Aortic Valve Repair versus Replacement

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CONVENTIONAL AV Replacement

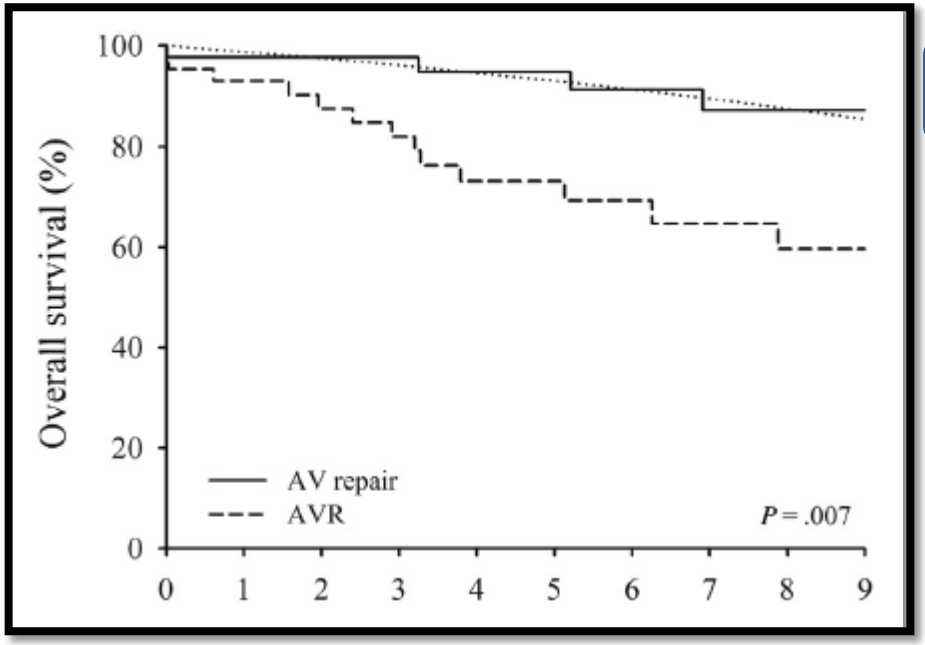
UNSOLVED ISSUES

- Thromboembolism
- Bleedings
- Valve degeneration/malfunction
- Patient-prosthesis mismatch
- Quality of life
- Endocarditis
- Long term survival

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

Why aortic valve repair today?

Low adoption rate because of:

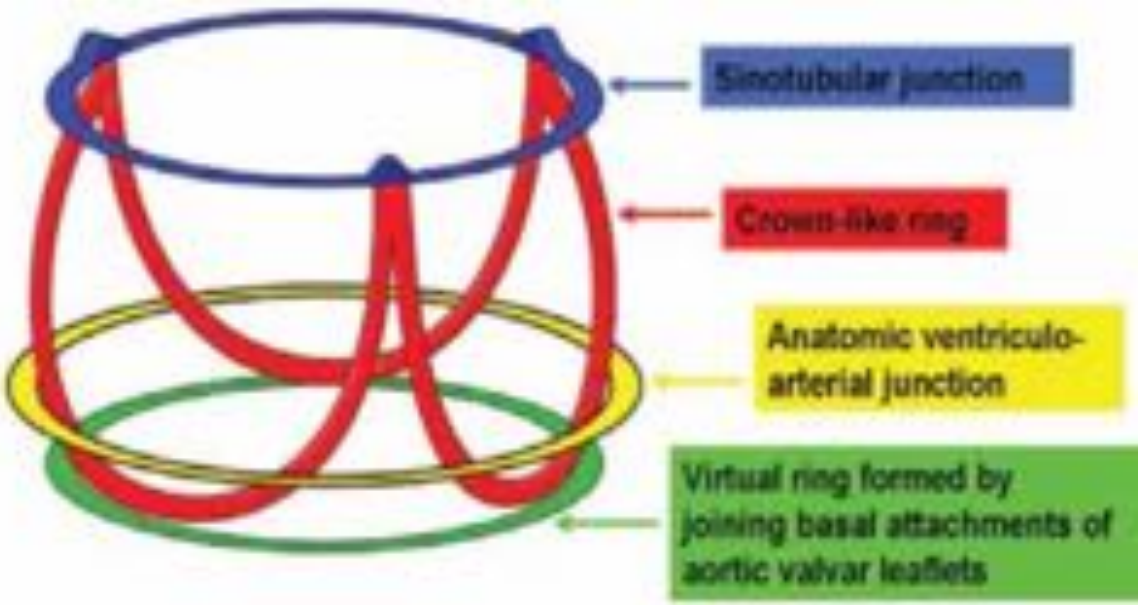
. Technical complexity

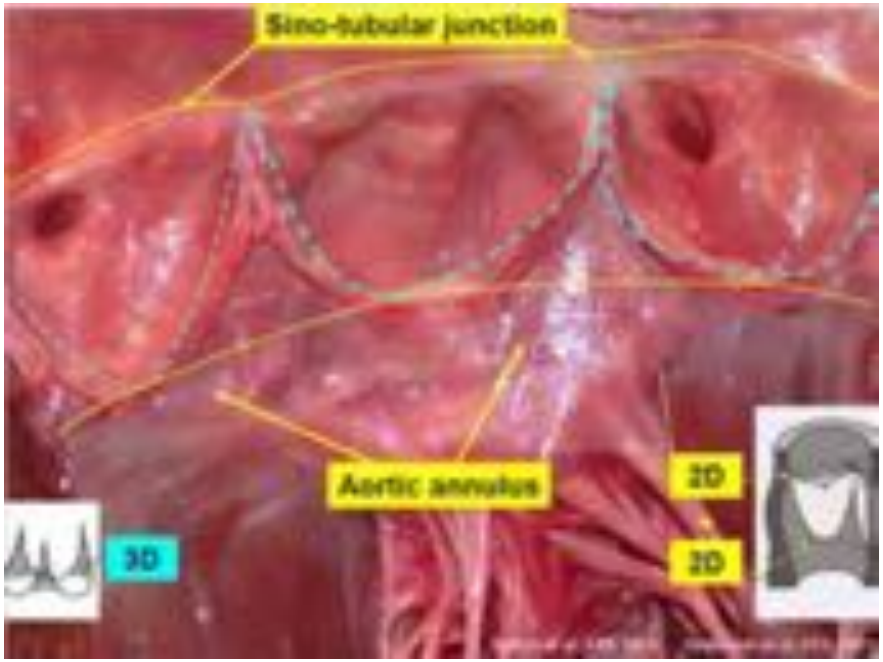
. Single Centre (single surgeon) series

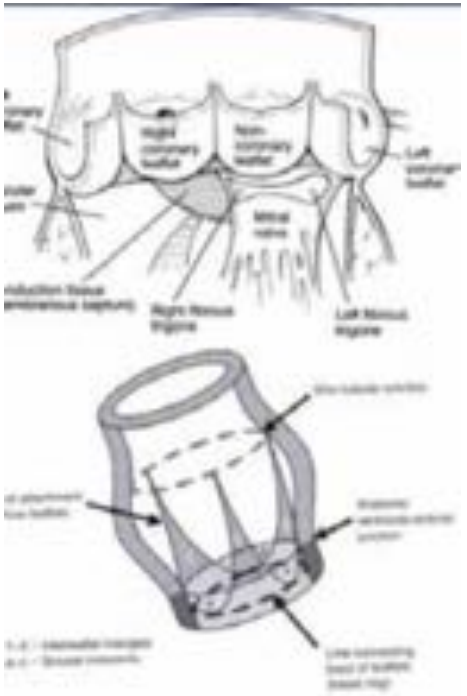
Why aortic valve repair today?

Recent renewed interest:

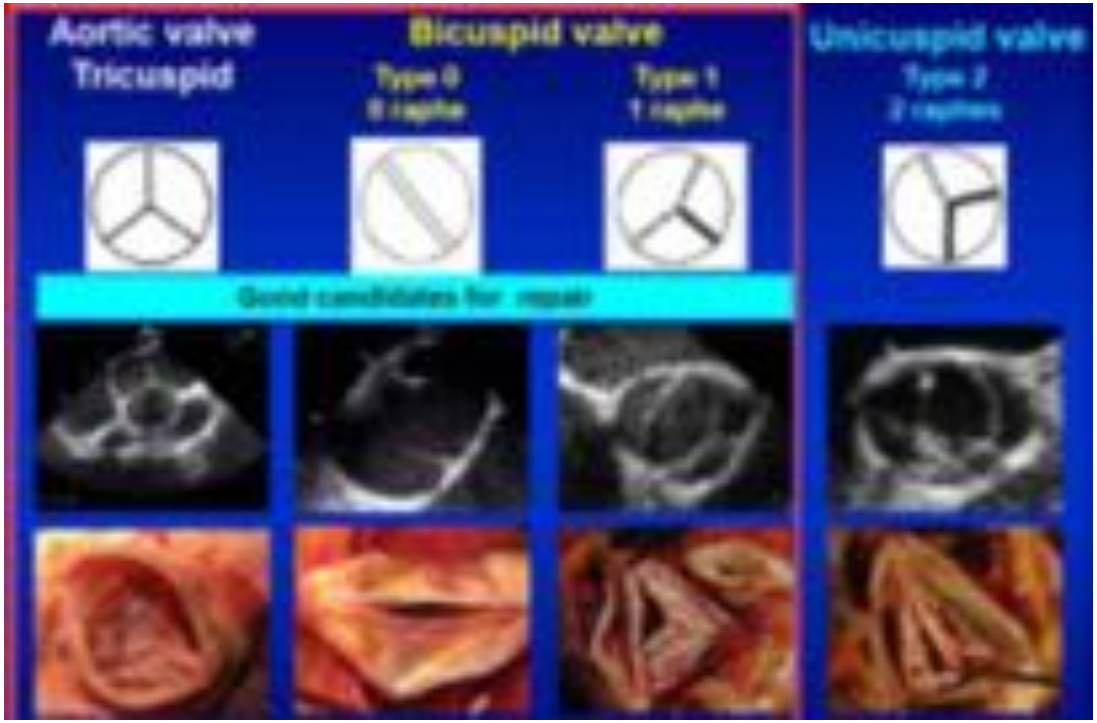
- **Better understanding of the surgical anatomy**
- **Systematic valve analysis to address repair**
- **Dedicated surgical instruments and devices to standardize and simplify the procedure**
- **Intraoperative quality control to predict long term results**

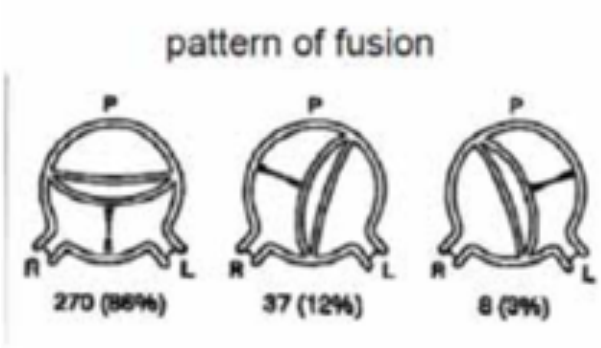

Sinotubular junction
Crown-like ring
Anatomic ventriculo-arterial junction
Virtual ring formed by joining basal attachments of aortic valvar leaflets

