

Sutureless/Rapid-deployment AVR, TAVR and Aortic Valve Repair

Jung-Hwan Kim

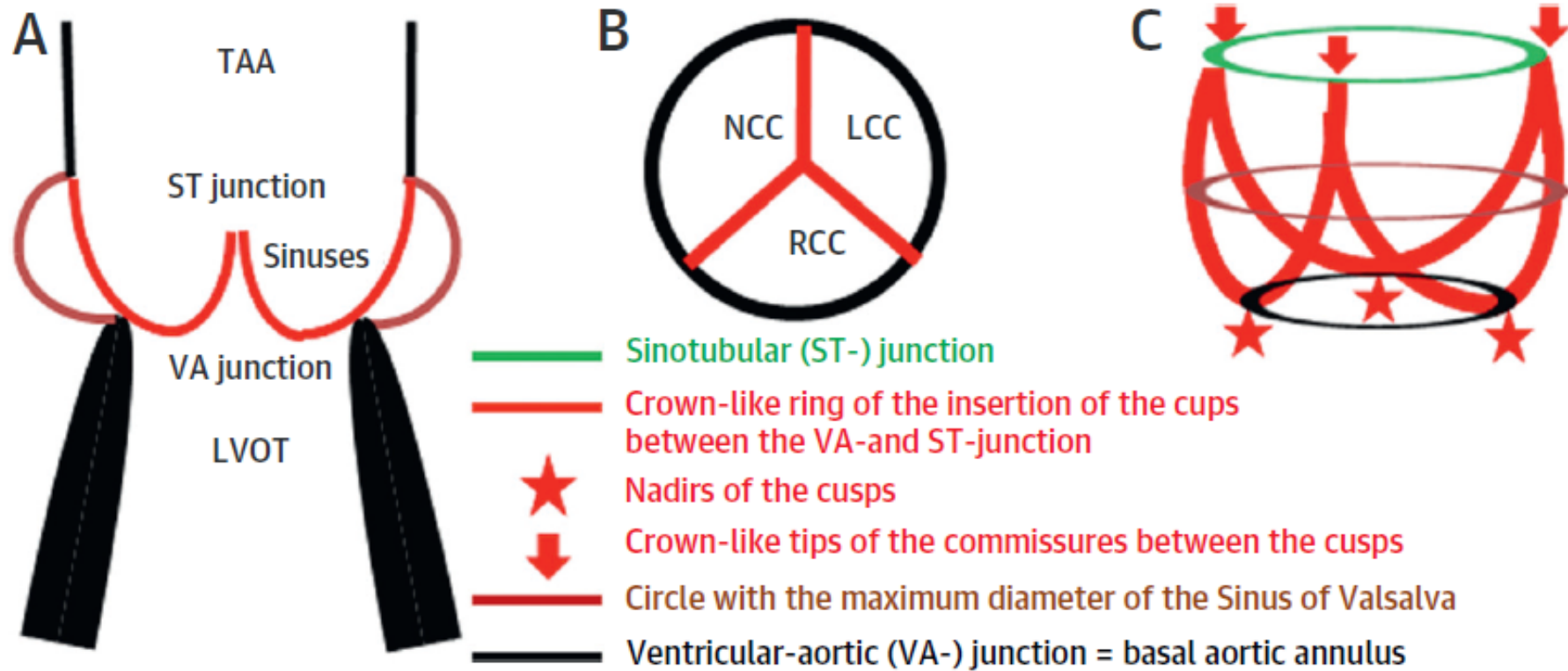
Division of Cardiovascular Surgery, Department of Thoracic and Cardiovascular Surgery,
Severance Cardiovascular Hospital, Yonsei University College of Medicine

Severance

Aortic Valve Repair

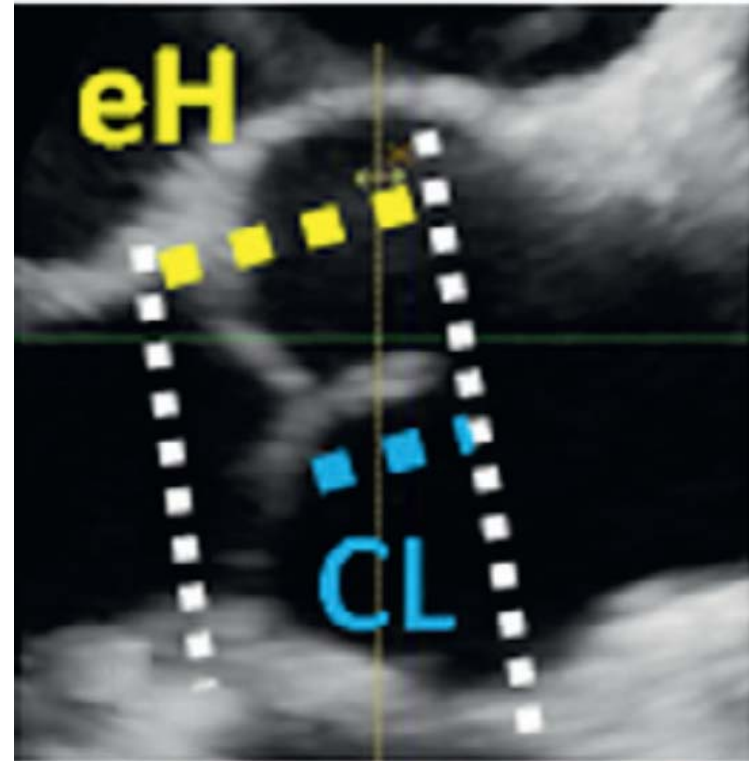
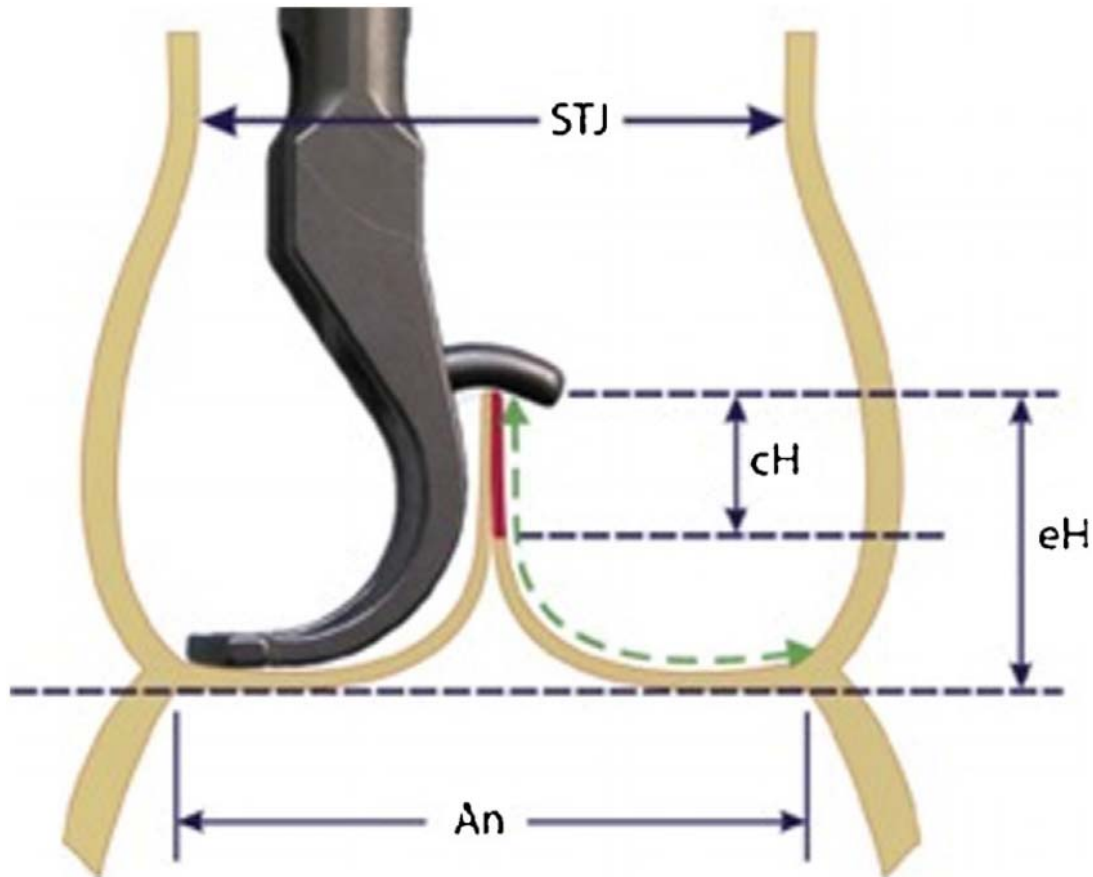
: Valve Sparing Root Replacement

Anatomy of aortic valve



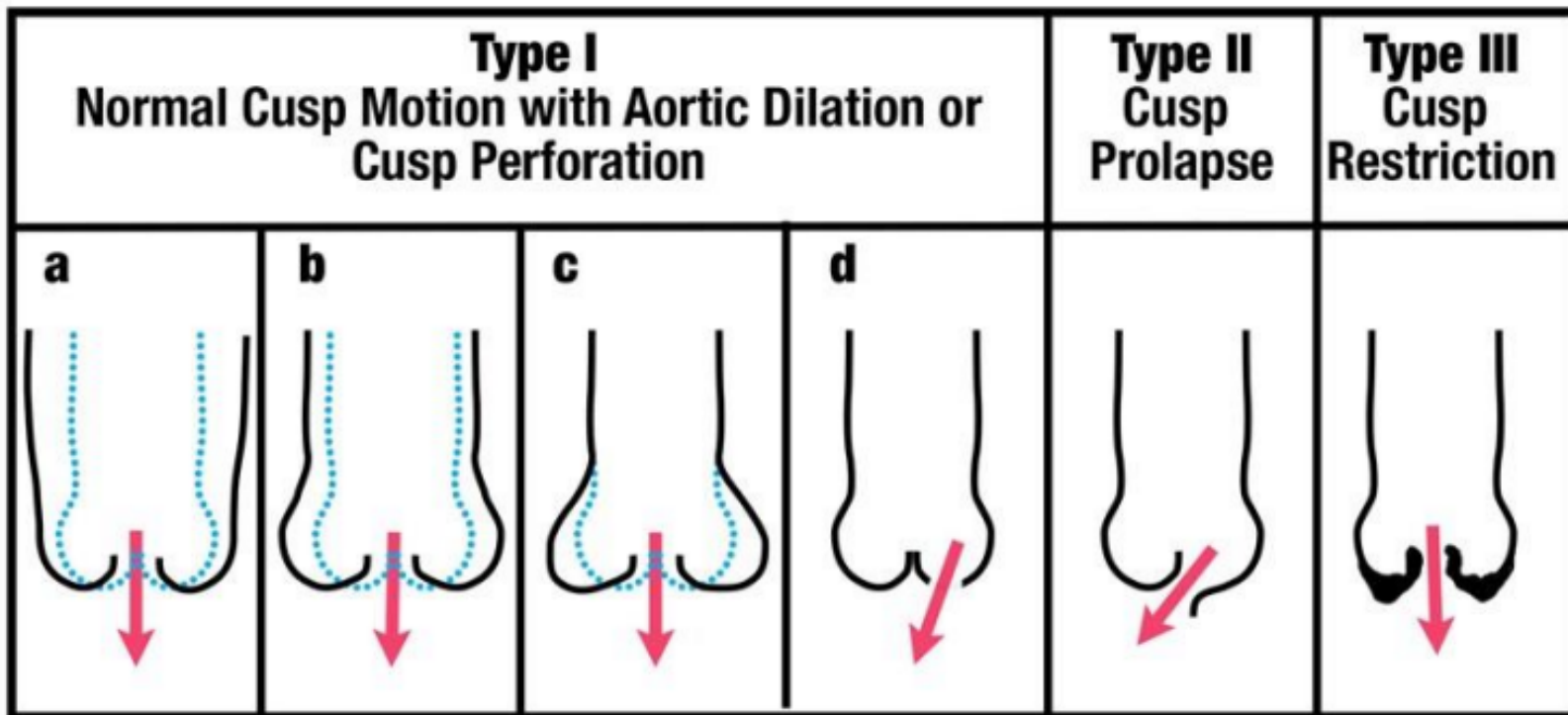
Andreas Hagendorff et al., *J Am Coll Cardiol Img* 2019;12:2225-44.

Anatomy of aortic valve



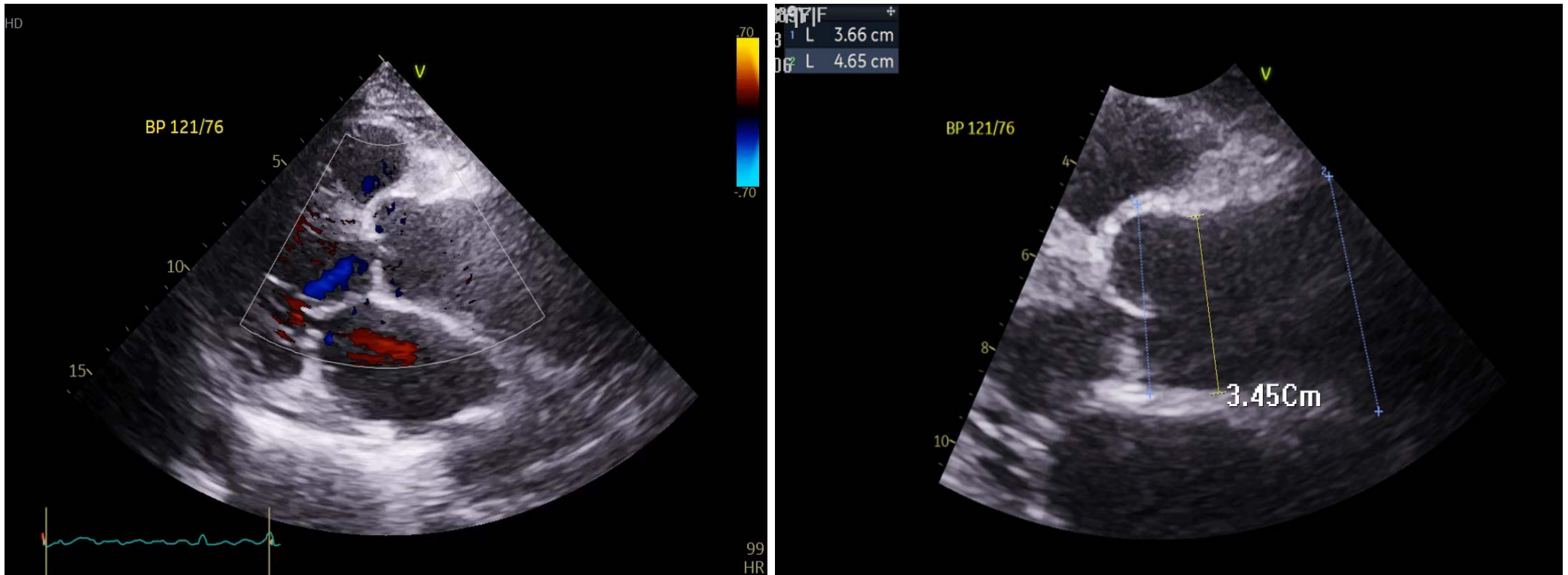
Rimmer L. et al, Heart Lung Circ. 2019;28:988-999.

