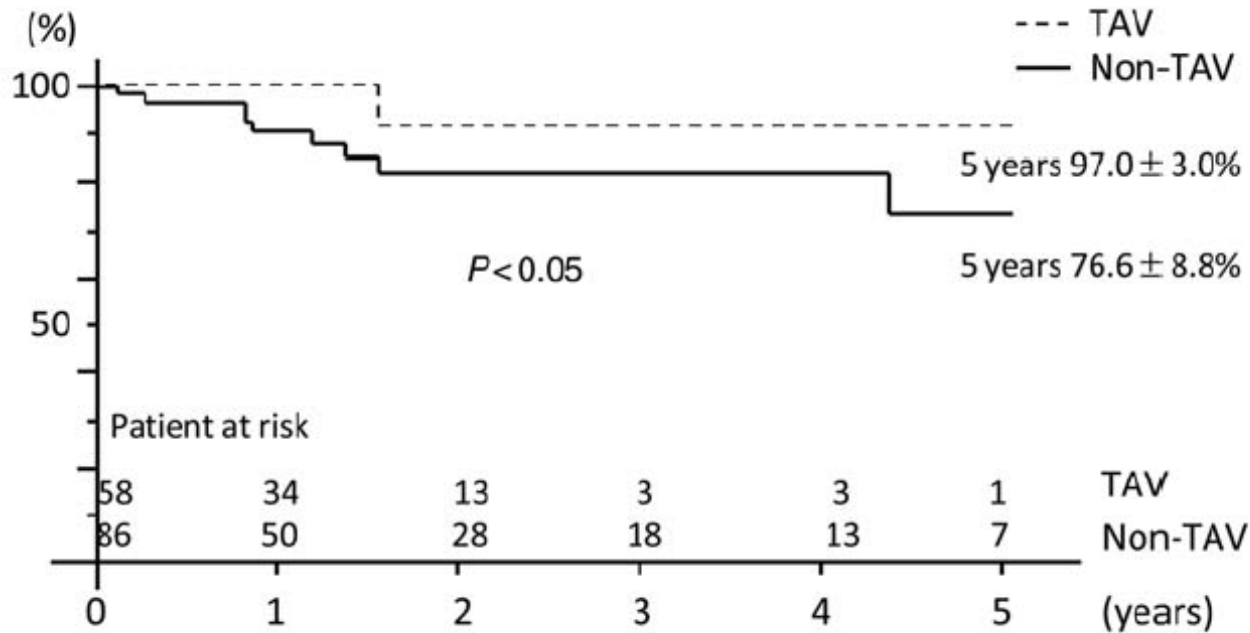


FIGURE 4. Left. The sinus rim is fixed in a systolic position. Right. The sinus rim reestablished in a diastolic position.