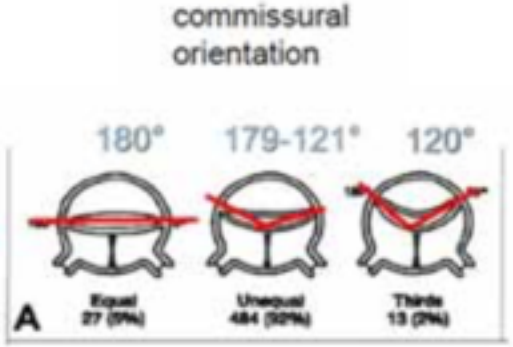

Sino-tubular junction
Aortic annulus
2D
2D
3D



Different AV Types

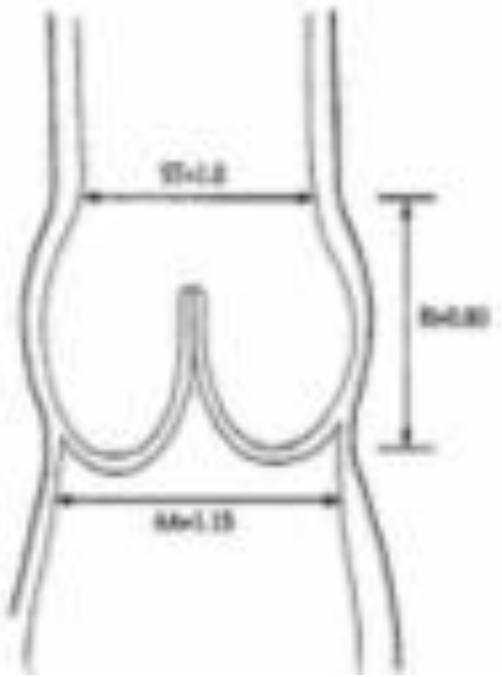






Mechanisms of AR are a combination of:

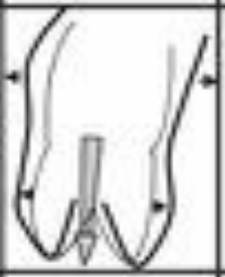
- Root pathology:
  - STJ
  - Sinuses of valsalva
  - Basal Ring
- Cusp pathology:
  - Cusp Prolapse
  - Calcific degeneration
  - Perforation



A logical approach

1. Funtional analysis of the aortic root and valve leaflets
2. Choice of the appropriate surgical technique

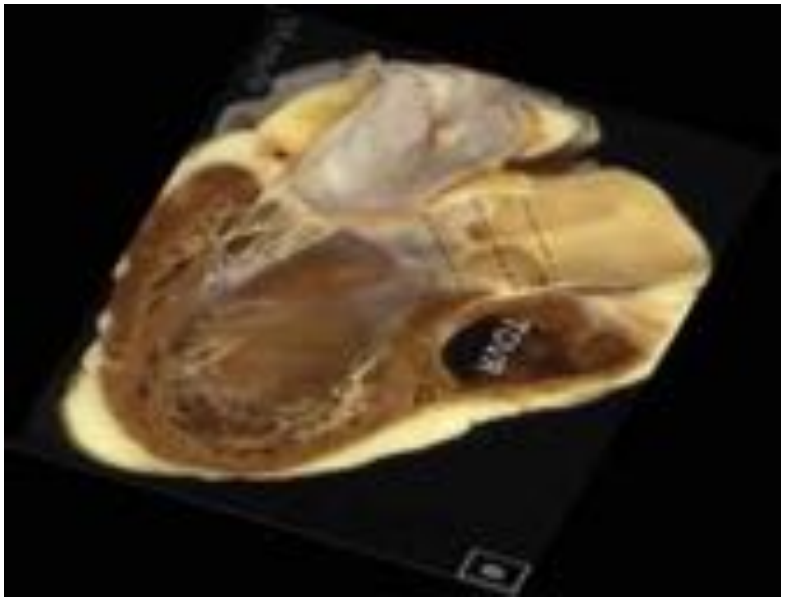
Functional classification of AI

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* *Decalcificatio* *Patch*

El Khoury G. Cur. Op. Card. 2005

TTE/TEE

Echo: Diameters of the aortic root and ascending aorta, Valve morphology, Central/Eccentric jet, Cusp height/configuration/morphology

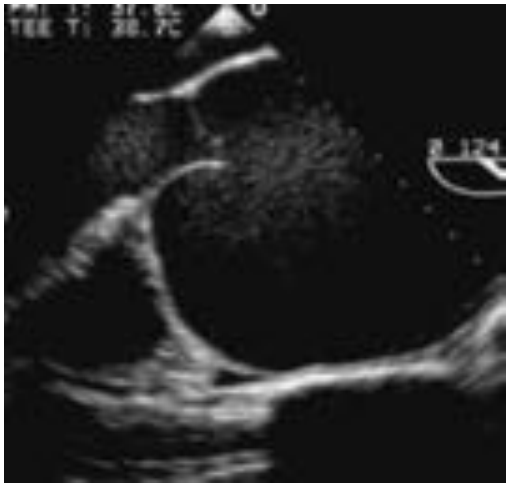


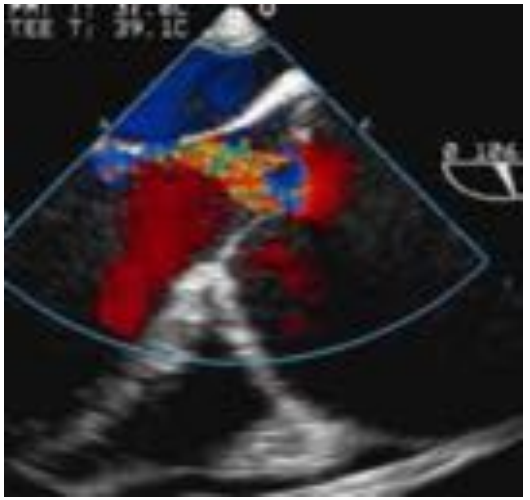
Functional classification of aortic insufficiency

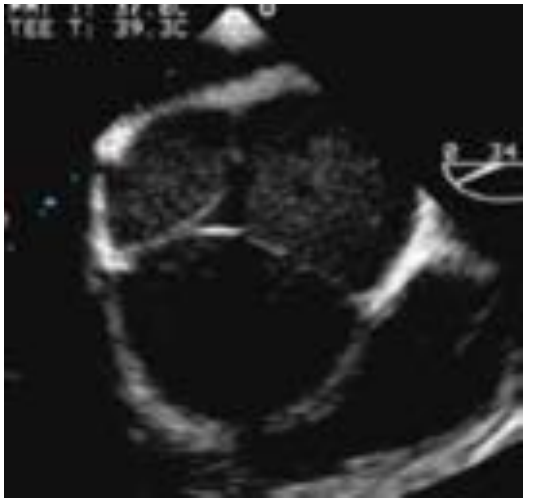
Mechanism of AV dysfunction

Type 1

- Central jet
- All cusps have same coaptatin height
- Lack of central coaptation







Root correction:

Reimplantation of Aortic Valve

(David 1992)
(AVJ ≥ 30 mm)

Root Remodeling

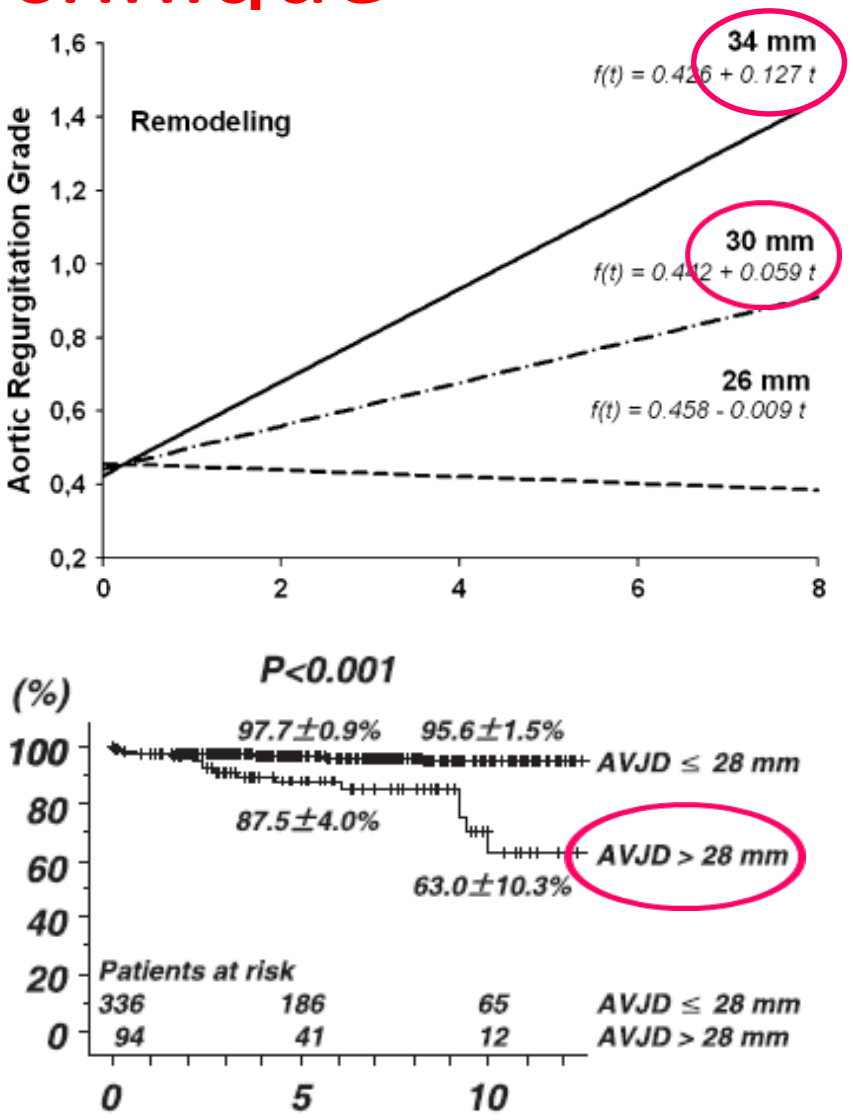
(Yacoub 1993)
(Sinus > 45 mm),

ST Junction Remodelling

(Frater 1986)
(Sinus < 40-45 mm)

Evolution of the Remodeling technique

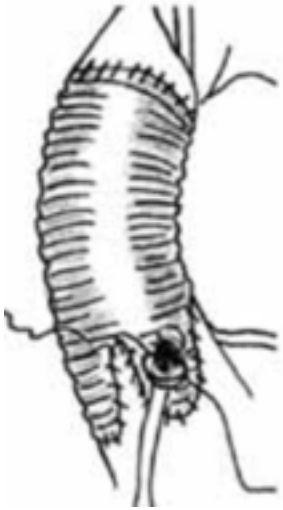
M. Yacoub



Hanke T. JTCS 2009 Kunihara T. JTCS 2012

Evolution of the Remodeling technique (Yacoub)

Remodelling

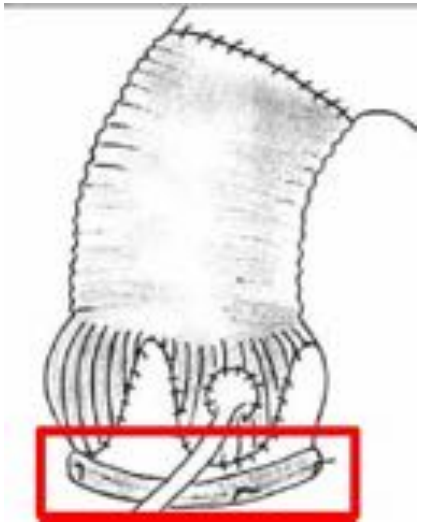


M. Yacoub

Partial external band

T. David 1996

Remodelling + Subvalvular Aortic Anuloplastic



E. Lansac 2006

Suture Anpl.

