

Concepts of BAV Repair

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Background

- Bicuspid aortic valve is the most common congenital heart failure (1-2%)¹
- Patients with BAV suffer from different pathologies²
- Aortic aneurysm (50%)³
- Aortic stenosis (40-50 years, 65%)⁴
- Aortic regurgitation (30-40 years, 35%)⁴

1. Roberts WC: The congenitally bicuspid aortic valve. Am J Cardiol. 1970

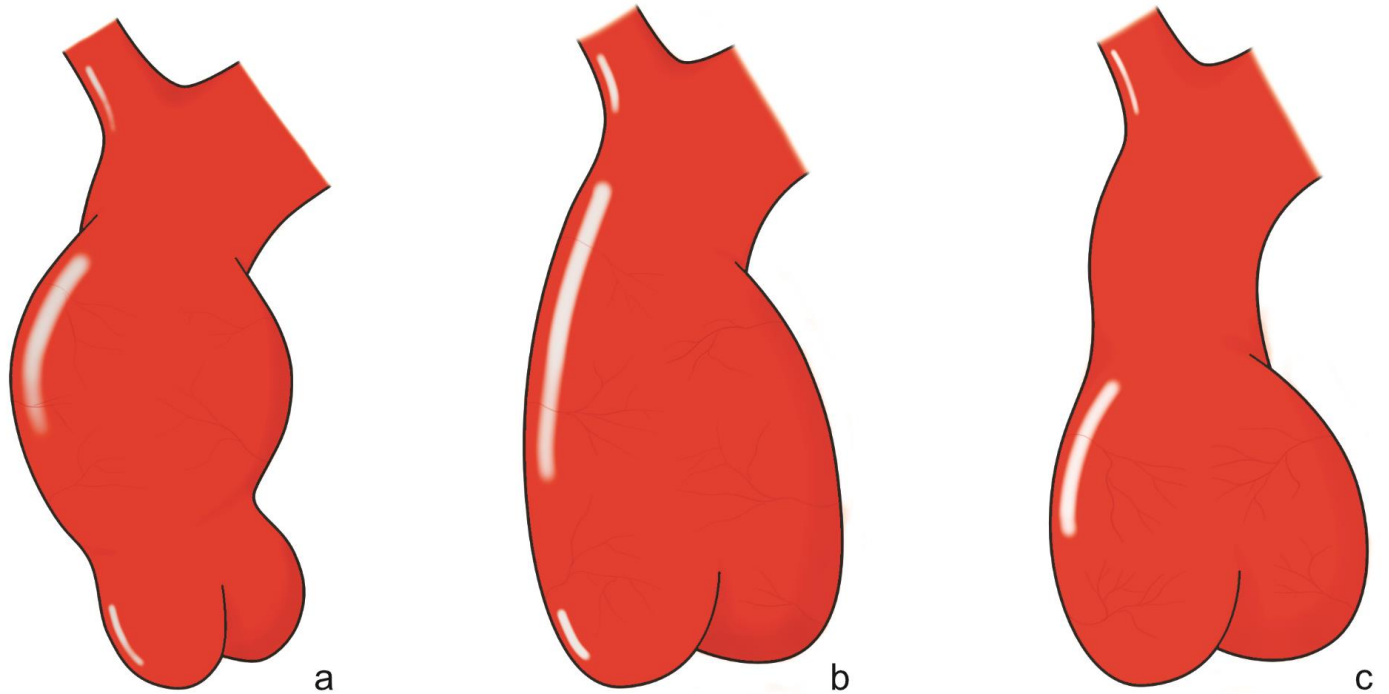
2. Michelena HI, Khanna AD, Mahoney D, et al.: Incidence of Aortic Complications in Patients With Bicuspid Aortic Valves. JAMA. 2011

3. Nistri S, Sorbo MD, Marin M, Palisi M et al.: Aortic root dilatation in young men with normally functioning bicuspid aortic valves. Heart. 1999

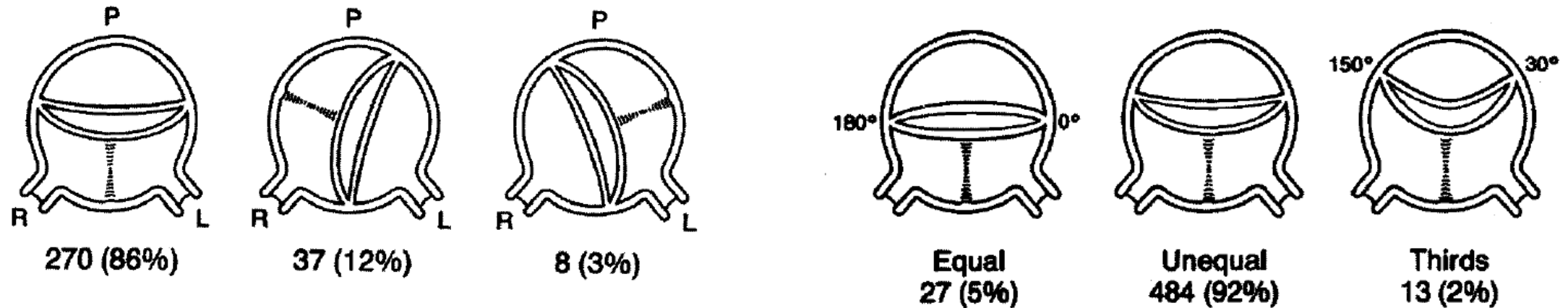
4. Michelena HI, Prakash SK, Della Corte A, et al.: Bicuspid Aortic Valve: Identifying Knowledge Gaps and Rising to the Challenge From the International Bicuspid Aortic Valve Consortium (BAVCon). Circulation 2014

Phenotypes of BAV associated Aneurysms

- a) ascending type (70%)
- b) combined (?)
- c) root type (25%)



BAV Anatomy is variable



First Steps

J THORAC CARDIOVASC SURG 1991;102:571-7

Valvuloplasty for aortic insufficiency

Twenty-eight consecutive patients underwent aortic valvuloplasty for aortic insufficiency caused by leaflet prolapse. The technique involved triangular resection of the free edge of the prolapsing leaflet, annular plication at the commissure, and resection of a raphe when present in bicuspid valves. Mean age of the patients was 46.8 ± 14.4 years. Twenty-six (92.7%) were male. Seventy-five percent of the patients had a bicuspid aortic valve; the remaining valves were tricuspid. The extent of aortic insufficiency was 3.6 ± 0.8 by aortography, 3.1 ± 0.1 by preoperative Doppler echocardiography, and 3.4 ± 0.7 by intraoperative Doppler echocardiography. The amount of aortic insufficiency decreased from 3.4 ± 0.7 to 0.6 ± 0.5 intraoperatively, immediately after repair ($p < 0.001$). Mean transvalvular gradient by echocardiography was 12.9 ± 6.8 mm Hg. There was one death in a patient who had an intraoperative cerebral vascular accident. Mean follow-up was complete at 6.9 months. One patient had a cerebral vascular accident and one patient required reoperation for recurrent aortic insufficiency caused by partial suture line dehiscence. In 15 patients with late echocardiograms, aortic insufficiency did not progress (0.7 ± 0.6 in the hospital and 0.8 ± 0.5 late). Aortic valve repair for aortic cusp prolapse effectively eliminates aortic insufficiency without causing aortic stenosis. At early follow-up the repair has been stable.