Freedom from Reoperation

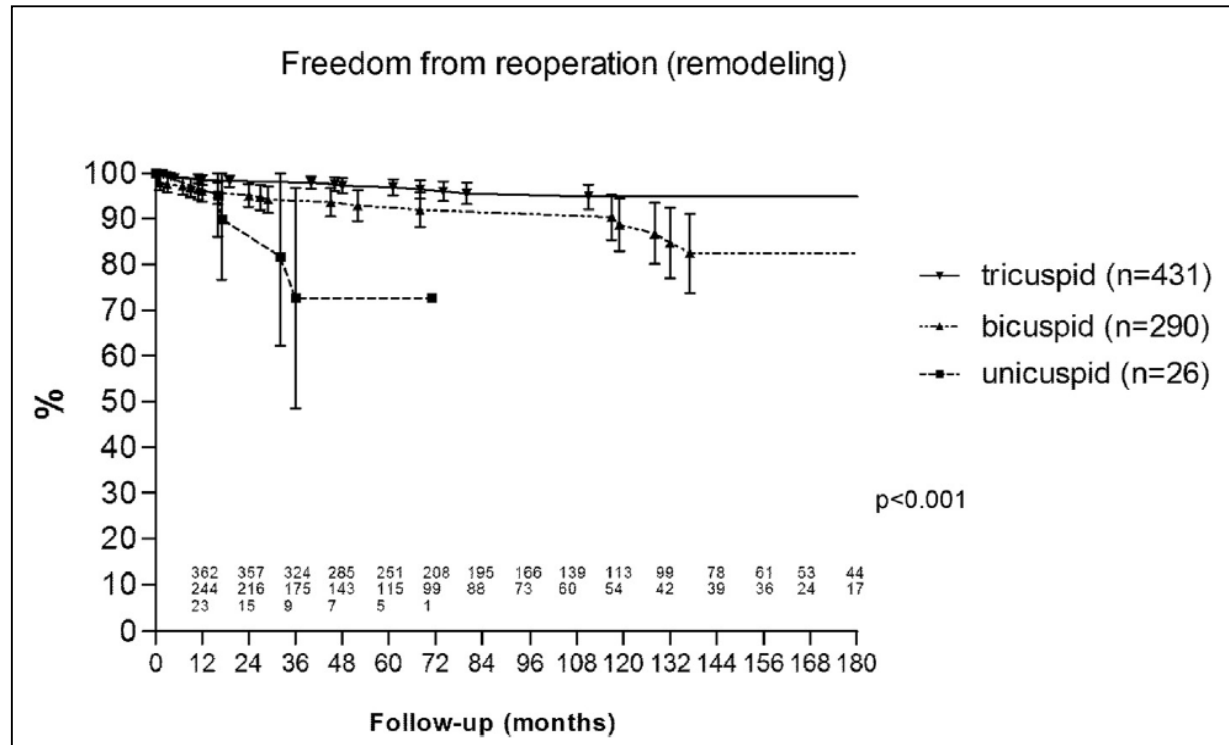


→ AV morphology is important!

Reexamining remodeling

TAV + BAV (UAV)

Hans-Joachim Schäfers, MD,^{a,c} Alexander Raddatz, MD,^b Wolfgang Schmied, Dipl Psych,^a
Hiroaki Takahashi, MD,^a Yujiro Miura, MD,^a Takashi Kunihara, MD,^a and Diana Aicher, MD^a

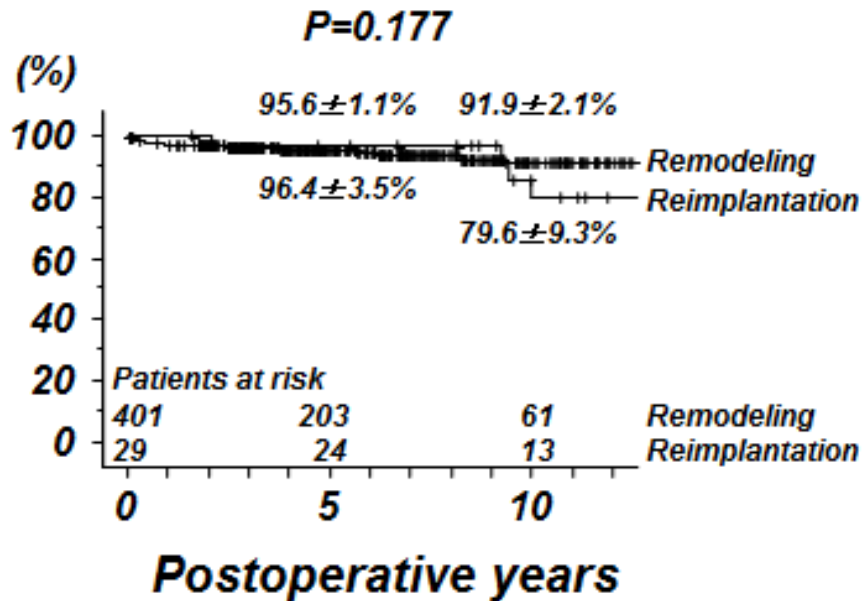


Preoperative aortic root geometry and postoperative cusp configuration primarily determine long-term outcome after valve-preserving aortic root repair

