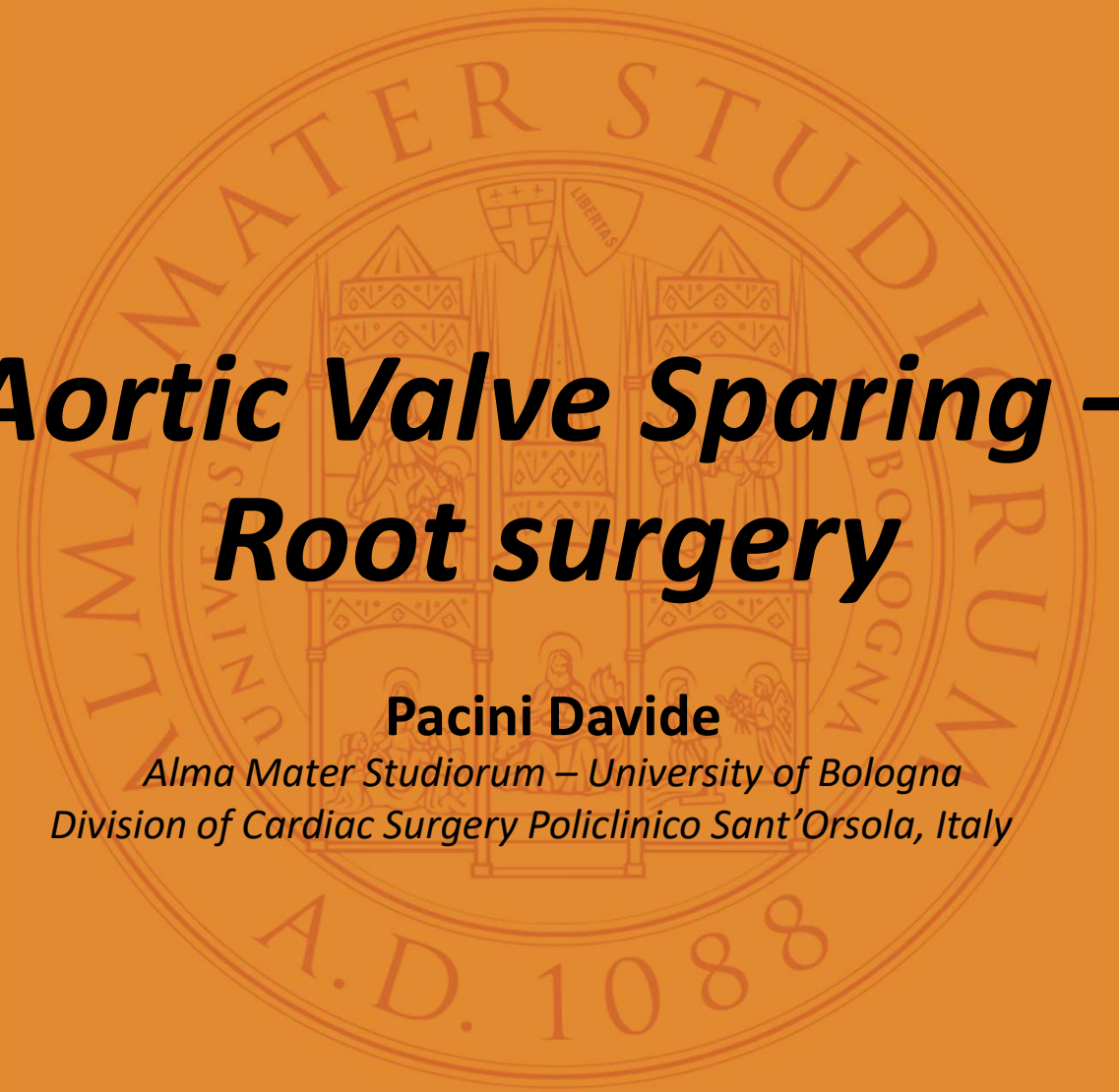


Aortic Valve Sparing – Root surgery

Pacini Davide

*Alma Mater Studiorum – University of Bologna
Division of Cardiac Surgery Policlinico Sant'Orsola, Italy*





Cite this article as: Murana G, Di Marco L, Pacini D. To spare or not to spare—that is the question. Eur J Cardiothorac Surg 2023; doi:10.1093/ejcts/ezad265.