- 75% bicuspid
- Short follow-up (6.9 months)
- Repair of the fused cusp
- Subcommissural annuloplasty

Delos M. Cosgrove, MD, Eliot R. Rosenkranz, MD (by invitation),
William G. Hendren, MD (by invitation), James C. Bartlett, DO^a (by invitation), and
William J. Stewart, MD^a (by invitation), *Cleveland, Ohio*

Intermediate-term durability of bicuspid aortic valve repair for prolapsing leaflet¹

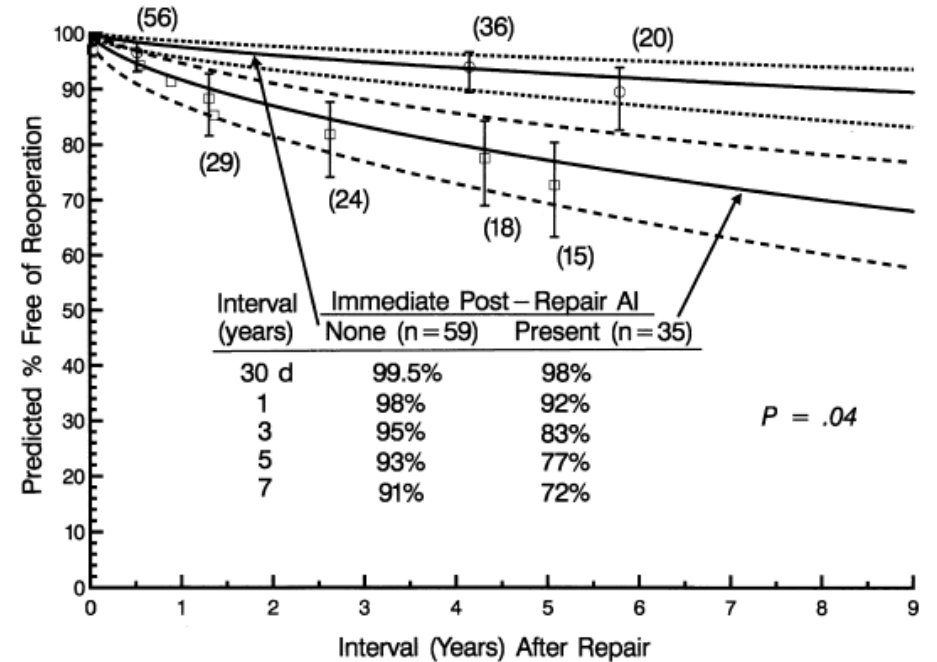
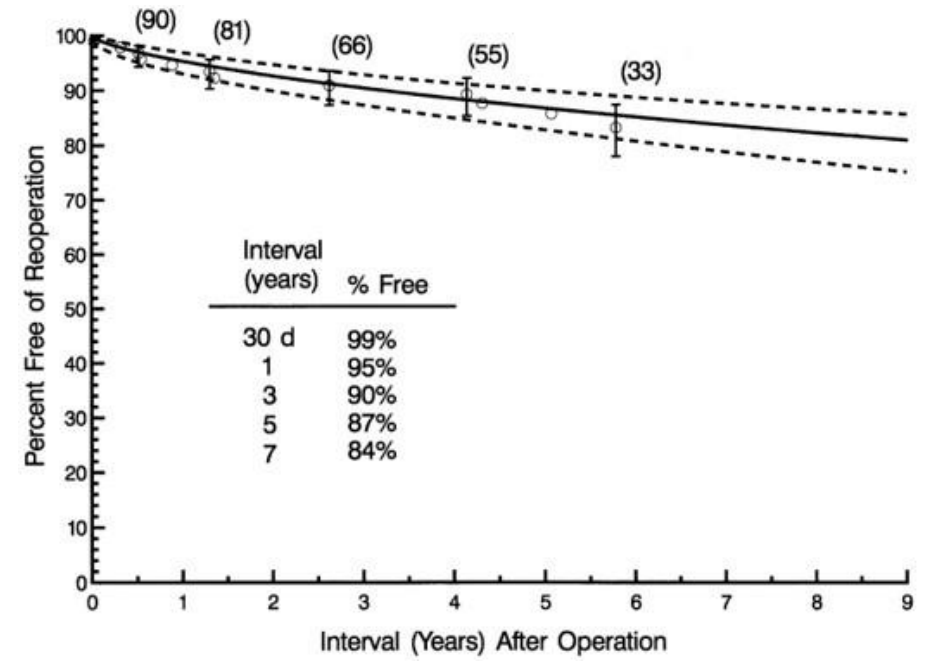
Filip P. Casselman^a, A. Marc Gillinov^a, Rami Akhrass^a, Vigneshwar Kasirajan^a, Eugene H. Blackstone^{a,b}, Delos M. Cosgrove^{a,*}

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- Underestimated aortic pathology?
- Non-fused cusp repair?



