# Alternatives/techniques chirurgicales pour la valve aortique


Pr Roland HENAINE

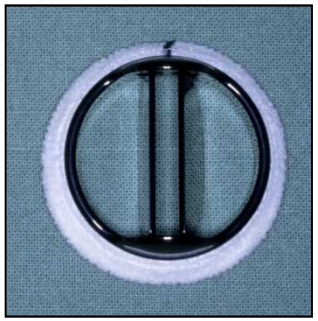
Service de chirurgie cardiaque C

Hôpital Cardiologique Louis Pradel

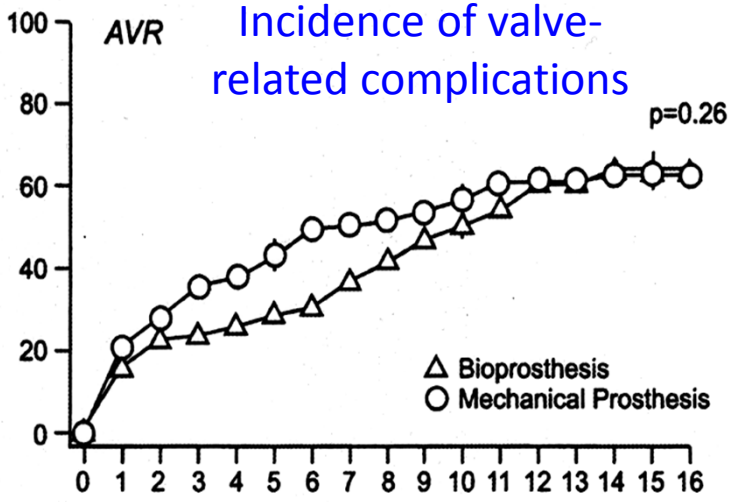
Lyon


VIème journée Inter Régionale de cardiologie pédiatrique et Congénitale Rhône-Alpes -Auvergne

# Aortic Valve Replacement



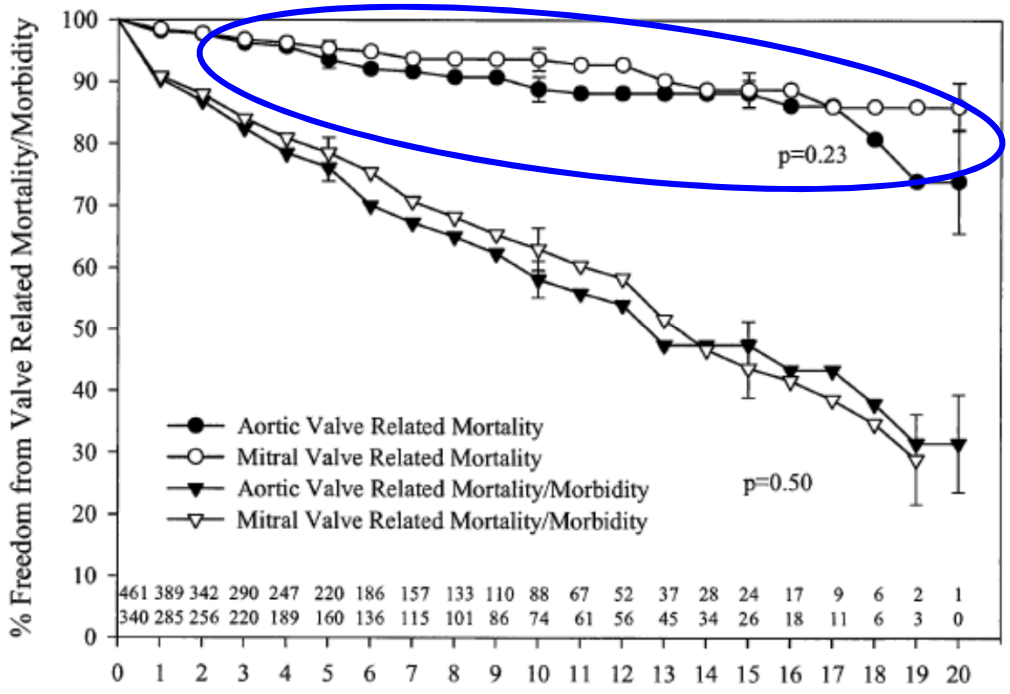
Thromboembolism
Anticoagulation/Hemorrhage
Structural failure
PV endocarditis




Hammermeister et al, JACC 2000

# AVR - Mechanical

## Prosthesis-related Mortality

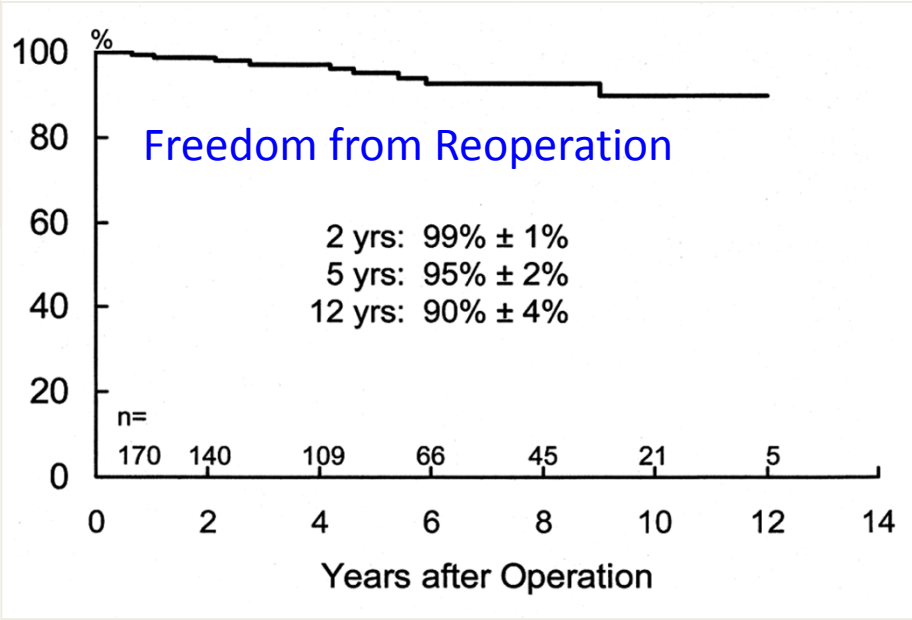



years after valve replacement

Ikonomidis JS, JTCVS 2003

Aortic Valve Replacement

# Pulmonary Autograft



European Heart Journal (2007) 28, 1993–2000
doi:10.1093/eurheartj/ehl550

Clinical research
Cogenital heart disease

# The Ross operation: a Trojan horse?†

Loes M.A. Klieverik[1]*, Johanna J.M. Takkenberg[1], Jos A. Bekkers[1], Jolien W. Roos-Hesselink[2], Maarten Witsenburg[3], and Ad J.J.C. Bogers[1]

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Received 6 October 2006; revised 22 December 20(

**KEYWORDS**
Ross operation;
Prospective study;
Survival;
Autograft dilatation;
Reoperation

**Aims** Th
(AVR) ar
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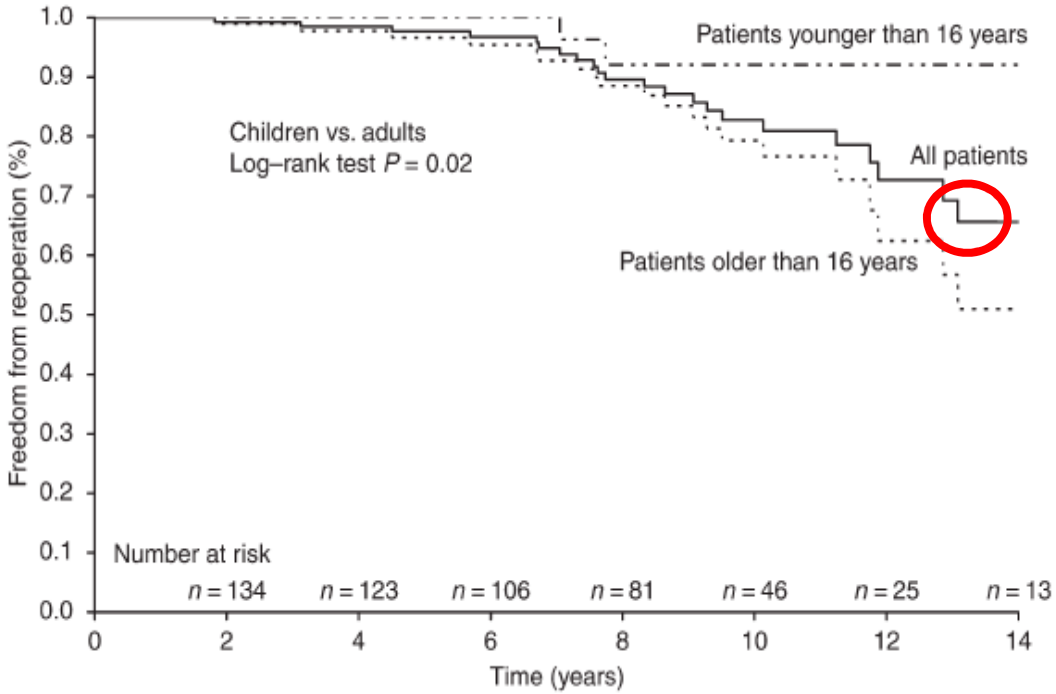
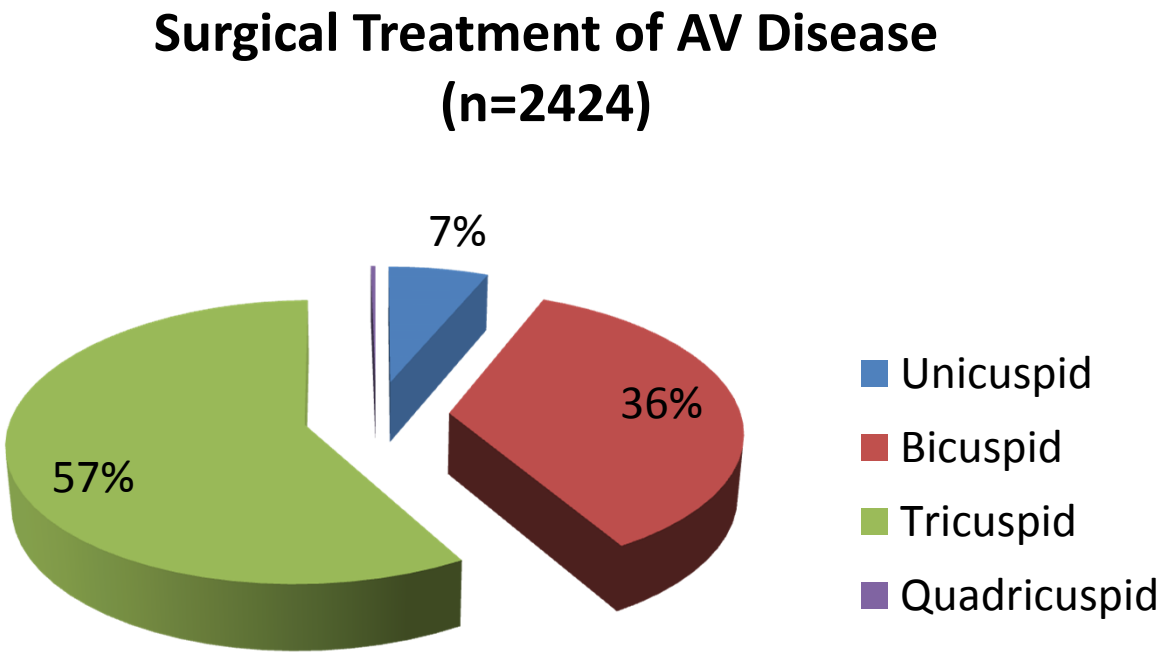