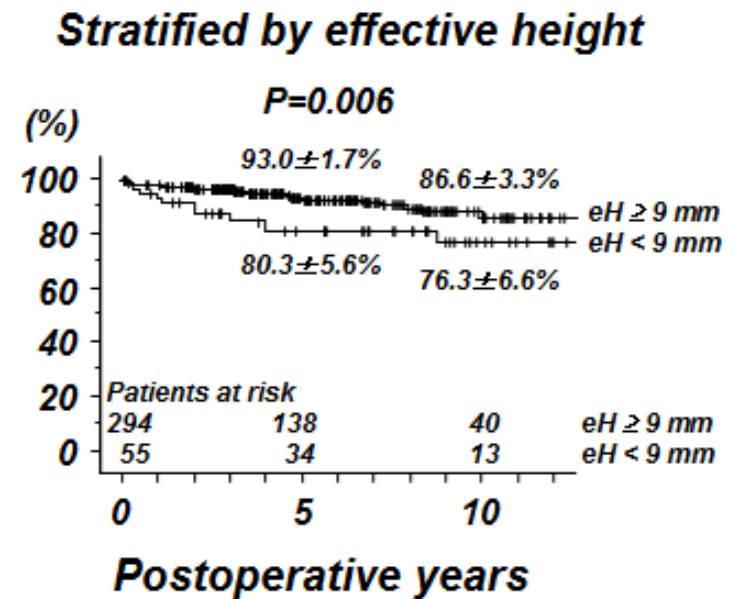
TAV + BAV

Takashi Kunihara, MD, PhD,^a Diana Aicher, MD,^a Svetlana Rodionycheva, MD,^a Heinrich-Volker Groesdonk, MD,^a Frank Langer, MD,^a Fumihiko Sata, MD, PhD,^b and Hans-Joachim Schäfers, MD, PhD^a

Freedom from Reoperation



Freedom from AR ≥ II



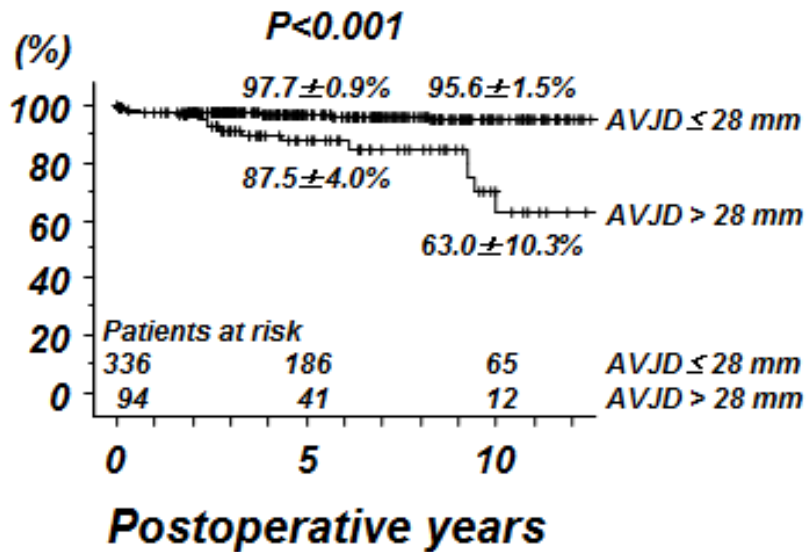
Preoperative aortic root geometry and postoperative cusp configuration primarily determine long-term outcome after valve-preserving aortic root repair

TAV + BAV

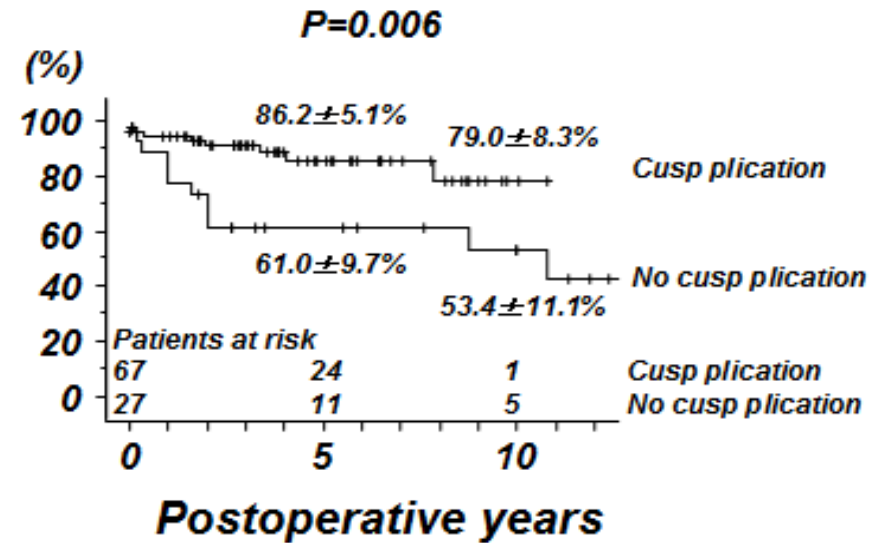
Takashi Kuniyama, MD, PhD,^a Diana Aicher, MD,^a Svetlana Rodioncheva, MD,^a Heinrich-Volker Groesdonk, MD,^a Frank Langer, MD,^a Fumihiko Sata, MD, PhD,^b and Hans-Joachim Schäfers, MD, PhD^a