HJ. Schäfers 2013

Annular stabilization

- **Suture annuloplasty**: PTFE suture

(Schneider U et al. Ann Thorac Surg 2016)

- **External annuloplasty**: expansible ring placed externally

(Lansac E et al. Eur J Cardiothorac Surg 2006)

- **Internal annuloplasty**: crown-shaped internal ring characterized by an elliptical base geometry and three (for tricuspid valves) subcommissural posts

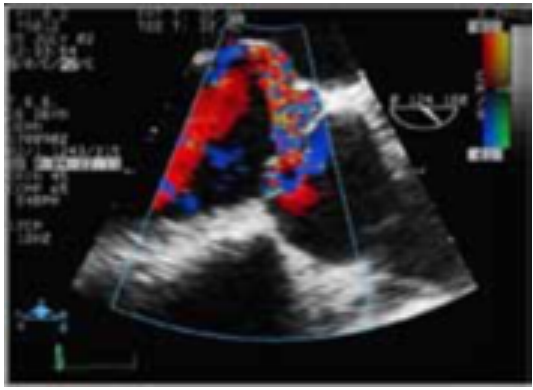
(Mazzitelli D et al. Eur J Cardiothorac Surg 2016)

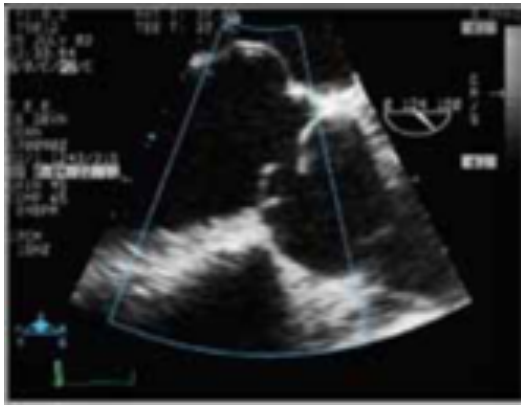
Functional classification of aortic insufficiency

Mechanism of AV dysfunction

Type 2 AI characteristics:

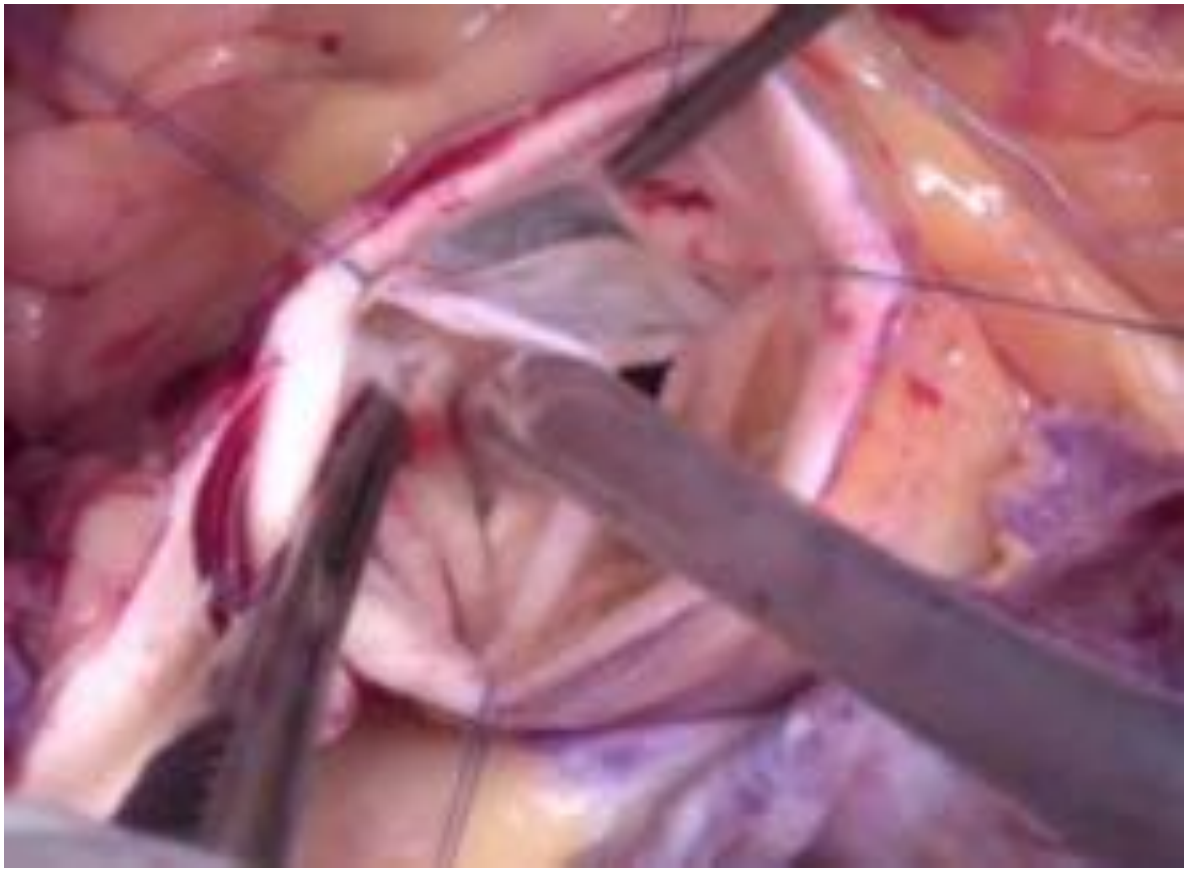
- Eccentric jet
  Sens. 92%, spec. 96%
- Cusp prolapse
- Cusp quality





M. Boodhwani, JTCVS 2013

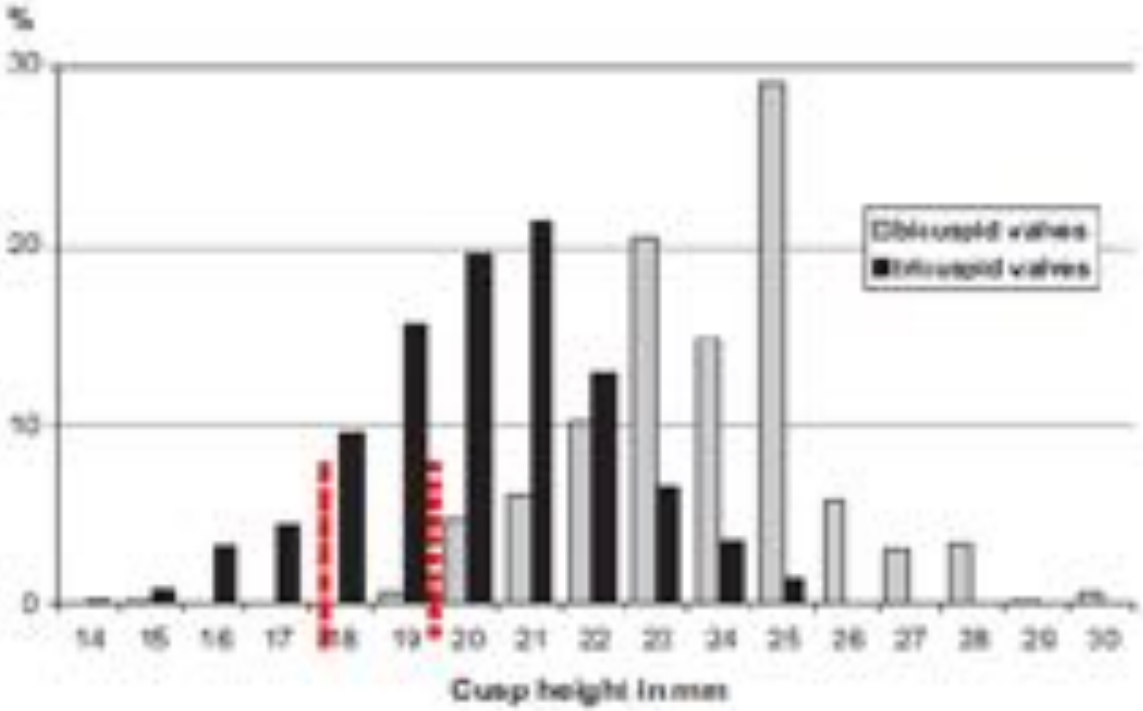
Intraoperative Valve Evaluation: Paramount Step

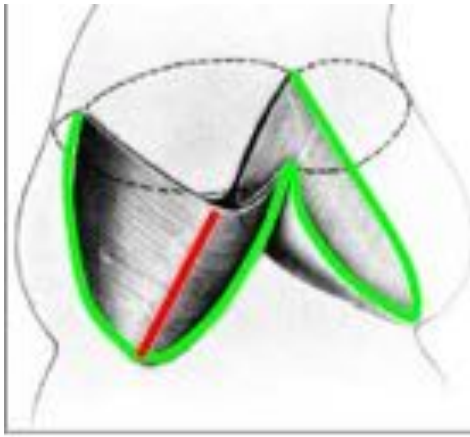


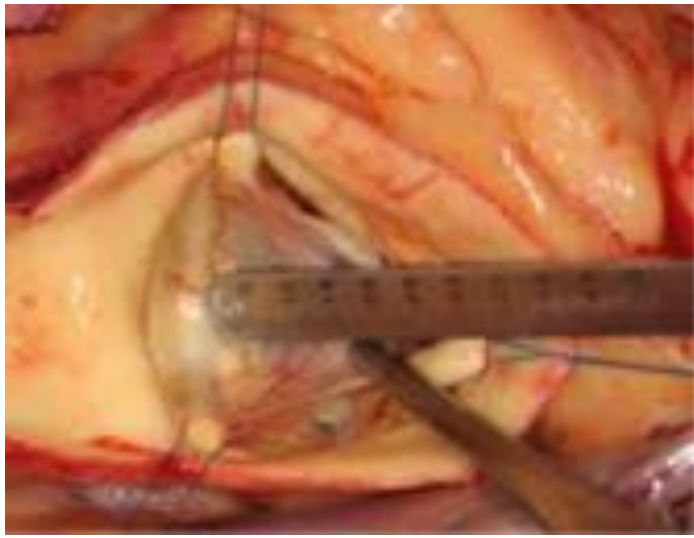
Exposure and cusp examination are essential to achieve successful repair