Aortic regurgitation

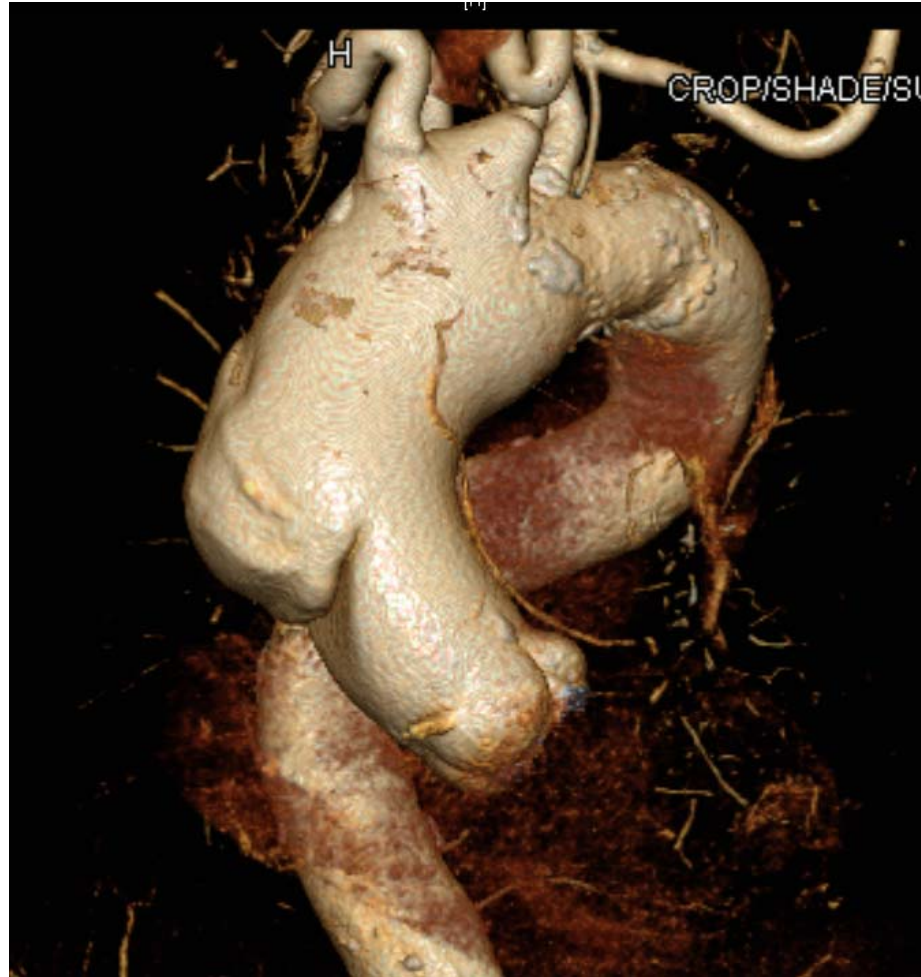


Zoghbi W et al. JASE 30: 303, 2017

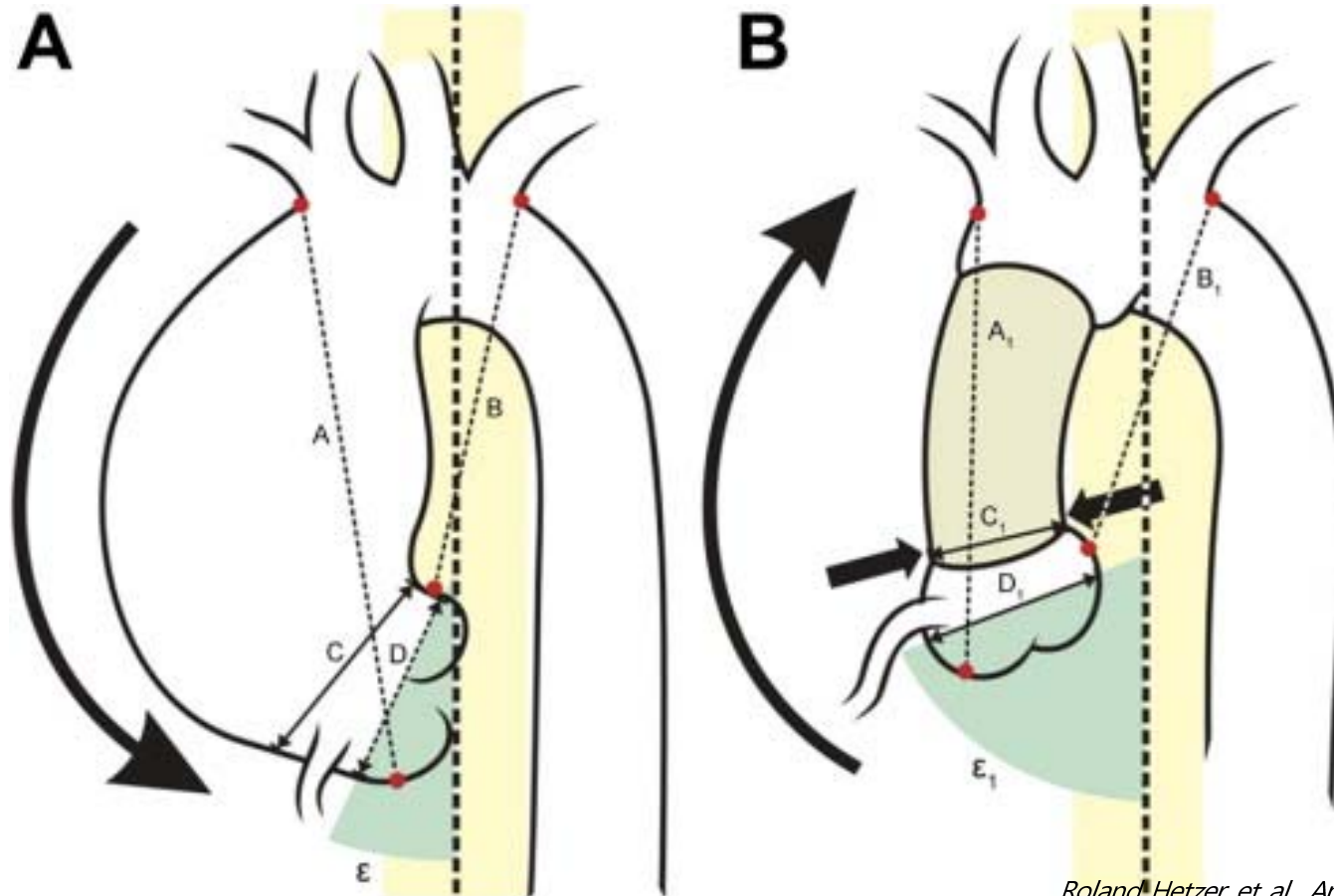
Type 1A AR



Type 1A AR

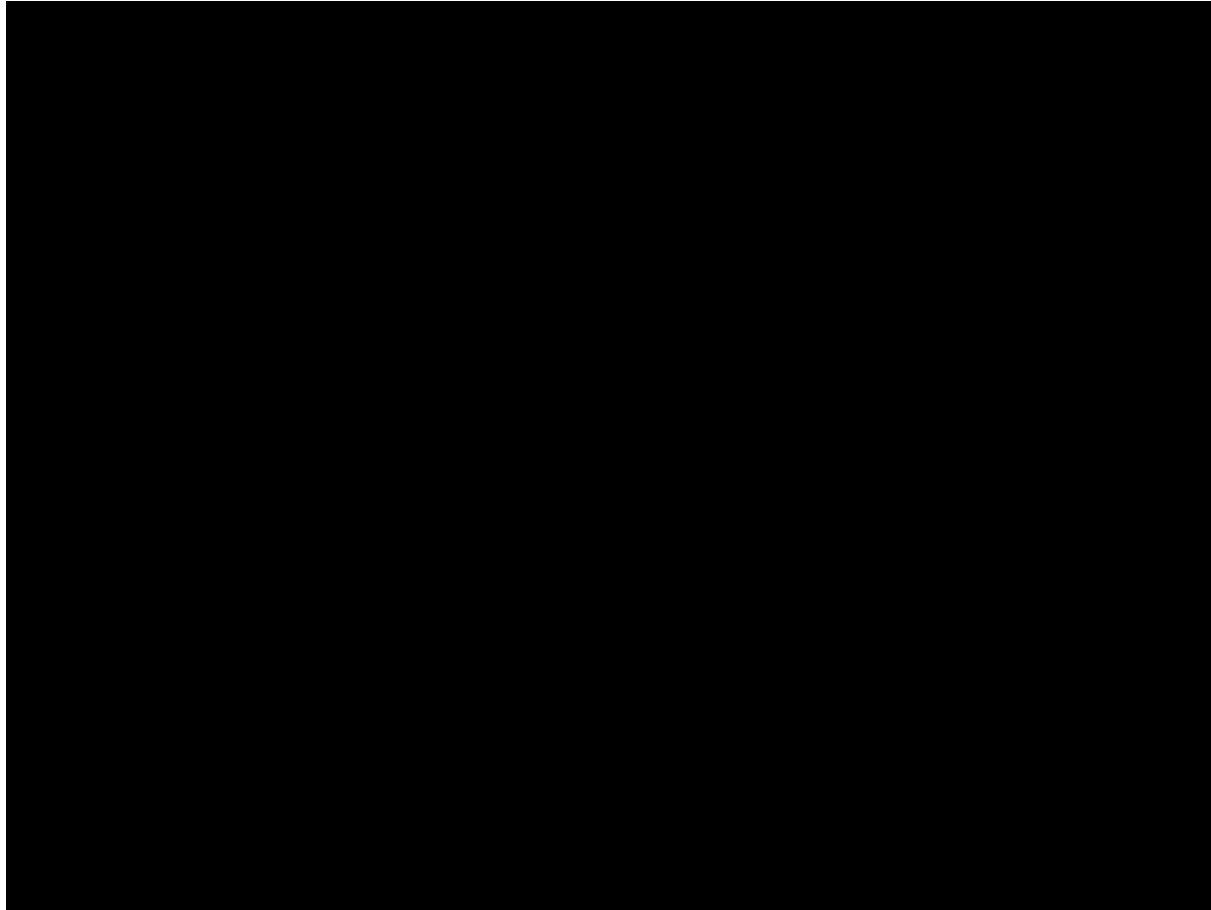


Type 1A AR: ST junction remodeling

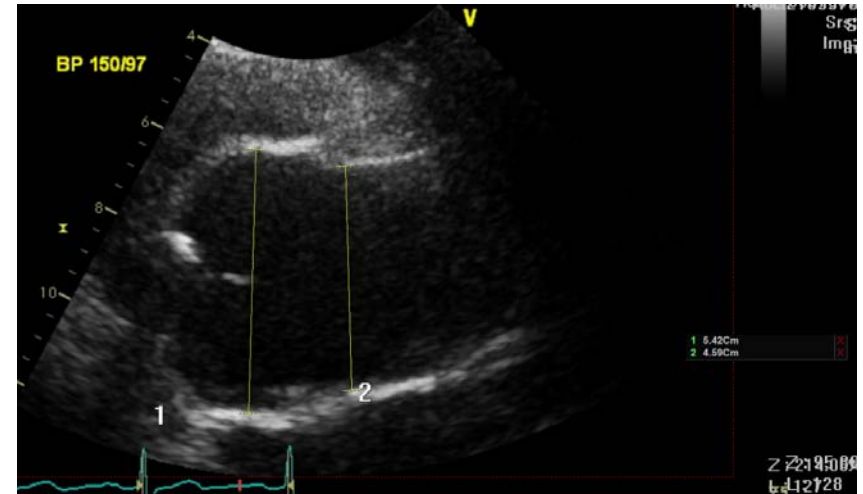
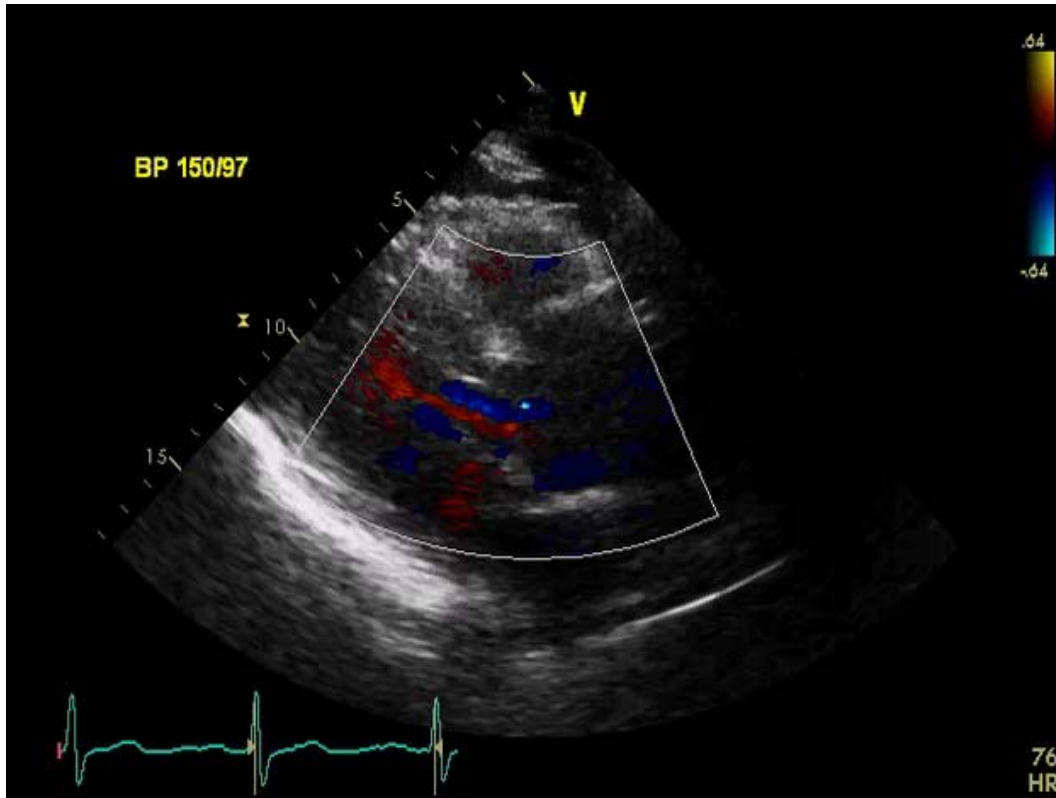


Roland Hetzer et al, *Ann Thorac Surg* 2012;94:1983-9.