Freedom from Reoperation

Stratified by annular diameter



Freedom from AR ≥ II in patients with annular diameter > 28mm



Preoperative aortic root geometry and postoperative cusp configuration primarily determine long-term outcome after valve-preserving aortic root repair

TAV + BAV

Takashi Kunihara, MD, PhD,^a Diana Aicher, MD,^a Svetlana Rodionycheva, MD,^a Heinrich-Volker Groesdonk, MD,^a Frank Langer, MD,^a Fumihiko Sata, MD, PhD,^b and Hans-Joachim Schäfers, MD, PhD^a

TABLE 1. Predictors of late aortic valve stability

	Univariate	Multivariate	HR	95% CI
	P value	P value		
AR grade ≥ II				
AVJ diameter > 28 mm	<.001	<.001	3.526	1.833–6.036
eH < 9 mm	<.001	<.001	3.354	1.857–6.060
STJ diameter	.025	.363		
Use of pericardial patch	.068	.071		
Concomitant CABG	.142	.177		
Reoperation				
AVJ diameter > 28 mm	<.001	<.001	5.676	2.281–11.300
Use of pericardial patch	.005	.022	3.815	1.208–12.048
eH < 9 mm	.042	.049	2.272	1.002–5.152
Body height	.115	.505		
Operative procedure	.177	.986		
Use of cusp plication	.188	.303		

Predictors of recurrent AR grade II or greater or reoperation on the aortic valve. HR, Hazard ratio; CI, confidential interval; eH, effective height; CABG, coronary artery bypass grafting.

AVJ > 28mm risk factor ?

or



AVJ indicator for large root (+ large cusps) which will prolapse after more reduction of root dimensions ?

Reexamining remodeling

TAV + BAV (UAV)

Hans-Joachim Schäfers, MD,^{a,c} Alexander Raddatz, MD,^b Wolfgang Schmied, Dipl Psych,^a Hiroaki Takahashi, MD,^a Yujiro Miura, MD,^a Takashi Kunihara, MD,^a and Diana Aicher, MD^a

