Why and When to Repair the Aortic Valve?

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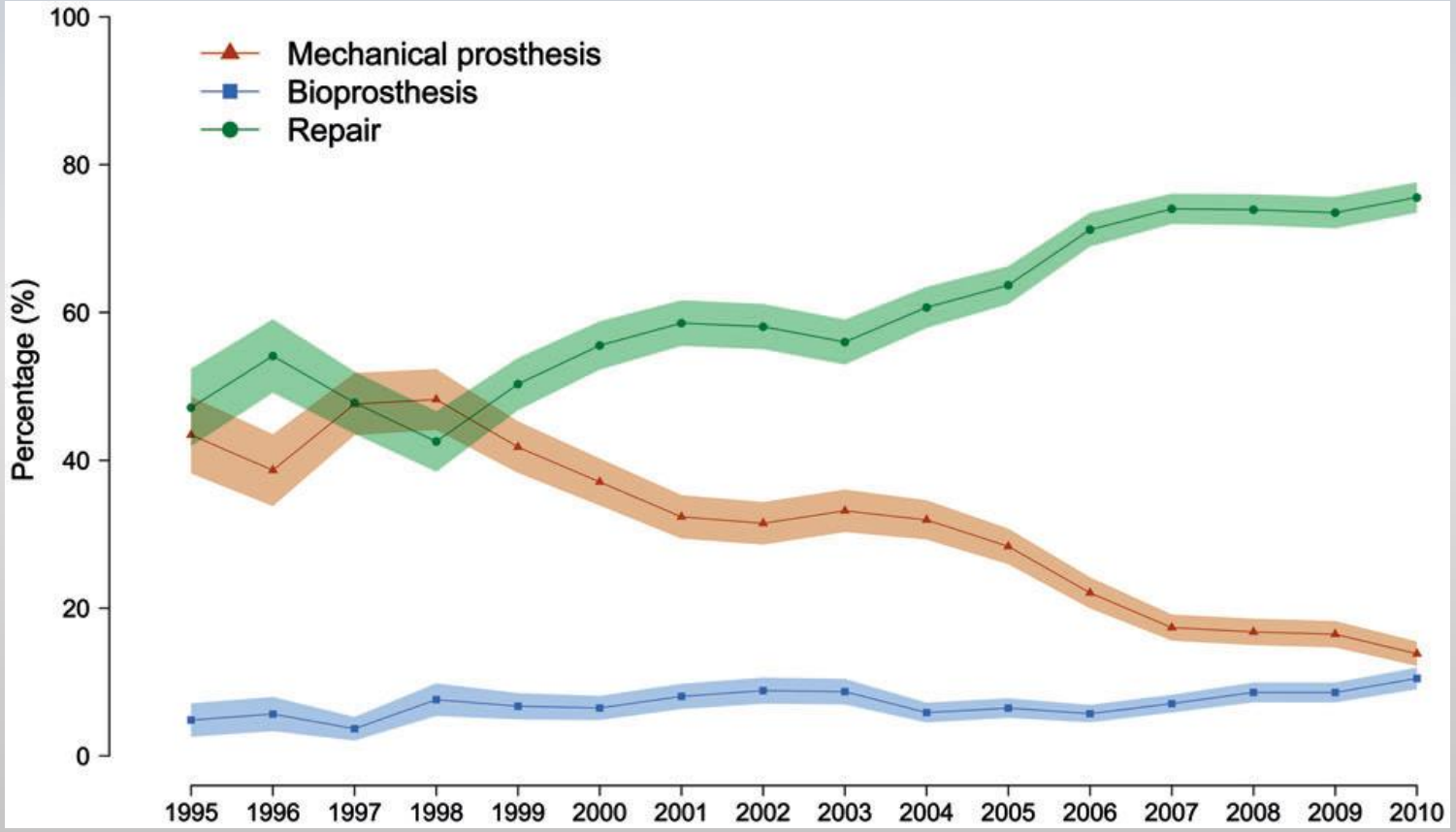
Homburg, September, 2017

The Chaim Sheba Medical Center at Tel Hashomer · Est. 1948 · The Hospital of Israel

The Leviev Heart Center

Mitral Surgery



Comment

Under-use of the Ross operation—a lost opportunity

*Magdi H Yacoub, Ismail El-Hamamsy, Hans-Hinrich Sievers, Blase A Carabello, Robert O Bonow, Paul Stelzer, Francisco D A da Costa, Hans J Schäfers, Peter Skillington, Efstratios I Charitos, Giovanni Battista Luciani, Johanna J M Takkenberg

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We declare no competing interests.

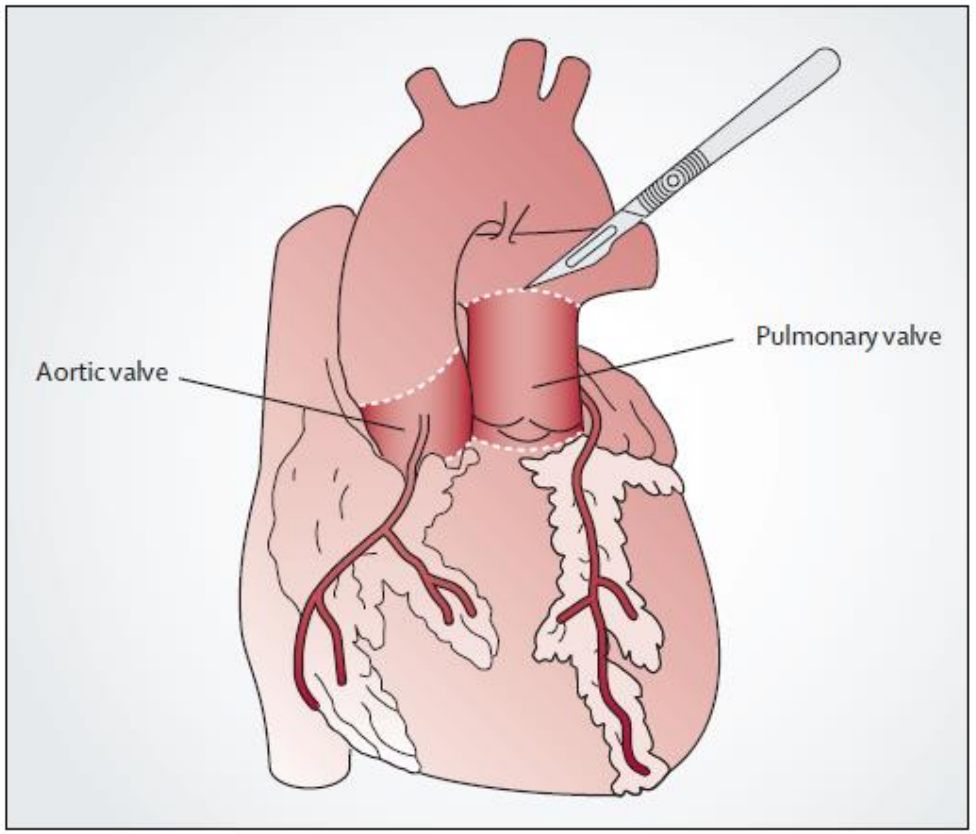


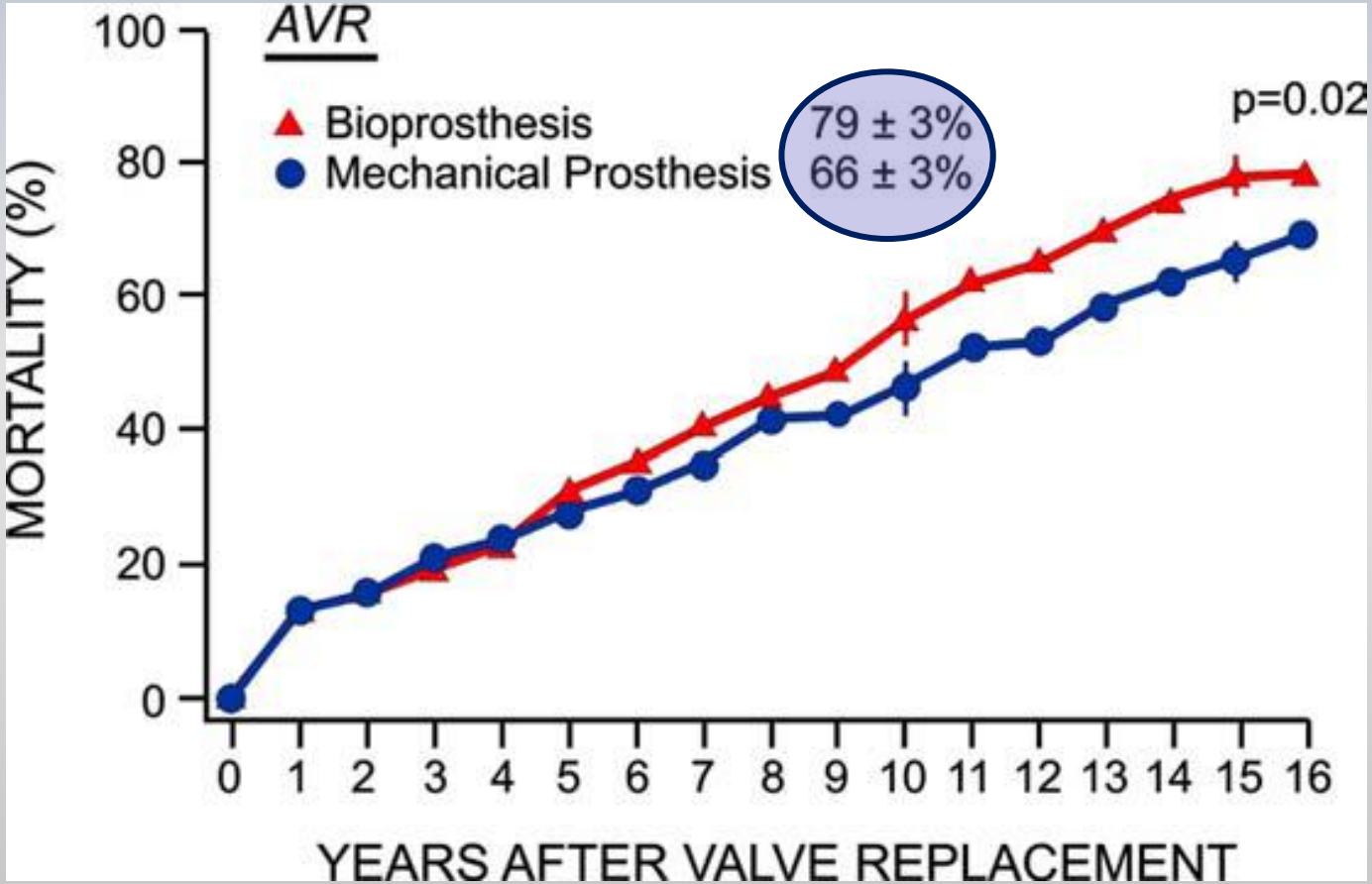
Figure: **The Ross procedure**
The patient's own pulmonary valve is used to replace the diseased aortic valve and a pulmonary homograft is inserted in the right ventricular outflow.

CONVENTIONAL AVR

SEVERAL ADVANTAGES

- Reproductible
- Short operative times
- Prosthesis durability can be anticipated
- Long-term data

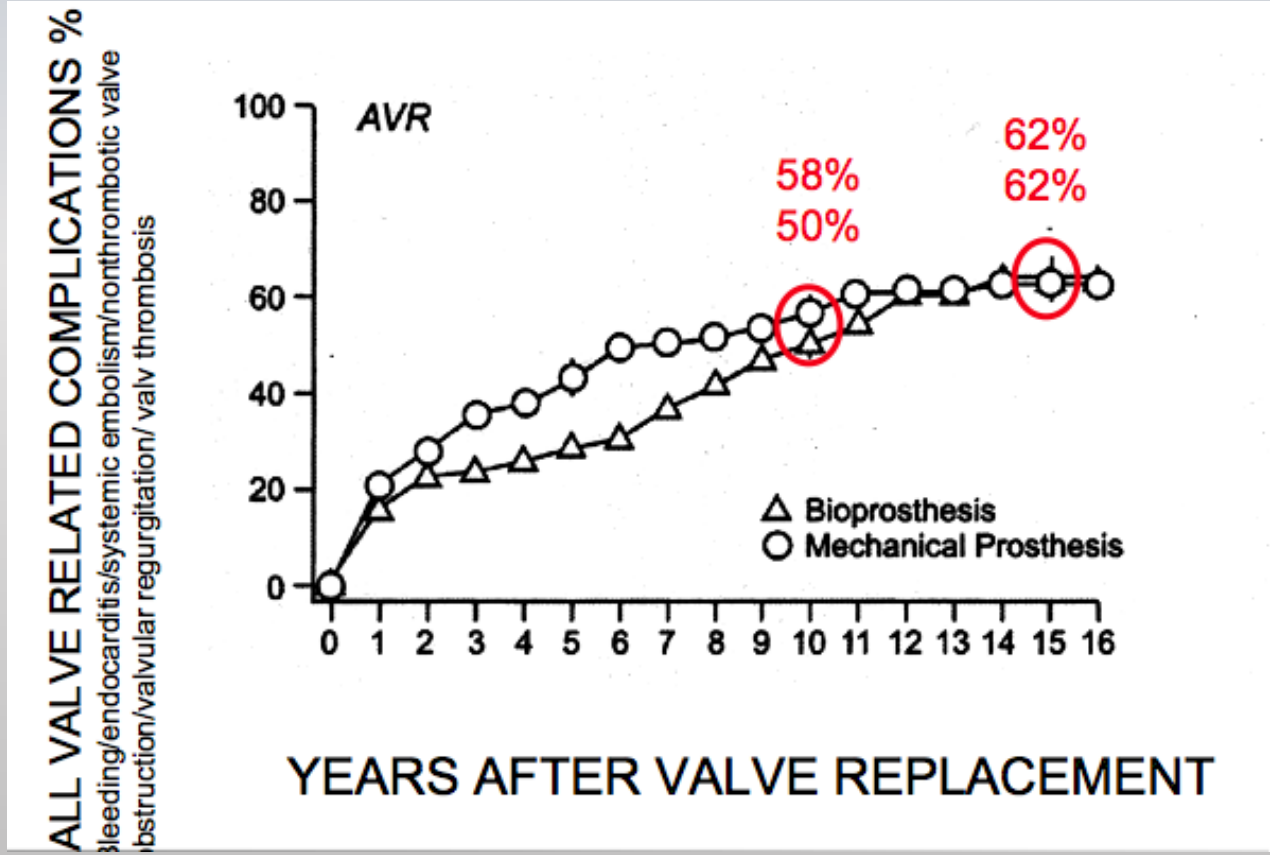
Late Mortality



J Am Coll Cardiol. 2000 Oct;36(4):1152-8

Outcomes 15 years after valve replacement with a mechanical versus a bioprosthetic valve: final report of the **Veterans Affairs randomized trial**

High Late Morbidity!



YOUNG ADULTS

- **High level of physical activity**

- **Quality of life**

- **Prolonged anticipated life expectancy**

  = Exposure to valve-related complications

  - Degeneration + Reoperation (tissue valves)
  - Bleeding + Thromboembolisms (mechanical valves)

AVR SURVIVAL

Observed and Relative Survival After Aortic Valve Replacement

Per Kvidal, MD,* Prof. Reinhold Bergström, PHD,‡ Lars-Gunnar Hörte, PM, BA,§ Elisabeth Ståhle, MD, PHD†

Uppsala and Stockholm, Sweden

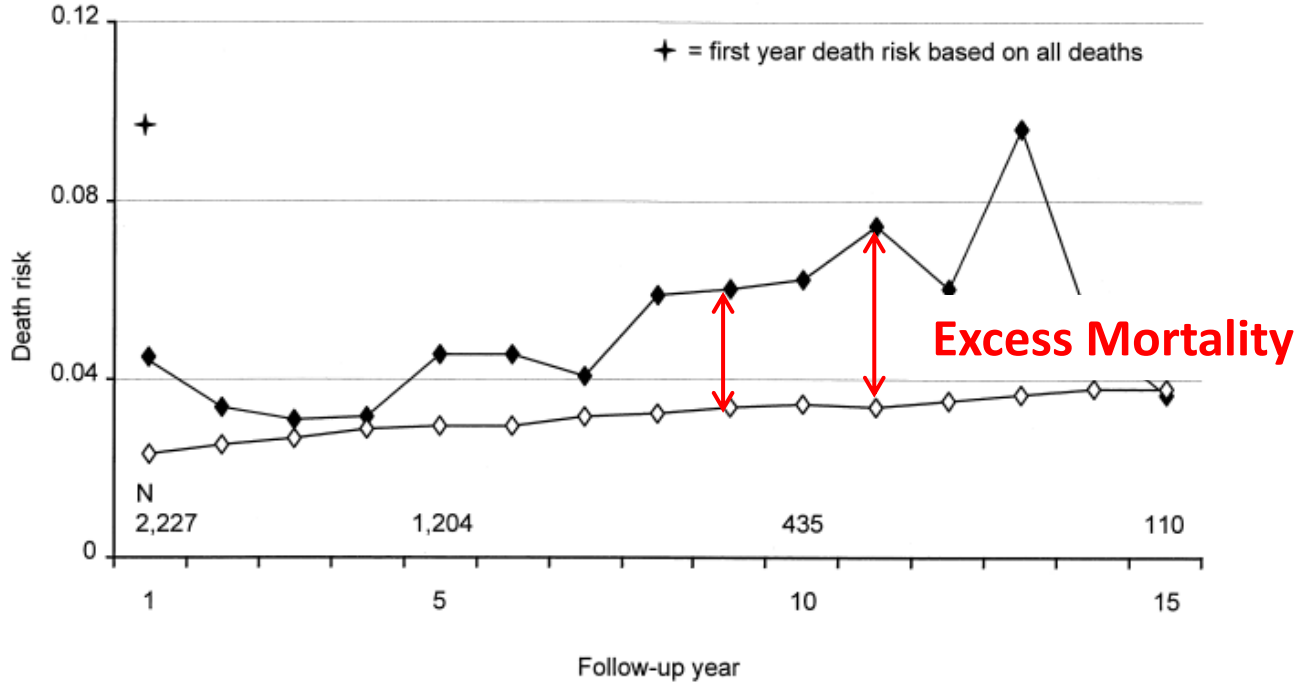


Figure 2. The annual observed **(solid diamonds)** and expected **(open diamonds)** death risk after primary AVR in patients who survived the first postoperative month (n = 2,227). The numbers (N) of patients at risk and the first year death risk are given.