# Indications en congénital avec ou sans dilatation de l'aorte

- Bicuspidie aortique ,monocuspidie
- Marfan
- Syndrome de Loeyz Dietz
- Syndrome de Turner
- Post chirurgical
  - Post valvulotomie
  - Cono truncal (Fallot,VDDI,Truncus)
  - Switch
  - Norwood
  - Ross

# Valve Morphology (Schaeffers 2015)



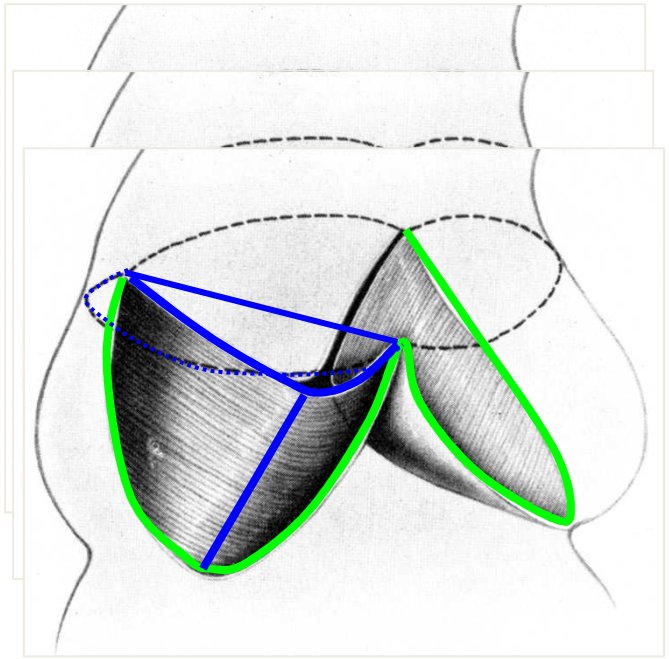
# Aortic Valve Repair - Assessment

## Difficulties

Dimensions- of aortic root/(ring)

Configuration/coaptation of cusps

Vision from outflow



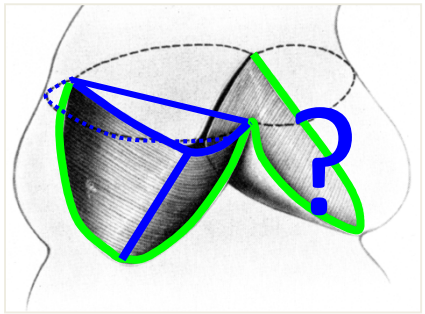
Geometry altered by non-filled state!

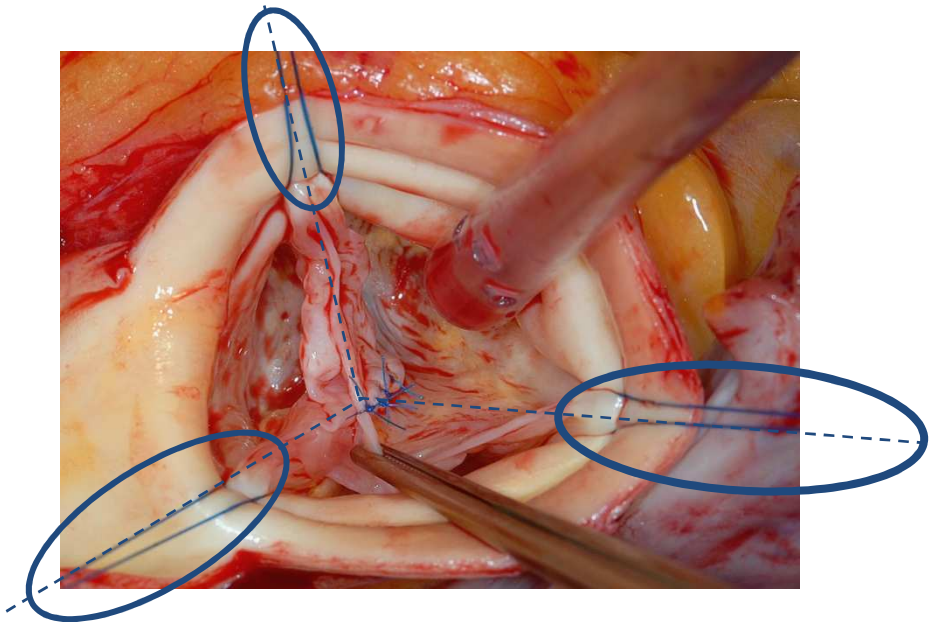
# Aortic Valve Repair - Assessment

## Solutions

Geometry altered by non-pressurized state!

Stay sutures!