To spare or not to spare—that is the question

Giacomo Murana ^{a,a}, Luca Di Marco ^{a,b} and Davide Pacini ^{a,b}

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^b Department of Medical and Surgical Sciences, DIMEC, Alma Mater Studiorum-University of Bologna, Bologna, Italy
 * Corresponding author. Division of Cardiac Surgery, Cardiac Surgery Department, IRCCS, Azienda Ospedaliero-Universitaria di Bologna, University of Bologna, Via Massarenti 9, 40138 Bologna, Italy. Tel: +39-51-2143361, fax: +39-051-345990, e-mail: g.murana@hotmail.com giacomo.murana@aosp.bo.it (G. Murana).
Keywords: Valve sparing • Aortic root replacement • Aortic regurgitation

A 49-year-old patient with severe aortic regurgitation (AR) was presented to the surgeon. The patient was associated with a bicuspid aortic valve (BAV) and a dilated aortic root. The surgeon decided to perform aortic root replacement (ARR) with valve sparing (VSRR) instead of aortic root replacement (ARR) with aortic valve replacement (AVR). The mean follow-up time was 3.2 years. The need for reoperation was equal in both groups. The VSRR group required associated aortic valve repair. The VSRR group had significantly better short-term outcomes such as in-hospital mortality and other complications, nor in 10-year survival. The mean follow-up time was 3.2 years. The need for reoperation was equal in both groups.



Background

- Valve-sparing root replacement (VSRR) has recently emerged as the preferred procedure whenever feasible
- Good results are now available in several valve phenotypes
- There is a large consensus on providing stabilization of the aortic annulus to achieve durable results
- Some predictors of valve failure have been identified (complex leaflets repair) but not all of them are still well-defined



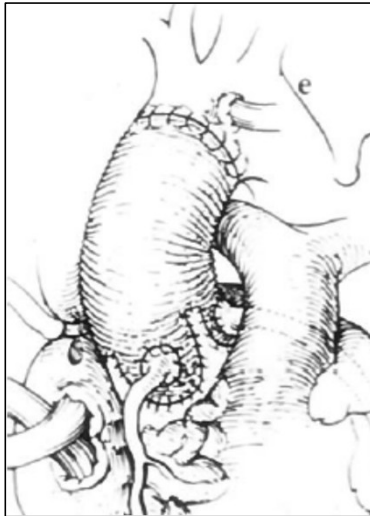


At the origin, were two great artists...

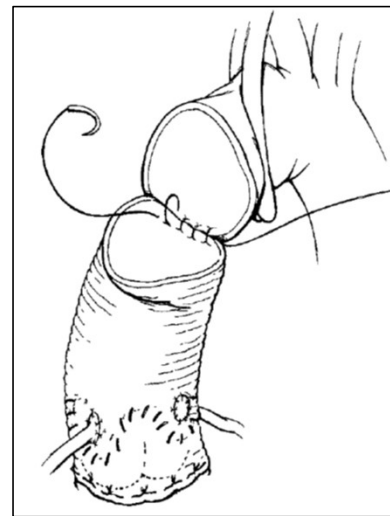


Sir Magdy Yacoub

Remodeling (1983)



Reimplantation (1992)



Tirone David

More art than science It was like that during those times



Then, other two great artists standardized the technique



The technique requires a number details that have to be controlled or standardized