Kvidal et al. JACC 2000

AVR IN THE YOUNG

Table 4. Basic Data Concerning Observed and Expected Deaths Based on Data From Follow-Up Years 1 through 15*

	Patient-Years at Risk	Observed Number of Deaths	Expected Number of Deaths	O/E Deaths
Age (yrs)				
≤50	2,182	31	6.8	4.5
51–60	2,954.5	98	36.9	2.7
61–70	5,578.5	274	152.1	1.8
≥71	3,579	212	208.2	1.0

The younger the patients are,
The higher excess mortality is

Kvidal et al. JACC 2000

MECHANICAL AVR IN THE YOUNG

Long-term outcomes after elective isolated mechanical aortic valve replacement in young adults

Ismail Bouhout, MSc,[a] Louis-Mathieu Stevens, MD, PhD,[b] Amine Mazine, MSc,[a] Nancy Poirier, MD,[a] Raymond Cartier, MD,[a] Philippe Demers, MD,[a] and Ismail El-Hamamsy, MD, PhD[a]

1997-2006: 469 isolated mechanical AVR <65 years

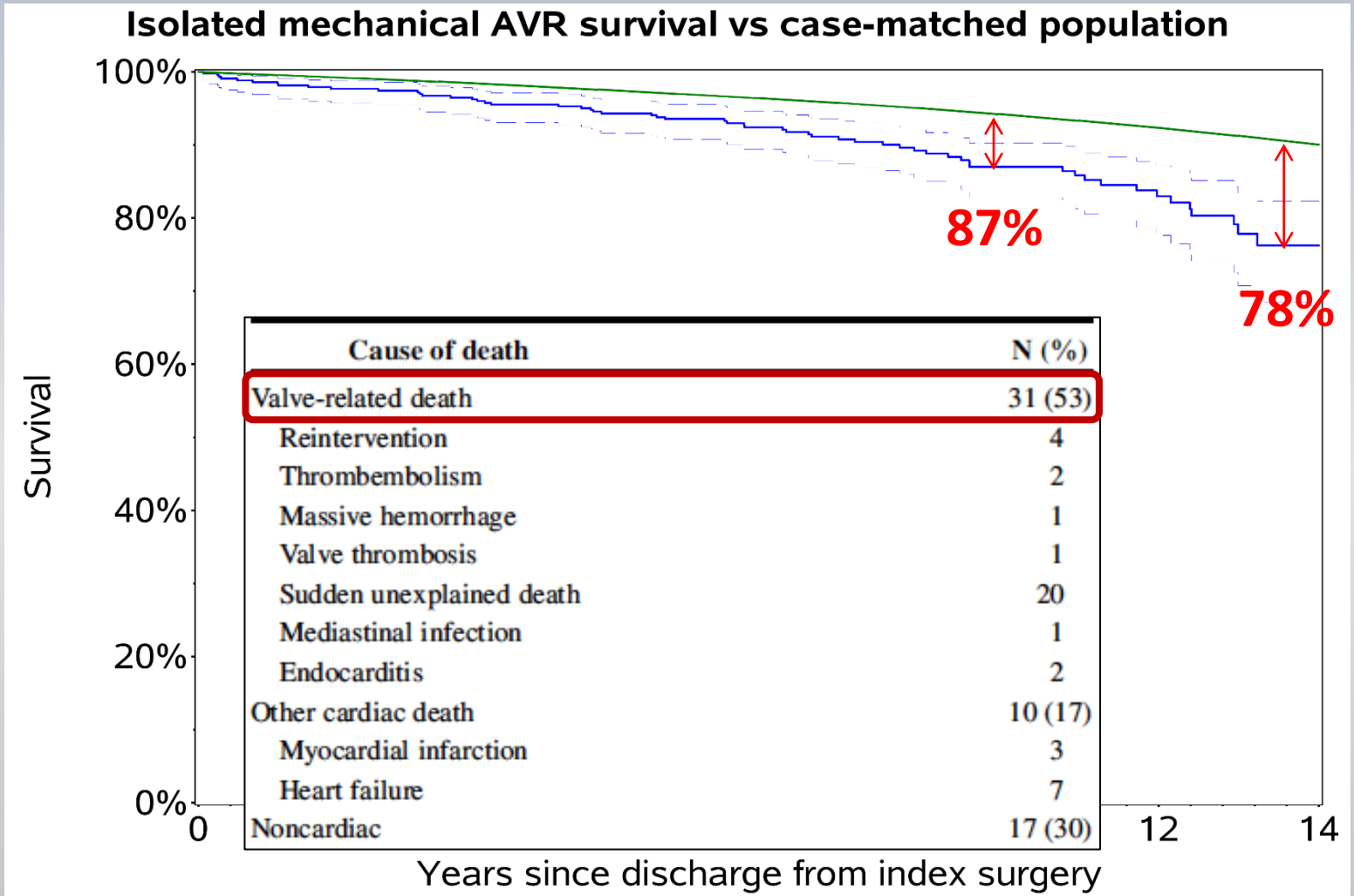
Mean follow-up: 9.1 ± 3.5 years

Follow-up 95% complete (4099 patient-years)

Mean age: 53.2 ± 9.2

Bouhout et al. JTCVS 2014

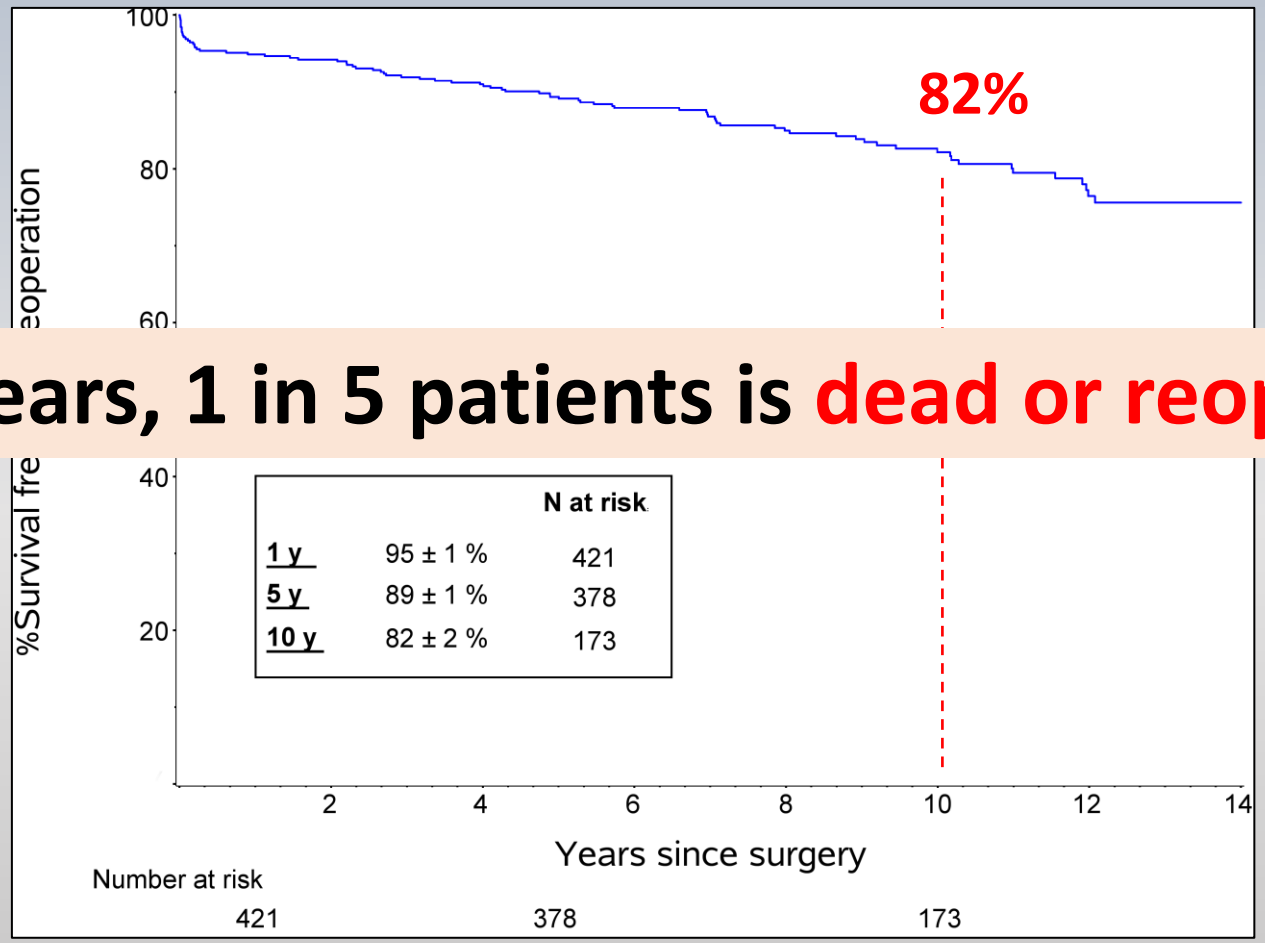
SURVIVAL – MECHANICAL AVR



Cause of death	N (%)
Valve-related death	31 (53)
Reintervention	4
Thrombembolism	2
Massive hemorrhage	1
Valve thrombosis	1
Sudden unexplained death	20
Mediastinal infection	1
Endocarditis	2
Other cardiac death	10 (17)
Myocardial infarction	3
Heart failure	7
Noncardiac	17 (30)

Bouhout et al. JTCVS 2014

SURVIVAL FREE FROM REOPERATION



A 10 years, 1 in 5 patients is dead or reoperated

Bouhout et al. JTCVS 2014

TISSUE AVR IN THE YOUNG

Survival after valve replacement for aortic stenosis: Implications for decision making

Tomislav Mihaljevic, MD,[a] Edward R. Nowicki, MD,[a] Jeevanantham Rajeswaran, MSc,[b] Eugene H. Blackstone, MD,[a,b] Luigi Lagazzi, MD,[a] James Thomas, MD,[c] Bruce W. Lytle, MD,[a] and Delos M. Cosgrove, MD[a]

3,049 Perimount patients; 1991-2004

". . .younger patients had worse than expected survival that was further diminished with insertion of a small prosthesis."

Mihajlevic et al. JTCVS 2008

TISSUE AVR IN THE YOUNG

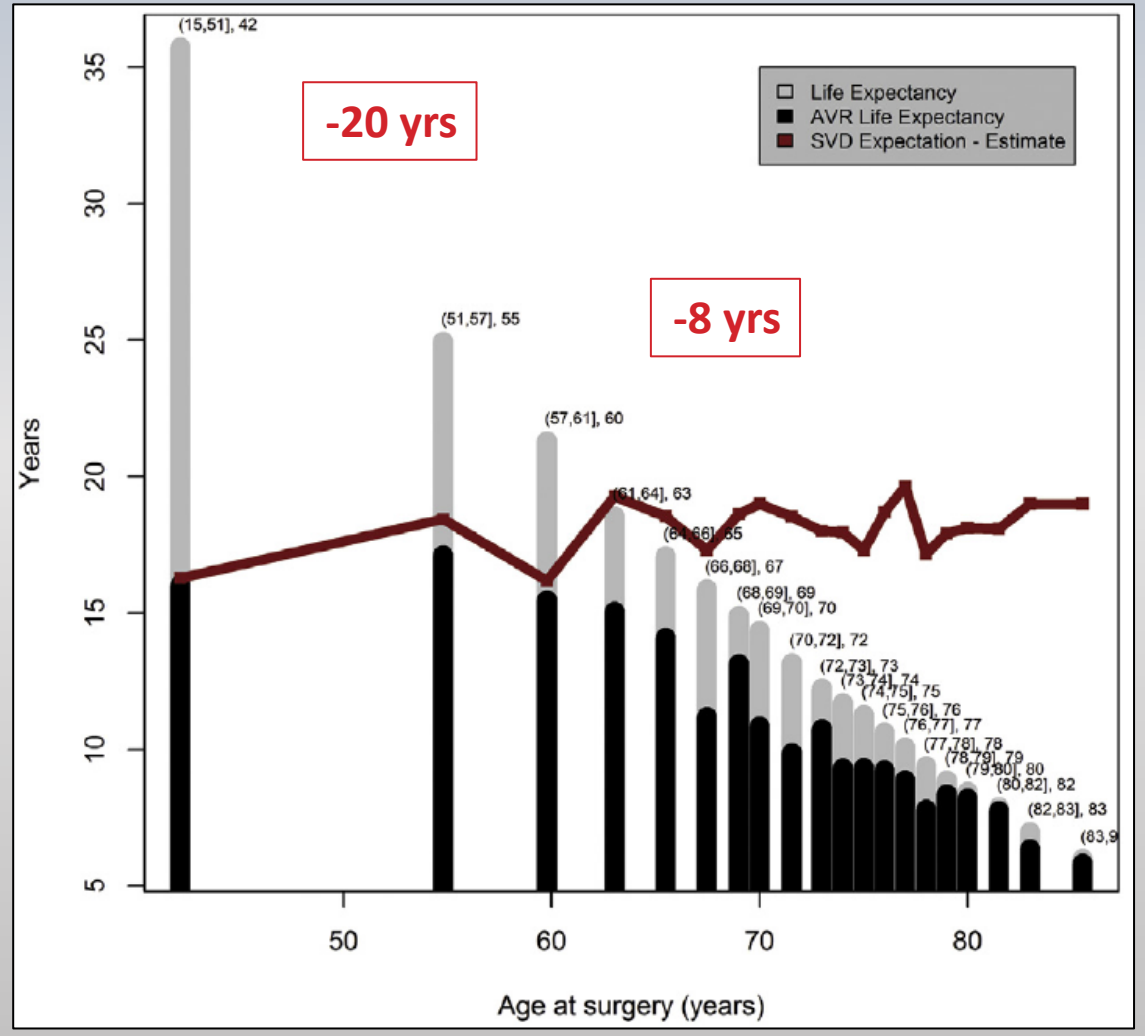
Very Long-Term Outcomes of the Carpentier-Edwards Perimount Valve in Aortic Position

Thierry Bourguignon, MD, Anne-Lorraine Bouquiaux-Stablo, MD, Pascal Candolfi, PhD, Alain Mirza, MD, Claudia Loardi, MD, Marc-Antoine May, MD, Rym El-Khoury, MD, Michel Marchand, MD, and Michel Aupart, MD

2,659 Perimount patients; 1984-2008

Bourguignon et al. Ann Thorac Surg 2015

Excess Mortality in Young Adults



Bourguignon et al. Ann Thorac Surg 2015

TISSUE AVR IN THE YOUNG

The Perimount Valve in the Aortic Position: Twenty-Year Experience With Patients Under 60 Years Old

Jessica Forcillo, MD, MS, Ismail El Hamamsy, MD, PhD,
Louis-Mathieu Stevens, MD, PhD, David Badrudin, Michel Pellerin, MD,
Louis P. Perrault, MD, PhD, Raymond Cartier, MD, Denis Bouchard, MD, MS,
Michel Carrier, MD, MBA, and Philippe Demers, MD, MS

Department of Cardiac Surgery, Montreal Heart Institute and Université de Montréal, Montreal, Quebec, Canada

1981-2011: 144 isolated bioprosthetic AVRs

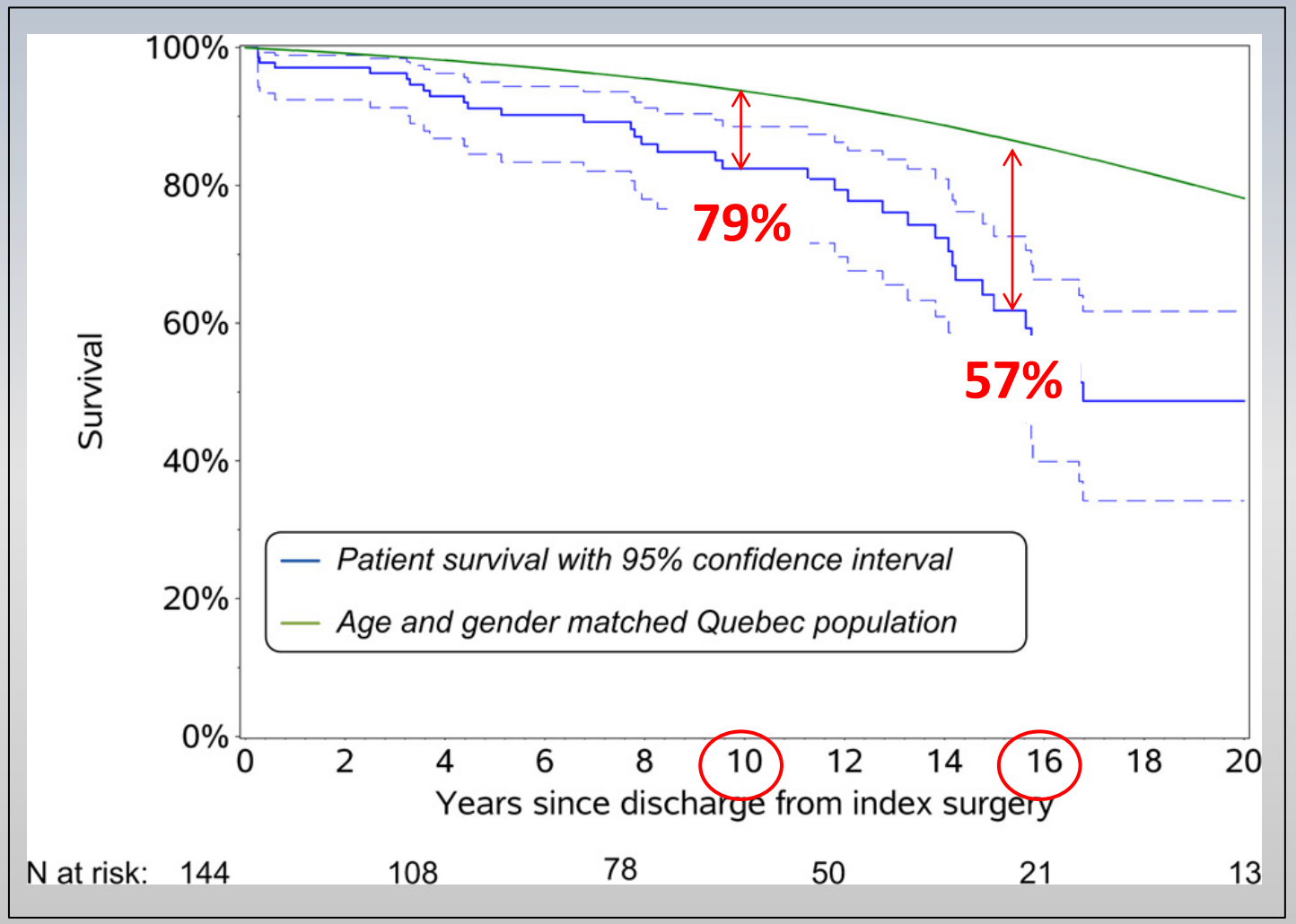
Exclusion: Concomitant procedures, reoperations, urgent operations