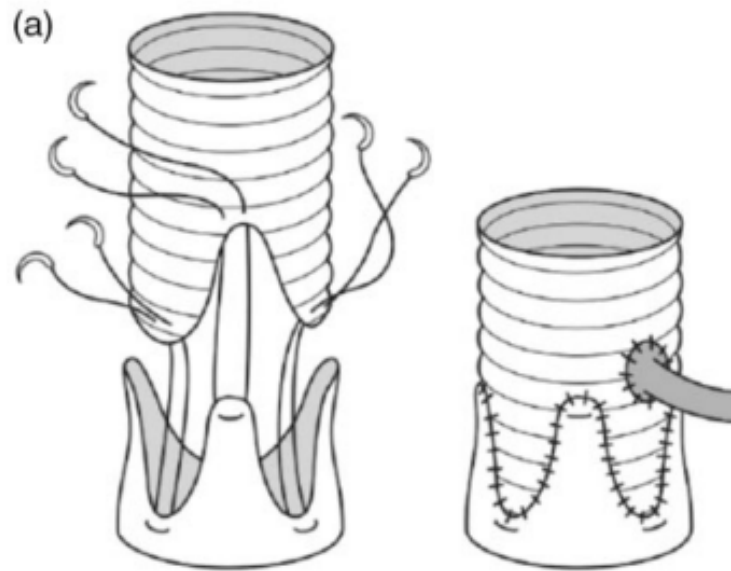
Type 1A AR: ST junction remodeling



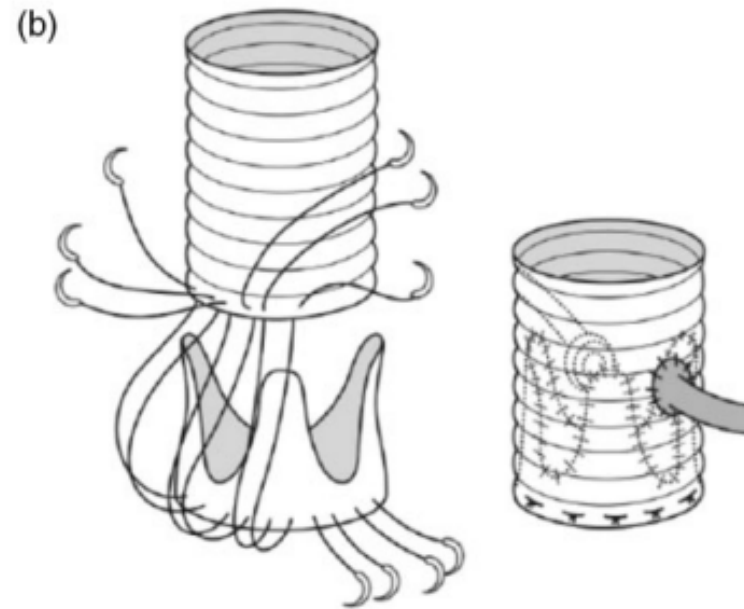
Type 1B AR



Type 1B AR: VSRR



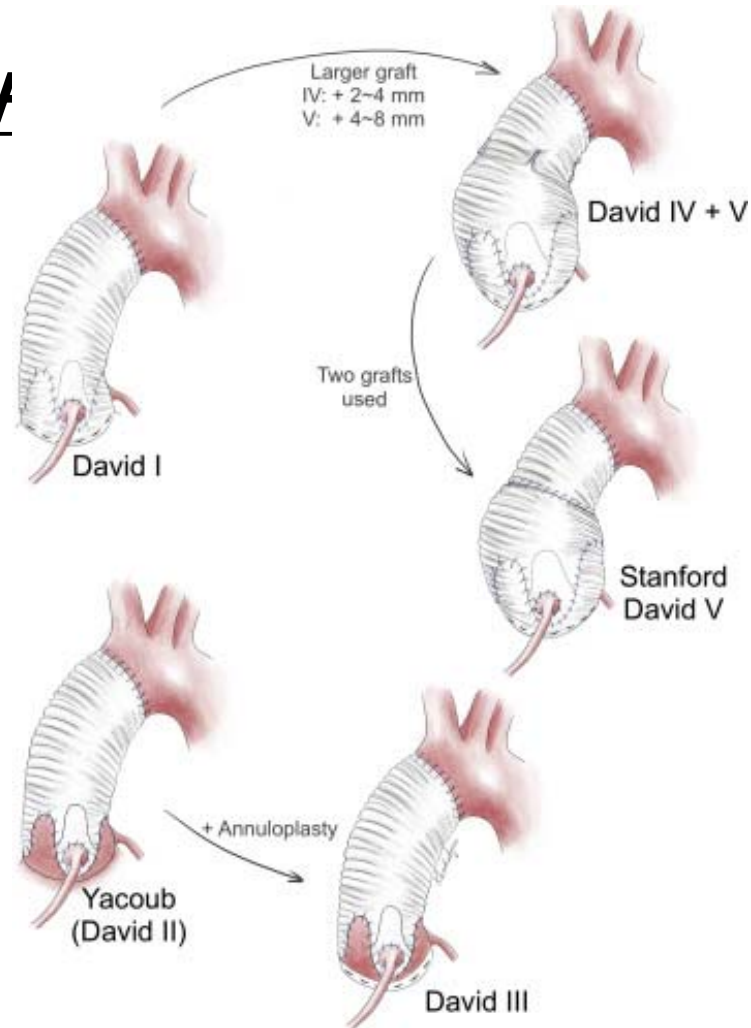
Aortic root remodeling



Aortic valve reimplantation

Shimizu H et al. Ann Thorac Cardiovasc Surg 2011;17:330–336.

Type 1B AR: VSRA



Zara Khachatryan et al, *J Thorac Cardiovasc Surg.* 2021 Apr 3:S0022-5223(21)00585-7.

Type 1B AR: VSRR

1 - The aortic root prepared

Type 1B AR: VSRR

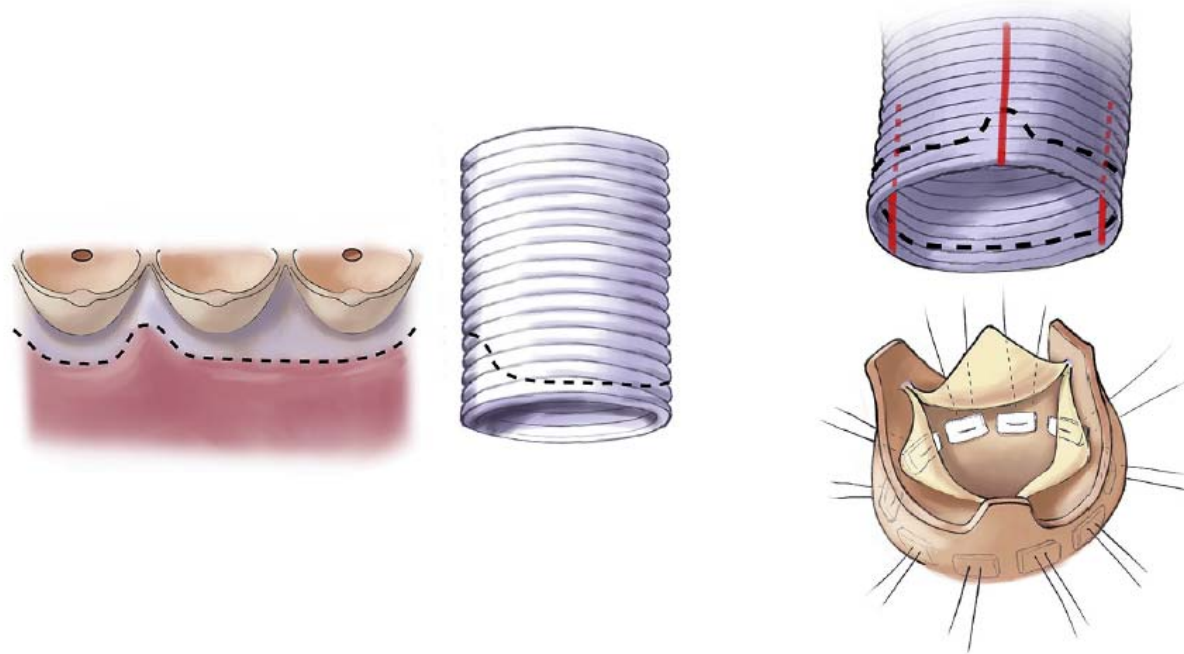


FIGURE 3. The aortic annuloplasty stitches are passed from the inside to the outside of the left ventricular outflow tract through a single horizontal plane except for the area of right coronary cusp, where it may have to be placed into its subcommissural triangles (*left panel*). The bundle of His should be avoided and that space left without a suture. These suture line must be spatially placed in the Dacron graft using the same spatial distribution as in the left ventricular outflow tract (*right panel*).

Tirone David. JTCVS Techniques 2021;7:72-8

Type 1B AR: VSRR

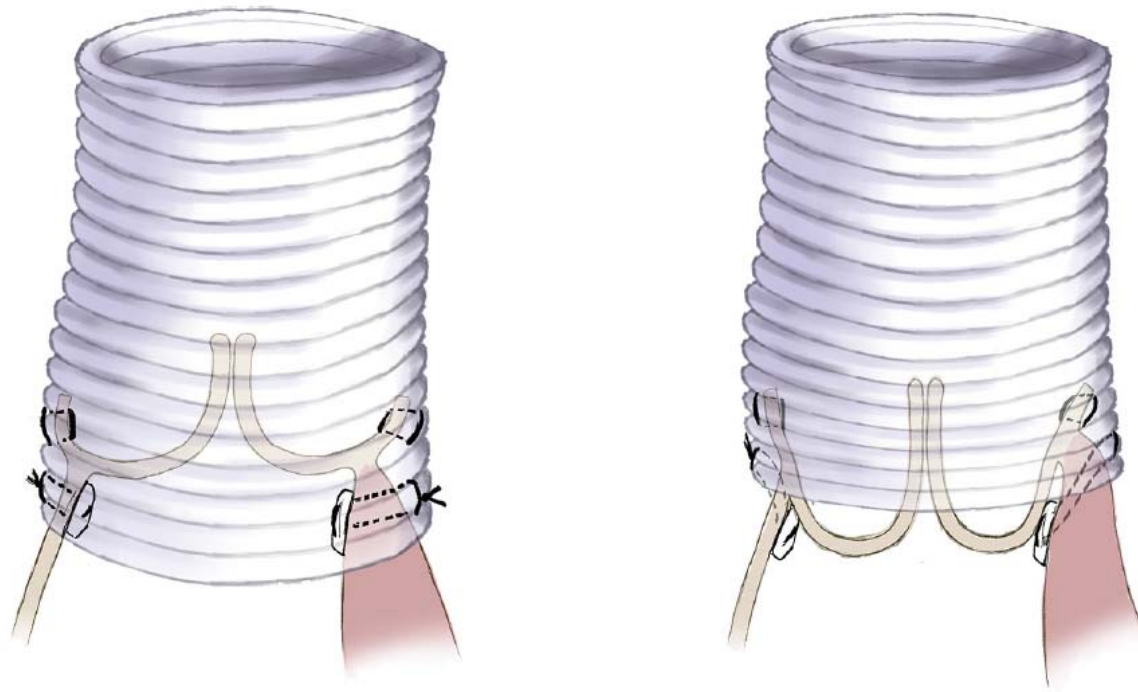


FIGURE 4. Once the annuloplasty is completed, the aortoventricular junction must lay inside the Dacron graft, as illustrated in the sketch on the *left panel*. If the graft lies at the same level as the aortic annulus or above it as shown on the *right panel*, early failure is likely to occur. This is largely due to inadequate dissection of the outflow tract and placement of the sutures.

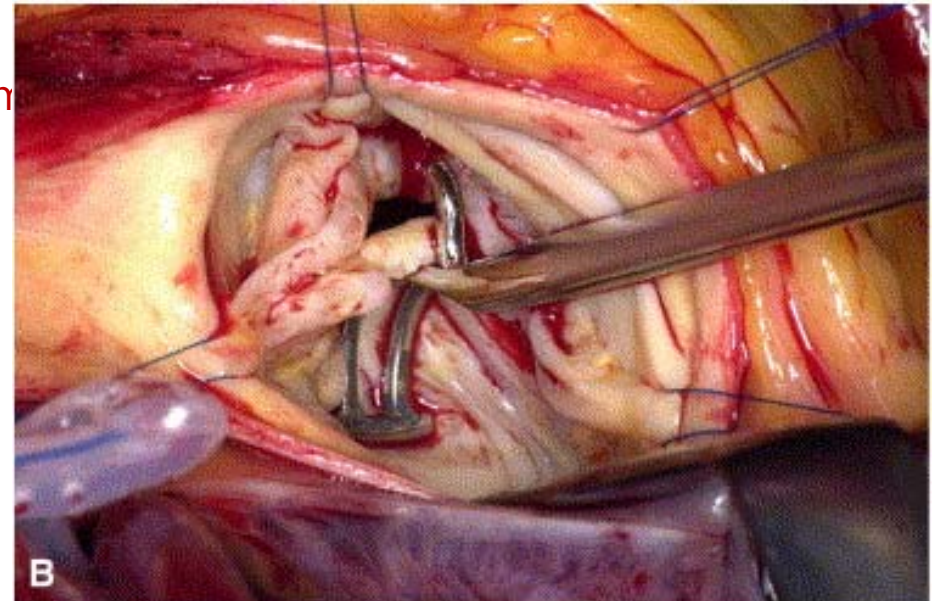
Tirone David. JTCVS Techniques 2021;7:72-8