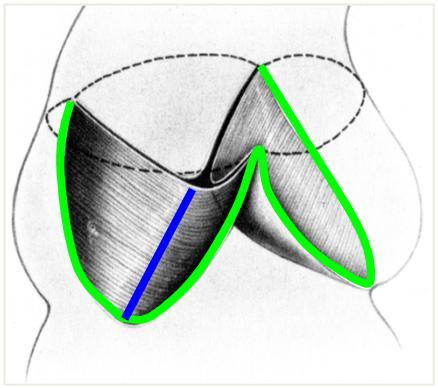


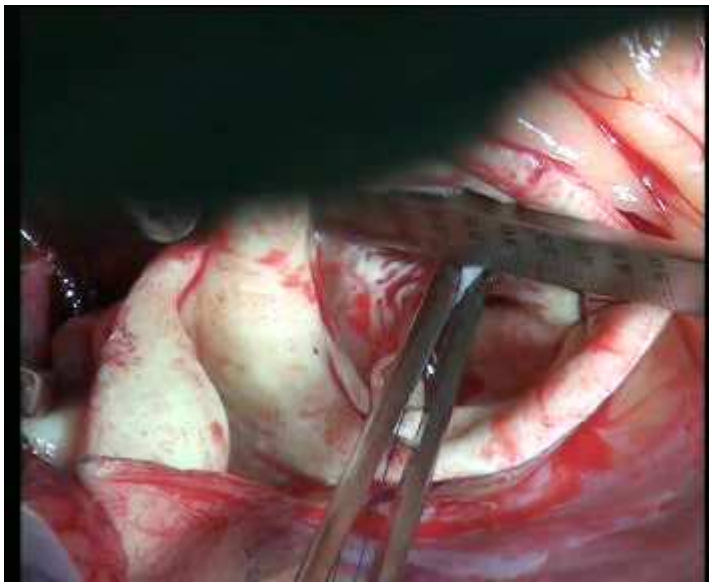



# Aortic Valve Repair - Assessment

## Solutions

Configuration/coaptation of cusps

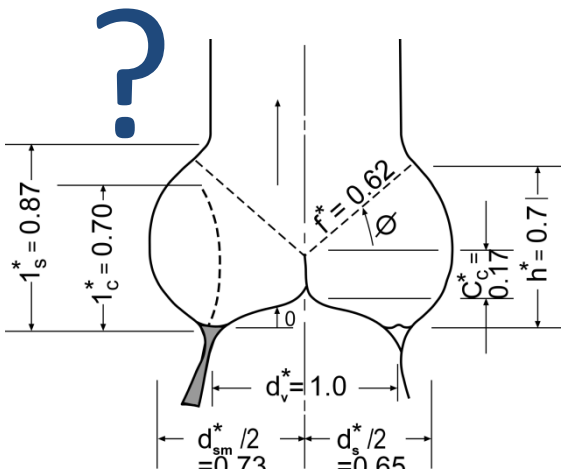




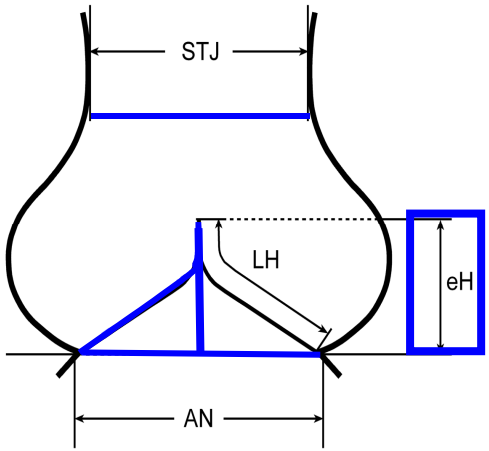
TAV: 17-22 mm
BAV: 20-25 mm

# Aortic Valve Repair - Assessment

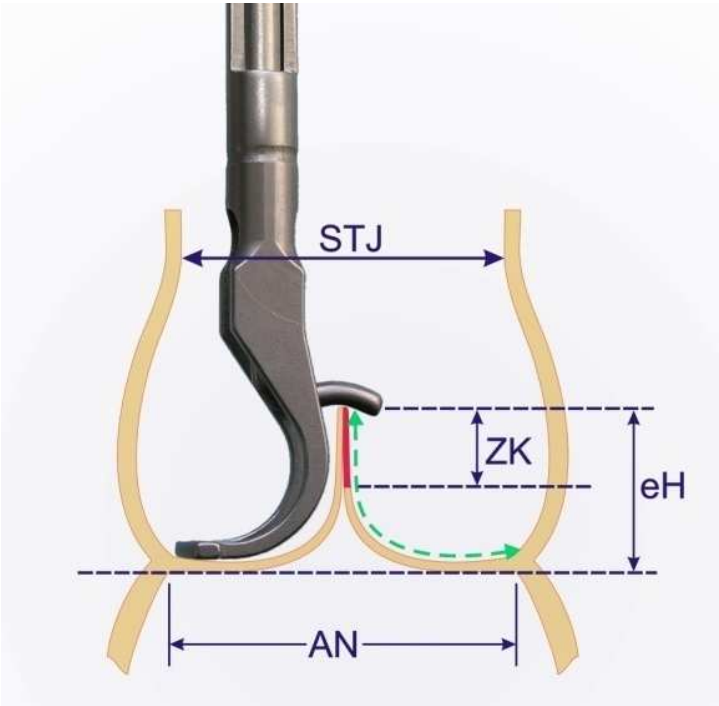
Cusp Configuration

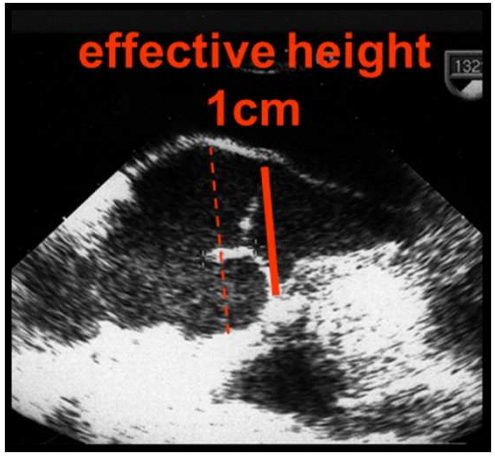



Swanson, Circ Res 1974




Schäfers JTCVS 2006



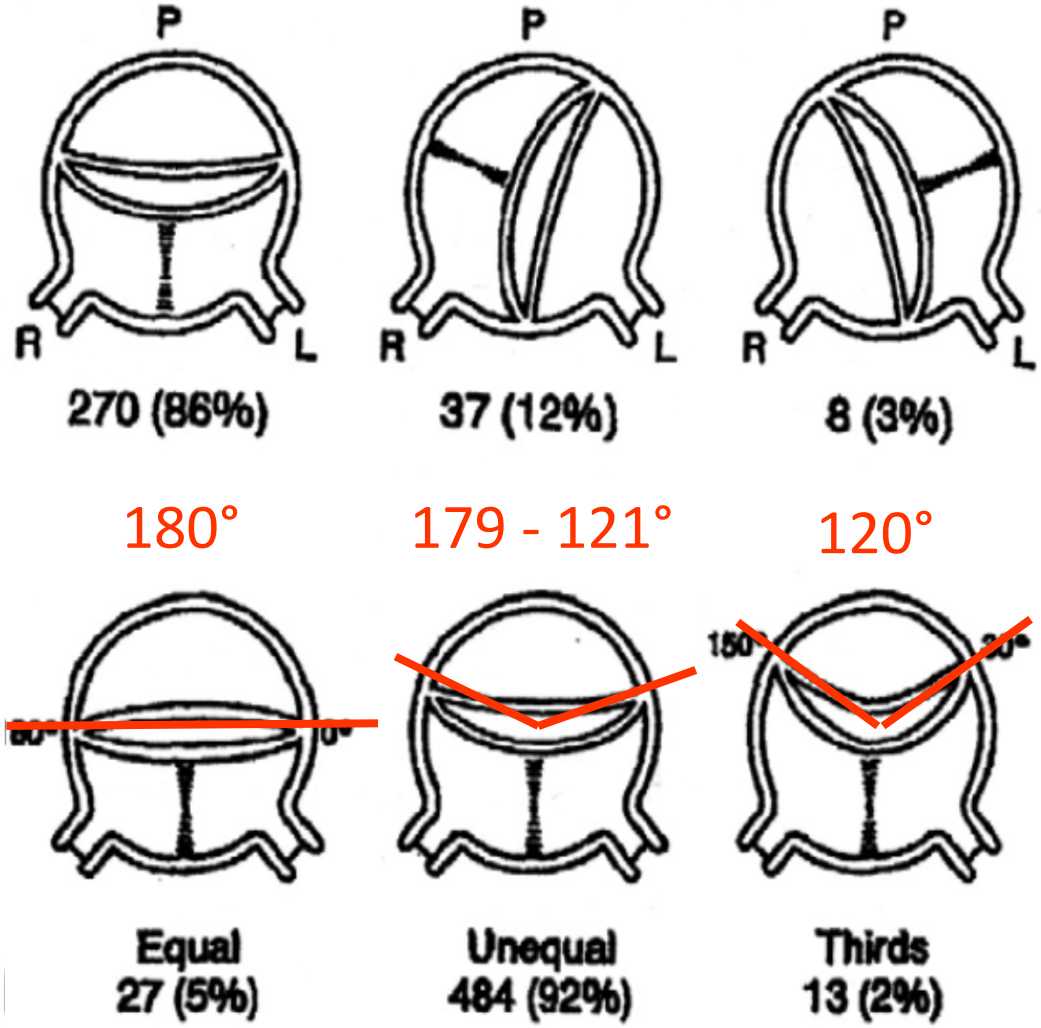

Schäfers JTCVS 2006

Control group.

| | Adults, $n$ = 100 |
|---|---|
| Age (years) | 33.8 ± 14 (19–76) |
| Body height (m) | 1.75 ± 0.09 (1.5–2) |
| Body weight (kg) | 71.9 ± 12.6 (42–105) |
| Body surface area ($m^2$) | 1.87 ± 0.2 (1.35–2.4) |
| Effective height (mm) | 9.5 ± 1.4 (7–12) |
| Aortoventricular diameter (mm) | 21 ± 2.8 (13.5–30.6) |
| Sinus Valsalva diameter (mm) | 28.5 ± 3.5 (21.1–40) |
| Sinutubular junction (mm) | 25 ± 3.7 (16–36.6) |
| Sinus height (mm) | 22.4 ± 4.2 (33.9) |

Bierbach et al. / Eur J Cardiothorac Surg 38 (2010) 400-406

# Anatomic Variants of bicuspid Valve Morphology



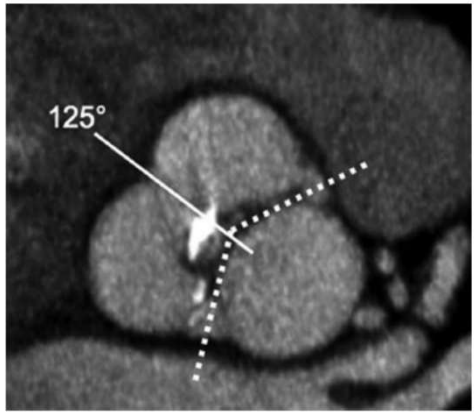
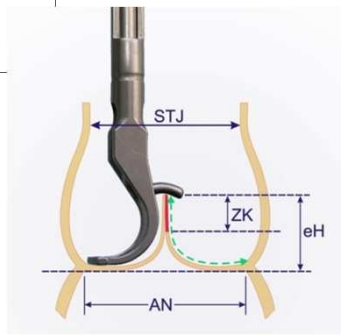




Figure 1. BAV with a commissural orientation of 125°.

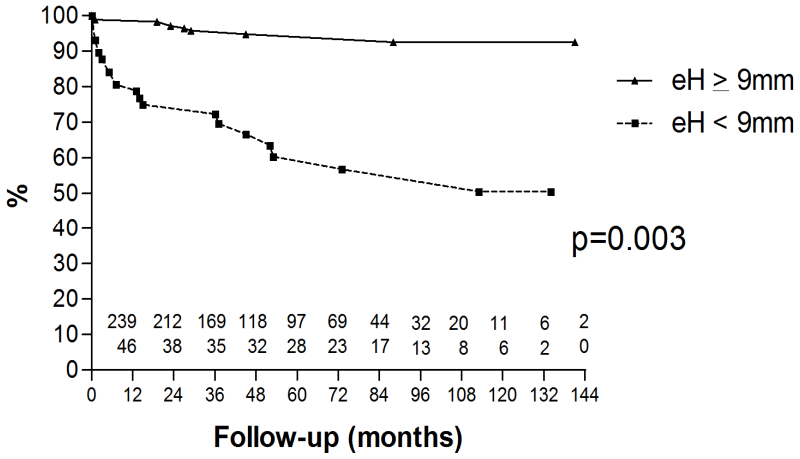
Sabet et al, Mayo Clin Proc, 1999;74:14-26

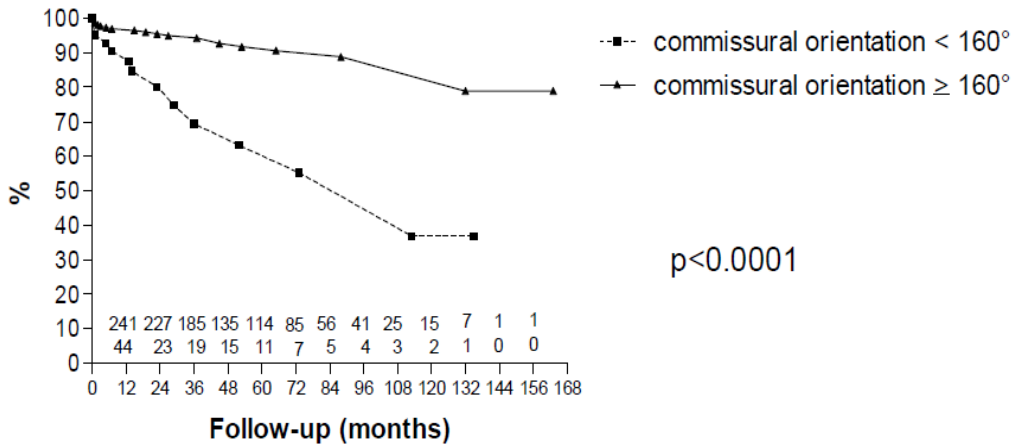
# Valve Configuration Determines Long-Term Results After Repair of the Bicuspid Aortic Valve