Remodeling of the Aortic Root and Reconstruction of the Bicuspid Aortic Valve

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Department of Thoracic and Cardiovascular Surgery, University Hospitals Homburg, Homburg, Germany

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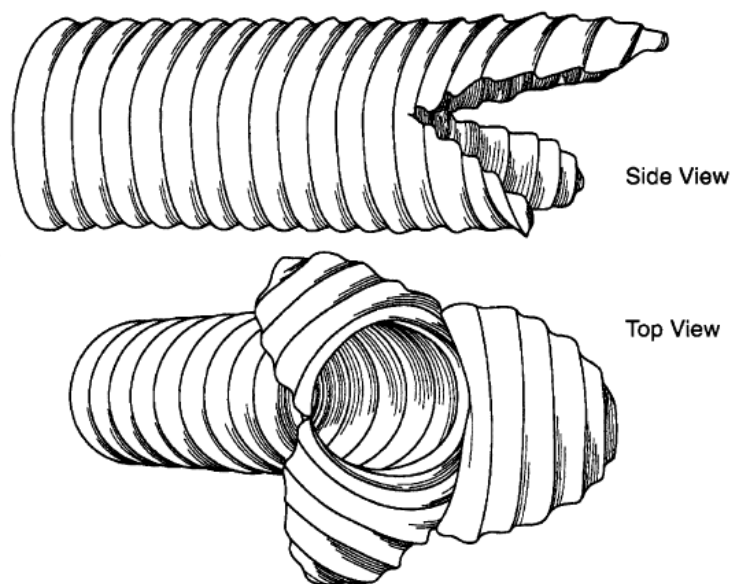


Table 2. Operative Data of Current Patient Cohort

Patient No.	Initials	ECC Time (min)	Cross-Clamp Time (min)	Type Valve Repair	AV Diameter (mm)	Size Graft (mm)	Degree Postop AR
1	M.H.	112	94	Plication	26	24	0
2	J.M.	114	81	Plication	28	28	0
3	M.B.	120	85	Plication	28	28	0
4	B.H.	75	56	Plication	25	24	I
5	G.A.	218	68	Plication	27	26	0
6	H.D.	95	72	Plication	27	26	0
7	A.B.	182	132	Plication	26	24	0
8	E.W.	104	75	Plication	24	24	0
9	E.S.	98	79	Plication	25	26	I
10	A.O.	119	82	Triang. resection	26	26	0
11	O.H.	110	78	Plication	27	26	0
12	K.S.	109	89	Triang. resection	27	26	0
13	J.R.	98	77	Triang. resection	26	24	I
14	G.W.	106	80	Triang. resection	27	26	I
15	R.W.	120	73	Plication	28	26	0
16	F.P.	94	77	Plication	28	26	0

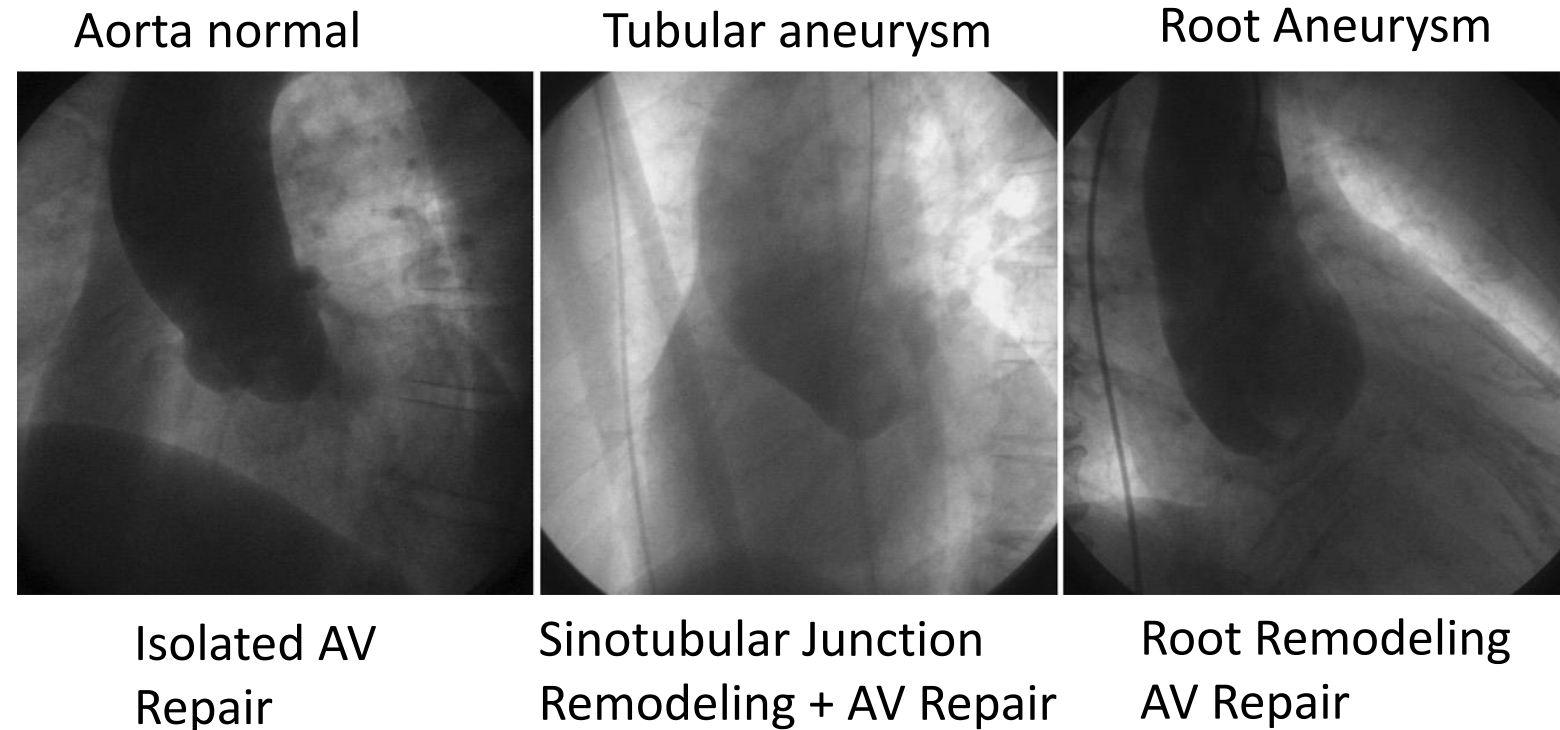
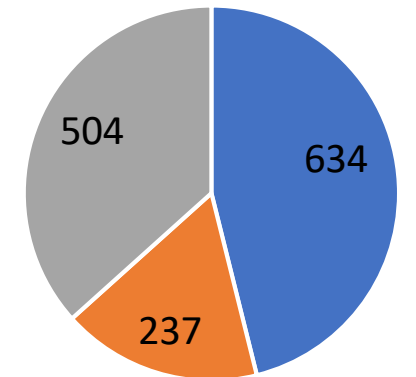
AR = aortic regurgitation; AV = aortoventricular junction; ECC = extracorporeal circulation.