Favorable INTRAOP Characteristics

Configuration/ coaptation of cusps: cusp height







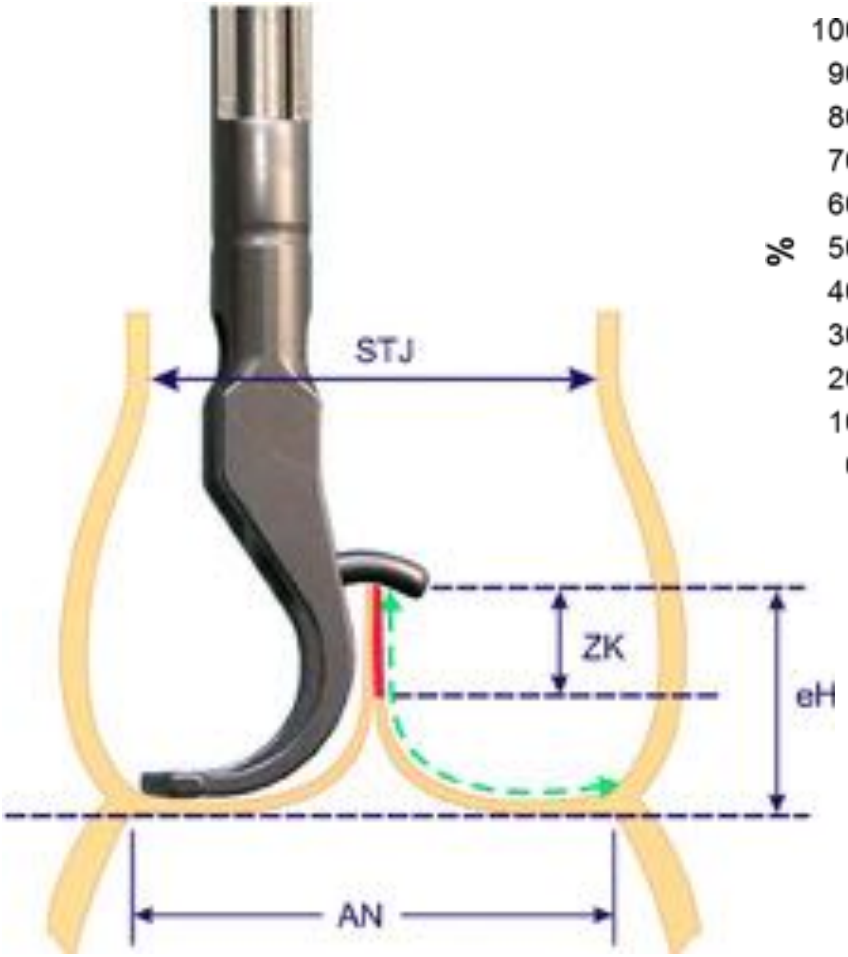
TAV: 17-22 mm
BAV: 20-25 mm

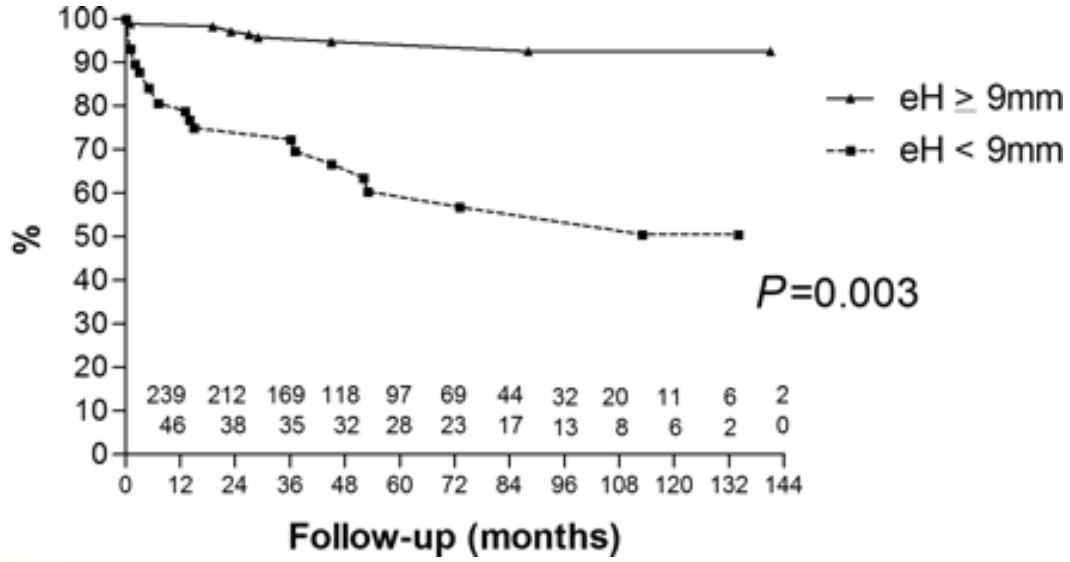
Schäfers HJ; J Thorac Cardiovasc Surg. 2013 ;

EFFECTIVE HEIGHT

Assesment of aortic cusp geometry

Measured intraoperatively with Schafers caliper, effective height (eH) should be of 9mm or more.





STJ: sinotubular junction

ZK: zone of coaptation

eH: effective height

AN: aortic anulus

Schäfers HJ; J Thorac Cardiovasc Surg. 2006

Cusp Correction:

Variety of Surgical Techniques

-Plication of free margin

- Resuspension of free margin

-Triangular resection

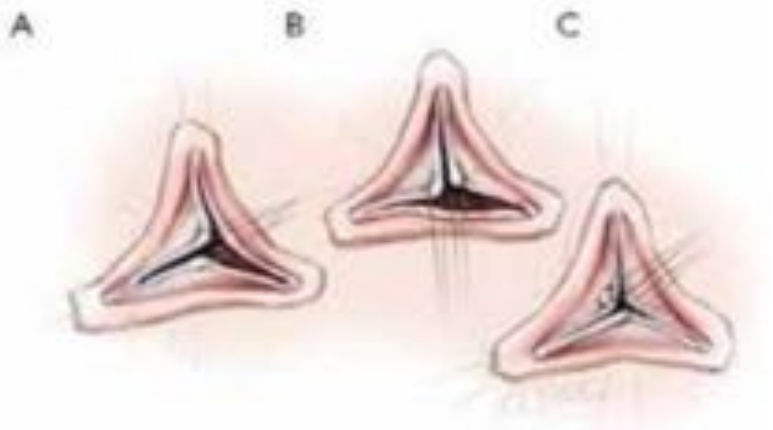
-Patch correction

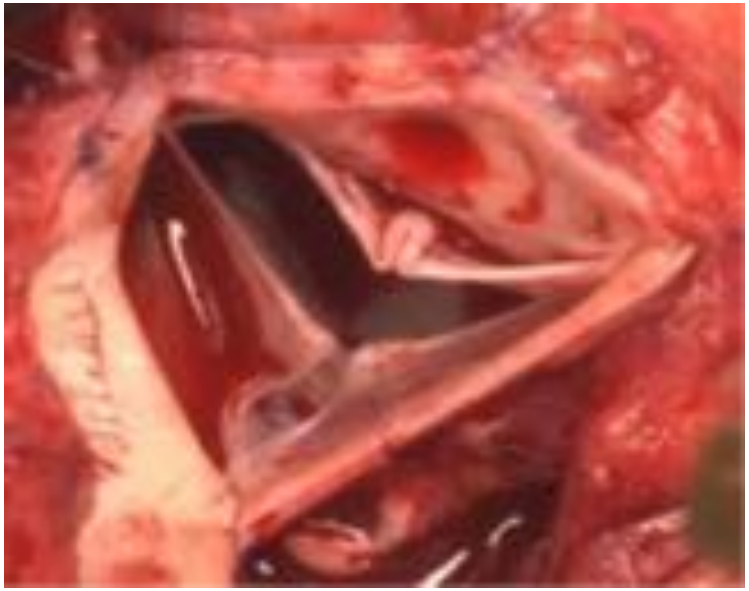
Reconstructive Technique:
Free Margin Plication/Resuspension

- Prolapse => Risk

-undercorrection leaving residual prolapse

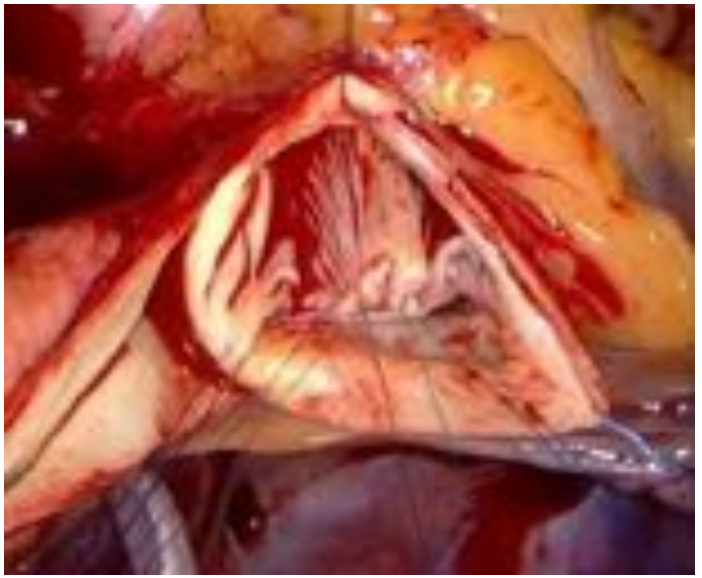
-overcorrection leading cusp restriction





