Reconstruction of the Aortic Valve and Root: A Practical Approach

September 14th-16th , Homburg/Saar, Germany

Aortic Valve Repair: The Brussels Approach

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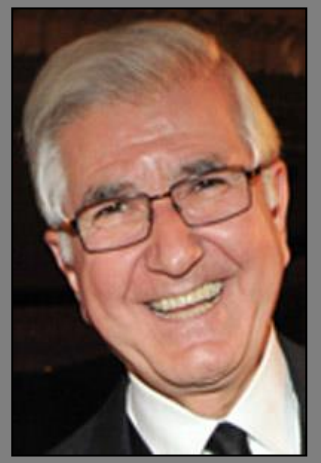
AV repair program in Brussels

- 1994

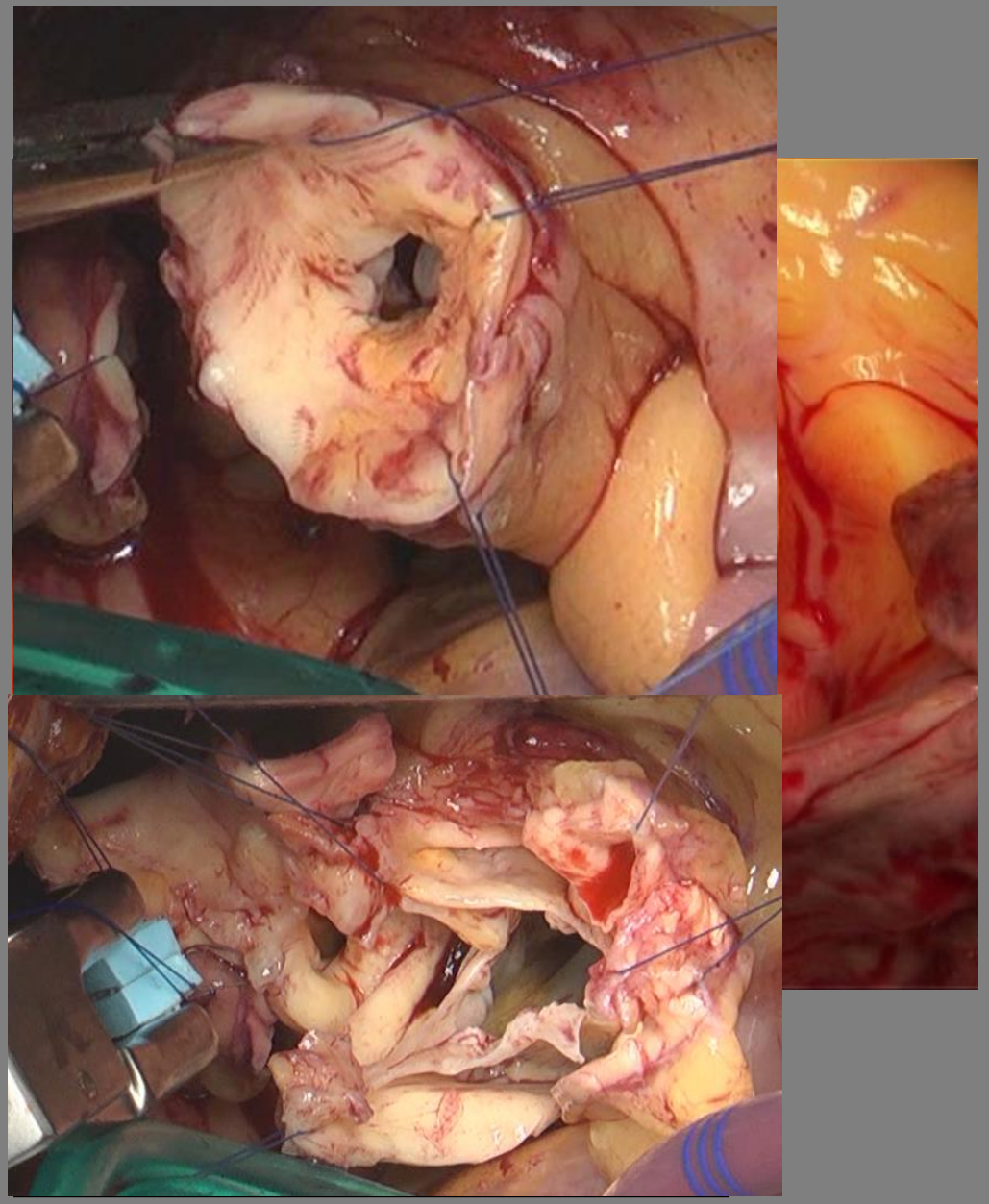


- 1996 – 2016: **850 Aortic valve repair/sparing**

Pathologies amenable to AV repair

Congenital

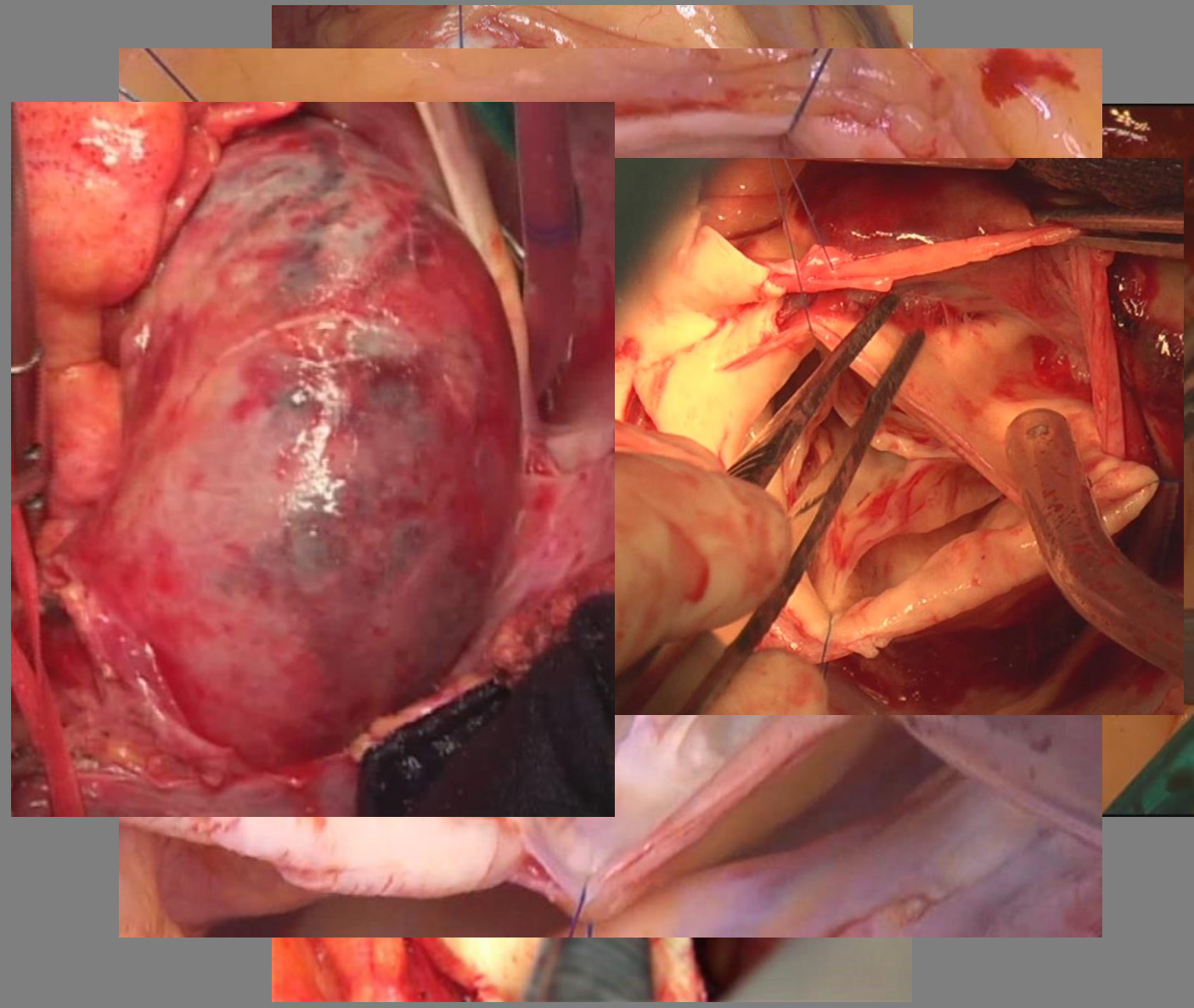
- Bicuspid
- Connective tissue disorders (Marfan, Loeys-Dietz, Ehler-Danlos, Familial Aneurysmal disease, …)
- Unicuspid
- Quadricuspid
- Supra-aortic stenosis



Pathologies amenable to AV repair

Acquired

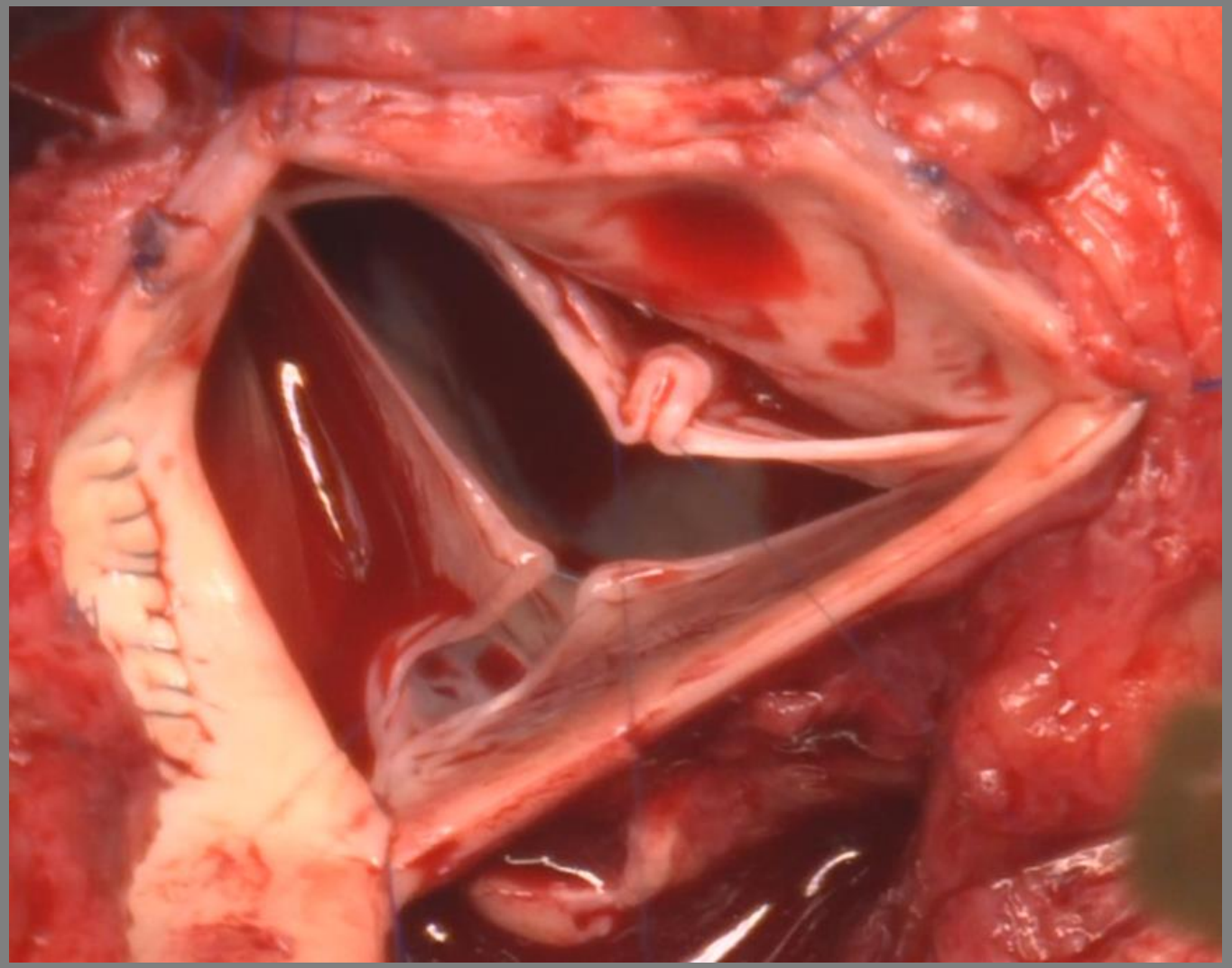
- Degenerative cusp
- Degenerative aortic aneurysm
  (Atherosclerosis)
- Traumatic
- Infectious
- Acute aortic dissection



Pathologies amenable to AV repair

Redo

- Ross repair
- Re-repair



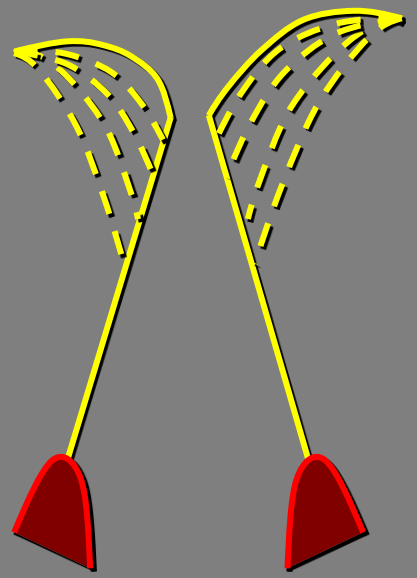
Functional classification of AI

Lesson from the mitral valve

Etiology	MV FED	AV Marfan
↓	↓	↓
Lesion	Cordale rupture	Root dilatation
↓	↓	↓
Dysfunction	Prolapse eccentric MI	Cusp tethering central AI

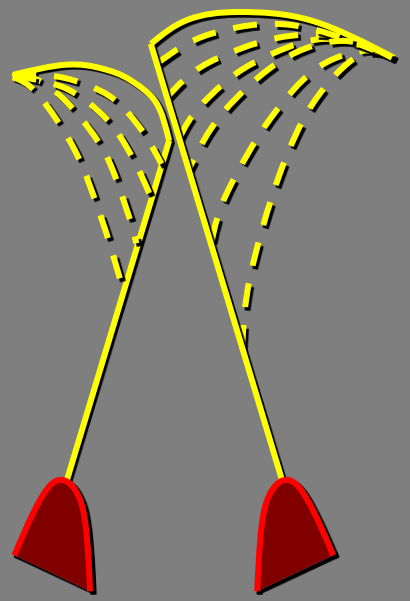
Functional classification of AI

Lesson from the mitral valve



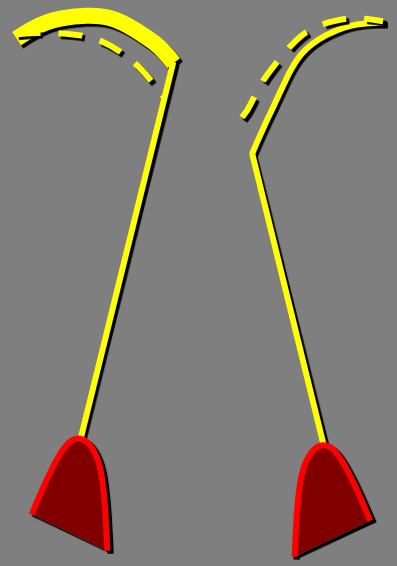
Type I

Annulus dilatation



Type II

Leaflet prolapse



Type III a,b

Leaflet restrictive motion

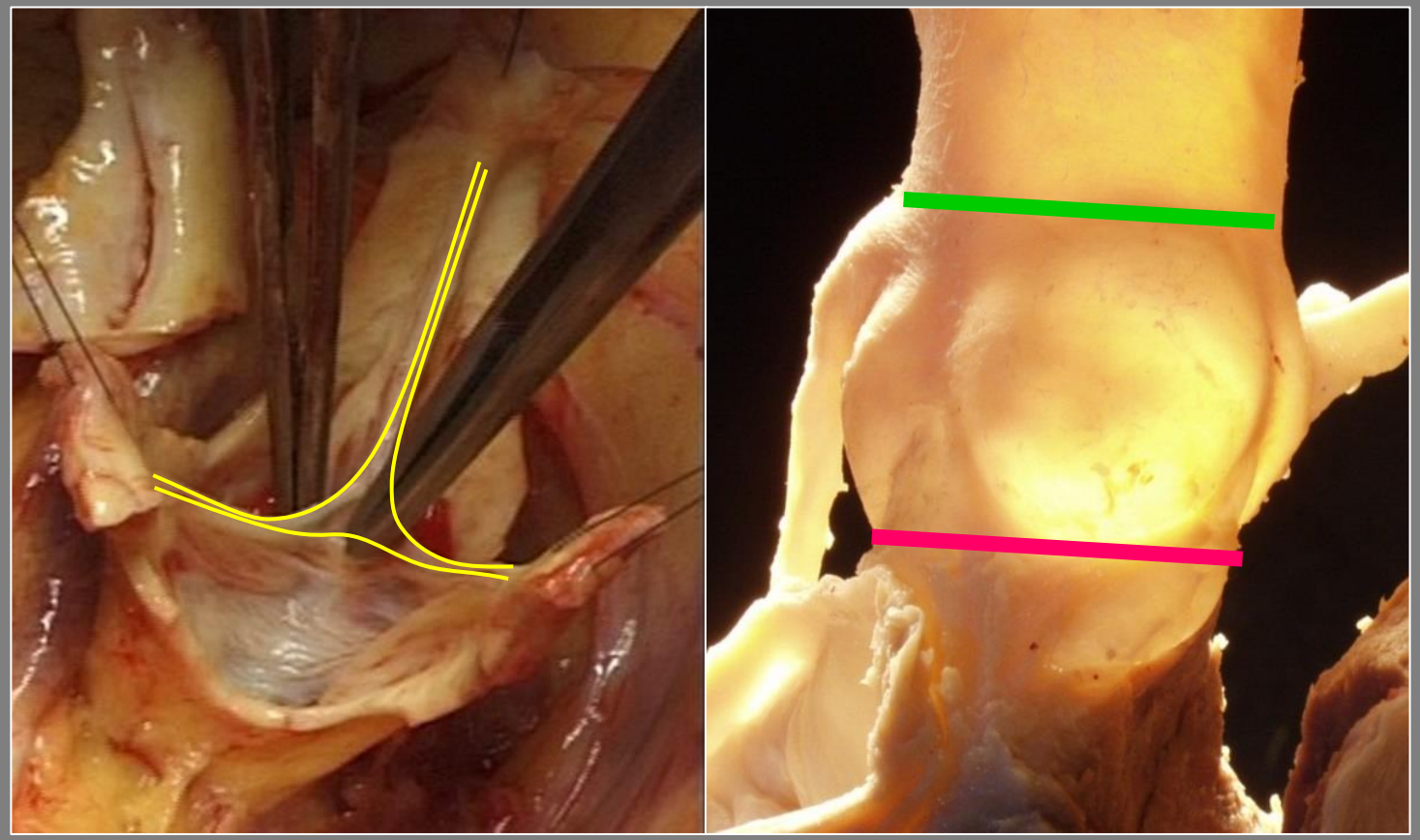
- ✓ Common language
- ✓ Plan surgical strategy
- ✓ Predict the outcomes

A. Carpentier

Functional classification of AI

The Functional Aortic Valve Unit

1. Cusp

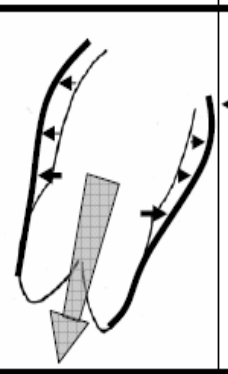
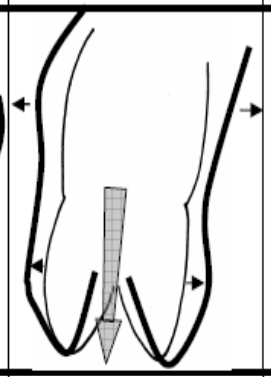
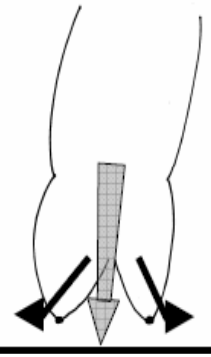
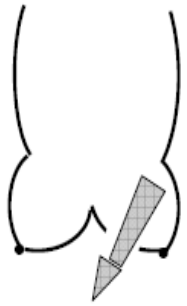
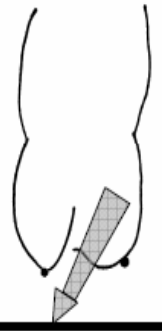
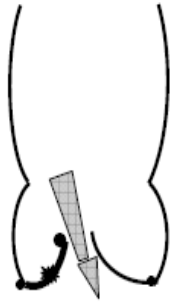


2. STJ

3. VAJ

FAA

Functional classification of AI

AI Class	Type I Normal cusp motion with FAA dilatation or cusp perforation				Type II Cusp Prolapse	Type III Cusp Restriction
	Ia	Ib	Ic	Id		
Mechanism						
Repair Techniques (Primary)	STJ remodeling *Ascending aortic graft*	Aortic Valve sparing: *Reimplantation or Remodeling with SCA*	SCA	Patch Repair *Autologous or bovine pericardium*	Prolapse Repair *Plication* *Triangular resection* *Free margin Resuspension* *Patch*	Leaflet Repair *Shaving* *Decalcification* *Patch*
(Secondary)	SCA		STJ Annuloplasty	SCA	SCA	SCA

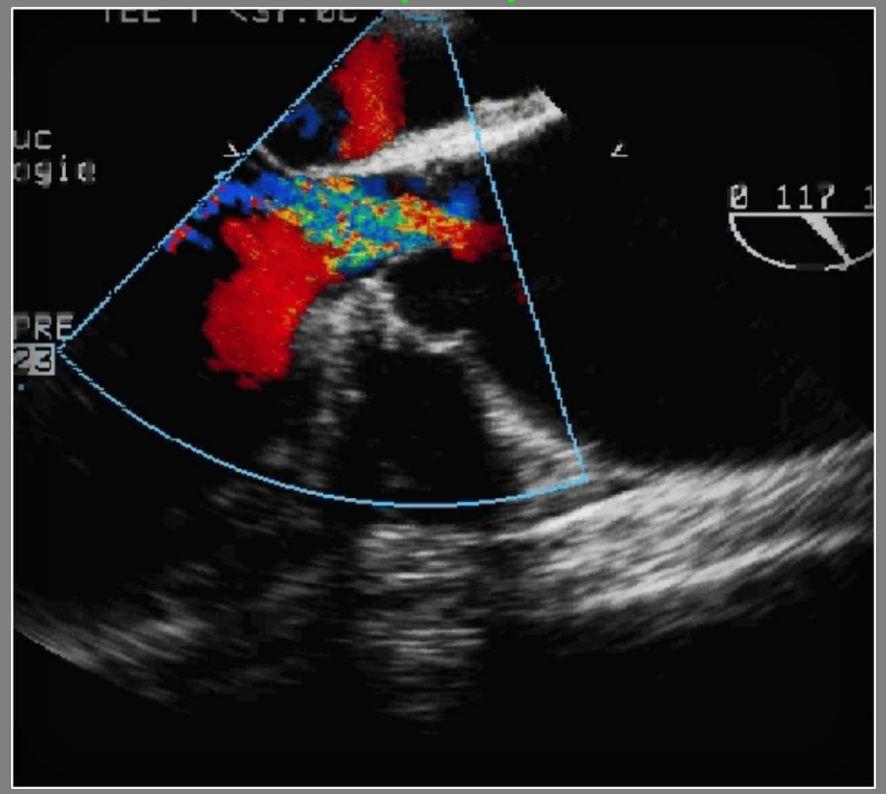
El Khoury G.
Cur. Op. Card. 2005

Functional classification of AI

Type 1: "FAA Dilatation"

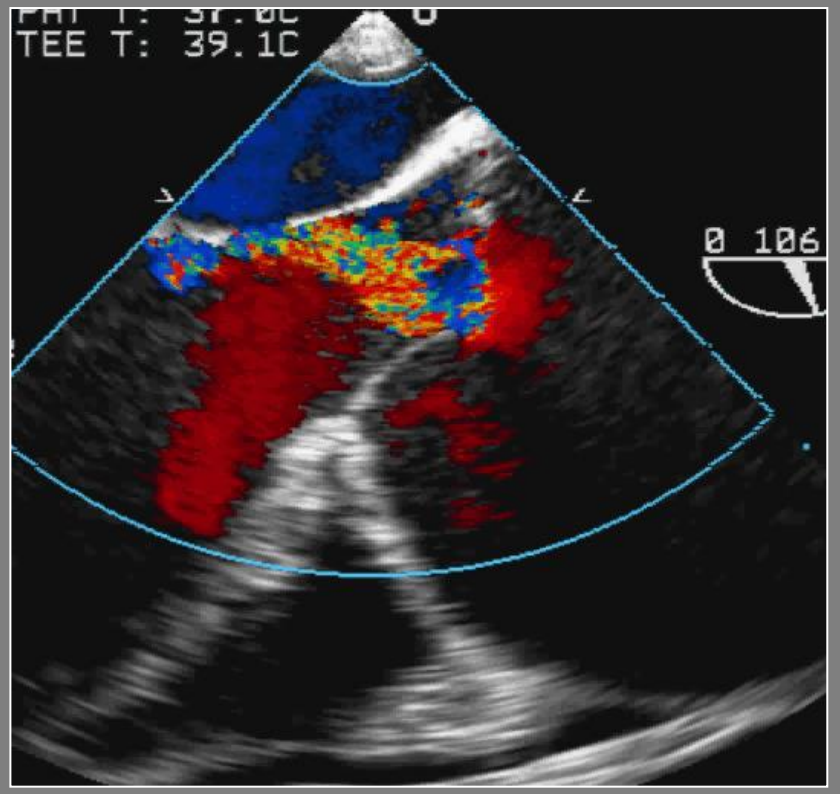
Type 1a

Asc. Ao. (STJ)



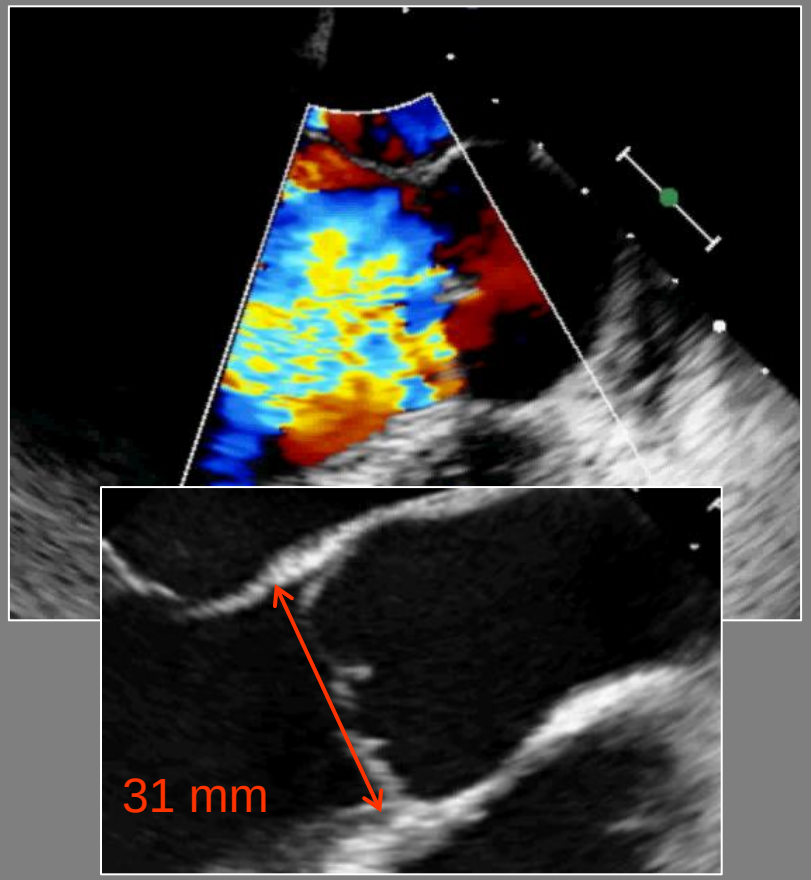
Type 1b

Root (STJ +VAJ)



Type 1c

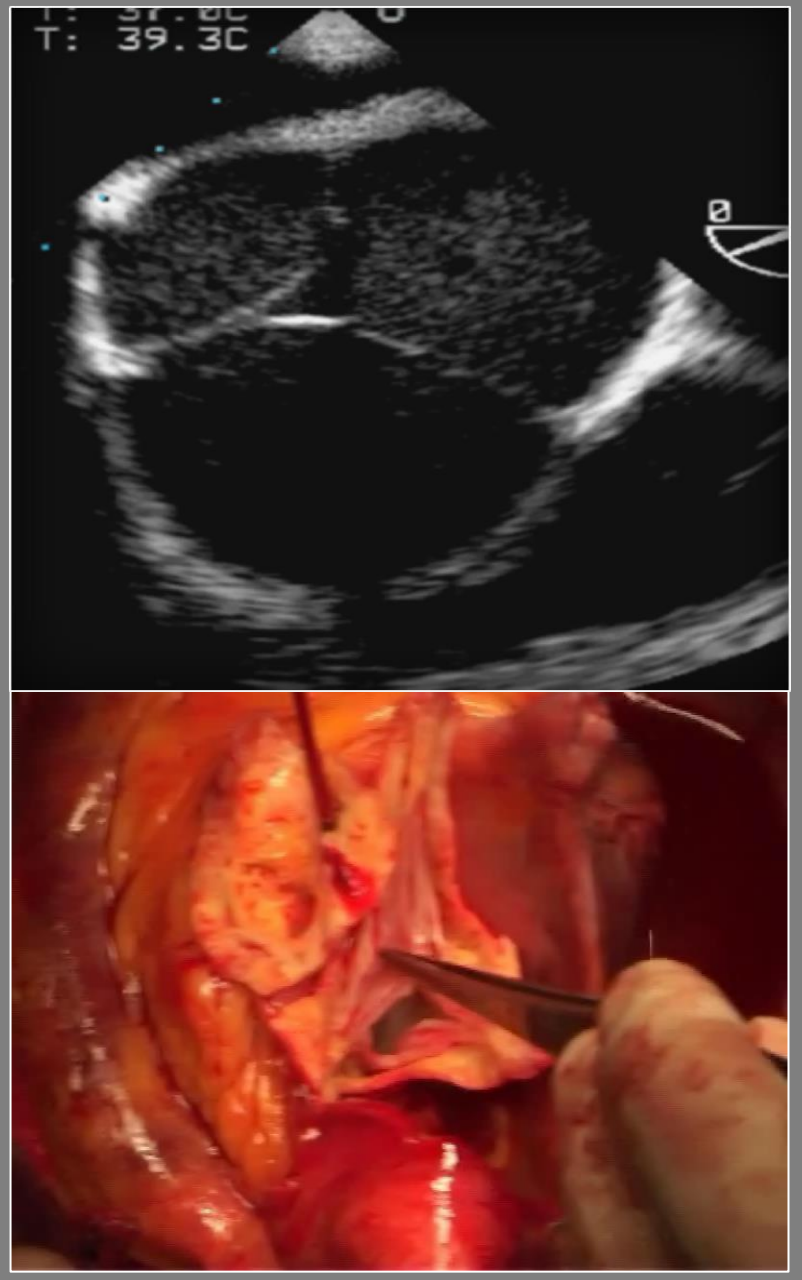
VAJ



Functional classification of AI

Type 1a and 1b: STJ dilatation

- ✓ *Functional restriction of the cusp (tethering) → central AI*
- ✓ *Effective height = supra normal (>9-10mm)*
- ✓ *Free margin elongation*
- ✓ *Commissural fenestration*



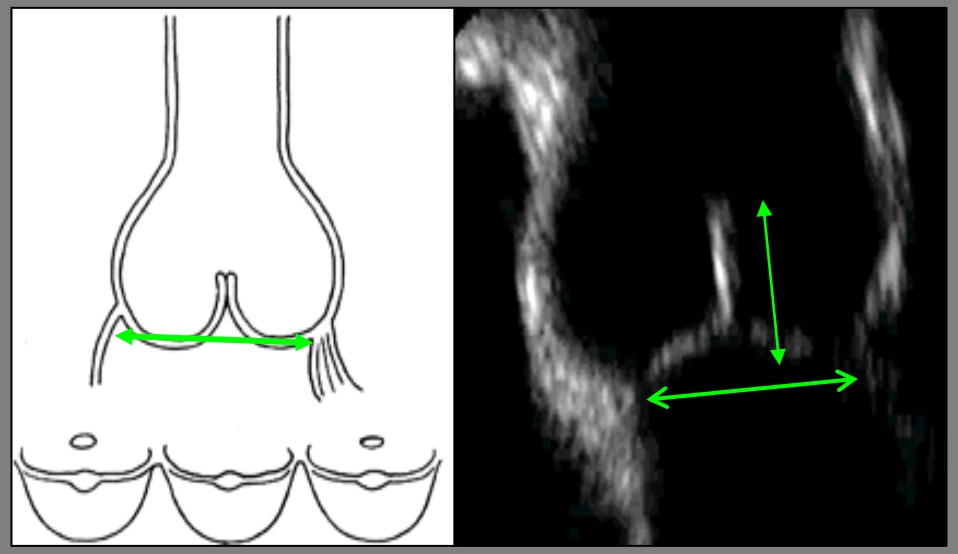
Functional classification of AI

Type 1b and 1C: VAJ dilatation

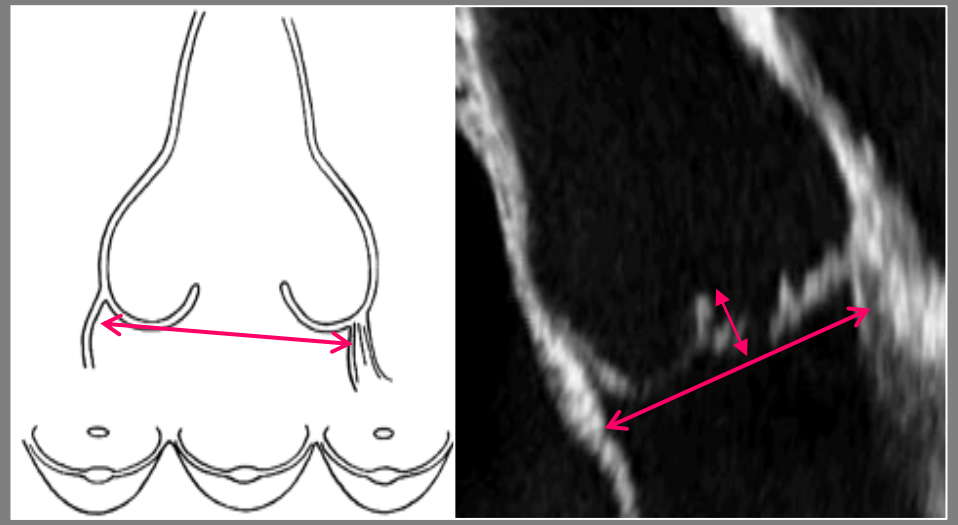
✓ *Effective height = infra normal (<9-10mm)*

✓ *Frequently associated with cusp prolapse*

Normal VAJ



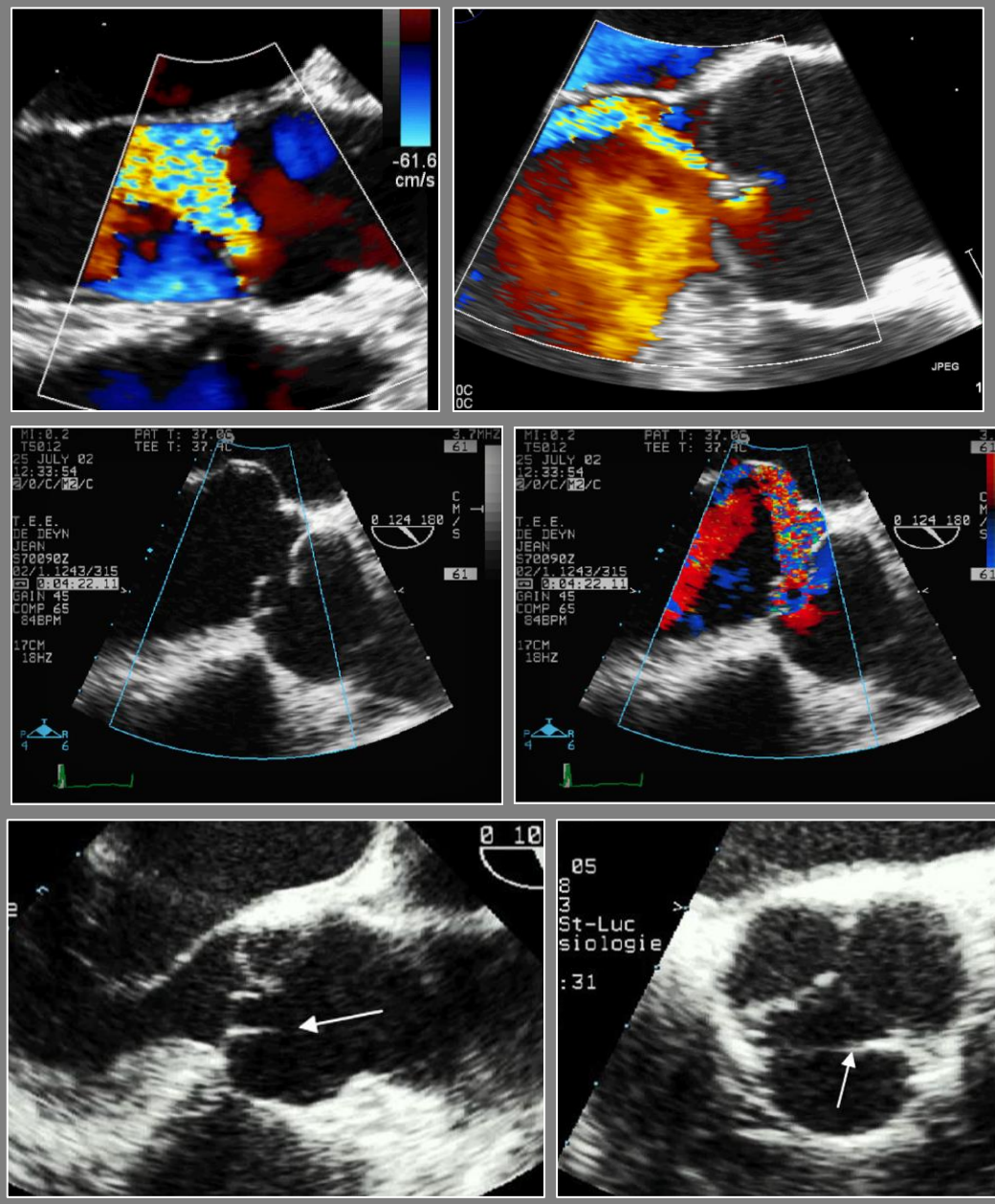
Dilated VAJ



Functional classification of AI

Type 2: *"Prolapse"*

- ✓ Eccentric jet
- ✓ Cusp billowing
- ✓ Transverse fold in cusp curvature

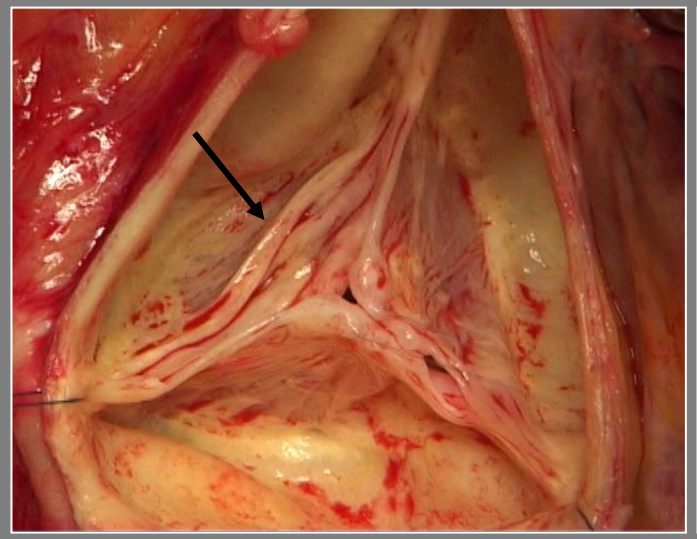
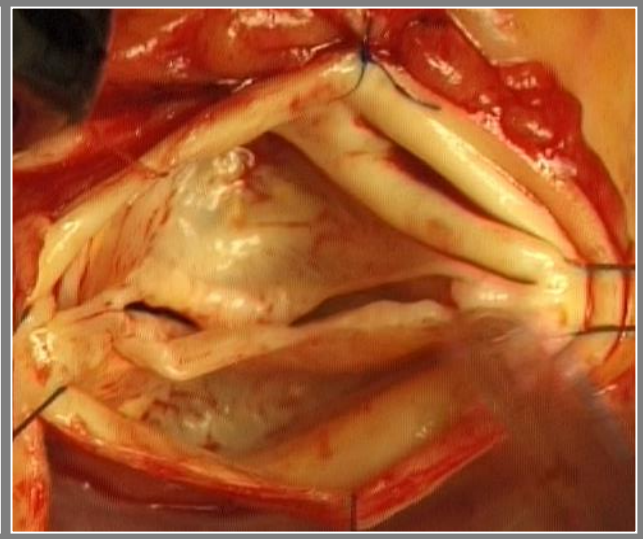
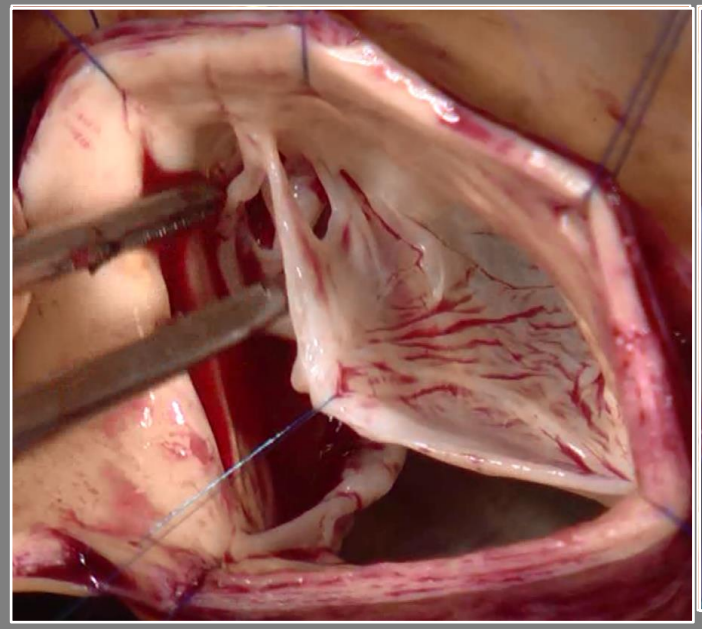
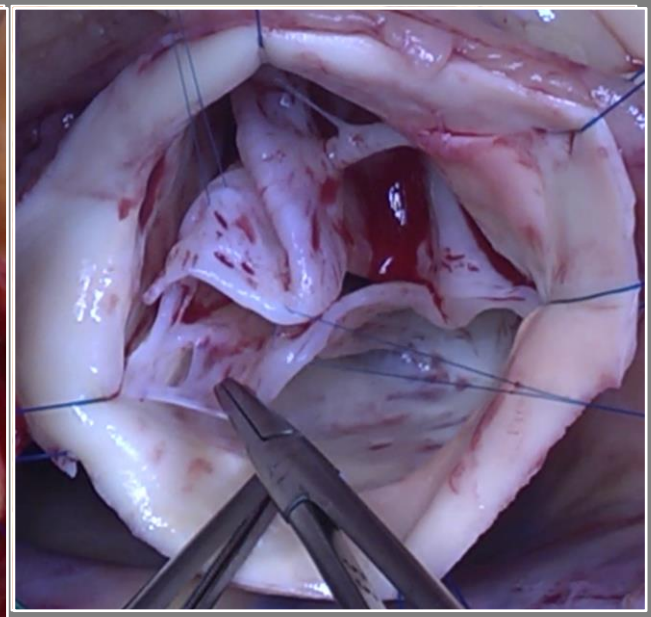