Developing standardized procedures

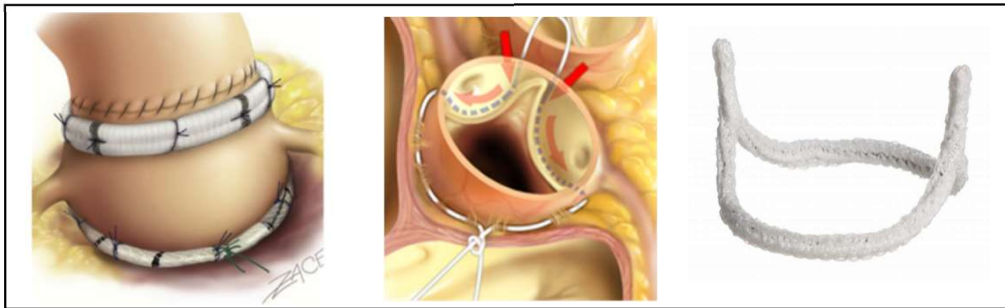
Valve sparing root replacement



Remodeling
+ annuloplasty

Reimplantation
+ Sinus of Valsalva

Annuloplasty

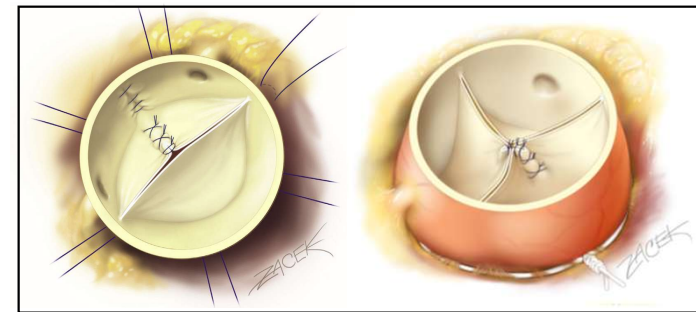


External Ring

Suture Annuloplasty

Internal Ring

Leaflet repair

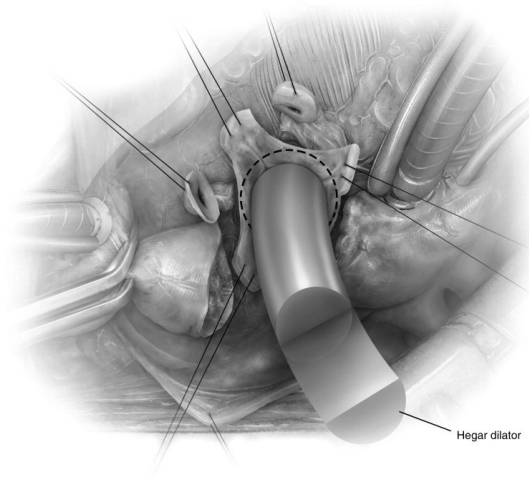
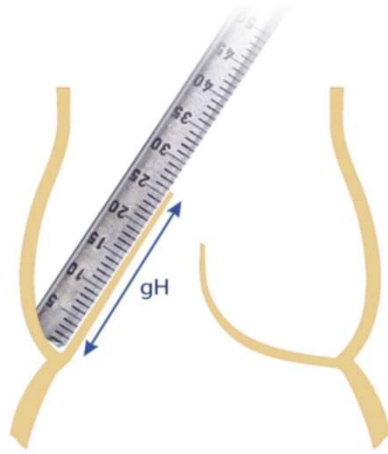