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



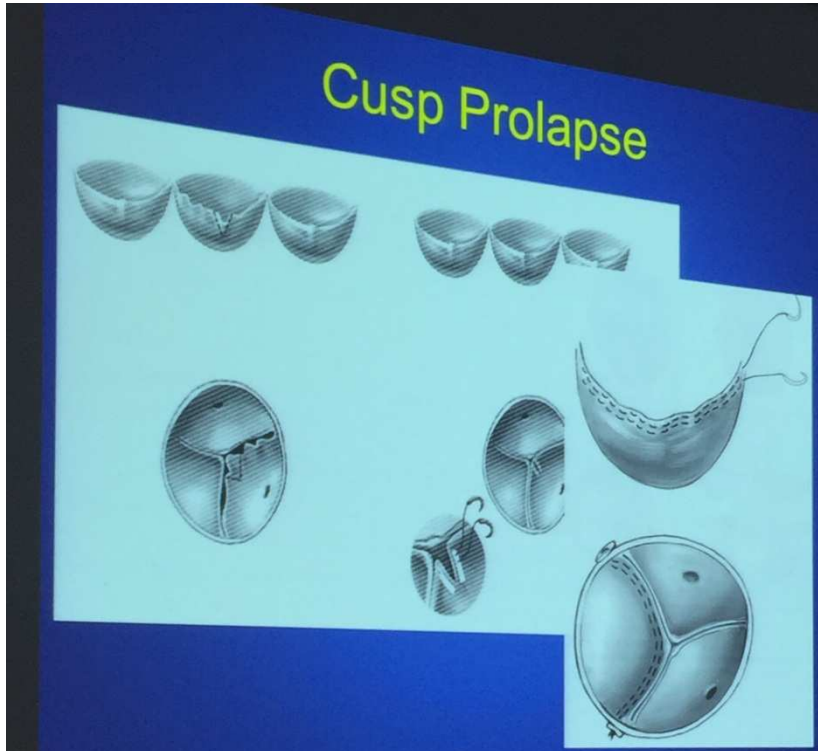

## Actuarial freedom from reoperation

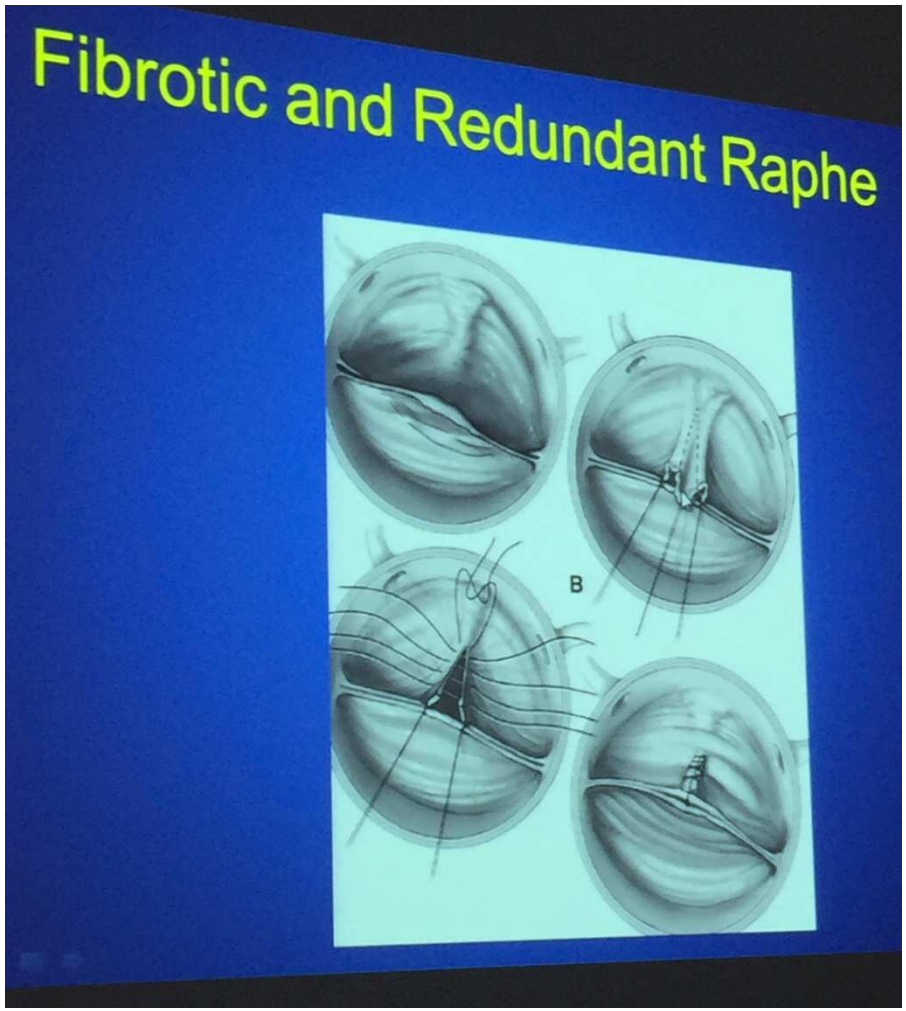


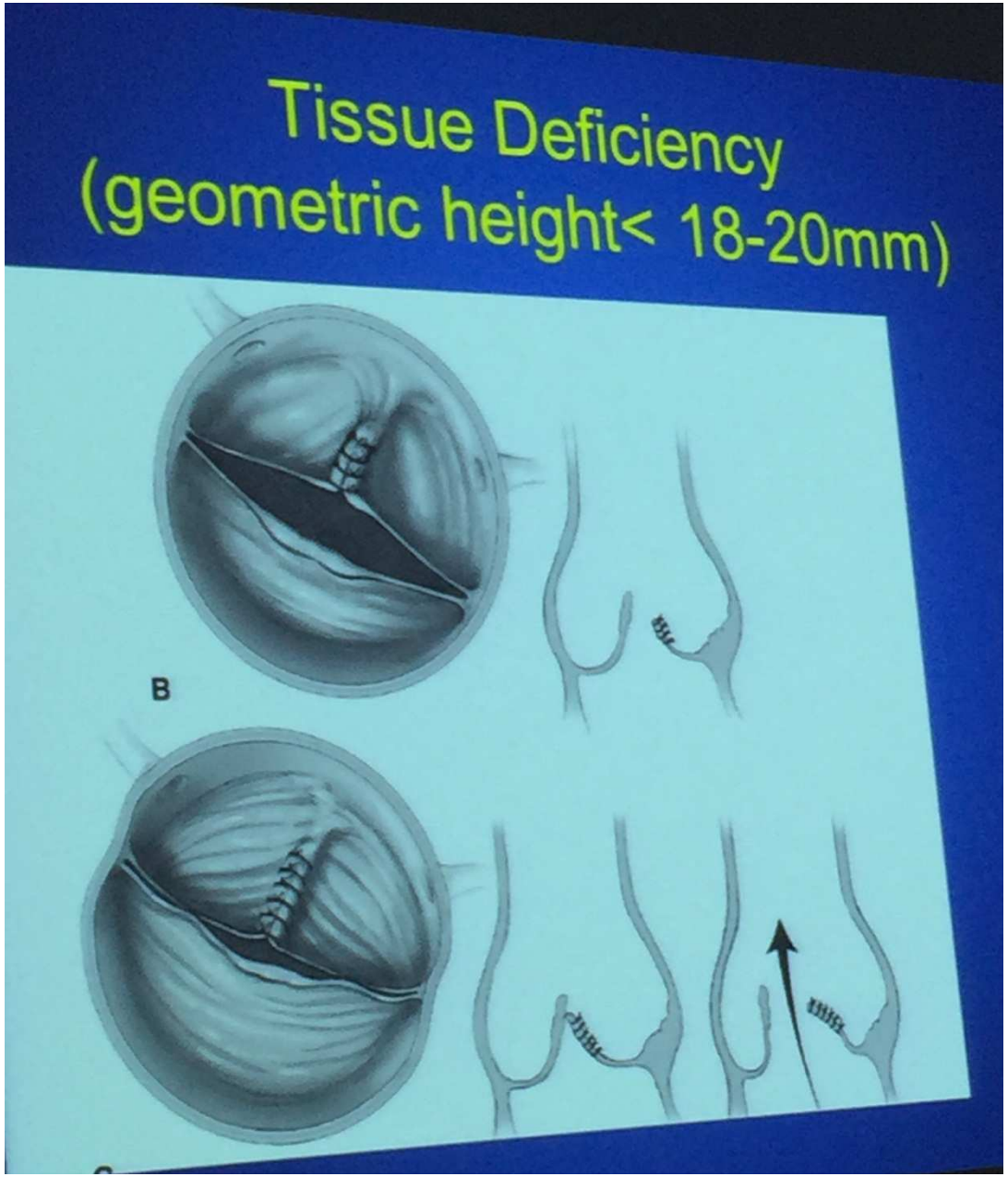



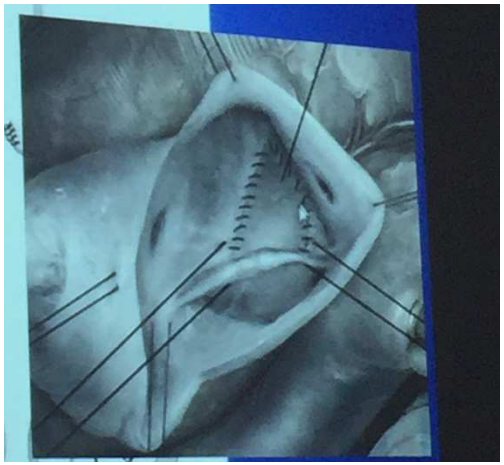

**Aicher et al. Circulation 2011 Jan 18;123(2):178-85**

# Techniques utilisées

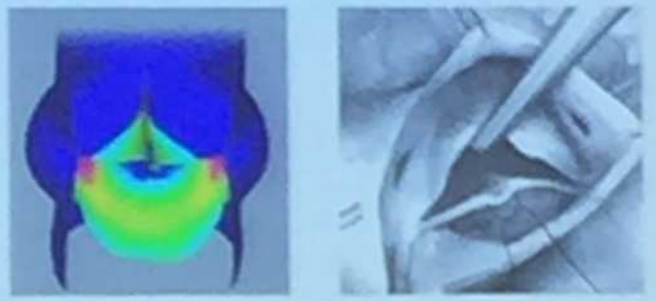


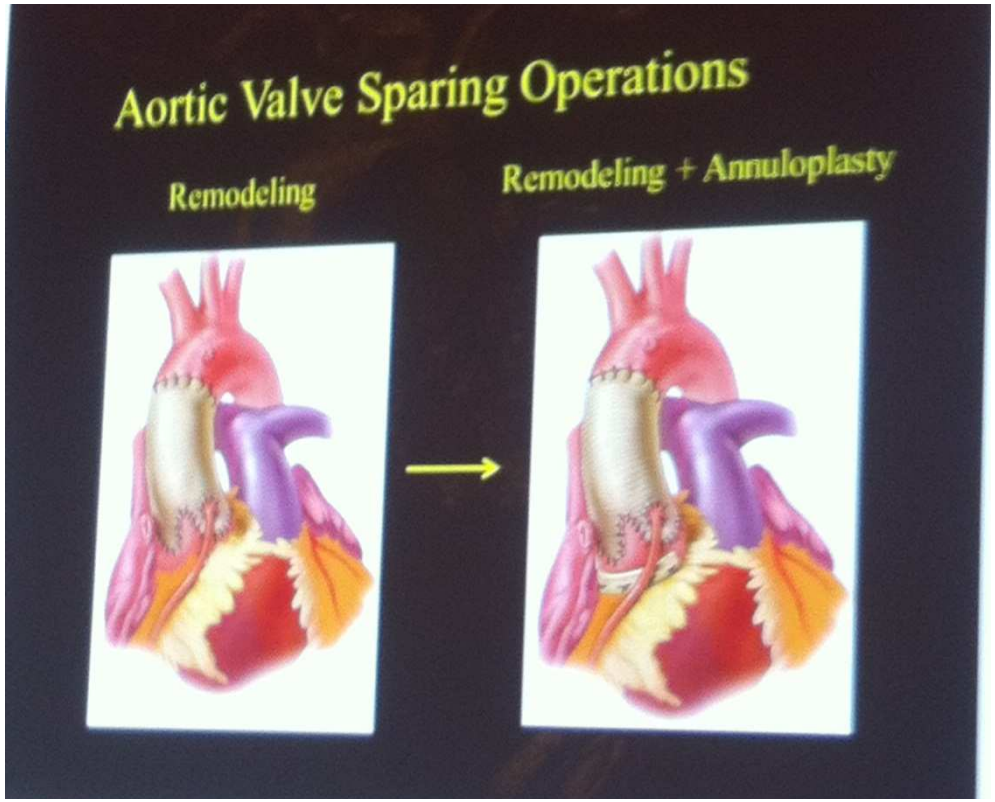

Tissue Deficiency
(geometric height< 18-20mm)
B

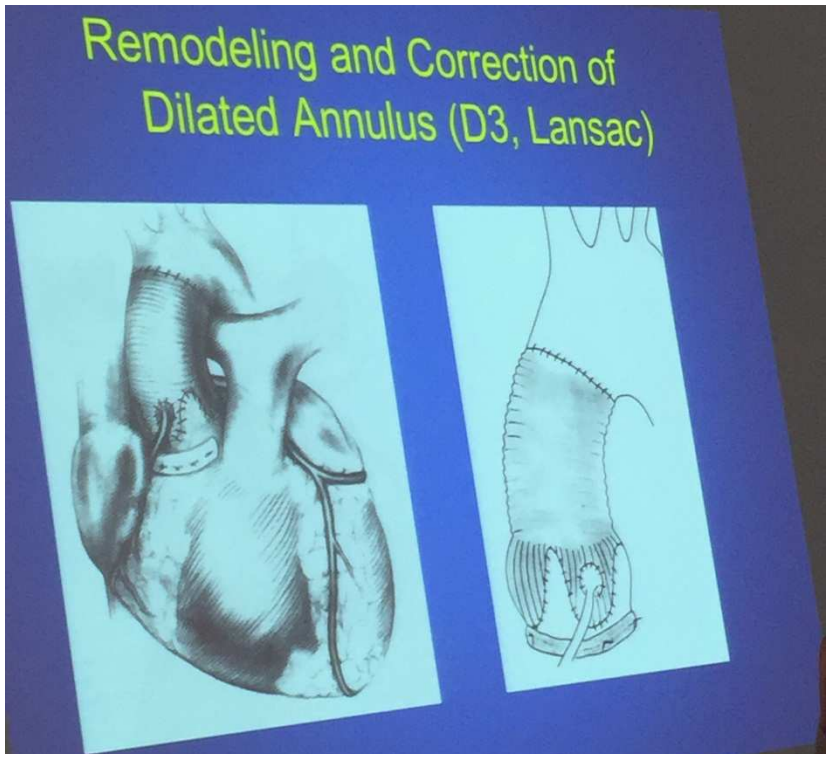


## Cusp Repair: Prolapse – Homburg Techniques

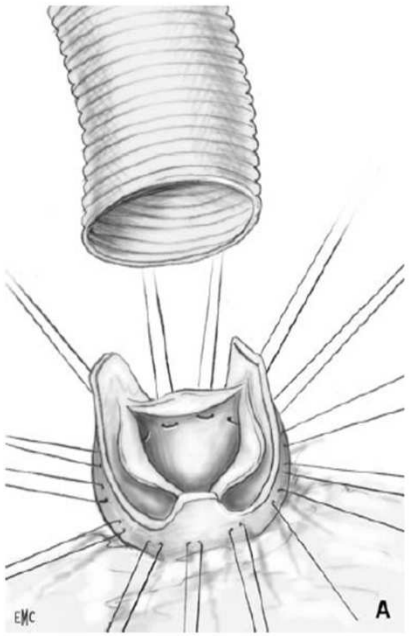
| | | |
|---|---|---|
| Prolapse | Central Cusp Plication |  |
| Prolapse + Redundancy/ Fibrosis | Triangular Resection |  |
| Prolapse + Calcium/ Fenestrations | Pericardial Patch |  |