M. Boodhwani, JTCVS 2013

Functional classification of AI

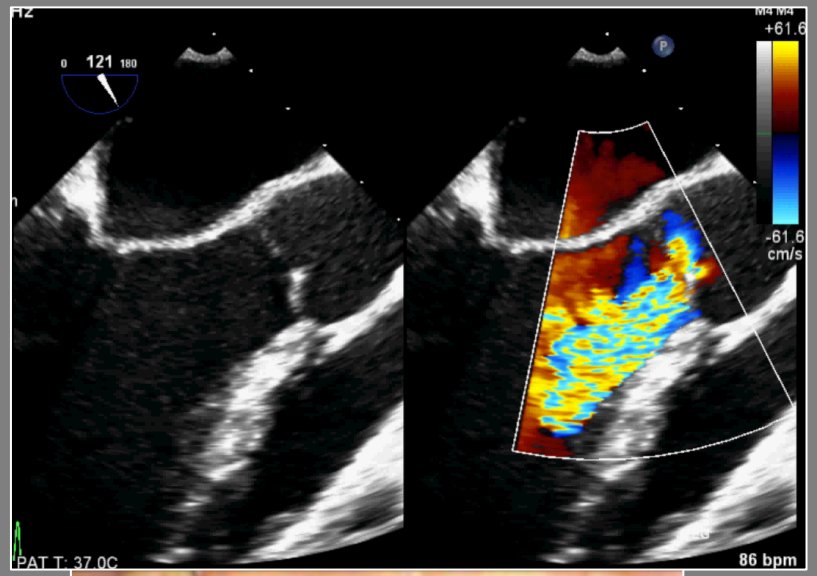
Type 2: *"Prolapse"*

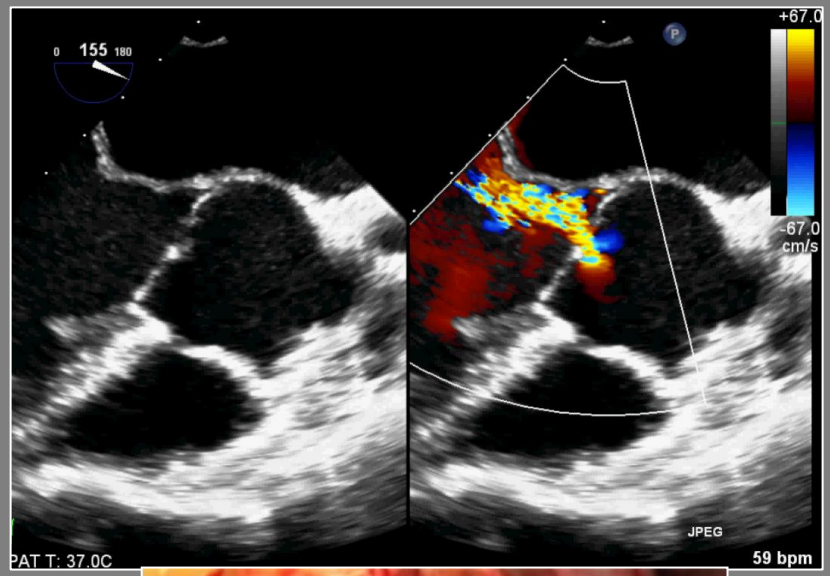
- ✓ Transverse fold in cusp curvature
- ✓= Free margin elongation
- ✓ below other normal FM
- ✓ Commissural fenestration

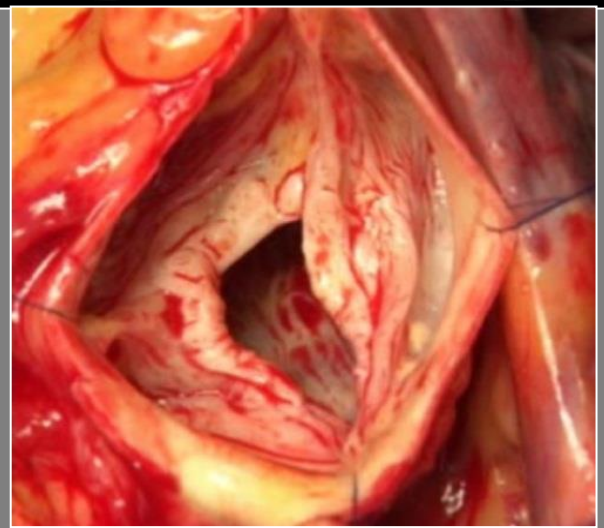





Functional classification of AI

Type 3: Restrictive cusp motion

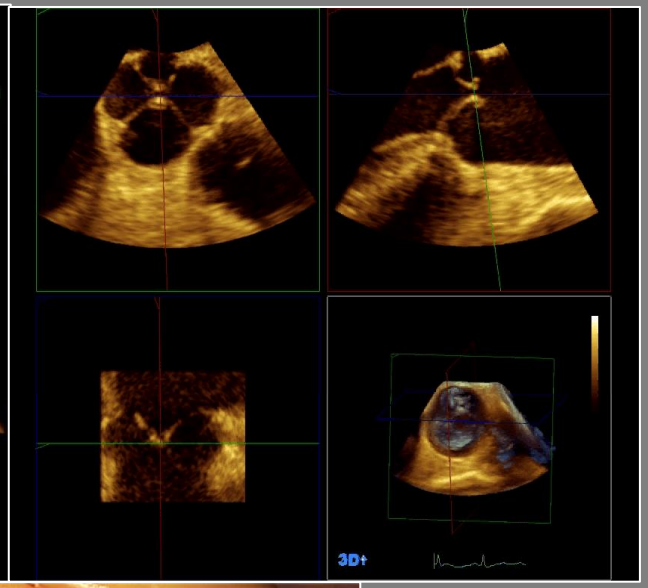


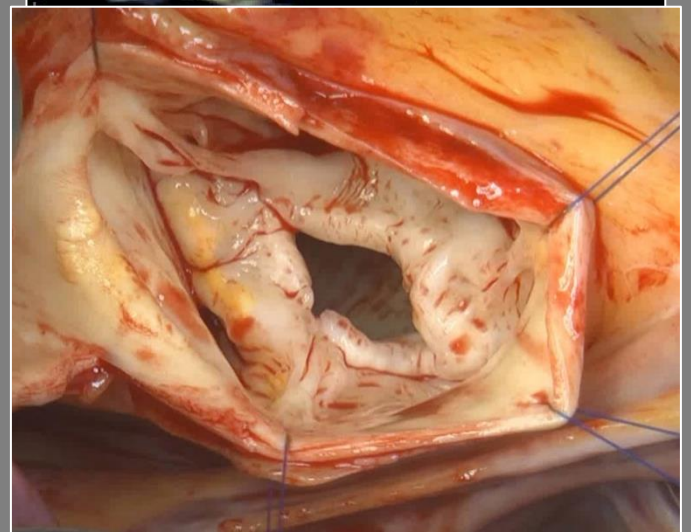


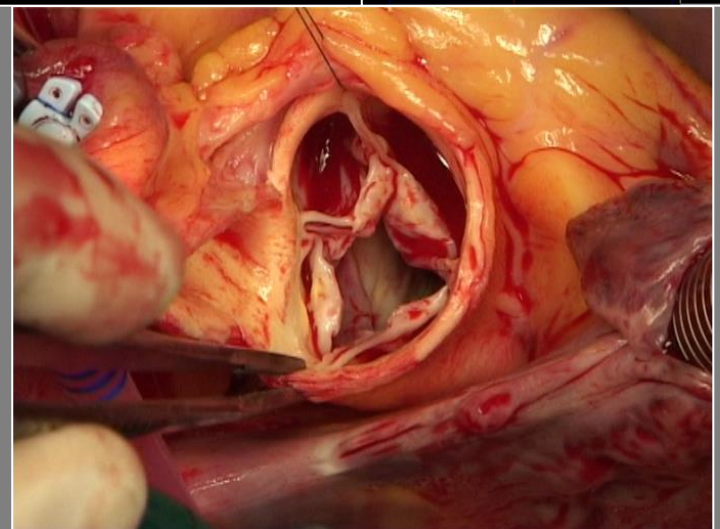


Functional classification of AI

Type 3: Restrictive cusp motion



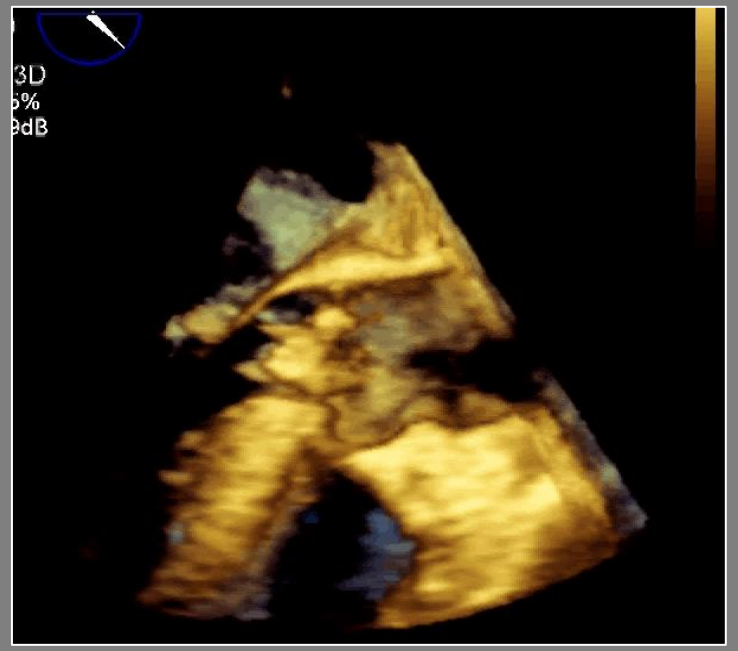


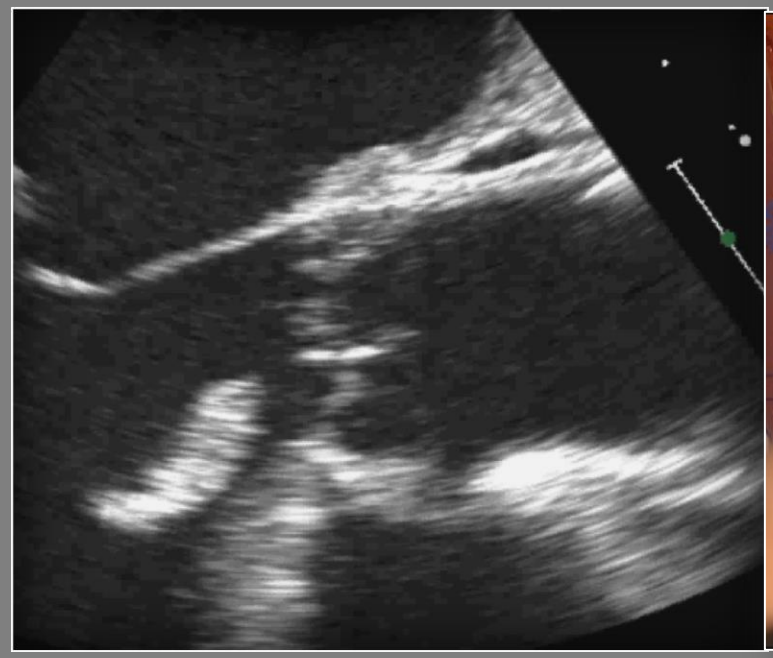


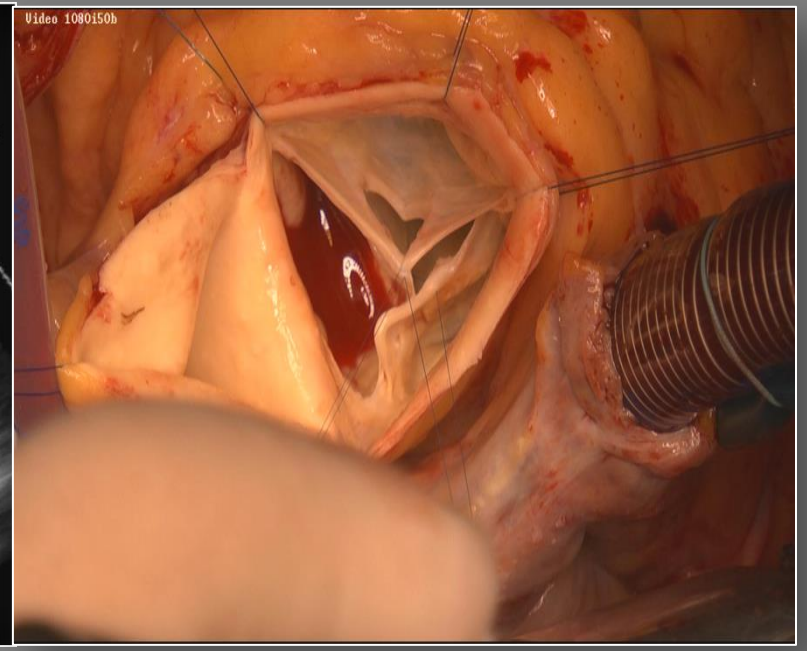
Functional classification of AI

Type 1d: Cusp perforation/destruction

(no prolapse, no restriction)

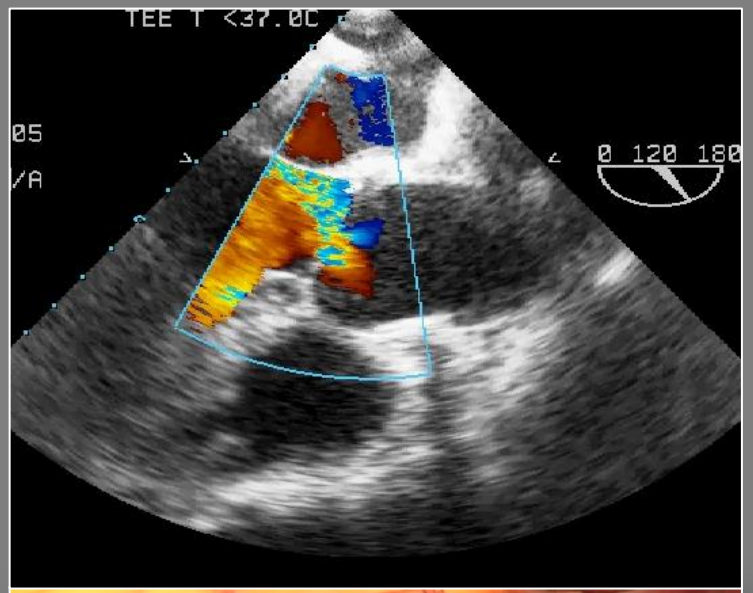


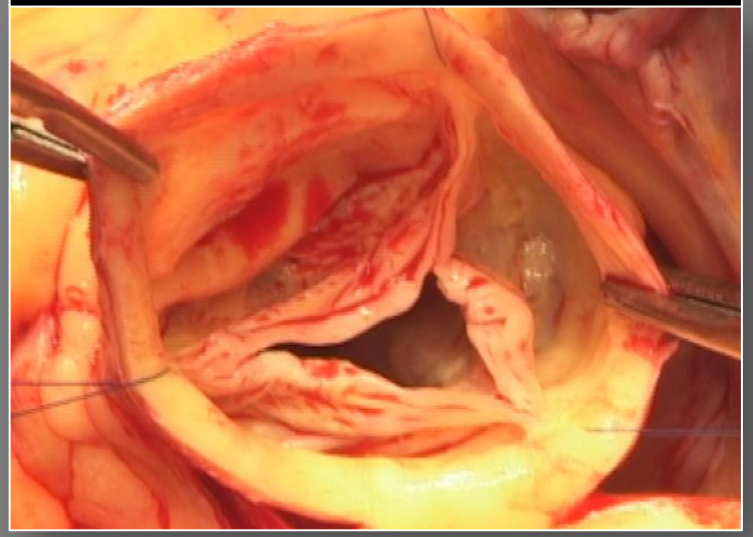




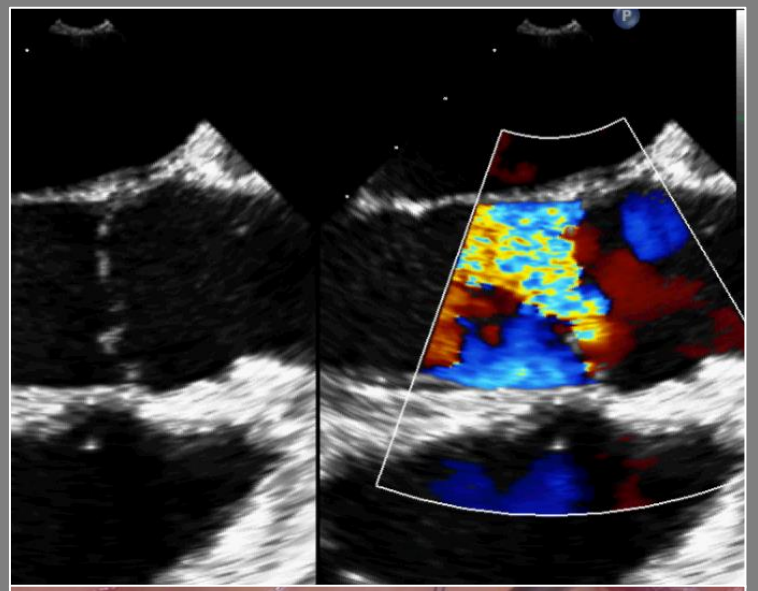
Functional classification of AI

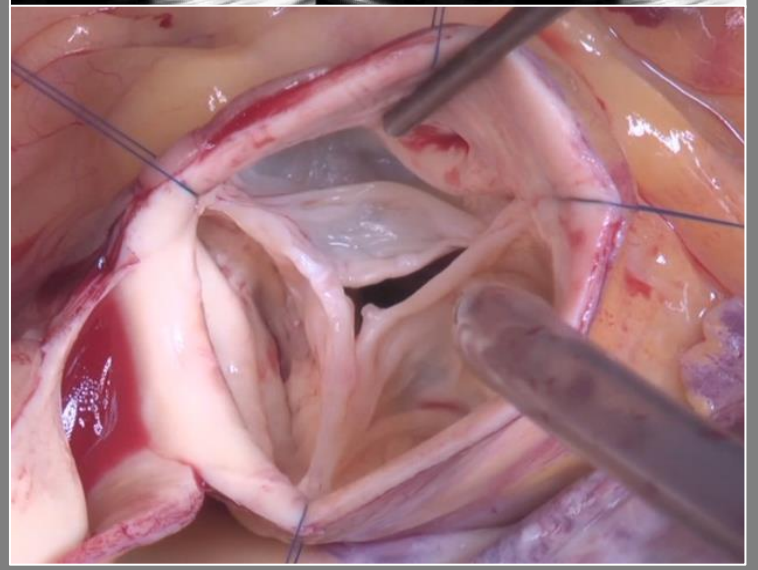
Type 1b+2





Type 1c+2





Principles of AV repair

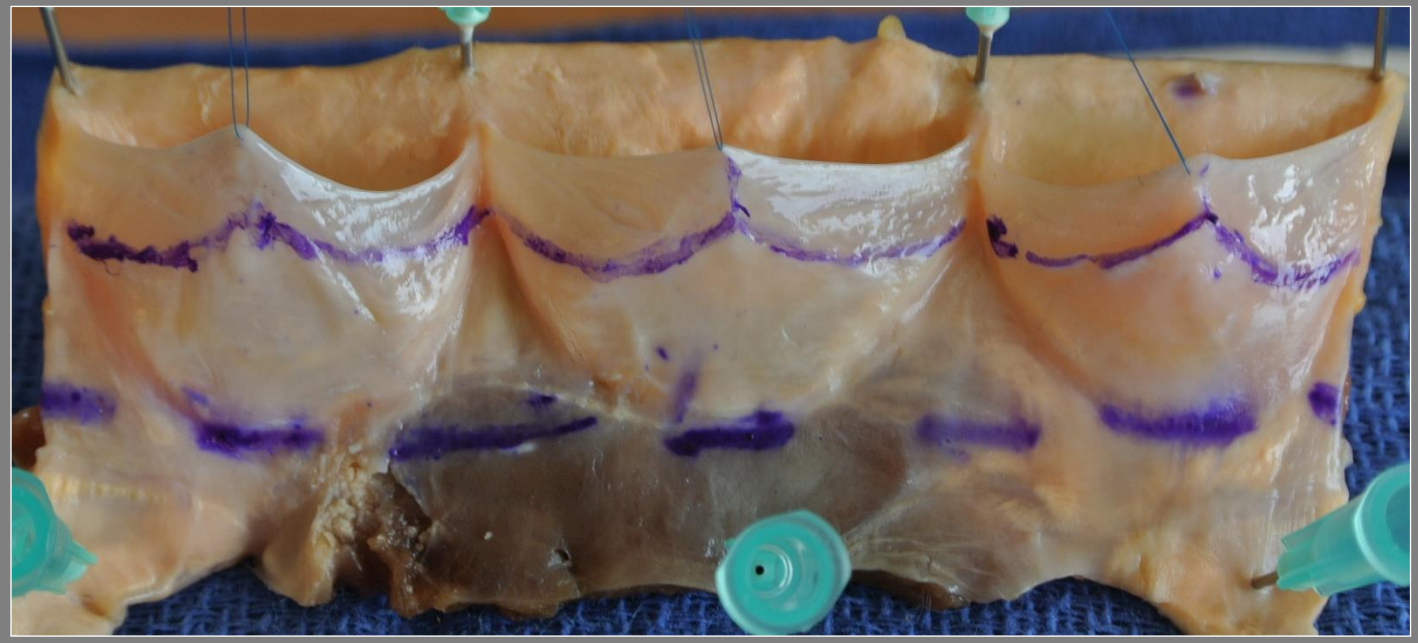
1. Restore and preserve cusp geometry and motion

+

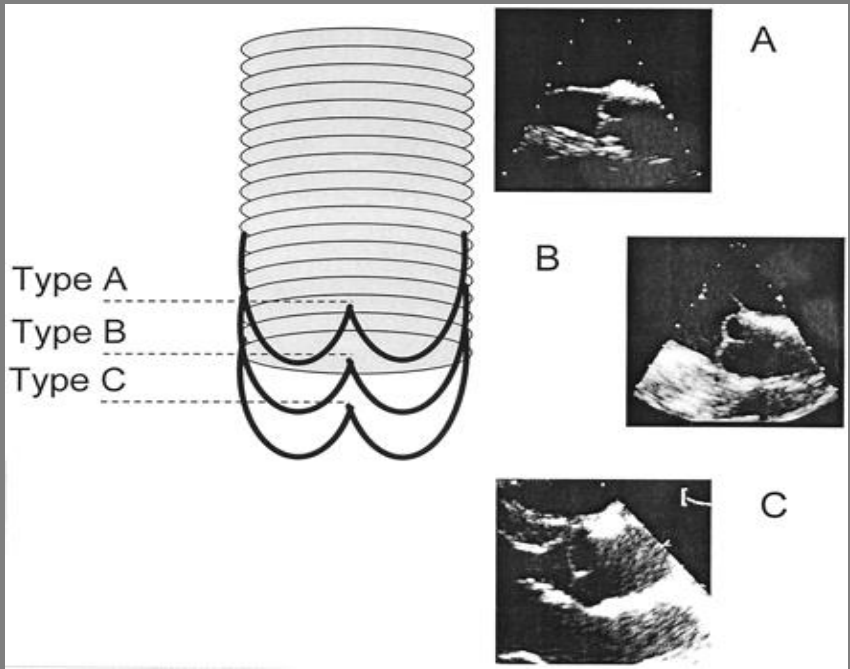
2. Remodel and stabilize the FAA

↓

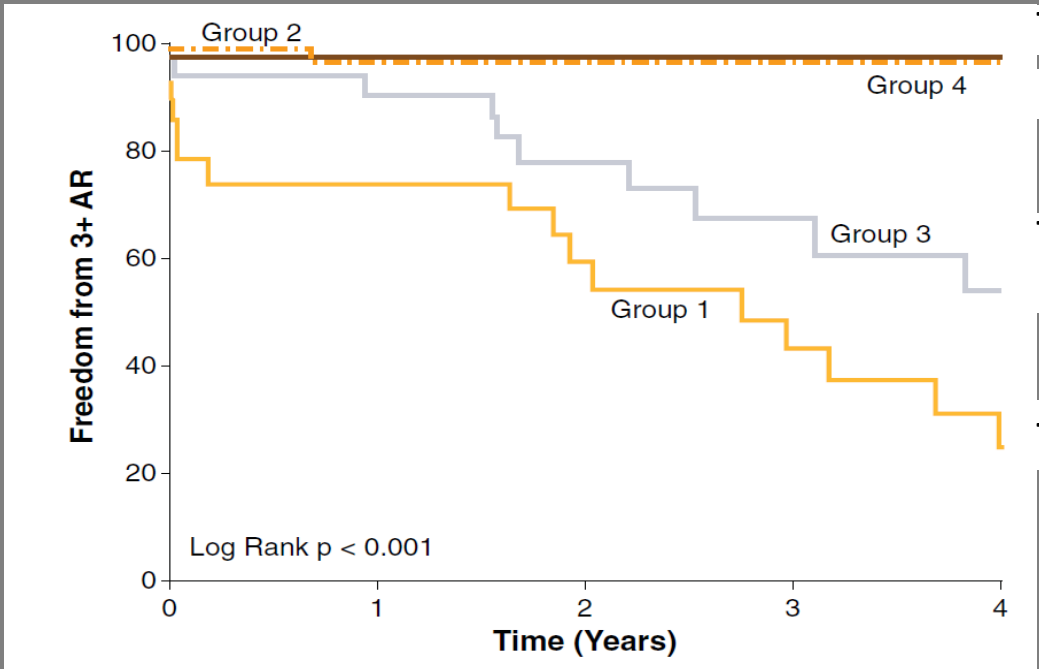
Optimal area of coaptation, stable over time



Principles of AV repair: Optimal coaptation



Pethig K. ATS 2002



le Polain JB. JACC Card. Im. 2009

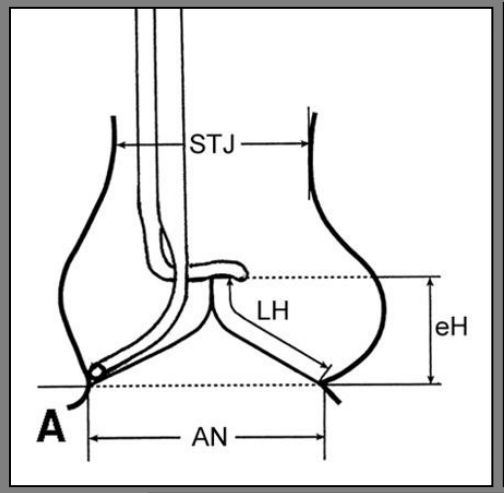
Tips > annulus, No AR

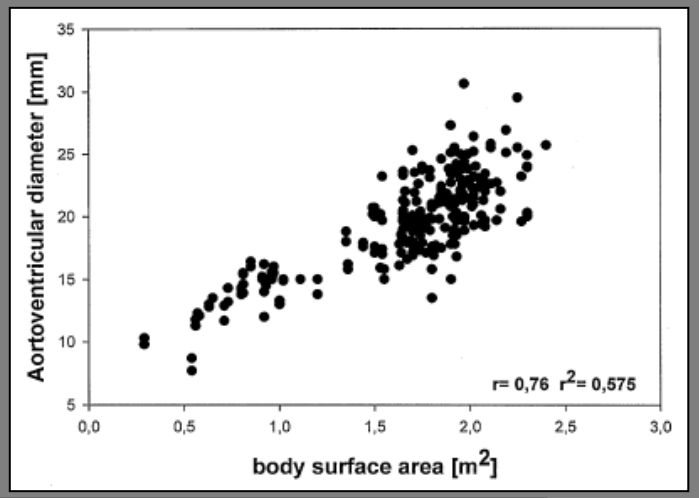
Residual AR, Coapt L >4 mm

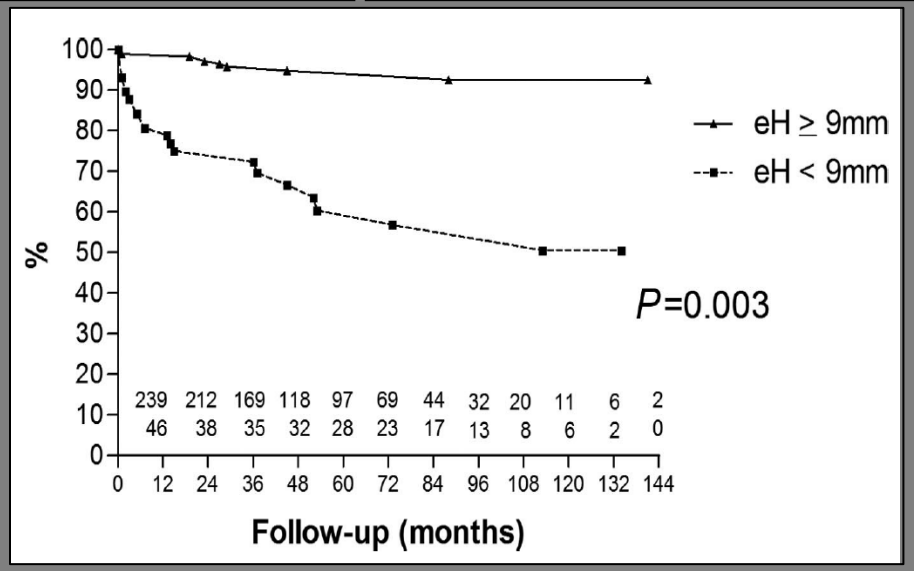
Tips > annulus,
Residual AR, Coapt L <4 mm

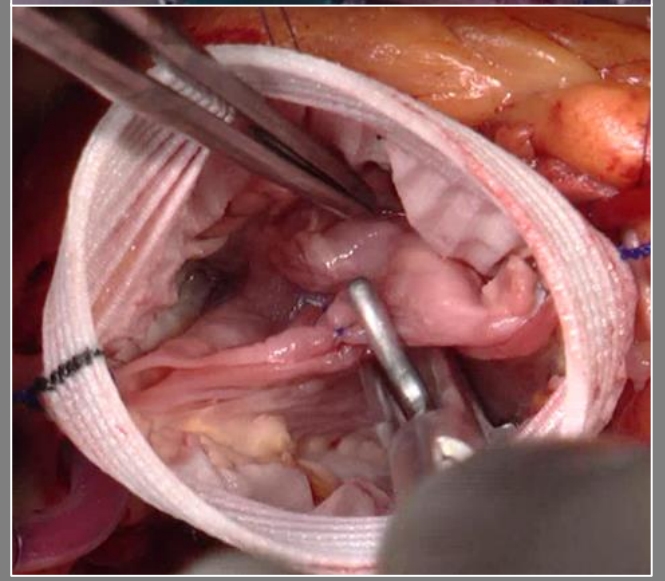
Tips < annulus

Principles of AV repair: Optimal coaptation









Schafers H.J. JCTVS 2006
Bierbach B.O., EJCTS 2010
Aicher D. Circ. 2011

Techniques of cusp repair

Cusp lesions

- Prolapse (type 2)
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction (type 3)
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction (type 1d)

Repair techniques

→ Central plication or Goretex resuspension

→ Goretex resuspension or Patch

→ Commissure reattaching or Patch

→ Resection + direct closure or patch

→ Resection + Patch

→ Resection + Patch

→ Patch

Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
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- Restriction/retraction
  - Raphe in BAV
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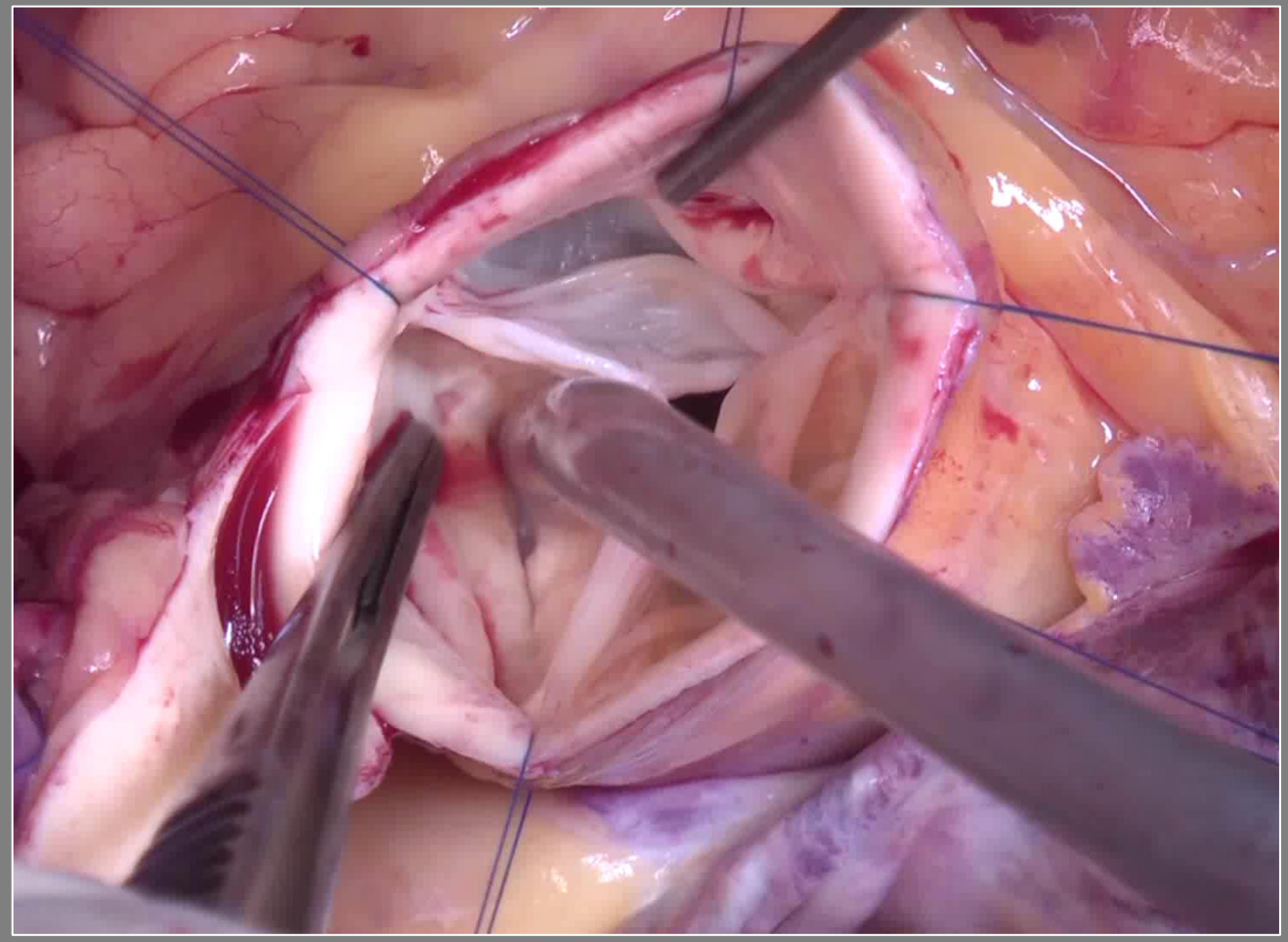
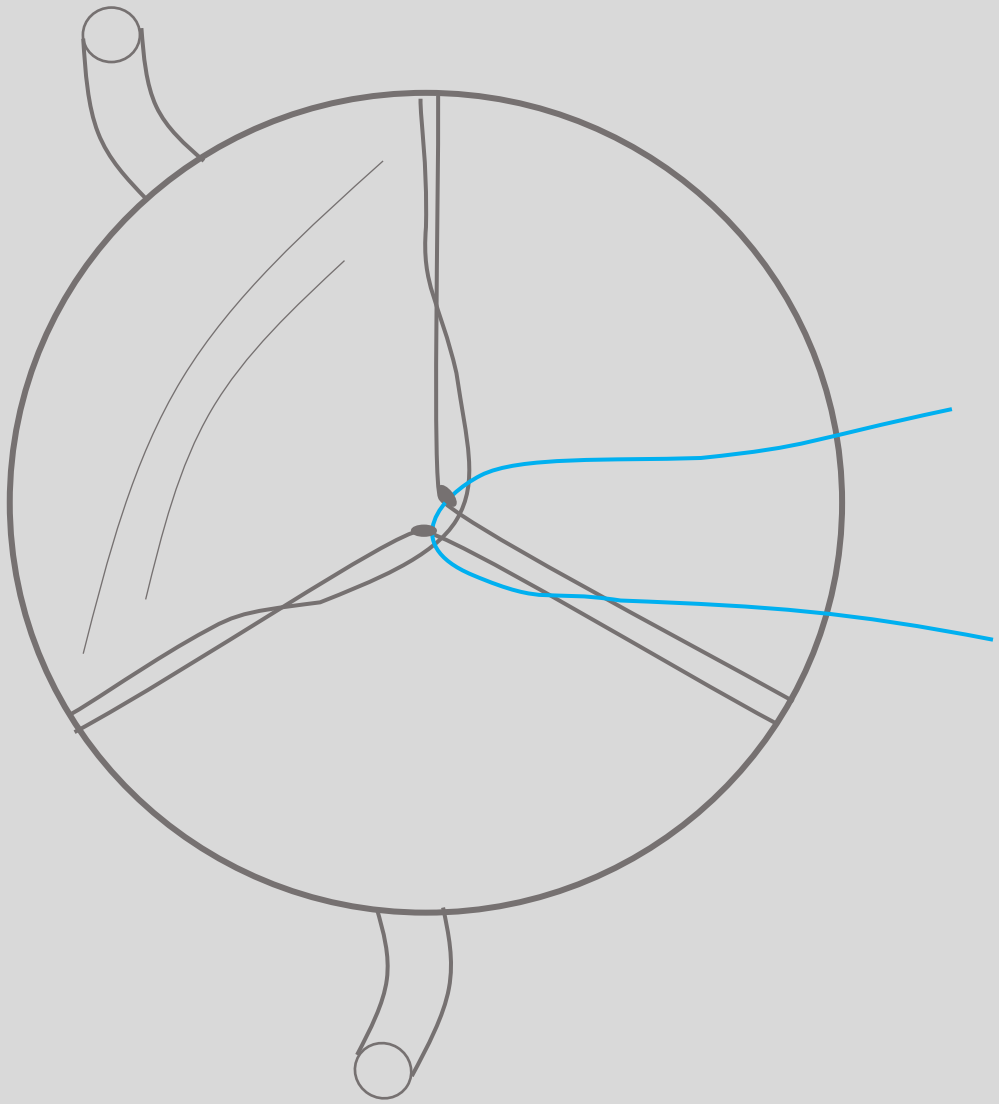
Repair techniques