Central cusp plication



Developing standardized procedures

Tool kit



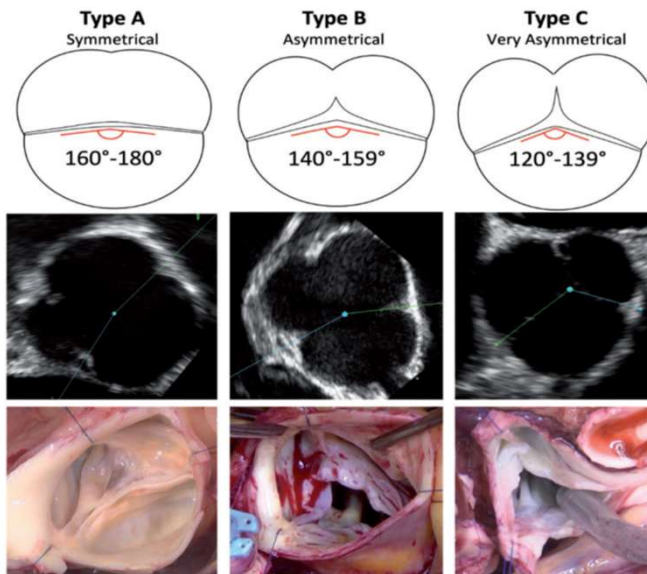


Observe and learn from anatomy...