Reconstructive Technique: Triangular resection

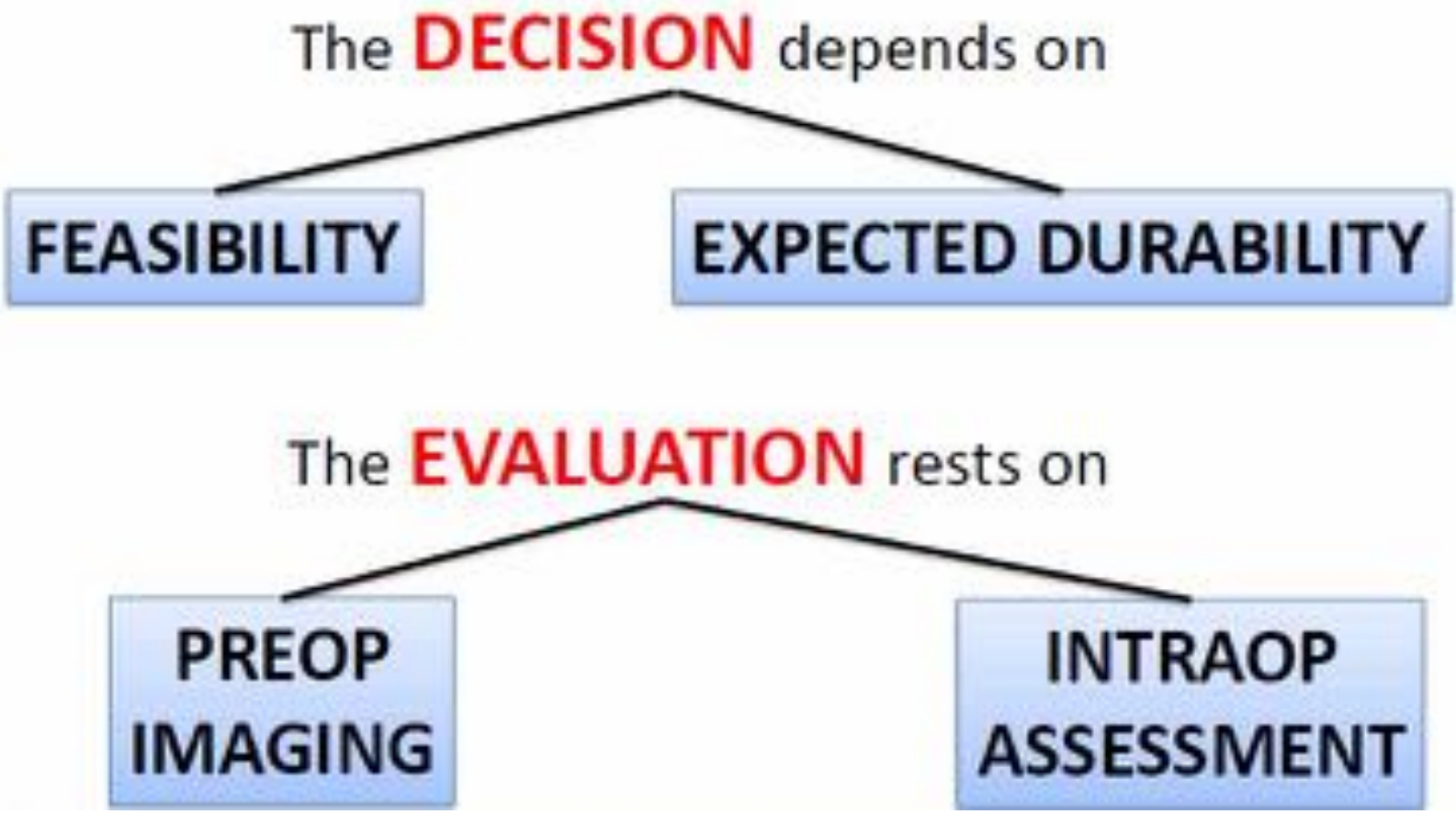
- Fibrosis,
- Calcuium,
- Redundancy



Reconstructive Technique: Patch Correction

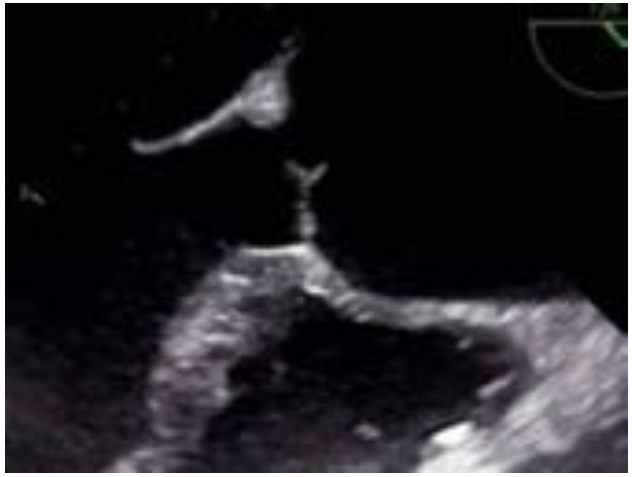
- Fenestration

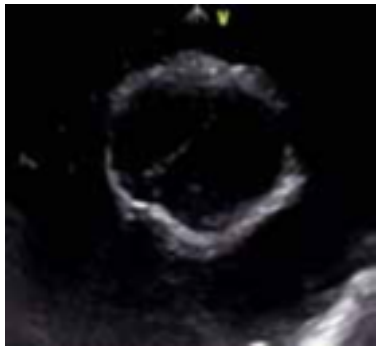
To Preserve or Not to Preserve?



Favorable ECHO Characteristics

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

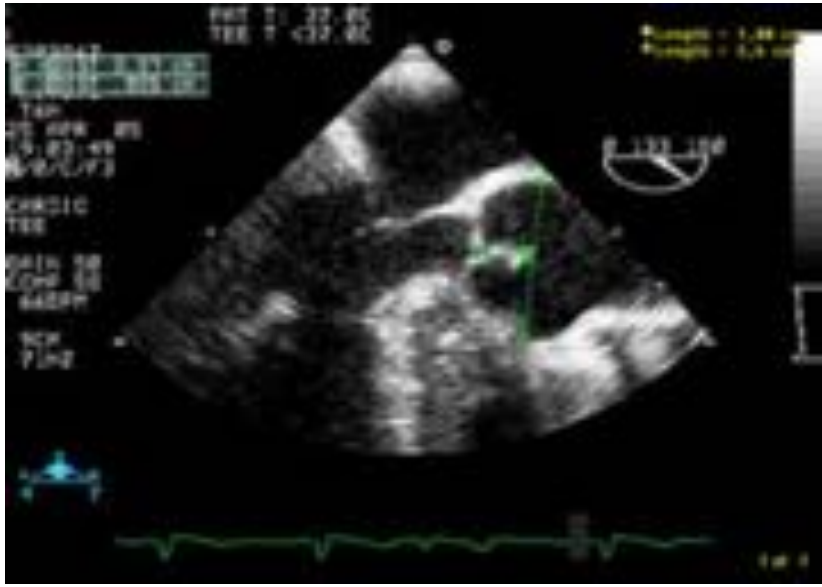




- **COMMISSURES (BAV)**
  - Close to symmetric
  - circumferential orientation 160-180°

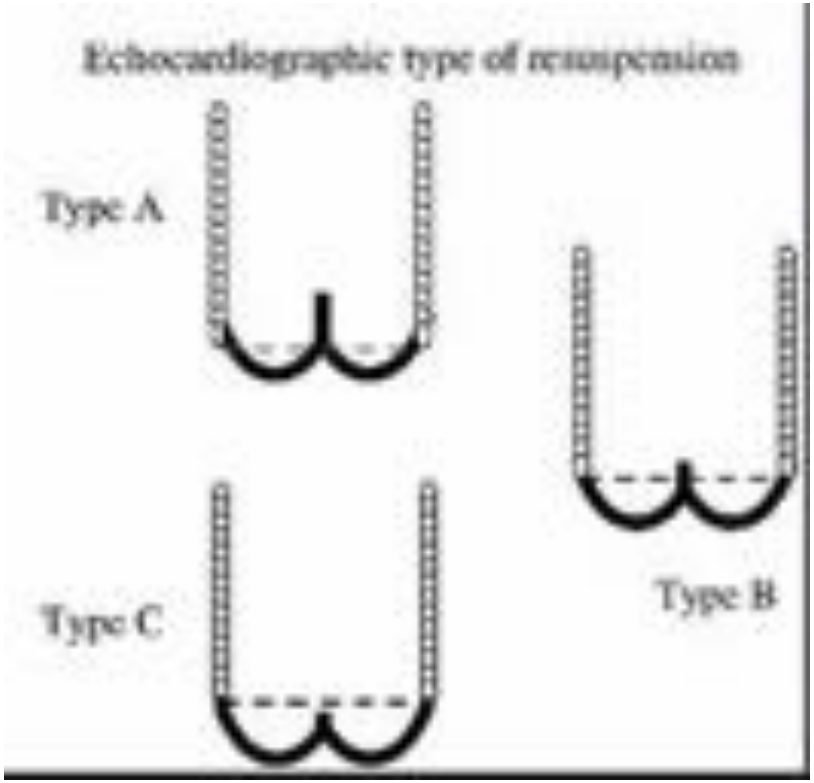
Optimal coaptation + Stabilisation

- Effective height (eH) ≥ 9 mm
- Coaptation length ≥ 4 mm
- No residual AR



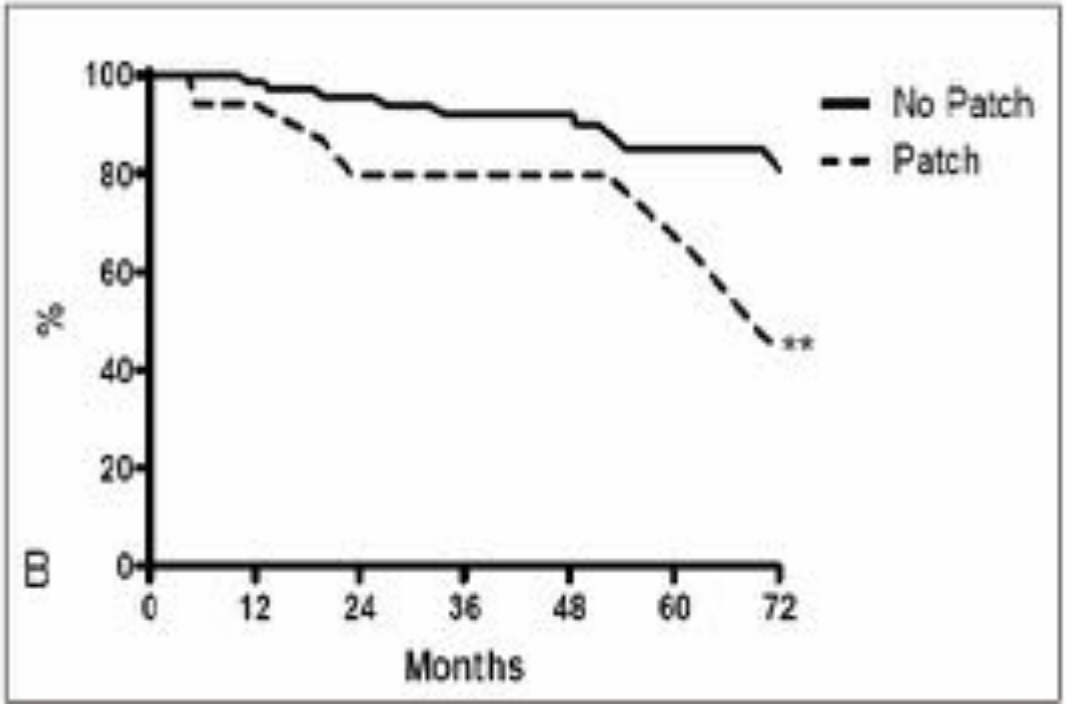
Pethig K. ATS 2002
le Polain de Waroux JB. JACC Card. Im. 2009
Bierbach BO. EJCTS 2010
Aicher D. Circ. 2011
De Kerchove L. JTCVS 2011

Relationship between height of resuspension of the reimplanted valve and occurence of postoperative aortic insufficiency