→ Central plication



Central Plication Technique: 1 cusp prolapse



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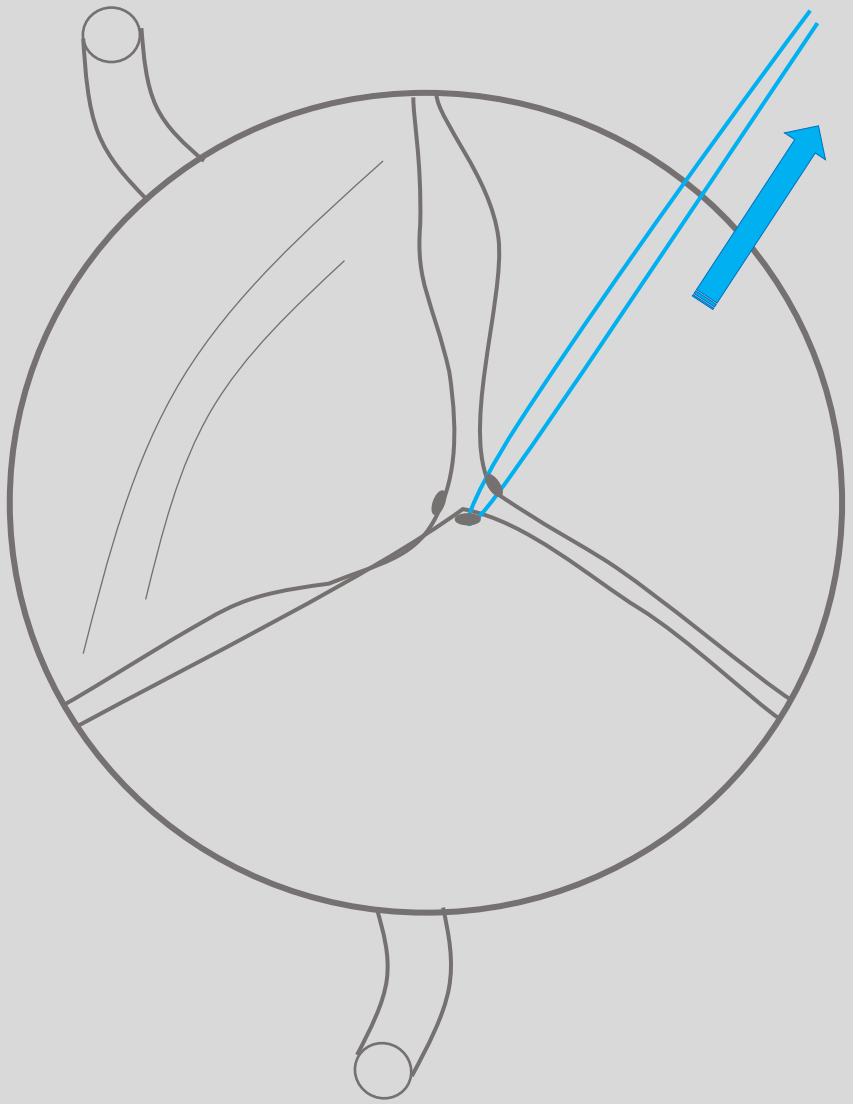

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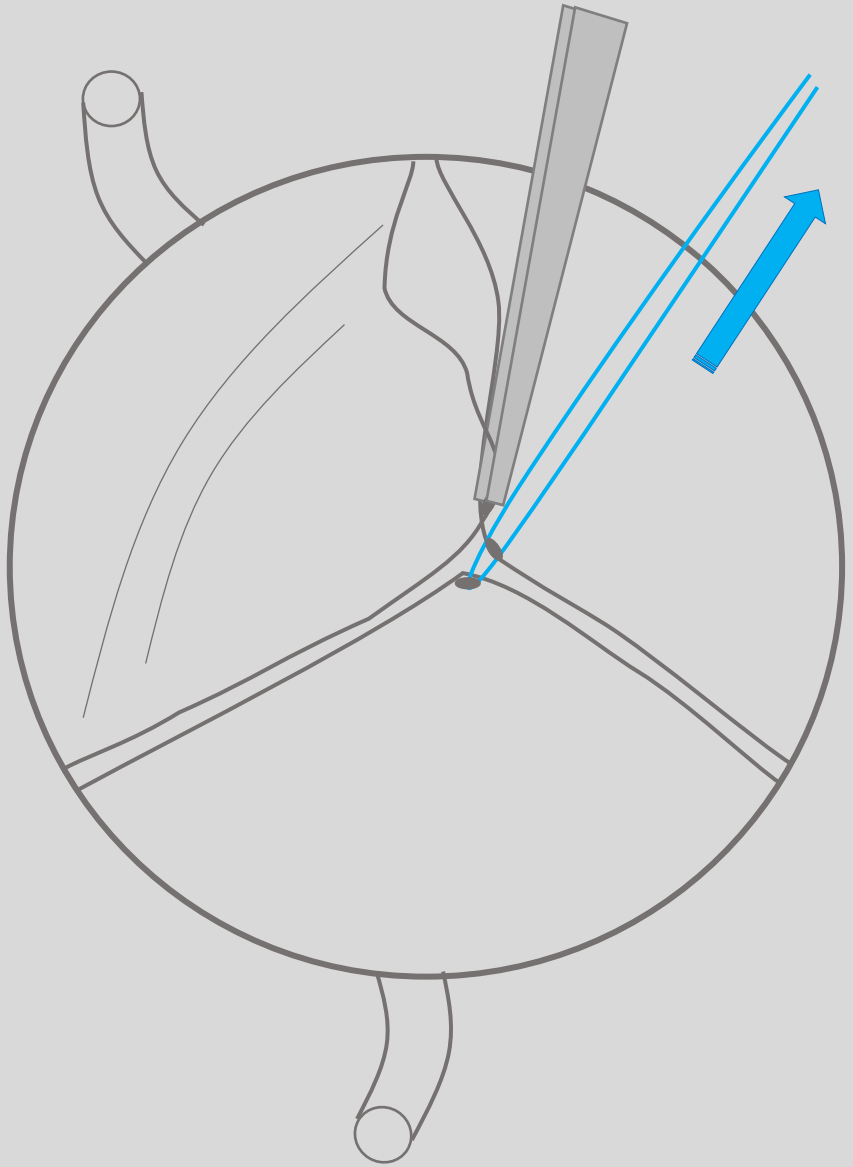

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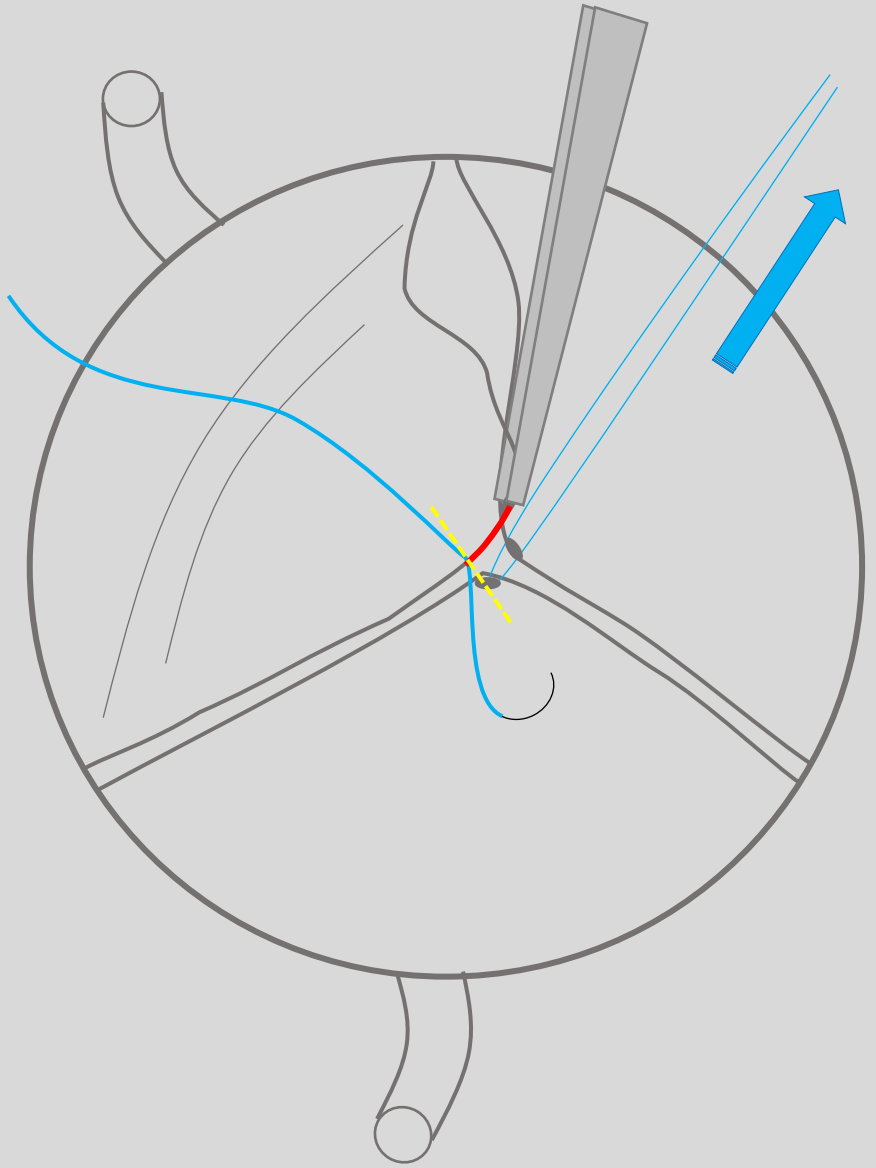

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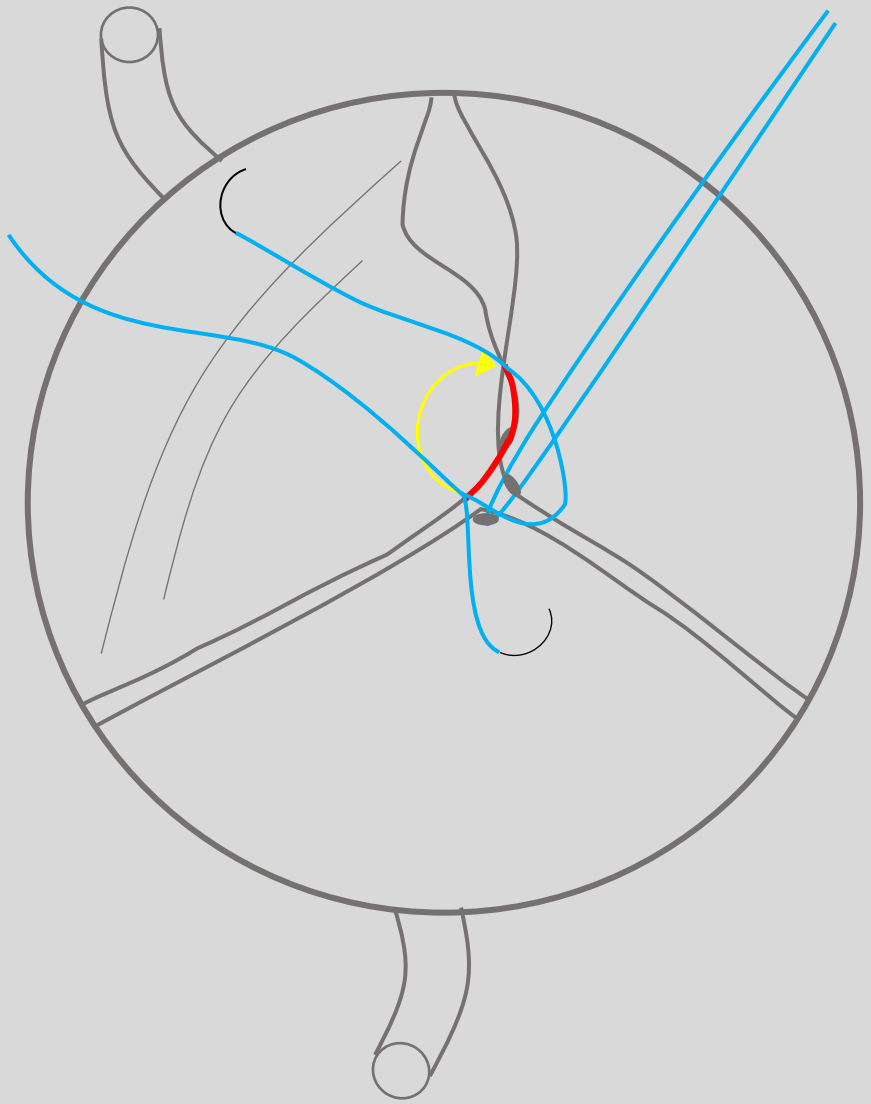
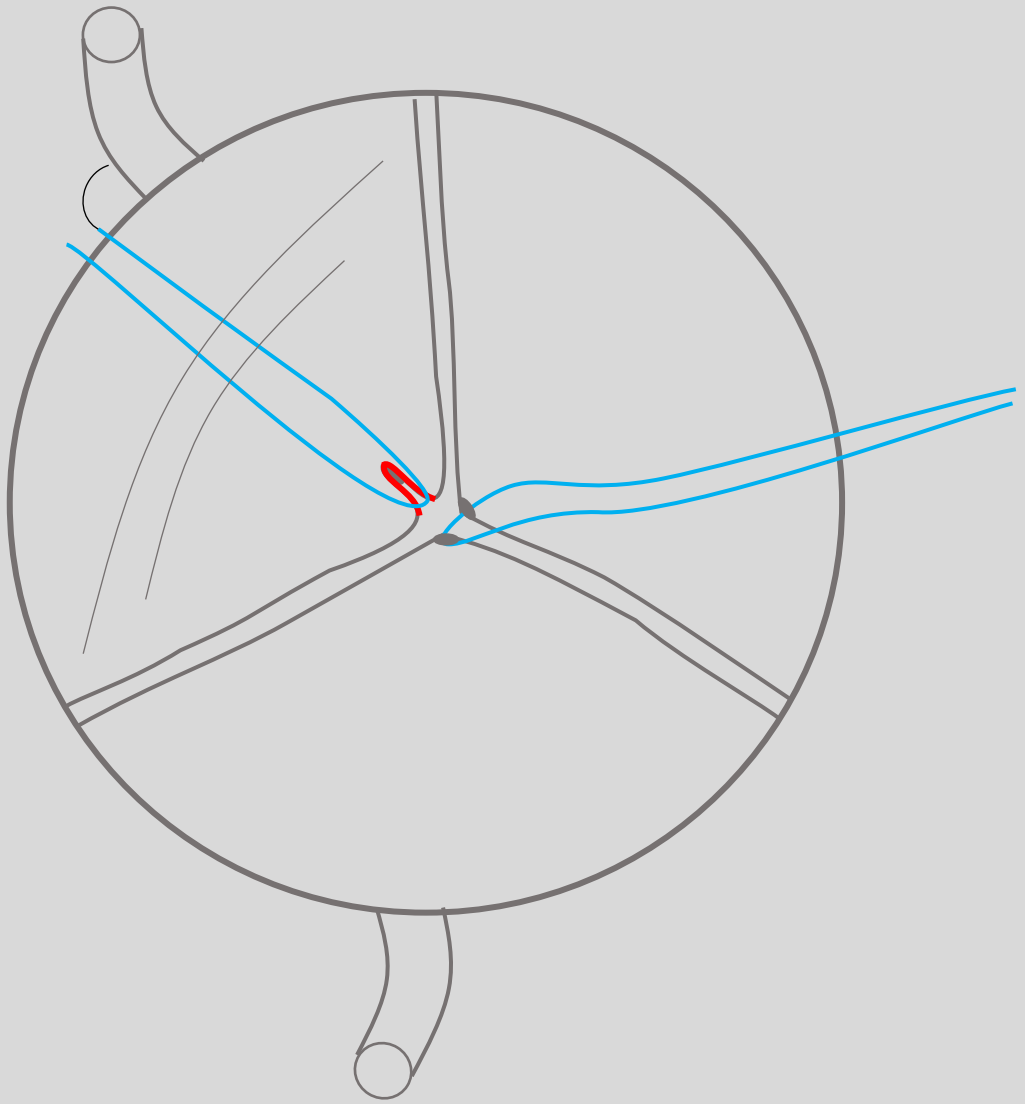
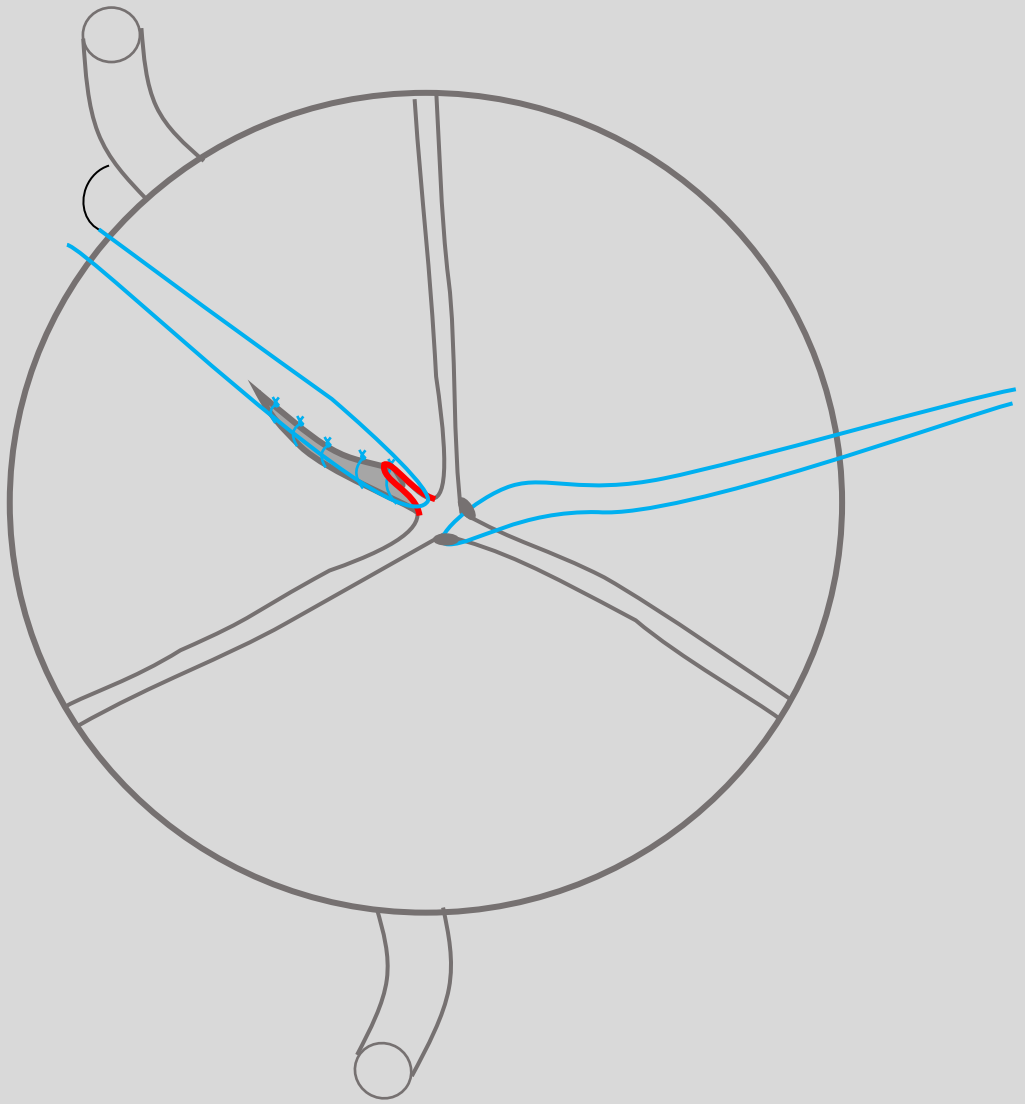


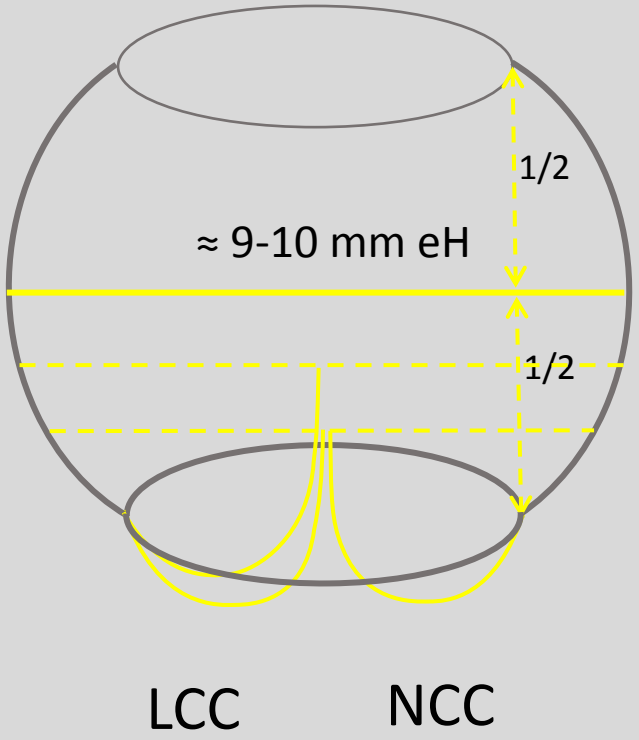
Central Plication Technique: 1 cusp prolapse

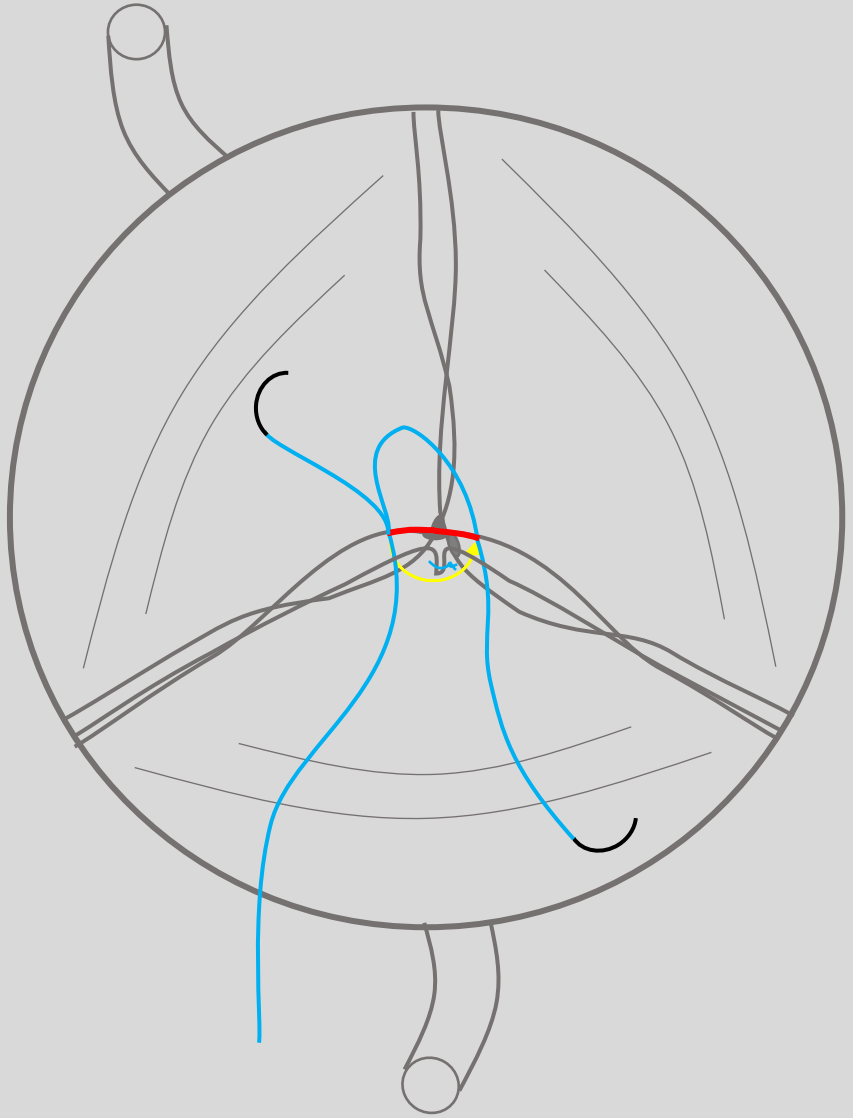


Central Plication Technique: 1 cusp prolapse

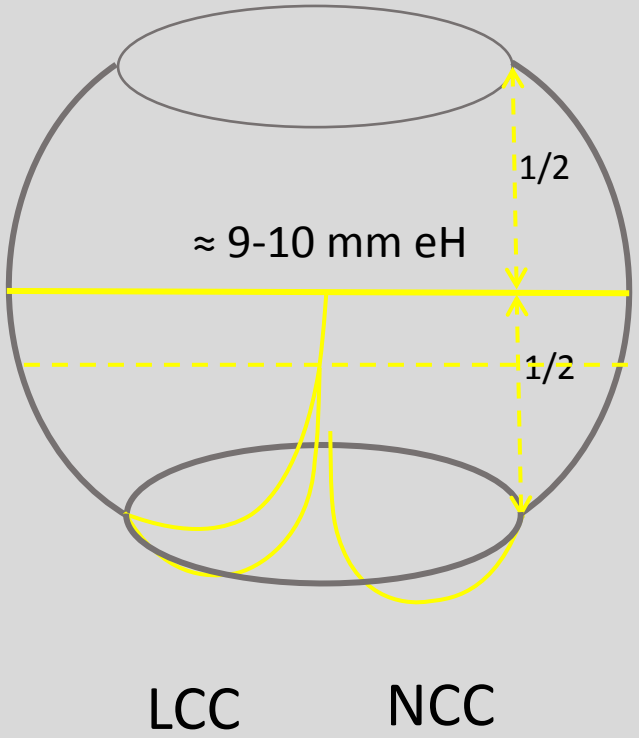


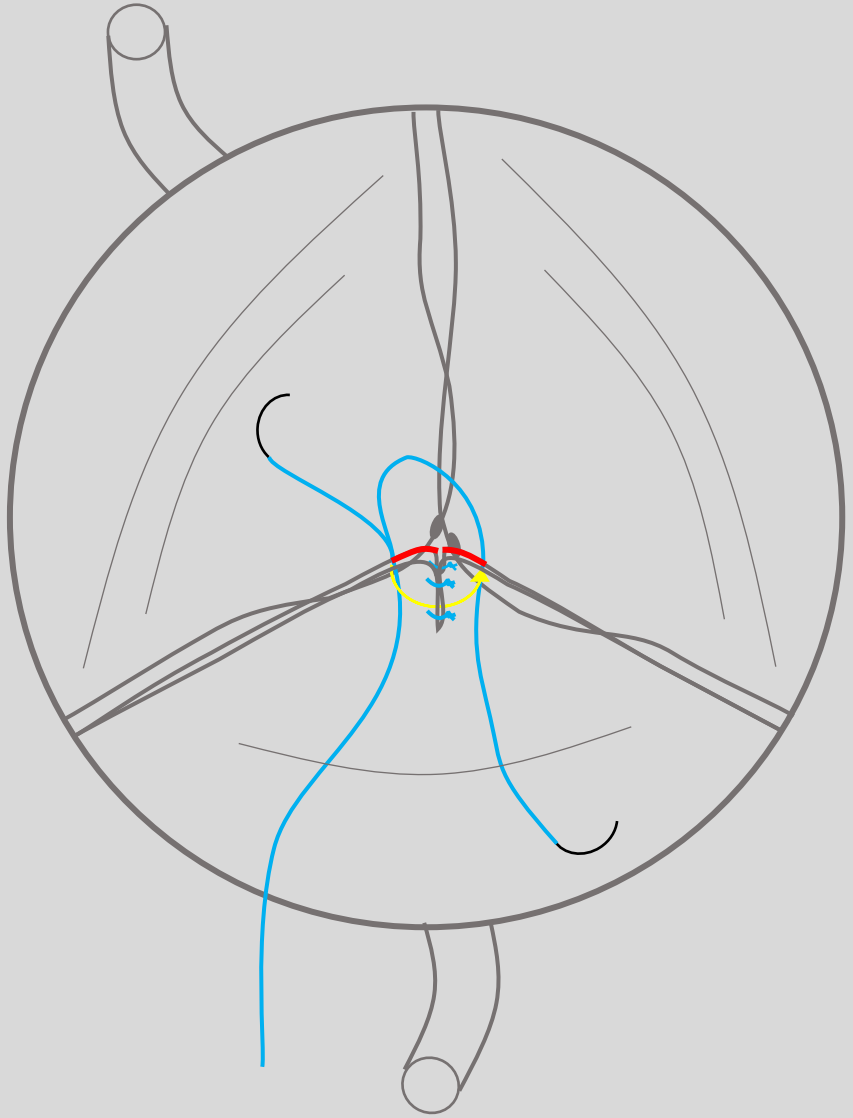
Central Plication Technique: 3 cusps prolapse



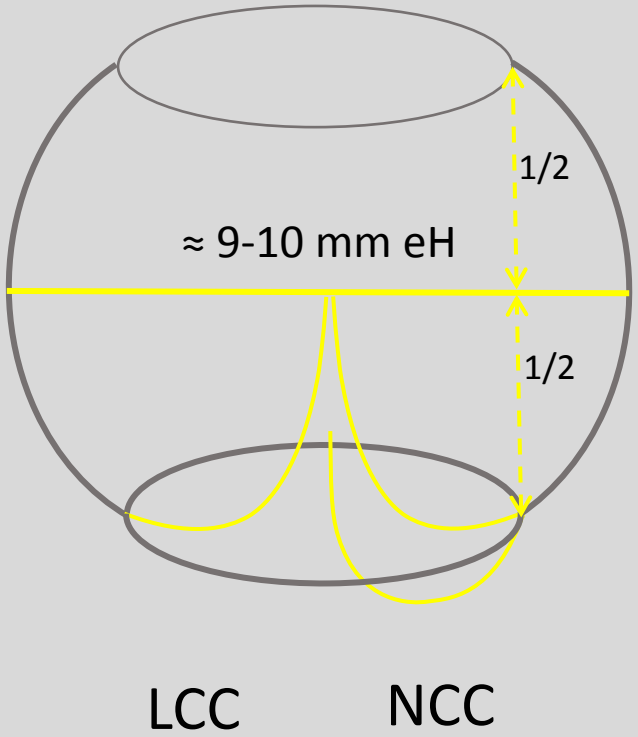


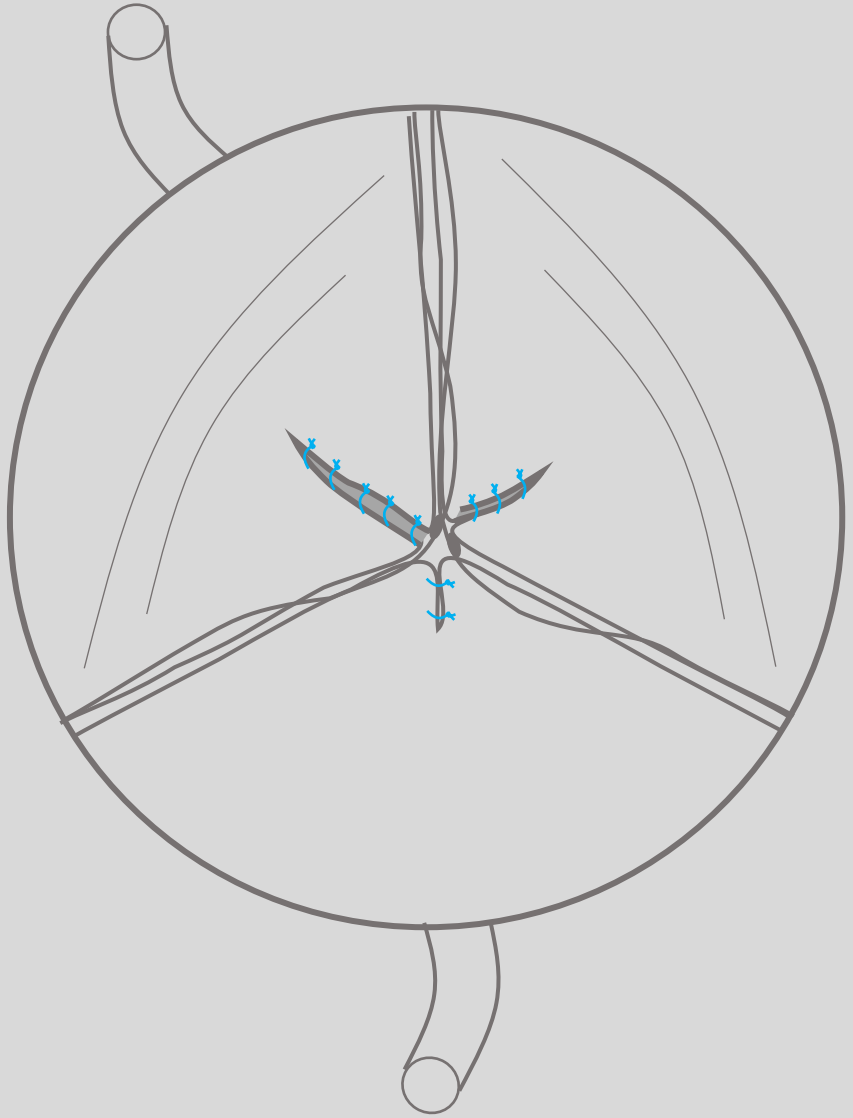
Central Plication Technique: 3 cusps prolapse





Central Plication Technique: 3 cusps prolapse





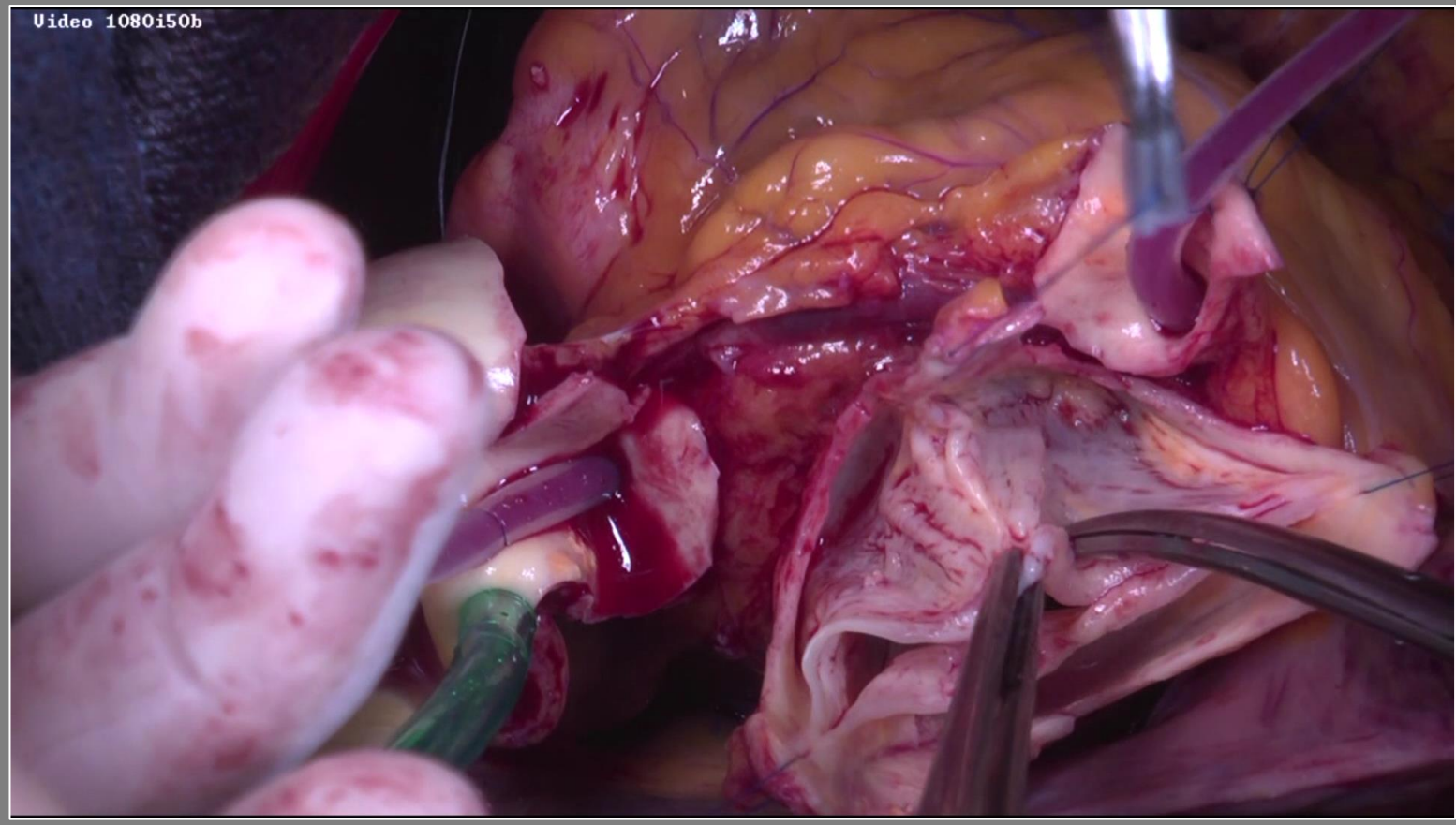
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Central plication



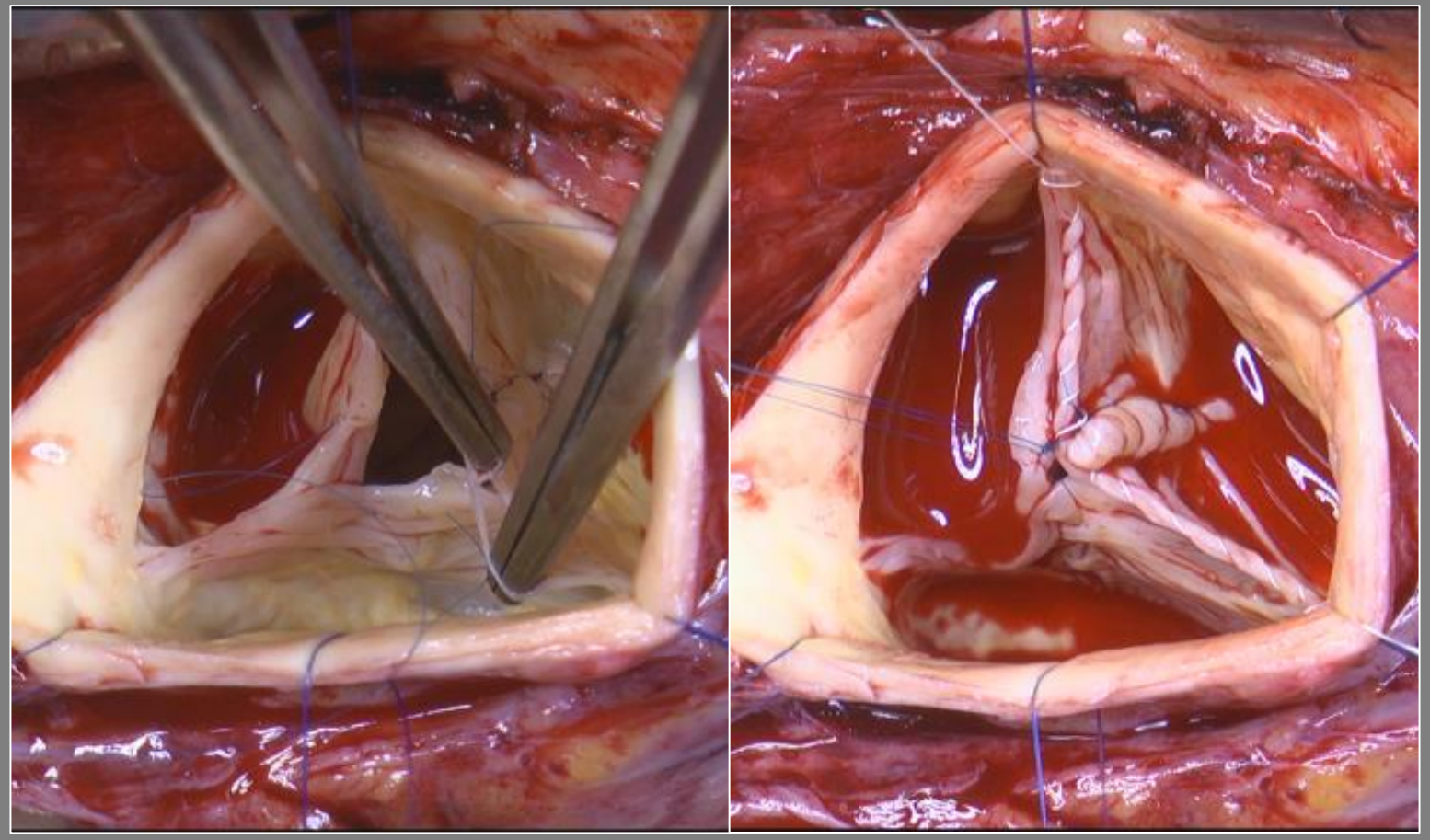
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration *« small »*
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Central plication + Gtx Resuspension



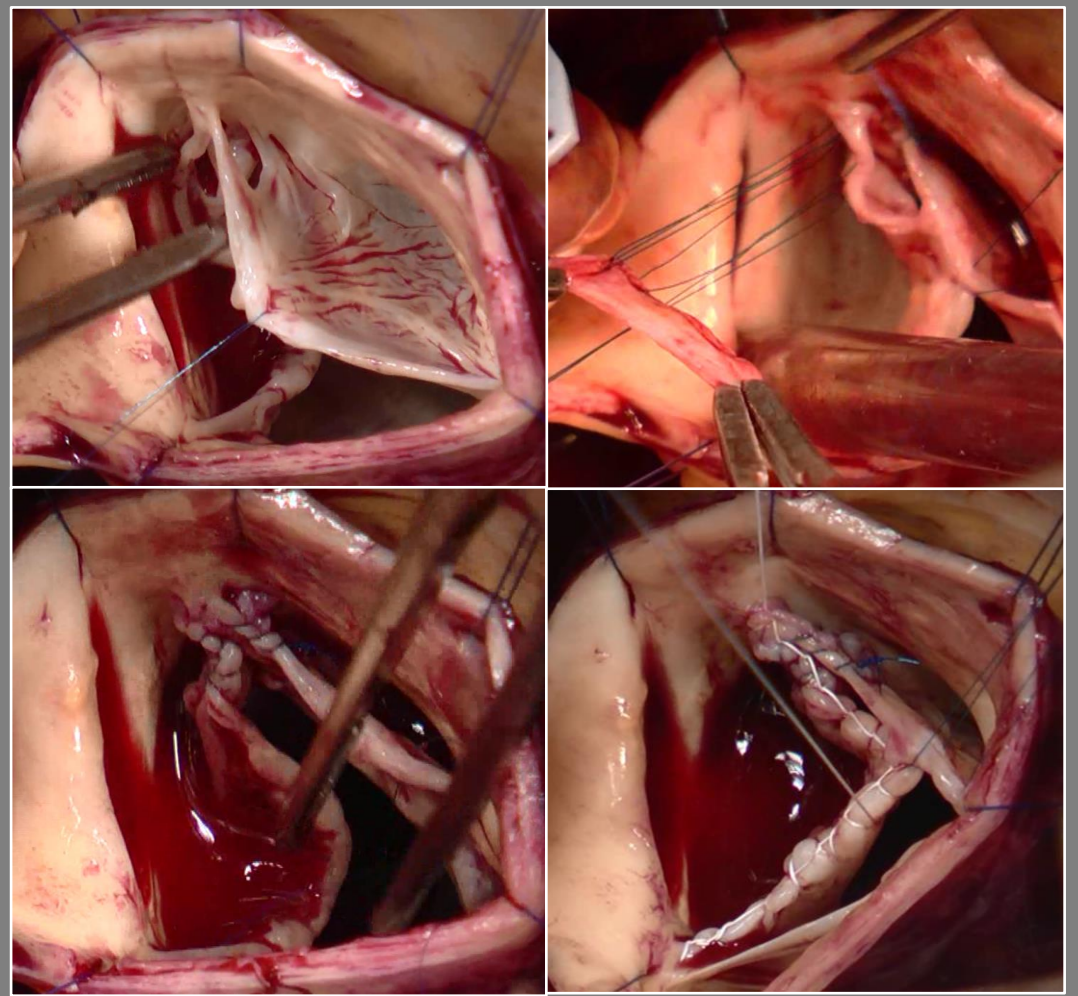
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration *« large »*
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Patch repair (2 patches) + Gtx resuspension