Mean age: 51 ± 9 years

Mean follow-up: 10 years

Forcillo et al. ATS 2014

TISSUE AVR IN THE YOUNG

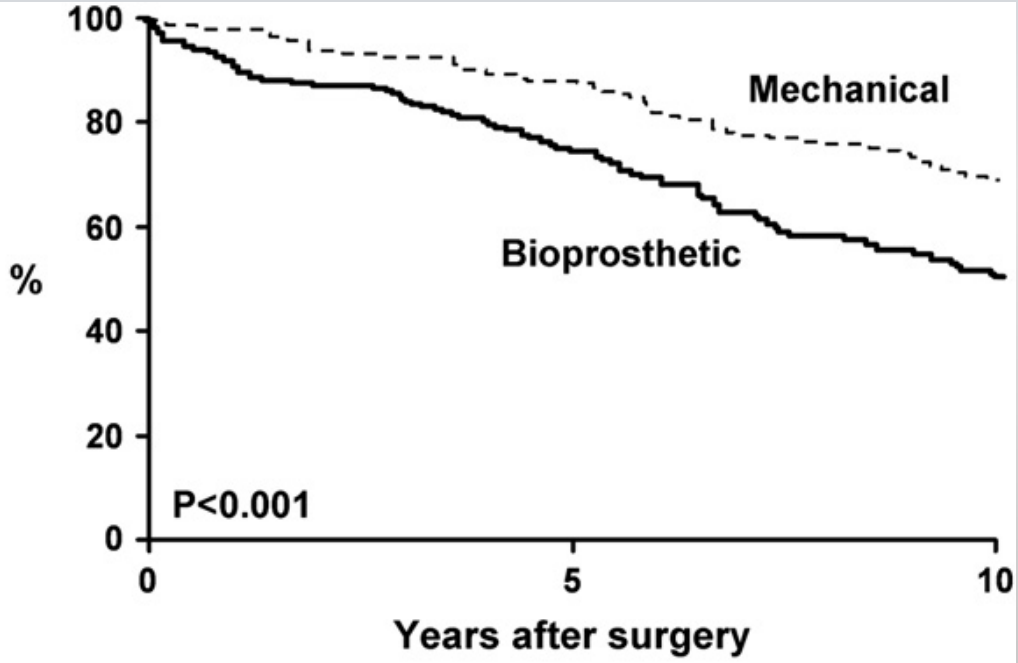


Forcillo et al. ATS 2014

Aortic valve replacement in patients aged 50 to 70 years: Improved outcome with mechanical versus biologic prostheses

Morgan L. Brown, MD,[a] Hartzell V. Schaff, MD,[a] Brian D. Lahr, MS,[b] Charles J. Mullany, MD,[a] Thoralf M. Sundt, MD,[a] Joseph A. Dearani, MD,[a] Christopher G. McGregor, MD,[a] and Thomas A. Orszulak, MD[a]

Survival



Mechanical	213	161	92
Bioprosthetic	202	144	49

J Thorac Cardiovasc Surg 2008;135:878-84

Risk-corrected impact of mechanical versus bioprosthetic valves on long-term mortality after aortic valve replacement

Ole Lund, MD, PhD, and Martin Bland, MSc, PhD

Meta-Analysis: Survival not affected by type of prosthesis

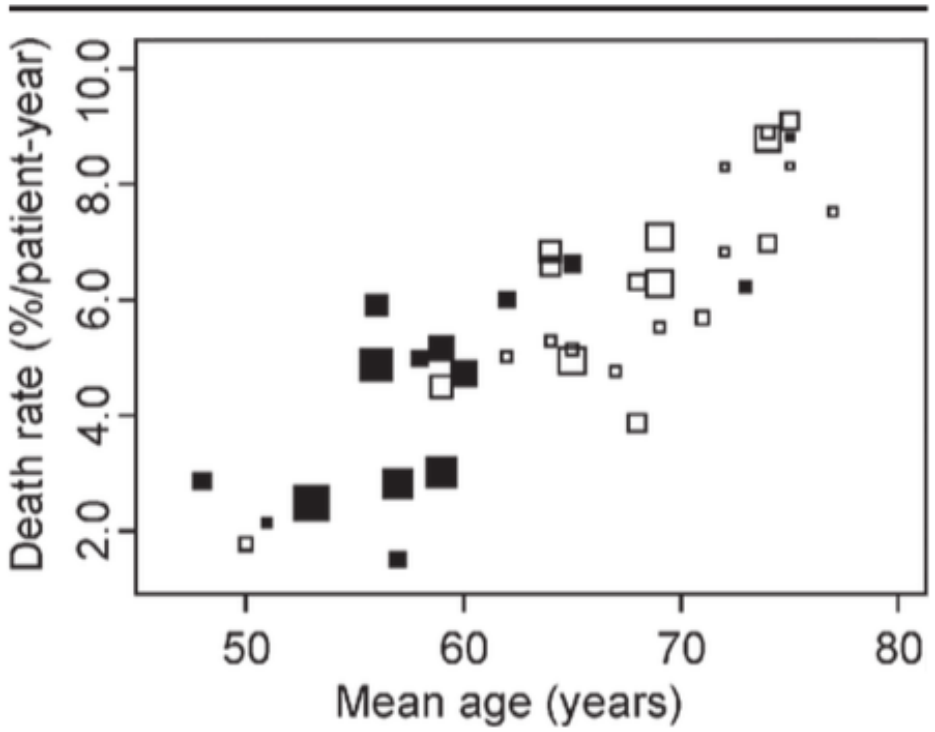


Figure 2. Total death rate of the 15 mechanical (■) and 23 bioprosthetic (□) valve series in relation to mean age of each series. Areas of the squares are proportional to the total follow-up (patient-y) in each valve series.

Comparison of outcomes after aortic valve replacement with a mechanical valve or a bioprosthesis using microsimulation

J P A Puvimanasinghe, J J M Takkenberg, M B Edwards, M J C Eijkemans, E W Steyerberg, L A van Herwerden, K M Taylor, G L Grunkemeier, J D F Habbema, A J J C Bogers

Heart 2004;**90**:1172–1178. doi: 10.1136/hrt.2003.013102

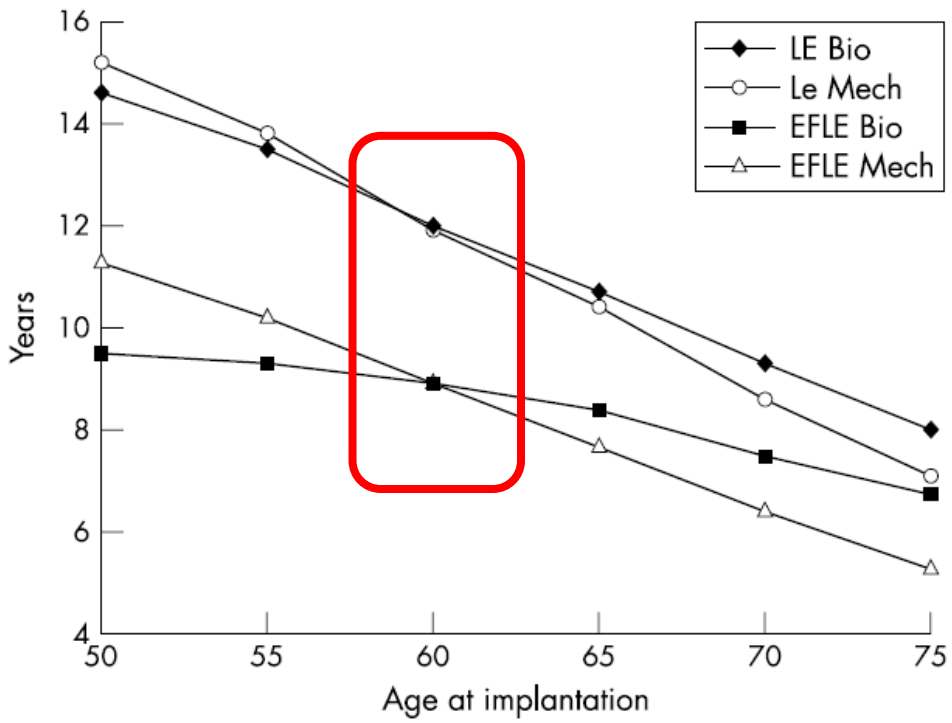


Figure 2 Comparison of life expectancy and event-free life expectancy in men after aortic valve replacement with mechanical valves and bioprostheses.

Conventional AVR is associated with

Excess Mortality

up to 60 years of age at the time of surgery, and significant VR morbidity

Procedure is palliative and not curative

THE AORTIC ROOT IS

A living structure with optimal geometry and biology

THE AORTIC ROOT COMPLEX

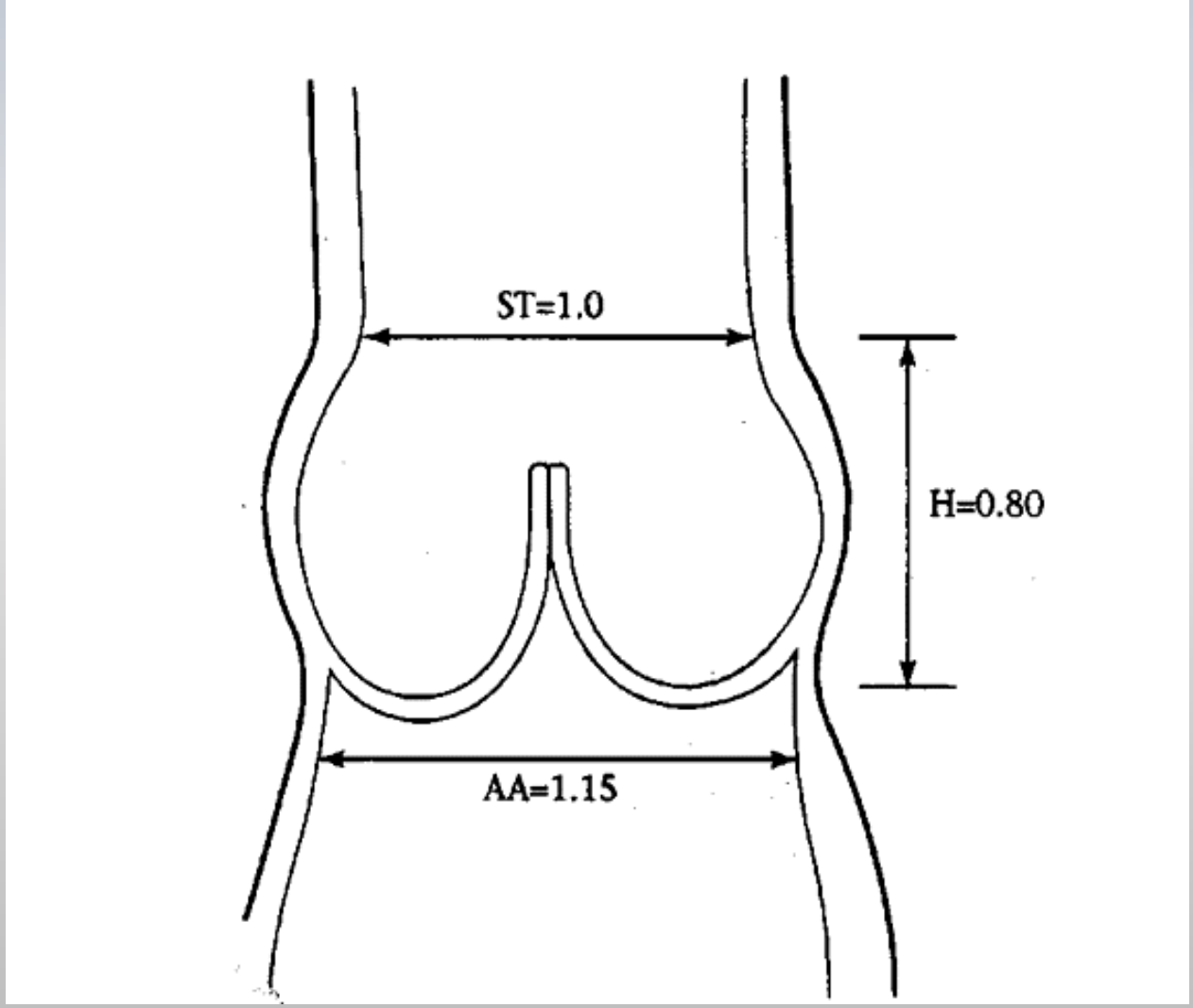
LIVING STRUCTURE

=

COMPLEX FUNCTIONS

- **Laminar flow**
- **Excellent hemodynamics**
- **Low thrombogenicity**
- **Resistance to infections**

The importance of geometry



AORTIC VALVE REPAIR/PRESERVING SURGERY

- No randomized trials
- Single-center (single-surgeon) series
- Difficult to compare AI patients to AS patients

AVIATOR

SURVIVAL

Risk of Valve-Related Events After Aortic Valve Repair

Joel Price, MD, MPH, Laurent De Kerchove, MD, David Glineur, MD, PhD, Jean-Louis Vanoverschelde, MD, PhD, Philippe Noirhomme, MD, and Gebrine El Khoury, MD

1995-2010: 475 elective AV repair (AI or aneurysm)

Mean age: 53 ± 16 years

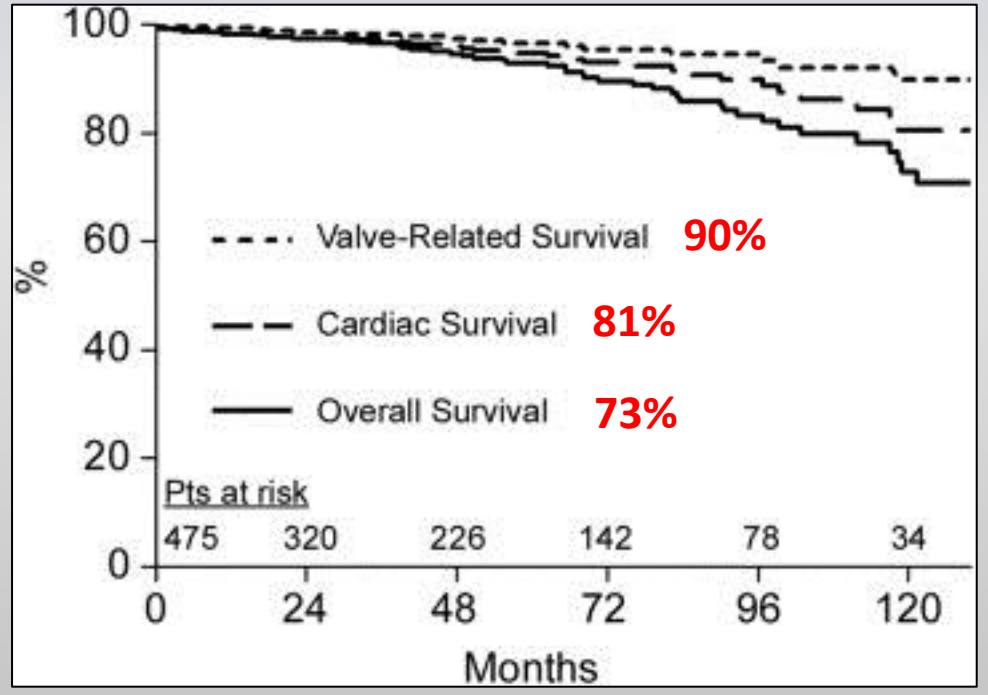
Mean follow-up: 4.6 years

Price et al. Ann Thor Surg 2013

SURVIVAL

Risk of Valve-Related Events After Aortic Valve Repair

Joel Price, MD, MPH, Laurent De Kerchove, MD, David Glineur, MD, PhD, Jean-Louis Vanoverschelde, MD, PhD, Philippe Noirhomme, MD, and Gebrine El Khoury, MD