Type 1B AR: VSRR

3 - Proximal end trimmed

Type 1B AR: VSRR

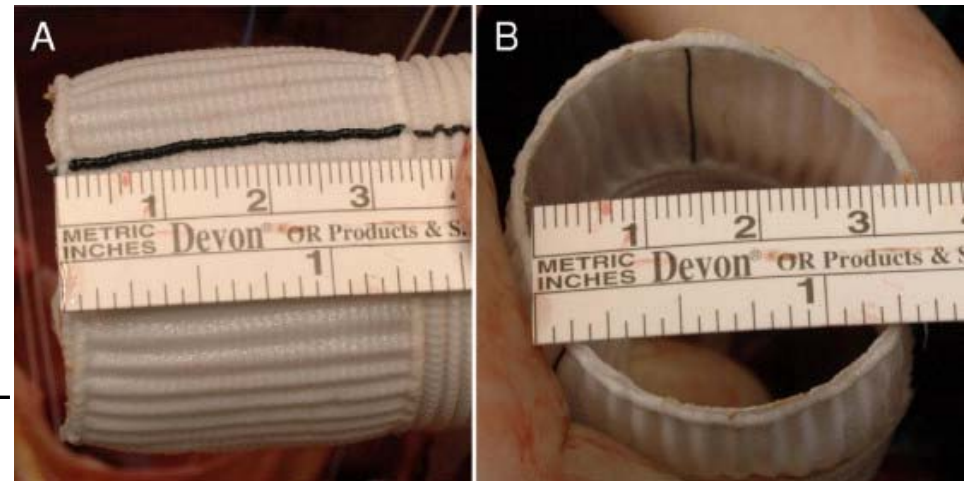
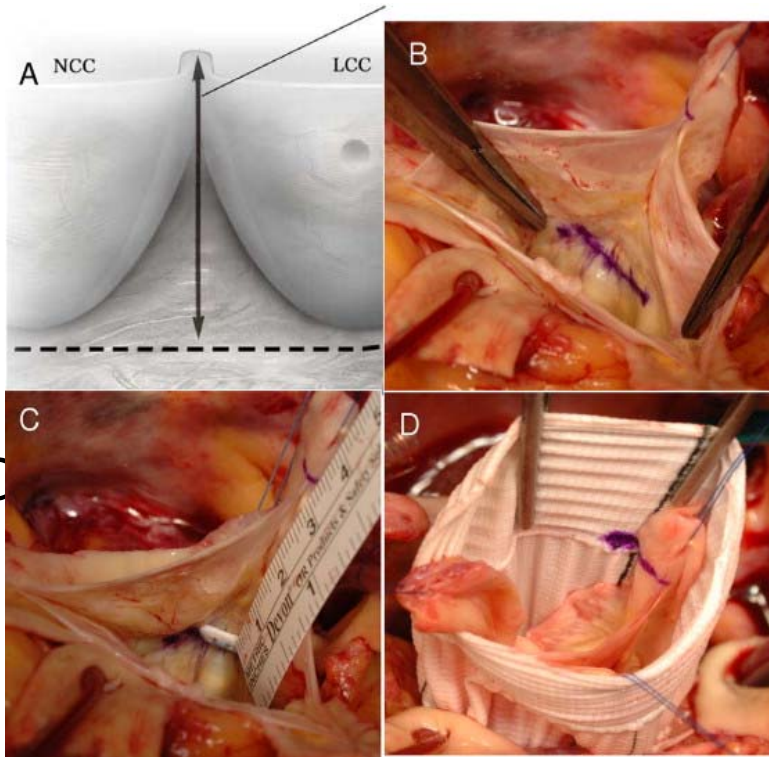
- Feindel-David formula
 - (leaflet height * 2/3 * 2) + (2 * thickness of the aortic wall)
 - Leaflet height=18mm
 - Internal radius=18*2/3*2=24mm
 - External diameter=24+4~6mm=28~30mm



Tirone David. JTCVS Techniques 2021;7:72-8

Type 1B AR: VSRR

- El Khoury technique

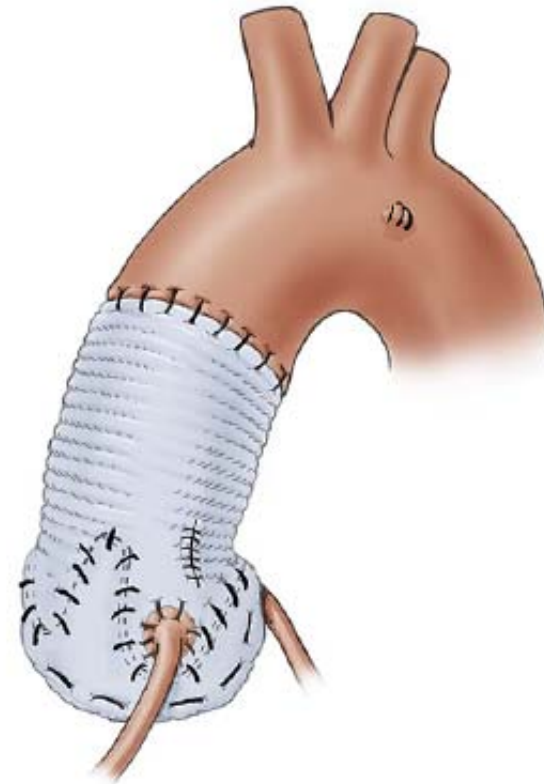
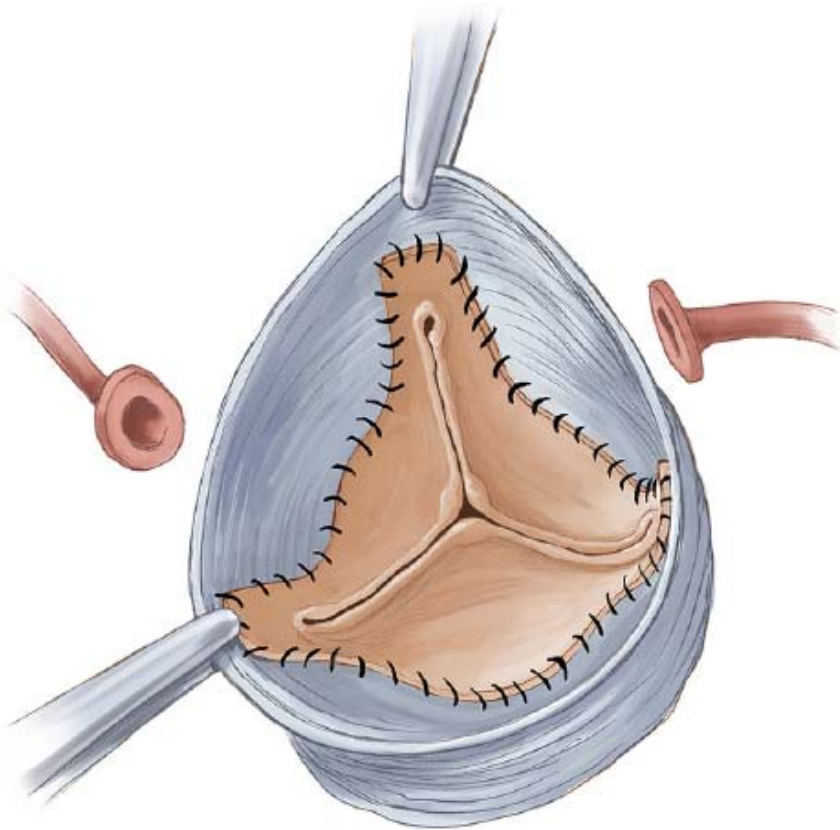


De Kerchove L et al, Ann Thorac Surg. 2011;92(2):749-751.

Type 1B AR: VSRR

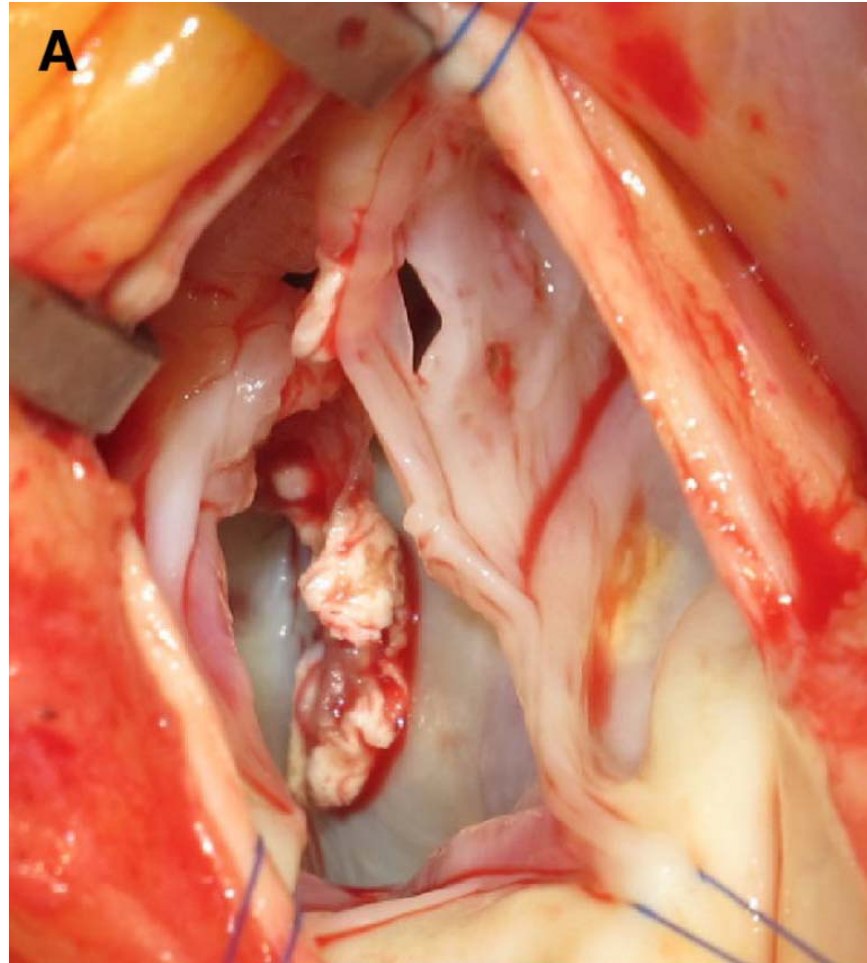
4 - Reimplantation at the level of
sinotubular junction

Type 1B AR: VSRR



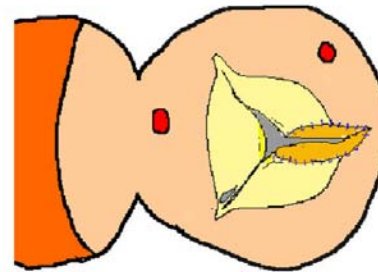
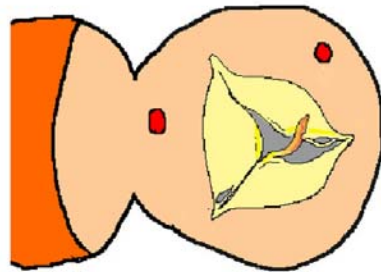
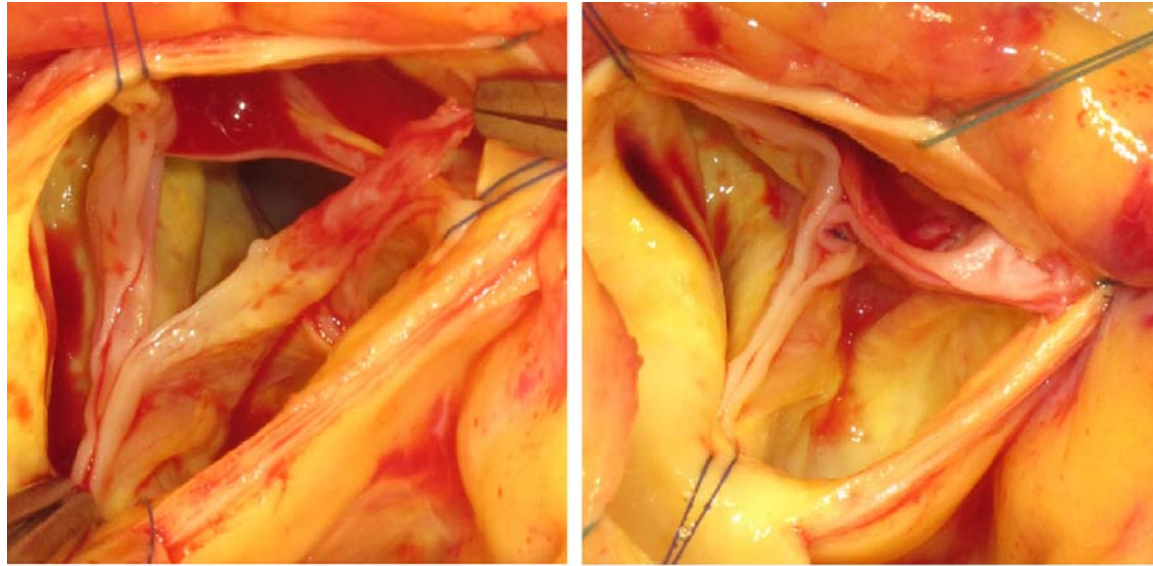
Tirone David. JTCVS Techniques 2021;7:72-8

Type 1D AR



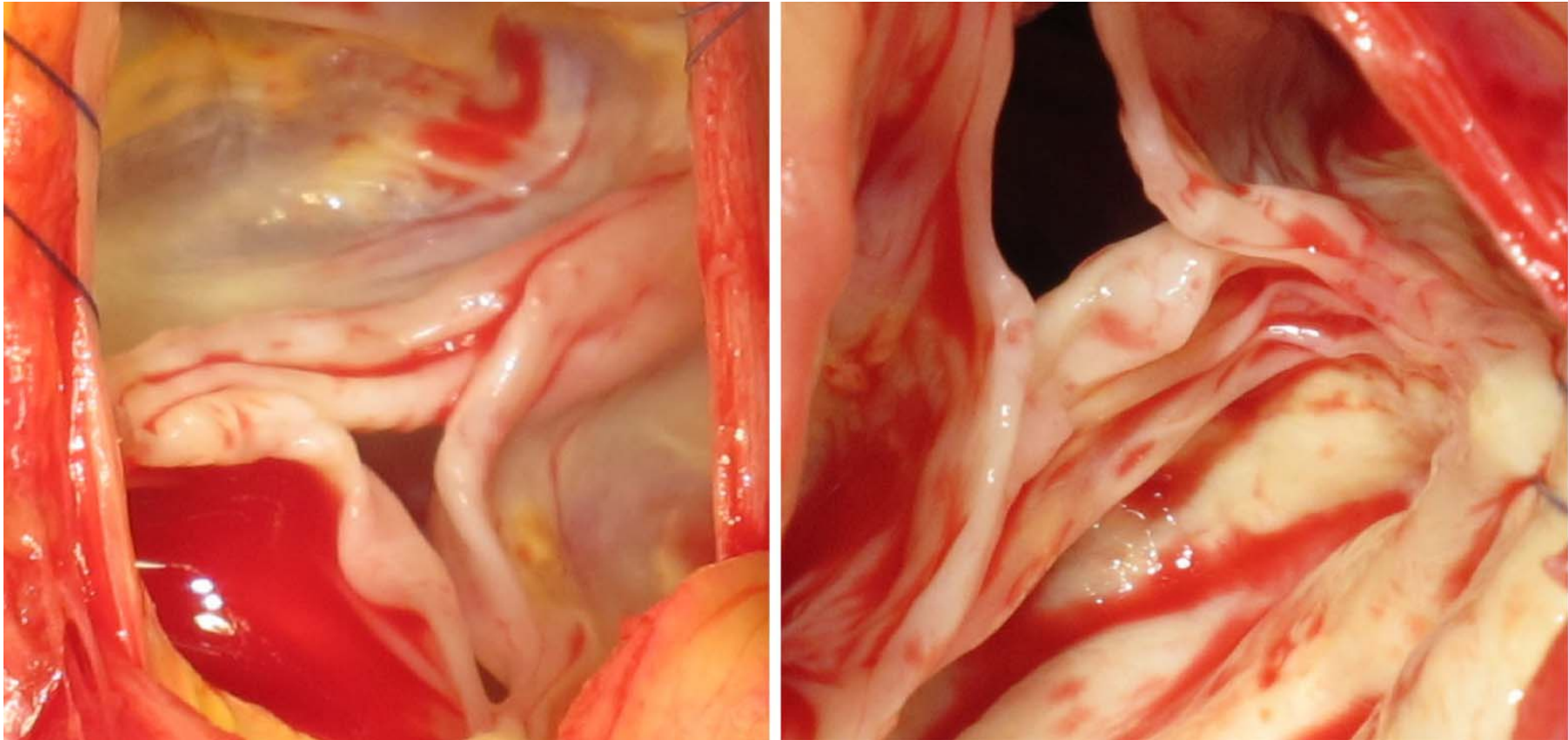
Tatsuhiko Komiya. Gen Thorac Cardiovasc Surg 2015;63:309–319.