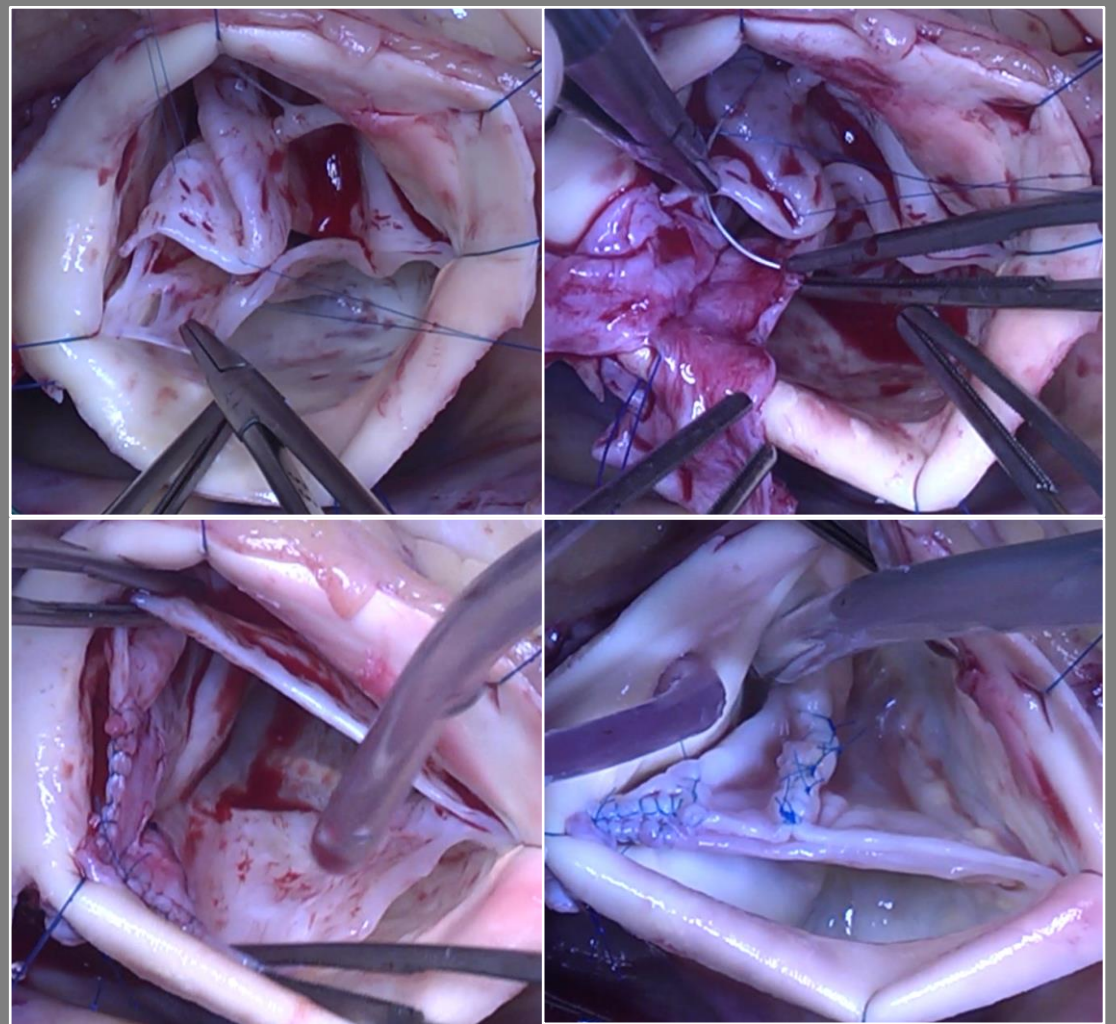
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration *« rutpured »*
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Patch repair (butterfly techn.) + Central Plication



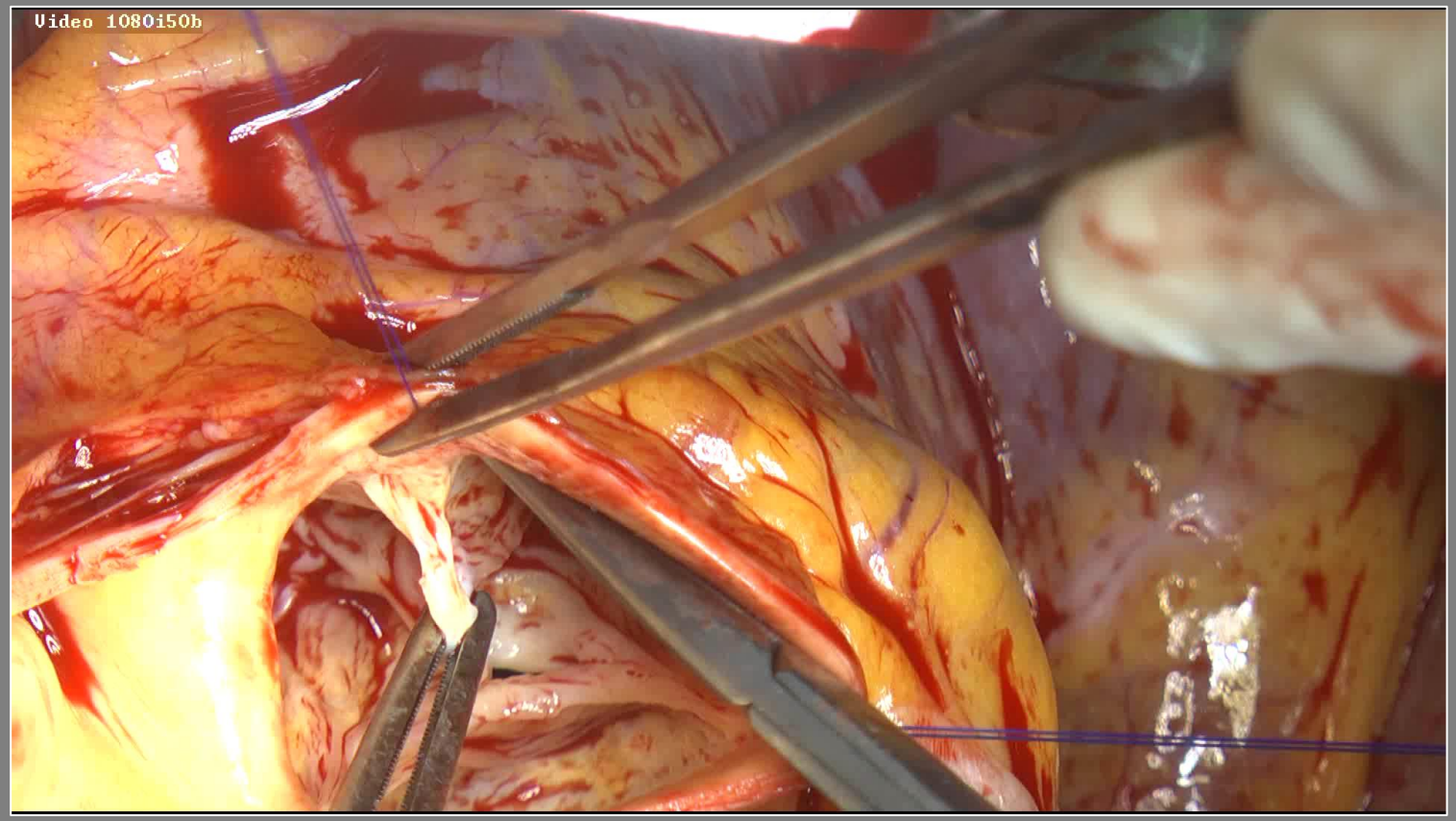
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Comm. reattachment + Goretex resuspension



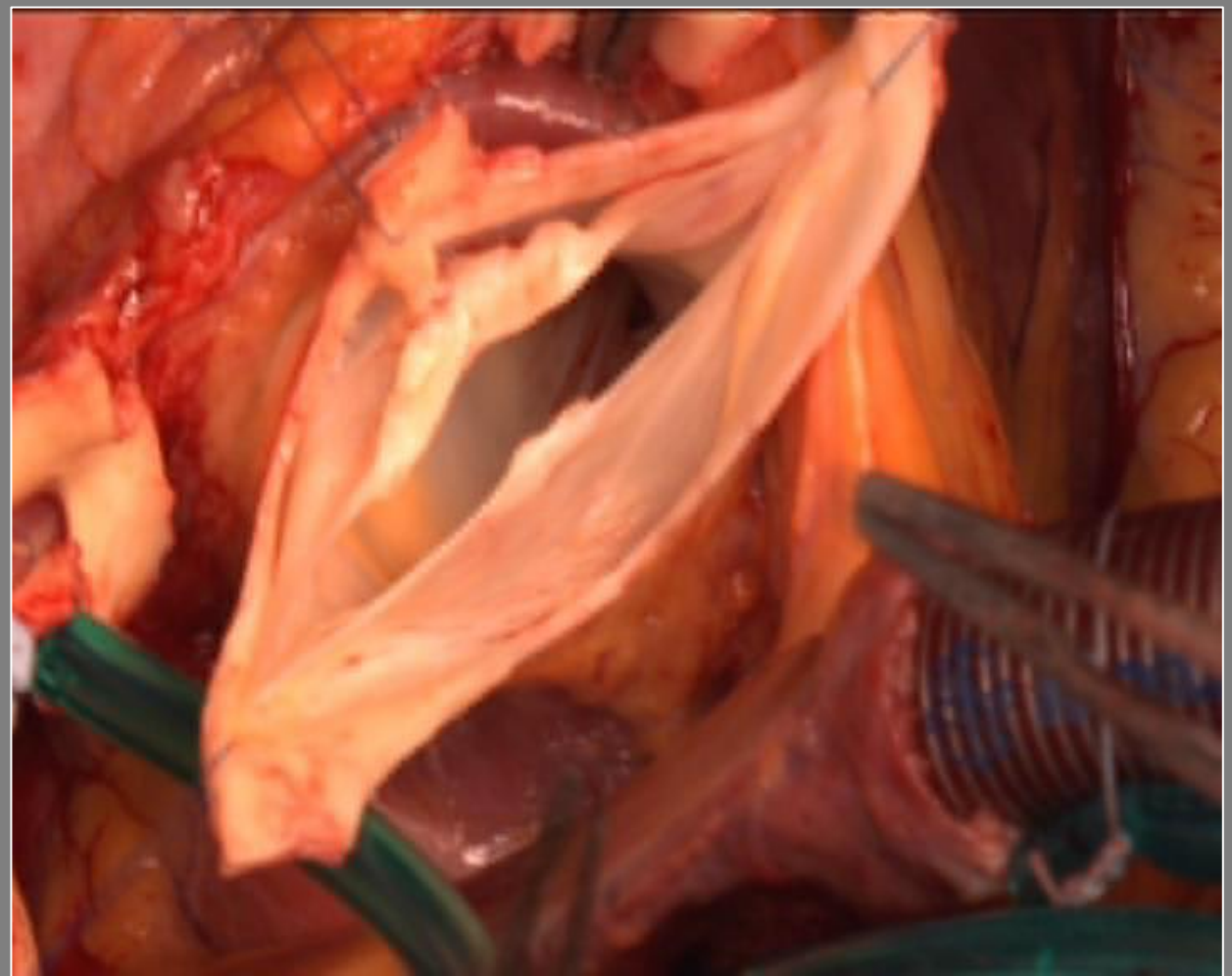
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Resection direct closure + VS Reimplantation



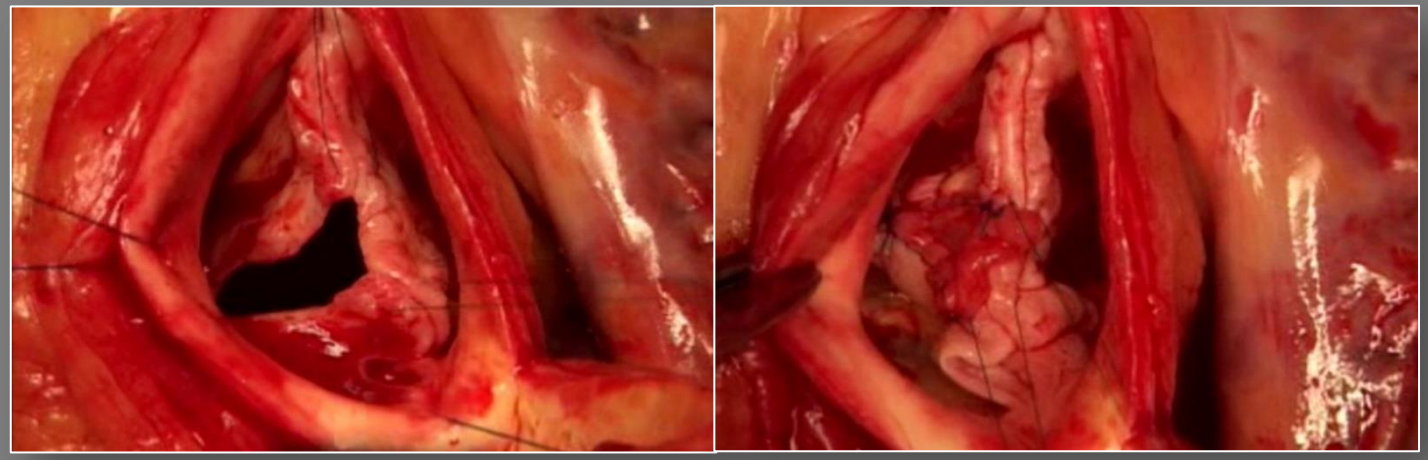
Techniques of cusp repair

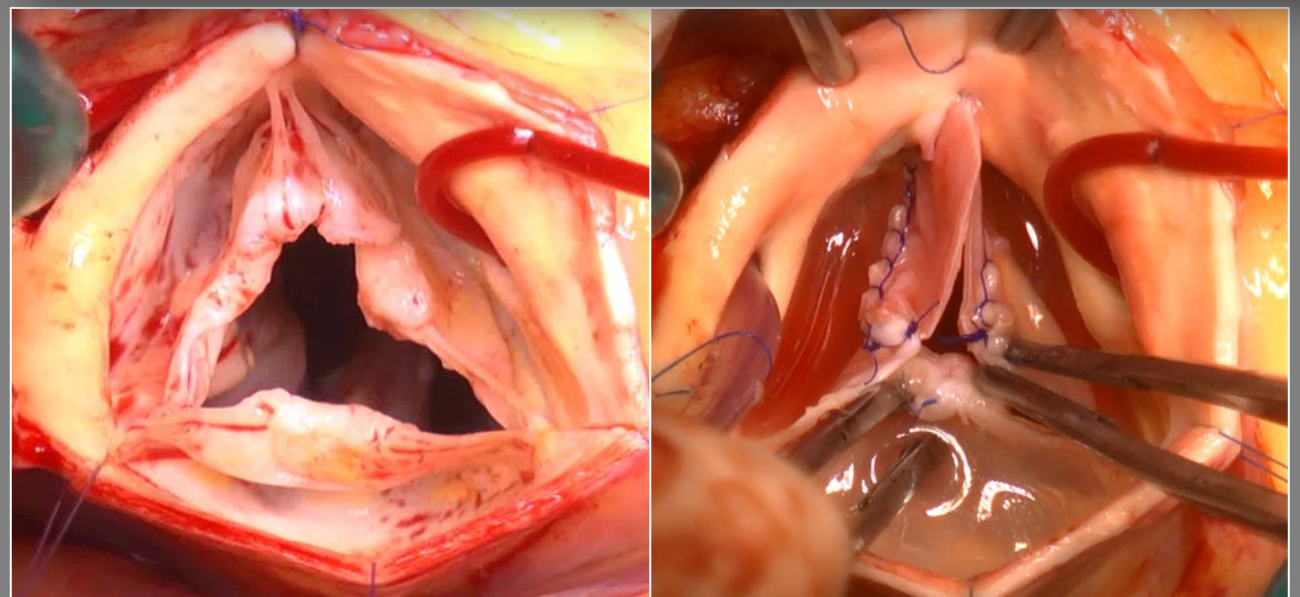
Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Resection + Patch repair





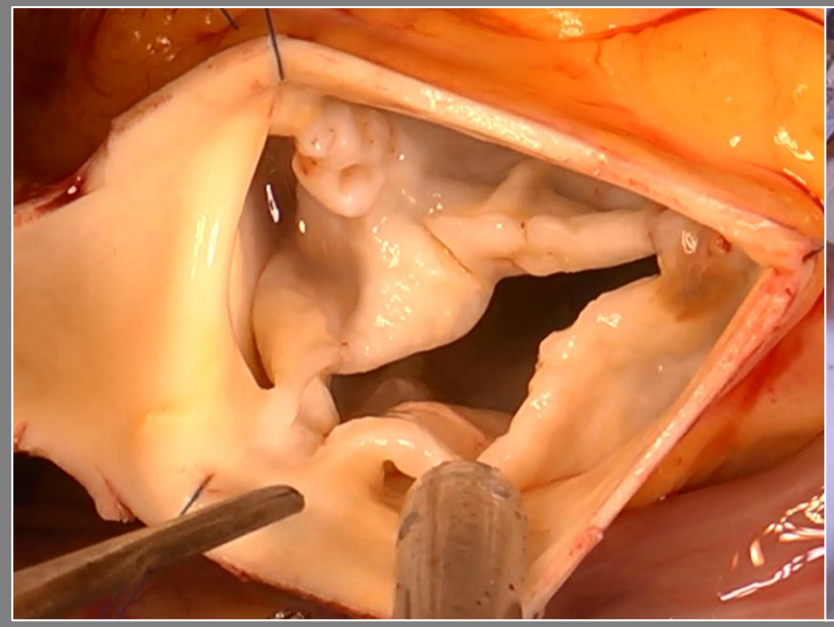
Techniques of cusp repair

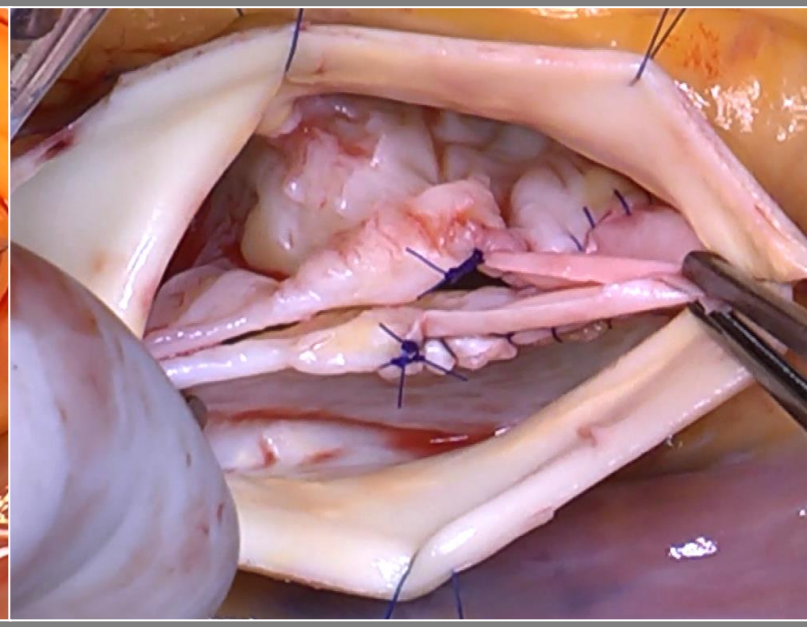
Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Resection + Patch repair





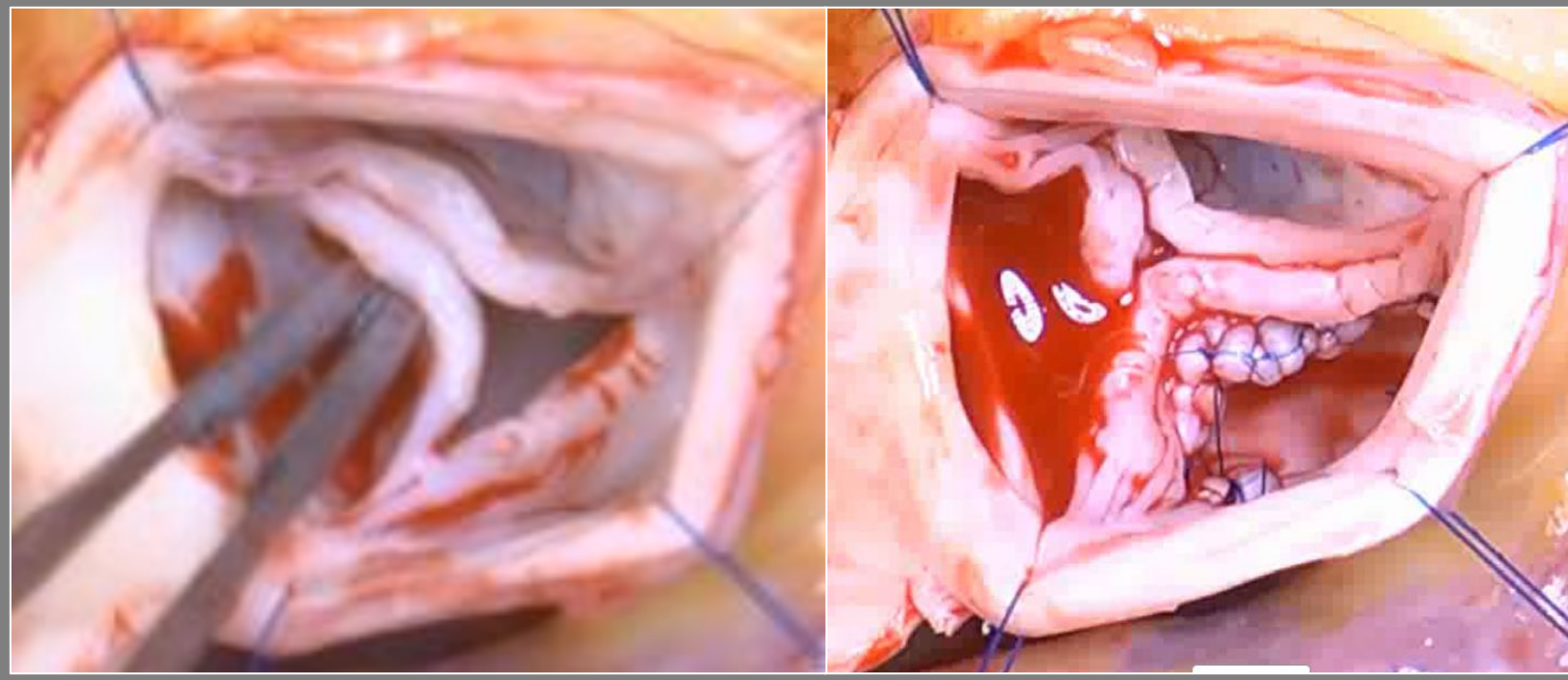
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration
  - Commissure disruption
- Restriction/retraction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

→ Cusp extension with patch



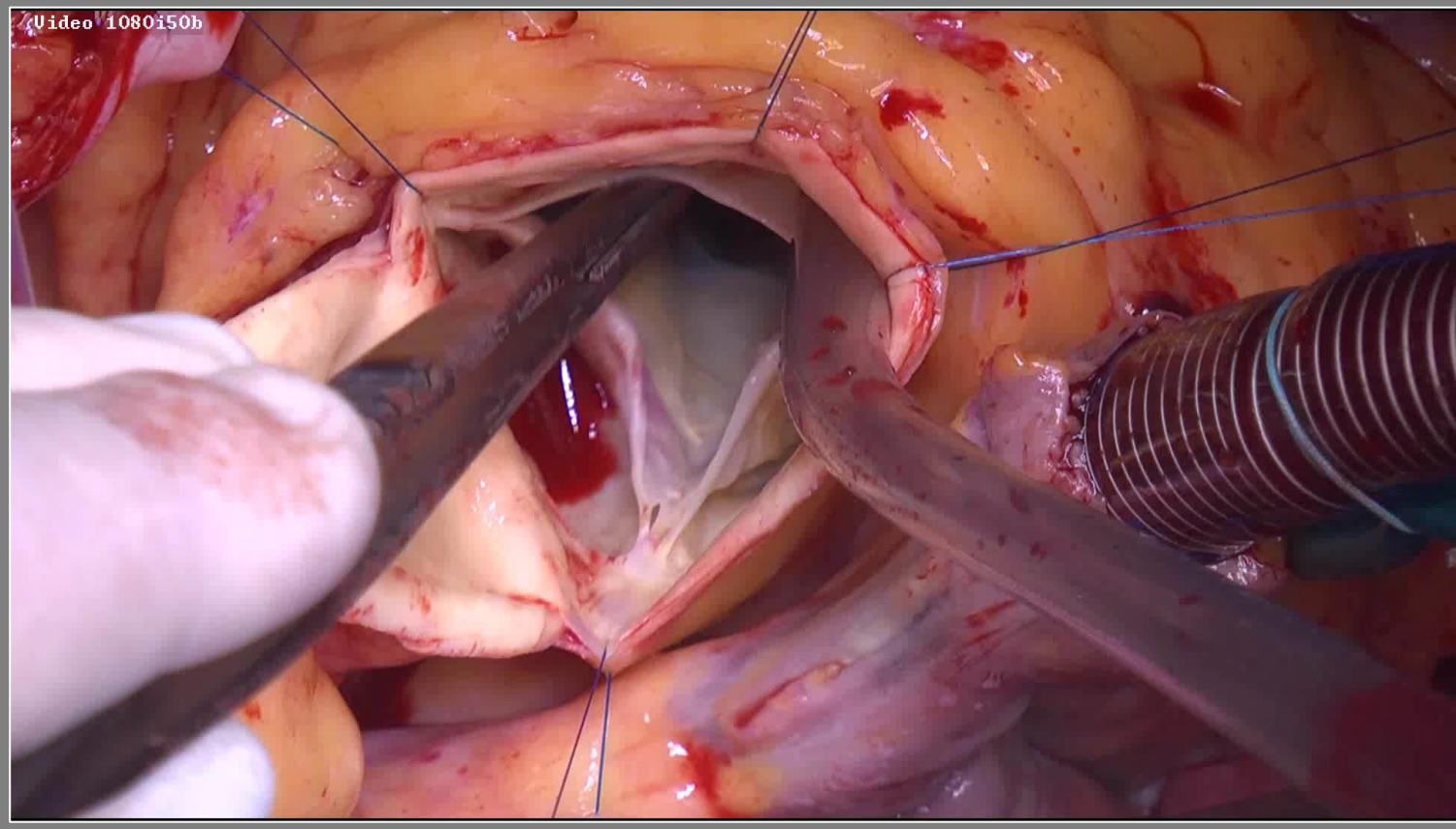
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration (large/rutpured)
  - Commissure disruption
- Restriction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/Destruction

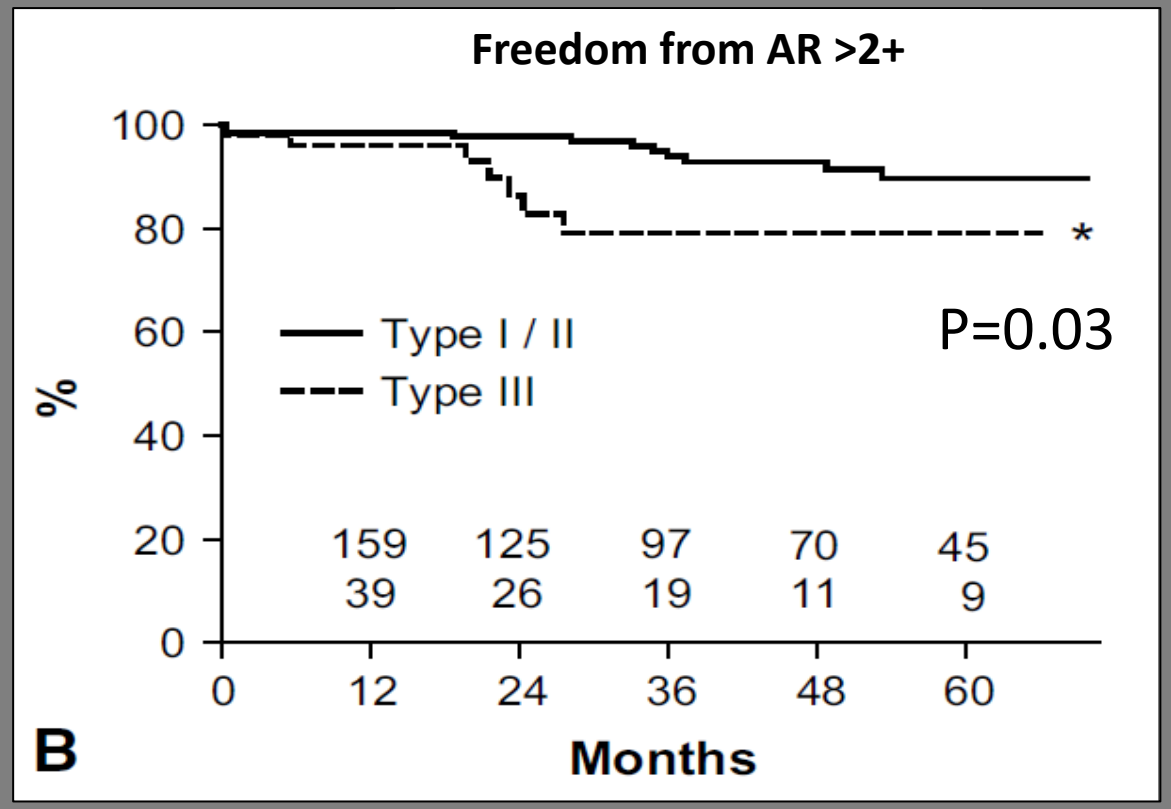
Repair techniques

→ Patch repair



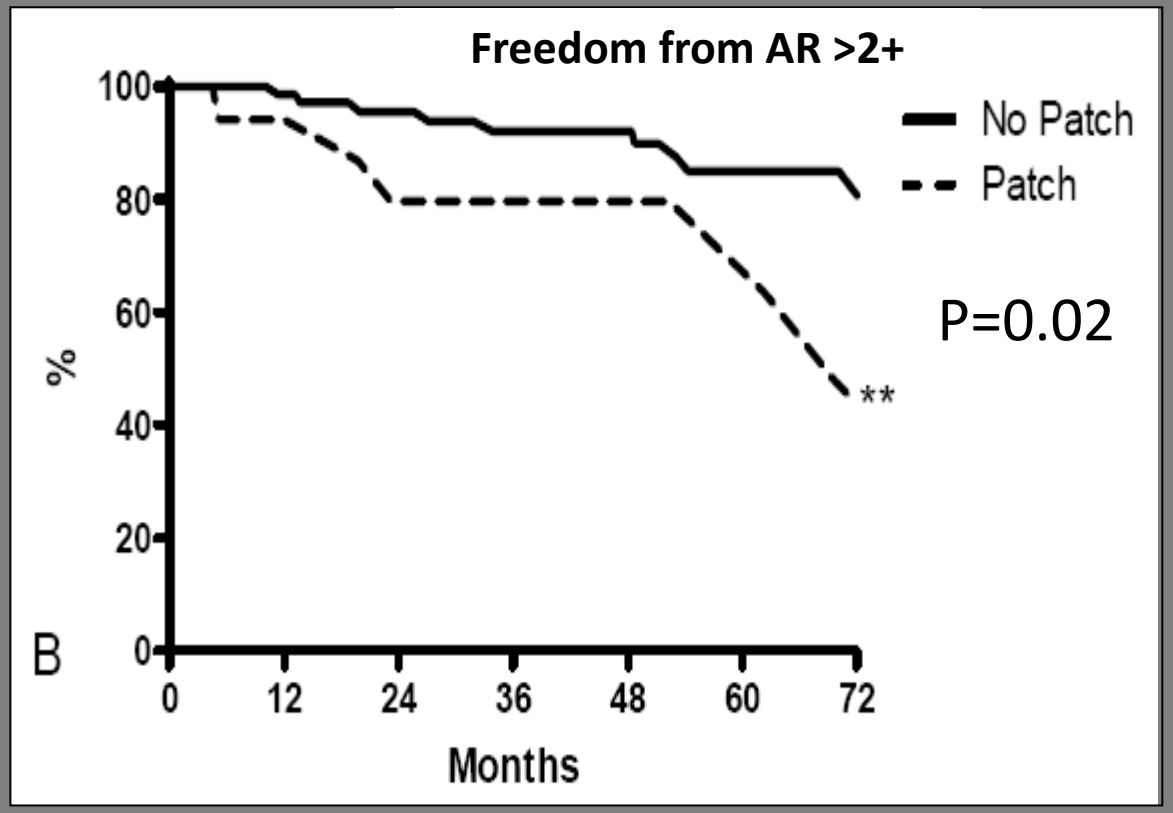
Techniques of cusp repair:
Outcome following type of AI

All repair cohort



M. Boodhwani, JTCVS 2009

BAV repair



Boodhwani M. JTCVS 2010

Techniques of FAA repair

Aorta lesions	Repair techniques
• Type 1a: Asc Ao (STJ)	→ Supra coronary ascending aorta replacement
• Type 1b: Root (STJ + VAJ)	→ Valve Sparing Reimplantation
• Type 1c: VAJ	→ Subcommissural annuloplasty or Ring annuloplasty

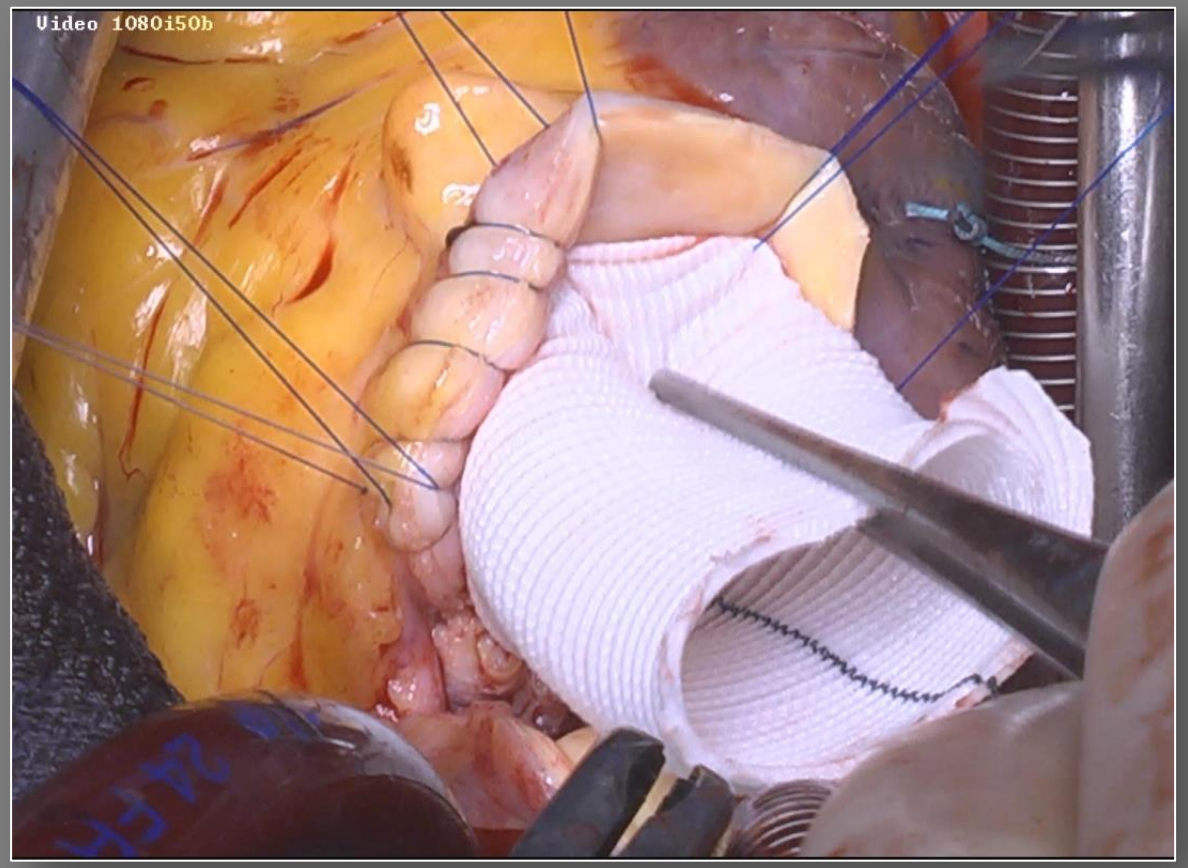
Techniques of FAA repair

Aorta lesions

- Type 1a: Asc Ao (STJ)
- Type 1b: Root (STJ + VAJ)
- Type 1c: VAJ

Repair techniques

→ Supra coronary ascending aorta replacement



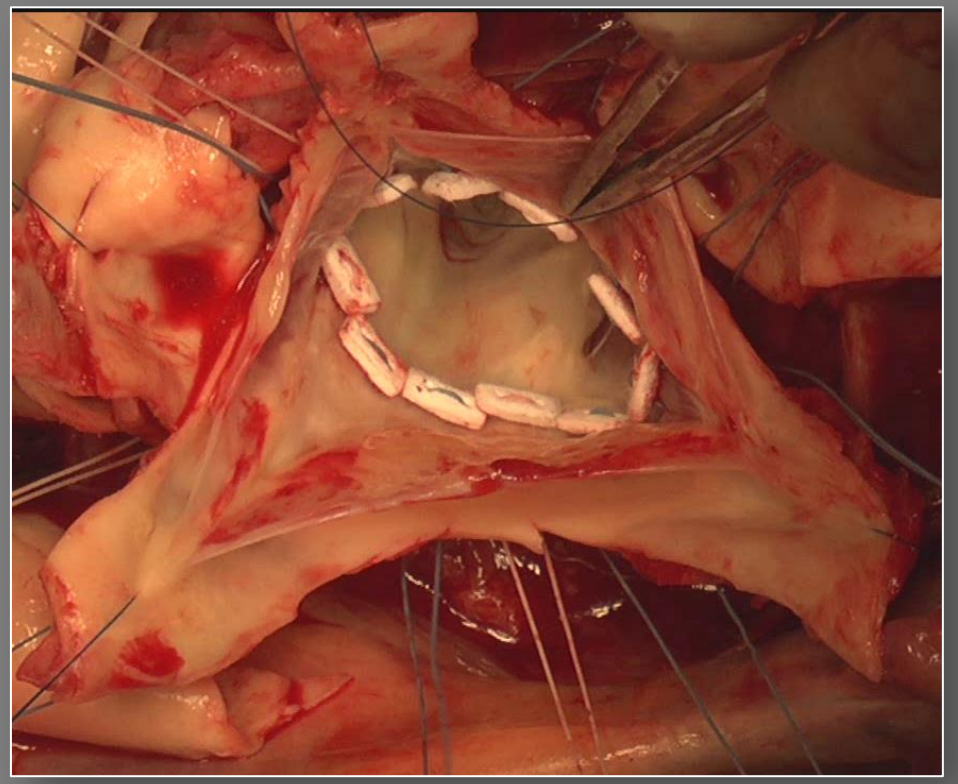
Techniques of FAA repair

Aorta lesions

- Type 1a: Asc Ao (STJ)
- Type 1b: Root (STJ + VAJ)
- Type 1c: VAJ

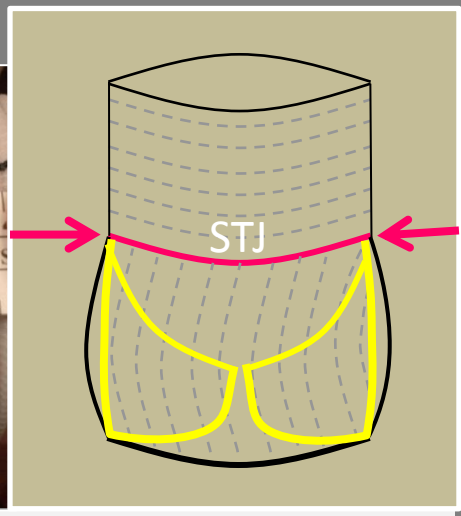
Repair techniques

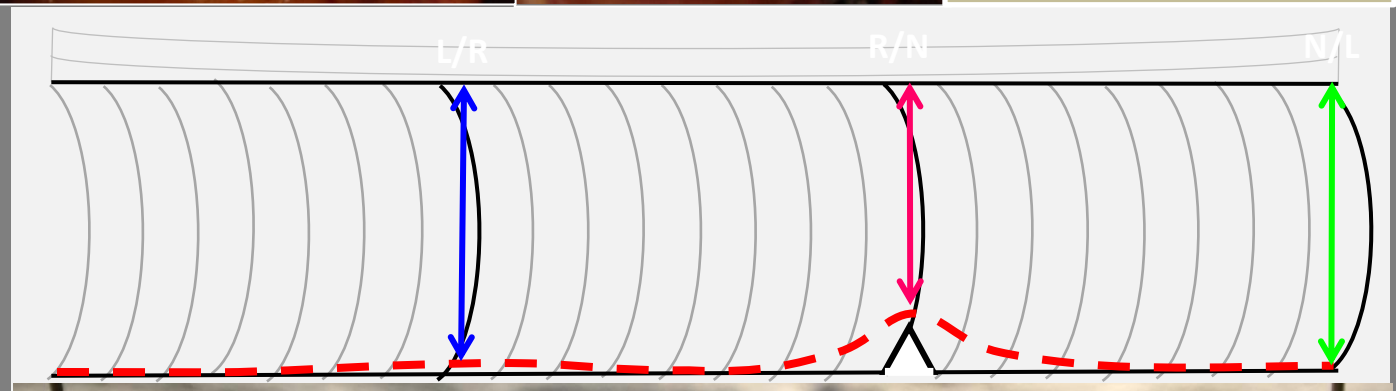
→ Valve Sparing Reimplantation

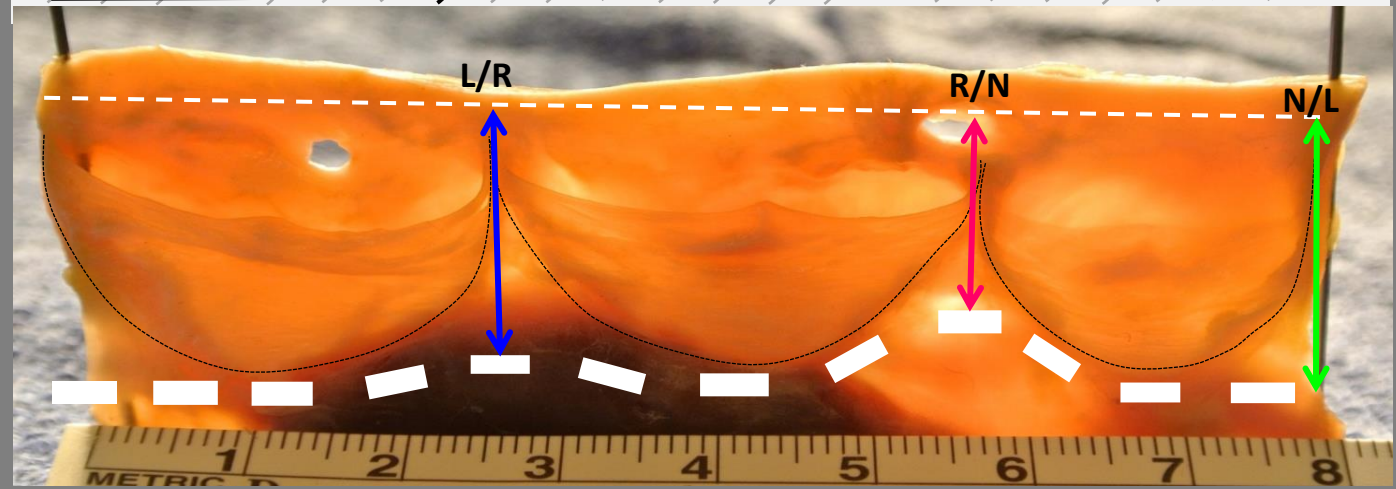


VS Reimplantation: Brussels Technique

1. Valve inspection
2. Root dissection
3. Complex cusp repair
4. Graft sizing & proximal suture line
5. Com. reimplantation & distal suture line
6. Residual prolapse repair
7. Coronary reimplantation