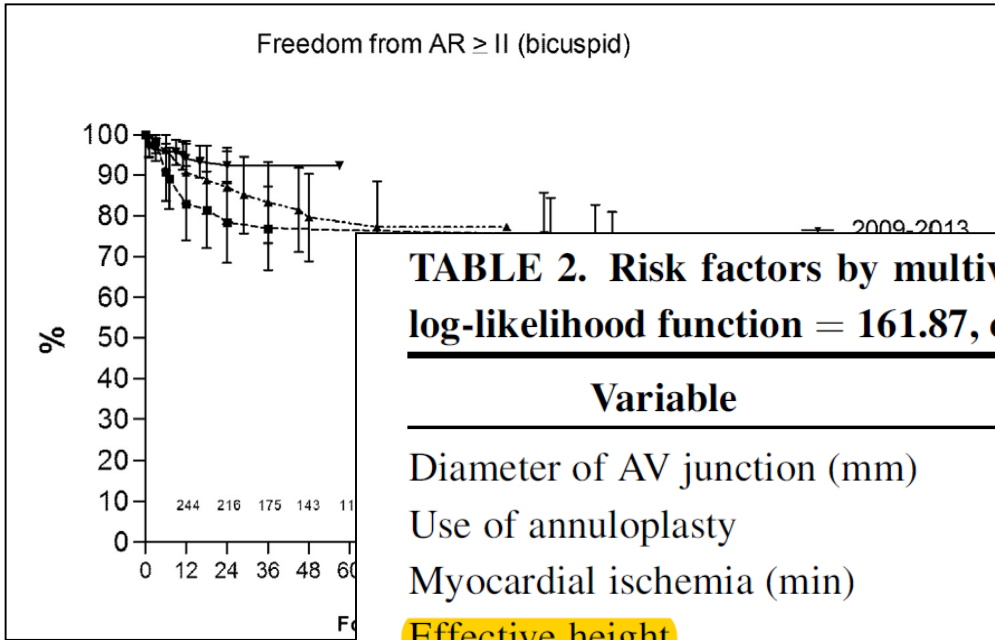
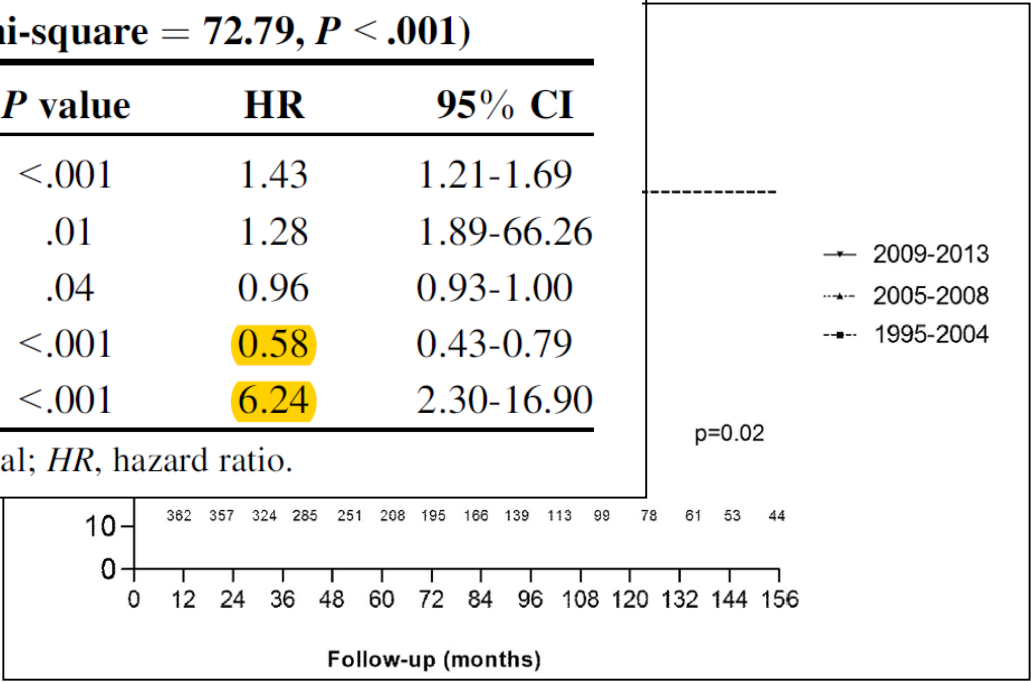


TABLE 2. Risk factors by multivariate Cox regression analysis (-2 log-likelihood function = 161.87, chi-square = 72.79, P < .001)

Variable	P value	HR	95% CI
Diameter of AV junction (mm)	<.001	1.43	1.21-1.69
Use of annuloplasty	.01	1.28	1.89-66.26
Myocardial ischemia (min)	.04	0.96	0.93-1.00
Effective height	<.001	0.58	0.43-0.79
Use of pericardial patch	<.001	6.24	2.30-16.90

AV, Aortoventricular; CI, confidence interval; HR, hazard ratio.



Two decades of experience with root remodeling and valve repair for bicuspid aortic valves



Ulrich Schneider, MD,^a Susanne K. Feldner, MD,^a Christopher Hofmann,^a Jakob Schöpe, MSc,^b Stefan Wagenpfeil, PhD,^b Christian Giebels, MD,^a and Hans-Joachim Schäfers, MD^a