Preservation of the Bicuspid Aortic Valve

Hans-Joachim Schäfers, MD, PhD, Diana Aicher, MD, Frank Langer, MD,
and Henning F. Lausberg, MD

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

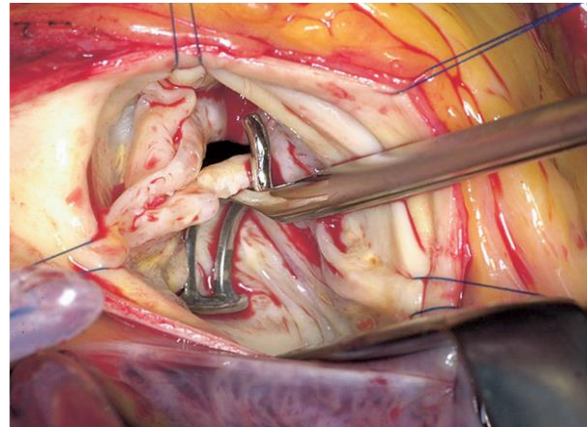
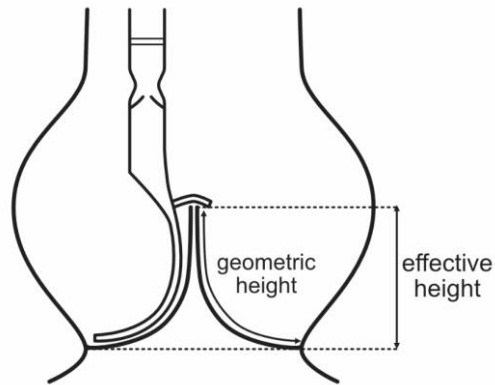
Homburg Experience
1995-2022
n=1375



A new approach to the assessment of aortic cusp geometry

Hans-Joachim Schäfers, MD, PhD, Benjamin Bierbach, MD, and Diana Aicher, MD, Homburg/Saar, Germany

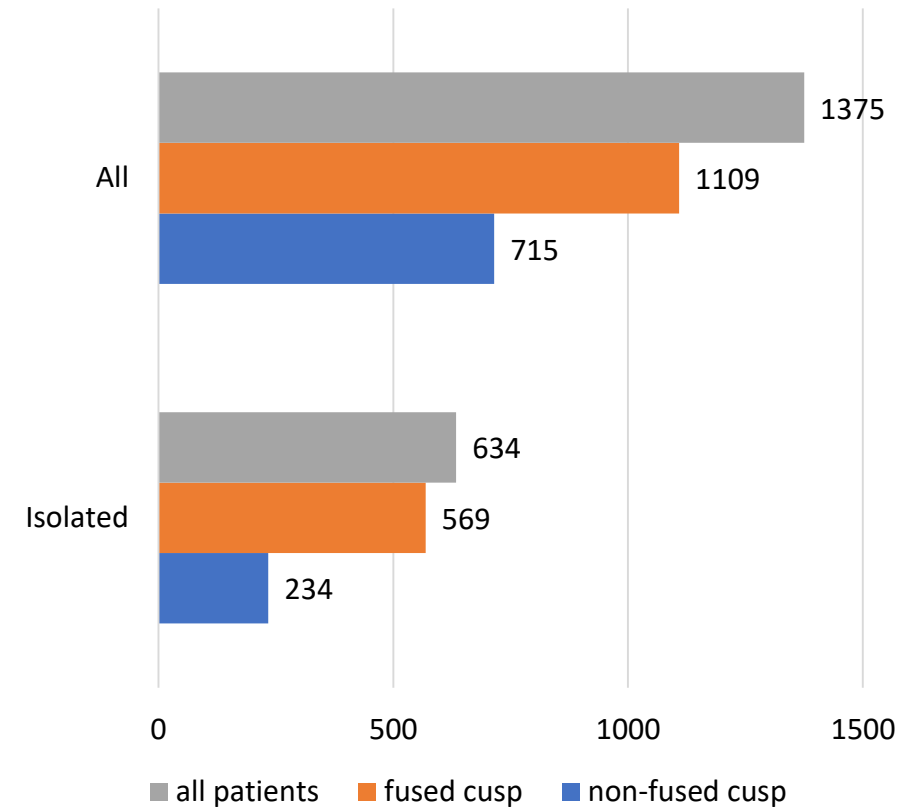
The Journal of Thoracic and Cardiovascular Surgery • August 2006



Assessment of the non-fused cusp for prolapse

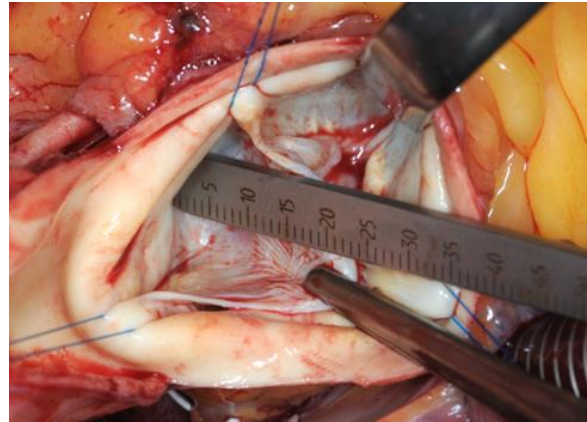
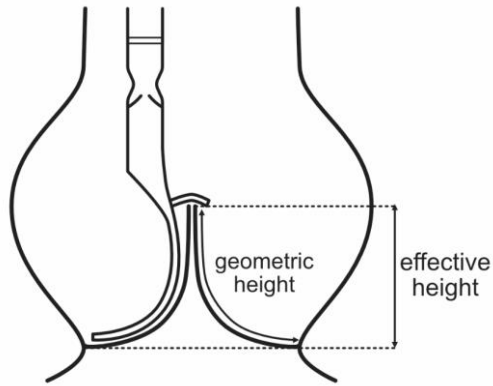
Use the correct(ed) non-fused cusp as reference for fused cusp repair

Homburg Experience
1995-2022
n=1375



Cusp height in aortic valves

Hans-Joachim Schäfers, MD,^a Wolfram Schmied, Dipl Psych,^a Gil Marom, MSc,^b and Diana Aicher, MD^a