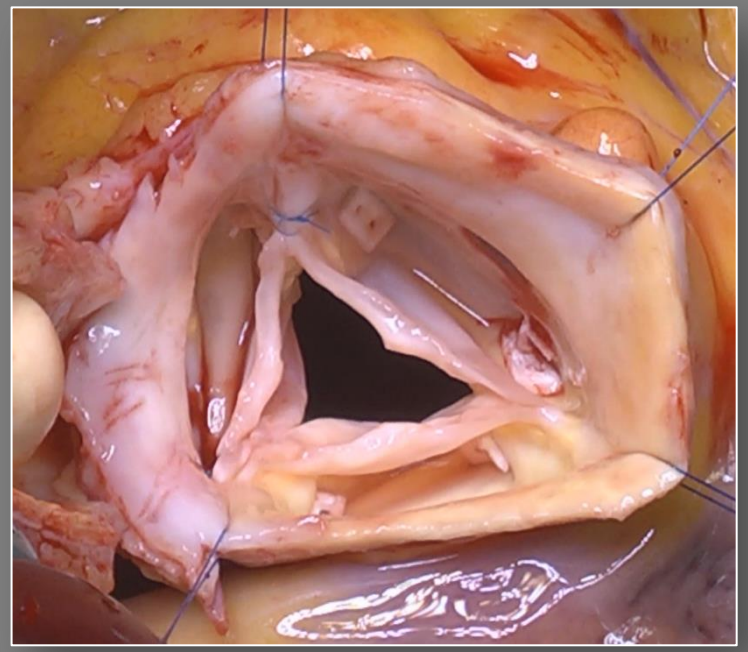
Techniques of FAA repair

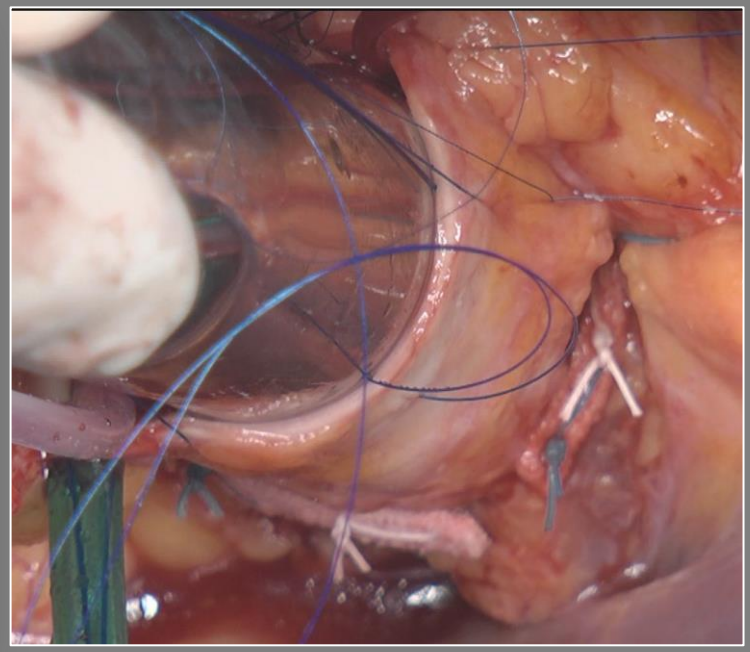
Aorta lesions

- Type 1a: Asc Ao dilat (STJ)
- Type 1b: Root (STJ + VAJ)
- Type 1c: VAJ

Repair techniques

→ Subcommissural annuloplasty or Ring annuloplasty

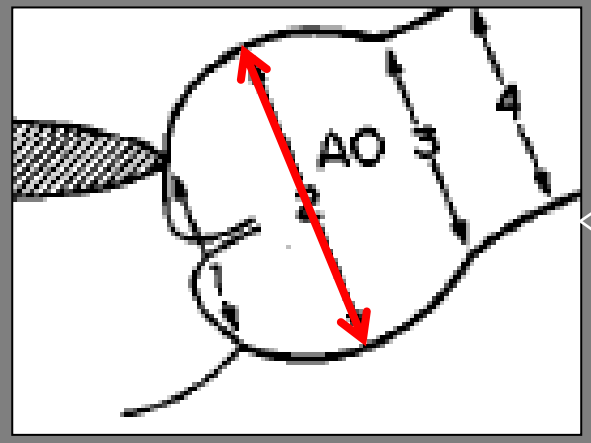




Techniques of FAA repair

Ring annuloplasty

Techniques of FAA repair

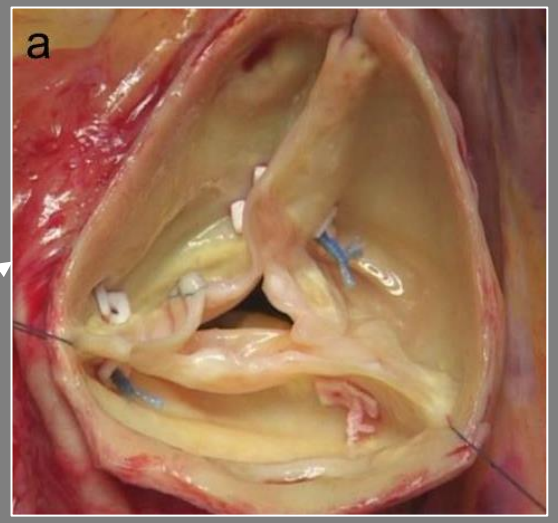


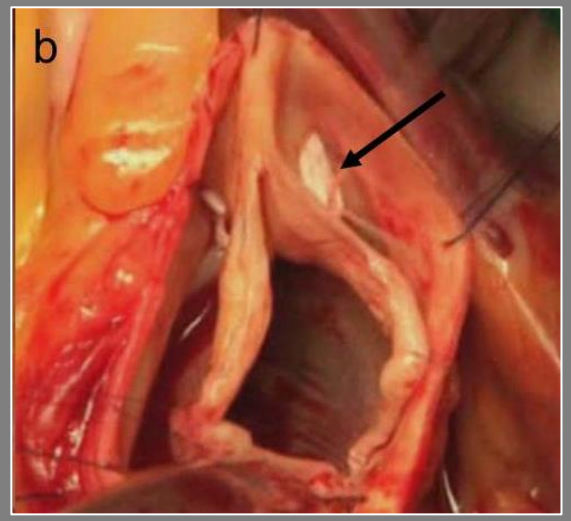
SCA:
Root < 45 mm

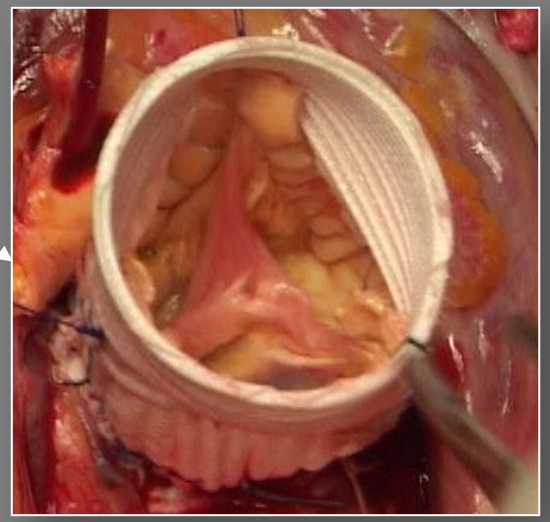
VSR:
Root > 45 mm

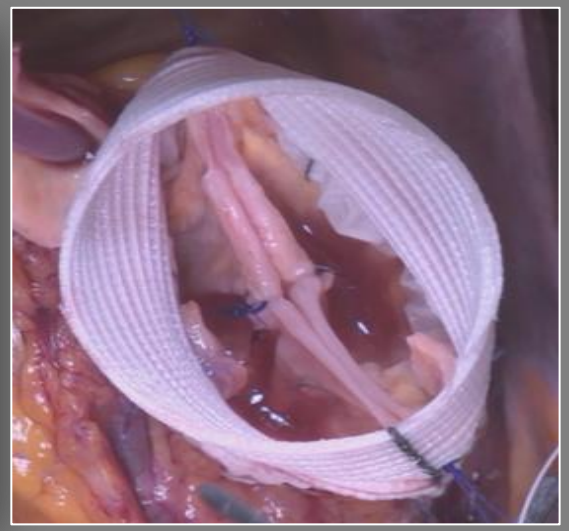
TAV

BAV





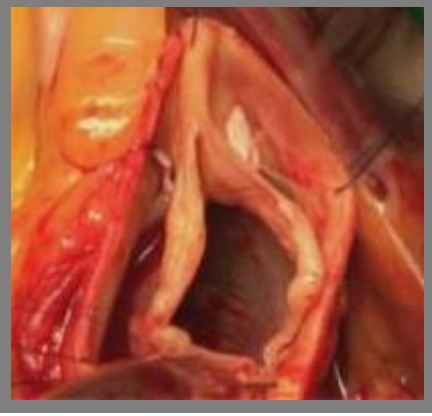


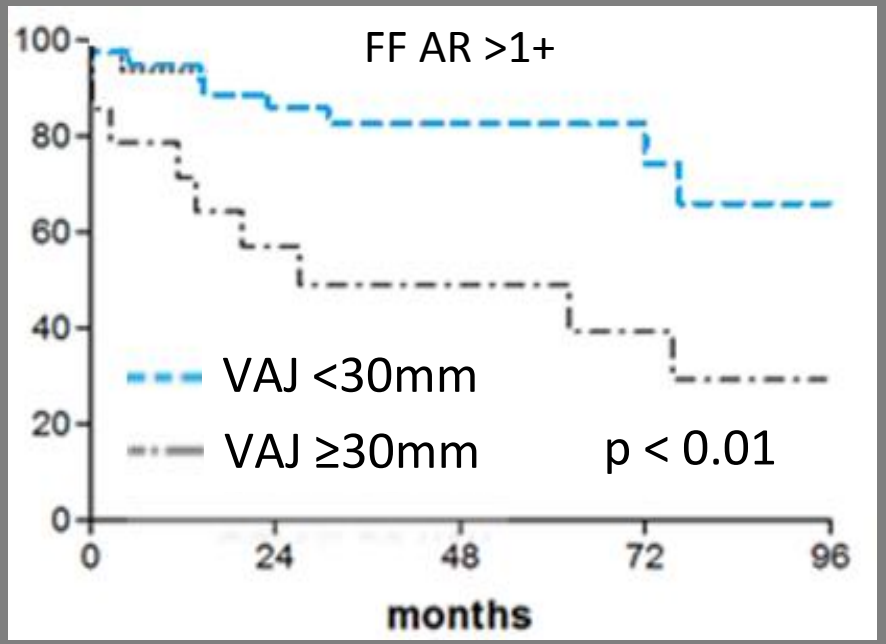


Techniques of FAA repair

Subcommissural annuloplasty and VAJ size

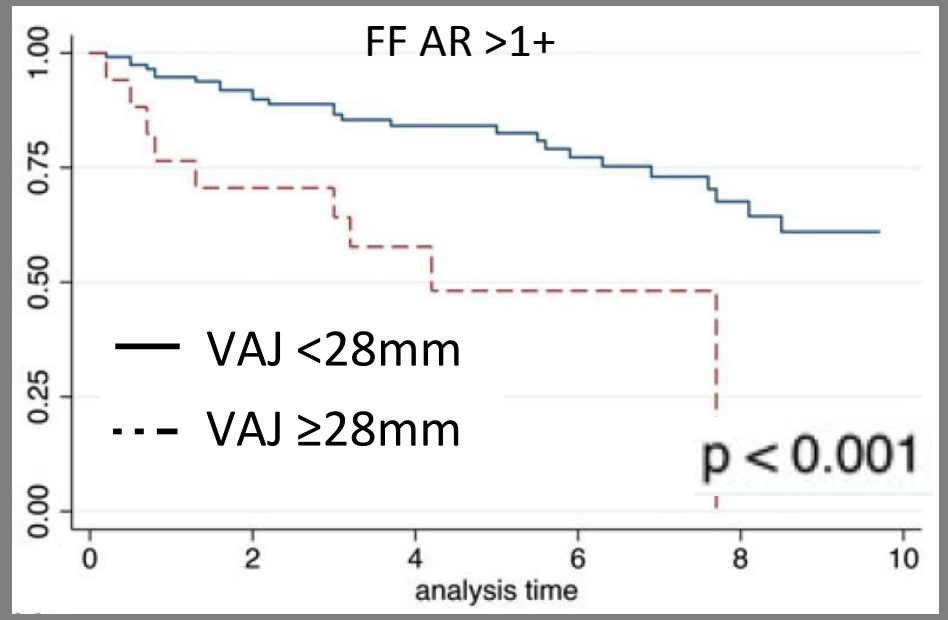
BAV





Navarra E. EJCTS 2013

TAV

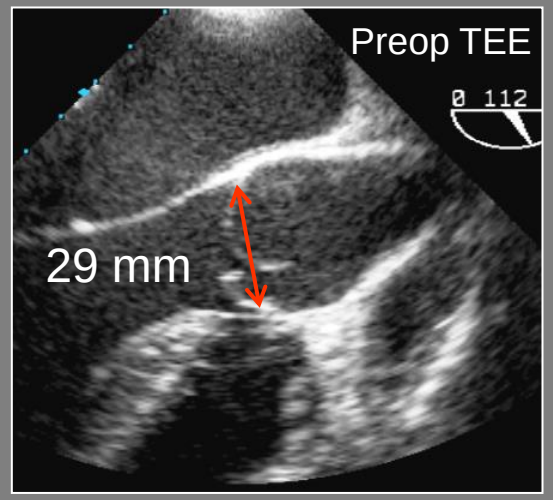


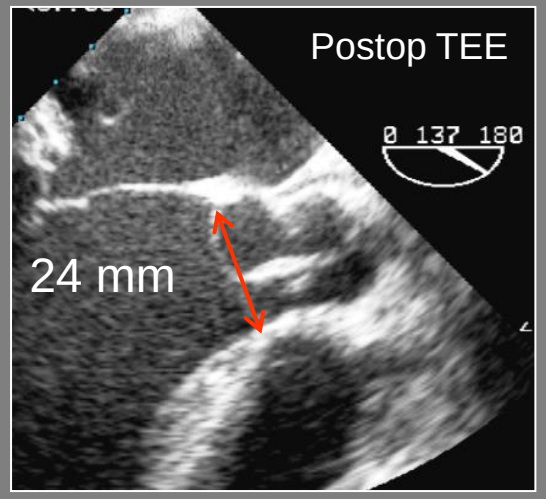
De Kerchove L. EJCTS 2015

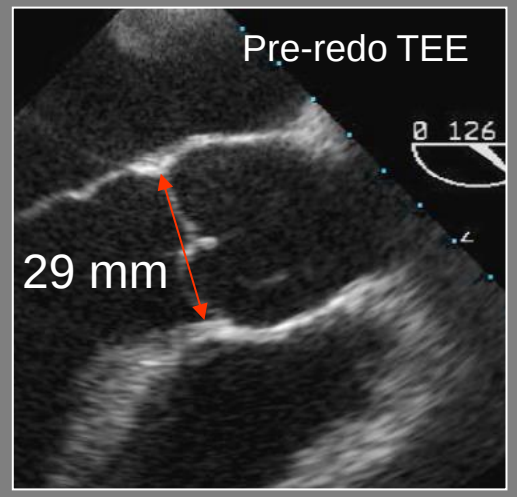
Techniques of FAA repair

SCA and VAJ size

VAJ dilatation

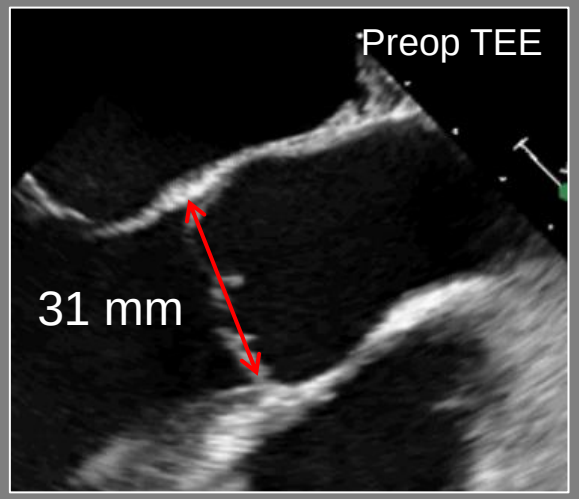


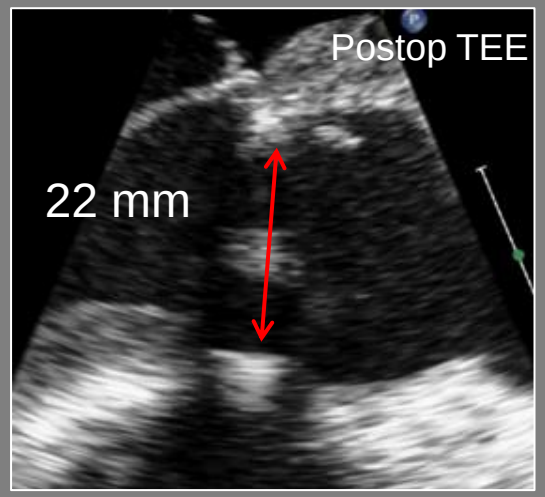


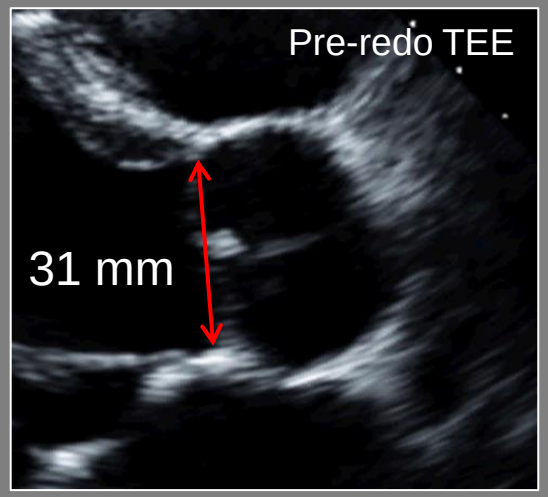


30 y♂: **BAV**, rapher res+direct closure, cusps resusp (Gtx), SCA

→ 6.5 y later: AI 3+







41 y ♂: **TAV**, RC plication and resuspension (Gtx), SCA

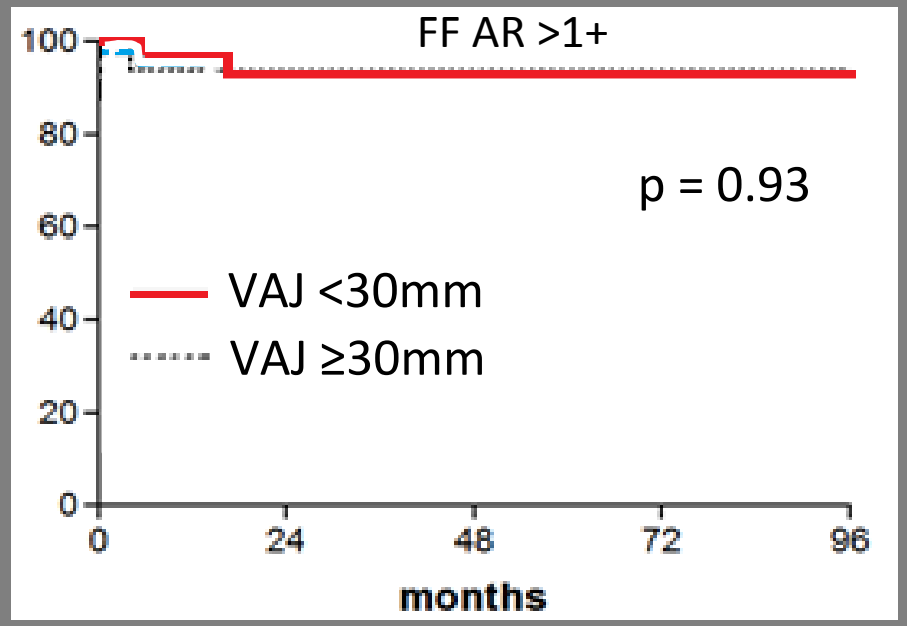
→ 2 y later : AI 3+

Techniques of FAA repair

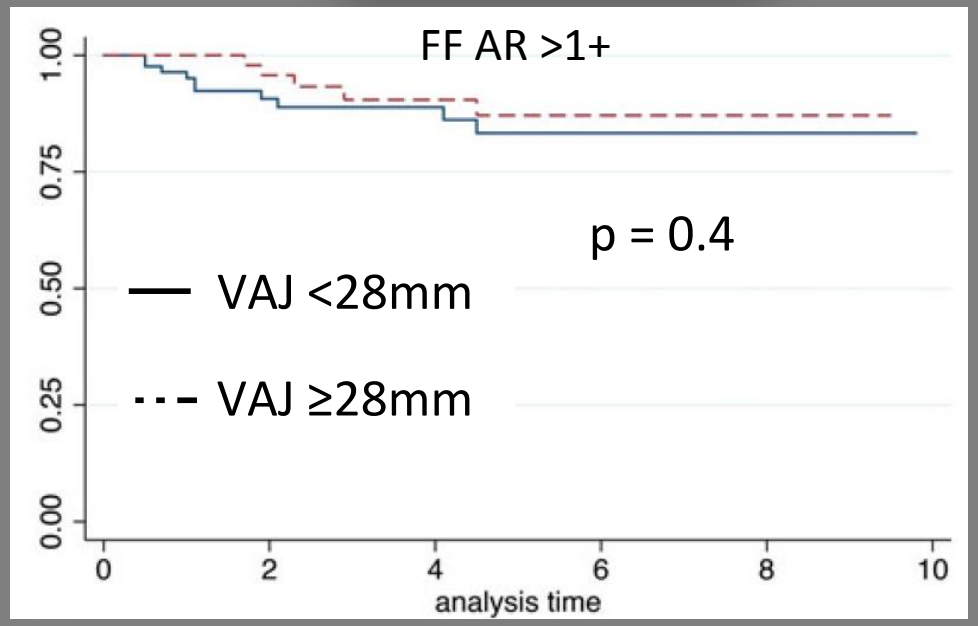
VS Reimplantation and VAJ size

BAV

TAV



Navarra E. EJCTS 2013



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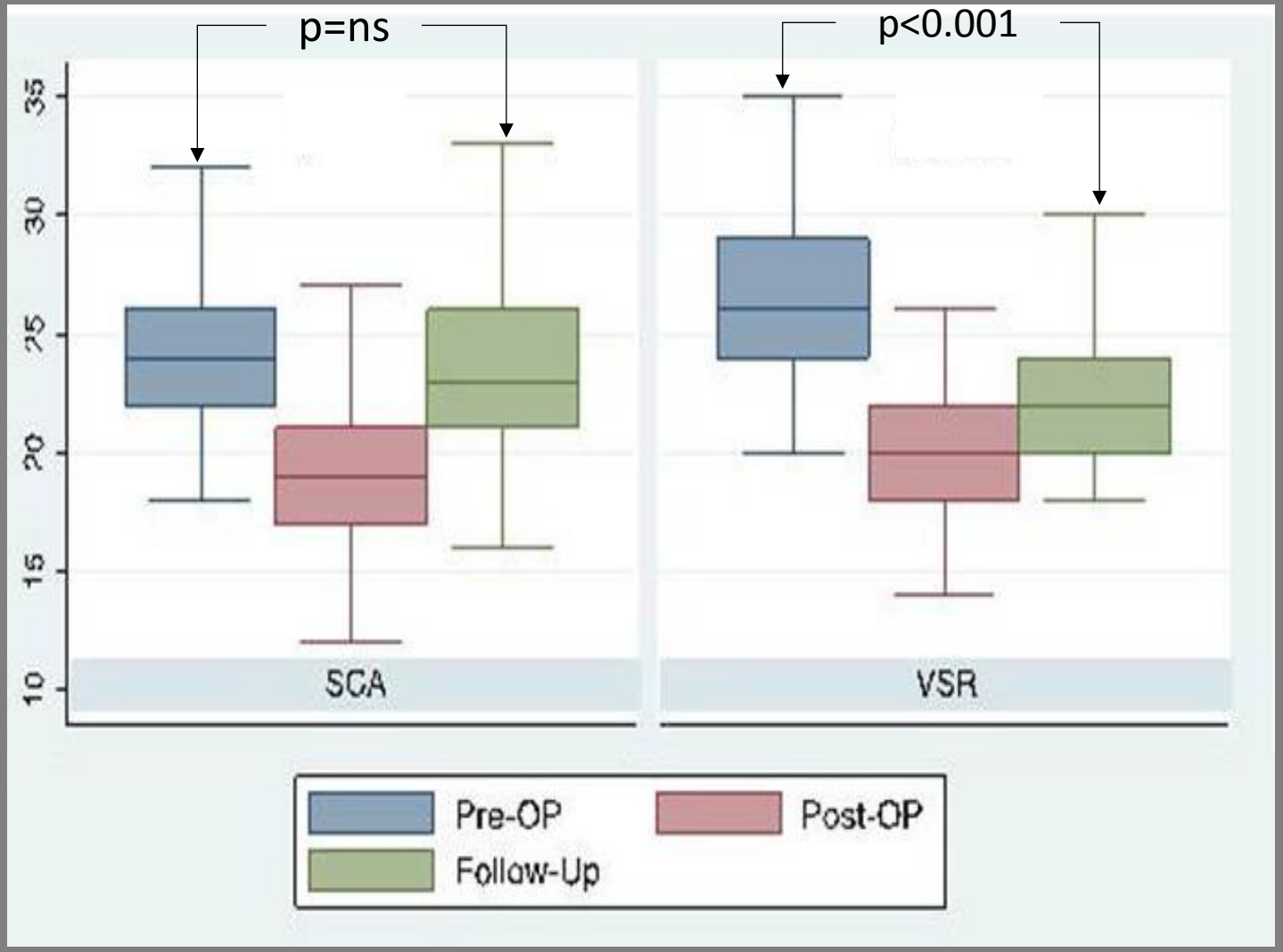
Techniques of FAA repair

SCA and VAJ size



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Brussels annuloplasty strategy (AV repair for severe AI)

Normal Root (<40 mm)

Dilated Root (≥40 mm)

Normal VAJ (<28 mm)
«Old patient» (>50 y)

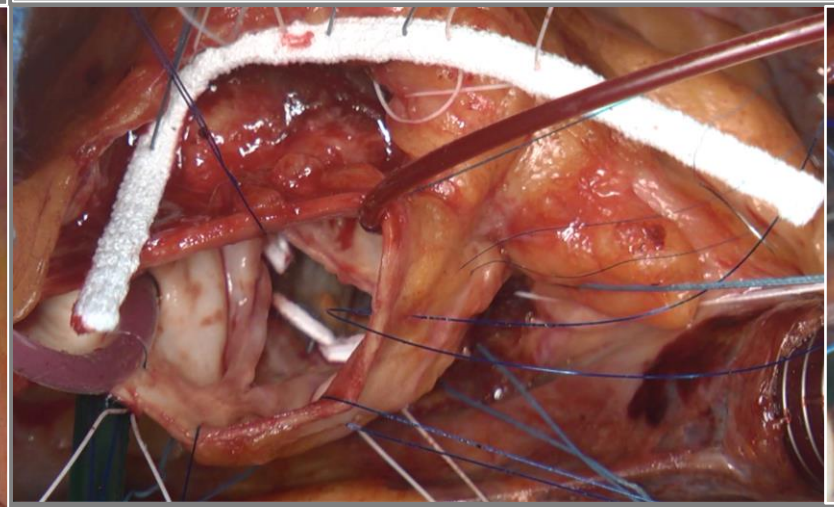
Large VAJ (≥28 mm)

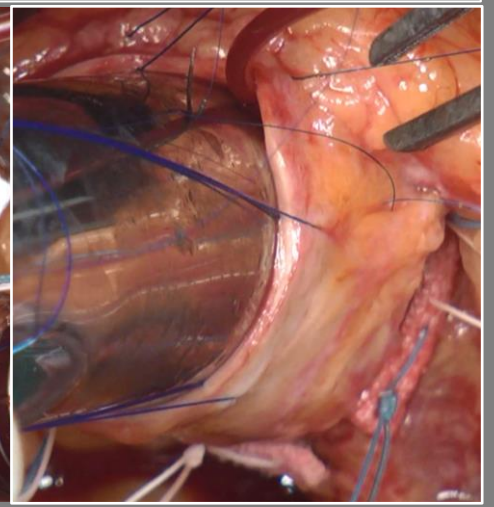
Large VAJ (≥28 mm)
Root wall fragility
Remodel BAV geometry 180°

Subcom. annuloplasty

External Ring Annuloplasty

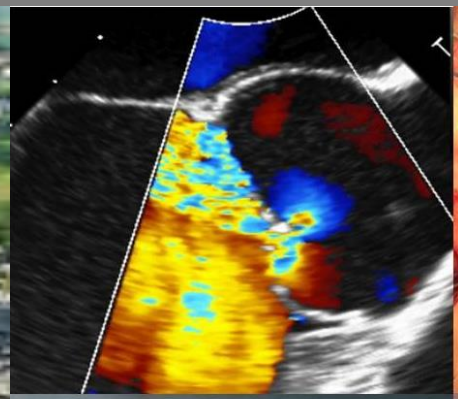
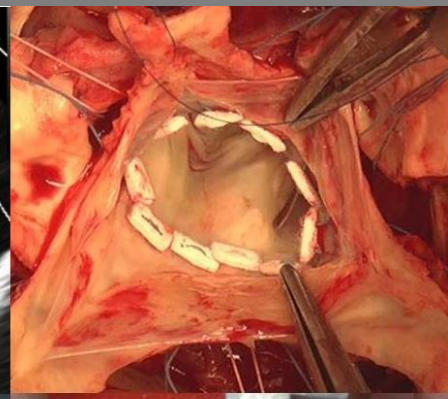
VS Reimplantion

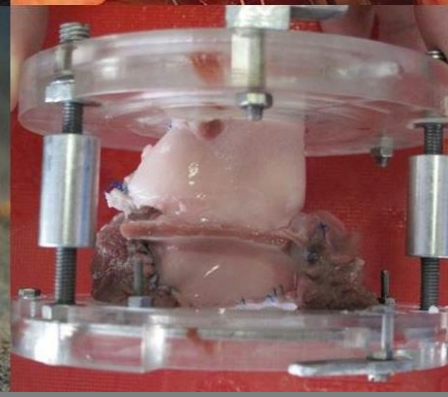




Thank you

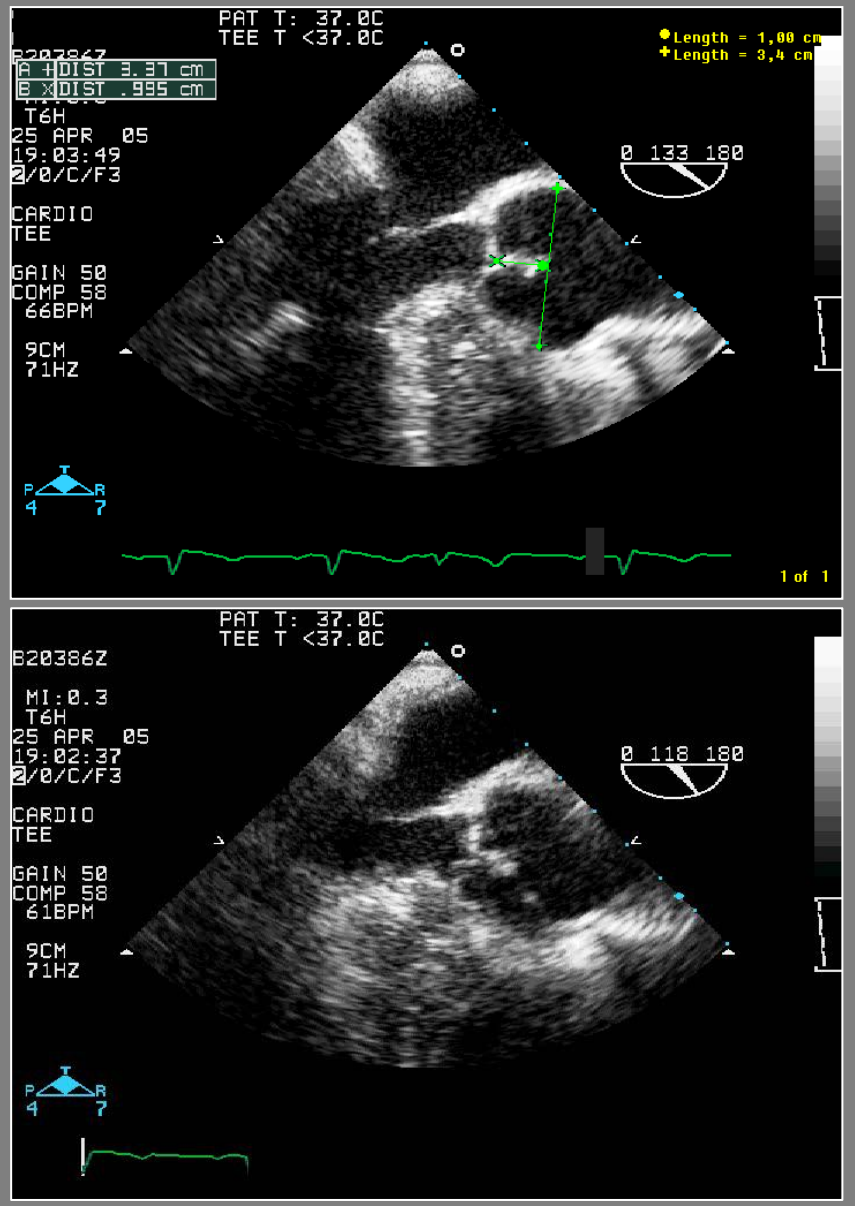




Main goal of AV repair: Optimal coaptation + Stabilisation

- Effective height (eH) ≥ 9 mm
- Coaptation length ≥ 4 mm
- Circumferential annuloplasty VAJ ≥28
- No residual AI
- Good cusp mobility



Pethig K. ATS 2002
le Polain de Waroux JB. JACC Card. Im. 2009
Bierbach BO. EJCTS 2010
Aicher D. Circ. 2011
De Kerchove L. JTCVS 2011

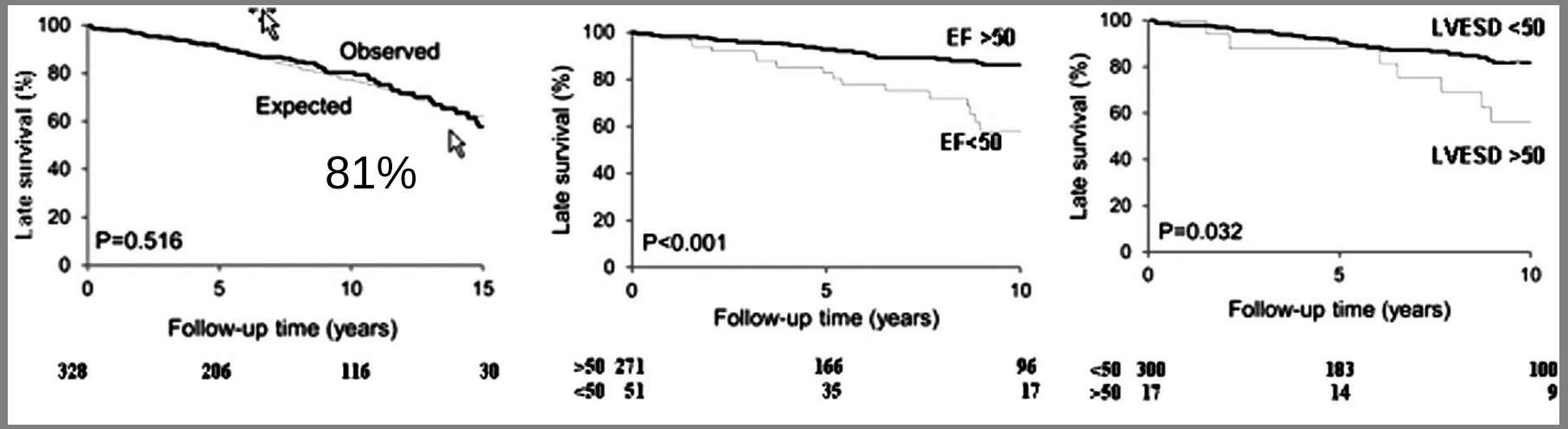
Brussels AV repair: Conclusions

- The mechanisms of AI are actually well understood and the use of a classification help to discuss indication, plan surgical strategy and analyze the outcomes.
- Surgeon dispose of a wide armamentarium of repair techniques adapted to the variety of valvular lesions.
- Durability of leaflet repair depend on the quality and quantity of tissues; long term results are excellent for in Type 1 (FAA dilatation) and 2 (Prolapse) and acceptable in type 3 (Restrictive).
- Next to leaflet tissues quality, optimal valve coaptation and annuloplasty are the principal determinants of repair durability.