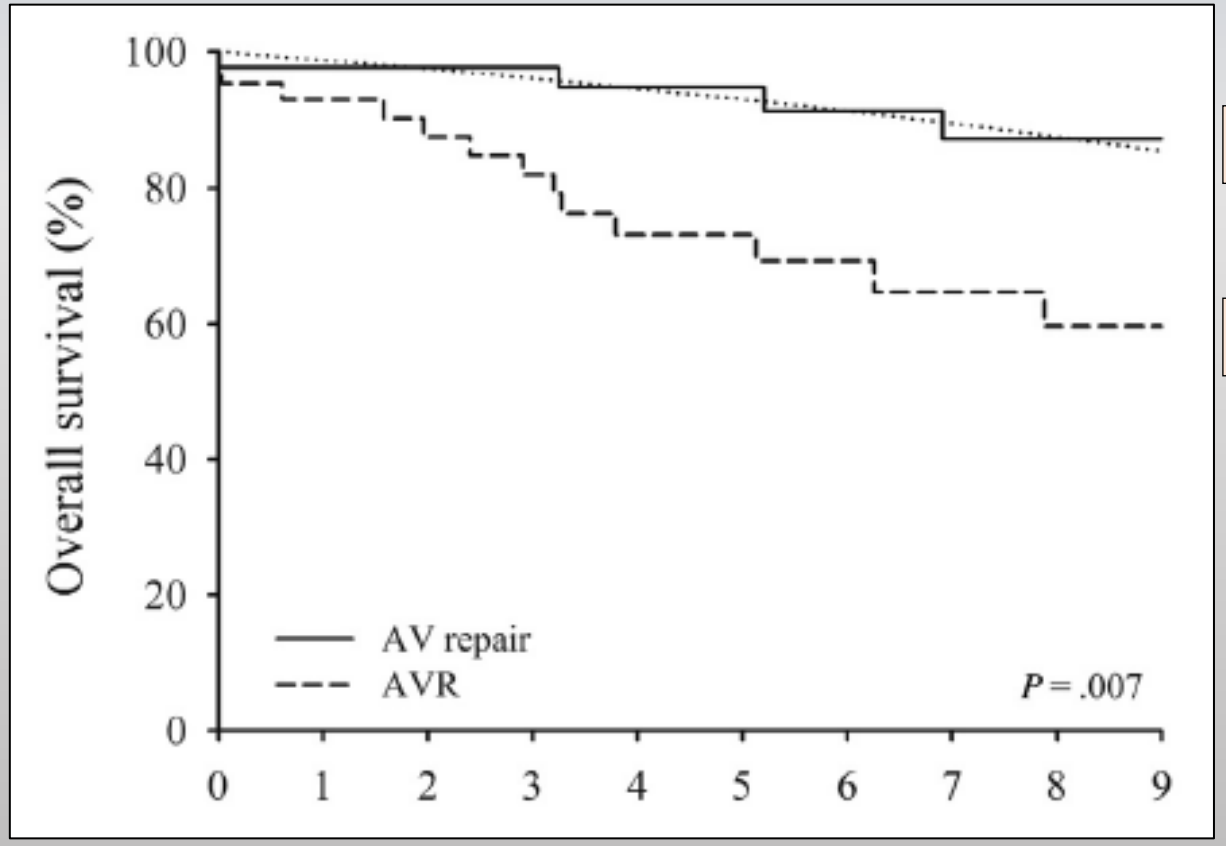
73%

Price et al. Ann Thor Surg 2013

SURVIVAL

Valve repair improves the outcome of surgery for chronic severe aortic regurgitation: A propensity score analysis

Christophe de Meester, MS,[a,b] Agnès Pasquet, MD, PhD,[a,b] Bernhard L. Gerber, MD, PhD,[a,b] David Vancraeynest, MD, PhD,[a,b] Philippe Noirhomme, MD,[a,c] Gébrine El Khoury, MD,[a,c] and Jean-Louis J. Vanoverschelde, MD, PhD[a,b]



REPAIR

AVR

de Meester et al. JTCVS 2014

SURVIVAL

A quarter of a century of experience with aortic valve-sparing operations

Tirone E. David, MD, Christopher M. Feindel, MD, Carolyn M. David, BN, and Cedric Manlhiot, BSc

1988-2010: 371 consecutive valve-sparing procedures (~15/year)

Mean age: 47 ± 15 years

Median follow-up: 8.9 years

David et al. JTCVS 2014

SURVIVAL

A quarter of a century of experience with aortic valve-sparing operations

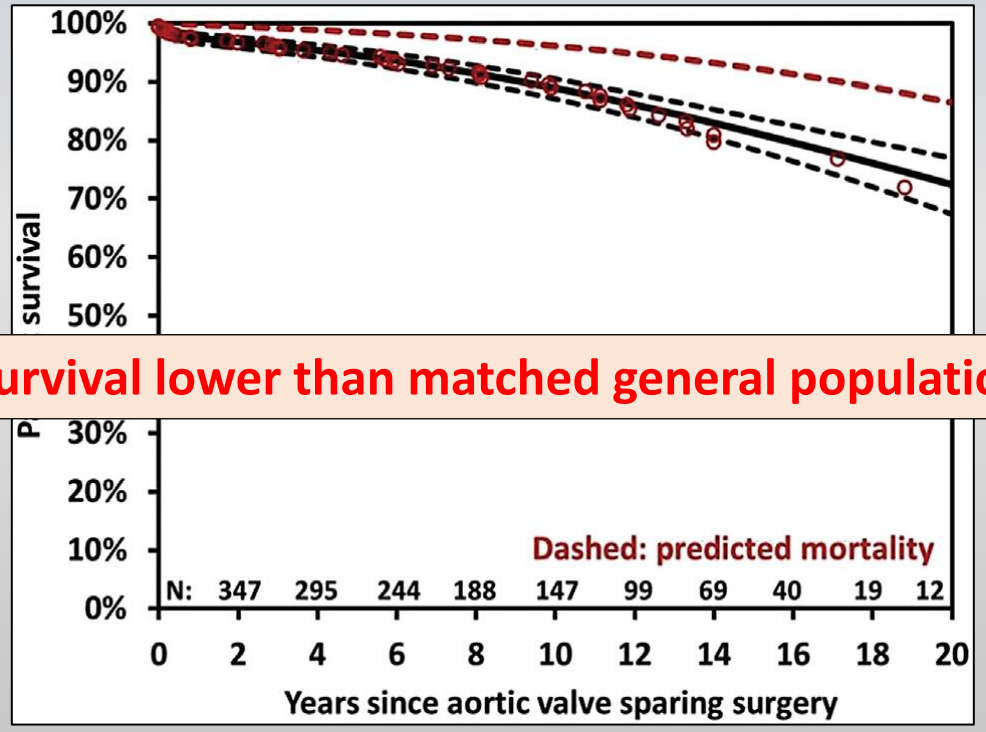
Tirone E. David, MD, Christopher M. Feindel, MD, Carolyn M. David, BN, and Cedric Manlhiot, BSc

12% Acute type A dissection

35% Marfan syndrome

N=296 Reimplantation

N=75 Remodeling



Survival lower than matched general population

David et al. JTCVS 2014

SURVIVAL

Aortic valve repair leads to a low incidence of valve-related complications

Diana Aicher [a], Roland Fries [b], Svetlana Rodionycheva [a], Kathrin Schmidt [a], Frank Langer [a], Hans-Joachim Schäfers [a,*]

1995-2007: 640 consecutive valve-sparing procedures

81% of all patients with AI

Mean age: 56 ± 17 years

Mean follow-up: 4.8 years

Aicher et al. EJCTS 2010

SURVIVAL

10% acute dissection

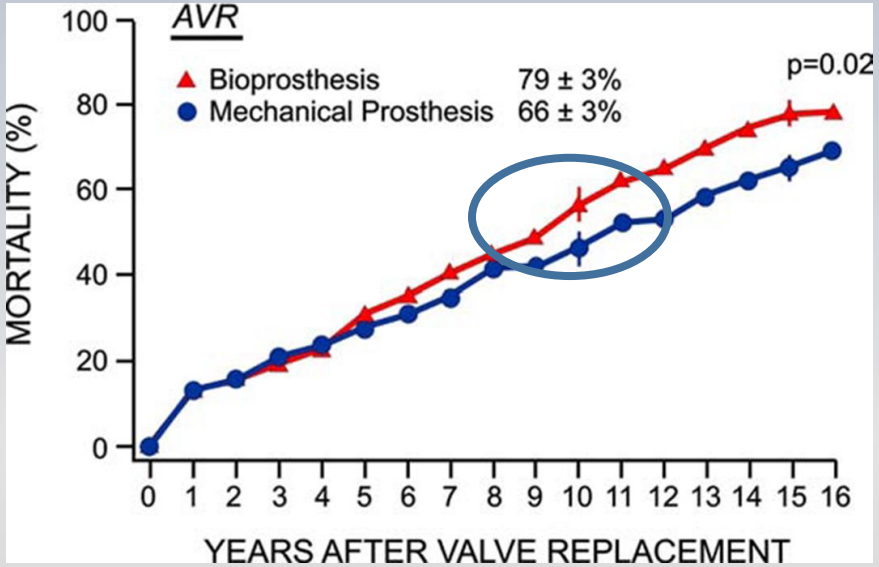
Survival for the whole patient cohort was 92% at 5 years and 80% at 10 years with significantly better survival in patients with a bicuspid rather than a tricuspid AV ($p = 0.0004$). Survival at 10 years was worse in patients with concomitant coronary artery bypass grafting (75% vs 85%; $p = 0.42$).

Aicher et al. EJCTS 2010

SURVIVAL SUMMARY

- **~80% survival at 10 years despite:**
  - Inclusion of acute type A dissections
  - Connective tissue disorders

- No studies into the second decade
  - Mean follow-up <10 years

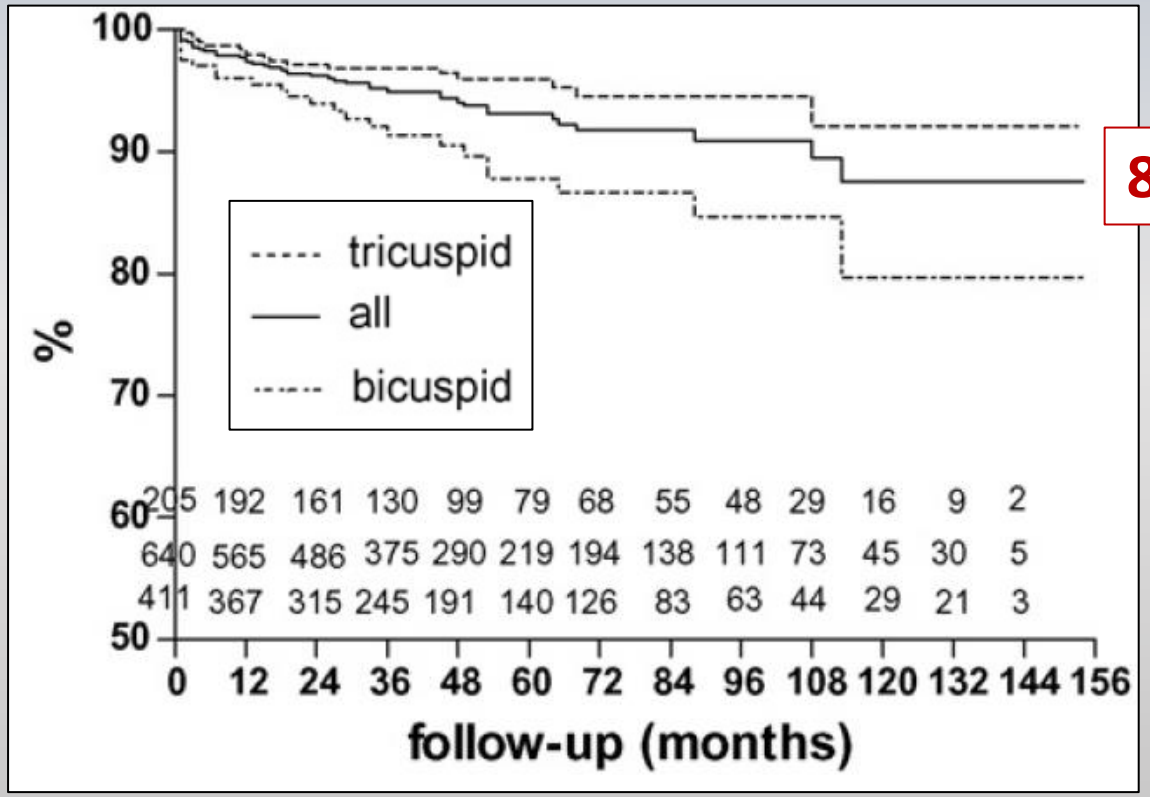


- **<u>Difficult to compare survival of AI pts to AS patients</u>**

VALVE-RELATED COMPLICATIONS

FREEDOM FROM ALL VALVE-RELATED COMPLICATIONS

(Reoperation, endocarditis, thromboembolism and hemmorhage)



88% at 10 years

Aicher et al. EJCTS 2010

VALVE-RELATED COMPLICATIONS

A quarter of a century of experience with aortic valve-sparing operations

Tirone E. David, MD, Christopher M. Feindel, MD, Carolyn M. David, BN, and Cedric Manlhiot, BSc

	Follow-up point (y)				
Freedom from	**1**	**5**	**10**	**15**	**18**
Mortality	97.3 ± 0.8	94.6 ± 1.2	89.0 ± 2.0	79.7 ± 3.4	76.8 ± 4.3
Reoperation*	99.7 ± 0.3	99.7 ± 0.3	97.0 ± 1.3	94.8 ± 2.0	94.8 ± 2.0
Aortic insufficiency†	99.7 ± 0.3	99.6 ± 0.4	93.2 ± 2.0	90.7 ± 2.6	78.0 ± 4.8
Mitral insufficiency‡	100	99.2 ± 0.6	92.8 ± 2.1	88.8 ± 3.5	88.8 ± 3.5
Thromboembolism§	99.5 ± 0.4	96.6 ± 1.0	94.1 ± 1.5	92.2 ± 2.4	90.1 ± 3.2
Valve-related event‖	98.1 ± 0.6	95.5 ± 1.1	91.2 ± 2.4	85.5 ± 3.8	79.4 ± 4.6

David et al. JTCVS 2014

VALVE-RELATED COMPLICATIONS

Reported Outcome After Valve-Sparing Aortic Root Replacement for Aortic Root Aneurysm: A Systematic Review and Meta-Analysis

Bardia Arabkhani, MD, Aart Mookhoek, MD, Isabelle Di Centa, MD, Emmanuel Lansac, MD, PhD, Jos A. Bekkers, MD, PhD, Rob De Lind Van Wijngaarden, MD, PhD, Ad J. J. C. Bogers, MD, PhD, and Johanna J. M. Takkenberg, MD, PhD

Variable	Pooled Data	Range	Included Studies (n)
Total patient number	4.777	32–430	31
Surgical period	1988–2012		31
Mean age (years)	51.0	29–63	30
Gender, male (%)	71.0	57%–85	30
Comorbidity			
Connective tissue disease (%)	23.9	0–100	35
Severe aortic regurgitation (%)	46.1	6.4–100	25
Bicuspid aortic valve (%)	14.1	0–33	28
Prior cardiac operation (%)	4.49	2–12	14
Other indications			
Acute type A dissection (%)	10.5	0–33	28

Arabkhani et al. ATS 2015

Reported Outcome After Valve-Sparing Aortic Root Replacement for Aortic Root Aneurysm: A Systematic Review and Meta-Analysis

Bardia Arabkhani, MD, Aart Mookhoek, MD, Isabelle Di Centa, MD, Emmanuel Lansac, MD, PhD, Jos A. Bekkers, MD, PhD, Rob De Lind Van Wijngaarden, MD, PhD, Ad J. J. C. Bogers, MD, PhD, and Johanna J. M. Takkenberg, MD, PhD

Table 2. Linearized Occurrence Rates of Late Outcome Events

Pooled Late Outcome Events	LOR + 95% CI	Heterogeneity (I^2)	Included Studies (n)	Events (n)	Patient Years (n)
Late mortality	1.53 (1.19–1.96)	82.6	31	262	21,274
Reoperation on aortic valve	1.32 (1.0–1.74)	72.3	31	228	21,274
Hemorrhage	0.23 (0.13–0.42)	78.7	26	15	19,158
Thromboembolism	0.41 (0.22–0.77)	27.6	26	42	19,158
Endocarditis	0.23 (0.11–0.51)	0.00	30	29	20,930
MAVRE	1.66 (1.24–2.23)	100	20	300	19,158

Arabkhani et al. ATS 2015

QUALITY OF LIFE

Quality of life after aortic valve surgery: Replacement versus reconstruction

Diana Aicher, MD,[a] Annika Holz,[a] Susanne Feldner, MD,[a] Volker Köllner, MD,[b] and Hans-Joachim Schäfers, MD[a]

TABLE 1. Patient characteristics

		No.	Sex (male/female)	Age at operation (y, mean ± SD)	Age at survey (y, mean ± SD)
AV REPAIR	Group I	87	63:24	38 ± 6	40 ± 6
MECHANICAL	Group II	40	35:5	40 ± 7	46 ± 7
ROSS	Group III	39	27:12	40 ± 7	46 ± 7