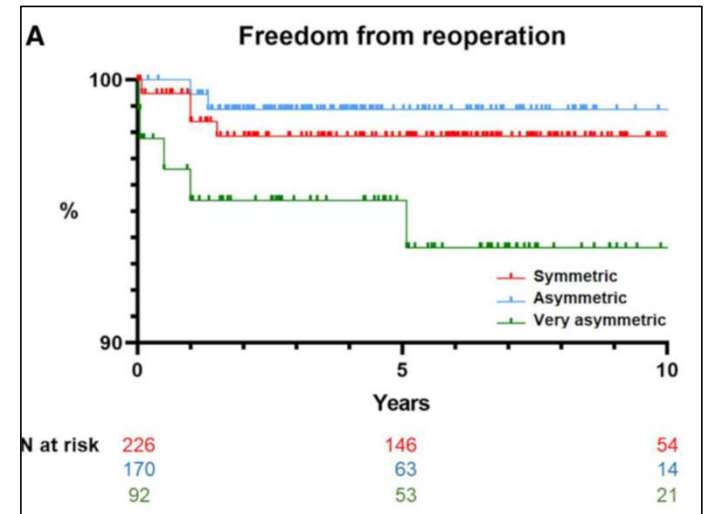
“Identikit” of the valve



TE-ECHO



L. De Kerchove, *EJCTS* 56 (2019) 351–359

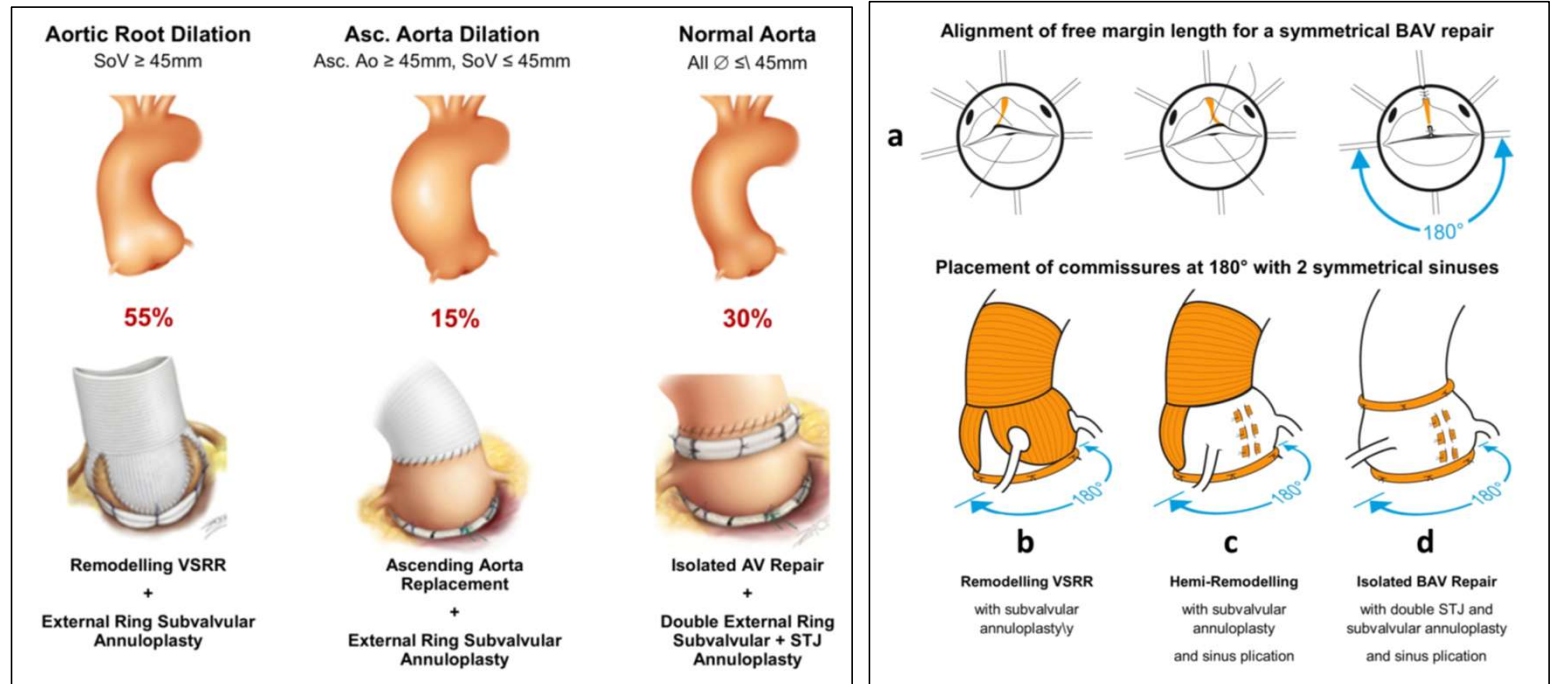


T. Ehrlich *EJCTS* 2024, 65(4), ezae163





Developing standardized procedures ...



“Rather than art, I would say knowledge, standardisation and precision” Emmanuel Lansac





Reimplantation vs Remodeling: state of the art

Aorta: Research

Valve-Sparing Aortic Root Replacement With Reimplantation vs Remodeling: A Meta-analysis

Check for updates

Michel Pompeu Sá, MD, PhD,^{1,2} Xander Jacquemyn, BSc,³ Ahmed K. Awad, MD,⁴ James A. Brown, MD,^{1,2} Danny Chu, MD,^{1,2} Derek Serna-Gallegos, MD,^{1,2} Fabian A. Kari, MD,⁵ and Ibrahim Sultan, MD^{1,2}

ABSTRACT

BACKGROUND Long-term outcomes of valve-sparing aortic root replacement (VSARR) with reimplantation vs remodeling in patients undergoing aortic root surgery remains a controversial subject.

METHODS This study was a pooled meta-analysis of Kaplan-Meier-derived data from comparative studies published by December 31, 2022.

RESULTS Fifteen studies met our eligibility criteria, comprising 3044 patients (1991 in the reimplantation group and 2018 in the remodeling group). Patients who underwent VSARR with remodeling had a higher risk of all-cause death (hazard ratio [HR], 1.54; 95% CI, 1.16-2.03; $P = .002$, log-rank test $P < .001$). Landmark analysis (with 4 years as the landmark time point) demonstrated that survival was lower in patients who underwent VSARR with remodeling (HR, 2.15; 95% CI, 1.43-3.24; $P < .001$) in the first 4 years. Beyond the 4-year time point, no difference in survival was observed (HR, 1.04; 95% CI, 0.72-1.50; $P = .822$). The risk for need of aortic valve and/or root reintervention was higher in patients undergoing VSARR with remodeling (HR, 1.49; 95% CI, 1.07-2.07; $P = .019$, log-rank test $P < .001$). We did not find statistically significant coefficients for the covariates of age, female sex, connective tissue disorders, bicuspid aortic valve, aortic dissection, coronary bypass surgery, total arch replacement, or annular stabilization, which means that these covariates did not modulate the effects observed in our pooled analyses.