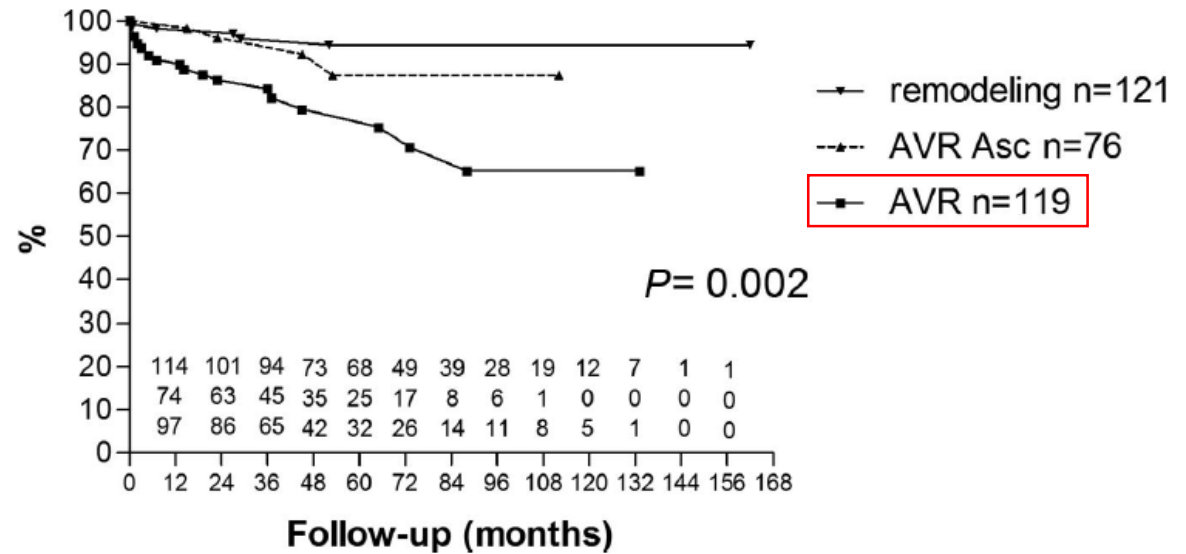
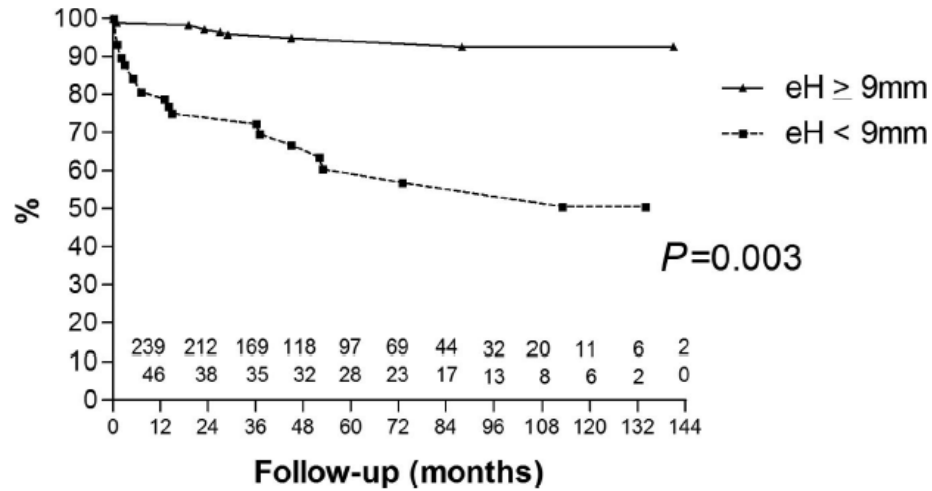


geometric height of the non-fused cusp less than 20mm indicates a cusp retraction

Normal geometric height ranges between 23-24mm

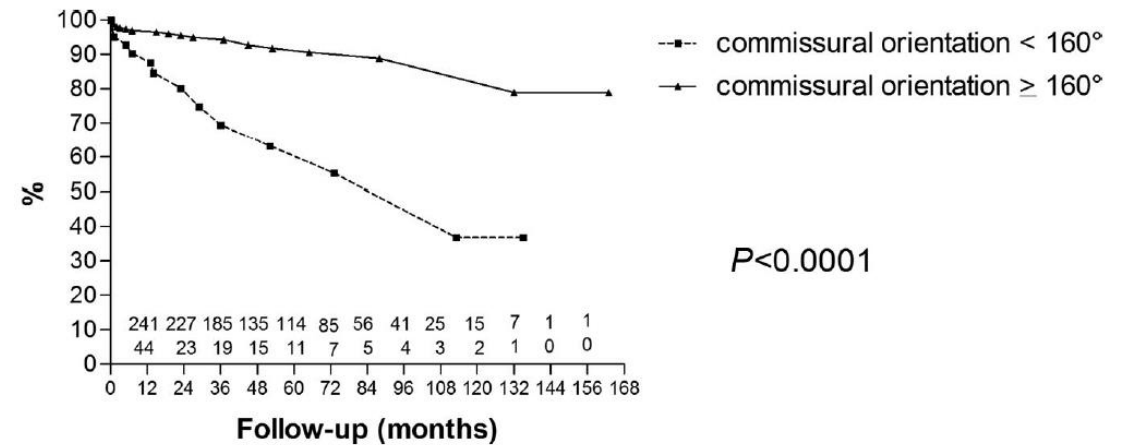
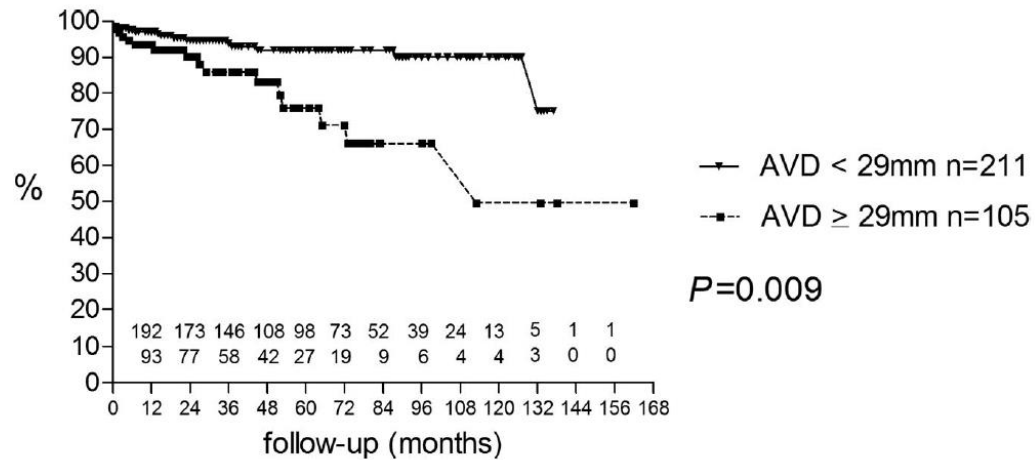
Valve Configuration Determines Long-Term Results After Repair of the Bicuspid Aortic Valve