Type 1D AR: Patch repair



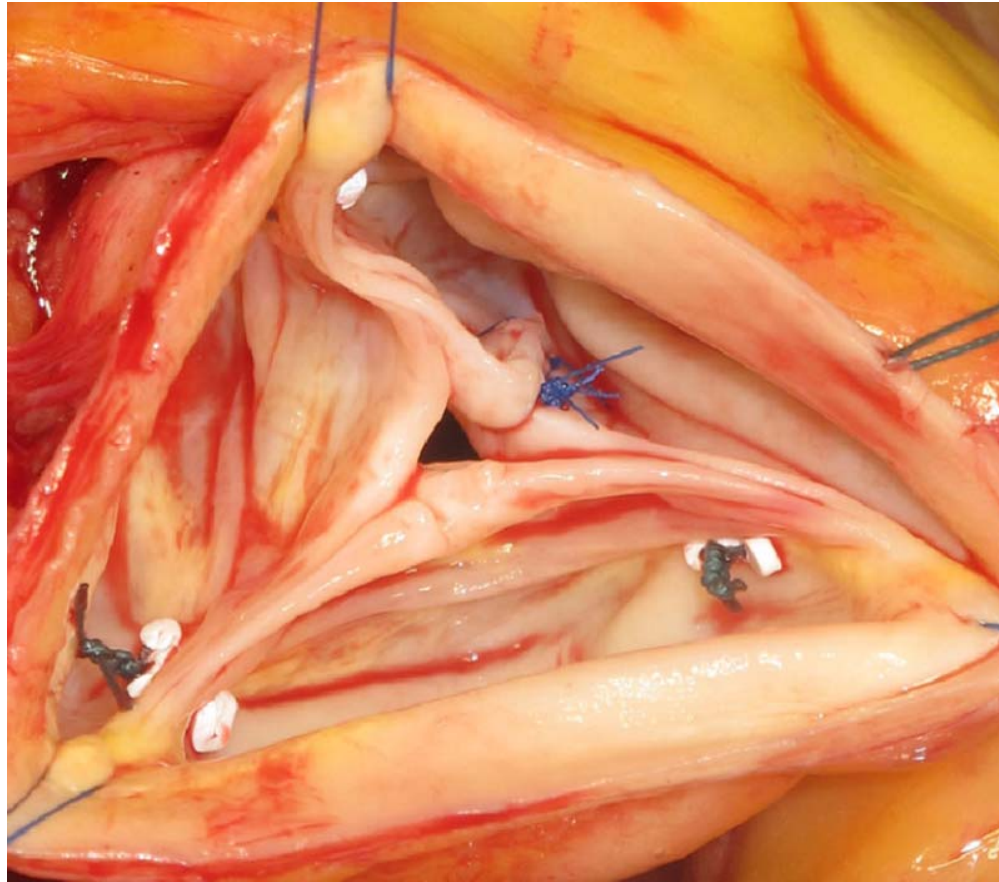
Tatsuhiko Komiya. *Gen Thorac Cardiovasc Surg* 2015;63:309–319.

Type 2 AR



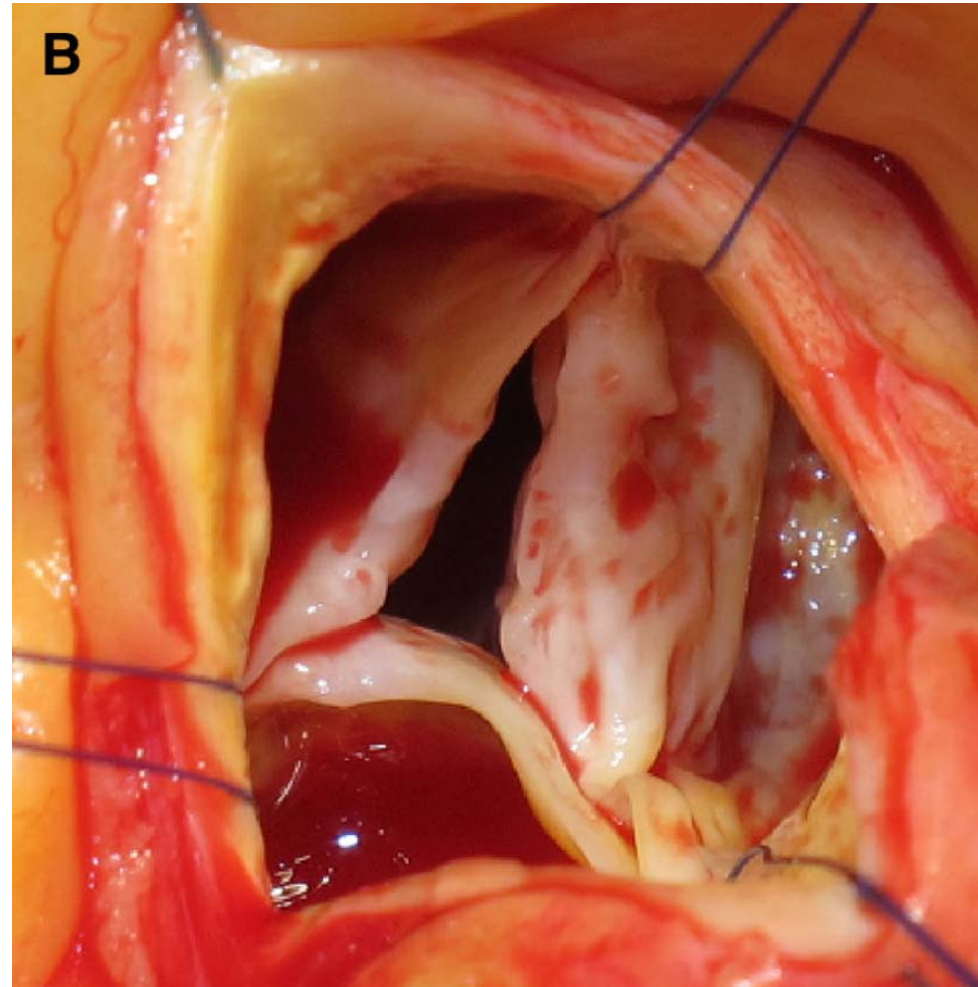
Tatsuhiko Komiya. Gen Thorac Cardiovasc Surg 2015;63:309-319.

Type 2 AR: Free margin plication




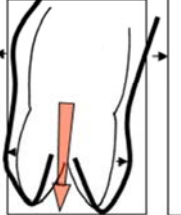
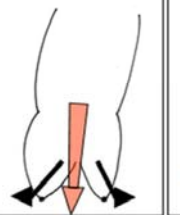
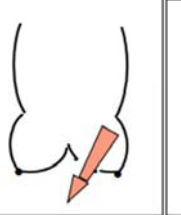
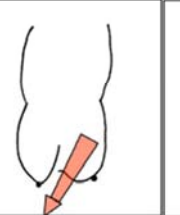
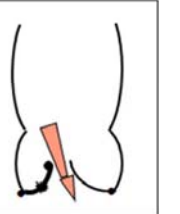
Tatsuhiko Komiya. *Gen Thorac Cardiovasc Surg* 2015;63:309–319.

Type 3 AR



Tatsuhiko Komiya. Gen Thorac Cardiovasc Surg 2015;63:309–319.

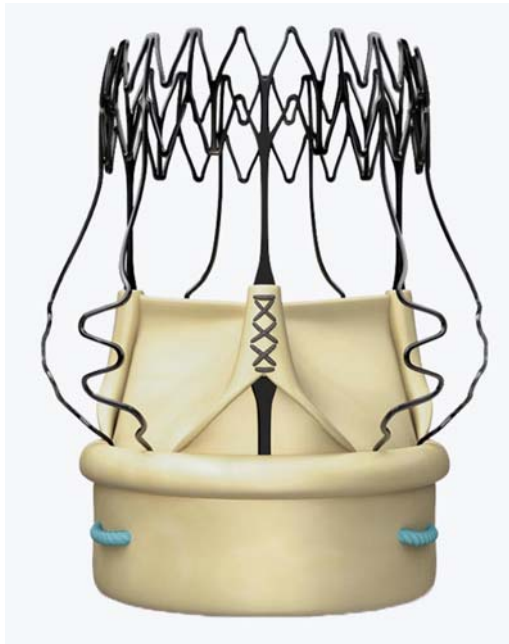
Aortic valve repair

AI Class	Type I Normal cusp motion with FAA dilatation or cusp perforation				Type II Cusp Prolapse	Type III Cusp Restriction
	1a	1b	1c	1d		
Mechanism						
Repair Technique (Primary)	STJ remodeling <i>Ascending aortic graft</i>	Aortic Valve sparing: <i>Reimplantation or remodeling with VAJ annuloplasty</i>	VAJ annuloplasty	Patch Repair <i>Autologous or bovine pericardium</i>	Prolapse Repair <ul style="list-style-type: none"> • Free margin plication • Triangular resection • Free margin resuspension • Patch 	Leaflet Repair <ul style="list-style-type: none"> • Shaving • Decalcification • Patch
(Secondary)	VAJ annuloplasty		STJ annuloplasty	VAJ annuloplasty	VAJ annuloplasty	VAJ annuloplasty

Ming Hao Guo et al., *Semin Thoracic Surg* 31:650–655.

Sutureless/Rapid-deployment AVR

Sutureless , Rapid deployment valve



Rapid deployment valve



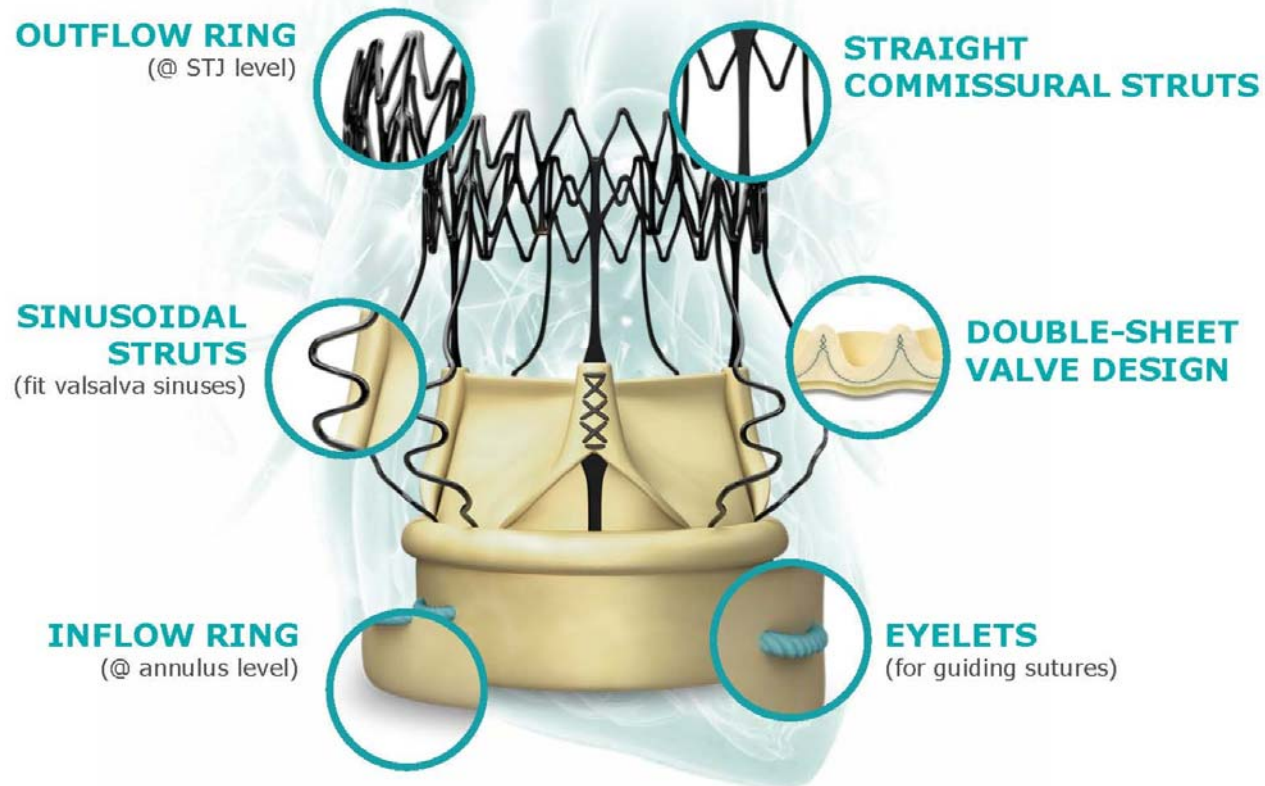
TABLE 1. Design Characteristics



	Edwards INTUITY	Sorin Perceval S
CE mark	2012	2011
Available patient follow-up	3 y	5 y
Design platform	Bovine pericardium, trileaflet, balloon expandable, stainless steel cloth-covered frame	Bovine pericardium, trileaflet, self-expandable nitinol frame with additional proximal and distal rings for annulus fixation
Available sizes	19, 21, 23, 25, 27 mm	21, 23, 25 mm
Rinsing	2 times, 60 s each	Not required
Sutures	3 actual sutures	None/only guiding sutures
Collapsible	Crimped	Yes, with collapsing tool

Glenn R. Barnhart et al., Innovations 2016;11:7-14

Basic structure



Indications and contraindications

8. INDICATIONS FOR USE

The Perceval bioprosthesis is indicated for the replacement of diseased, damaged, or malfunctioning native or prosthetic aortic valves.



9. CONTRAINDICATIONS

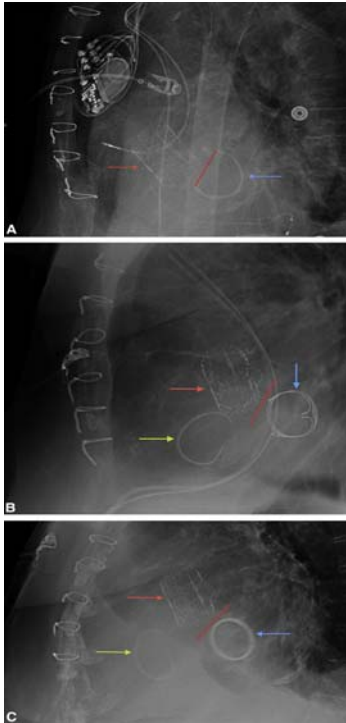
Use of the Perceval prosthesis is contraindicated in the following cases:

1. Aneurysmal dilation or dissection of the ascending aortic wall;
2. Known hypersensitivity to nickel or cobalt alloys;
3. Anatomical characteristics outside the specification given in **Table 1**.