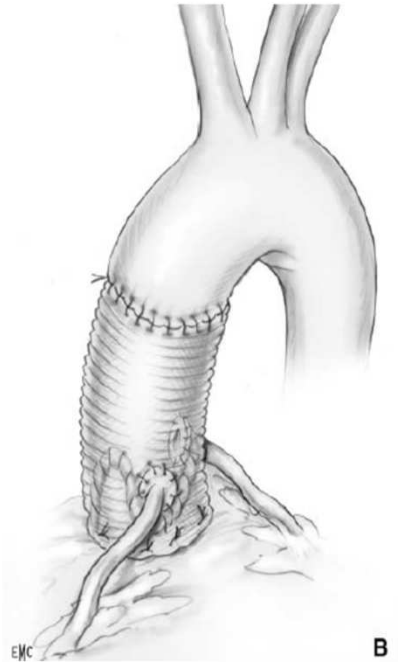
# Remodeling: opération de Yacoub

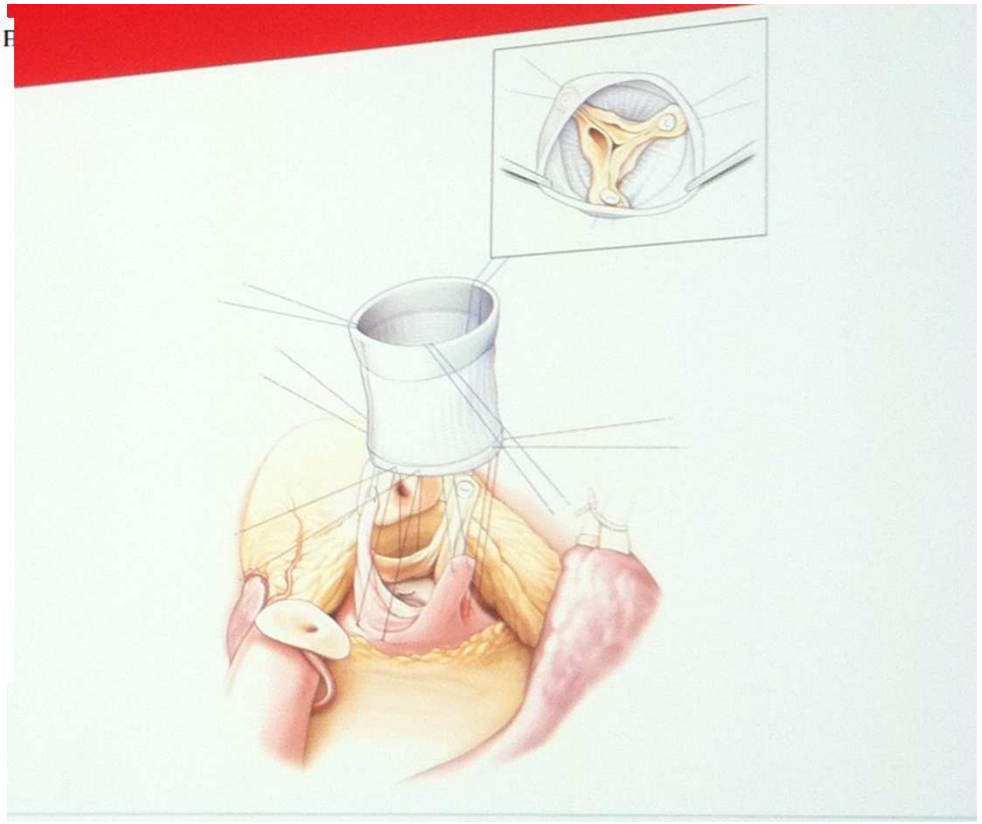


# Réimplantation /Tirone David

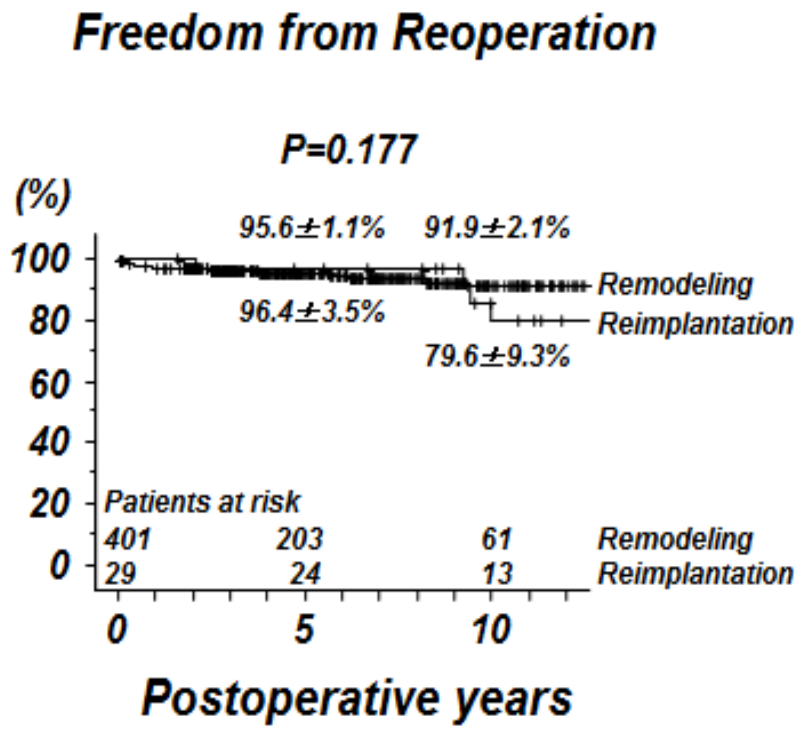


# Preoperative aortic root geometry and postoperative cusp configuration primarily determine long-term outcome after valve-preserving aortic root repair

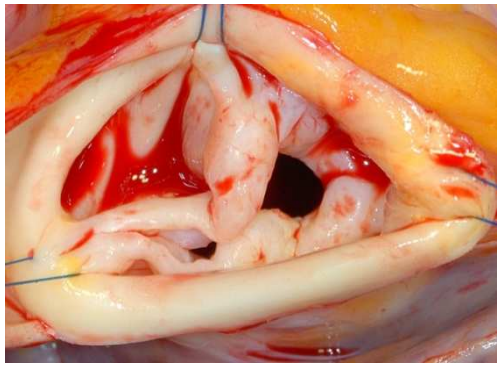
Takashi Kunihara, MD, PhD,[a] Diana Aicher, MD,[a] Svetlana Rodionycheva, M
Heinrich-Volker Groesdonk, MD,[a] Frank Langer, MD,[a] Fumihiro Sata, MD, PhD,[b] and
Hans-Joachim Schäfers, MD, PhD[a]

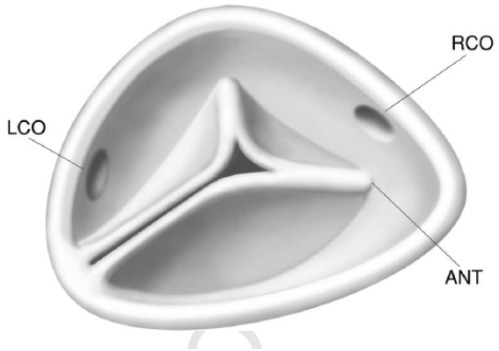



Kunihara et al. JTCVS 2012 Jun;143(6):1389-1395

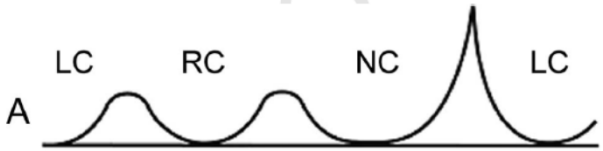
# Reconstruction of the Unicuspid Aortic Valve: Pushing the limits?

# Bicuspidization of the Unicuspid Aortic Valve

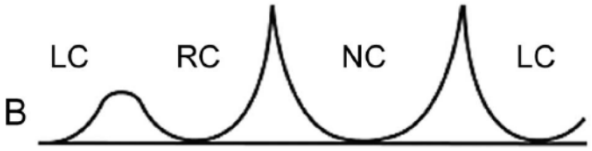





unicuspid




bicuspid




Prevalence 0.04% (?)