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



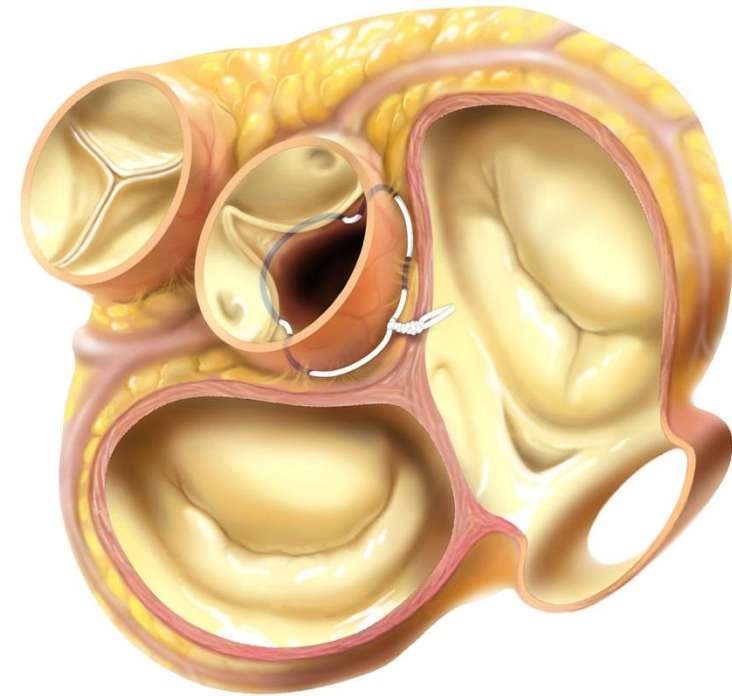
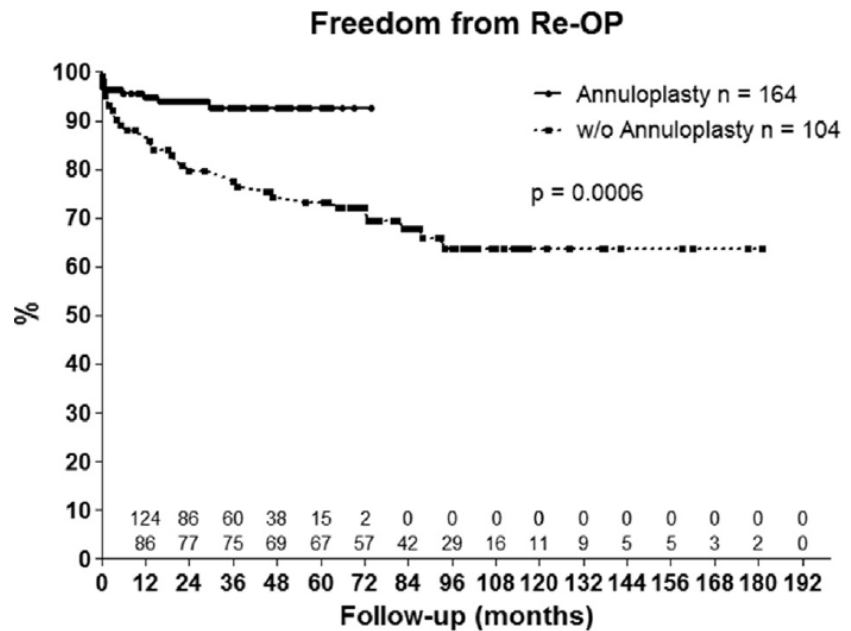
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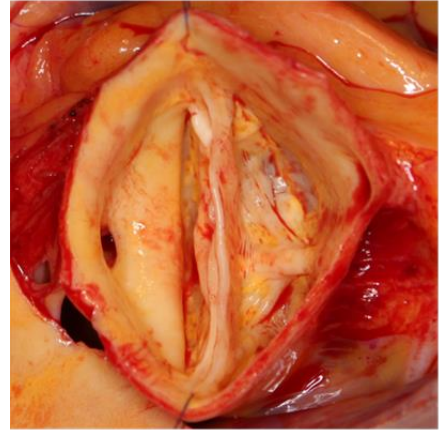
Suture Annuloplasty Significantly Improves the Durability of Bicuspid Aortic Valve Repair

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

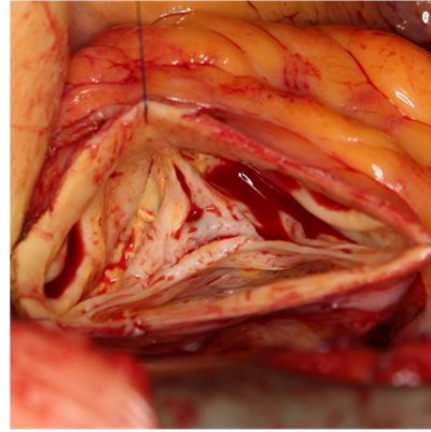
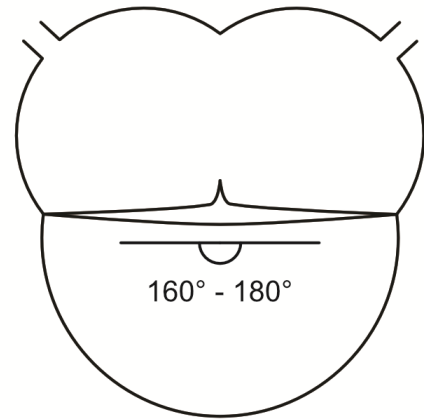


Diana Aicher, Ulrich Schneider, Wolfram Schmied, Takashi Kuniyama, Masato Tochii, Hans-Joachim Schäfers. Early results with annular support in reconstruction of the bicuspid aortic valve. J Thorac Cardiovasc Surg. 2012

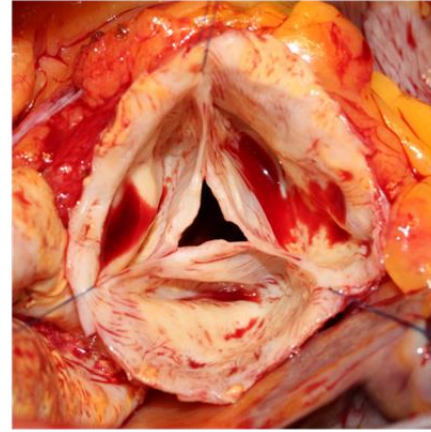
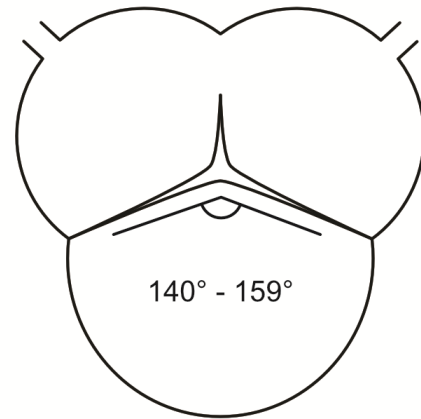
BAV Anatomy is Variable