Pethig K. Ann Thorac Surg, 73:29-33, 2002

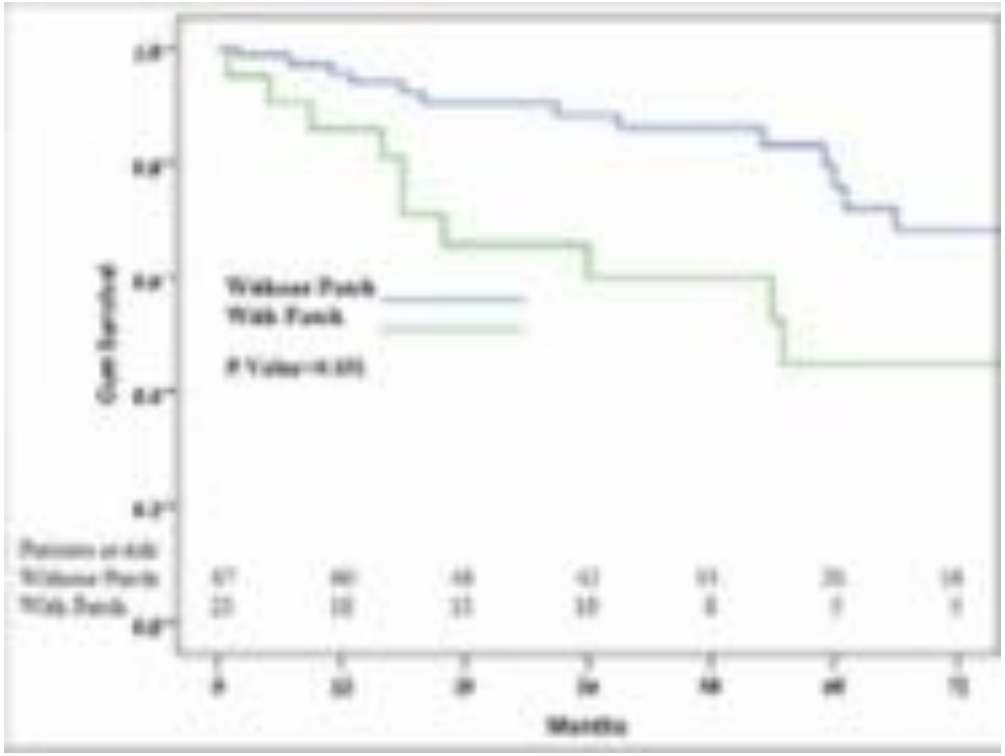
AVOIDANCE OF PATCH REPAIR

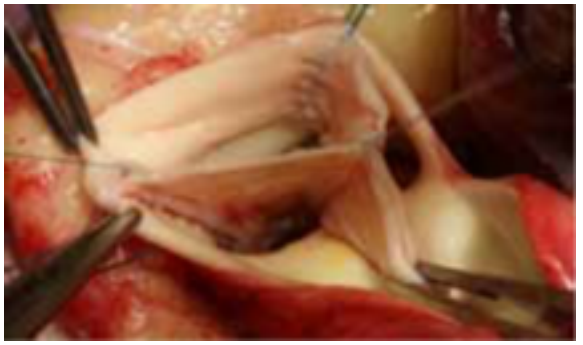


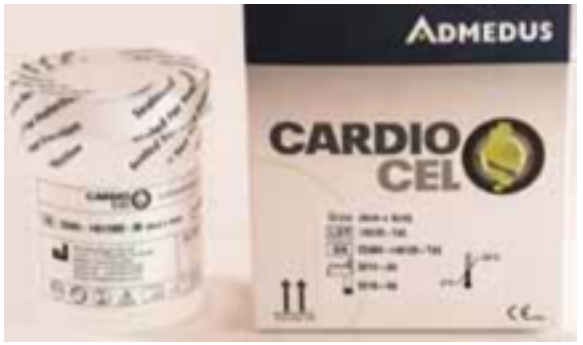
Boodhwani et al. JTCVS 2010

Pericardial Patch Augmentation

Other materials

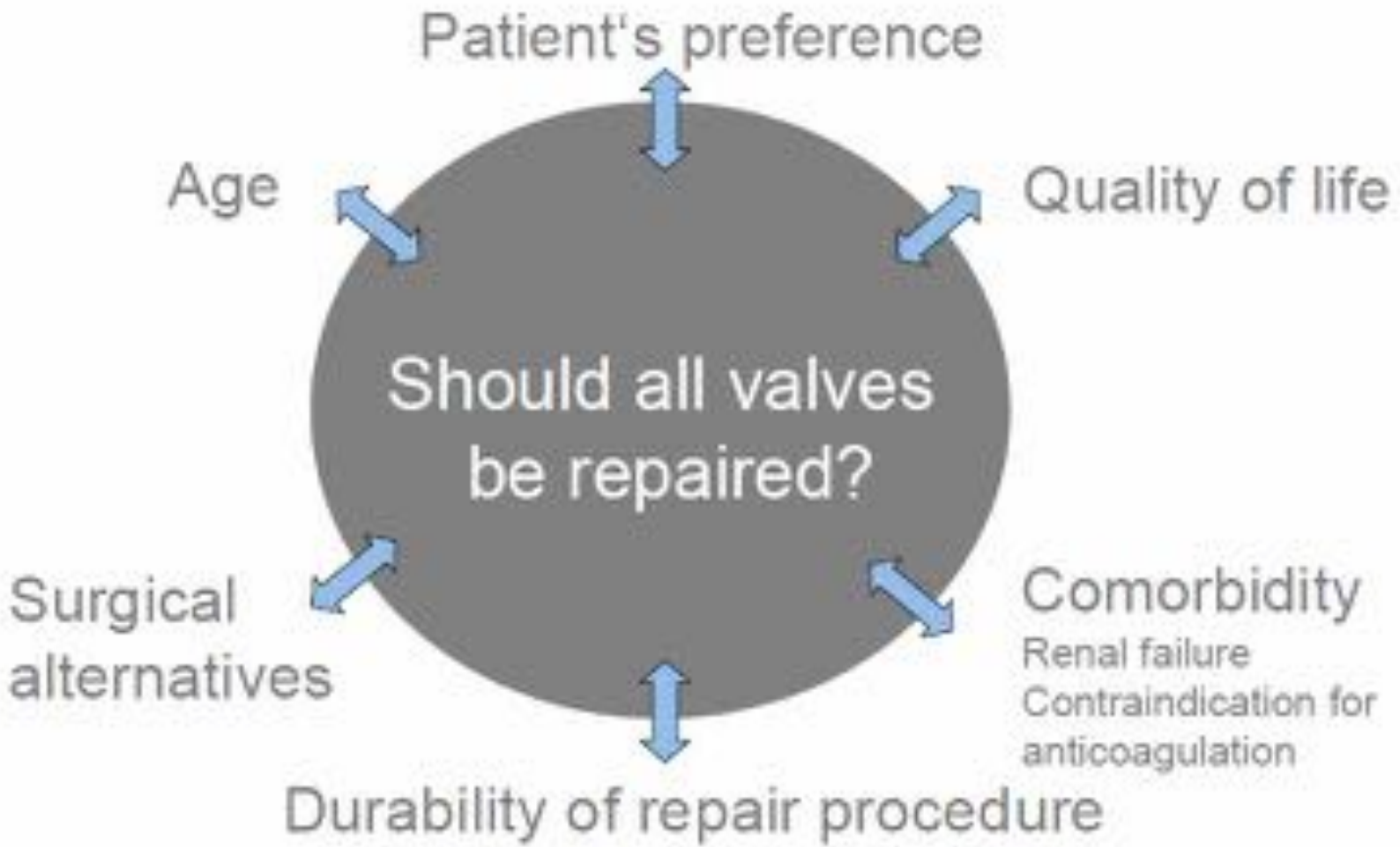




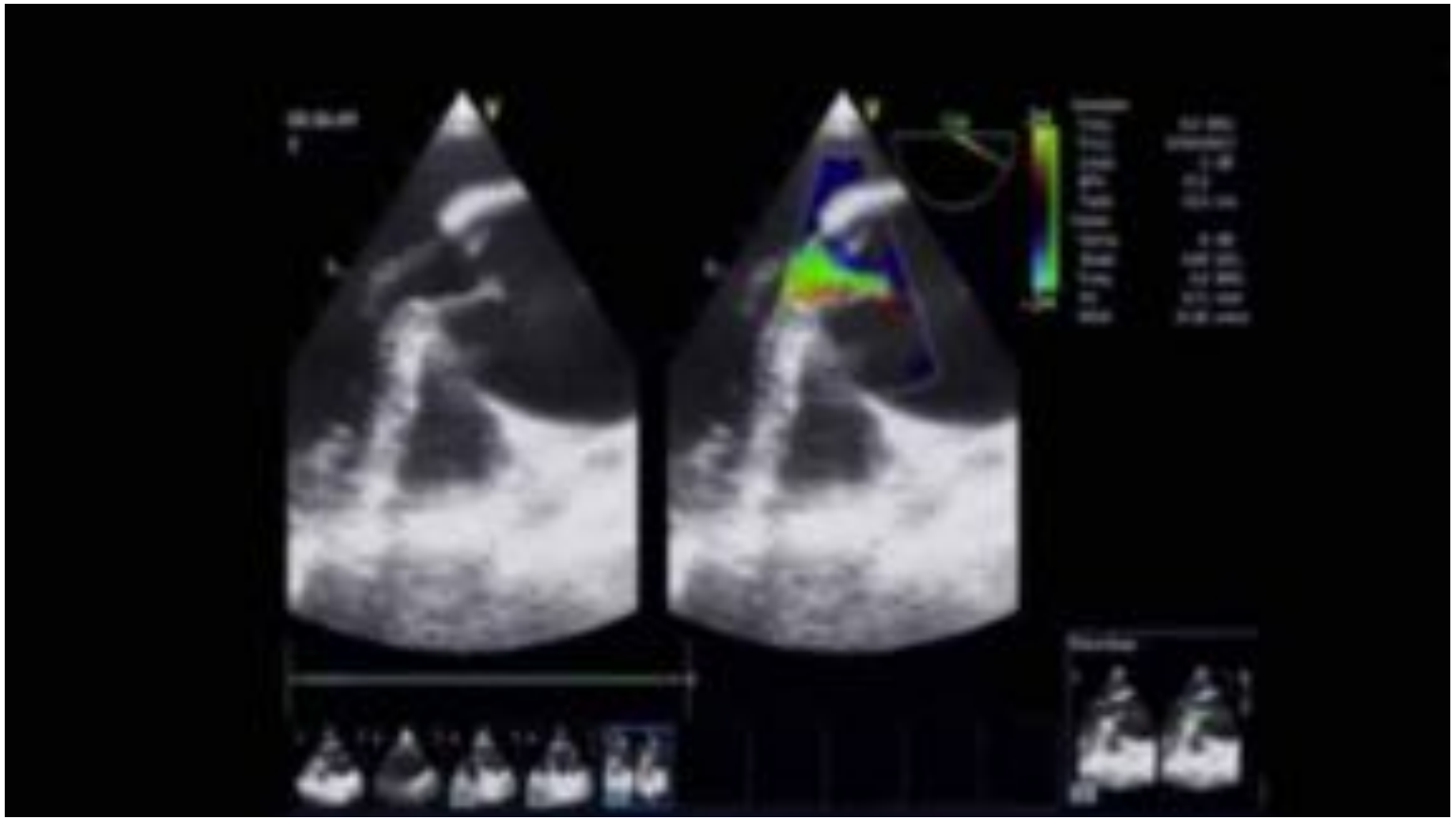


Presented at the EACTS 2016

Patient selection

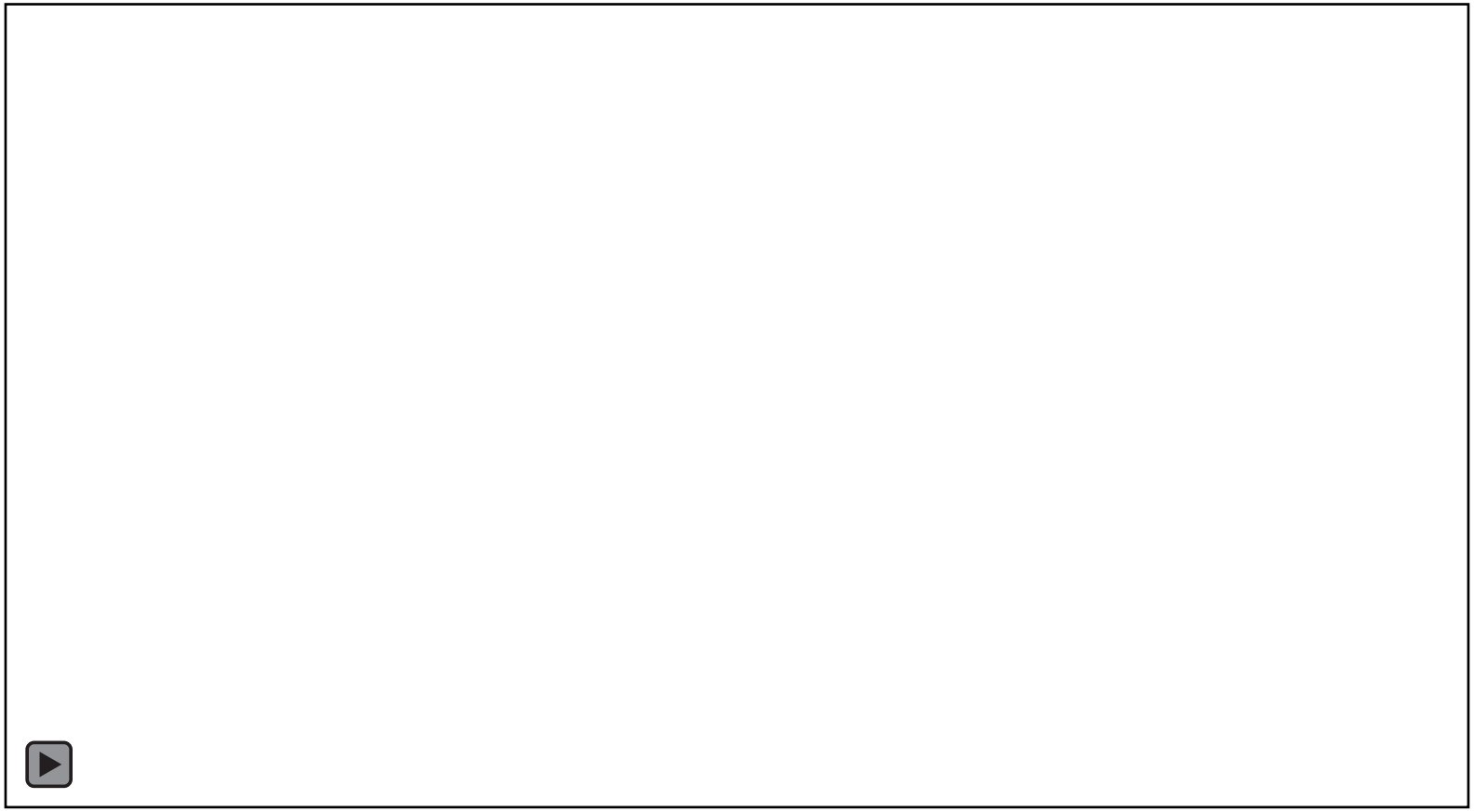


Root Remodeling+Annuloplasty+AV repair



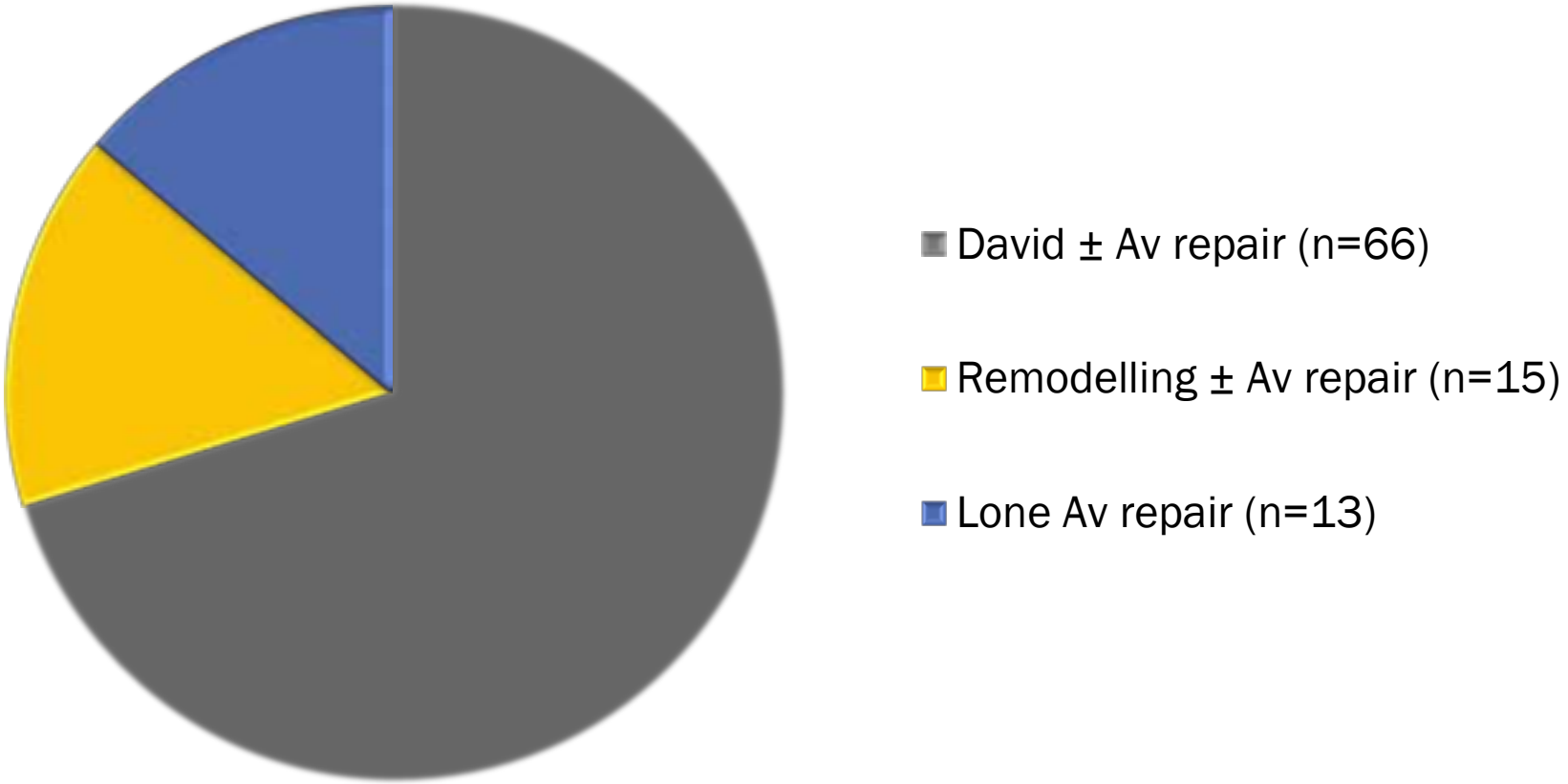
Bicuspid AV repair + Annuloplasty

AV repair + HAART annuloplasty ring