AR / AS / ascending aorta aneurysm

Anderson RA, JHVD 2001

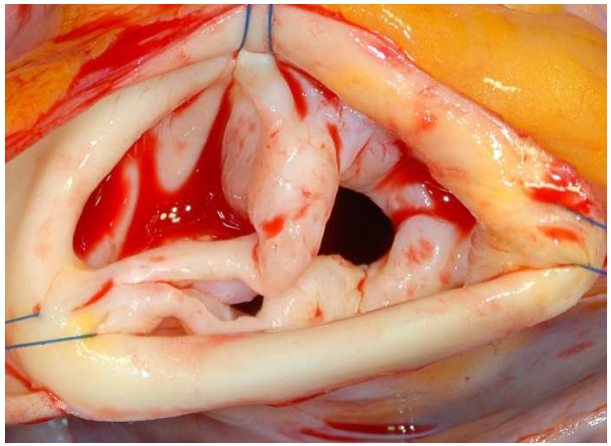
# Aortic Valve Repair - Design

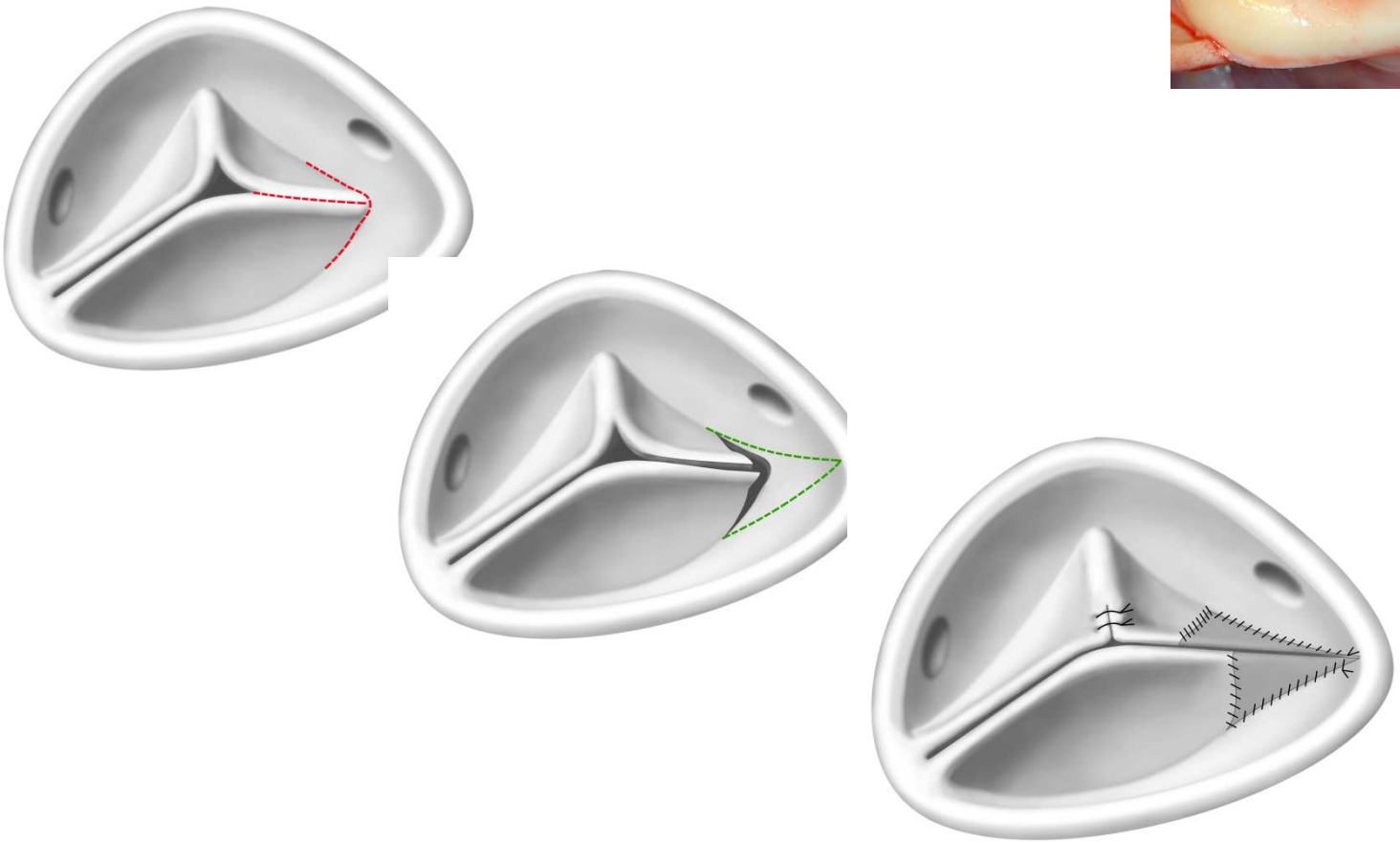
Aortic Valve Anatomy

| Morphology | Incidence | Mean Age of Failure |
|---|---|---|
| Unicuspid | < 1% | 20s (32.2) |
| Bicuspid | 2% | 60s (52.3) |
| Tricuspid | 97 %(?) | ? ( > 65) |
| Quadricuspid | < 1 % | 40s (46.) |

Roberts WC, Circulation 2005

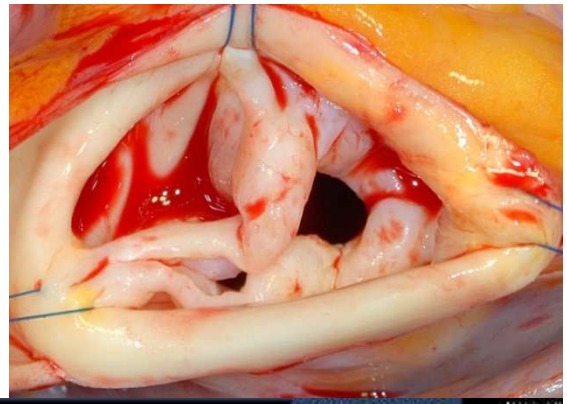
# Bicuspidization of the Unicuspid Aortic Valve

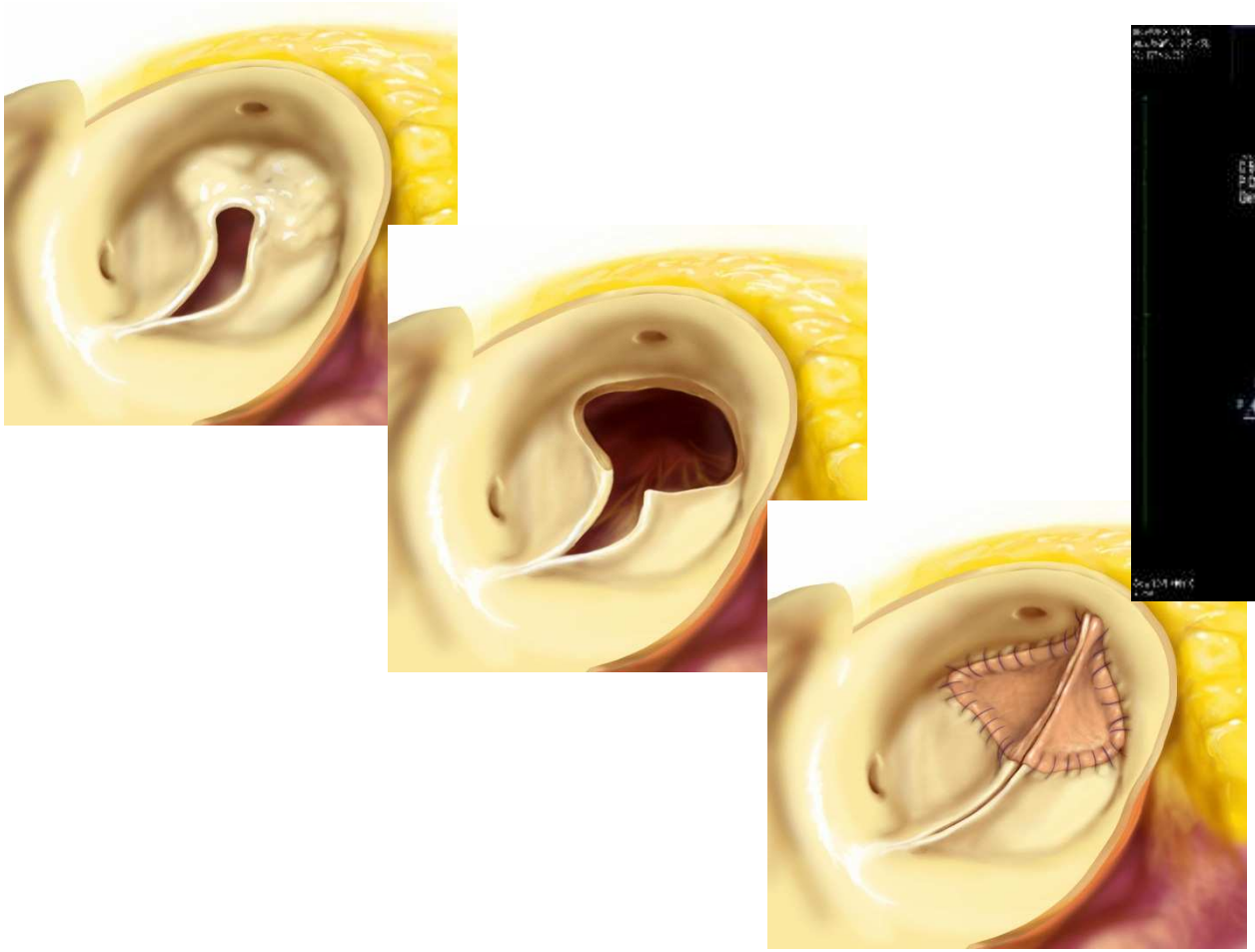




Schäfers HJ, ATS 2008

# Bicuspidization of the Unicuspid Aortic Valve II





Aicher, Ann Thorac Surg 2013

# Bicuspidization of the UAV

## Aortic Valve Function After Bicuspidization of the Unicuspid Aortic Valve

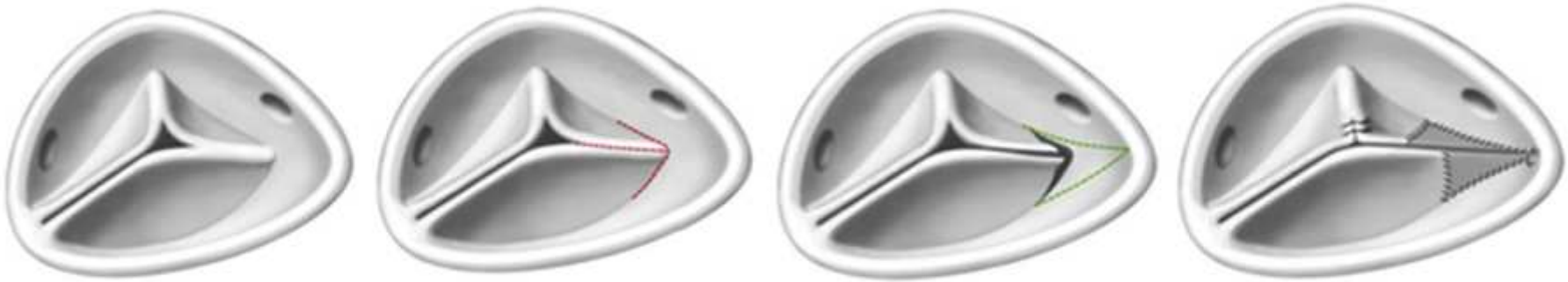


*Fig 1. Bicuspidization of the unicuspid aortic valve: Design I.*

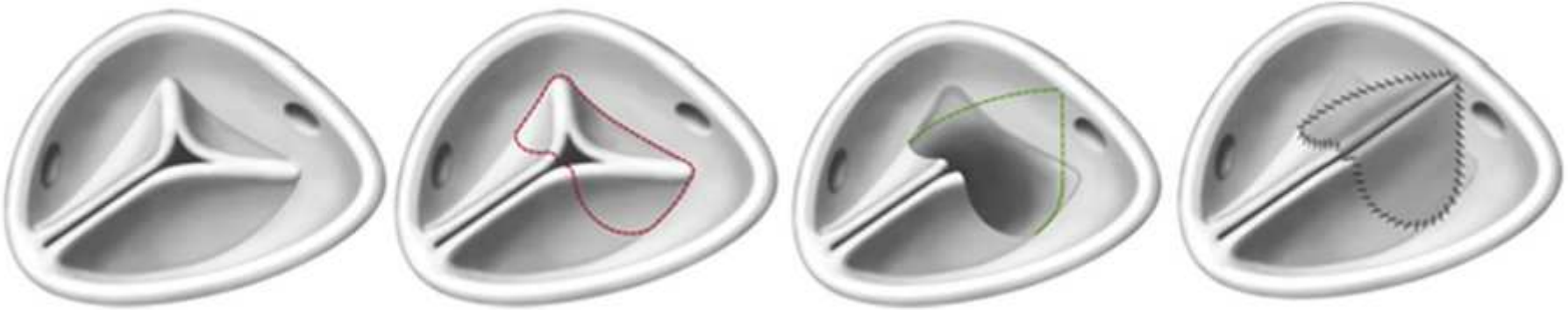


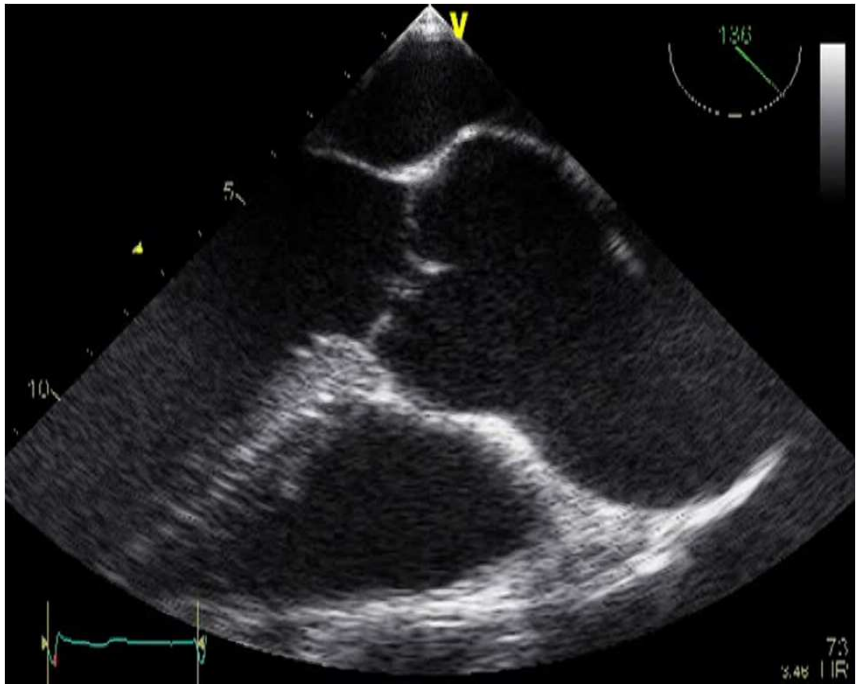
*Fig 2. Bicuspidization of the unicuspid aortic valve: Design II.*