TABLE 2. Competing risks regression models

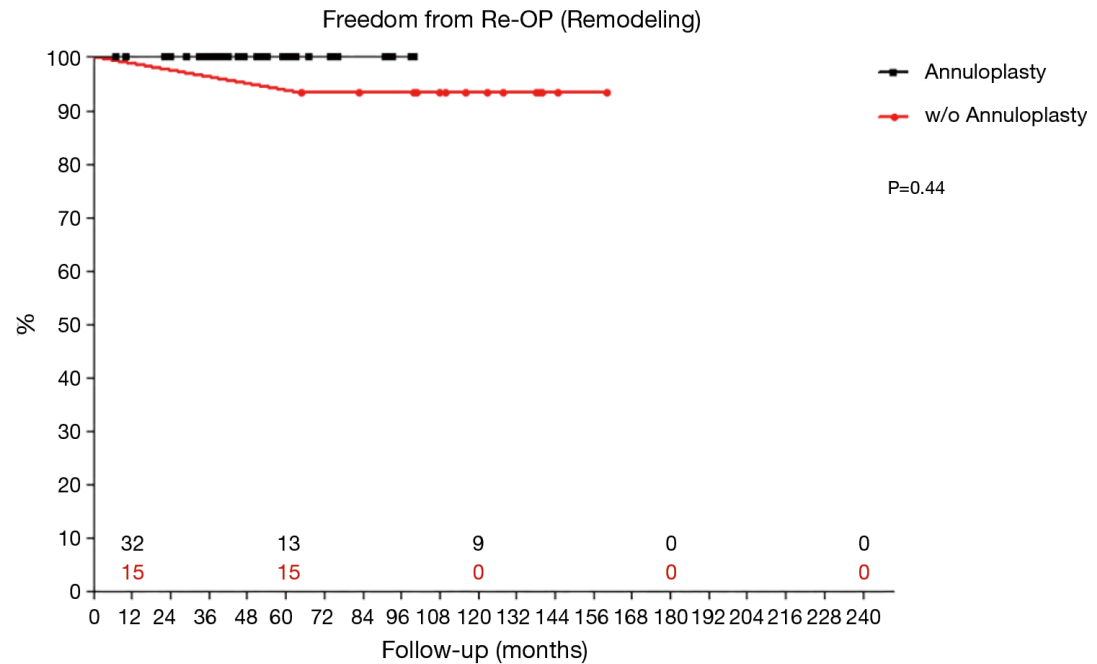
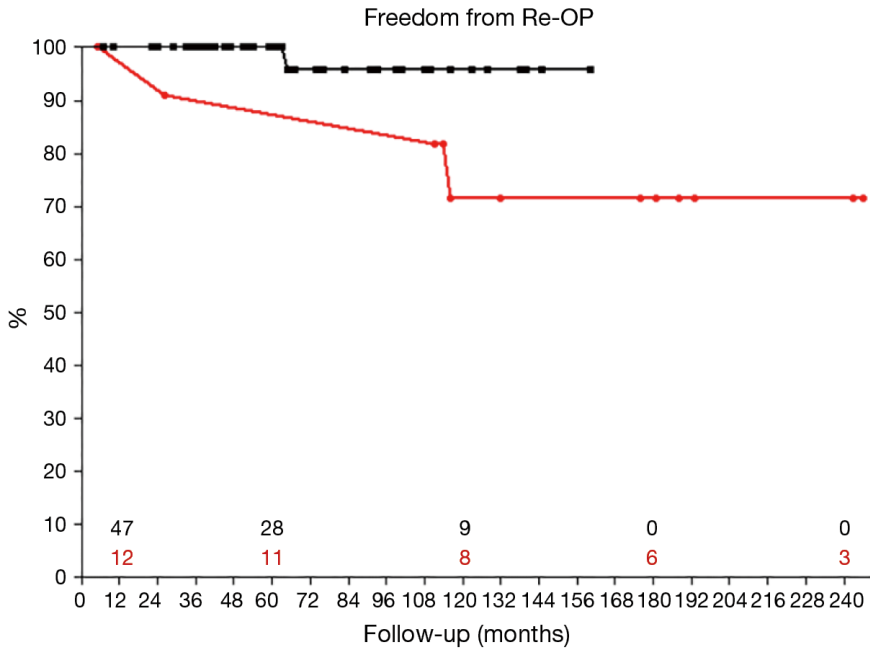
	Crude model			Adjusted model		
	Subdistributional HR	P value	95% CI	Subdistributional HR	P value	95% CI
Effective height measurement†	1.62	.240	0.73-3.63	1.23	.680	0.46-3.27
Aneurysm‡	0.49	.083	0.22-1.10	0.53	.130	0.24-1.20
Graft size§ (24 mm)	1.14	.760	0.49-2.65	1.22	.670	0.49-3.03
Graft size§ (28 mm)	1.58	.480	0.44-5.72	1.34	.690	0.32-5.65
Degree of fusion	0.59	.220	0.25-1.39	0.38	.034	0.15-0.93
Calcification¶	2.31	.030	1.08-4.94	4.34	.002	1.69-11.16
Pericardial Patch#	5.17	<.001	2.28-11.7	4.00	.002	1.65-9.66
Annuloplasty**	1.55	.300	0.68-3.52	1.21	.680	0.49-2.97

Competing Risks Regression Models (adjusted for age, calcification* [no/yes], degree of fusion* [no/yes], sex [male/female]). *Only when not considered as investigated independent variable. Bold values indicate statistical significance. HR, Hazard ratio; CI, confidence interval. †Reference group: no effective height measurement. ‡Reference group: AR. §Reference group: graft size (26 mm). ||Reference group: partial. ¶Reference group: no calcification. #Reference group: no pericardial patch. **Reference group: no annuloplasty.