Av repair:
Our Experience 2006-2017: 94pts

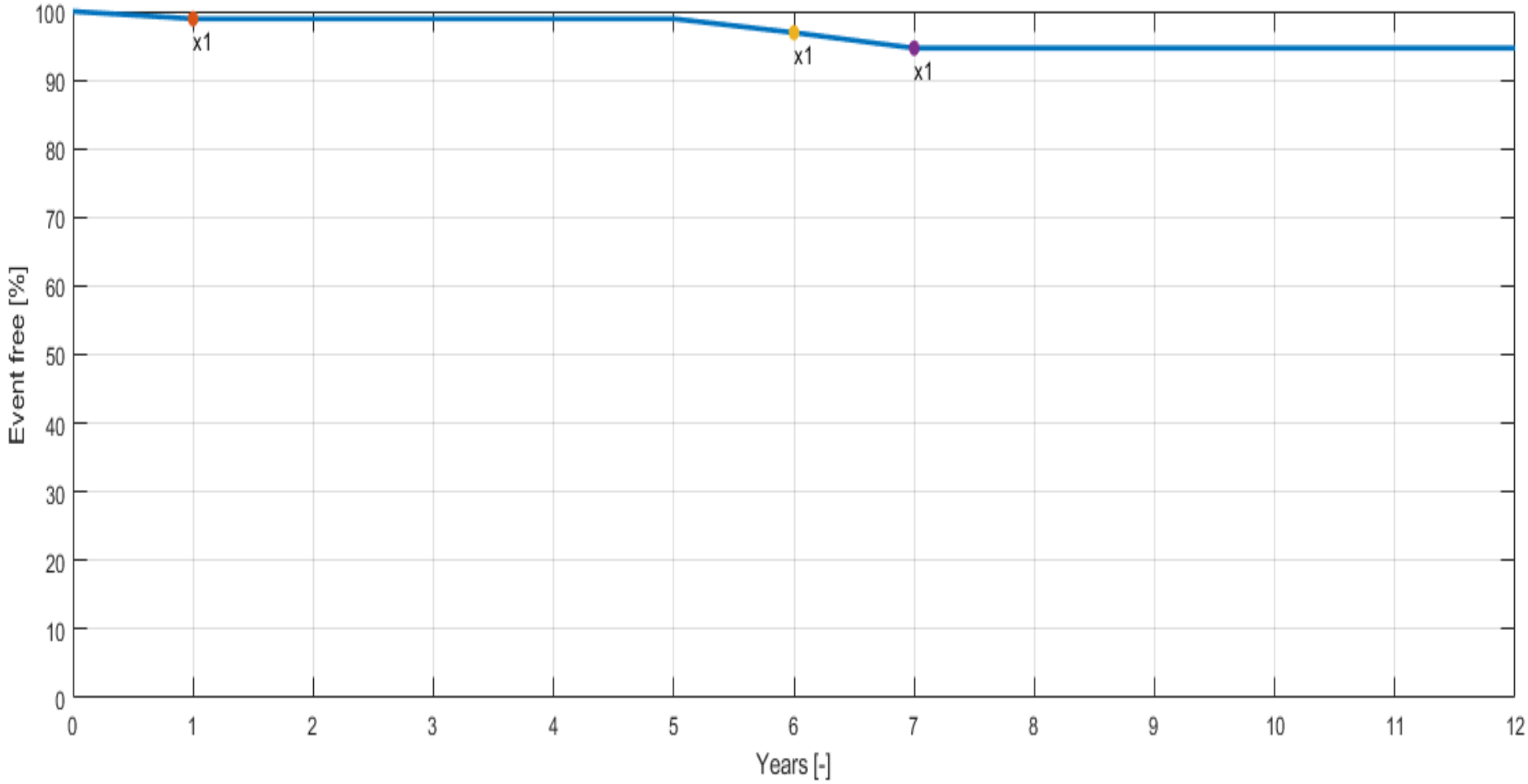
AORTIC VALVE REPAIR: 94 PATIENTS



Baseline characteristics 2006-2017 94pts

Patients number	94	-
Male	78	82,98%
Female	16	17,02%
Age (years)	57.71 ± 15.14	-
Smoke	35	37,23%
Family history of heart disease	25	26,60%
Family history of Marfan syndrome	7	7,45%
Coronary artery disease	11	11,70%
Dyslipidaemia	16	17,02%
Diabetes	2	2,13%
Arterial hypertension	53	56,38%
IRC	2	2,13%
Endocarditis	0	0,00%
Cerebrovascular disease	4	4,26%
Previous acute myocardial infarction	4	4,26%
NYHA class	1.86	-
EF	-	61,10% ± 6,64%
Bicuspid	15	15,96%