Aicher et al. JTCVS 2011

Valve-specific questions	Group I	Group II	Group III	*P* value
1. If I had to do it over again, would I make the same decision to have surgery?				
Yes	94.0%	89.7%	100.0%	.821
I don't know	3.6%	7.7%	0.0%	
No	2.4%	2.6%	0.0%	
2. Is there a valve sound that bothers me?				
Never/rarely	91.5%	41.0%	92.4%	<.001
Occasionally	6.1%	33.3%	5.1%	
Frequently/always	2.4%	25.7%	2.5%	
3. Following my valve surgery, the frequency of doctor visits and blood tests bothers me.				
Never/rarely	75.9%	61.6%	84.2%	.011
Occasionally	20.5%	17.9%	13.2%	
Frequently/always	3.6%	20.5%	2.6%	
4. The possibility of complications due to my implanted valve concerns me.				
Never/rarely	48.2%	48.7%	61.5%	.309
Occasionally	43.4%	30.8%	33.3%	
Frequently/always	8.4%	20.5%	5.2%	
5. I am concerned about possible bleeding caused by my anticoagulant medication.				
Never/rarely	80.5%	43.6%	79.5%	<.001
Occasionally	12.2%	15.4%	7.7%	
Frequently/always	7.3%	41.0%	12.8%	
6. I am afraid that my valve may fail.				
Never/rarely	53.7%	51.3%	76.9%	.036
Occasionally	34.1%	28.2%	17.9%	
Frequently/always	12.2%	20.5%	5.2%	
7. I am afraid that I may need another valve operation.				
Never/rarely	38.0%	48.7%	53.8%	.382
Occasionally	45.0%	25.6%	25.6%	
Frequently/always	17.0%	25.7%	20.6%	

Aicher et al. JTCVS 2011

Quality of life after aortic valve repair is similar to Ross patients and superior to mechanical valve replacement: a cross-sectional study

Pavel Zacek[1*†], T. Holubec[2†], M. Vobornik[1], J. Dominik[1], J. Takkenberg[3], J. Harrer[1] and J. Vojacek[1]

Table 4 QoL expressed in relation to specific valve related concerns, acc. Perchinsky (modif.) [12]

	Y (repair) $n = 36$ (%)	O (repair) $n = 52$ (%)	Ross $n = 22$ (%)	M (mechAVR) $n = 29$ (%)
1. If you had to do it over again, would you chose the same procedure?				
Yes	92	71	82	72
I don't know	6	21	18	21

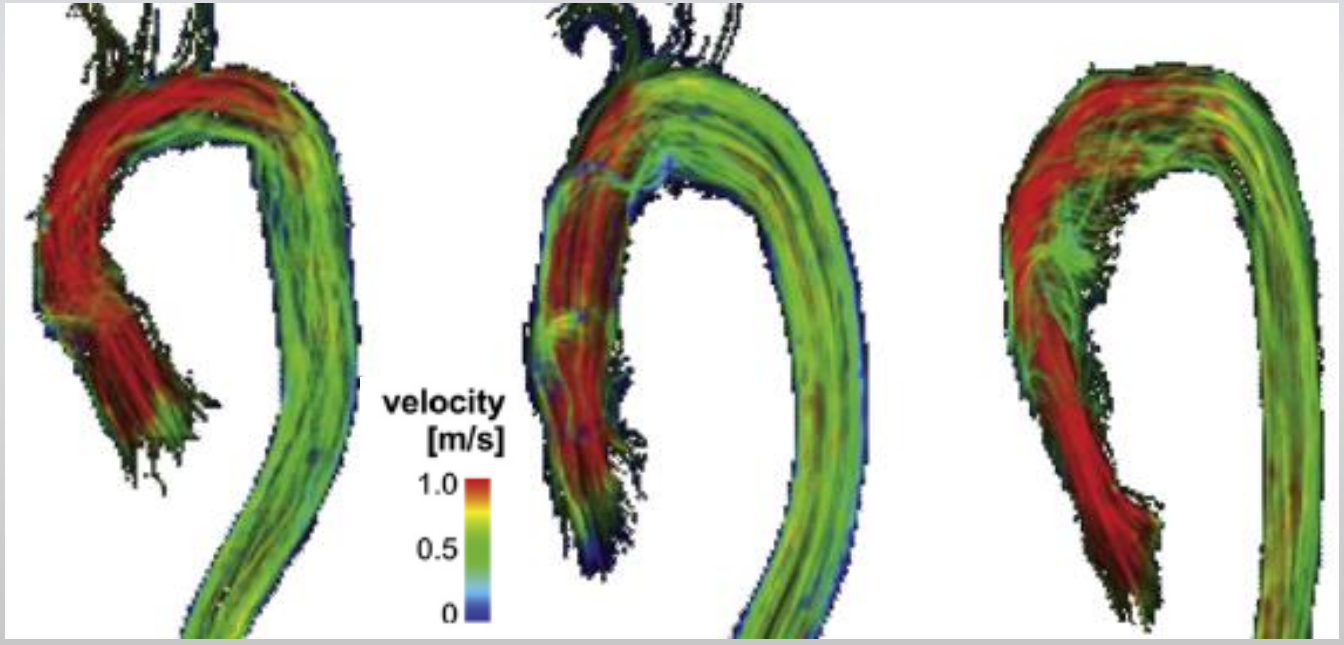
Conclusions: Postoperative quality of life is influenced by the type of aortic valve procedure and is negatively linked with mechanical prosthesis implantation and long-term anticoagulation. Aortic valve-sparing strategy should be considered in cases with suitable valve morphology due to favorable clinical results and beneficial impact on the long-term quality of life.

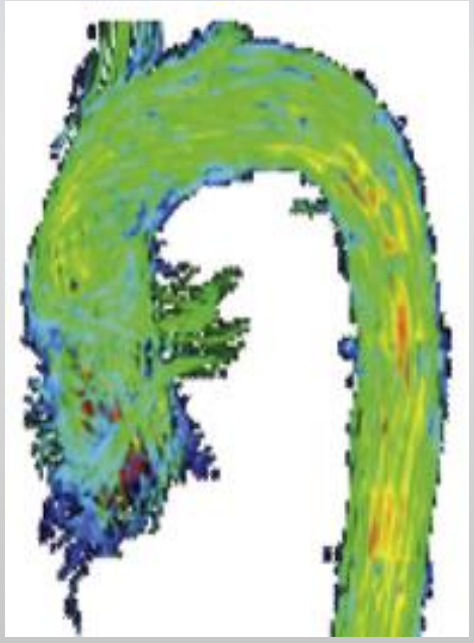
Zacek et al. BMC Cardiovasc Dis 2016

HEMODYNAMICS

Comparison of Hemodynamics After Aortic Root Replacement Using Valve-Sparing or Bioprosthetic Valved Conduit

Jeremy D. Collins, MD, Edouard Semaan, MD, Alex Barker, PhD,
Patrick M. McCarthy, MD, James C. Carr, MD, Michael Markl, PhD, and
S. Chris Malaisrie, MD





Collins et al. ATS 2015

Comparison of Hemodynamics After Aortic Root Replacement Using Valve-Sparing or Bioprosthetic Valved Conduit

Background. The purpose of this study is to compare aortic hemodynamics and blood flow patterns using in-

second, $p < 0.005$). Flow asymmetry in BIO-ARR was increased compared with VSARR, evidenced by more

Conclusions. The VSARR results in improved hemodynamic outcomes when compared with BIO-ARR, as indicated by reduced peak velocities in the aortic root and less helix flow in the AAo by 4D flow MRI. Longitudinal research assessing the clinical impact of these differences in hemodynamic outcomes is warranted.

the aortic root and AAo in both VSARR and BIO-ARR were elevated compared with controls (1.1 to 1.3m/

(Ann Thorac Surg 2015;100:1556–62)

Collins et al. ATS 2015

SUMMARY WHY TO REPAIR

- Improved Survival (evidence is limited)
- Reduced Valve-related complications
- Improved Quality of life

- New prosthesis
- New anticoagulant therapy
- Valve in valve impact
- Reduced Redo risk

European Journal of Cardio-Thoracic Surgery Advance Access published November 1, 2013

European Journal of Cardio-Thoracic Surgery (2013) 1–2
doi:10.1093/ejcts/ezt513

EDITORIAL COMMENT

Initial experience with rivaroxaban in mechanical valve prosthesis in an animal model

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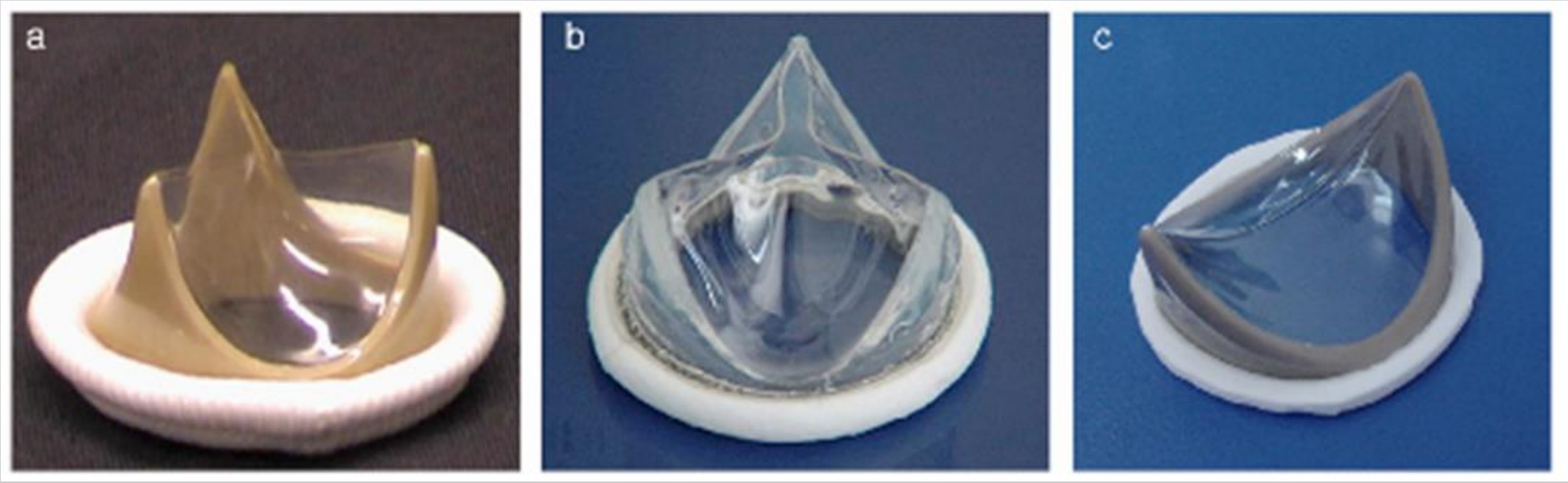
Keywords: Factor Xa inhibitors • Heart valve • Thromboembolism • Valvular prosthesis

Newer Generation Prosthesis?



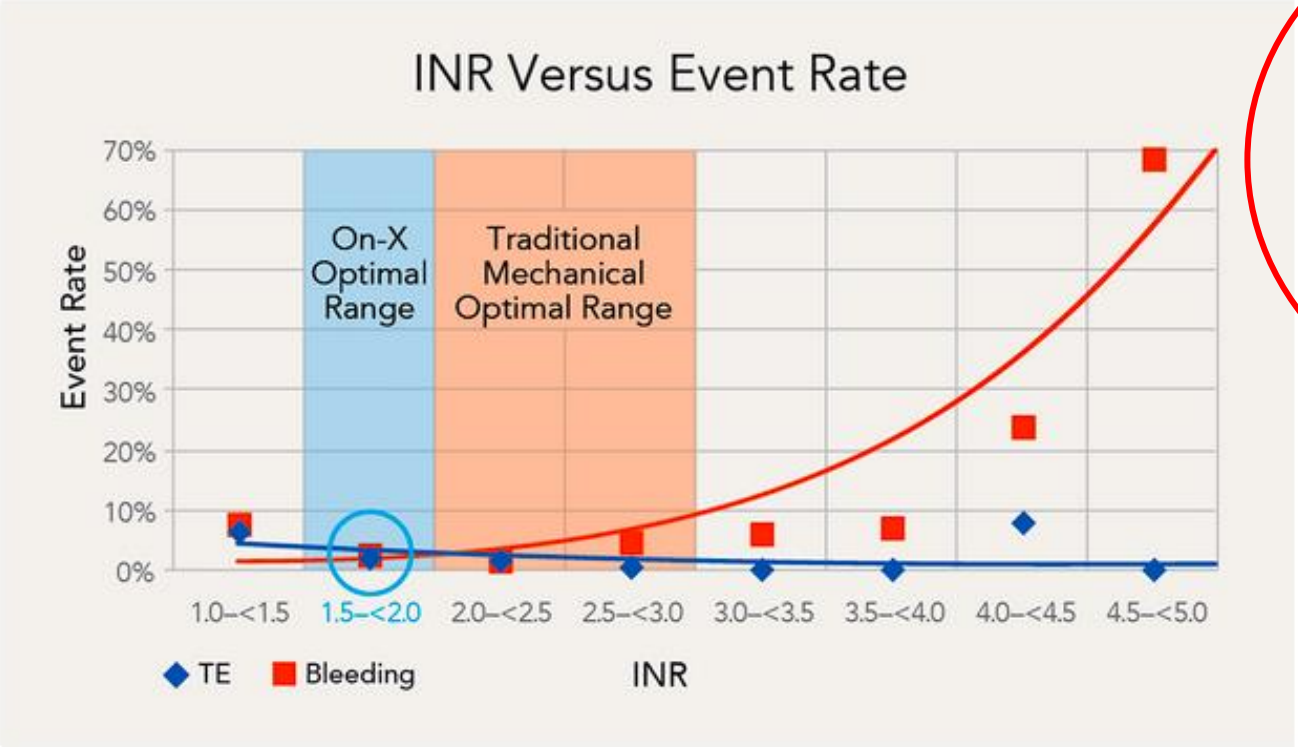
On-X valve

On-X aortic heart valves

INR: 1.5–2.0 | Design | PROACT | Con

PROACT RESULTS

Prospective Randomized On-X Valve Anticoagulation Clinical Trial



- 65% Fewer Bleeds
- No Increase in TE
- INR: 1.5–2.0
- 63,000 INR Data Points
- 33 US Centers

Learn More

» Read the article at JTCVS

» Watch the slide presentation

» Request more information

PROACT Trial (n=375 pts)

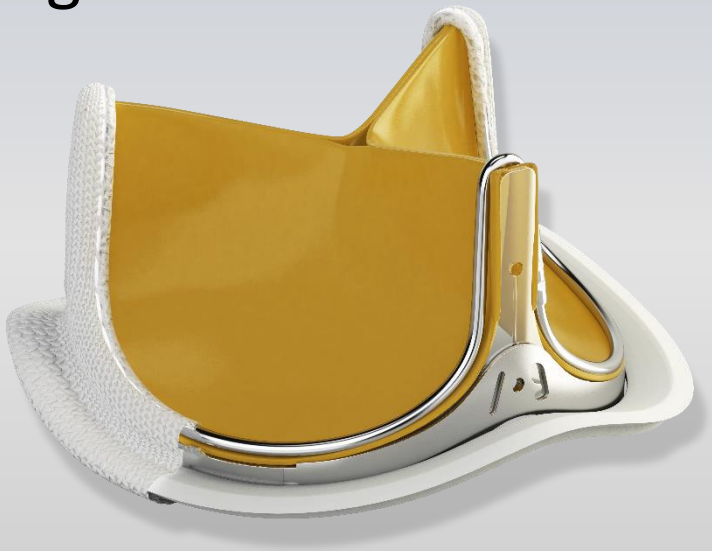
AVR High-risk postrandomization event comparisons

Primary Event	Test group (pt-yr = 766.2) Patients (n)	Test group Rate (%/pt-yr)	Control group (pt-yr = 878.6) Patients (n)	Control group Rate (%/pt-yr)	Rate Ratio (test/ctrl)	95% CI	*P*-value
Bleeding							
Major	**12**	**1.57**	**34**	**3.87**	**0.40**	**0.21-0.78**	**0.007**
Hemorrhagic stroke	1	0.13	4	0.46	0.29	0.03-2.56	0.264
Minor	**9**	**1.17**	**35**	**3.98**	**0.29**	**0.14-0.61**	**0.001**
Total	**21**	**2.74**	**69**	**7.85**	**0.35**	**0.21-0.57**	**<0.001**
Ischemic stroke	6	0.78	7	0.80	0.98	0.33-2.92	0.975
TIA	11	1.44	7	0.80	1.80	0.70-4.65	0.223
Neurologic event	17	2.22	14	1.59	1.39	0.69-2.82	0.359
Peripheral TE	4	0.52	1	0.11	4.59	0.51-41.04	0.173
All TE	21	2.74	15	1.71	1.61	0.88-3.11	0.161
Thrombosis	2	0.26	2	0.23	1.15	0.16-8.14	0.891
Major event (major bleeding, all TE, thrombosis)	35	4.57	51	5.80	0.79	0.51-1.21	0.275
Primary endpoint	**44**	**5.74**	**86**	**9.79**	**0.59**	**0.41-0.84**	**0.004**

Puskas et al. JTCVS 2014

A new class of resilient bovine pericardial valves

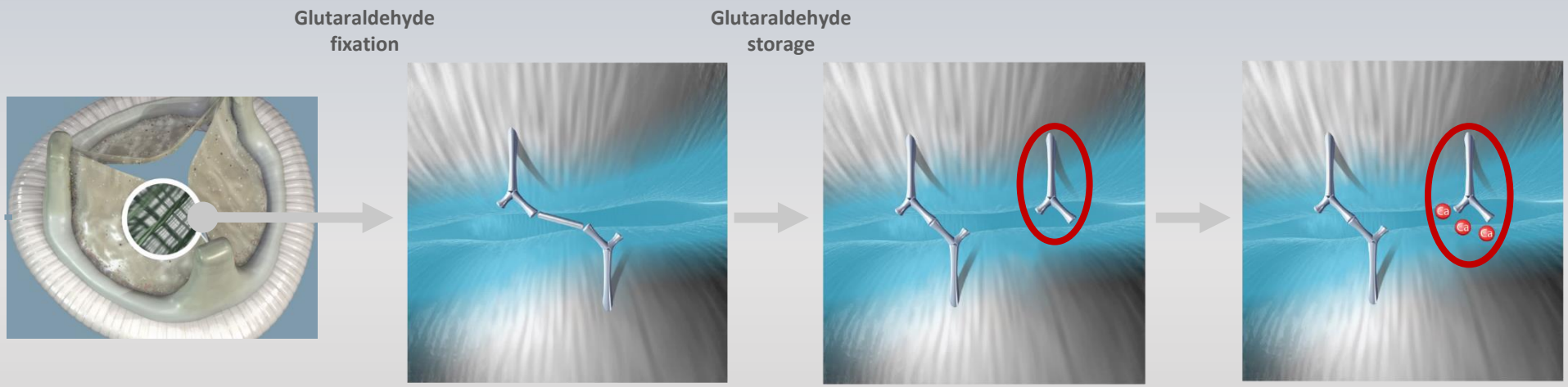
- builds on PERIMOUNT valve design
- RESILIA tissue preservation
- VFit Technology