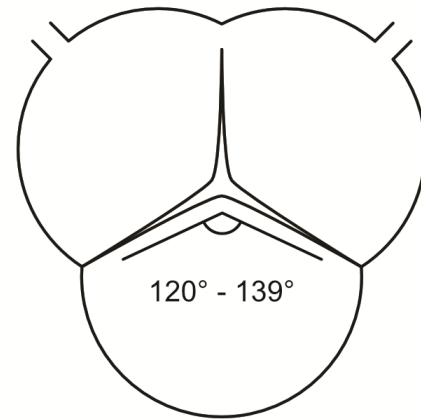
Type A 40%



Type B 40%

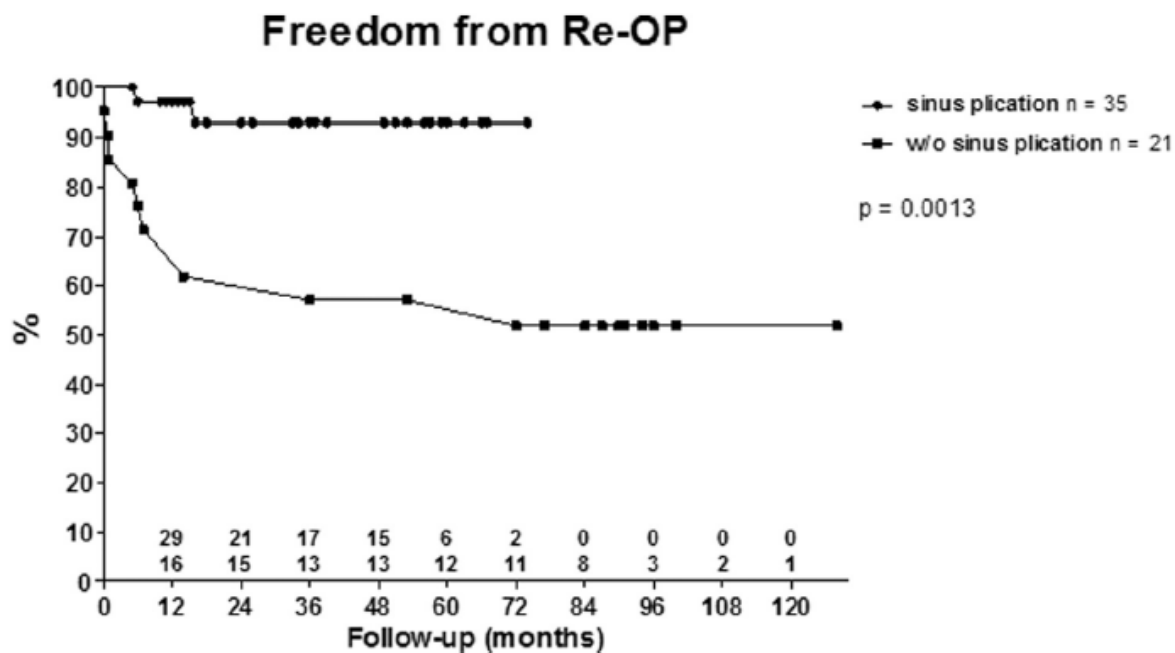
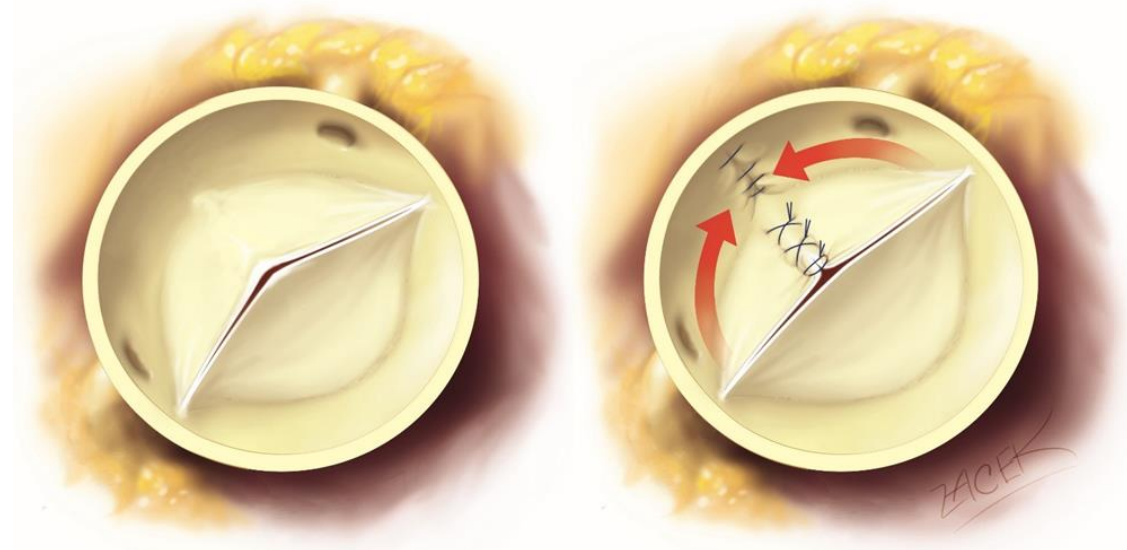


Type C 20%



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

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



Ehrlich T, de Kerchove L, Vojacek J, Boodhwani M, El-Hamamsy I, De Paulis R, et al. State-of-the-art bicuspid aortic valve repair in 2020. Prog Cardiovasc Dis. 2020

At discharge the mean peak transvalvular gradient in the study group was 14.3 ± 6.5 mm Hg, and it was 28.9 ± 18.5 mm Hg in the control group ($p = 0.003$).