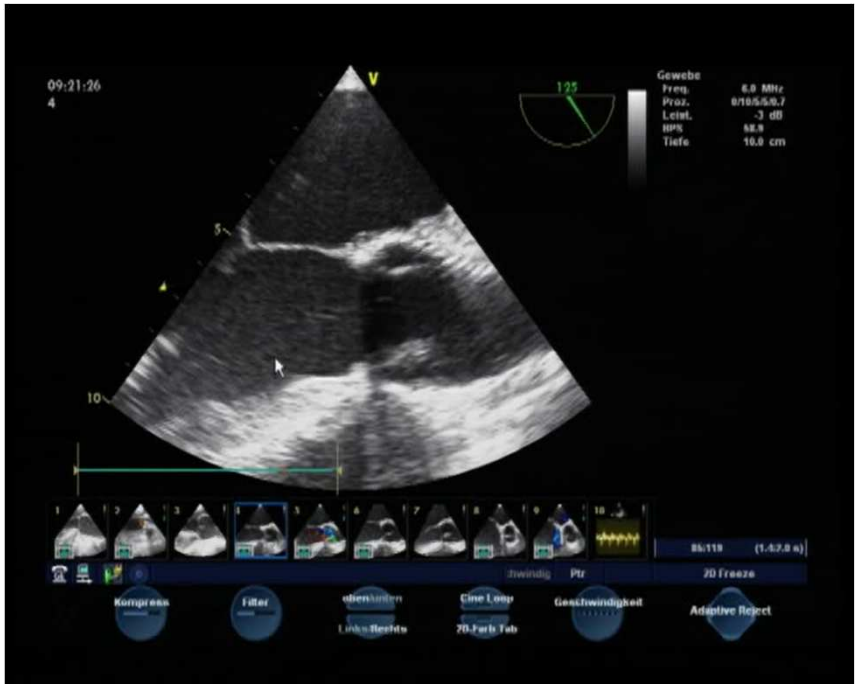
# Bicuspidization of the UAV


Courtesy Pr.Schaeffers

# Pré

# Post





Courtesy Pr.Schaeffers

# Reconstruction of the UAV

- Repair: conversion to bicuspid design
  - Creation of 2nd (anterior) commissure
  - Add pericardial patches to augment cusps
  - Geometric height > 20 mm
  - Effective height > 9 mm
  - Annular stabilization

→ = effective valve function

? Durability - optimal patch material
- annular stabilization
→ - probably patch ≤ 40% of final cusp size

# Bicuspidization of the UAV

## Aortic Valve Function After Bicuspidization of the Unicuspid Aortic Valve

Diana Aicher, MD, Moritz Bewarder, Michael Kindermann, MD,
Hashim Abdul-Khalique, MD, PhD, and Hans-Joachim Schäfers, MD, PhD

Department of Thoracic and Cardiovascular Surgery, University of Saarland, Homburg/Saar, Germany; Department of Cardiology Caritas Klinikum, Saarbrücken, Germany; Department of Pediatric Cardiology, University of Saarland, Homburg/Saar, Germany

*Background.* Unicuspid aortic valve (UAV) anatomy leads to dysfunction of the valve in young individuals. We introduced a reconstructive technique of bicuspidizing the UAV. Initially we copied the typical asymmetry of a normal bicuspid aortic valve (BAV) (I), later we created a symmetric BAV (II). This study compared the hemodynamic function of the two designs of a bicuspidized UAV.

*Methods.* Aortic valve function was studied at rest and during exercise in 28 patients after repair of UAV (group I, n = 8; group II, n = 20). There were no differences among the groups I and II with respect to gender, age, body size, or weight. All patients were in New York Heart Association class I. Six healthy adults served as control individuals. All patients were studied with transthoracic echocardiography between 4 and 65 months postoperatively. Systolic gradients were assessed by continuous wave Doppler while patients were at rest and exercising on a bicycle ergometer.

*Results.* Aortic regurgitation was grade I or less in all patients. Resting gradients were significantly elevated in group I compared with group II and control individuals (group I, peak 33.8 ± 7.8 mm Hg; mean 19.1 ± 5.4 mm Hg; group II, peak 15.8 ± 5.4, mean 8.2 ± 2.8 mm Hg; control individuals, peak 6.0 ± 1.6, mean 3.2 ± 0.8 mm Hg; $p < 0.001$). At 100 W peak gradients were highest in group I (group I, 62.7 ± 16.7 mm Hg; group II, 28.1 ± 7.6 mm Hg; control individuals, 15.4 ± 4.6 mm Hg; $p < 0.001$).

*Conclusions.* Converting a UAV into a symmetric bicuspid design results in adequate valve competence. A symmetric repair design leads to improved systolic aortic valve function at rest and during exercise.

(Ann Thorac Surg 2013;■:■–■)


THG

# Results of Aortic Valve Repair (Homburg)

## Patients 10/95- 1/2015: n=2073

| | |
|---|---|
| • Hospital mortality | 35 (1.7%) |
| • AV-Block | 10 (0.5%) |
| • Neurologic events | |
| • early | 15 (0.7%) |
| • late (thrombembolic) | 17 (0.3%/pt year) |
| • Endocarditis | 16 (0.25%/pt year) |
| • Reoperations | 155 (7.5%) |

Mean Follow-up: 5.7 ± 3.5 years [1-231 months]

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

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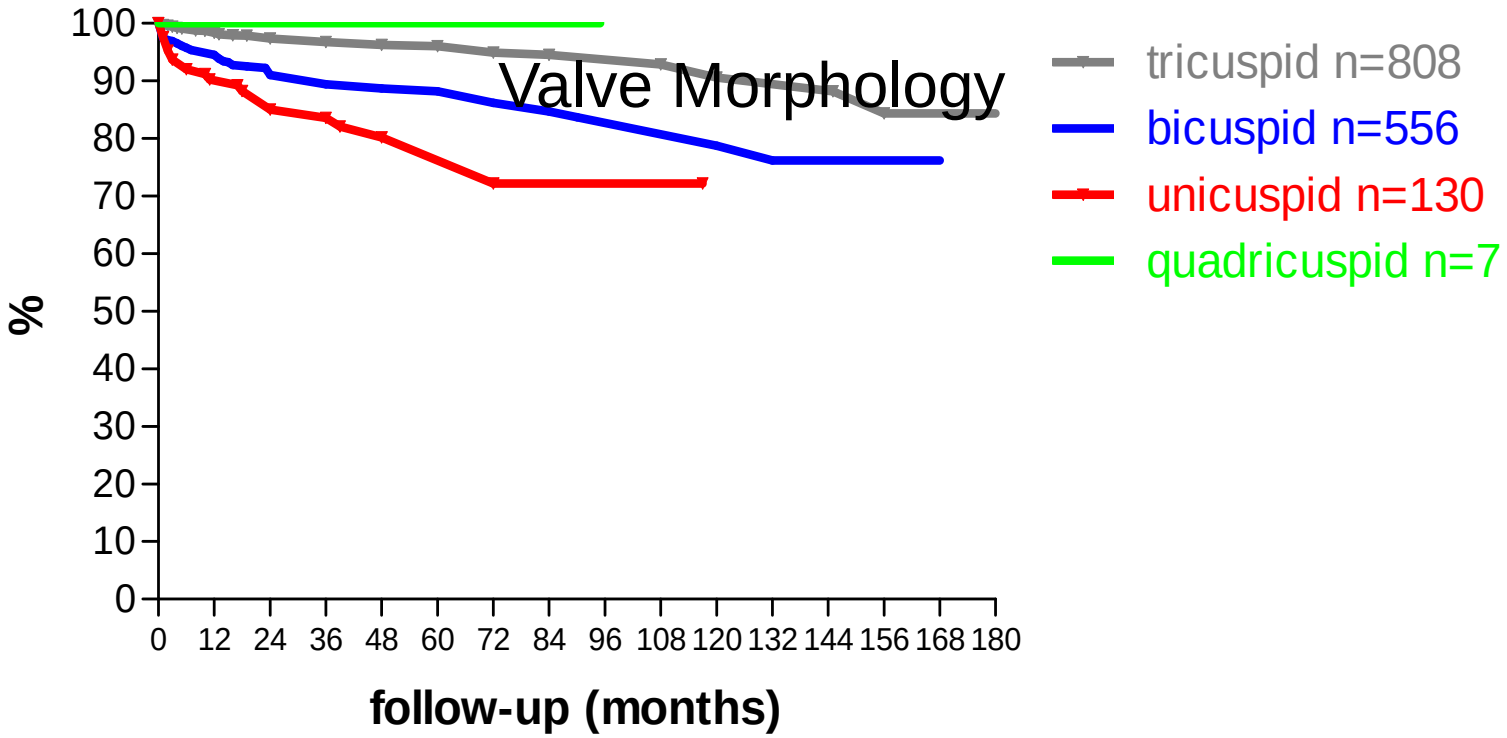
**Abstract**

**Objective:** Aortic valve replacement for aortic regurgi
complications. Aortic valve repair is an alternative appr
period, 640 patients underwent aortic valve repair for re
($n = 3$) aortic valve. The mechanism of regurgitation in
($n = 323$) or combined pathologies. Treatment consisted
patients were followed clinically and echocardiograph
**Results:** Hospital mortality was 3.4% in the total patien
(0.2% per patient per year) and endocarditis (0.16% per p
in bicuspid and 97% and 93% in tricuspid aortic valves ($p$
replacement was 95% and 90% in bicuspid and 97% and 94
years was 88%. **Conclusions:** Reconstructive surgery of th
Freedom from valve-related complications after valve


Freedom from all valve-related complications at 10 years was 88%.

Freedom from valve-related complications after valve repair seems superior compared to available data on standard aortic valve replacement.