Resilient Tissue Valves

Edwards

Multiple factors influence tissue calcification, some of which are inherent to the current technology (e.g. free aldehydes)[1]



Collagen fibers consist of free amino acid side chains

Within the collagen matrix, glutaraldehyde fixation strengthens the tissue by creating crosslinks

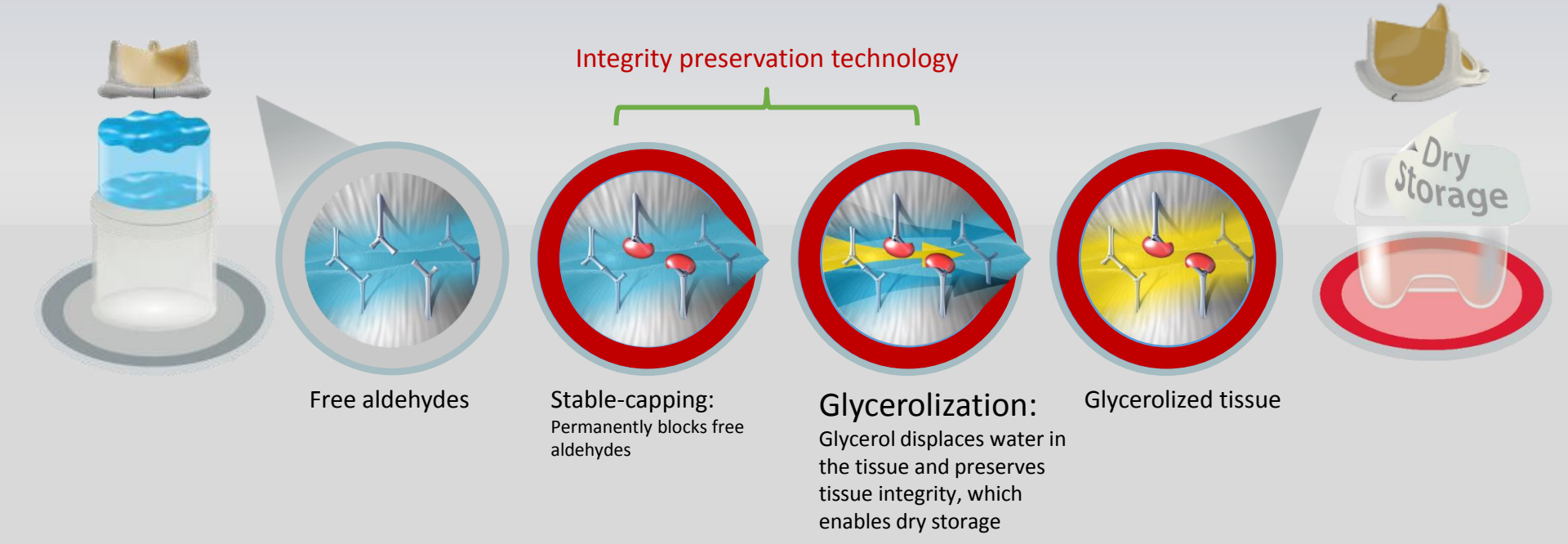
However, a side effect of glutaraldehyde fixation and storage is the introduction of free aldehydes

In vivo, calcium binds to free aldehydes

Tissue exposure to free aldehydes during glutaraldehyde fixation and storage is a major cause of calcification.

1. Schoen FJ, Levy RJ. *Ann Thorac Surg*. 2005;79:1072–80.

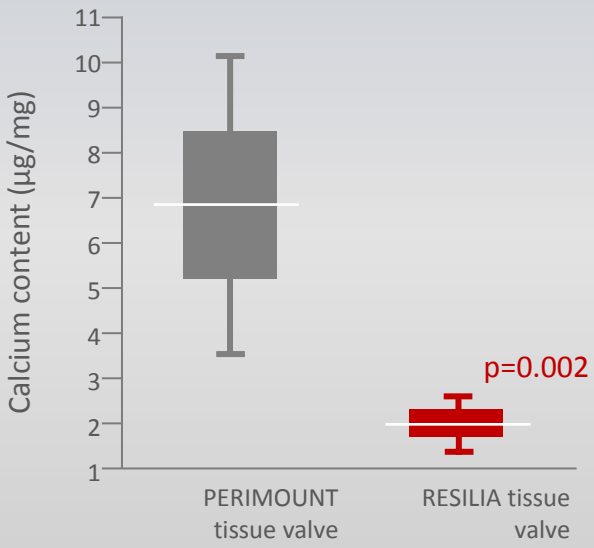
- Integrity preservation technology incorporates two features with a new way to virtually eliminate free aldehydes while preserving and protecting the tissue



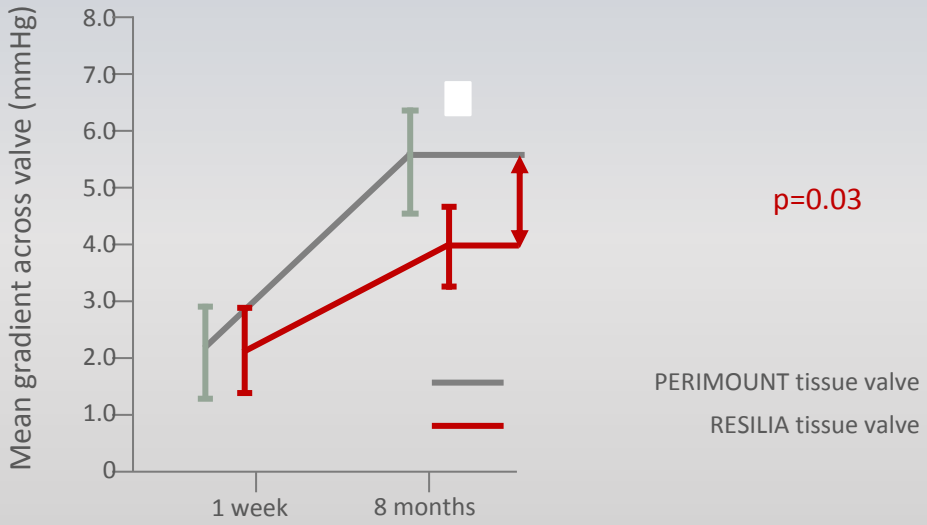
Juvenile sheep model: Significant improvement in anti-calcification and sustained hemodynamic properties compared with the PERIMOUNT valve

"This model mirrors the **accelerated calcification** that is often seen in younger humans."

Final calcium content at end of 8 months[1]



Mean gradient across both valve groups[1]



Calcium content was **72% lower**, and mean gradient was **significantly lower** than in the control group*

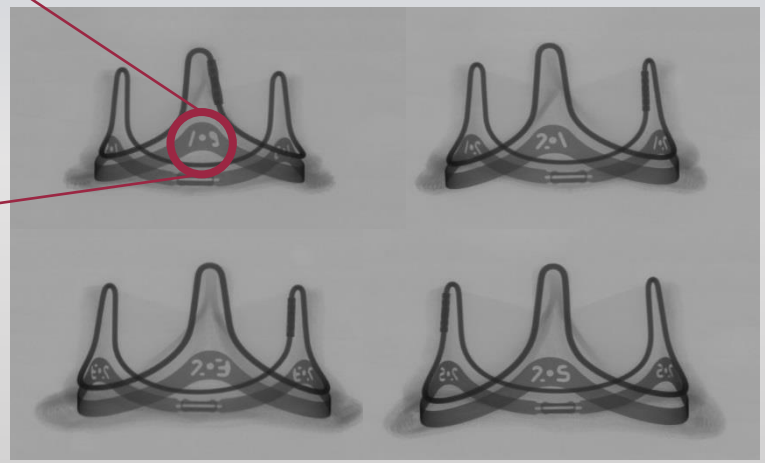
* No clinical data are available that evaluate the long-term impact of RESILIA tissue in patients.

1. Flameng W, et al. *J Thorac Cardiovasc Surg*. 2015;149:340–5.

The technology incorporates two novel features designed for potential future valve-in-valve (ViV) procedures

VFit technology

Incorporates two



- **Fluoroscopically visible size markers**

Technology incorporates two features designed for potential future valve-in-valve (ViV) procedures

AORTIC VALVE REPAIR

WHEN?

To Preserve or Not to Preserve?

The **DECISION** depends on

- **FEASIBILITY**
- **EXPECTED DURABILITY**

The **EVALUATION** rests on

- **PREOP IMAGING**
- **INTRAOP ASSESSMENT**

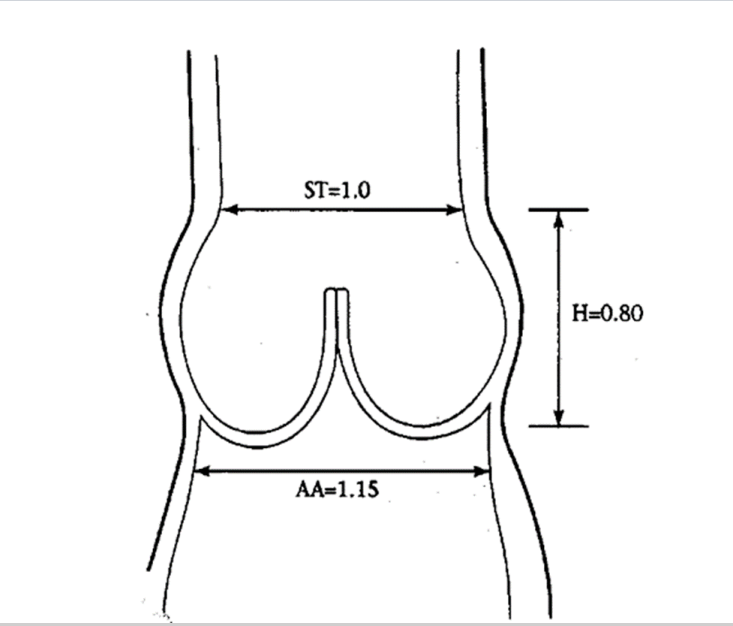
Mechanisms of AR are <u>a combination of:</u>

Root pathology:

Asc. Aortic aneurysm (STJ)

Root aneurysm:

- STJ
- Annular dilataion



Cusp pathology:

Cusp Prolapse

Calcific degeneration

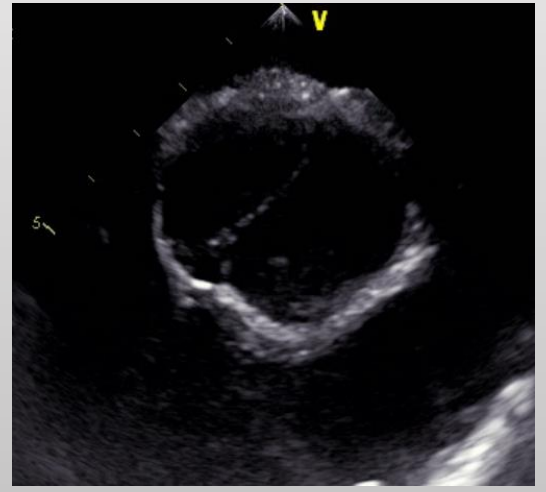
Commissural pathologies

To recognize the anatomical and operative factors associated with better repair durability

Favorable ECHO Characteristics

- **CUSPS**
  - Pliable
  - Little to no calcium
  - Sufficient tissue length (Gh)

- **AORTIC ANNULUS**
  - <28mm

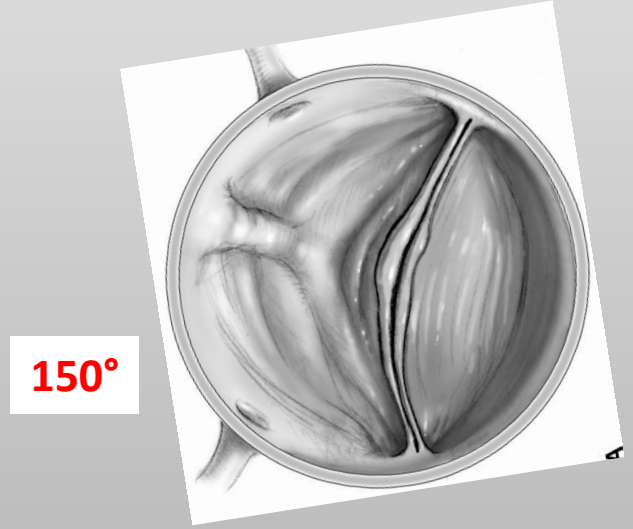


- **COMMISSURES (BAV)**
  - Close to symmetric circumferential orientation 160-180°

Favorable INTRAOP Characteristics

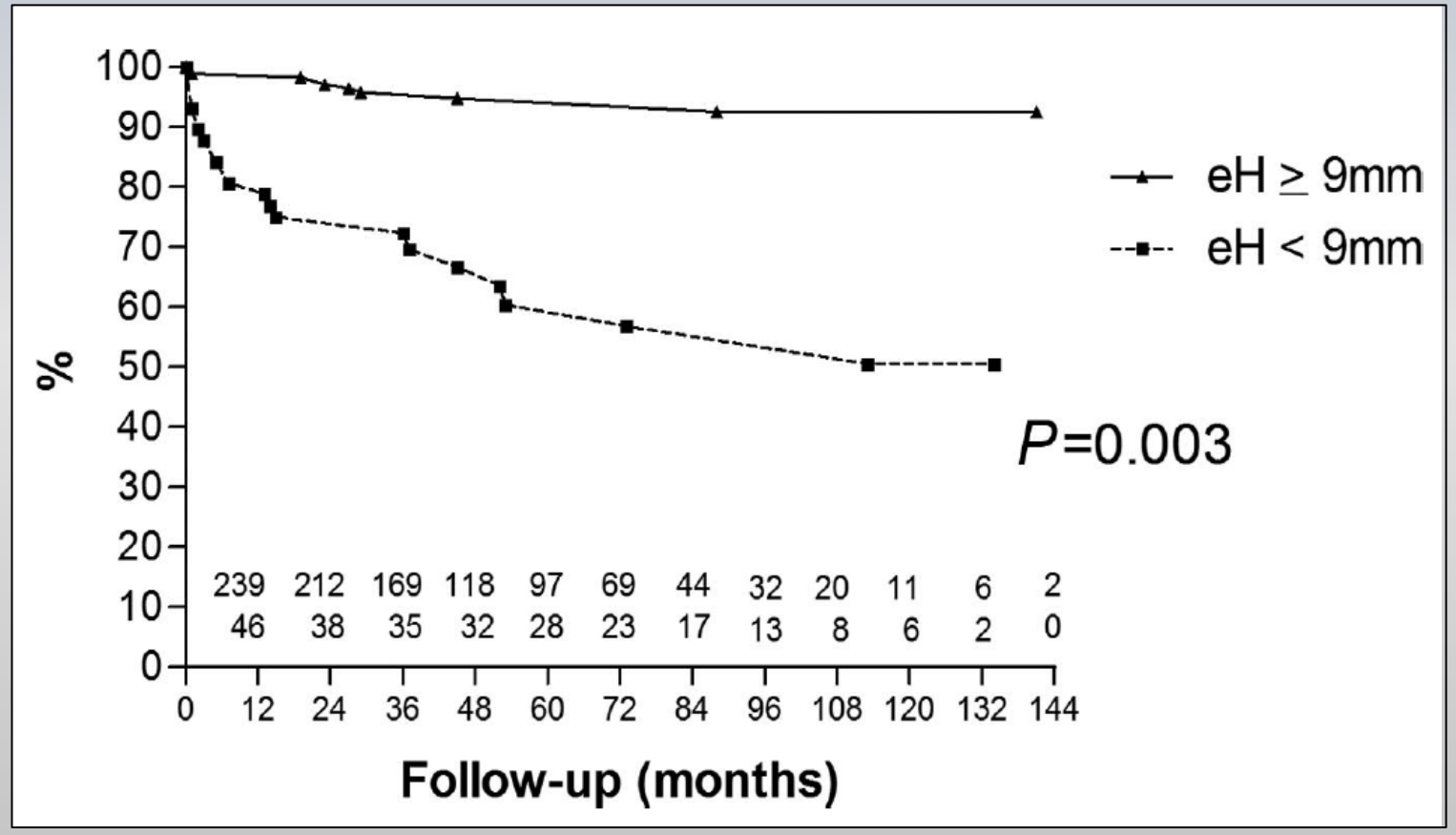
- **CUSPS**
  - Geometric height ≥20mm(BAV)>18 (TAV)
  - Little to no calcium/fenestrations