Steps of BAV Repair

- Management of aortic pathology
- Selection of adequate substrate (gH)
- Cusp configuration (eH)
- Annuloplasty
- Sinus Plication for asymmetric BAV

➡ Differentiated Anatomic Reconstruction of BAVs

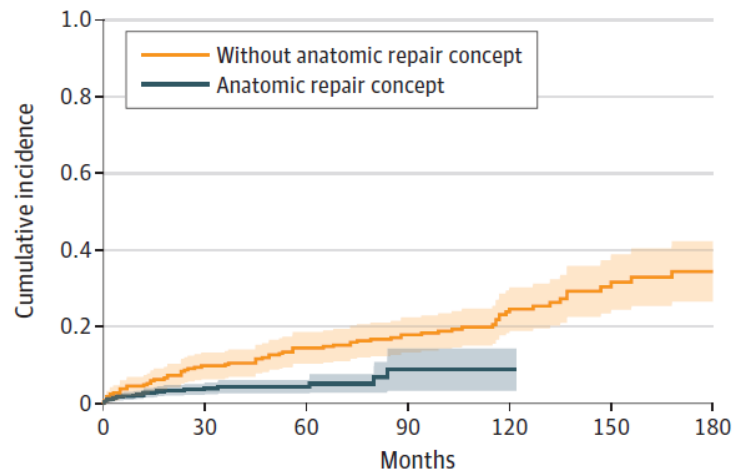
Reconstruction of Bicuspid Aortic Valves

JAMA Cardiology | Original Investigation

Long-term Results of Differentiated Anatomic Reconstruction of Bicuspid Aortic Valves

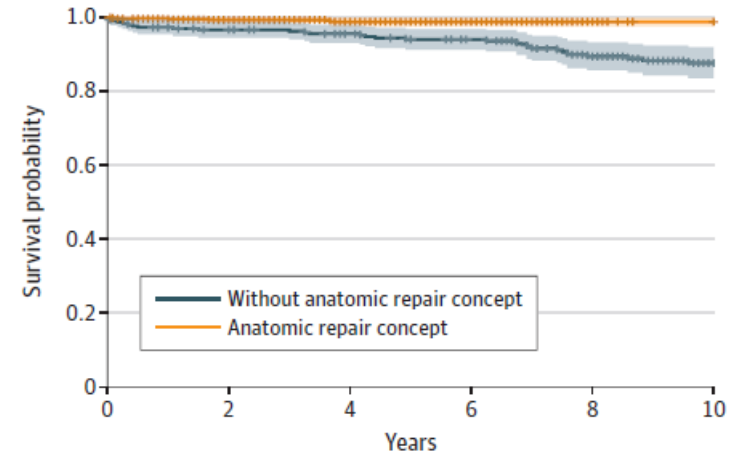
Ulrich Schneider, MD; Christopher Hofmann, MD; Jakob Schöpe, MSc; Ann-Kristin Niewald, BSc; Christian Giebels, MD; Irem Karliova, MD; Hans-Joachim Schäfers, MD

A Cumulative incidence of reoperation after BAV repair



No. at risk	0	30	60	90	120	150	180
Without anatomic repair concept	296	253	235	204	120	75	58
Anatomic repair concept	726	278	126	33	13		

B Survival of study population

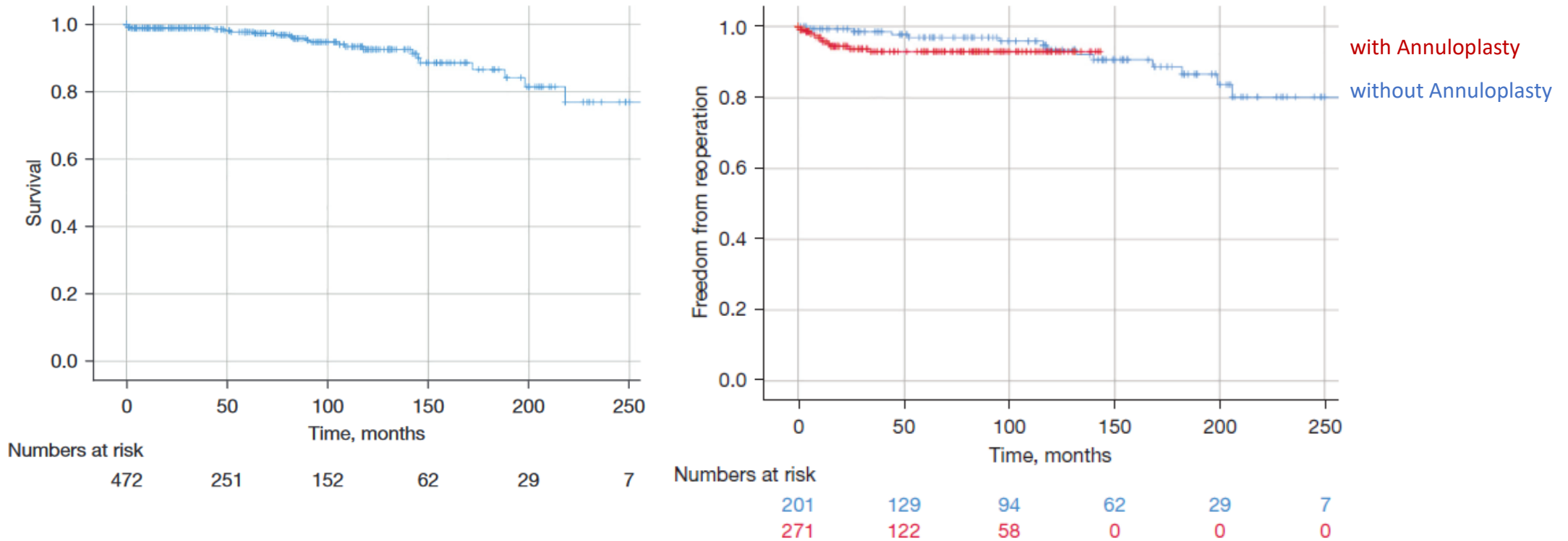


No. at risk	0	2	4	6	8	10
Without anatomic repair concept	297	272	258	243	190	113
Anatomic repair concept	727	491	172	80	18	7

Interestingly, ...

Twenty-five years' experience with root remodeling and bicuspid aortic valve repair

Lennart Froede, Karen B. Abeln, Tristan Ehrlich, Susanne K. Feldner, Hans-Joachim Schäfers



Conclusion

- Aortic root pathologies in BAV have to be addressed
- Symmetric prolapse (involving non-fused cusp) is common and must be addressed
- Asymmetric valve configuration is a predictor for failure. It can be corrected by altering the commissural orientation (root replacement, sinus plication)
- Annular dilation is common and must be treated with an annuloplasty (in isolated BAV repair)

➡ excellent long-term repair results