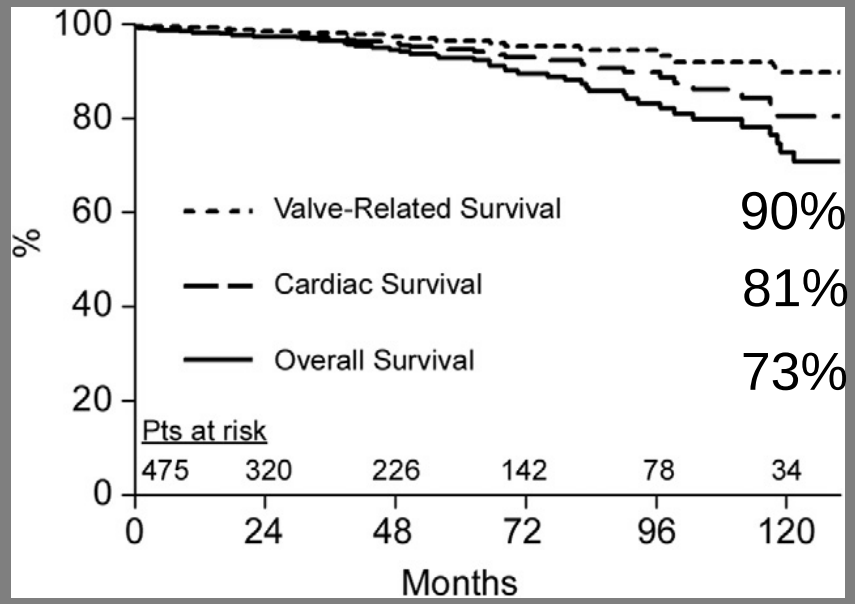
AV Repair: Hospital Mortality (elective surgery)

- 0.6% V. Sharma, H. Schaff JTCVS 2014
- 0.8% J. Price, G. Elkhoury ATS 2013
- 0.8% D. Aicher, H-J Schafers EJCTS 2010
- 1% T. David JTCVS 2014

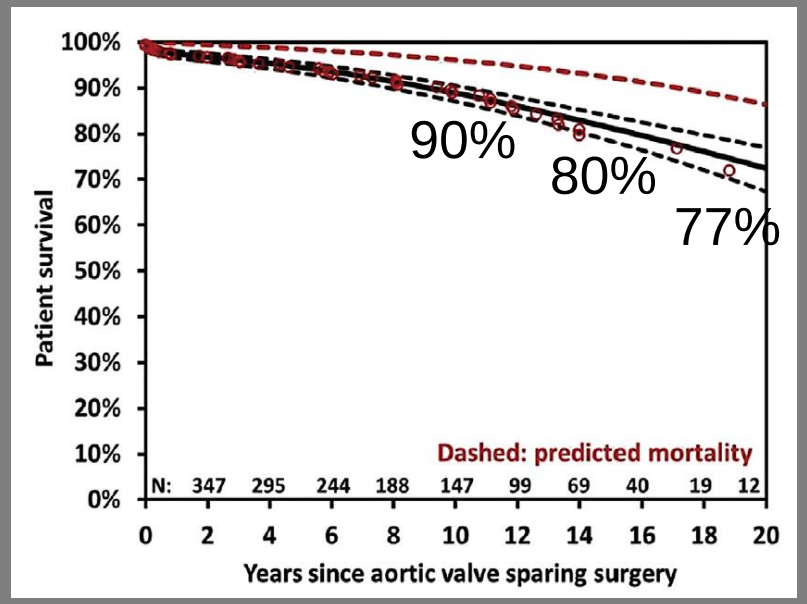
AV Repair: Long term Survival



V. Sharma, H. Schaff JTCVS 2014



J. Price ATS 2013



T. David JTCVS 2014

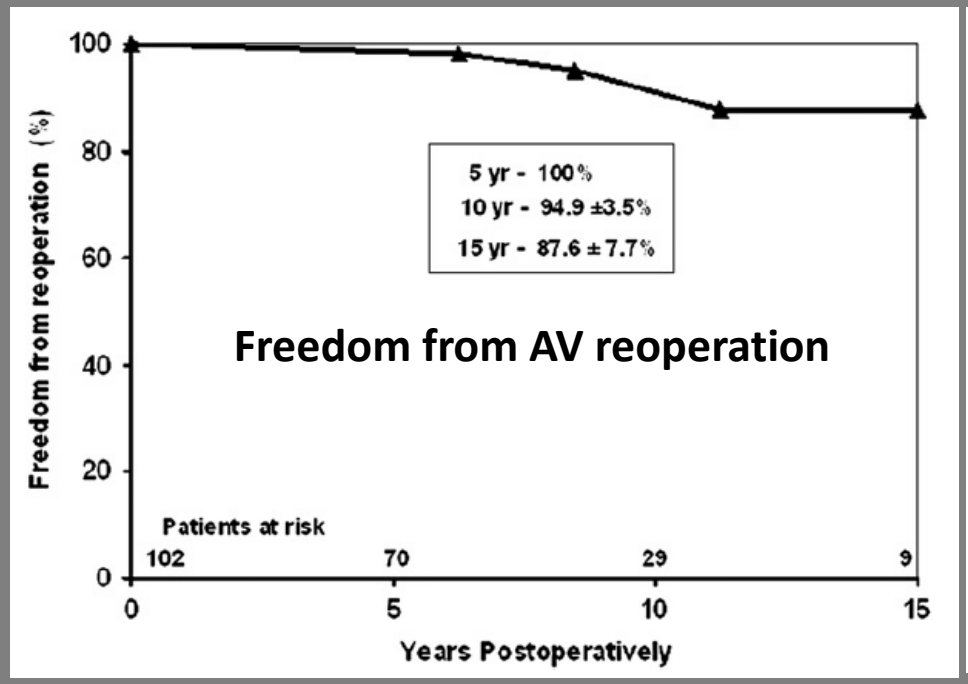
AV Repair: Freedom from Reoperation & AI

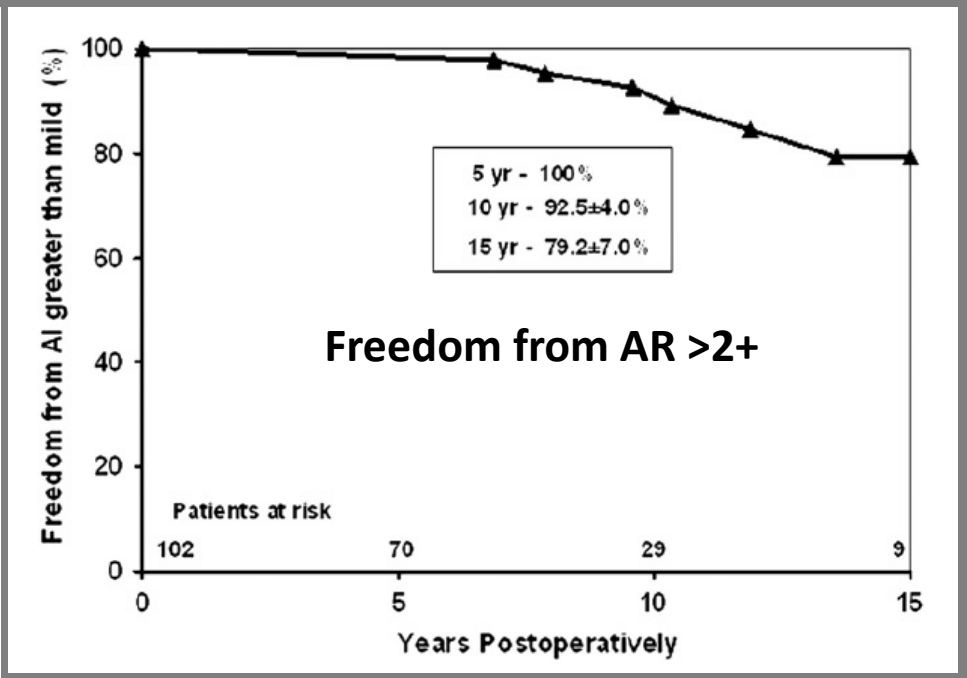
Authors	Period	Cohort	Technique	FF AV Reop	FF recurrent AR >2+
H. Schaff JTCVS 2014	1986- 2011	331	Cusp 100% Sparing 0%	10 y 80%	10 y 75%
T. Kunihara JTCVS 2012	1995-2007	640	Cusp 80% Sparing 50%	10 y 88%	10 y 80%
J. Price ATS 2013	1995-2010	475	Cusp 68% Sparing 50%	10 y 86%	10 y 85%
T. David JTCVS 2014	1988- 2010	371	Cusp 50% Sparing 100%	10 y 97% 18 y 95%	10 y 93% 18 y 78%

Root pathology > Cusp pathology

AV Repair:

Valve sparing in Marfan Syndrome





T. David, JTCVS 2009

AV Repair:
Leaflet repair in valve sparing surgery

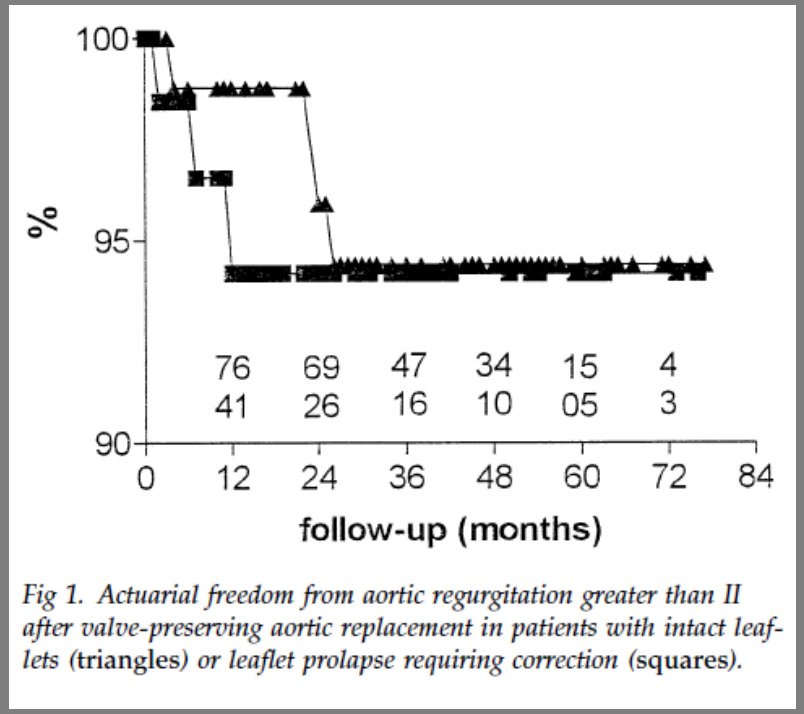
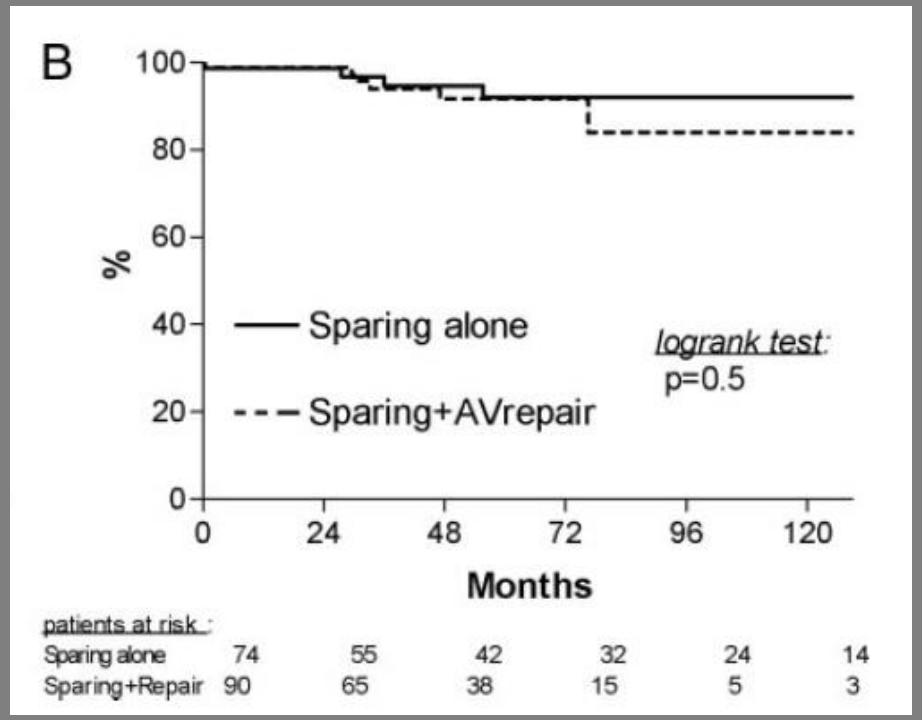


Fig 1. Actuarial freedom from aortic regurgitation greater than II after valve-preserving aortic replacement in patients with intact leaflets (triangles) *or leaflet prolapse requiring correction* (squares).

H.J. Schäfers ATS 2002



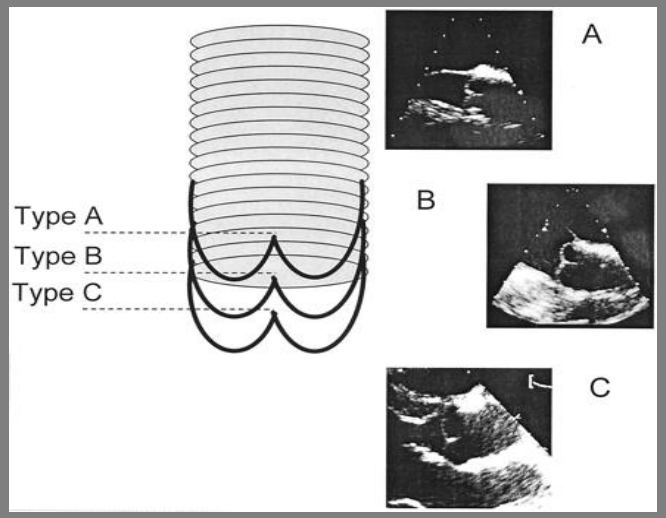
L. de Kerchove Circ. 2009

Cusp repair = risk factor of reoperation or recurrent AR

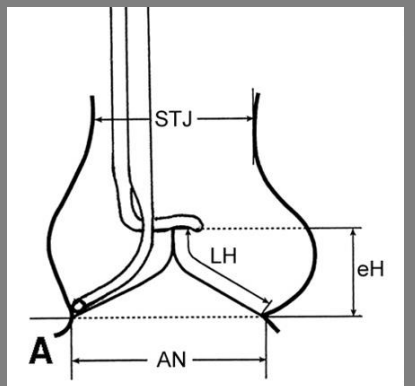
- *E. Lansac EJCTS 2010 (negative impact of cusp repair decrease with experience)*
- *P.P. Urbanski EJCTS 2012*

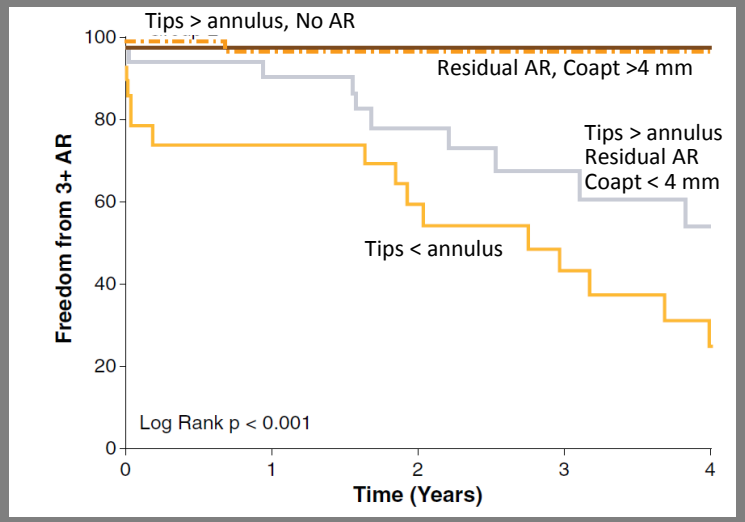
AV repair

Risk factor of repair failure: Cusp coaptation

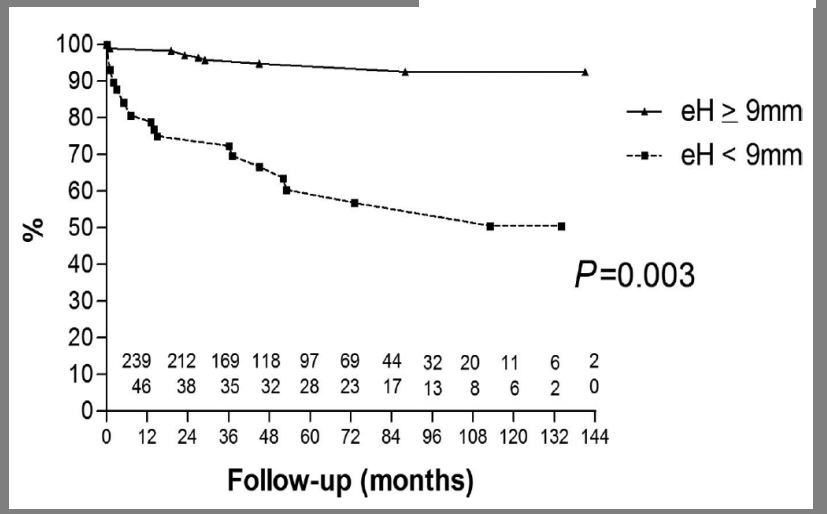


Pethig K. ATS 2002





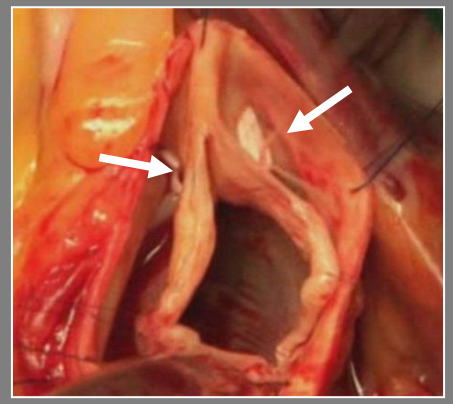
le Polain JB. JACC Card. Im. 2009



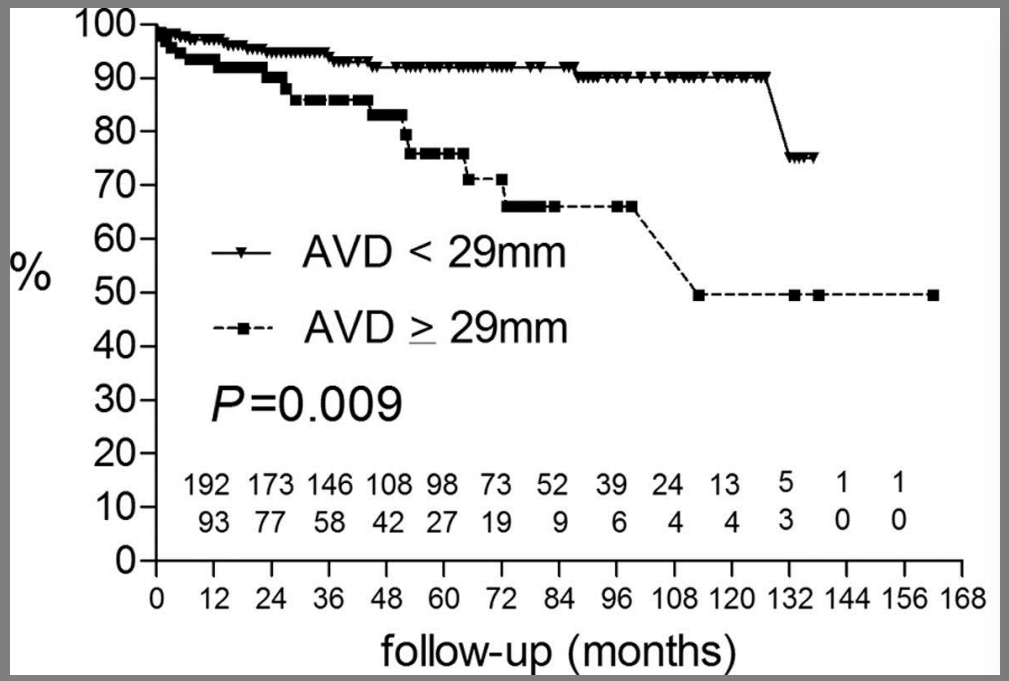
Aicher D. Circ. 2011

AV repair

Risk factor of repair failure: VAJ dilatation

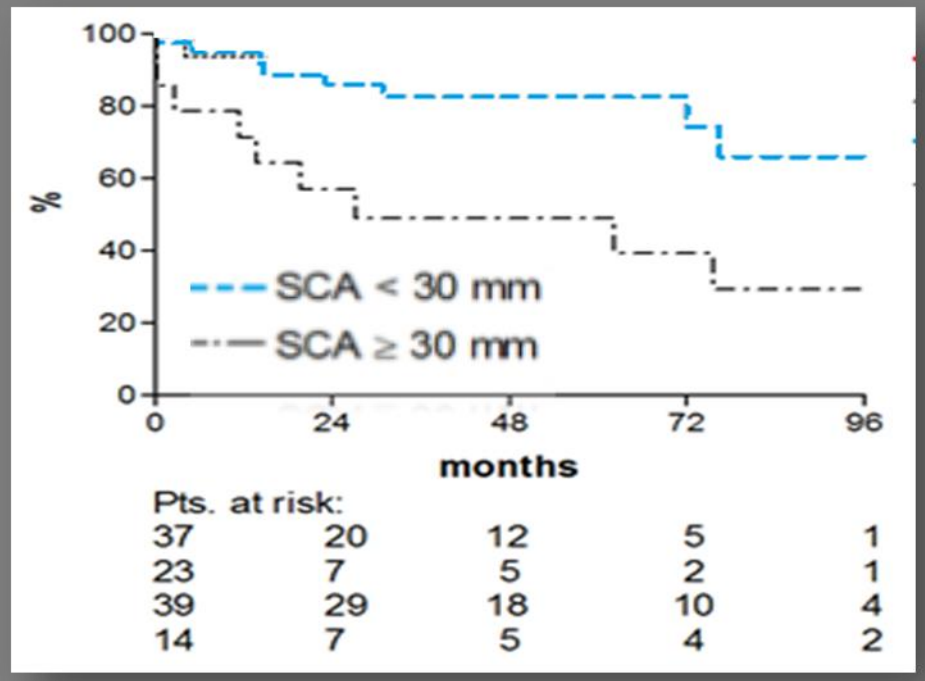


No annuloplasty



Aicher D. Circ. 2011

SC annuloplasty



Navarra E. EJCTS 2013

AV repair

TAV versus BAV

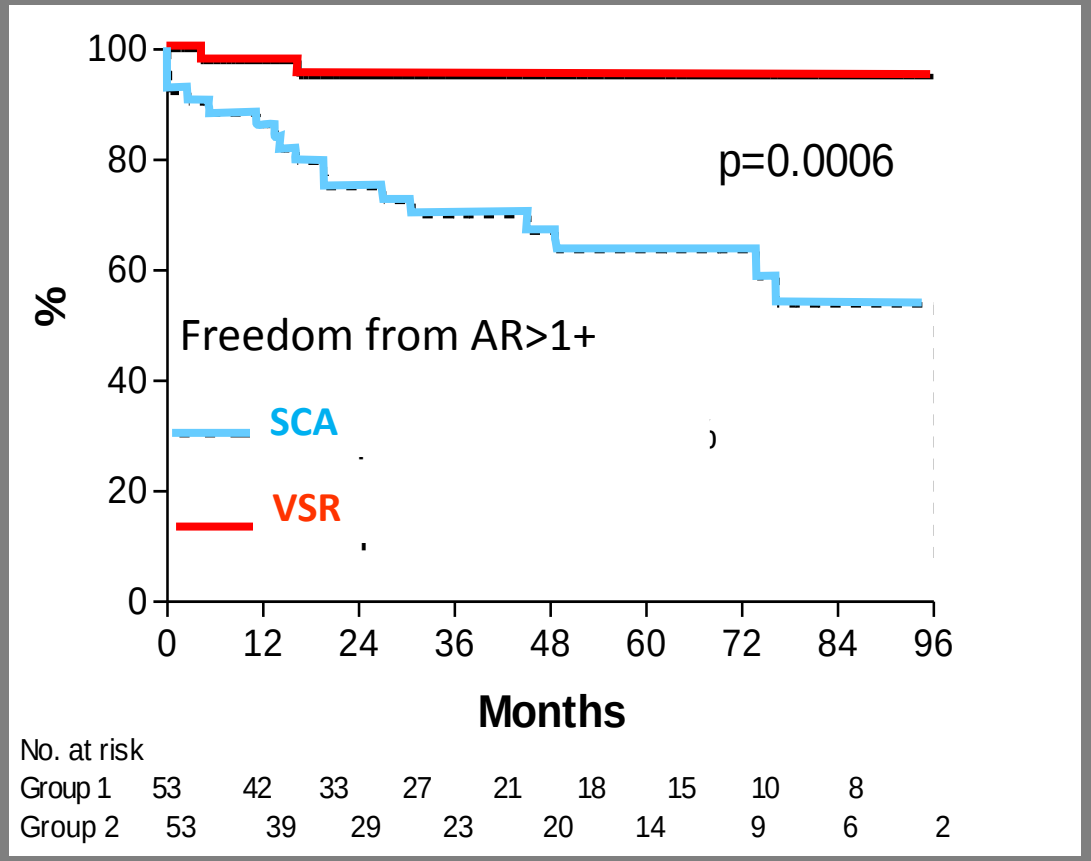
Freedom from reoperation

BAV		TAV
• 84% (7 y) *Casselman JTCVS 1999*	<	• 94% (12 y) *David JTCVS 2010*
• 81% (10 y) *Aicher EJCTS 2010*		• 93% (10 y) *Aicher EJCTS 2010*
• 81% (10 y) Price ATS *2013*		• 89% (10 y) *Price ATS 2013*

AV repair

Valve sparing reimplanation in BAV repair

Matched comparison VSR vs SCA



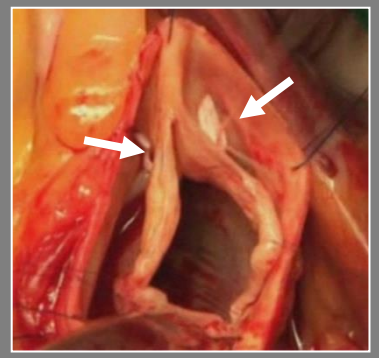
De Kerchove L. JTCVS 2011

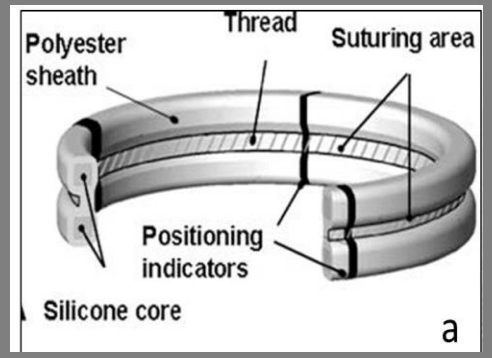
AV repair

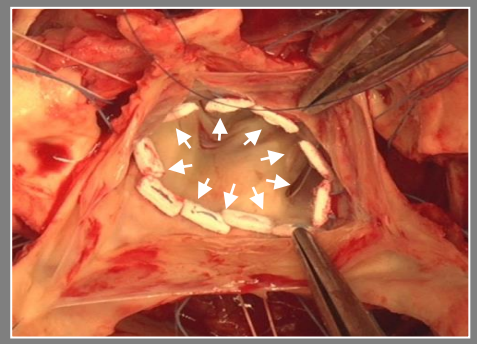
Aorta/Annuloplasty repair strategy

AV repair for AR

- Normal Root (<45 mm)
  - Normal VAJ (<26 mm) → Subcom. Anpl.
  - Large VAJ (>26 mm) → Ring Annuloplasty
  - Large VAJ (>26 mm) + Modify valve geometry → VS Reimplantation
- Dilated Root (≥45 mm) → VS Reimplantation

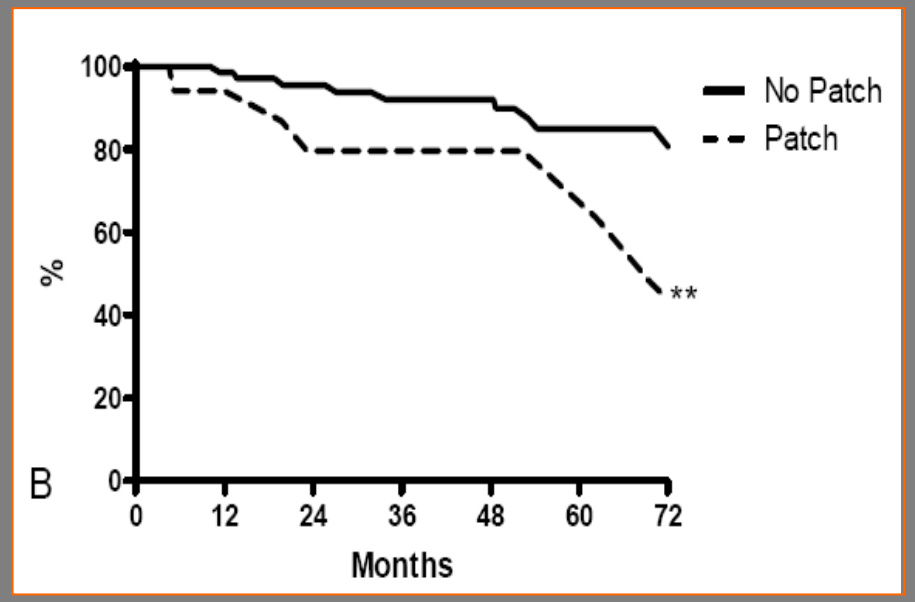




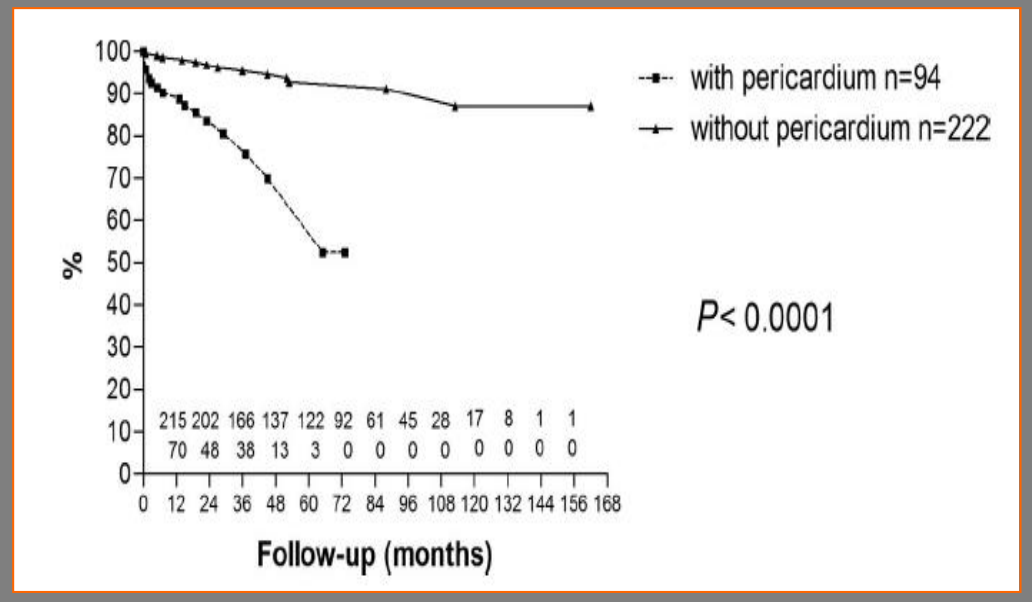


AV repair

Risk factor of repair failure: Patch repair



Boodhwani M. JTCVS 2010

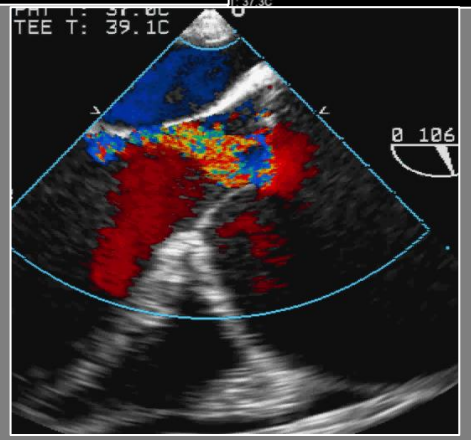


Aicher D. Circ. 2011

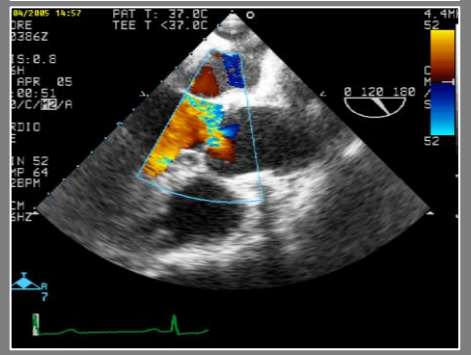
AV repair:

Probability of Cusp Repair in valve sparing surgery

- No AR → low 10 %



- AR, central jet → Moderate 30-50 %



- AR, eccentric jet → High ≈ 100 %

AV Repair: Valve related event

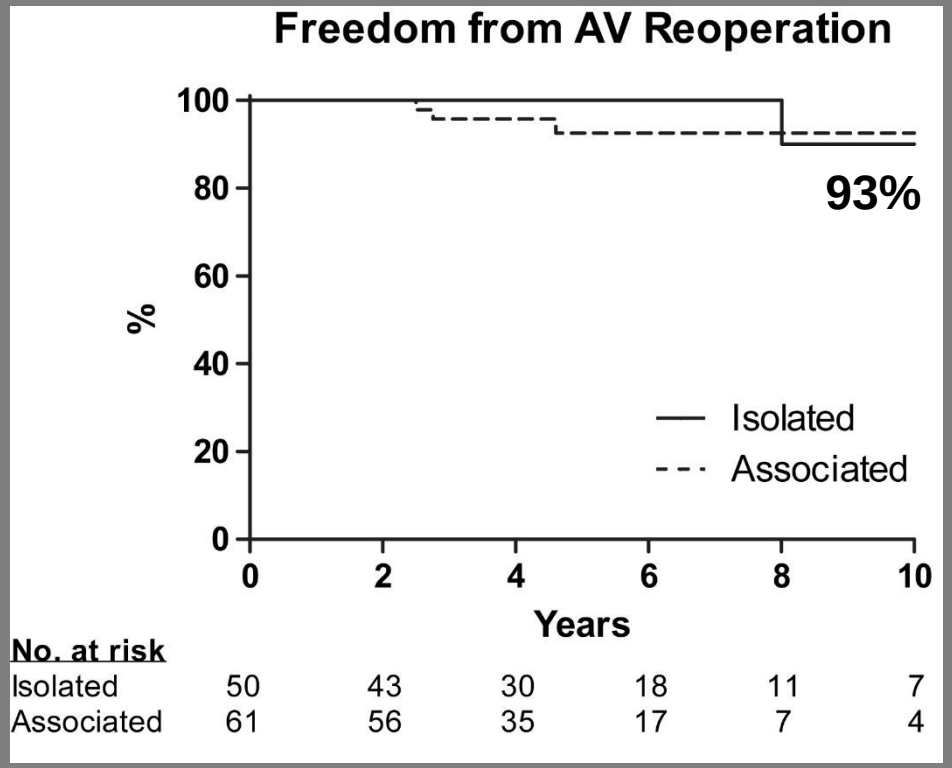
- Thromboembolic event 0.2 % - 0.7% /y

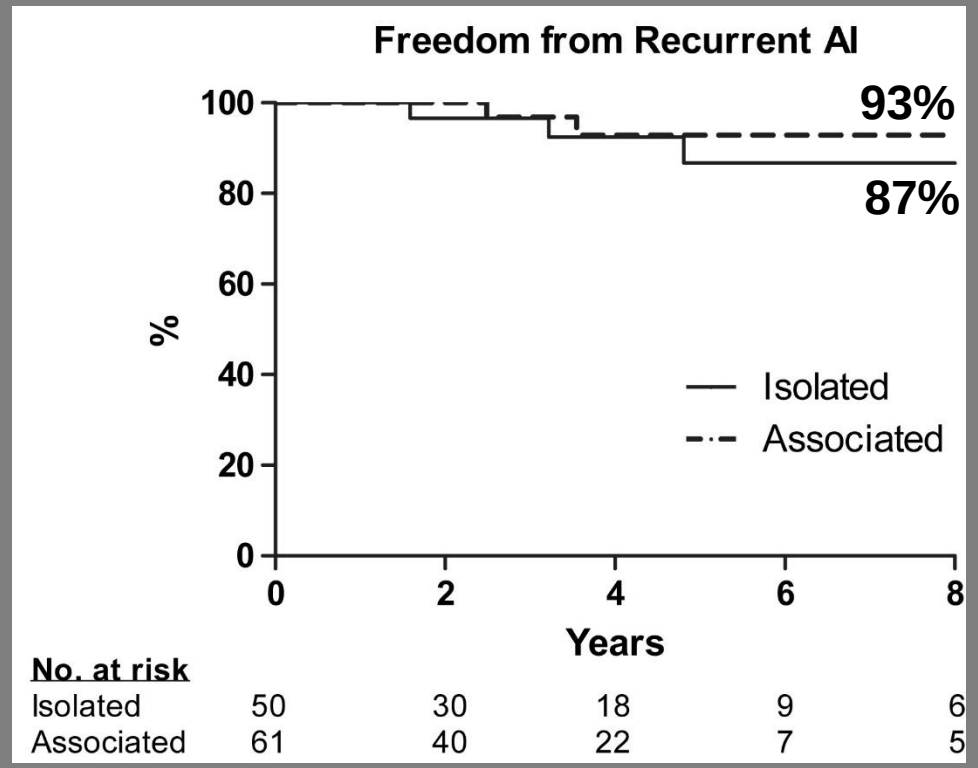
  92-95% @ 10 y; 87- 90% @ 15 y
- Endocarditis 0.2% /y
- All VRE (reop, thromb, bleed, endoc)

  74 - 90% @ 10 y; 80% @ 18 y

V. Sharma, H. Schaff JTCVS 2014
J. Price, G. Elkhoury ATS 2013
D. Aicher, H-J Schafers EJCTS 2010
T. David JTCVS 2014

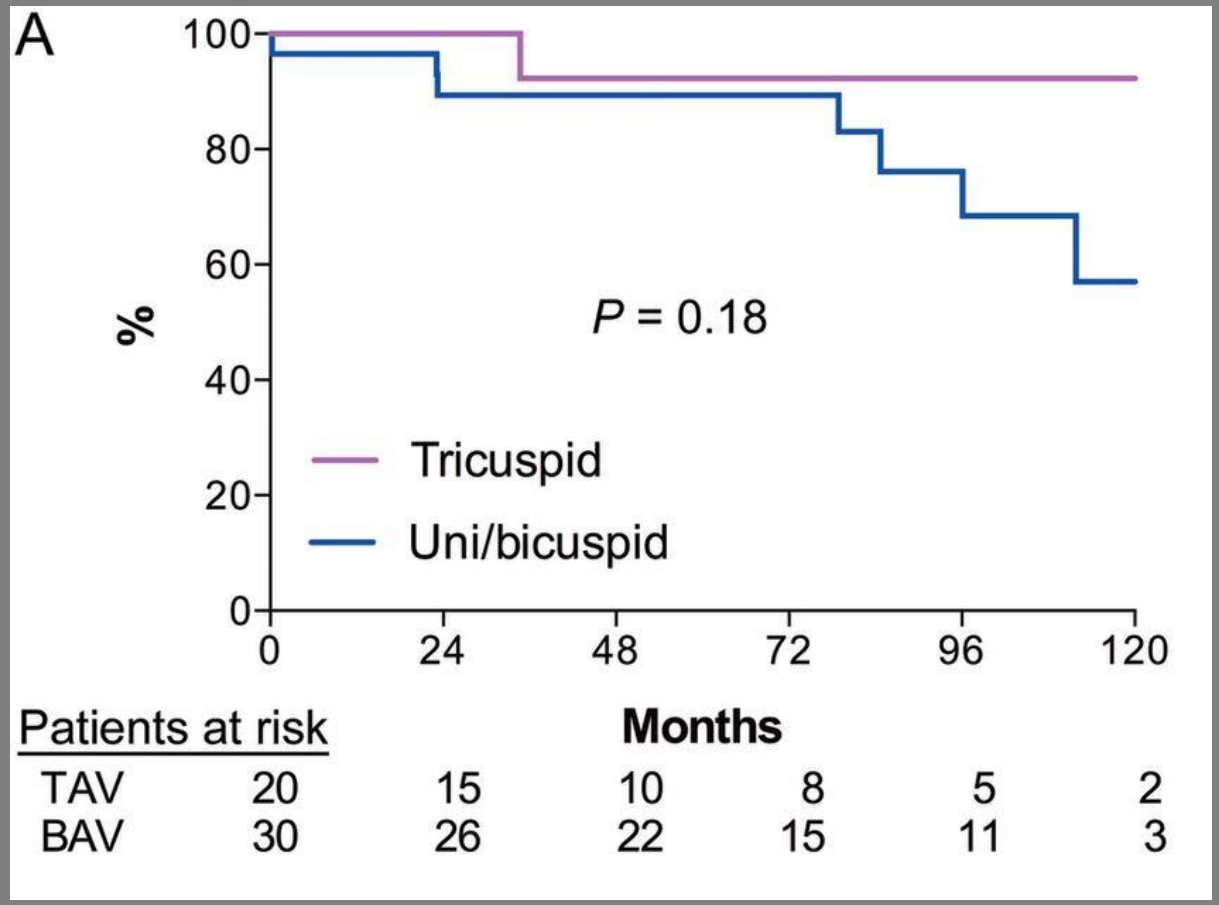
AV Repair:
Prolapse repair (Type 2)





M. Boodhwani, JTCVS 2011

AV Repair:
Leaflet repair with patch



Mozala Nezhad Z. EJCTS 2014

BAV Repair

Cusp Anatomy

Type 0

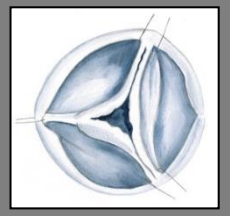
Type 1

Raphe Morphology

Prolapsing

Raphe Thinned

Restrictive

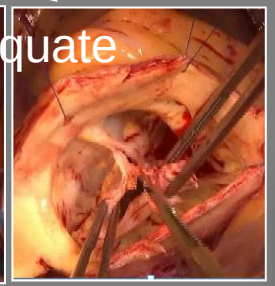


Raphe Resected

Quantity of Cusp Tissue ?