- **COMMISSURES**
  - Circumferential orientation 160-180°



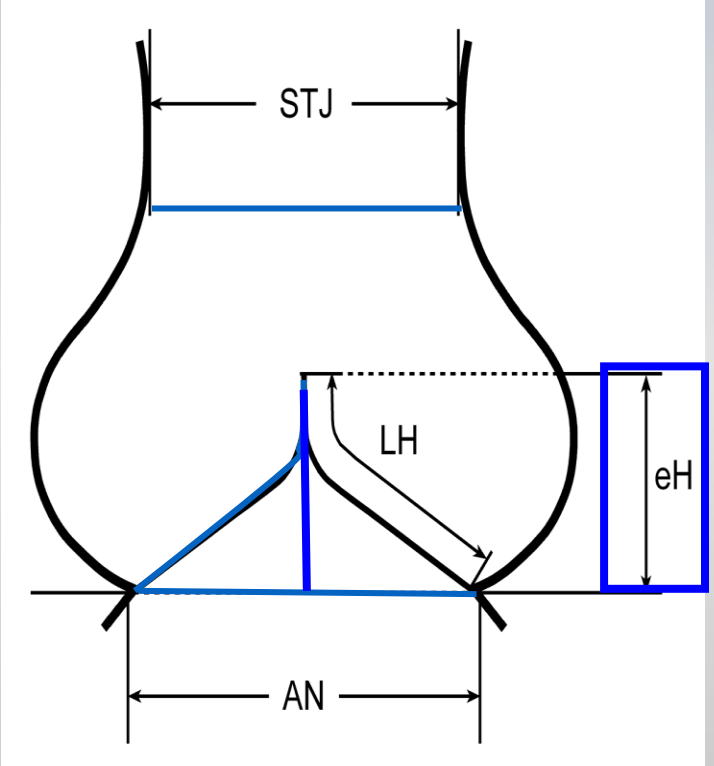
RELEVANCE OF CUSP PROLAPSE

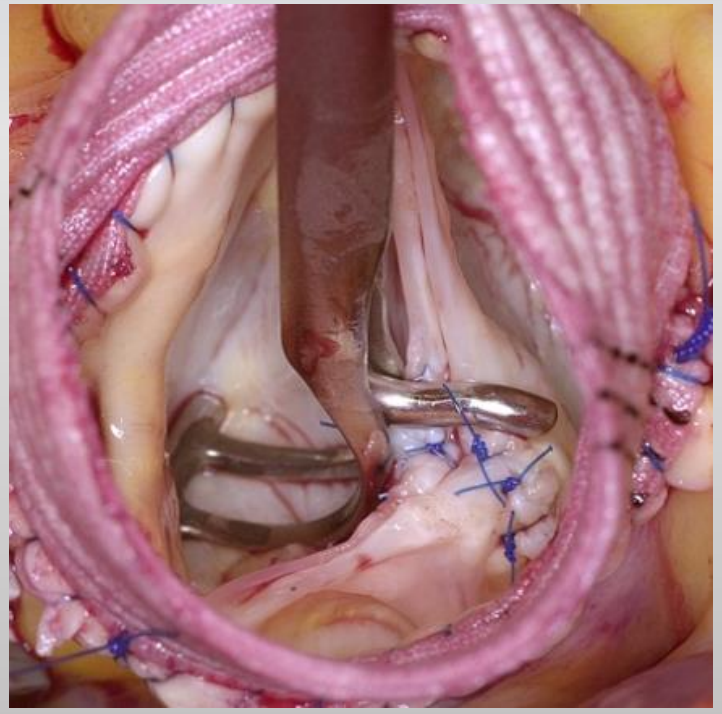
EFFECTIVE HEIGHT



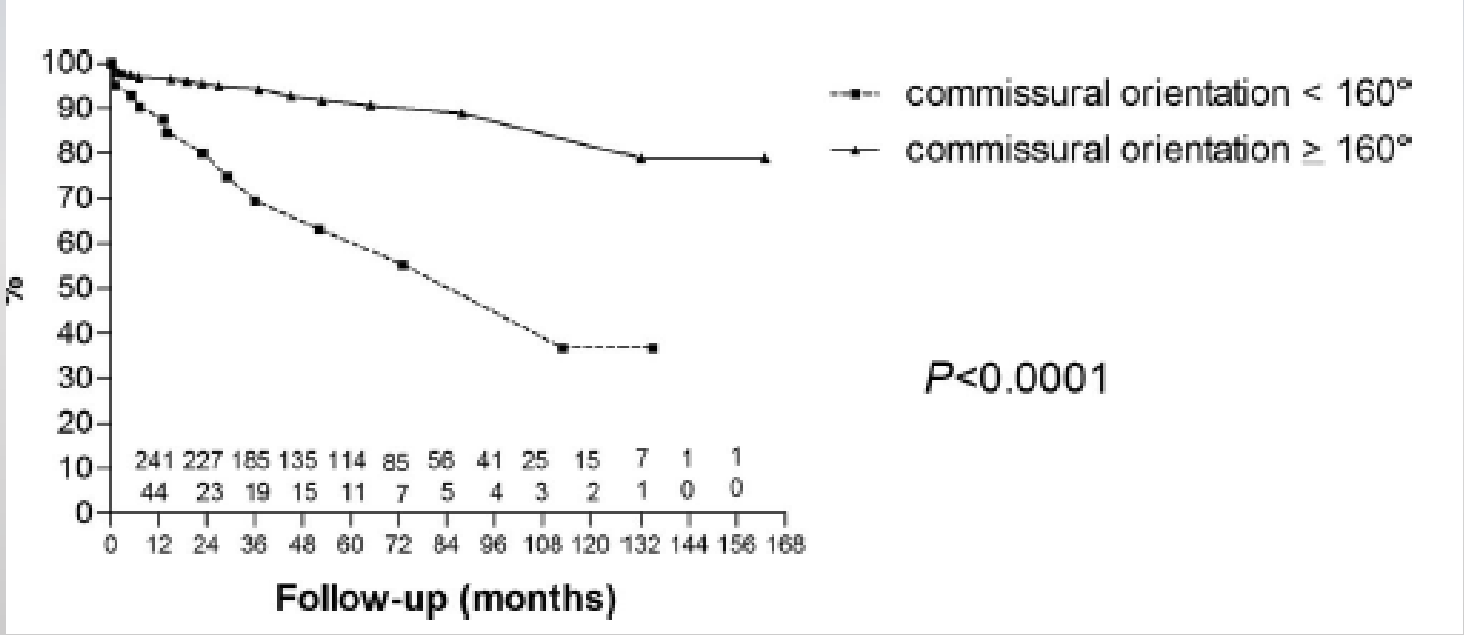
Aicher et al. Circulation 2011

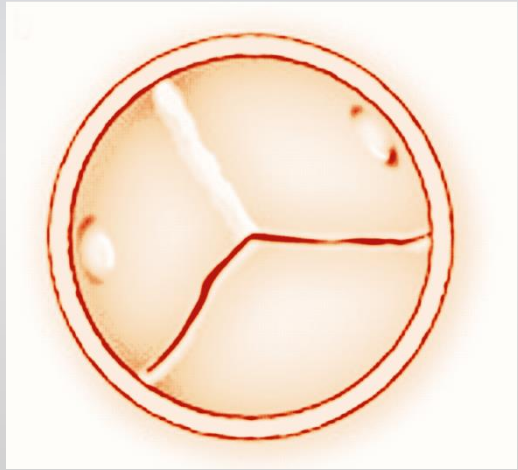
The Effective Height Concept





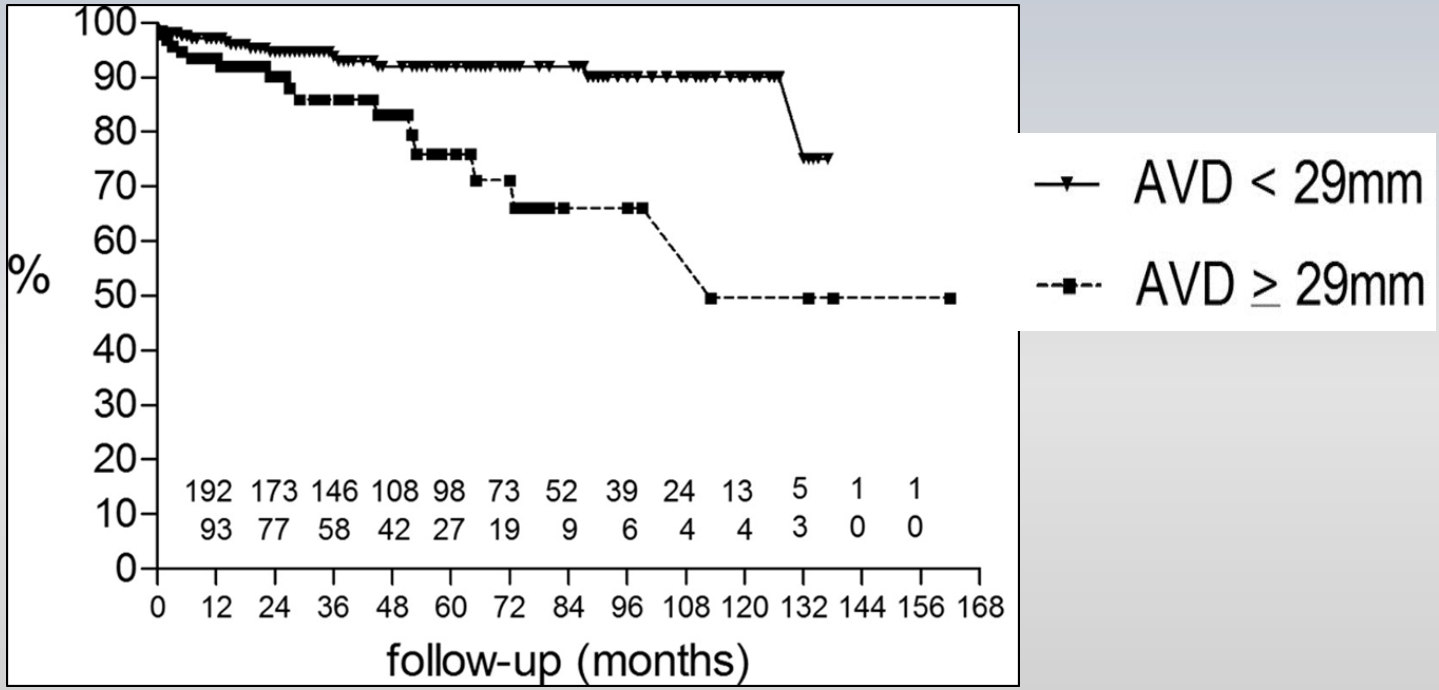
Freedom from reoperation BAV repair depending on the orientation of the 2 normal commissures