Valve-sparing aortic root replacement in patients with Marfan syndrome—the Homburg experience

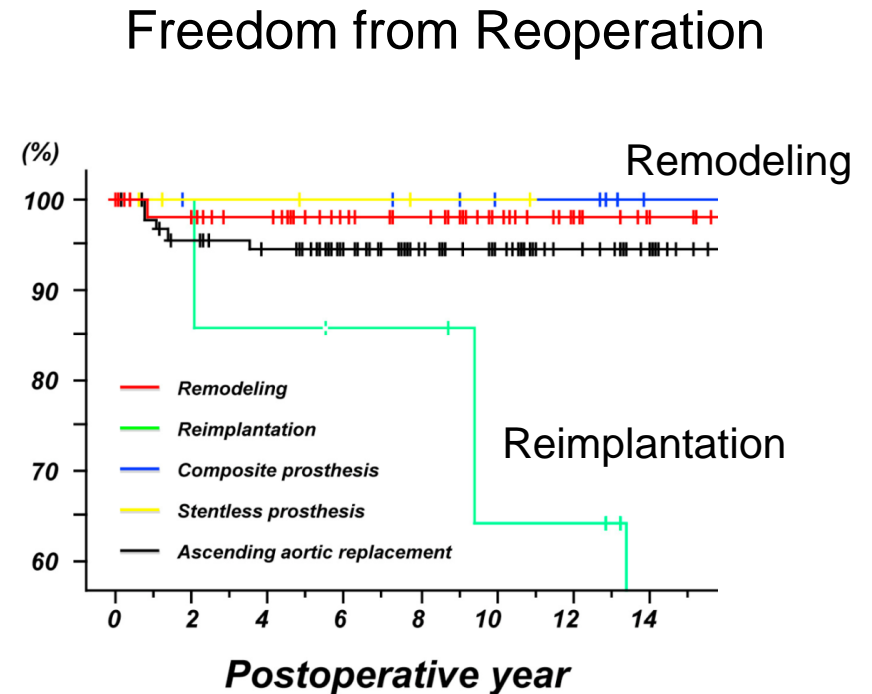
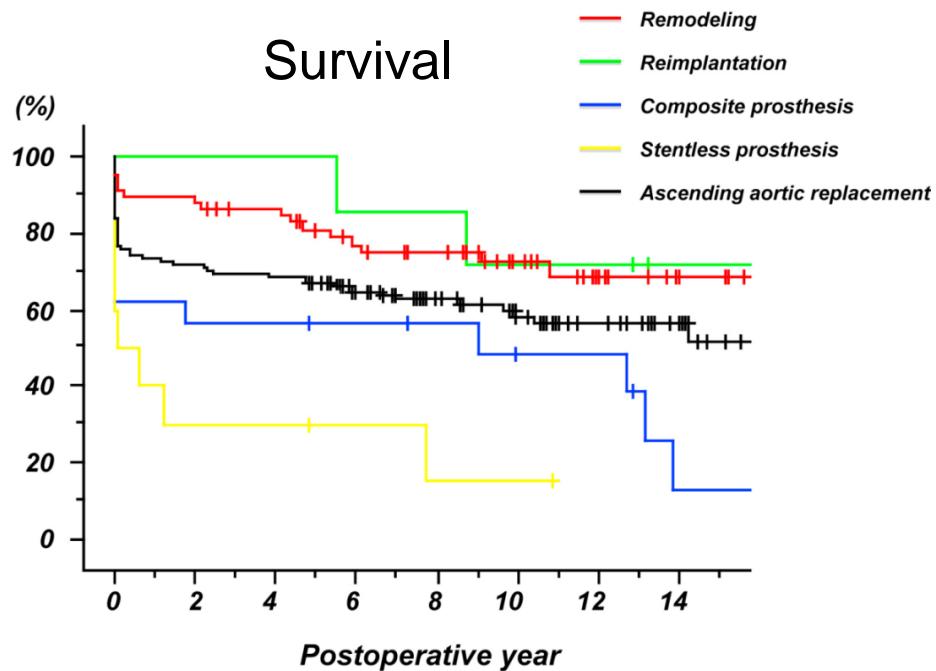
Ulrich Schneider, Tristan Ehrlich, Irem Karliova, Christian Giebels, Hans-Joachim Schäfers