CONCLUSIONS VSARR with reimplantation is associated with better overall survival and lower risk of need for reintervention over time compared with VSARR with remodeling. Regarding overall survival, we observed a time-varying effect that favored the reimplantation technique up to 4 years of follow-up, but not beyond this time point.

(Ann Thorac Surg 2024;117:501-9)

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AIM: Long-term outcomes of VSARR:

reimplantation vs remodeling

- 3044 patients
- 15 studies - nonrandomized and observational (2002-2022)
- Inclusion criteria: FU >1 year

Study	Study Design	Total Sample (N)	Reimplantation (n)	Remodeling (n)
Chauvette, ⁹ 2022	NR, NP, MC	237	100	137
Sievers, ¹⁰ 2018	NR, NP, SC	83	44	39
Lenoir, ¹¹ 2018	NR, NP, SC	142	59	83
Klotz, ¹² 2018	NR, NP, SC	315	214	101
Price, ¹³ 2016	NR, NP, SC	98	69	29
Kunihara, ¹⁴ 2016	NR, NP, SC	66	7	59
Kari, ¹⁵ 2016	NR, NP, MC	1015	889	126
Kallenbach, ¹⁶ 2013	NR, P, MC	96	83	13
Subramanian, ¹⁷ 2012	NR, NP, SC	78	27	51
Svensson, ¹⁸ 2011	NR, NP, SC	144	72	72
David, ¹⁹ 2010	NR, NP, SC	289	228	61
Patel, ²⁰ 2008	NR, NP, SC	84	44	40
Jeanmart, ²¹ 2007	NR, NP, SC	114	66	48
Erasmí, ²² 2007	NR, NP, SC	164	68	96
Graeter, ²³ 2002	NR, NP, SC	119	21	98