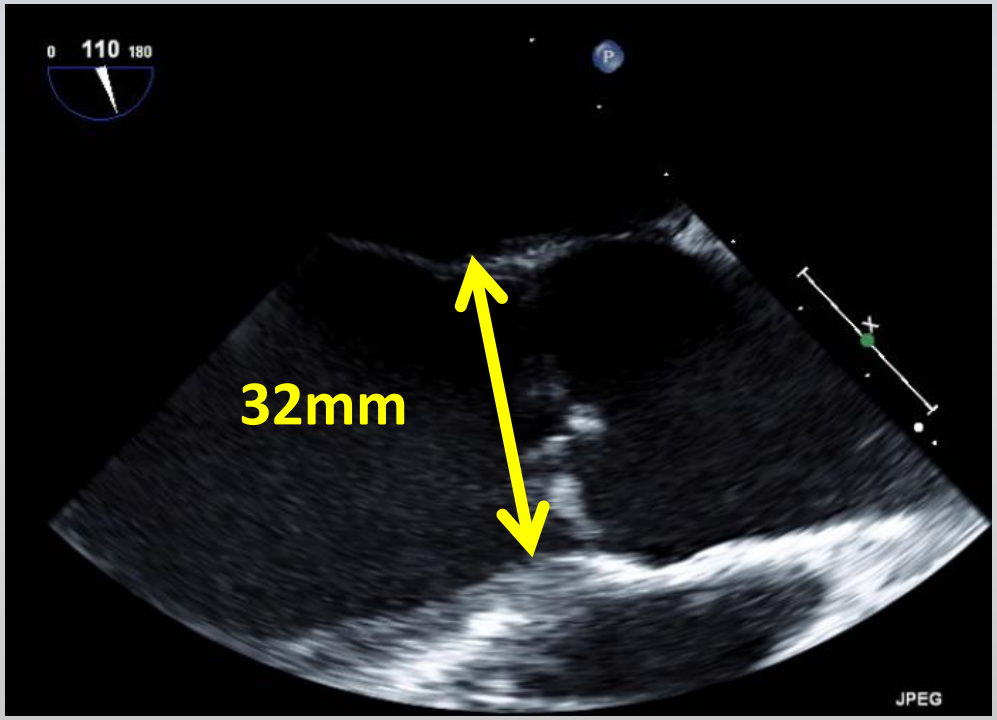




Aicher D et al. Circulation 2011;123:178-185

The importance to treat annular dilatation

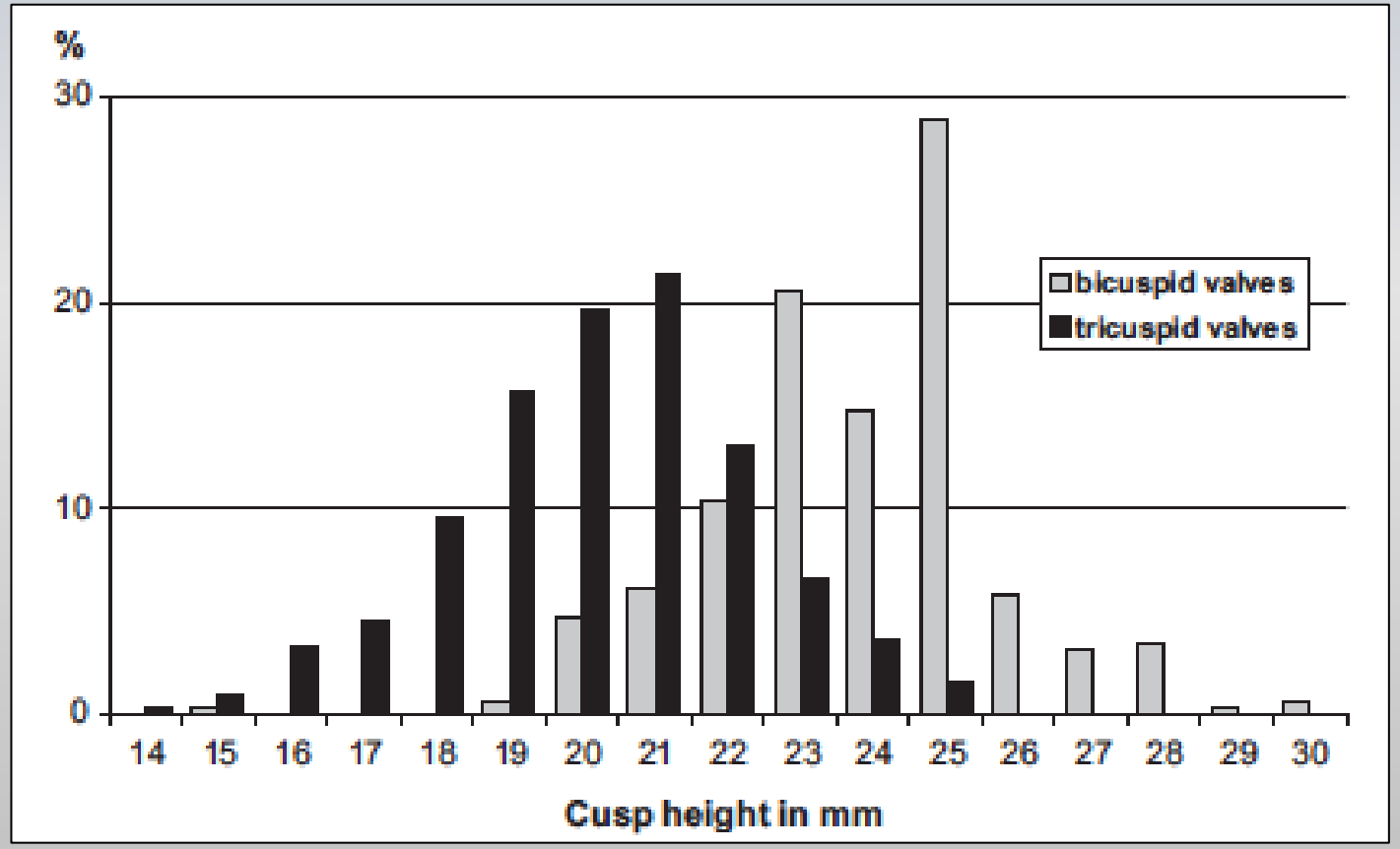


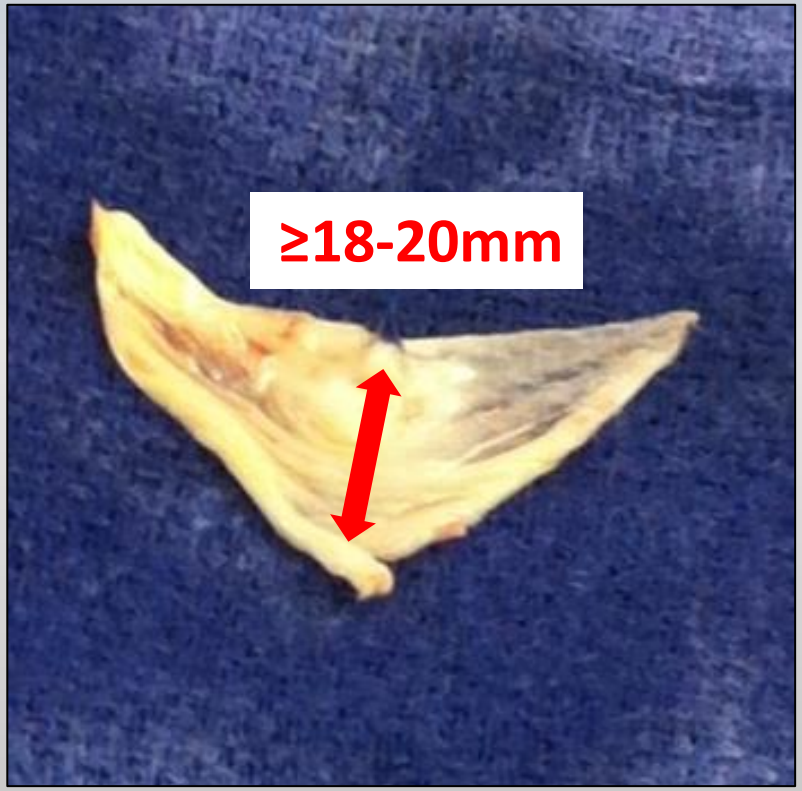


Aicher et al. Circulation 2011

Tissue deficiency

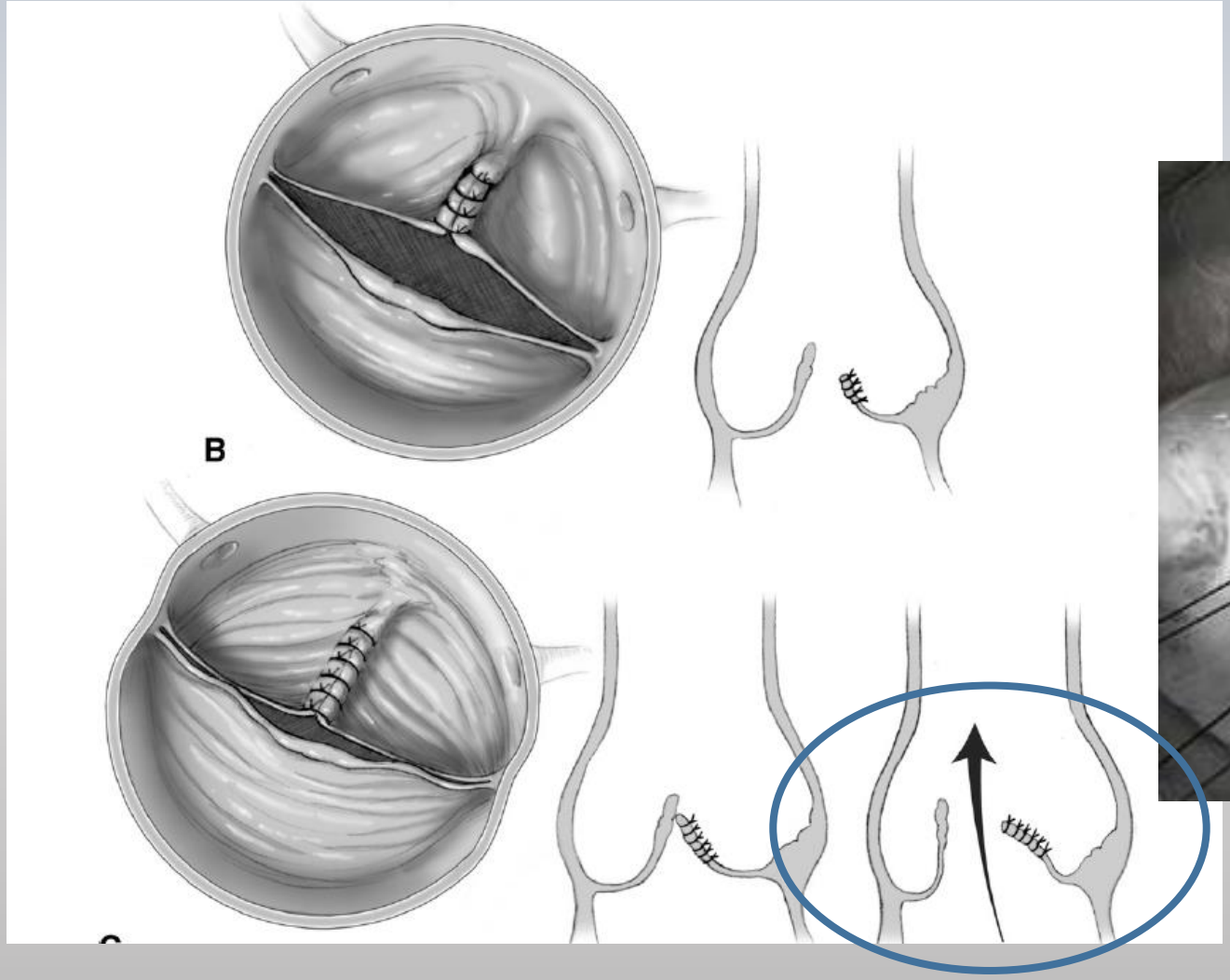
GEOMETRIC HEIGHT

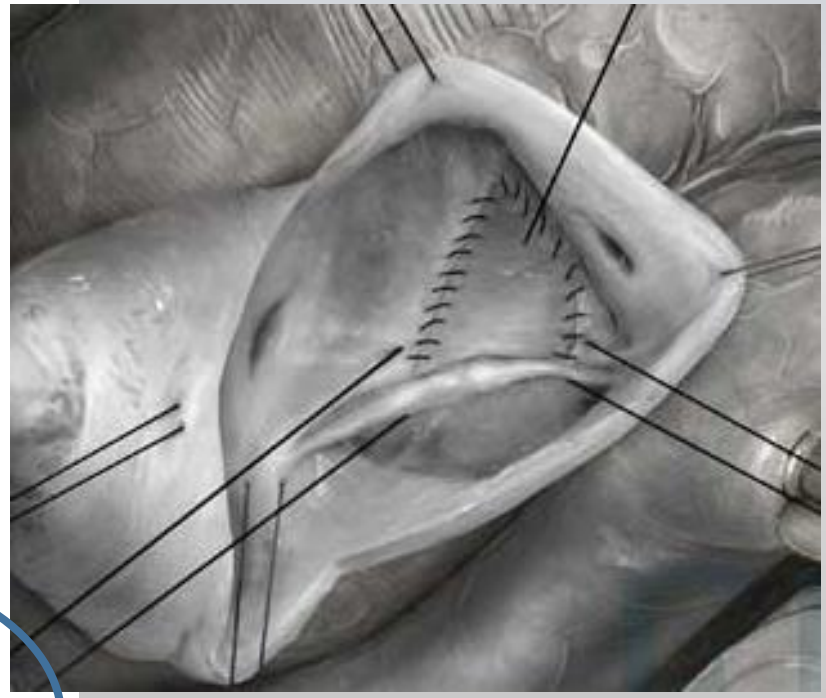




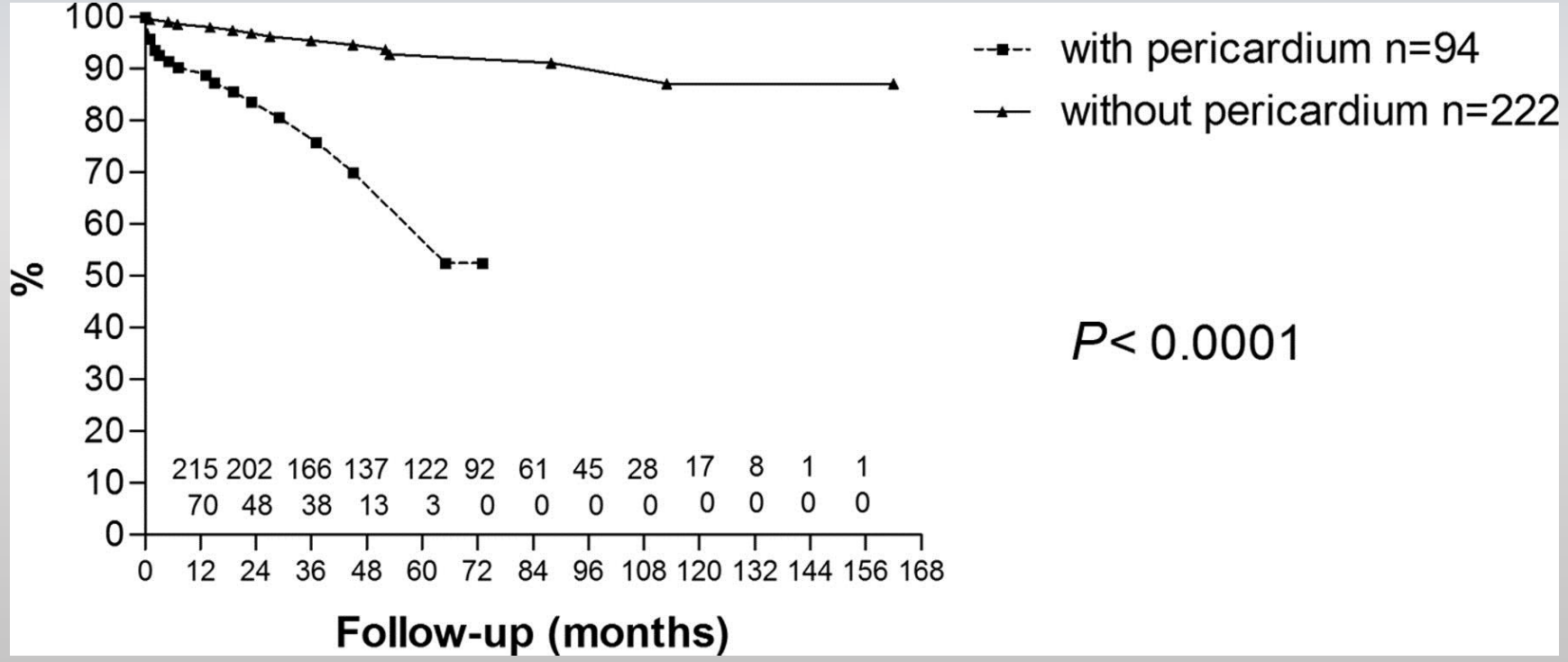
Schafers et al. JTCVS 2013

Tissue Deficiency
(geometric height< 18-20mm)





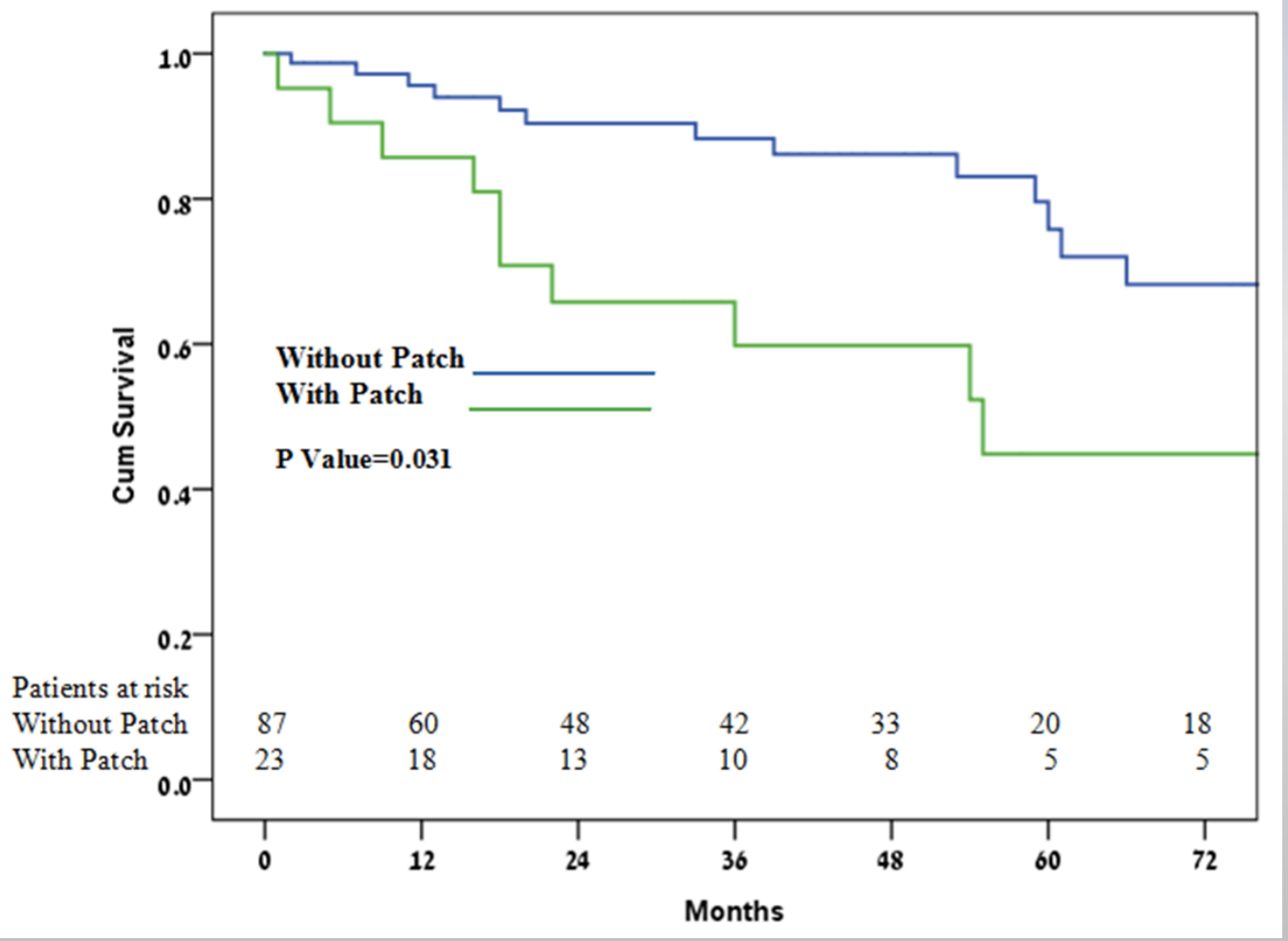
Freedom from reoperation after BAV repair depending on the use of a pericardial patch



Aicher D et al. Circulation 2011;123:178-185

Pericardial Patch Augmentation

Other materials(Cor-matrix, Gortex membrane, Cardiocell)



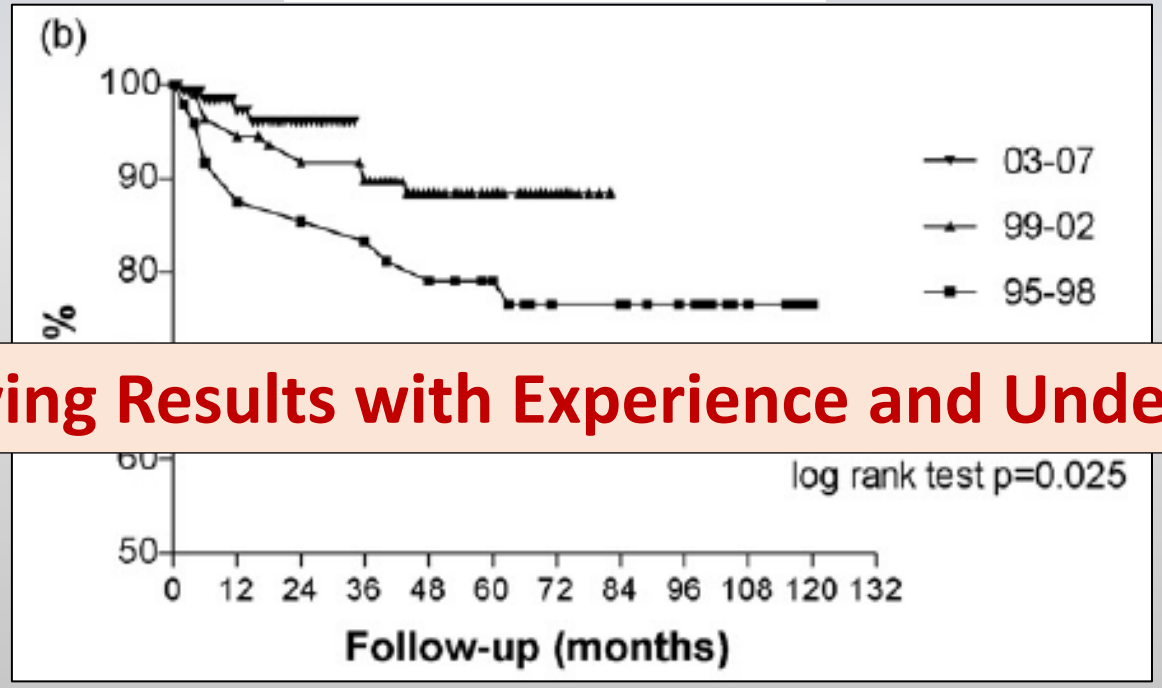
Presented at the EACTS 2016

The impact of experience

Aortic valve repair leads to a low incidence of valve-related complications

Diana Aicher [a], Roland Fries [b], Svetlana Rodionycheva [a], Kathrin Schmidt [a], Frank Langer [a], Hans-Joachim Schäfers [a,*]

Freedom from AR ≥ II



Improving Results with Experience and Understanding

Aicher et al. EJCTS 2010

SUMMARY

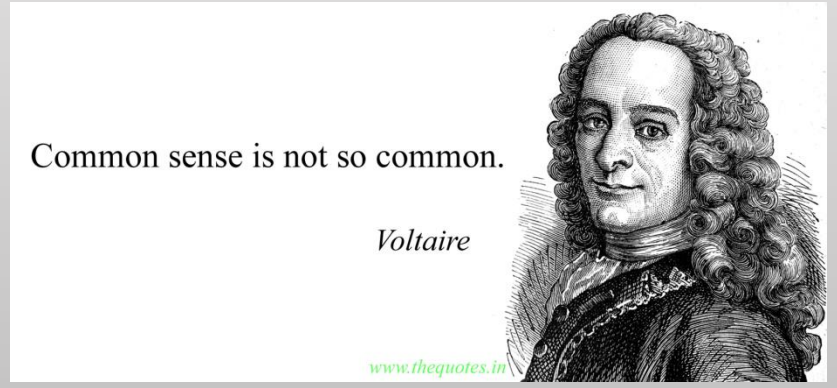
AORTIC VALVE REPAIR

- ***WHY?***
  - Better survival
  - Less valve-related complications
  - Better quality of life

- ***WHEN?***
  - Echo and intraoperative determination
  - Feasibility is not enough, repair should be durable– **JUDGEMENT**


SUCCESS
it's not always what you see

Thank you!


Common sense is not so common.
Voltaire
www.thequotes.in