Acquired cardiovascular disease

Expanding the indication for sutureless aortic valve replacement to patients with mitral disease

Tam Hoang Minh MD, Amine Mazine MD, Ismail Bouhout MD, Ismail El-Hamamsy MD, PhD, Michel Carrier MD, MBA, Denis Bouchard MD, PhD, Philippe Demers MD, MSc  



Conclusions: In our experience, sutureless AVR in the setting of concomitant mitral surgery is a feasible and reproducible procedure. **Elderly patients undergoing multiple valve surgery present a higher operative risk,** therefore extending the indication for sutureless AVR to patients with concomitant mitral disease could greatly benefit this specific population. (J Thorac Cardiovasc Surg 2014;148:1354-9)

J Thorac Cardiovasc Surg 201

Innovations: Technology and Techniques in Cardiothoracic and Vascular Surgery



TABLE 2. Recommendations of Experts for the Implantation of Sutureless and Rapid Deployment Valves in Minimally Invasive Aortic Valve Replacement After Second Round of the Panel Process

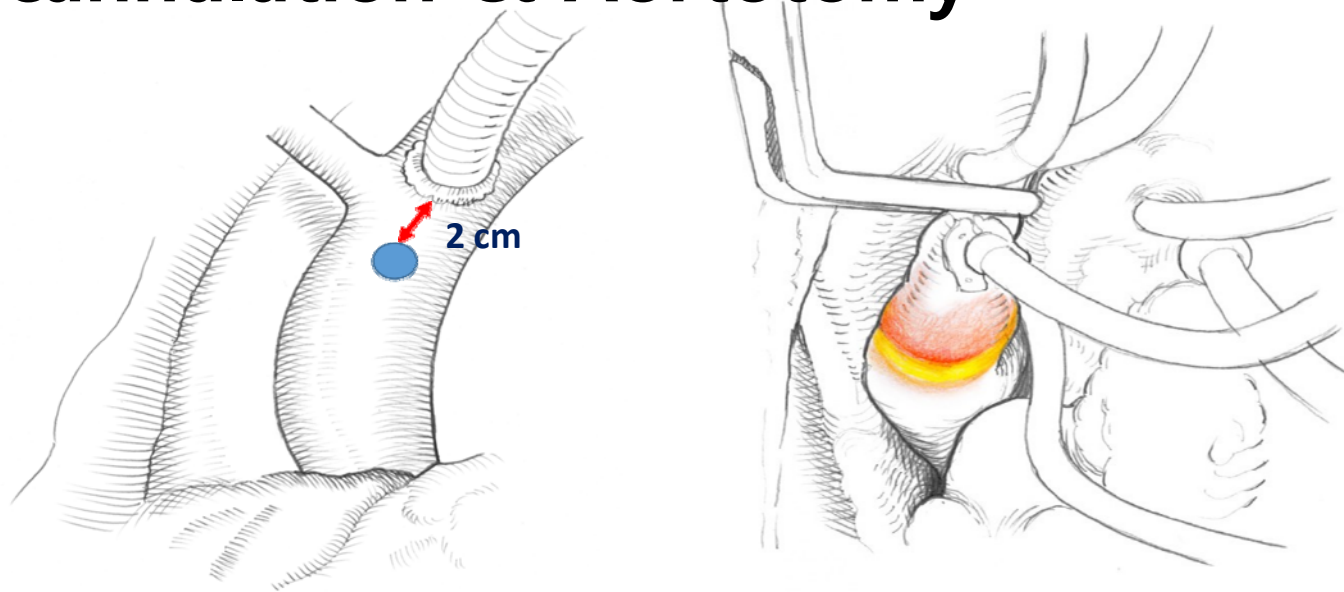
Recommendation

1. Use of sutureless and rapid deployment valves together with minimally invasive approaches in patients requiring biological valve replacement and not serving as candidates for TAVI
2. Use of sutureless and rapid deployment valves are recommend in order to reduce extracorporeal circulation and aortic cross-clamp time
3. Suitable annular sizes (after decalcification) of 19 to 27 mm
4. Oversizing with sutureless valves is not beneficial and can have negative impact
5. Contraindication for annular abscess or destruction due to infective endocarditis
6. Contraindication for bicuspid valve type 0
7. Implantation possible in bicuspid valves type 1 and 2 if
 - a. coronary ostia do not have 180-degree position,
 - b. round annulus, and
 - c. uniform height of the commissures (type 2).
8. Use of sutureless and rapid deployment valves reduces early complications as prolonged ventilation, blood transfusion, atrial fibrillation, pleural effusions, paravalvular leakages and aortic regurgitation, and renal replacement therapy, respectively
9. Use of sutureless and rapid deployment valves results in reduced ICU and hospital stay
10. Use of sutureless and rapid deployment valves will lead to a higher adoption rate of minimally invasive approaches in aortic valve replacement
11. Take respect to necessary, brief learning curves for both sutureless and minimally invasive programs

5. **Contraindication** for annular abscess or destruction due to infective endocarditis

6. **Contraindication** for bicuspid valve type 0

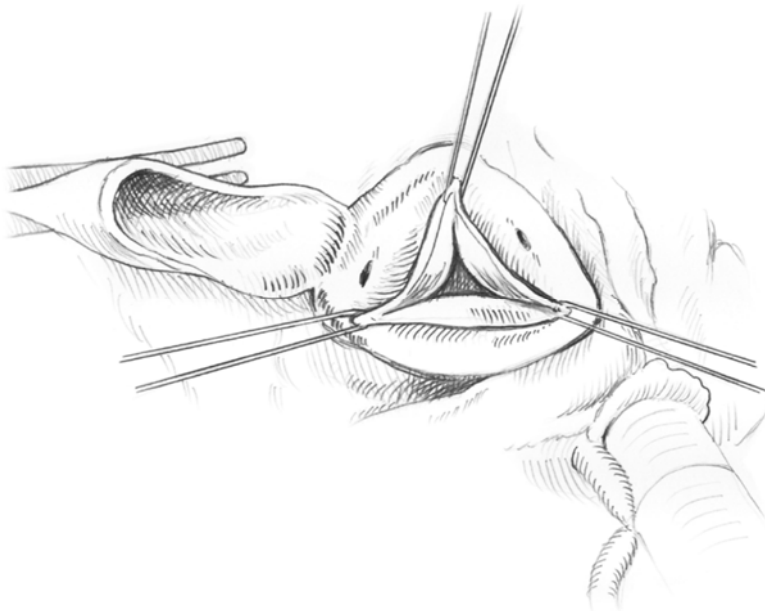
Aortic cannulation & Aortotomy



- It is recommendable to perform the aortic cannulation in the arch 2 cm more distally than usual, leaving 2-3 cm between cross clamp and the aortotomy, as shown in the picture. (Find yellow fat band!!!!)
- A transverse aortotomy located at least 3.5 cm above the aortic annulus or at least 0.5 cm above the STJ is considered optimal.

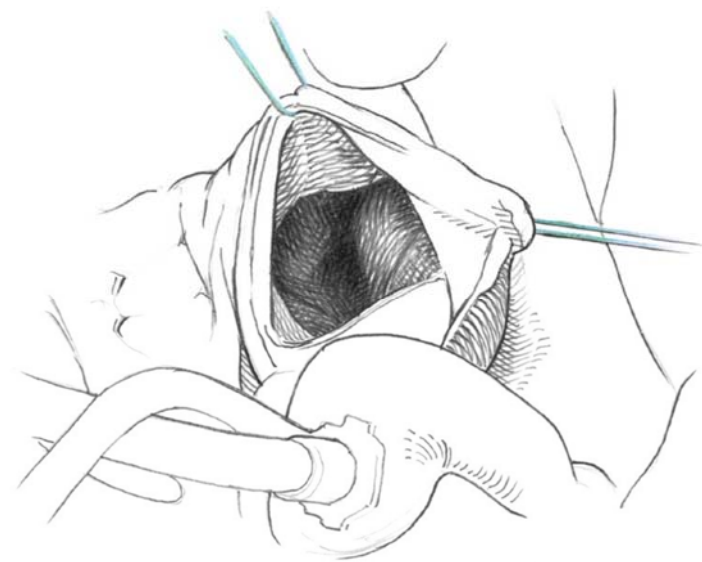
Decalcification

Traction suture in commissure



Just transverse, not hockey stick

Careful decalcification

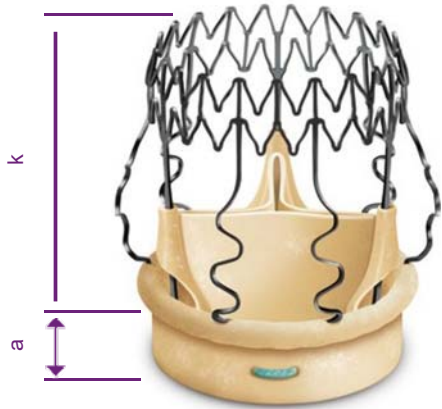


Ensure that the aorto-mitral curtain remains intact

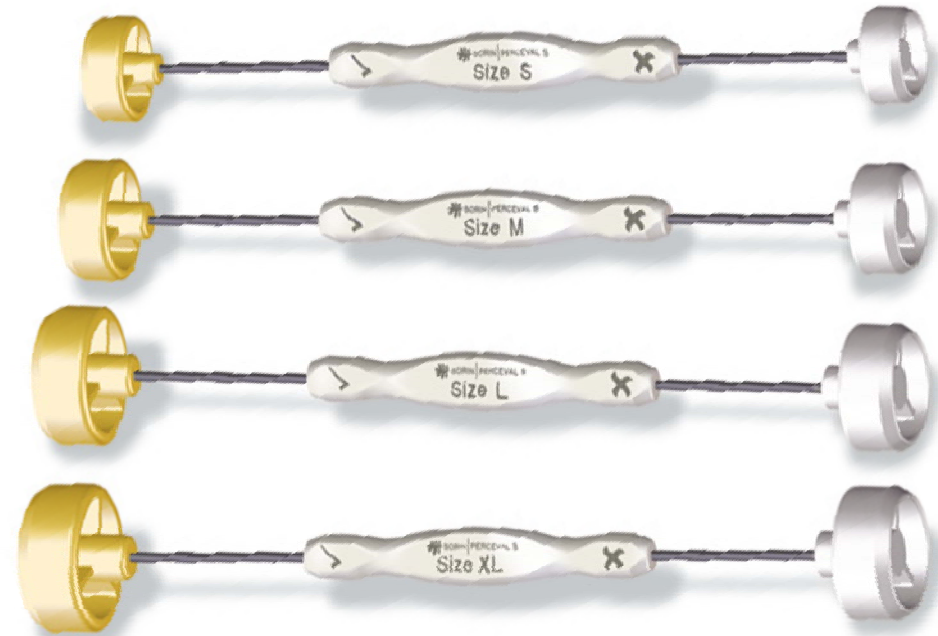
Decalcification



Sizing is most important

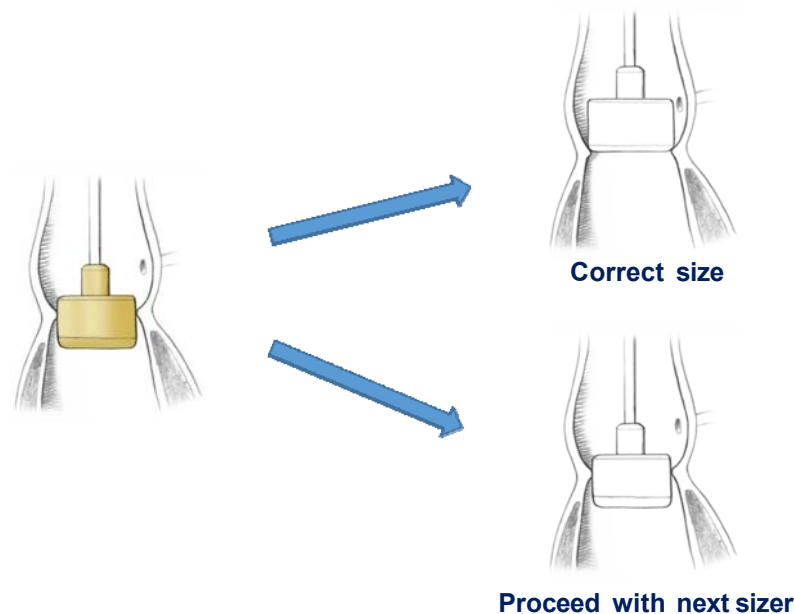


Size	S	M	L	XL
a (mm)	6.0	6.5	7.0	8.0
k (mm)	25	26.5	28.5	29.5



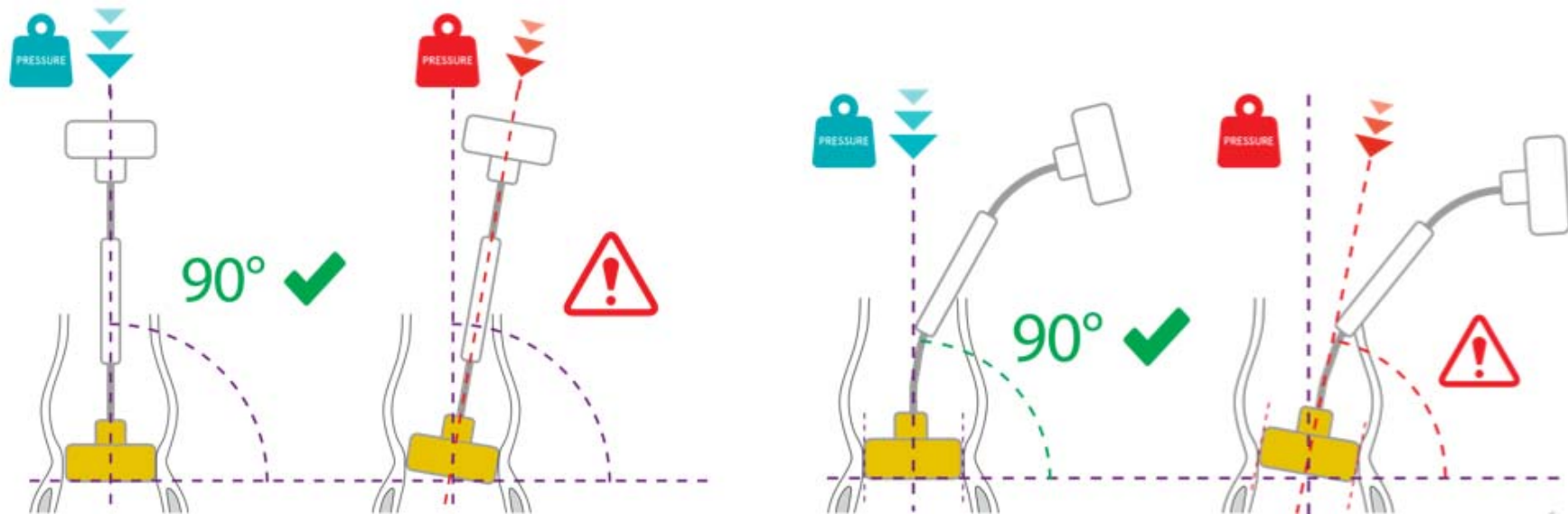
Sizing is most important

- ✓ Yellow obturator passes easily through the aortic annulus
- ✓ White obturator remains stable above the aortic annulus
- ✓ Avoid forcing the white obturator through the annulus