Aortic Valve Sparing – Root Surgery

Reimplantation vs Remodeling: state of the art

Aorta: Research

Valve-Sparing Aortic Root With Reimplantation: A Meta-Analysis

Michel Pomier
James A. Brindley
Fabian A. Kahl

ABSTRACT

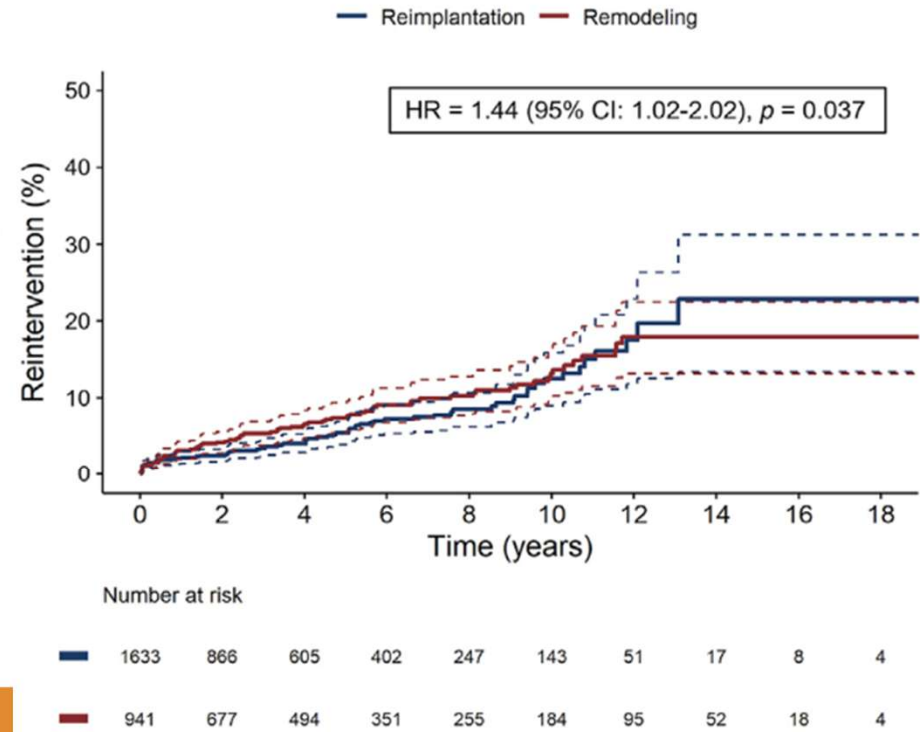
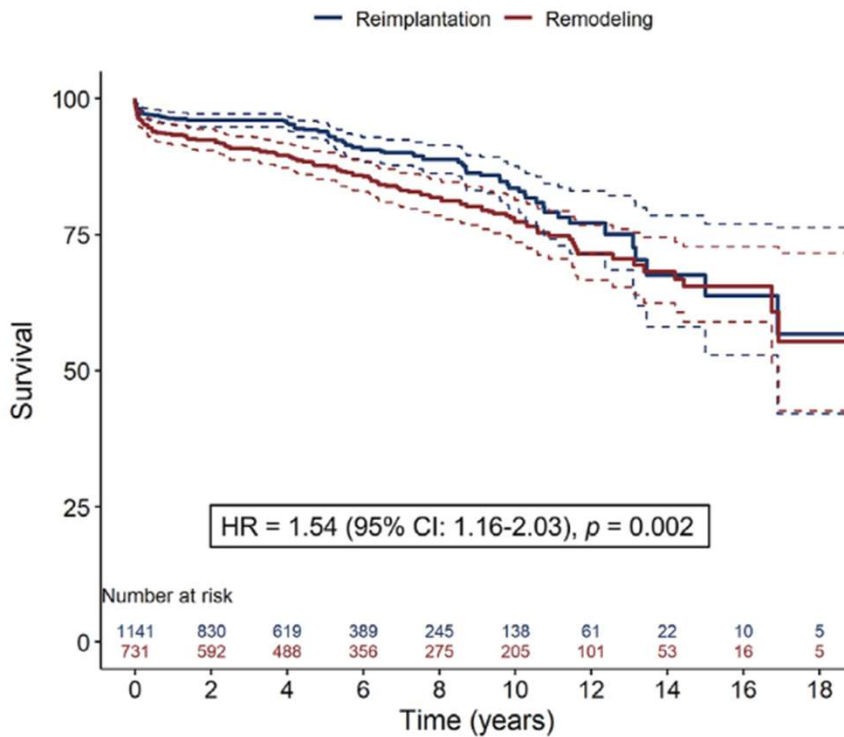
BACKGROUND remodeling in

METHODS The meta-analysis included studies published by December 31, 2018.

RESULTS Fifty-two studies (19,318 patients) were included in the meta-analysis. The hazard ratio (HR) for all-cause mortality was 1.54 (95% CI, 1.16-2.03; $p = 0.002$) for remodeling compared with reimplantation. The HR for reoperation was 1.44 (95% CI, 1.02-2.02; $p = 0.037$) for remodeling compared with reimplantation.

CONCLUSION Reimplantation had a lower risk of all-cause mortality and reoperation compared with remodeling.

Remodeling had a higher risk of all-cause death and reoperation





Reimplantation vs Remodeling: state of the art

European Journal of Cardio-Thoracic Surgery 2022, 62(3), ezac366
<https://doi.org/10.1093/ejcts/ezac366> Advance Access publication 2 August 2022

ORIGINAL ARTICLE

Cite this article as: Chauvette V, Kluin J, de Kerchove L, El Khoury G, Schäfers H-J, Lansac E et al. Outcomes of valve-sparing surgery in heritable aortic disorders: results from the AVIATOR registry. Eur J Cardiothorac Surg 2022; doi:10.1093/ejcts/ezac366.