Adequate

≈ 180°

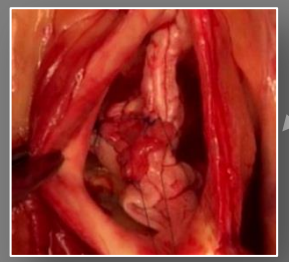


≈ 120°

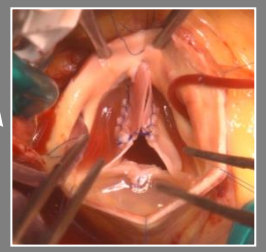
Central Plication, Triangular Resection

Tricuspidisation

Inadequate



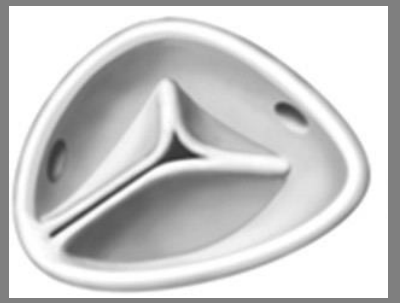
≈ 180° Triangular Patch



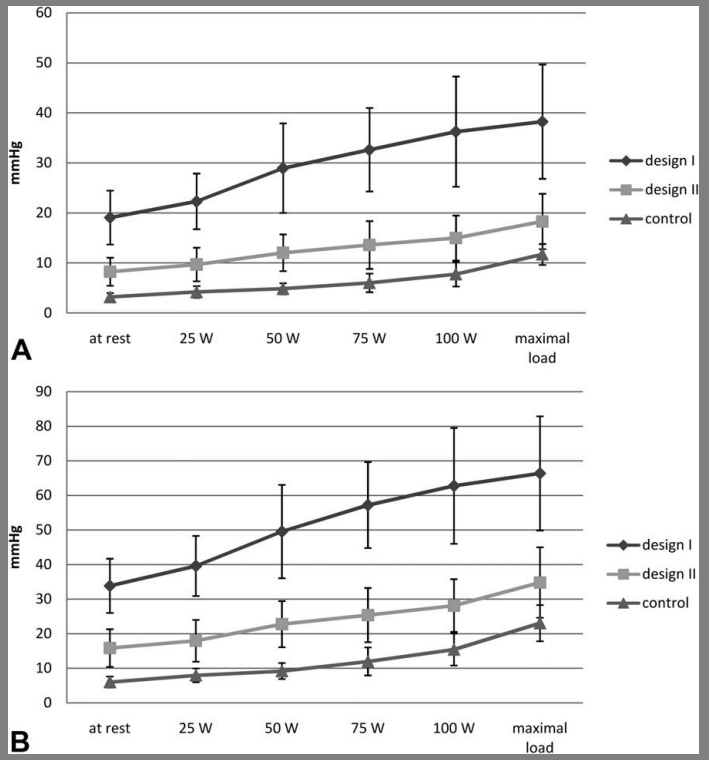
≈ 120° Commissural Patch

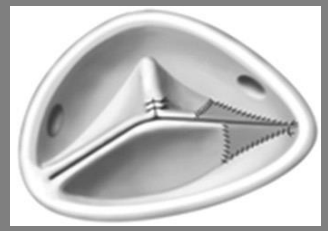
AV Leaflet Repair: Results

Unicuspid valve repair



- 2001 – 2011: 118 pts
- mean age: 27 years
- FF reoperation @ 3 years: 80% 86 %





Design I

Design II

D. Aicher JTCVS 2013

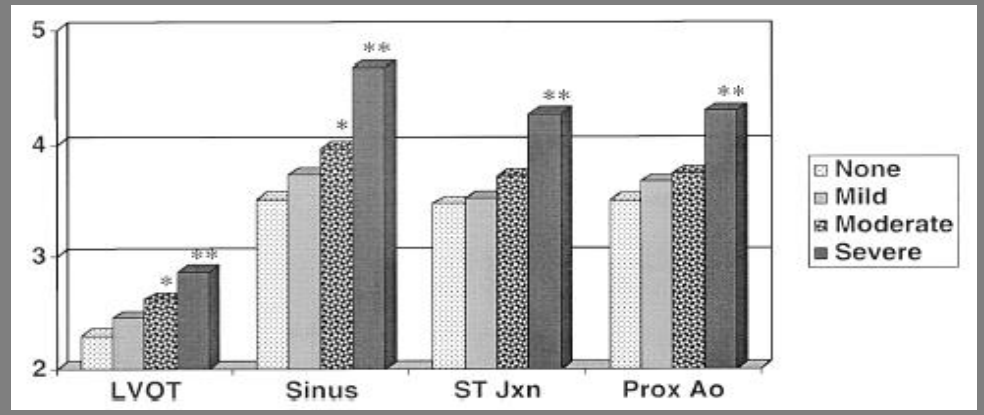
Functional classification of aortic regurgitation

Mechanism of AV dysfunction

Table II. Degree of AR and aortic root size indexed by body surface area at follow-up study

	Mild AR (cm/m^2) ($n = 67$)	Moderate AR (cm/m^2) ($n = 45$)	Severe AR (cm/m^2) ($n = 15$)	p Value*
Aortic anulus	1.29 ± 0.23	1.38 ± 0.23	1.39 ± 0.11	0.055
Valsalva sinuses	1.89 ± 0.34	2.04 ± 0.31	2.09 ± 0.32	0.025
Supraaortic ridge	1.49 ± 0.30	1.71 ± 0.35	1.76 ± 0.43	0.001
Ascending aorta	1.97 ± 0.42	2.16 ± 0.49	2.19 ± 0.47	0.049

Padial LR, Am Heart J. 1997



Keane MG, Circulation. 2000

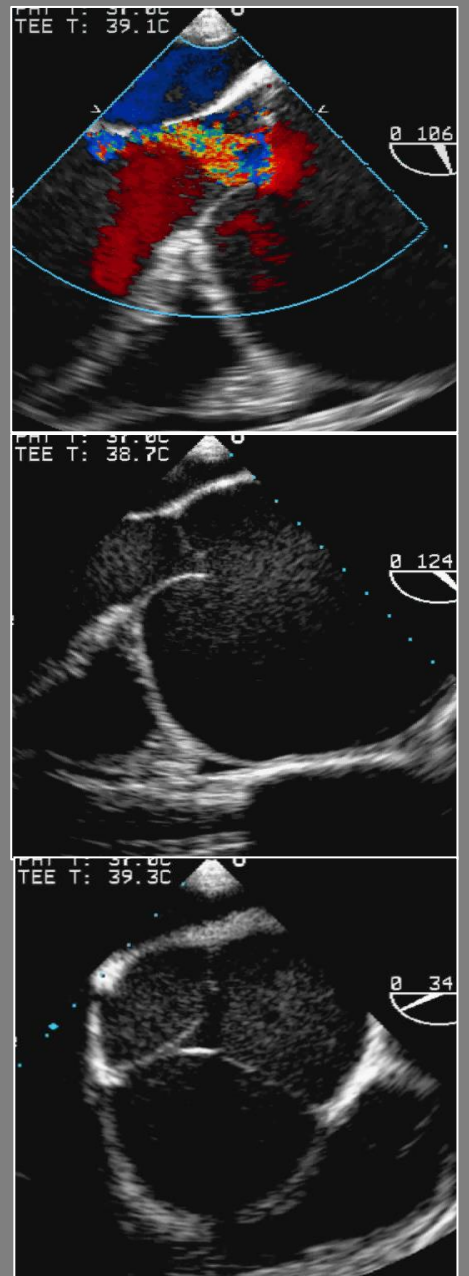
In patients with chronic AR, the severity of AR is correlated with the degree of STJ and VAJ dilatation

Functional classification of aortic regurgitation

Mechanism of AV dysfunction

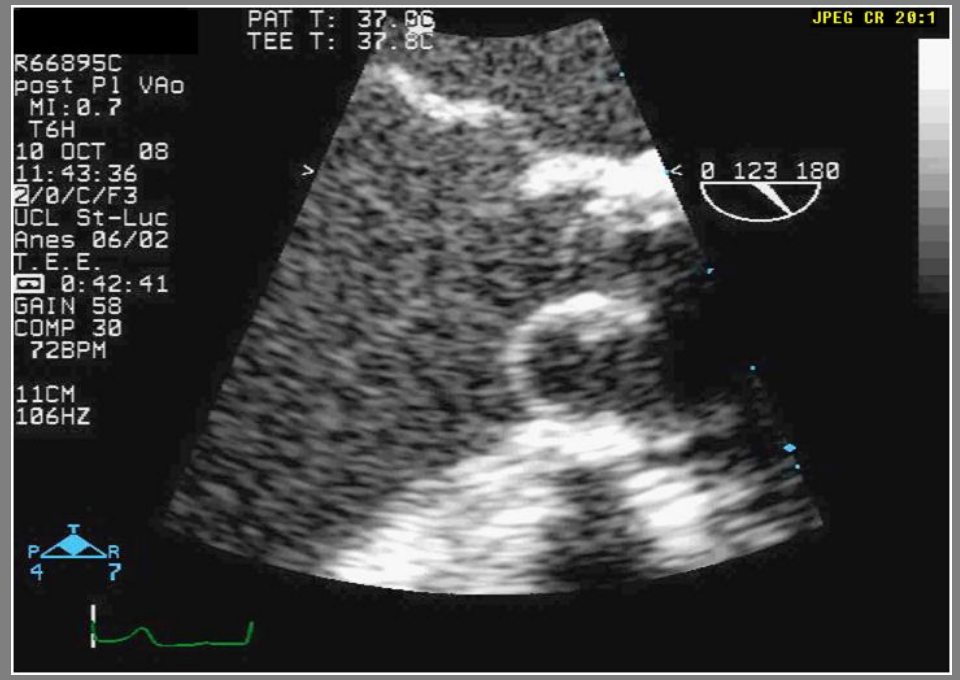
Type I characteristics

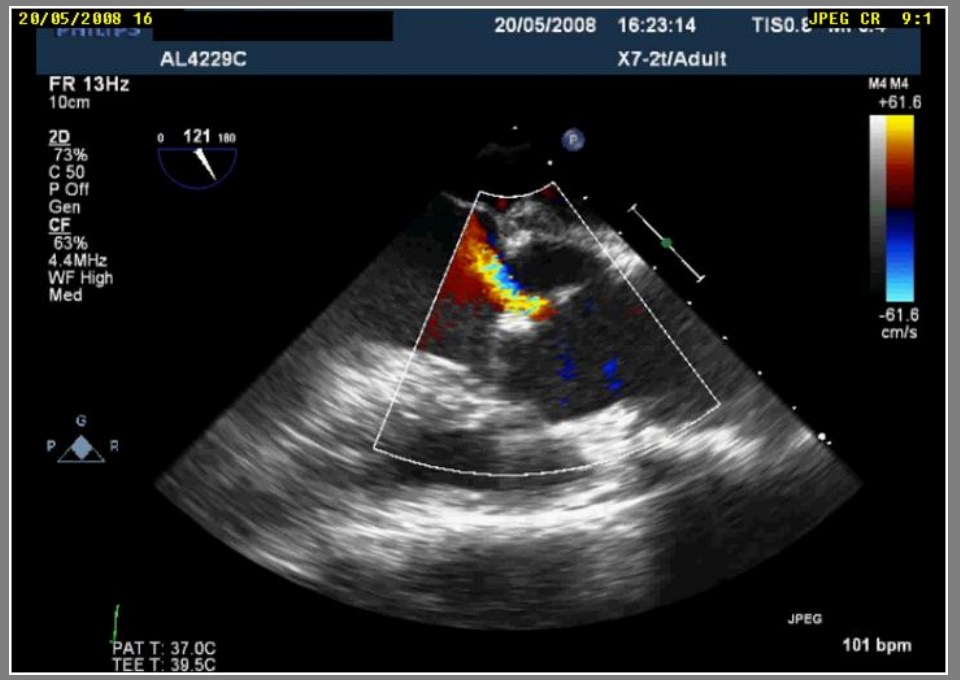
- ✓ Central jet ⊾ to subvalvular plane
- ✓all cusps have same coaptatin hight
- ✓ lack of central coaptation



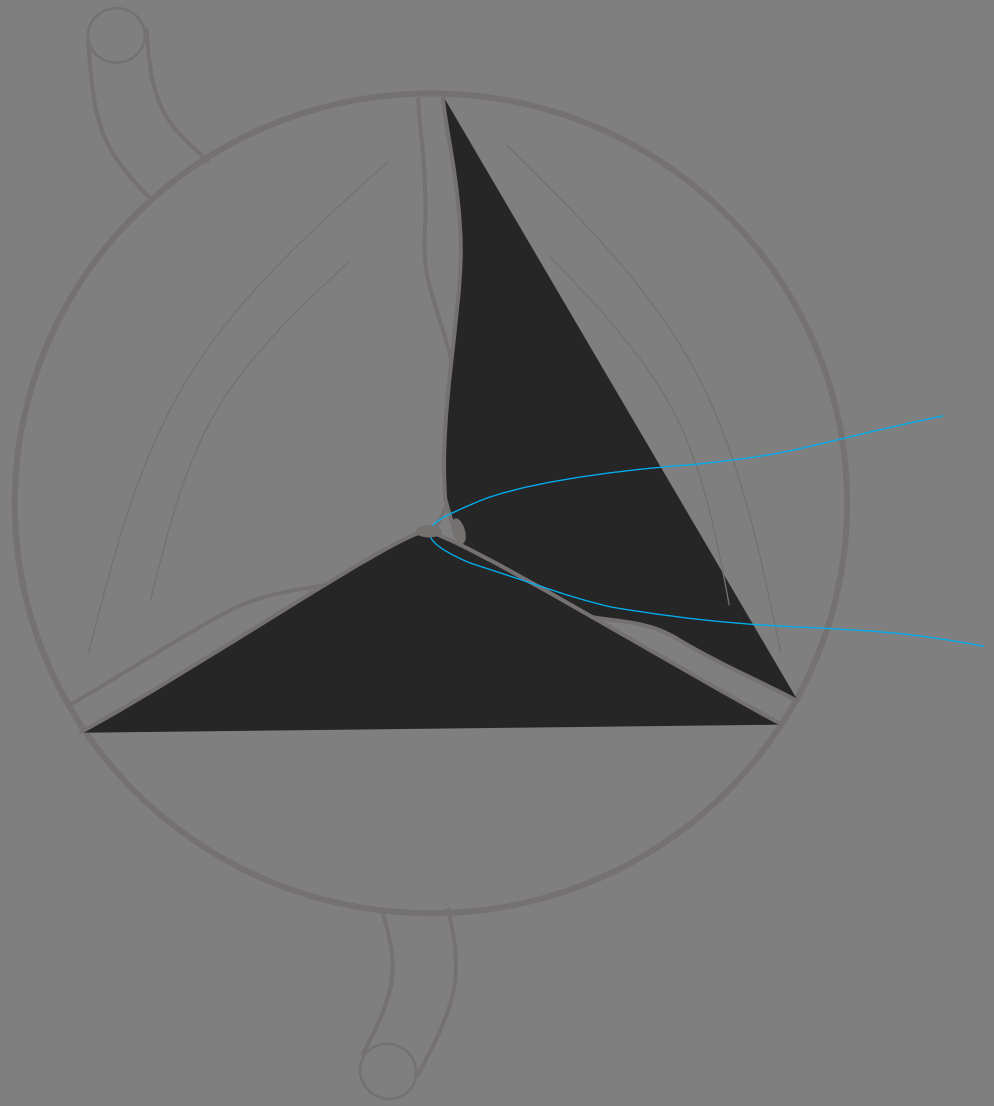
Principles of AV repair/sparing surgery

Optimal coaptation ?

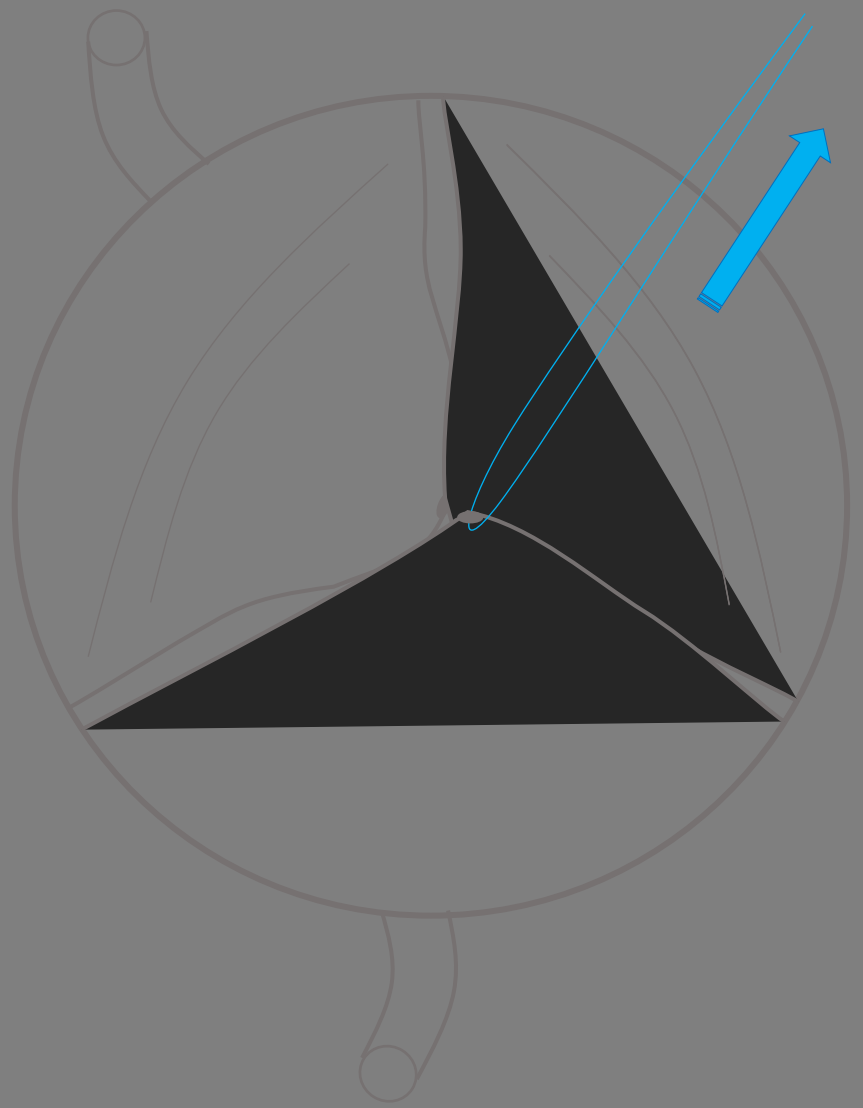




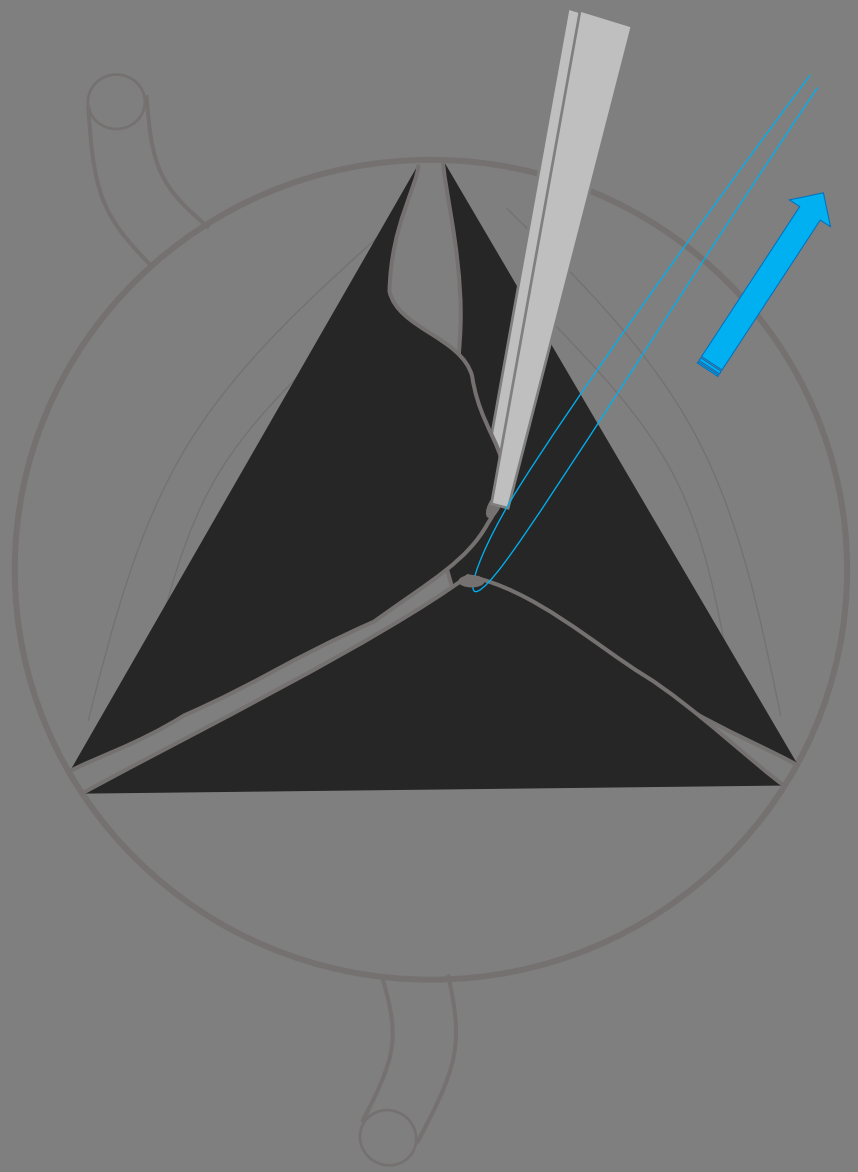
Central Plication Technique: 2 cusp prolapse



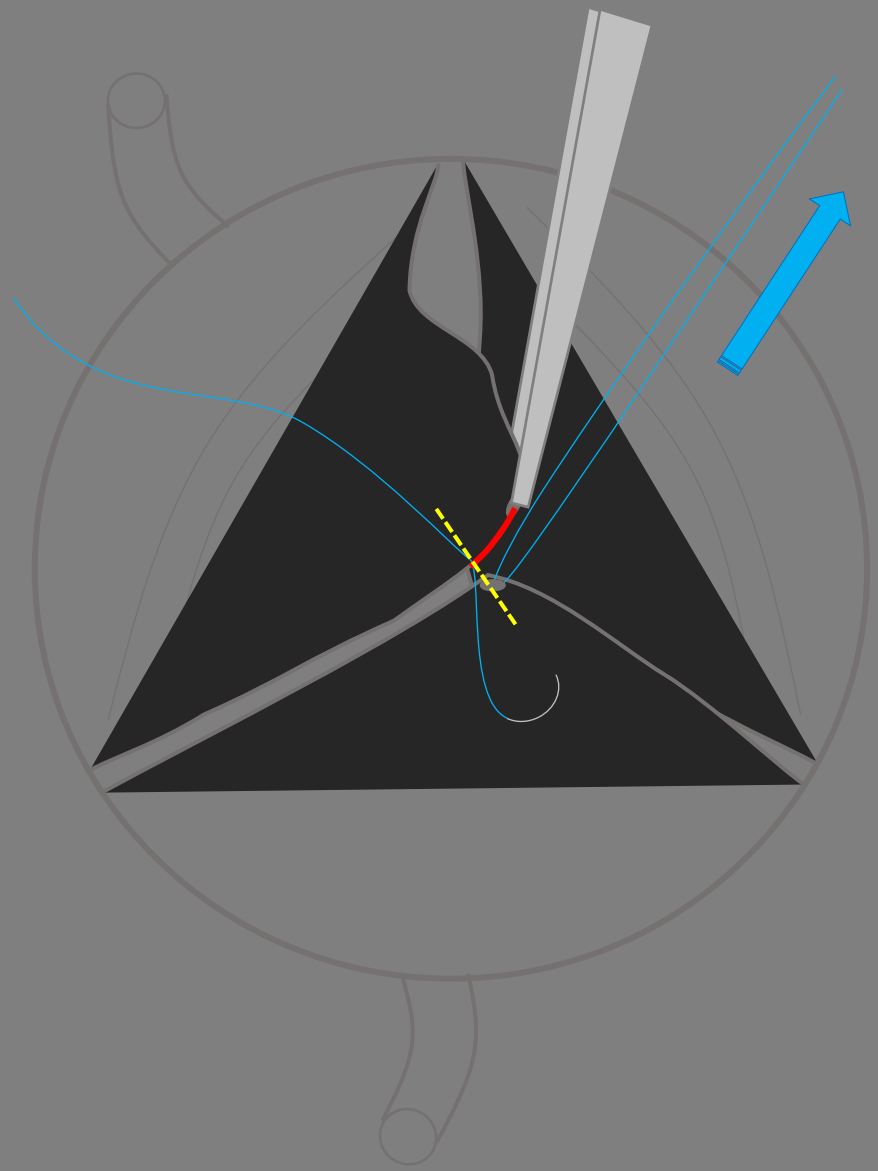
Central Plication Technique: 2 cusp prolapse repair



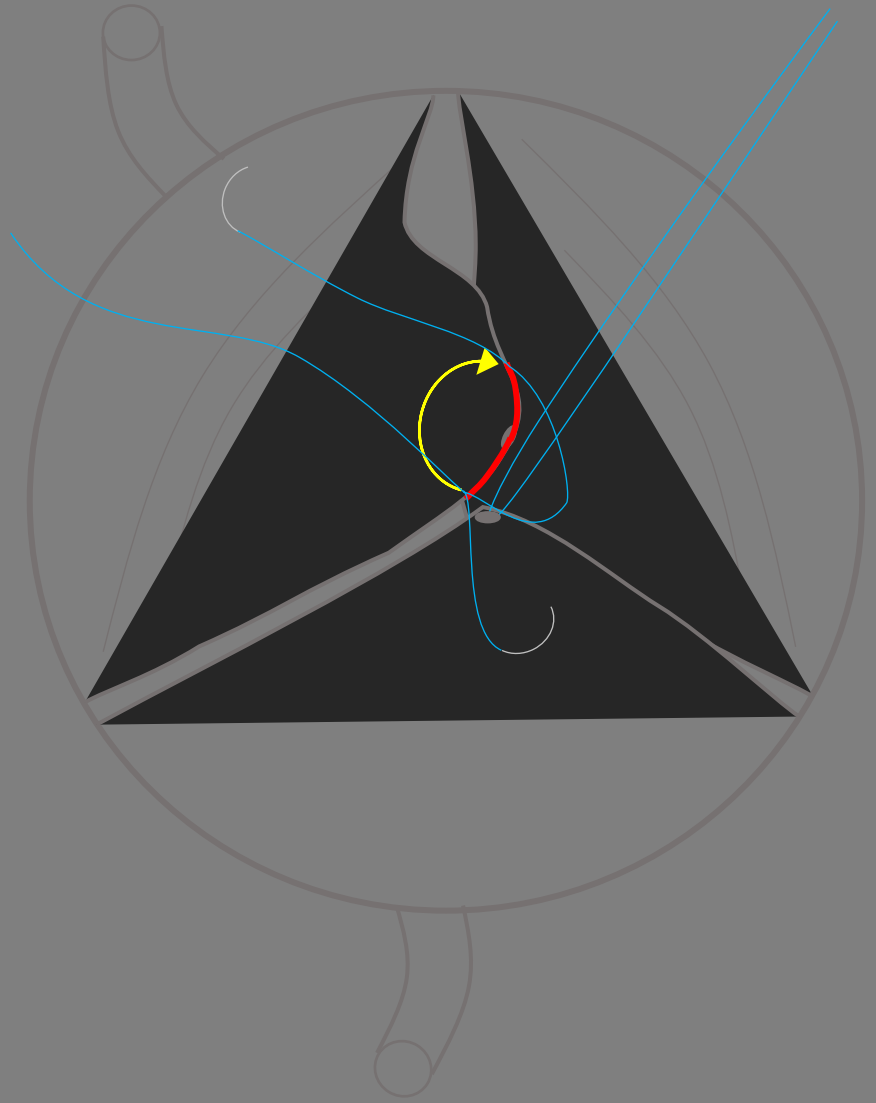
Central Plication Technique: 2 cusp prolapse



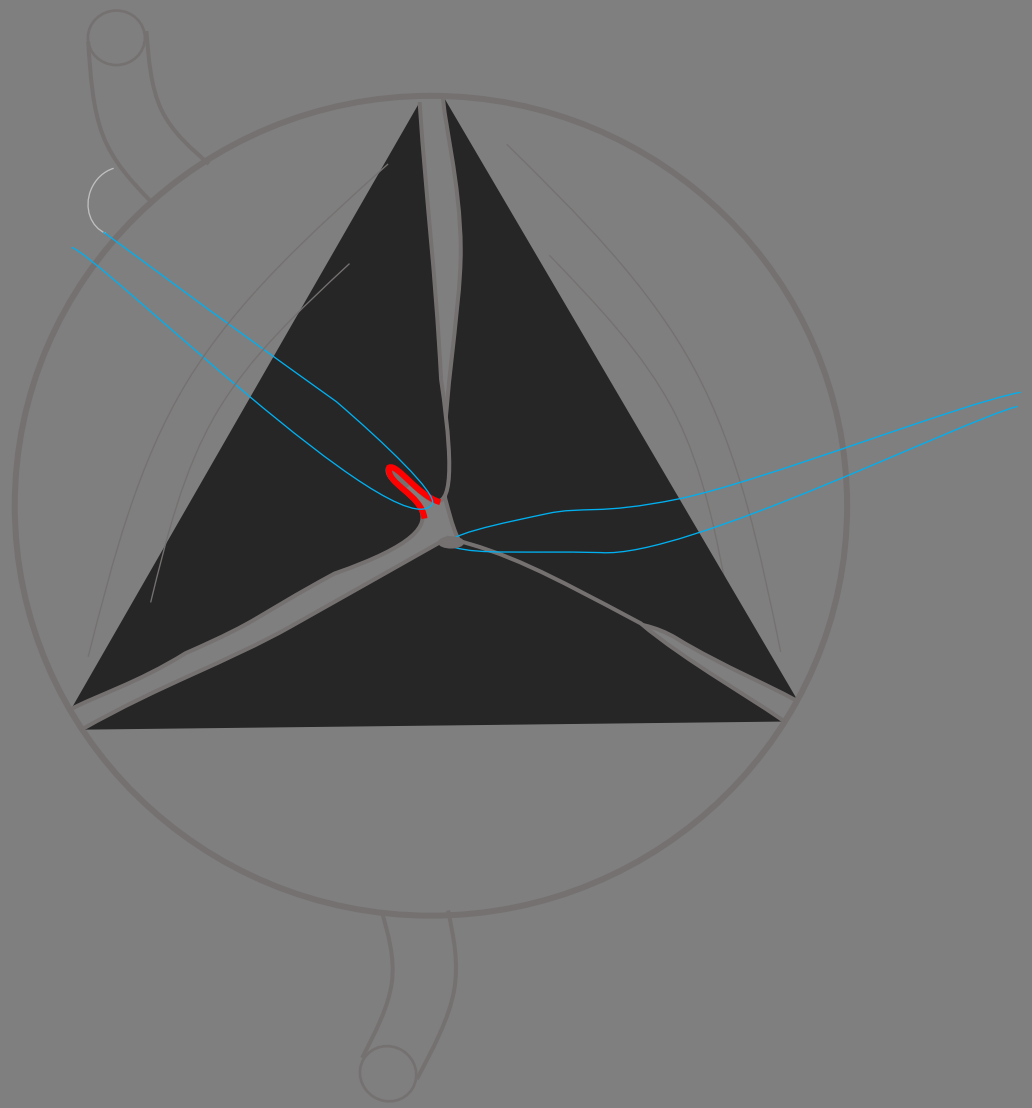
Central Plication Technique: 2 cusp prolapse



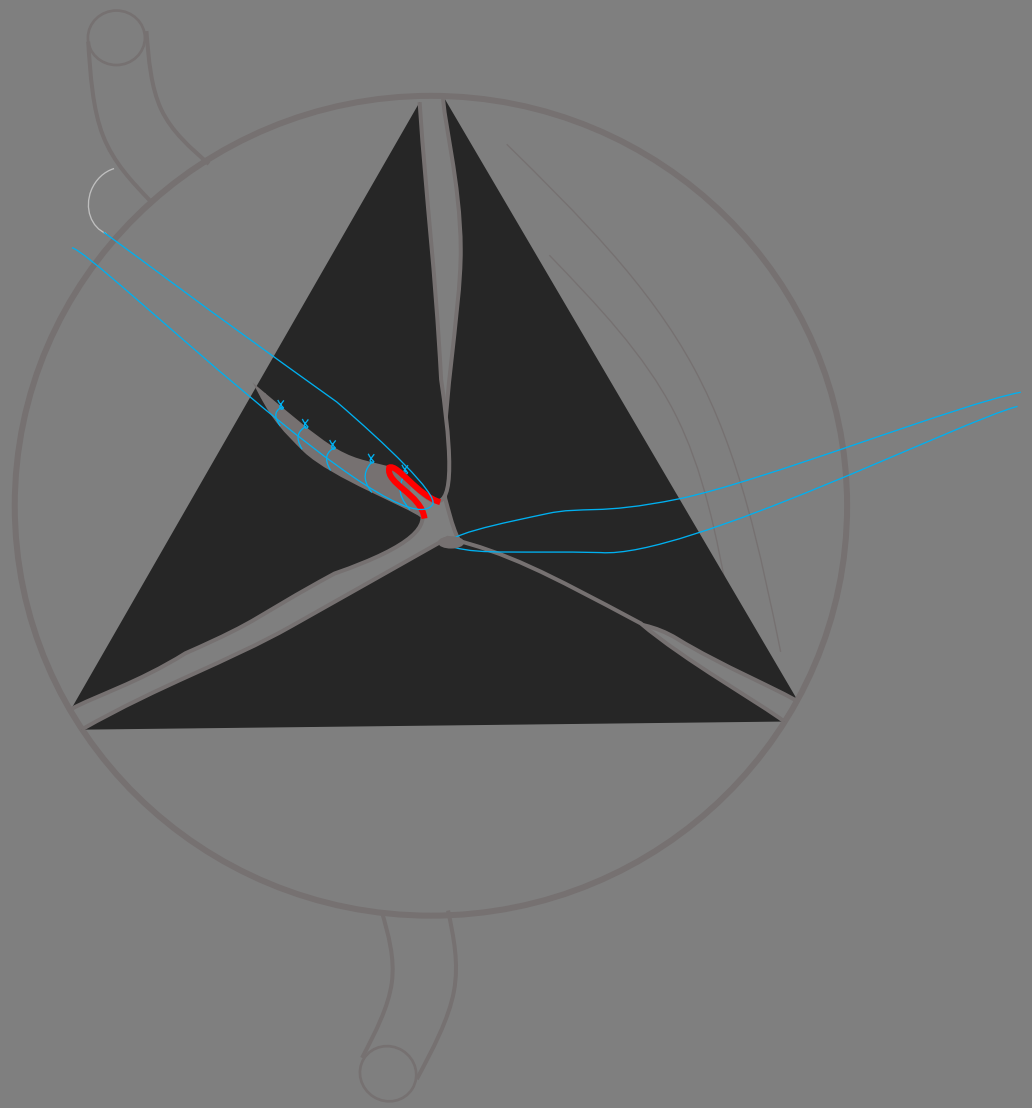
Central Plication Technique: 2 cusp prolapse



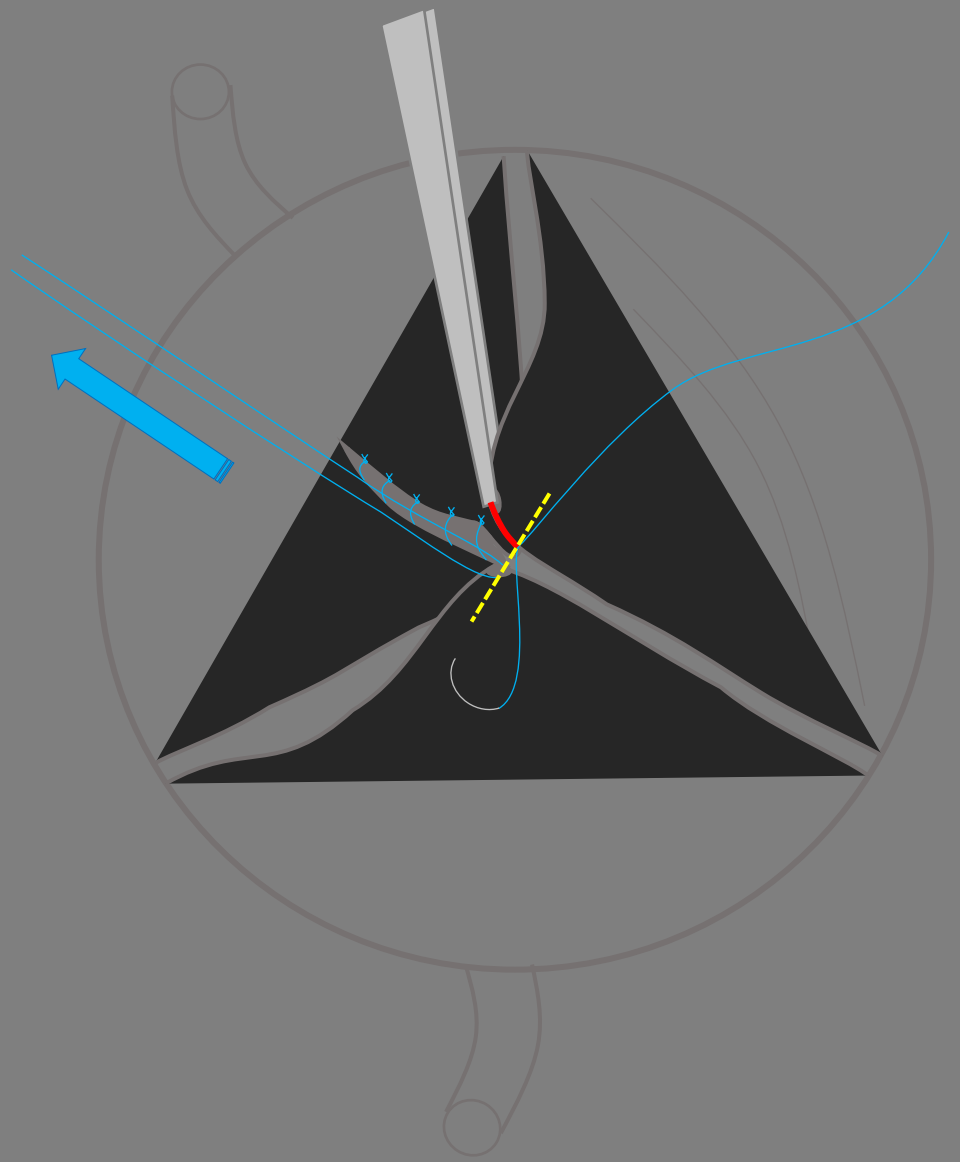
Central Plication Technique: 2 cusp prolapse



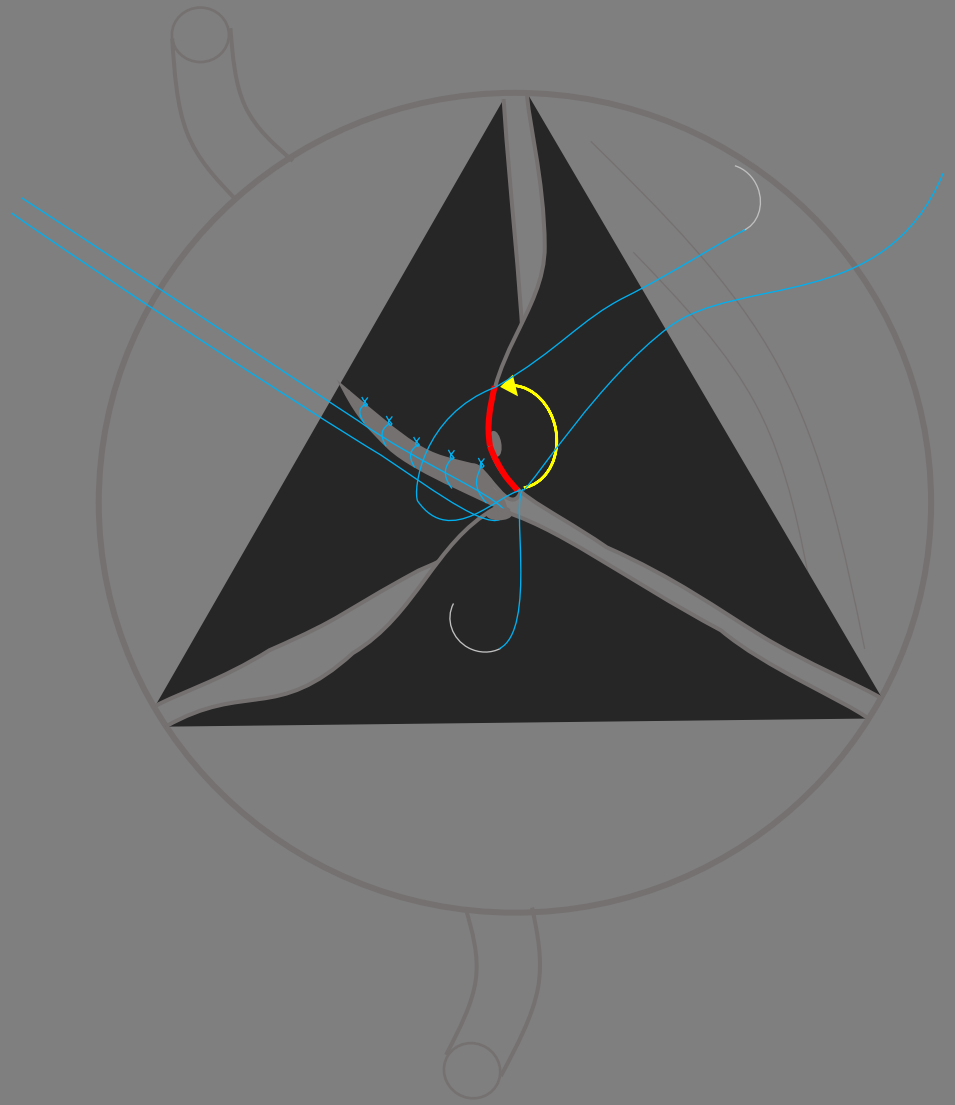
Central Plication Technique: 2 cusp prolapse