Sizing is most important

Perpendicular alignment



Sizing is most important : AVOID OVERSIZING

Effects of oversizing on Perceval EOA

100%



Correct Sizing

94%



1 Size Oversizing

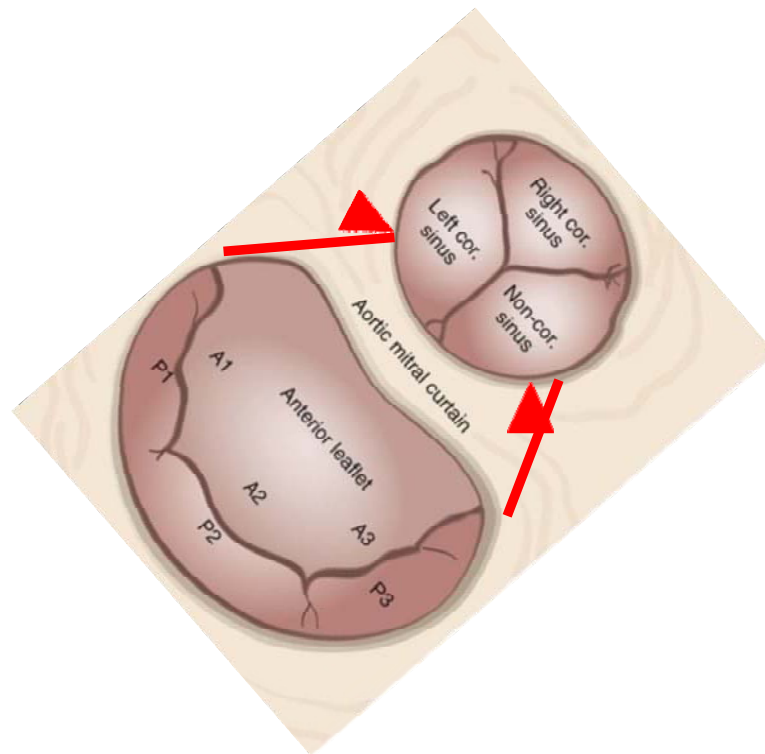
80%



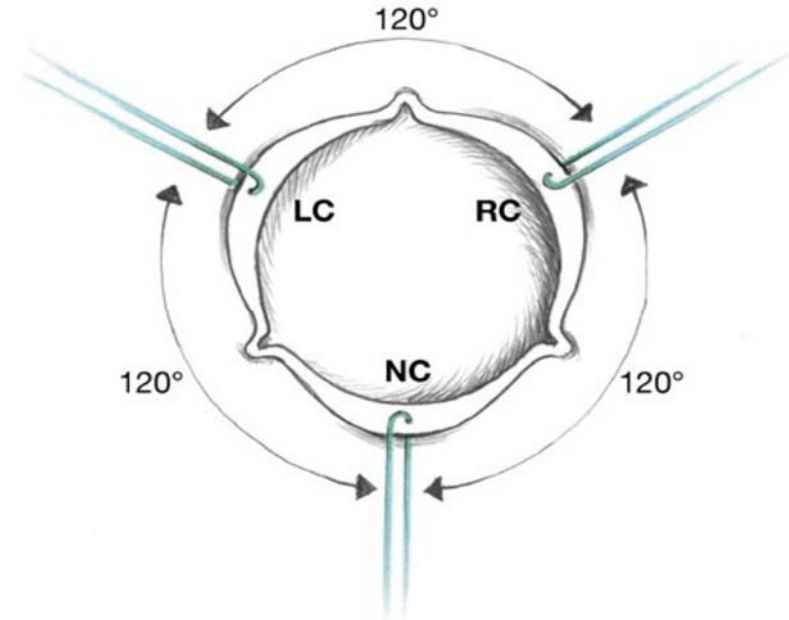
2 Sizes Oversizing

If you can see the coaptation line looked like seagull,
it is maybe wrong size valve

Guiding sutures



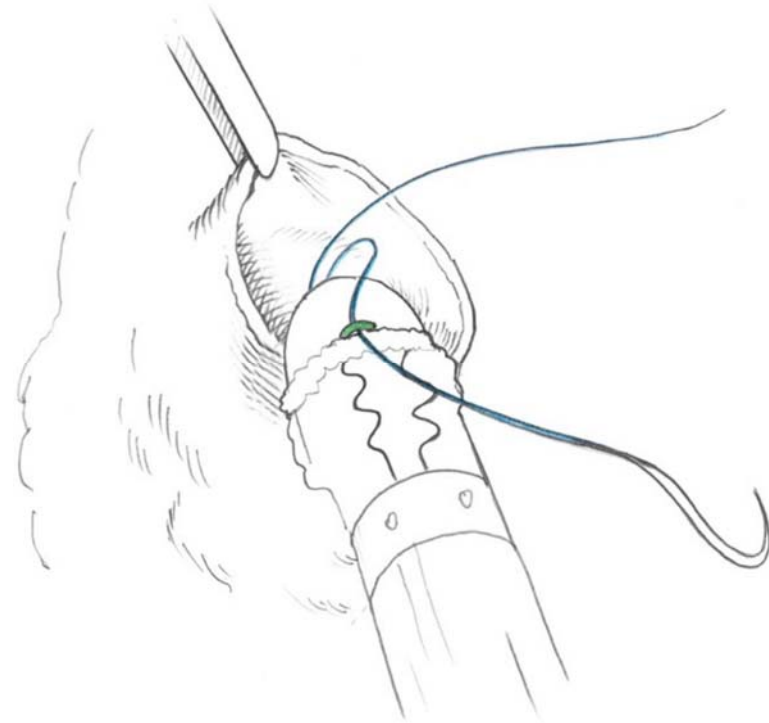
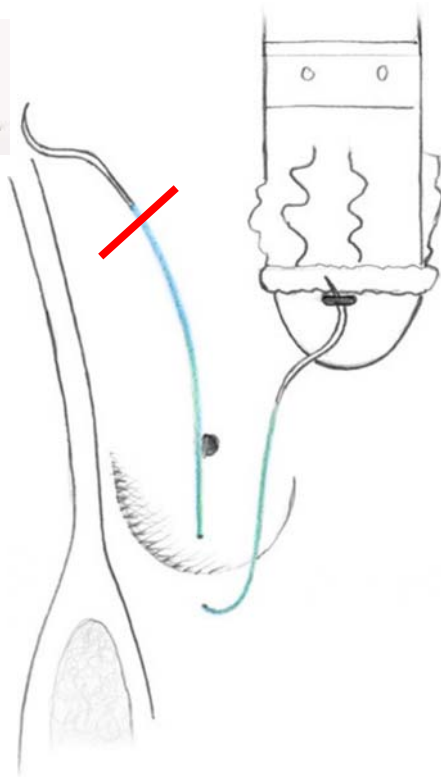
- ✓ 3 Nadir position
- ✓ For beginner, sizer is recommended
- ✓ Check MV relationship with AV



Guiding sutures

The needle of the LVOT extremity must be inserted in the eyelets

Cut the needle from the aortic extremity of the guiding suture



Guiding sutures

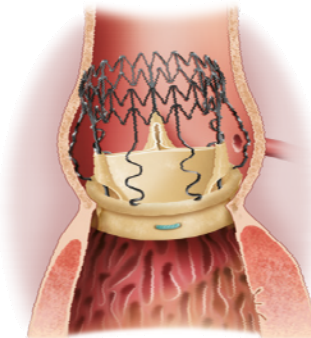
: **DO NOT TIE GUIDING SUTURES**

Tying Guiding Sutures can impair Valve Performance

Uneven expansion (distorted valve)

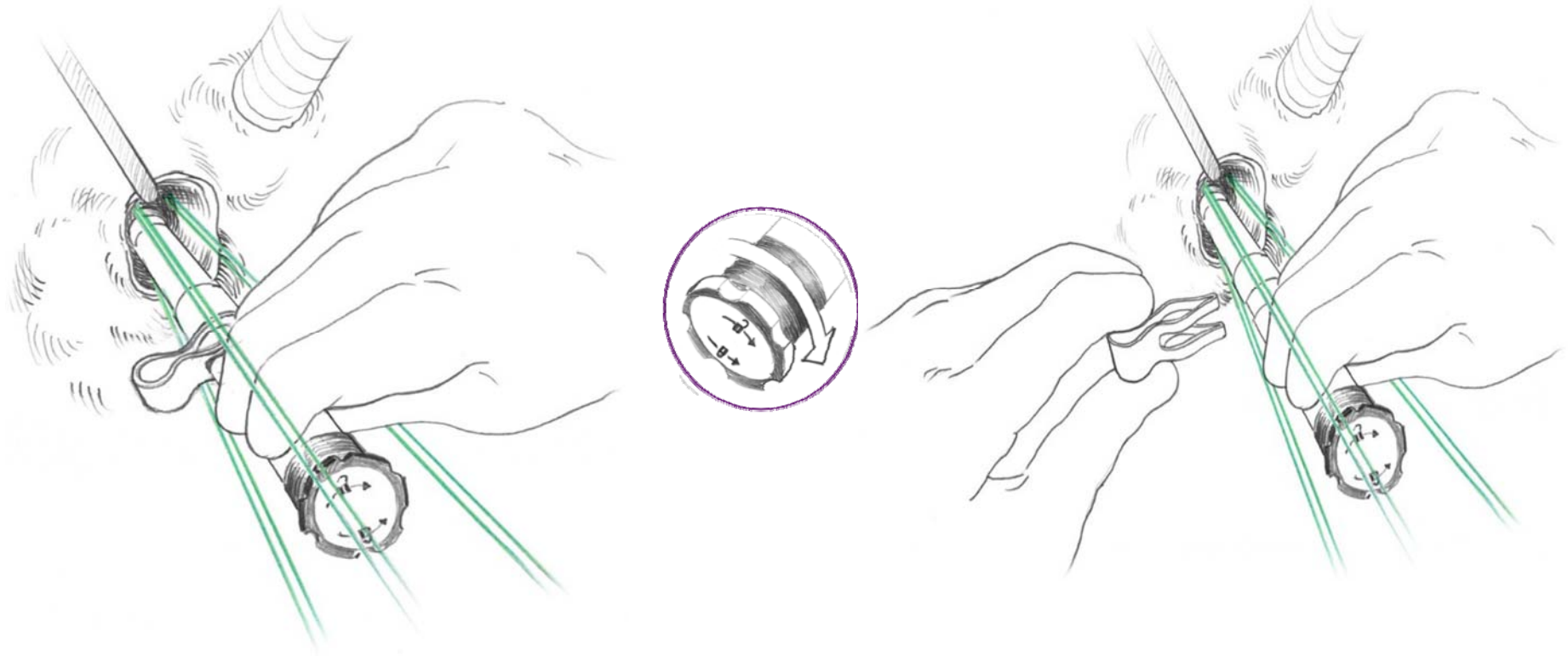


Sub-optimal seating (tilted valve)

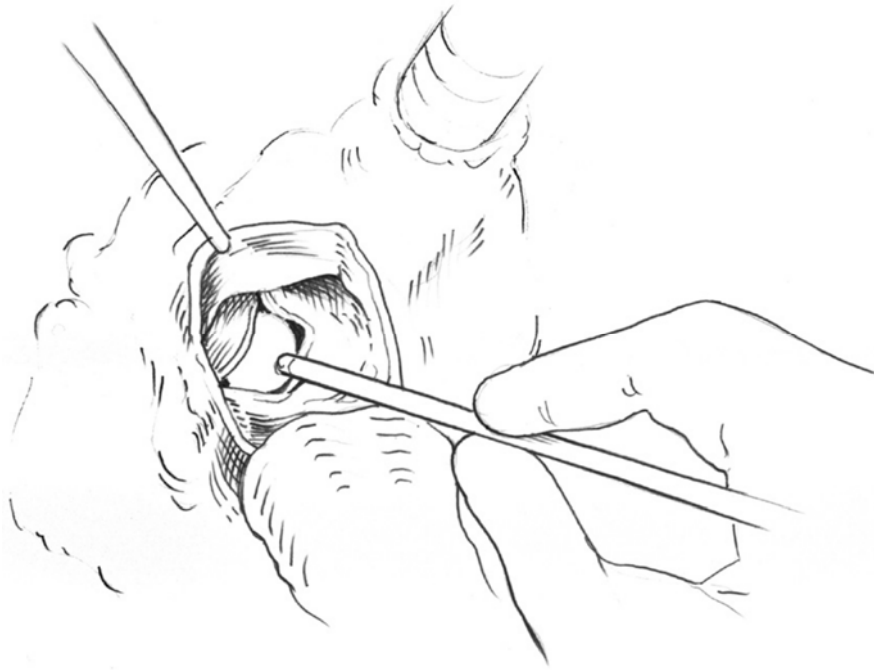


NO need to tie the guiding sutures: Perceval is very stable in the aortic root. There is only one published case of migration, and only one reported in the Perceval clinical studies due to initial malpositioning.