VPS for preexistent root dilatation in AADA

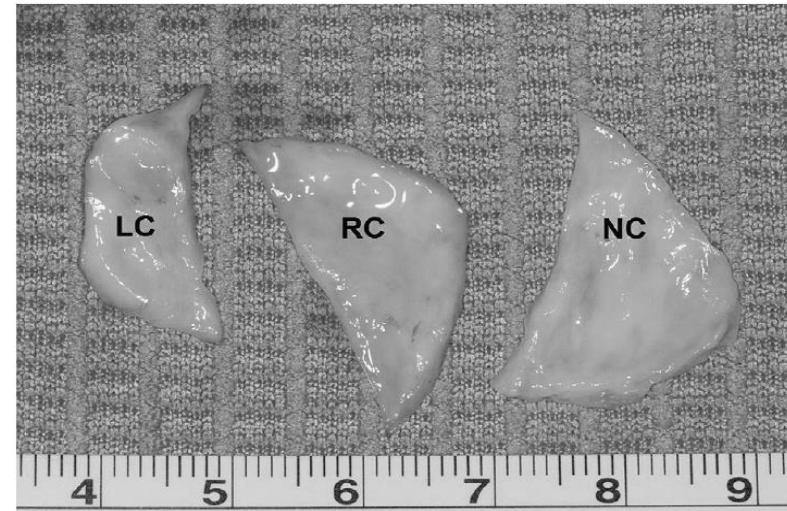
Aortic root remodeling leads to good valve stability in acute aortic dissection and preexistent root dilatation

Takashi Kuniyama, MD, PhD, Niklas Neumann, MD, Steffen Daniel Kriechbaum, MD, Diana Aicher, MD, and Hans-Joachim Schäfers, MD, PhD



Causes and management of aortic valve regurgitation after aortic valve reimplantation

Christian Giebels, MD, Diana Aicher, MD, Takashi Kuniyama, MD, PhD, Svetlana Rodionycheva, MD, Wolfram Schmied, Dipl Psych, and Hans-Joachim Schäfers, MD



Failure after Reimplantation

early – generalized cusp prolapse due to low commissural height

late – cusp retraction

Failures of Valve-sparing Aortic Root Replacement Using the Root Remodeling Technique

Christian Giebels, MD, Julia-Carolin Fister, MD, Tristan Ehrlich, MD, Jan Federspiel, MD, and Hans-Joachim Schäfers, MD

TABLE 2 Main Indications for Reoperation and Modes of Valve Failure

Indications and Failure Modes	All (n = 54)	TAV (n = 23)	BAV (n = 26)	UAV (n = 5)
Indication for reoperation				
Regurgitation	39 (72.2)	19 (82.6)	15 (57.7)	5 (100.0)
Endocarditis	7 (13.0)	4 (17.4)	3 (11.5)	...
Stenosis	6 (11.1)	...	6 (23.1)	...
VSD	2 (3.7)	...	2 (7.7)	...
Modes of valve failure				
Patch dehiscence	16 (29.6)	...	12 (46.2)	4 (80.0)
Cusp prolapse	14 (25.9)	12 (52.2)	2 (7.7)	...
Retraction	8 (14.8)	7 (30.4)	1 (3.8)	...
Endocarditis	7 (13.0)	4 (17.4)	3 (11.5)	...
Aortic stenosis	6 (11.1)	...	6 (23.1)	...
VSD caused by erosion	2 (3.7)	...	2 (7.7)	...
Unrecognized UAV	1 (1.9)	1 (20.0)

Dichotomous variables are n (%). BAV, bicuspid aortic valve; TAV, tricuspid aortic valve; UAV, unicuspid aortic valve; VSD, ventricular septal defect.

No (isolated) annular dilatation!!

Cusp related failure >95%

Patch-related failure in 30% (BAV and UAV)

Only 1 recurrent/persistent prolapse p 2004!

Conclusions

STJ remodeling is a good option in patients with preserved sinus dimensions.

Valve stability after root remodeling and reimplantation are identical – even in Marfan patients.

Additional cusp repair improves long-term results.

Root remodeling can preserve the aortic valve with excellent long-term stability also in aortic dissection and root dilatation.



Thank you for your Attention!