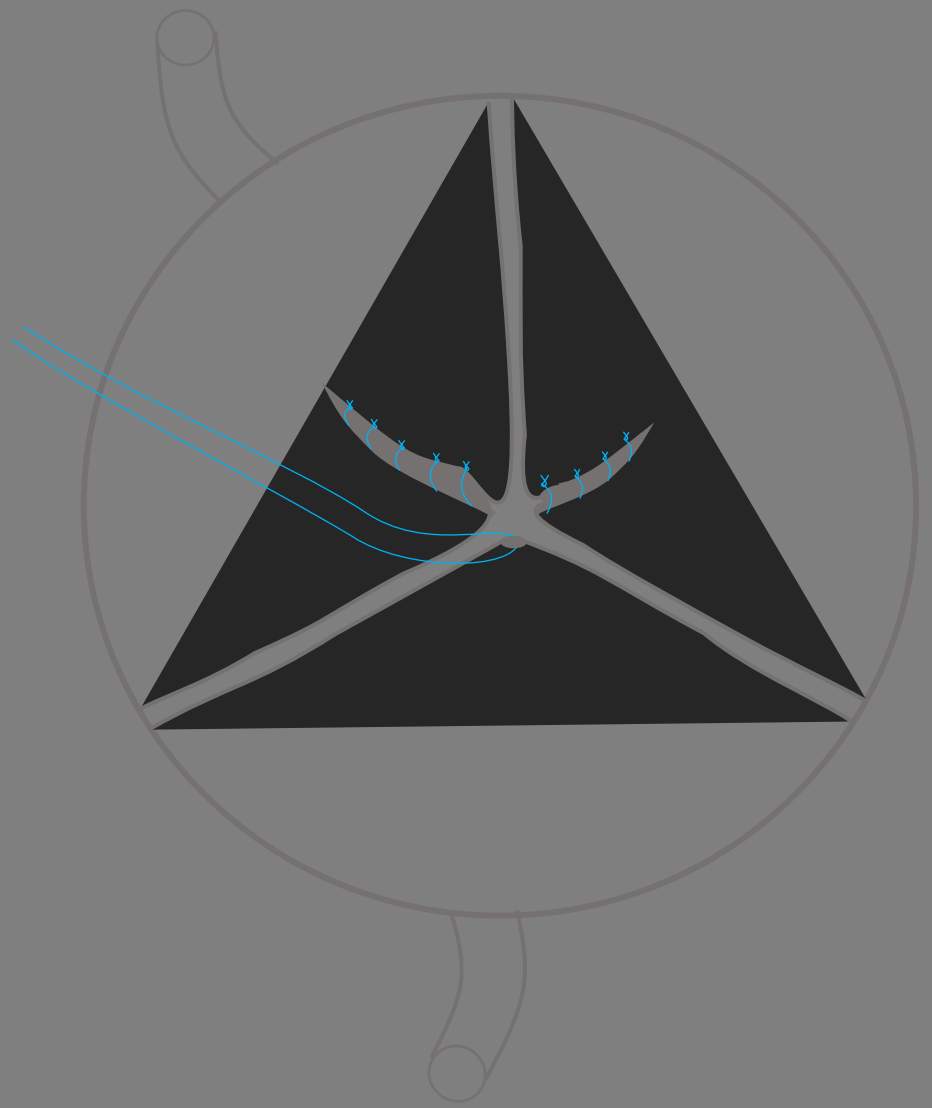
Central Plication Technique: 2 cusp prolapse



Central Plication Technique: 2 cusp prolapse



Central Plication Technique: 2 cusp prolapse



Reimplantation Technique

Probability of Cusp Repair

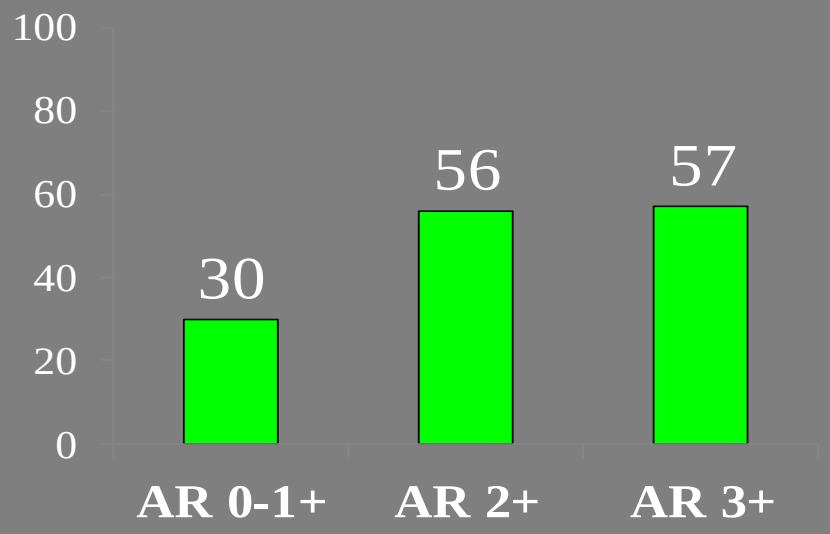
- AV morphology
  - In tricuspid **52%**
    - T. David JTCS. 2006: ±58%
    - D. Aicher. JTCS 2007: ±53%
  - In bicuspid **93%**
    - D. Aicher. JTCS 2007: ±86%

Reimplantation Technique

Probability of Cusp Repair

➢ Preoperative AR

- In tricuspid **52%**

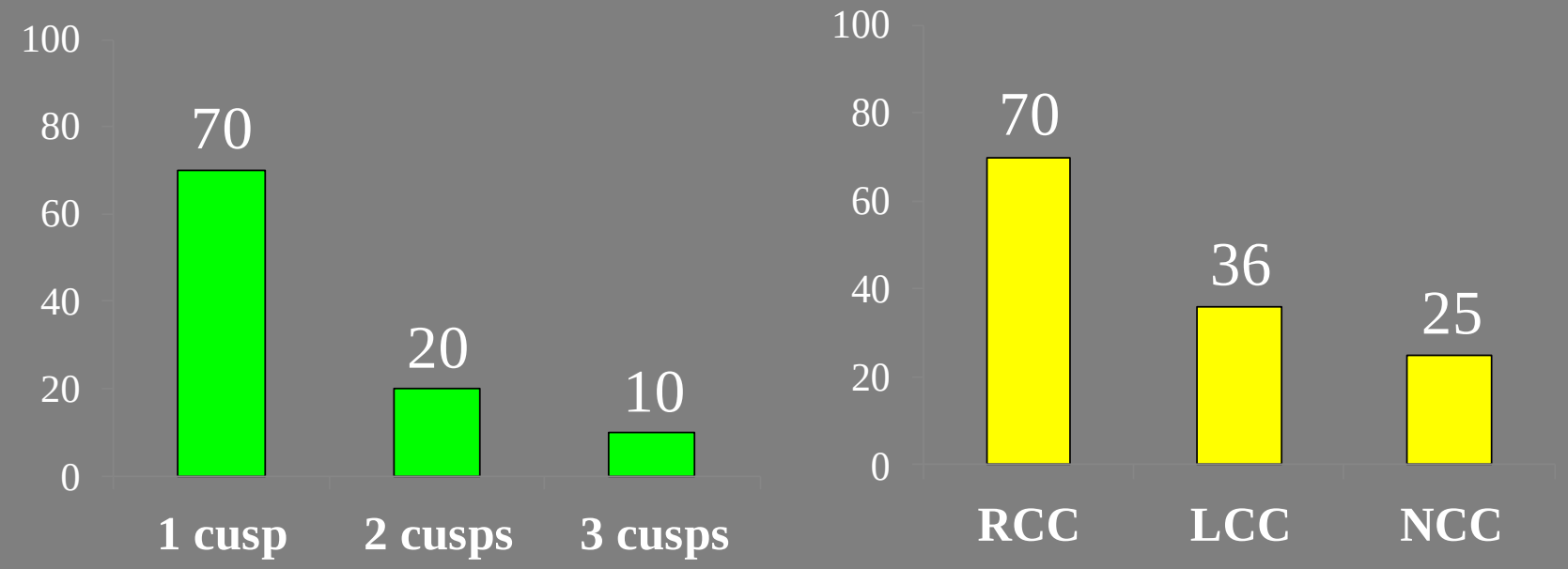


D. Aicher. JTCS 2007

E. Lansac EJCTS. 2010

Reimplantation Technique

Probability of Cusp Repair

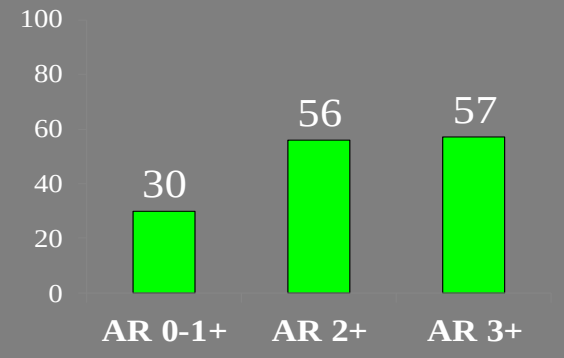


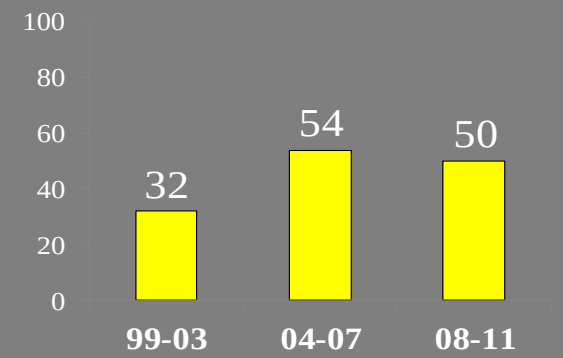
Reimplantation Technique

Probability of cusp repair

- AV morphology

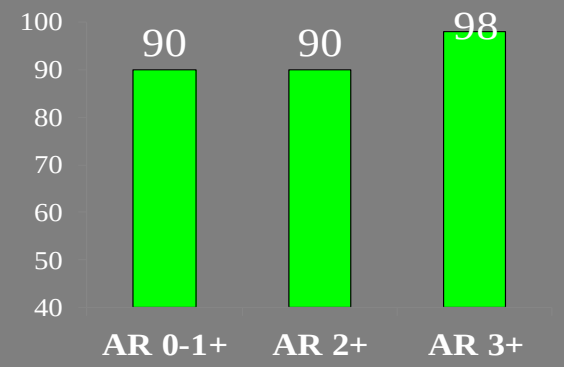
- In tricuspid **52%**

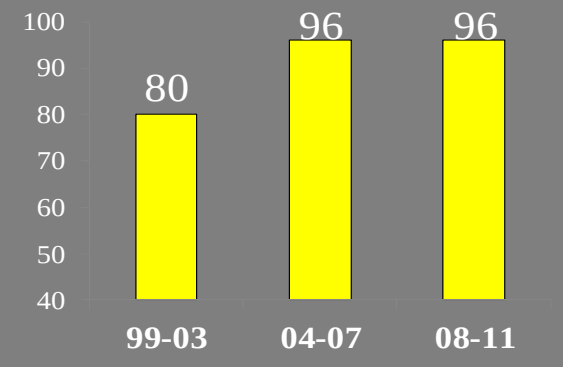




D. Aicher. JTCS 2007

- In bicuspid **93%**



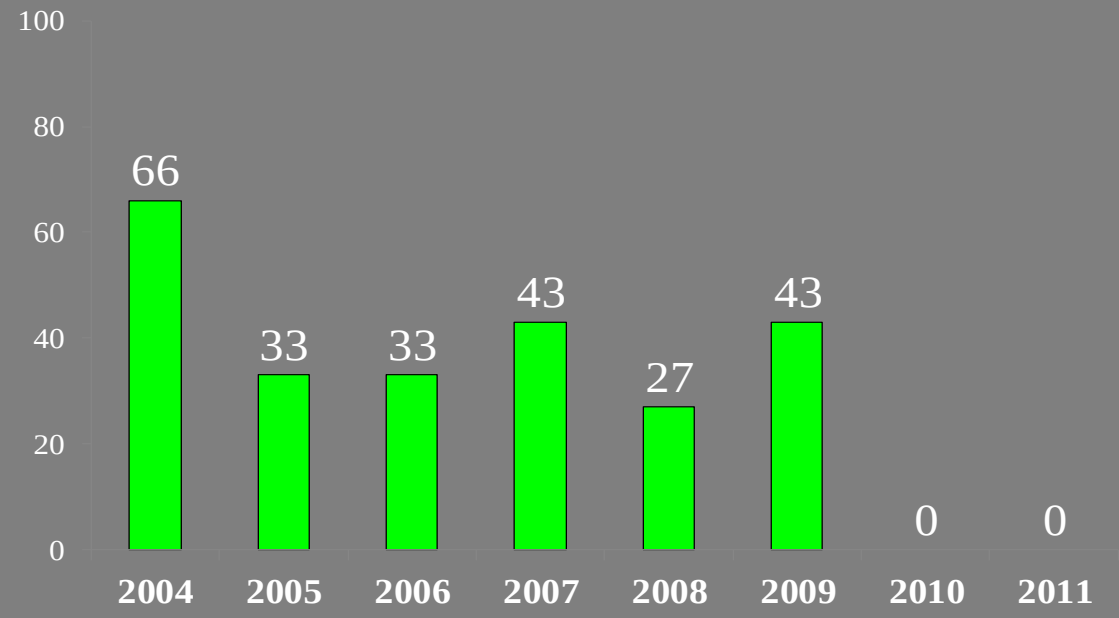


E. Lansac EJCTS. 2010

Reimplantation Technique

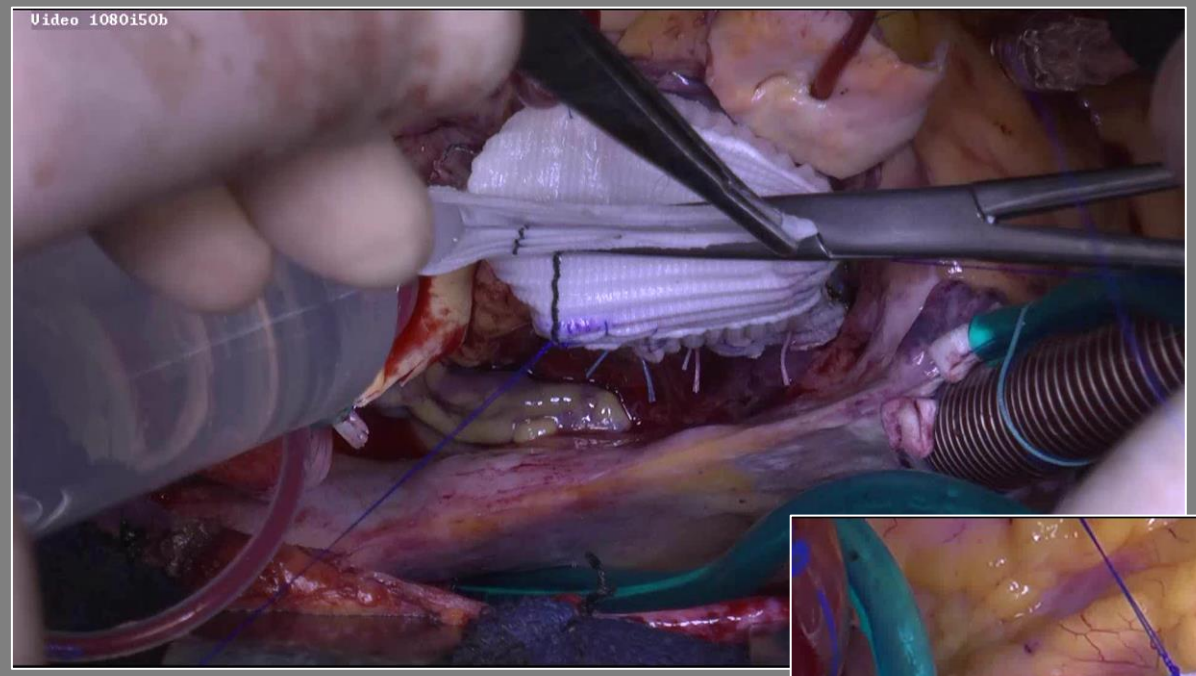
Probability of cusp repair

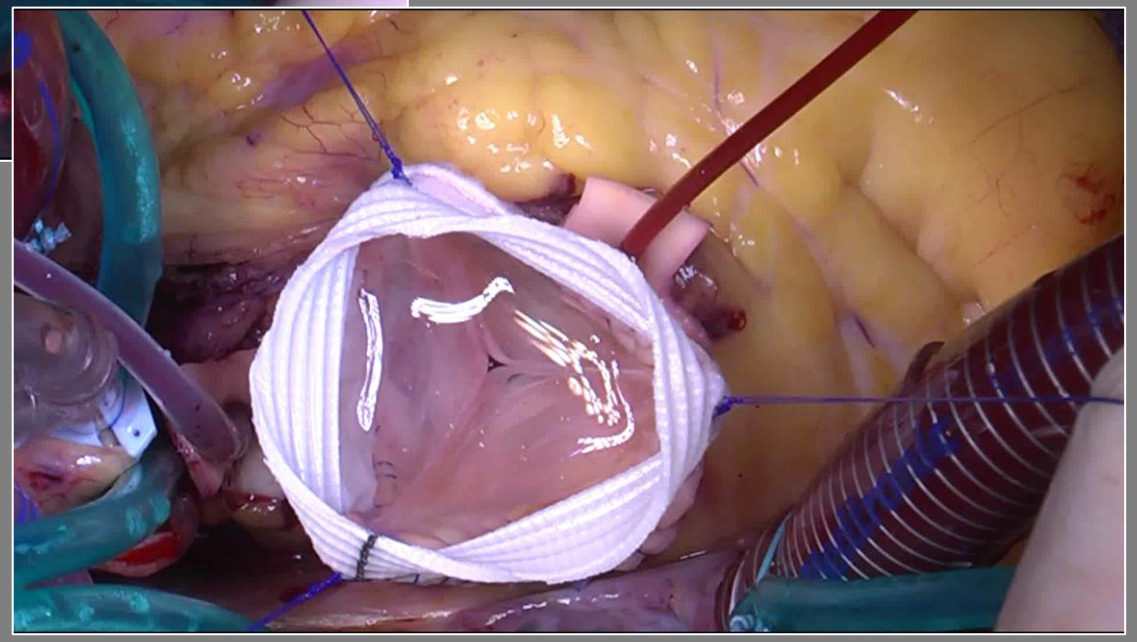
- Preoperative AR 0-1+
  - In tricuspid



Reimplantation Technique

Water Test, residual prolapse repair





AV Repair

*Surgery for A*I

- Symptomatic severe AI
- Assympt severe AI + EF <50%

or + LVED >65 (70) mm, LVES >50 mm

Surgery for Ao. Aneurism

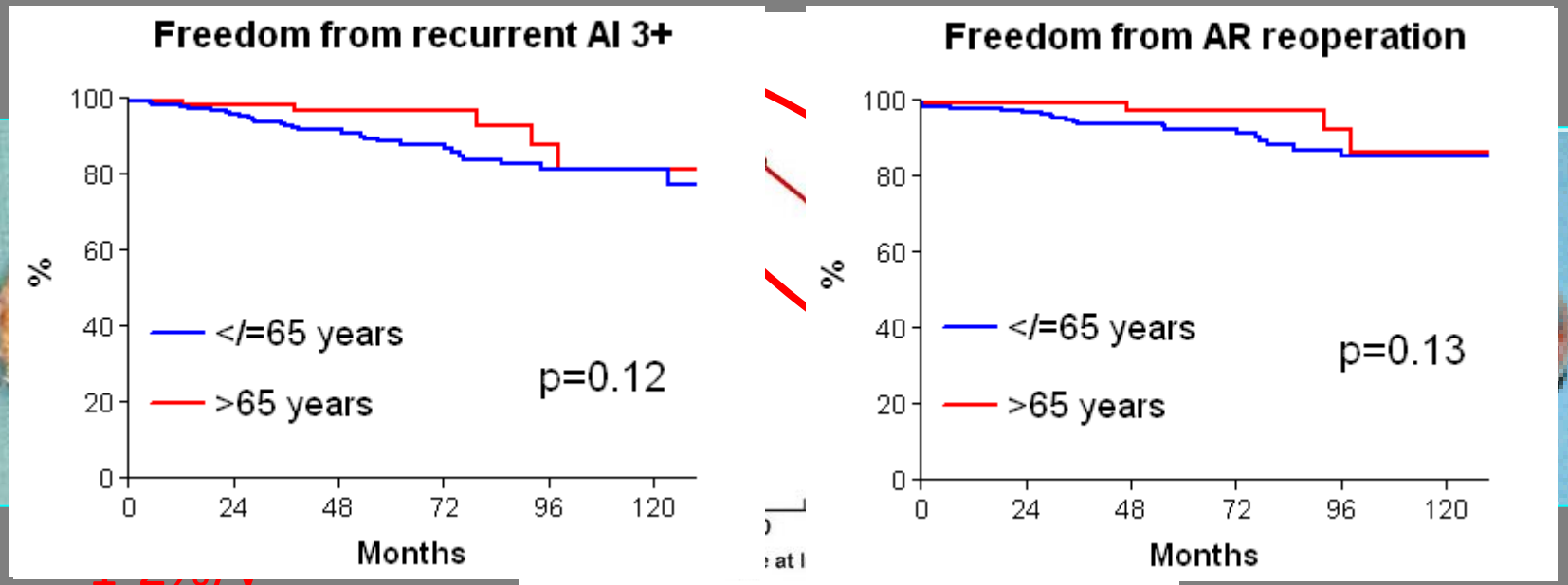
- > 55 mm in TAV
- > 50 mm in Marfan, BAV at risk
- > 45 mm in Marfan at risk, if surgery for severe AI

2. Patients selection for AV repair

1. Pediatric
2. Young adults

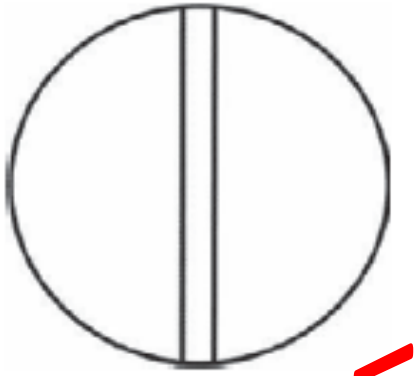
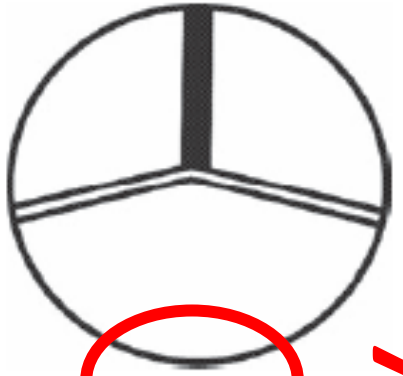
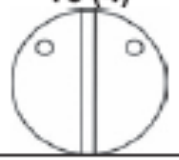
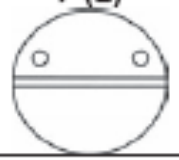
} Main TARGET of AV repair

3. > 65 years = 23% of AV repair population (1996 – 2012, 620 pts)



BAV Repair

Classification of cusp phenotypes

main category: number of raphes	0 raphe - Type 0		1 raphe - Type 1			2 raphes - Type 2
						
	21 (7)		269 (88)			14 (5)
1. subcategory: spatial position of cusps in Type 0 and raphes in Types 1 and 2	lat 13 (4) 	ap 7 (2) 	L – R 216 (71) 	R – N 45 (15) 	N – L 8 (3) 	L – R / R – N 14 (5) 
2. subcategory:						
VALVULAR FUNCTION I	6 (2)	1 (0.3)	79 (26)	22 (7)	3 (1)	6 (2)
VALVULAR FUNCTION S	7 (2)	5 (2)	119 (39)	15 (5)	3 (1)	6 (2)
VALVULAR FUNCTION B (I + S)		1 (0.3)	15 (5)	7 (2)	2 (1)	2 (1)
VALVULAR FUNCTION No			3 (1)	1 (0.3)		

H. Sievers, J.Thor. Cardiovasc.Surg. 2007

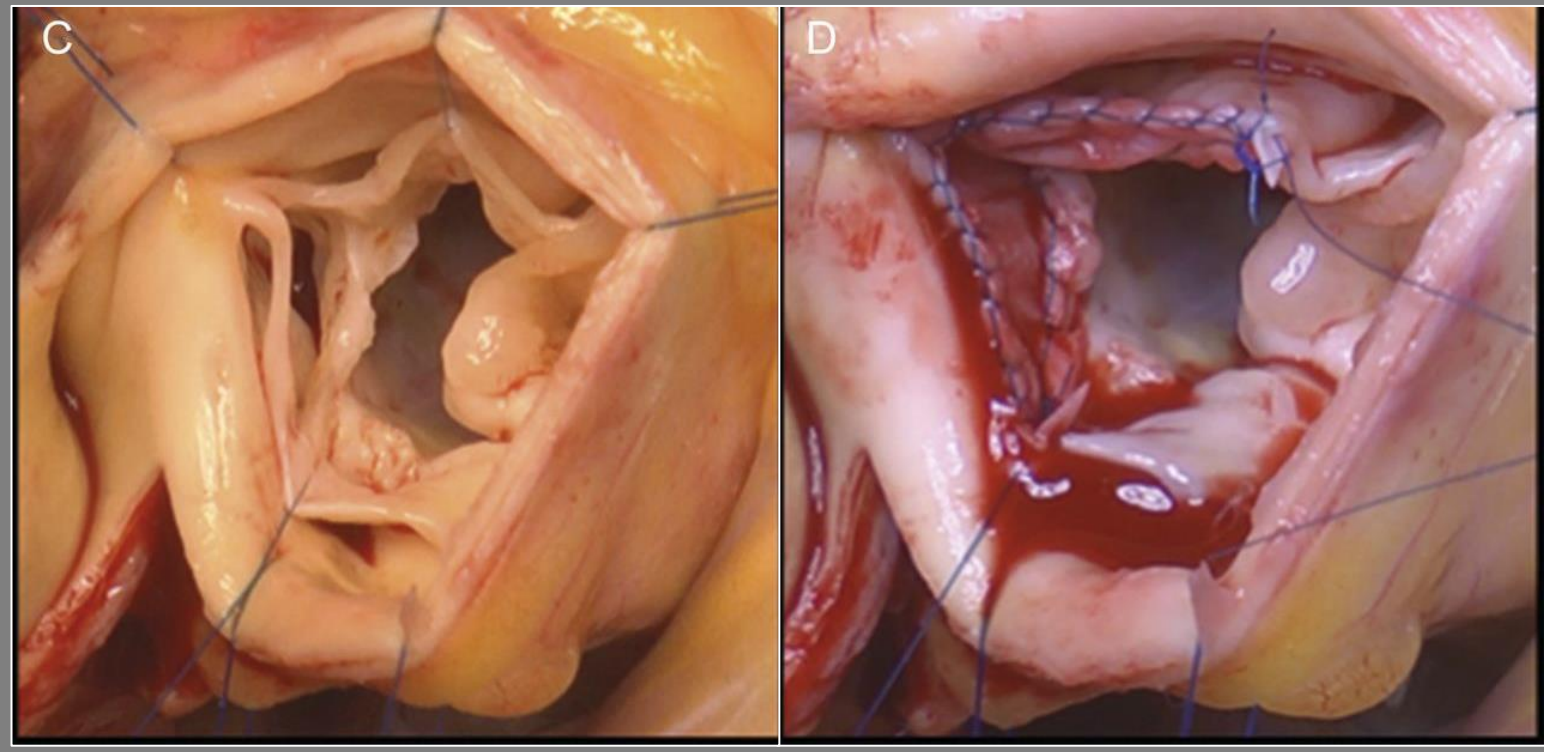
Techniques of cusp repair

Cusp lesions

- Prolapse
  - Free margin elongation
  - Fenestration *« large »*
  - Commissure disruption
- Restriction
  - Raphe in BAV
  - Unicuspid valve
  - Fibosis/Calcification
- Perforation/destruction

Repair techniques

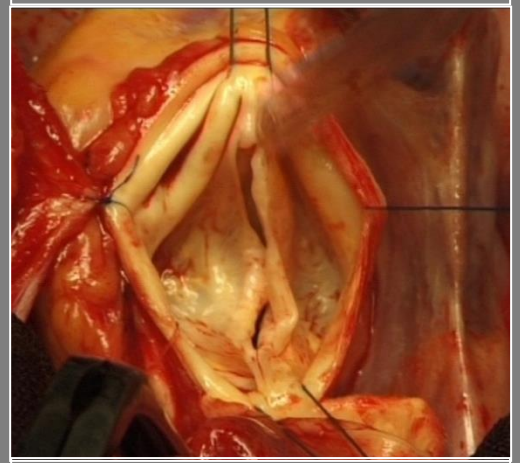
→ Patch repair (2 patches)



BAV repair

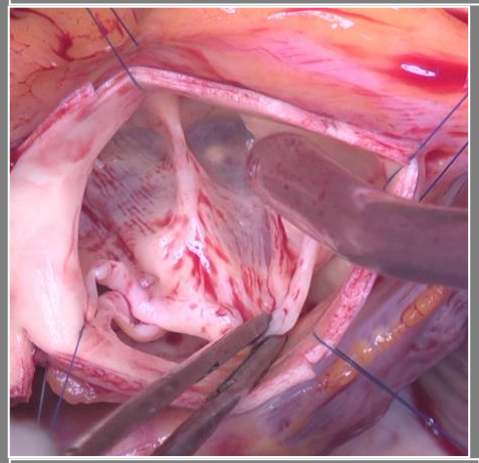
Classification of cusp phenotypes

Type 0 *(Sievers Classif.)*

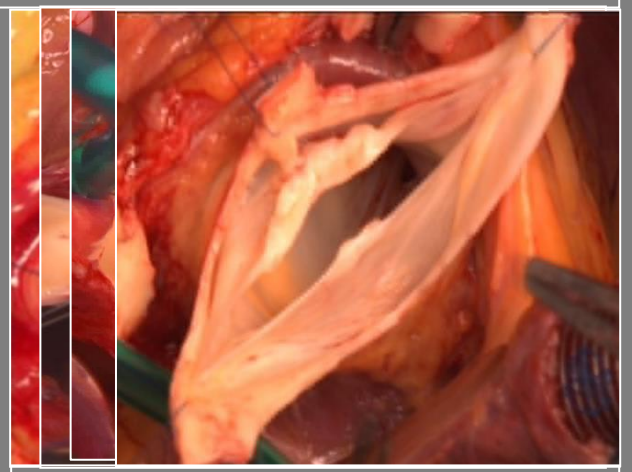


- ≈ 180°
- No raphe
- Prolapse

Type 1 *(Sievers classif.)*



- Raphe
- Complete fusion
- 160° – 180°
- Prolapse

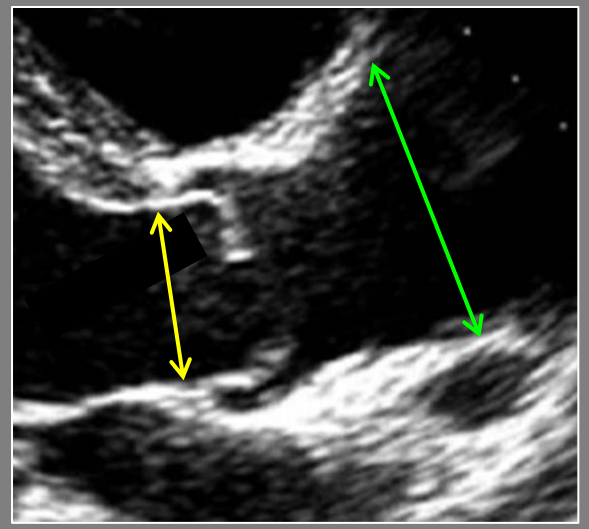


- Thick, calc. raphe
- Incomplete fusion
- 120° – 160 °
- Restrictive

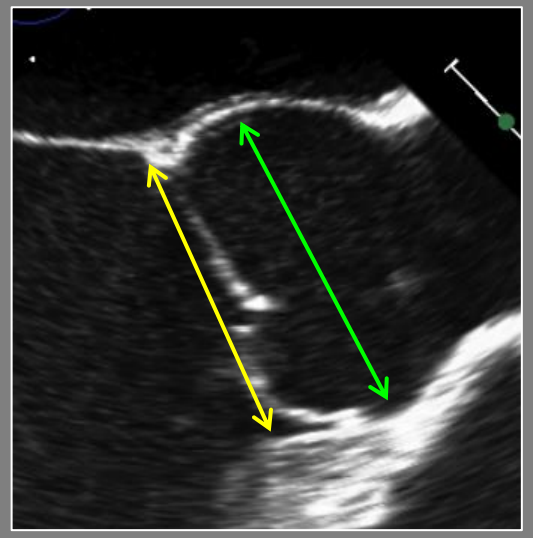
BAV Repair

Aortopathy

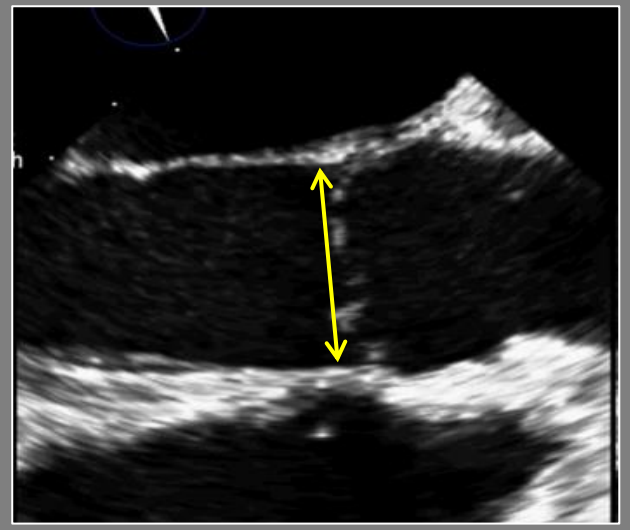
Dilated Asc. Aorta



Dilated Root



Normal Aorta



- Dilated ventriculo-aortic junction 28 – 30 mm

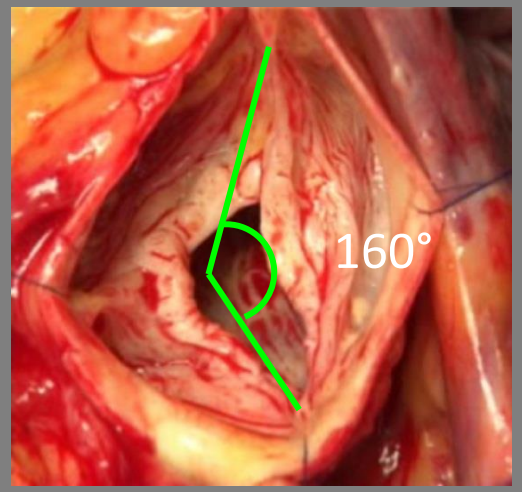
de Kerchove JTCVS 2010
Schäfers JTCVS 2013

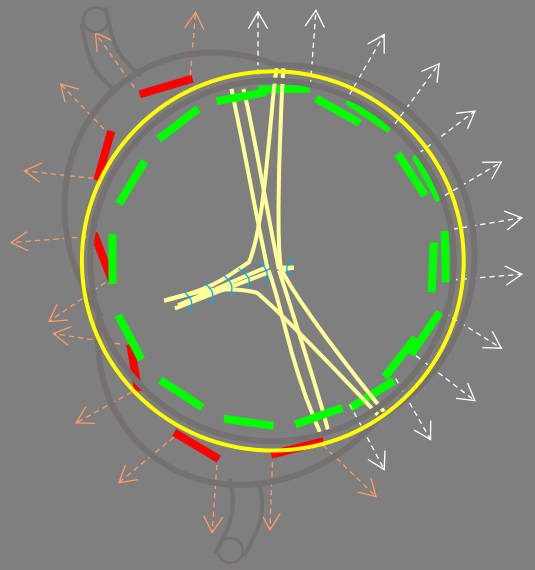
BAV repair

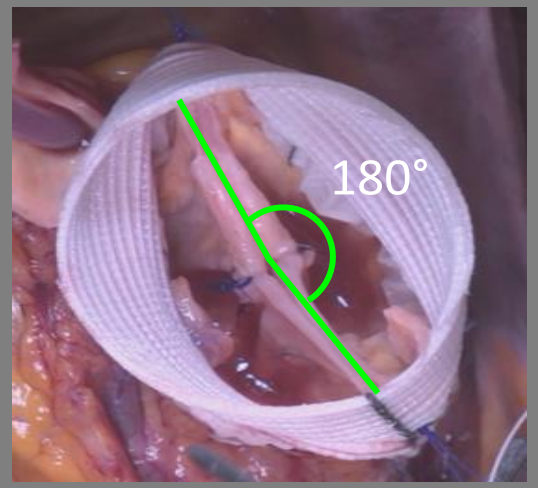
Valve sparing Reimplantion

1. Circumferential prosthetic based annuloplasty
2. Modify commissure orientation (≈180°)
    - Improve durability
    - Reduce the need of patch repair

Type 1 BAV





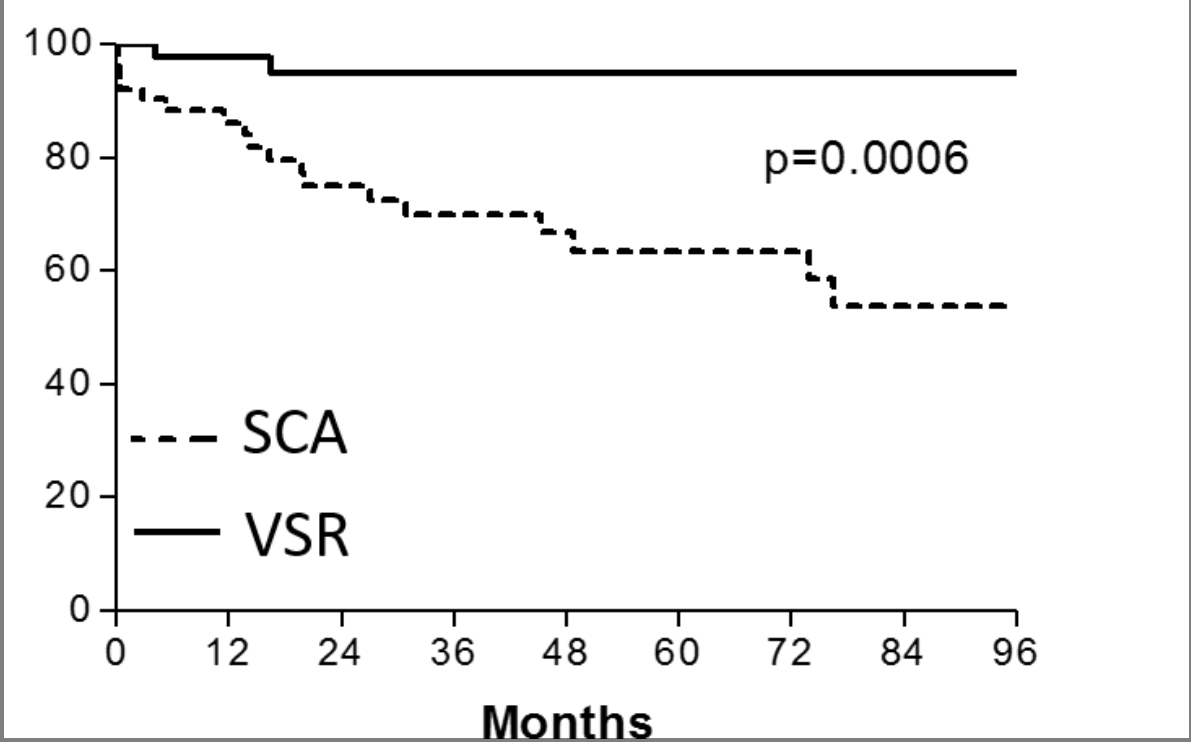


Techniques of FAA repair

SCA vs VSR (matched comparison)

BAV

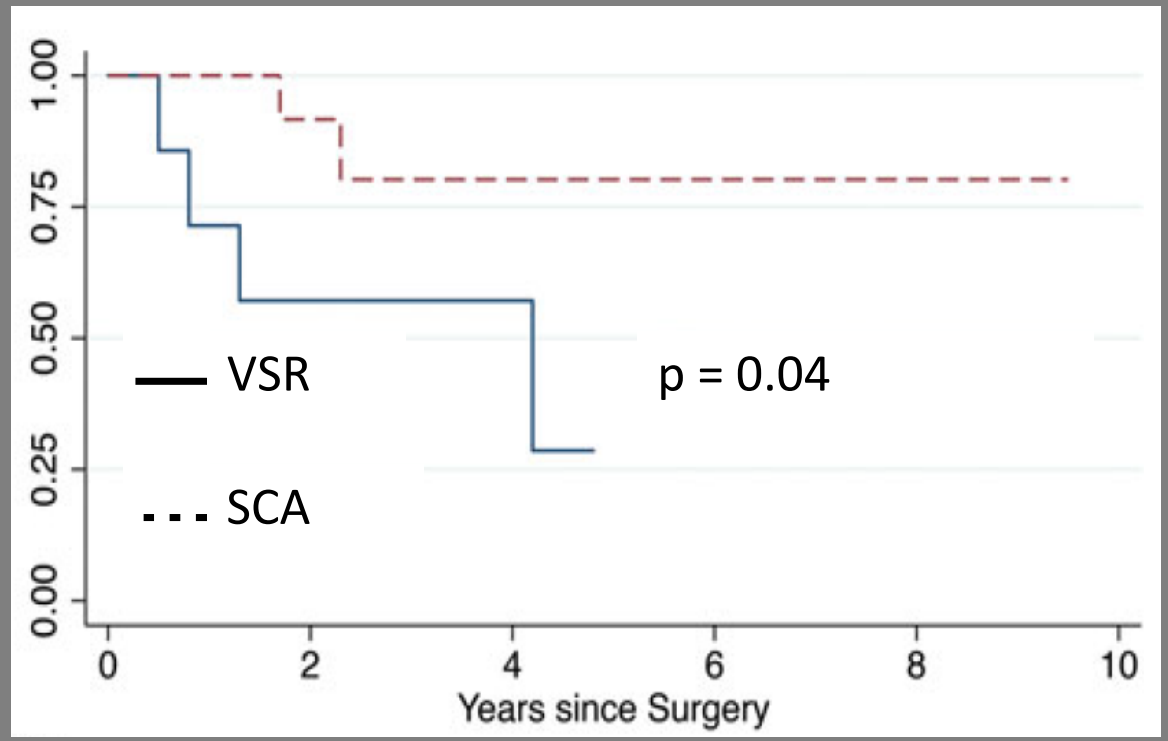
FF AR >1+



De Kerchove L. JTCS 2010

TAV

FF AR >1+



De Kerchove L. EJCTS 2015