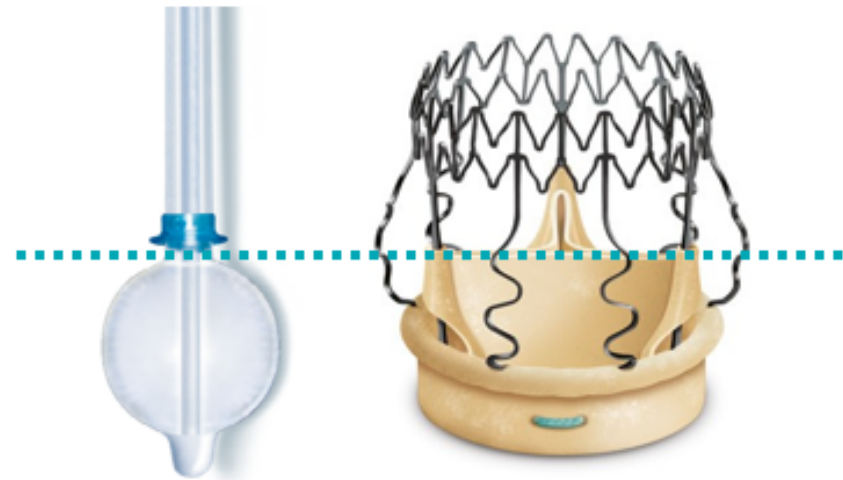
Valve positioning



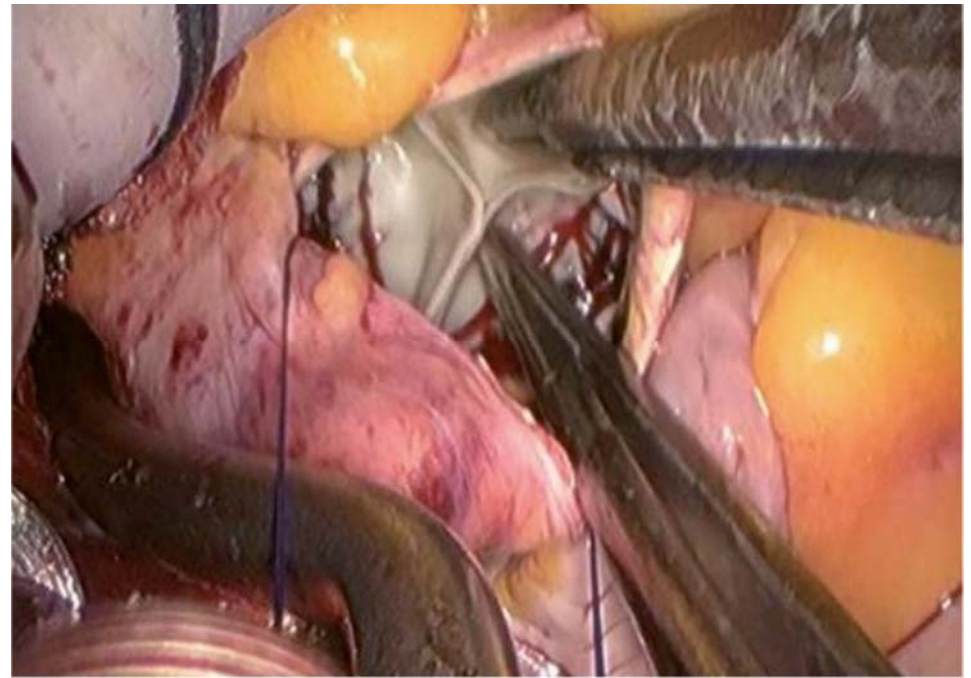
Balloon



90° to the plane of the annulus

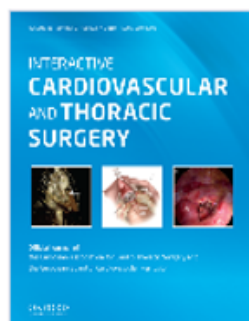


Valve positioning & cooptation





Sutureless AVR vs. TAVR

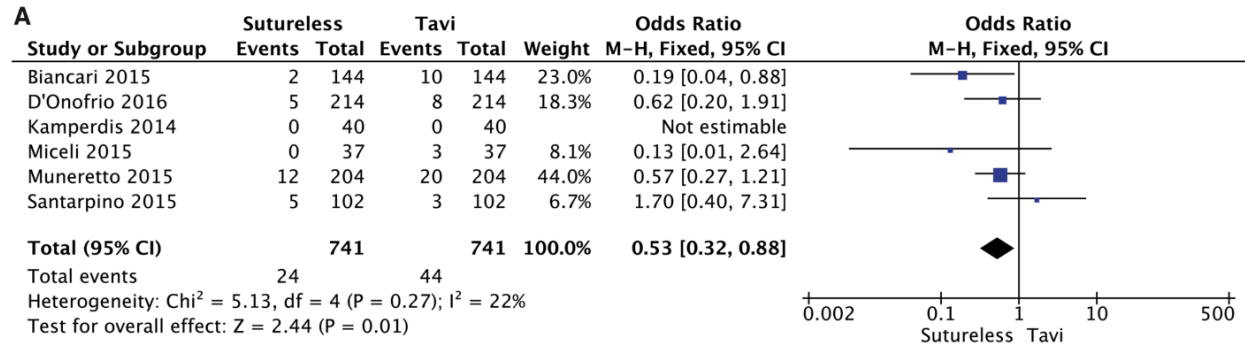


Volume 26, Issue 2
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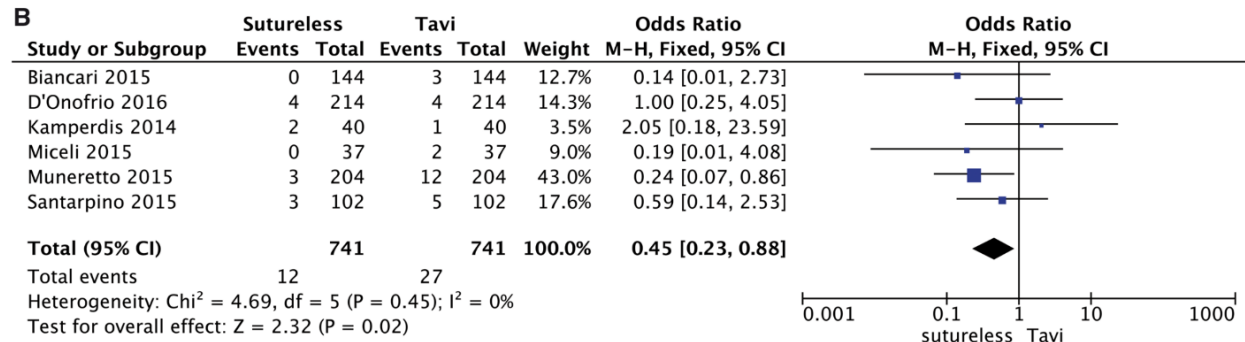
Sutureless aortic valve replacement versus transcatheter aortic valve implantation: a meta-analysis of comparative matched studies using propensity score matching ^{FREE}

Massimo Meco, Antonio Miceli, Andrea Montisci ✉, Francesco Donatelli, Silvia Cirri, Matteo Ferrarini, Antonio Lio, Mattia Glauber Author Notes

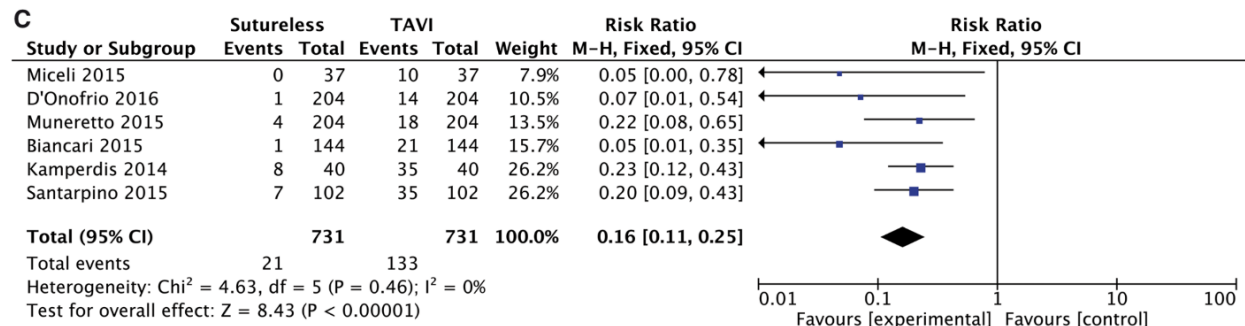
Interactive Cardiovascular and Thoracic Surgery, Volume 26, Issue 2, 1 February 2018, Pages 202–209, <https://doi.org/10.1093/icvts/ivx294>



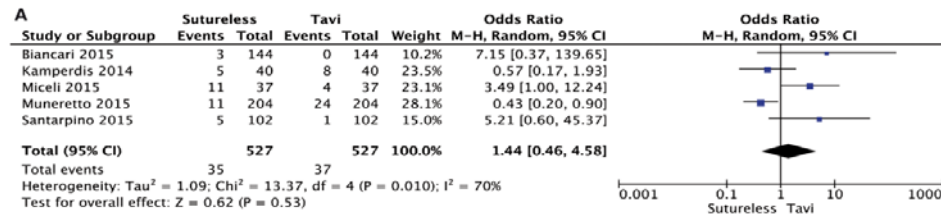
Postoperative mortality



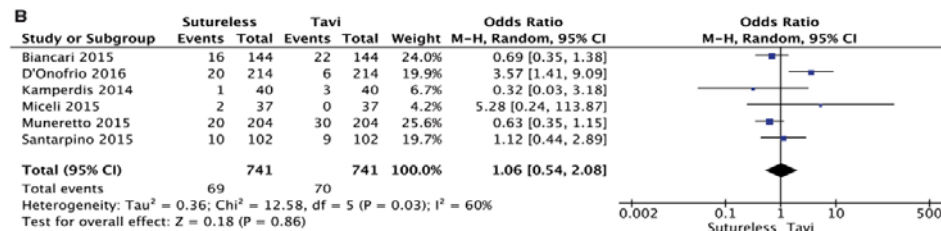
Postoperative stroke



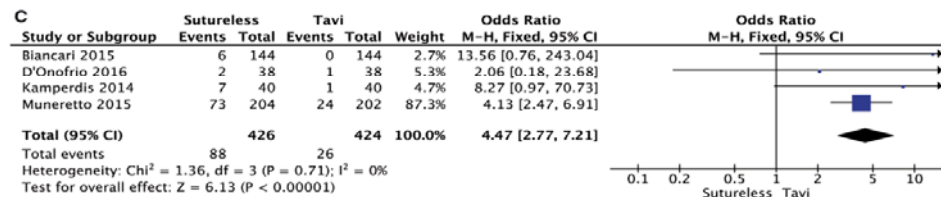
Postoperative aortic regurgitation



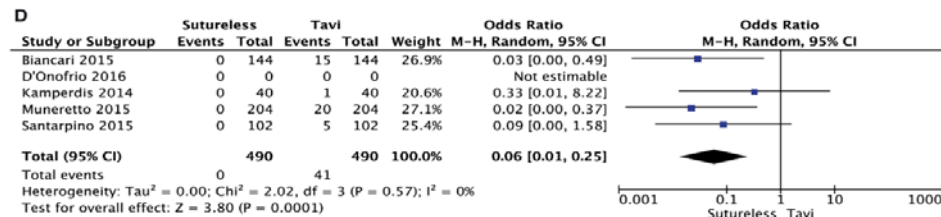
postoperative renal failure



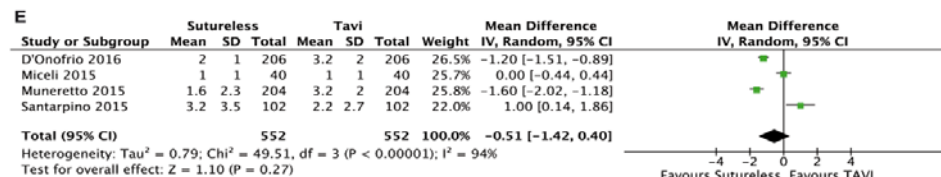
postoperative pacemaker implantation



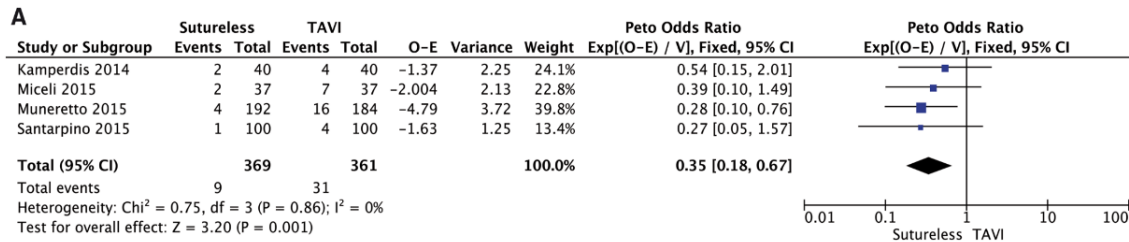
postoperative blood transfusions



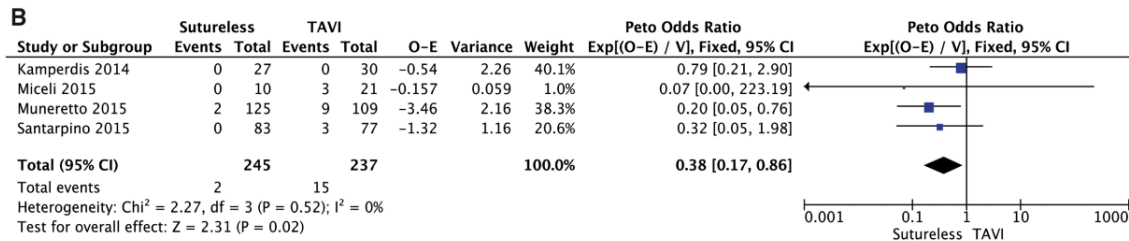
postoperative vascular complications



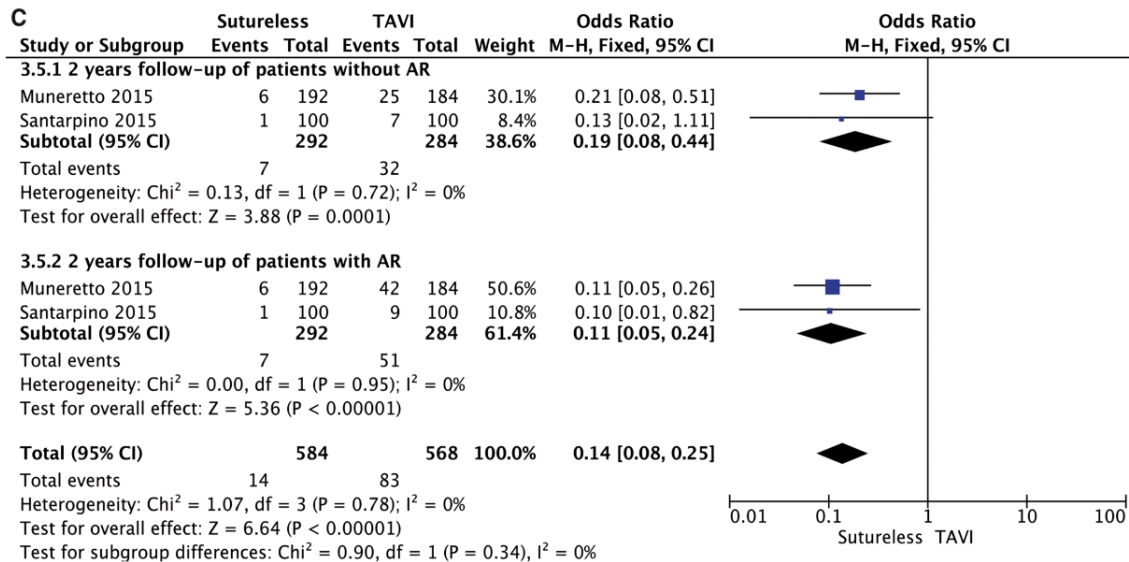
postoperative intensive care unit stay



1-year mortality



2-year mortality



meta-analysis of studies assessing the effect of postoperative aortic regurgitation on 2-year mortality



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