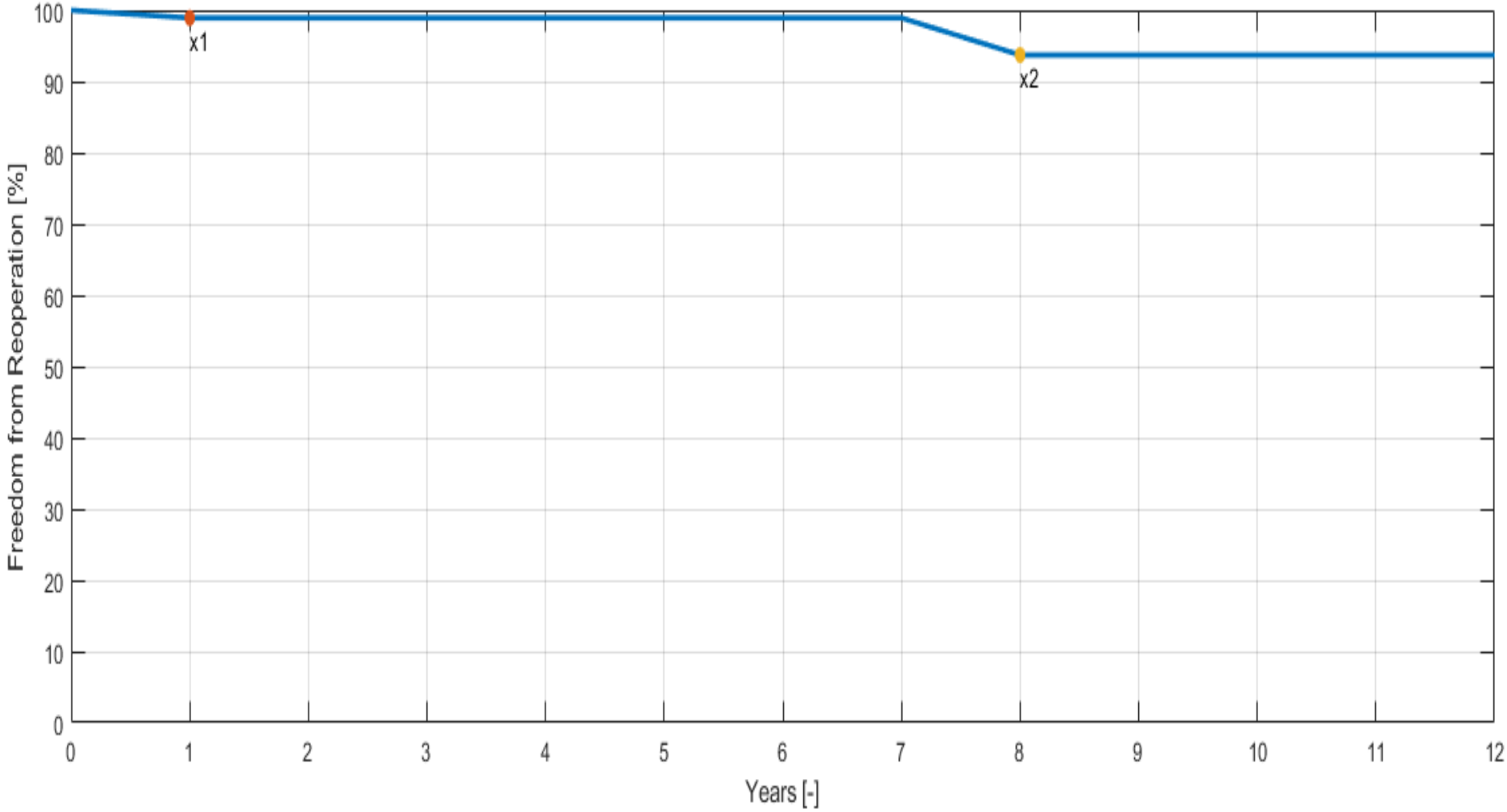
Freedom from re AI>2+



Patients at risk

94	79	73	61	56	49	43	36	30	21	12	2

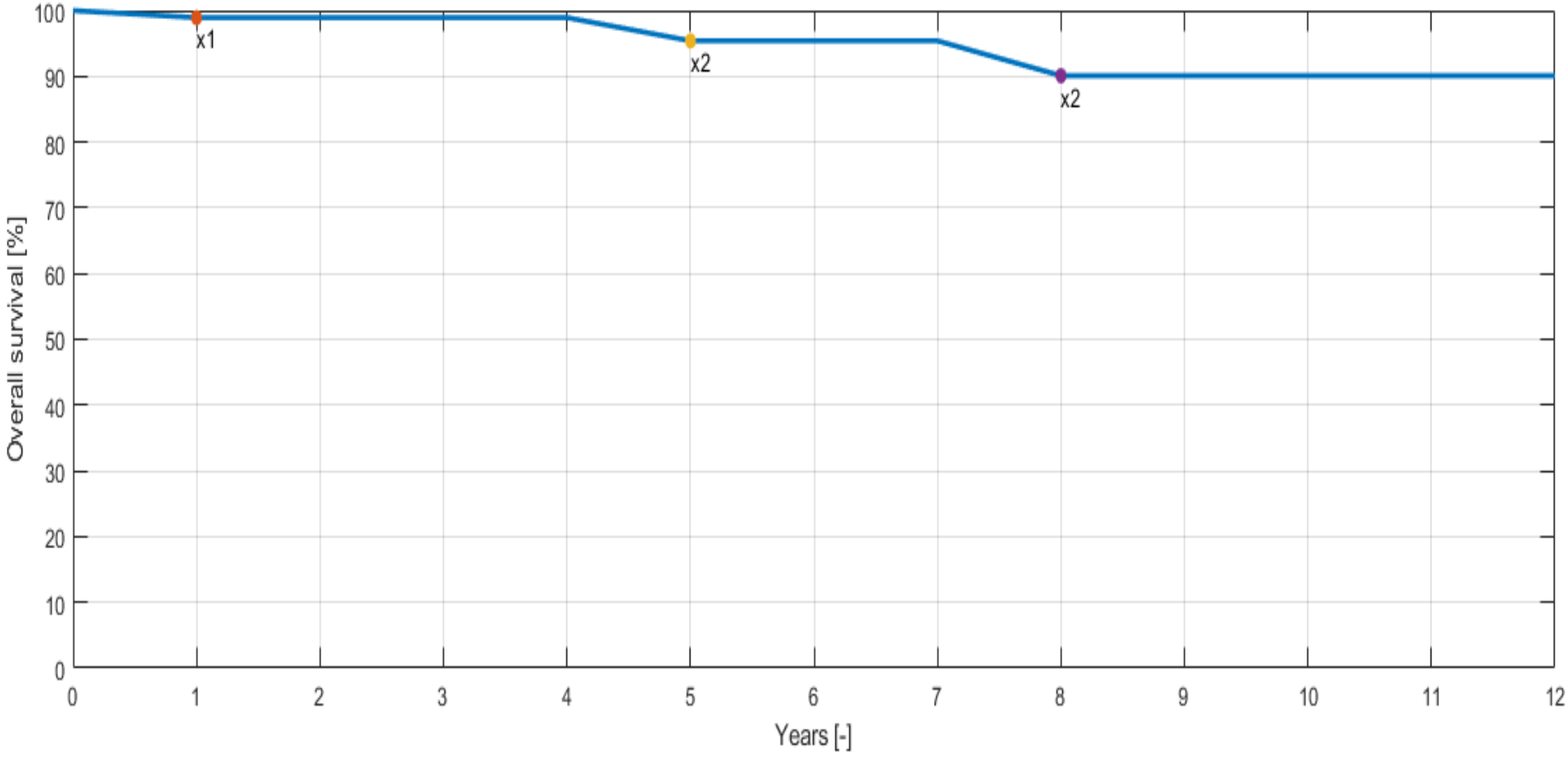
Freedom from Reoperation



Patients at risk

94	79	73	61	56	49	44	38	30	21	12	2

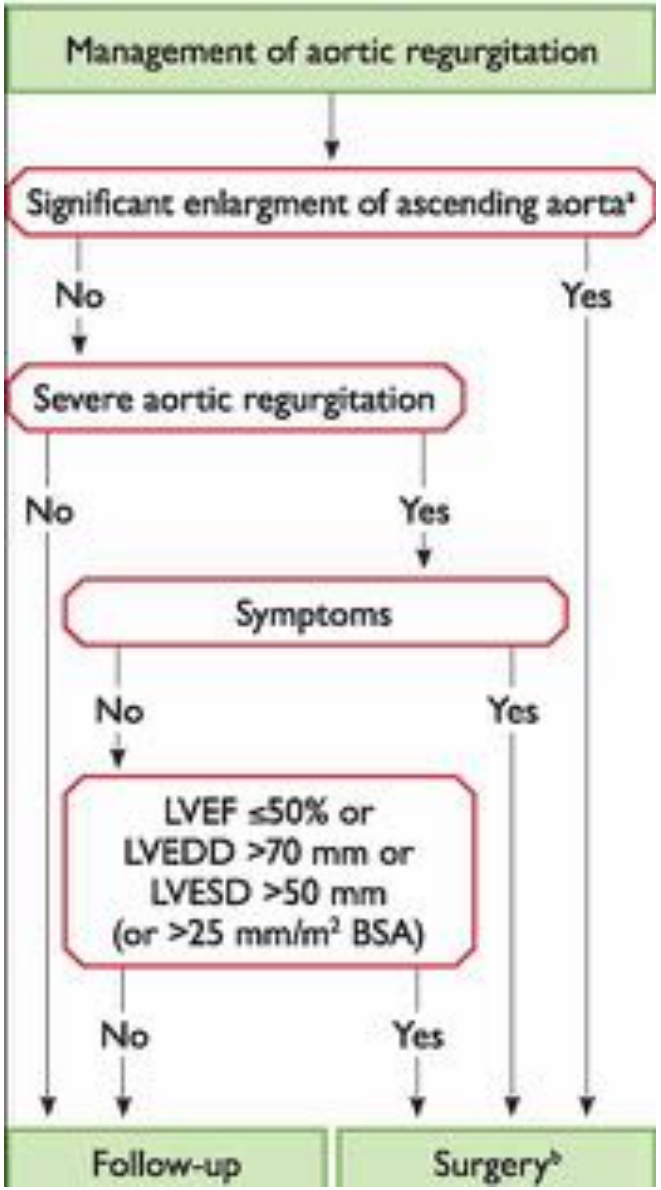
Overall survival



Patients at risk

94	79	73	61	56	47	42	36	26	18	11	2

ESC GUIDELINES 2017:



Indications for surgery	Class[c]	Level[c]
A. Severe aortic regurgitation		
Surgery is indicated in symptomatic patients.	I	B
Surgery is indicated in asymptomatic patients with resting LVEF <50%.	I	B
Surgery is indicated in patients undergoing CABG or surgery of the ascending aorta or of another valve.	I	C
Heart Team discussion is recommended in selected patients in whom aortic valve repair may be a feasible alternative to valve replacement.	I	C
Surgery should be considered in asymptomatic patients with resting ejection fraction >50% with severe LV dilatation: LVEDD >70 mm or LVESD >50 mm (or LVESD >25 mm/m² BSA in patients with small body size).	IIa	B
B. Aortic root or tubular ascending aortic aneurysm[d] (irrespective of the severity of aortic regurgitation)		
Aortic valve repair, using the reimplantation or remodelling with annuloplasty technique, is recommended in young patients with aortic root dilation and tricuspid aortic valves when performed by experienced surgeons.	I	C
Surgery is indicated in patients with Marfan syndrome who have aortic root disease with a maximal ascending aortic diameter ≥50 mm.	I	C
Surgery should be considered in patients who have aortic root disease with maximal ascending aortic diameter:	IIa	C
• ≥45 mm in the presence of Marfan syndrome and additional risk factors[e] or patients with a TGFBR1 or TGFBR2 mutation (including Loeys–Dietz syndrome).[f]	IIa	C
• ≥50 mm in the presence of a bicuspid valve with additional risk factors[e] or coarctation.	IIa	C
• ≥55 mm for all other patients.	IIa	C
When surgery is primarily indicated for the aortic valve, replacement of the aortic root or tubular ascending aorta should be considered when ≥45 mm, particularly in the presence of a bicuspid valve.[g]	IIa	C

Conclusions

1.Aortic valve repair is a valuable surgical option especially in patients with prolonged aniticipated life expectancy

2.Functional classification of AI and dedicated surgical instruments and devices have facilitated this procedure

3.Preoperative and Intraoperative Echocardiographic evaluation are essential to achieve successful repair

4.Intraoperative surgical valve analysis in a systematic approach avoiding “eyeballing” evaluations is mandatory

5.Intraoperative parameters are available to predict long term results

6.New tissue egineering materials may improve results also in complex leaflet extension surgery

Respect rather than Resect!