# Freedom from Reoperation



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

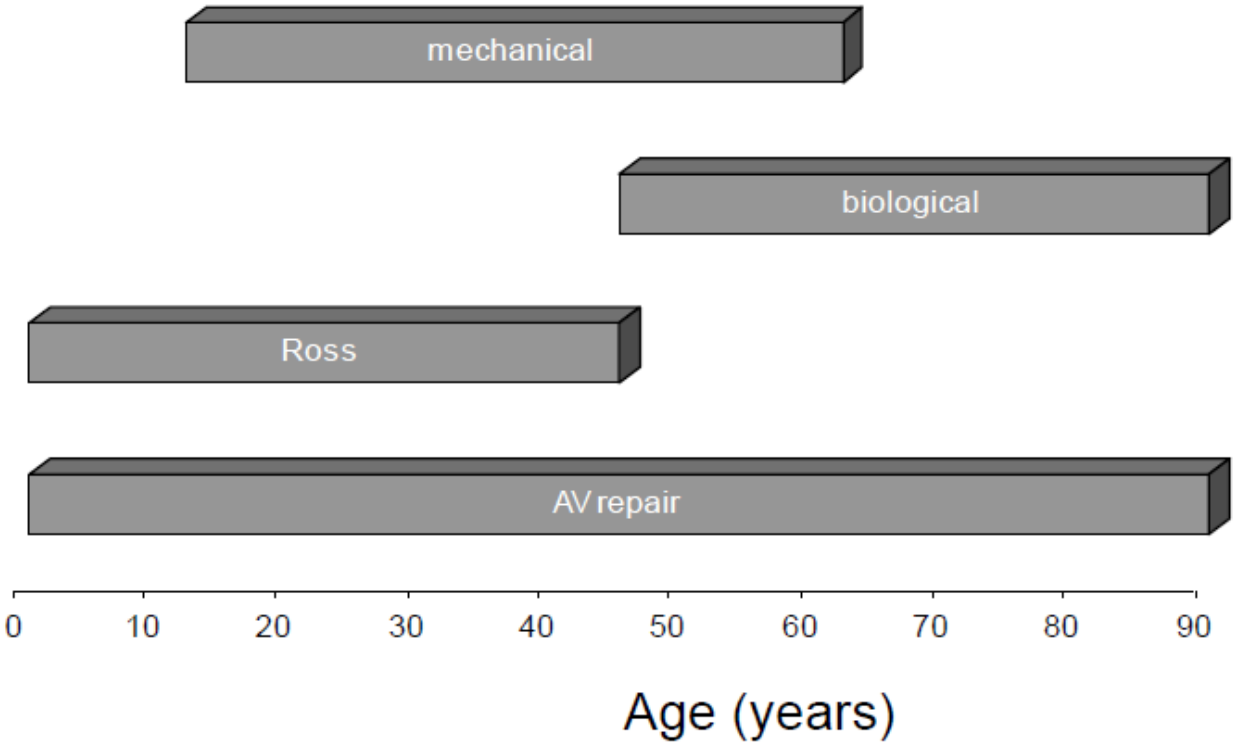
Diana Aicher, MD; Takashi Kunihara, MD; Omar Abou Issa, MD; Brigitte Brittner, MD; Stefan Gräber, MD; Hans-Joachim Schäfers, MD

**Table 2. Results of Multivariable Analysis of Predictors for Reoperation**

| | HR | 95% Confidence Interval | *P* |
|---|---|---|---|
| Age | 0.955 | 0.928–0.982 | 0.001 |
| eH | 0.740 | 0.612–0.894 | 0.002 |
| AVD | 1.302 | 1.076–1.575 | 0.007 |
| Commissural orientation | 0.961 | 0.938–0.985 | 0.002 |
| Pericardial patch | 5.175 | 2.100–12.753 | 0.000 |
| Subcommissural plication | 0.699 | 0.299–1.633 | 0.408 |
| Root repair | 2.354 | 0.770–7.192 | 0.133 |

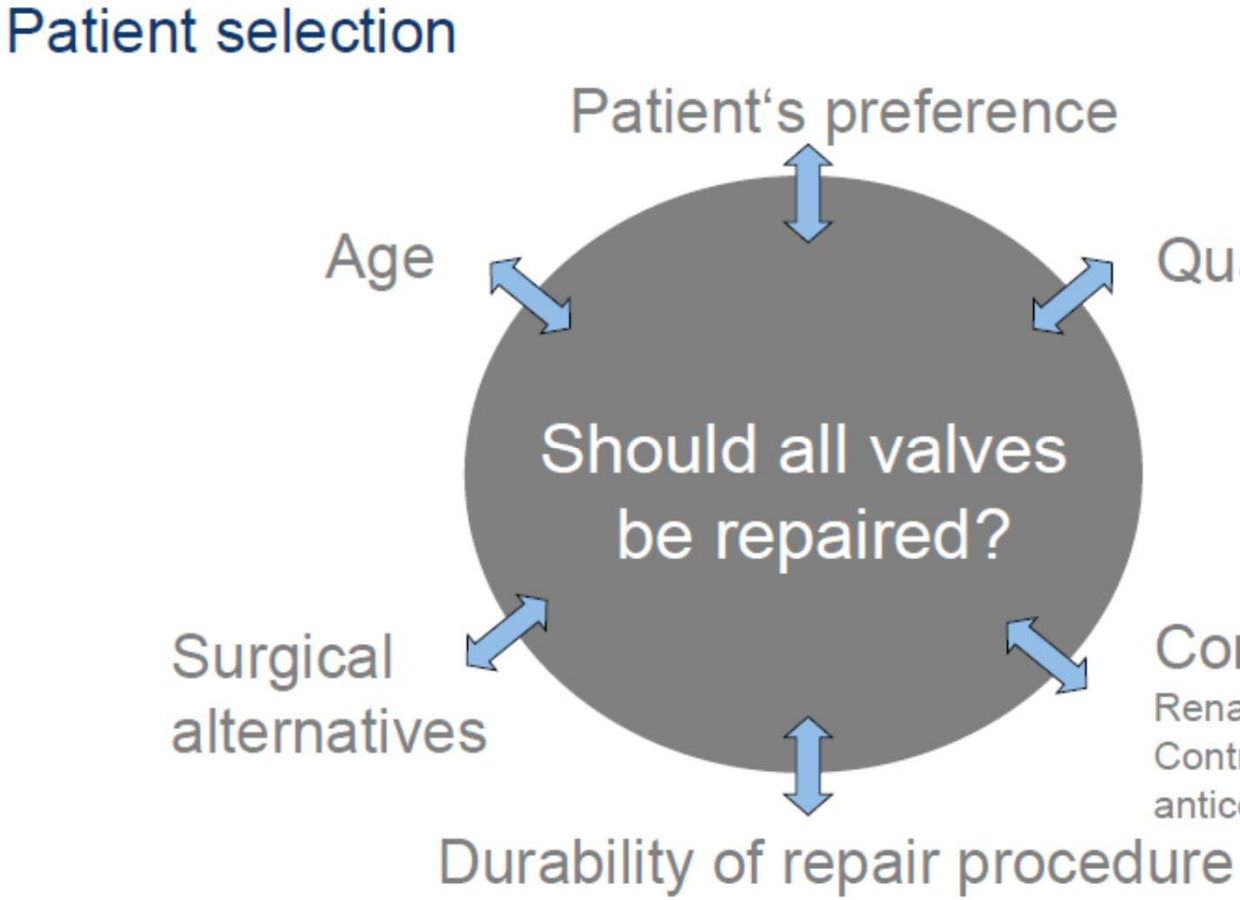
Aicher et al. Circulation 2011 Jan 18;123(2):178-85

# Homburg approach



# Comment développer le programme?

# Sélection des patients

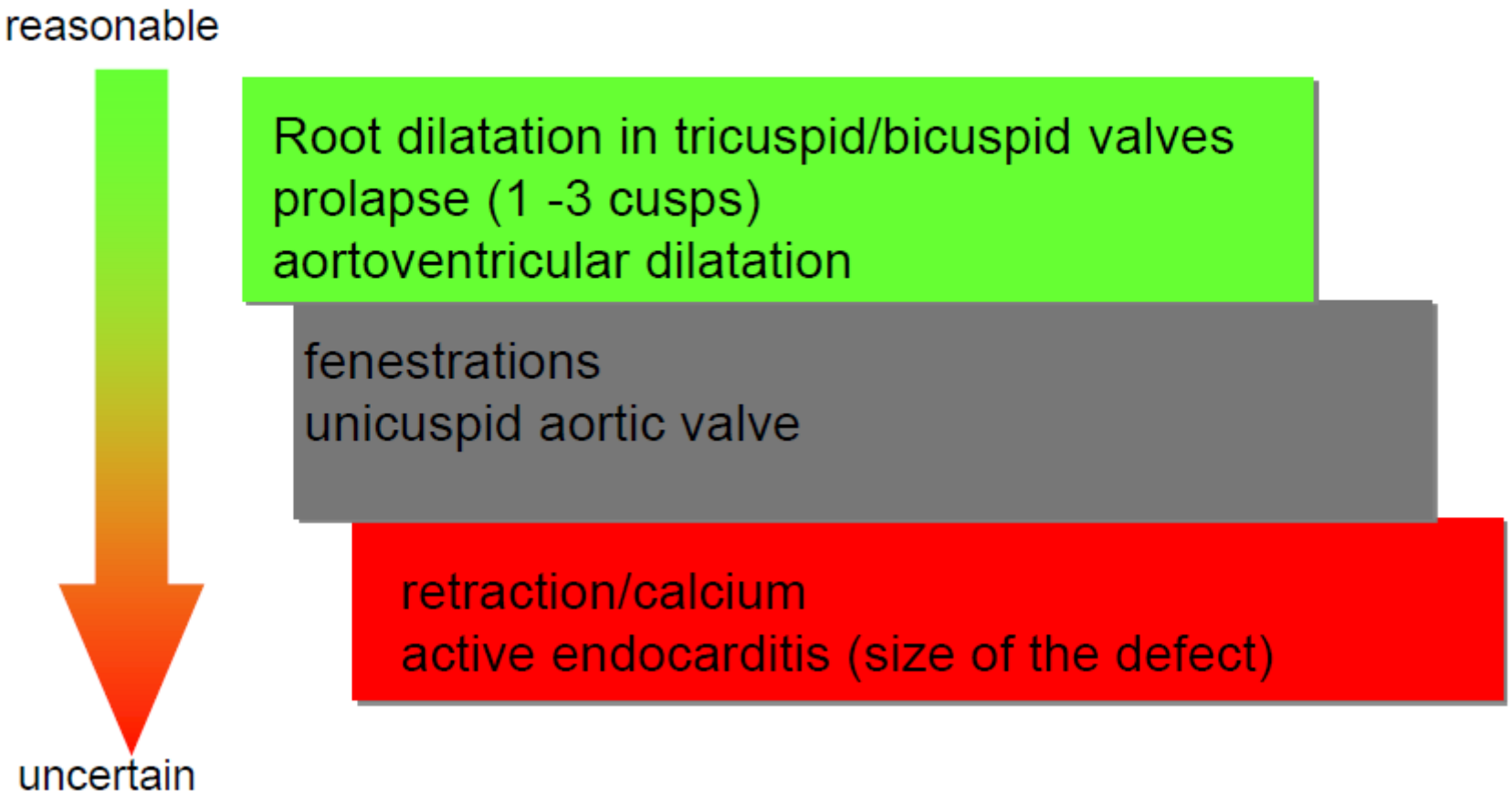


## Patient Selection

### What valve pathology can be repaired?

- Bi- /tricuspid aortic valves with preservation of the natural design (Aicher JTCVS 2004; Schäfers ATS 2007)
- Unicuspid switched to bicuspid design (Schäfers ATS 2008)
- Quadricuspid switched to tricuspid design (Schmidt ATS 2008)

# Levels of Difficulty in Aortic Valve Repair



# Travail d’équipe

Team Play

Clinical cardiologists

Image Cardiologists

BAV clinic

Marfan clinic

Surgeons

Anesthesiologists

# Conclusion

- Nécessité d’une bonne évaluation des indications et de la valve
- Amélioration des résultats avec l’expertise
- Heart team/réseau
- Moindre morbi -mortalité
- Ne coupe pas les ponts au Ross

# Merci!

Pr Roland HENAINE
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**<u>Support du cours dans :</u>** **www.chircardio-lyon.org**

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