Outcomes of valve-sparing surgery in heritable aortic disorders: results from the AVIATOR registry

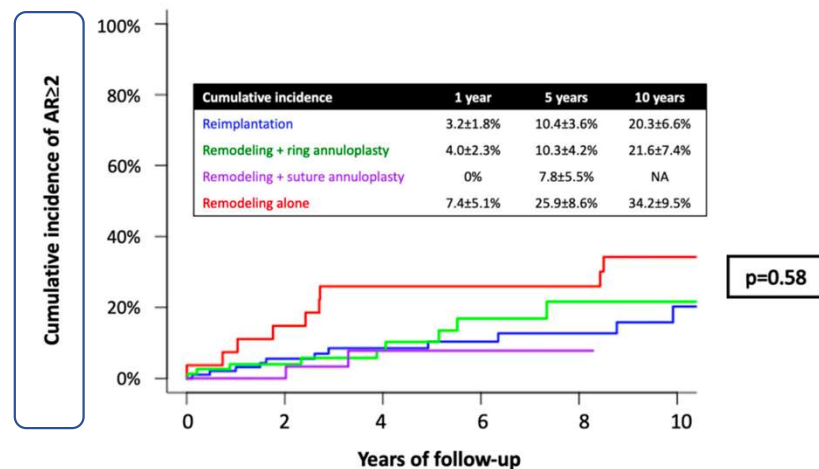
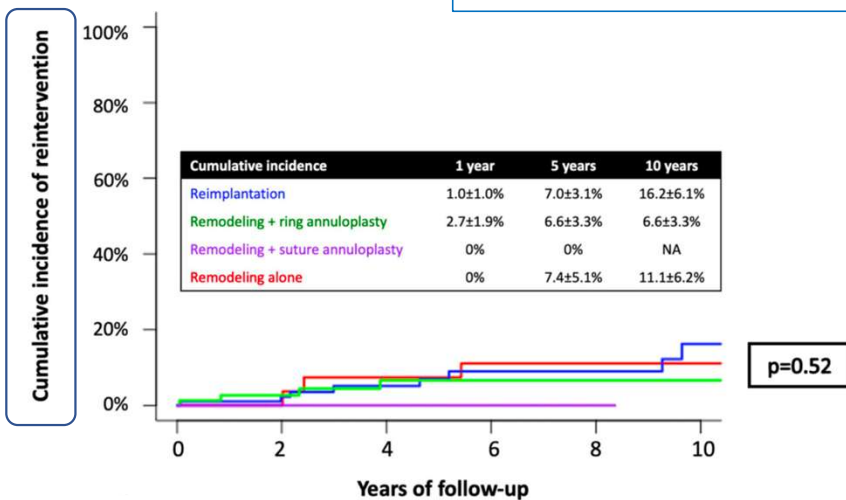
Vincent Chauvette^a, Jolanda Kluin^b, Laurent de Kerchove^c, Gebrine El Khoury^c, Hans-Joachim Schäfers^d, Emmanuel Lansac^e and Ismail El-Hamamsy^{f,*}

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^b Department of Cardio-Thoracic Surgery, Academic Medical Center, Amsterdam, Netherlands
^c Department of Cardiovascular and Thoracic Surgery, Cliniques Universitaires Saint-Luc, Brussels, Belgium
^d Department of Thoracic and Cardiovascular Surgery, Saarland University Medical Center, Homburg (Saar), Germany
^e Department of Cardiac Surgery, Institut Mutualiste Montsouris, Paris, France
^f Department of Cardiovascular Surgery, Mount Sinai Hospital, Icahn School of Medicine at Mount Sinai, New York, NY, USA

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Received 16 February 2022

Remodeling with annuloplasty results in similar incidence of reoperations, survival and changes in annulus size compared to reimplantation





Reimplantation vs Remodeling: state of the art

European Journal of Cardio-Thoracic Surgery 2022, 62(3), ezac366
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Outcomes of valve-sparing surgery in heritable aortic disorders: results from the AVIATOR registry

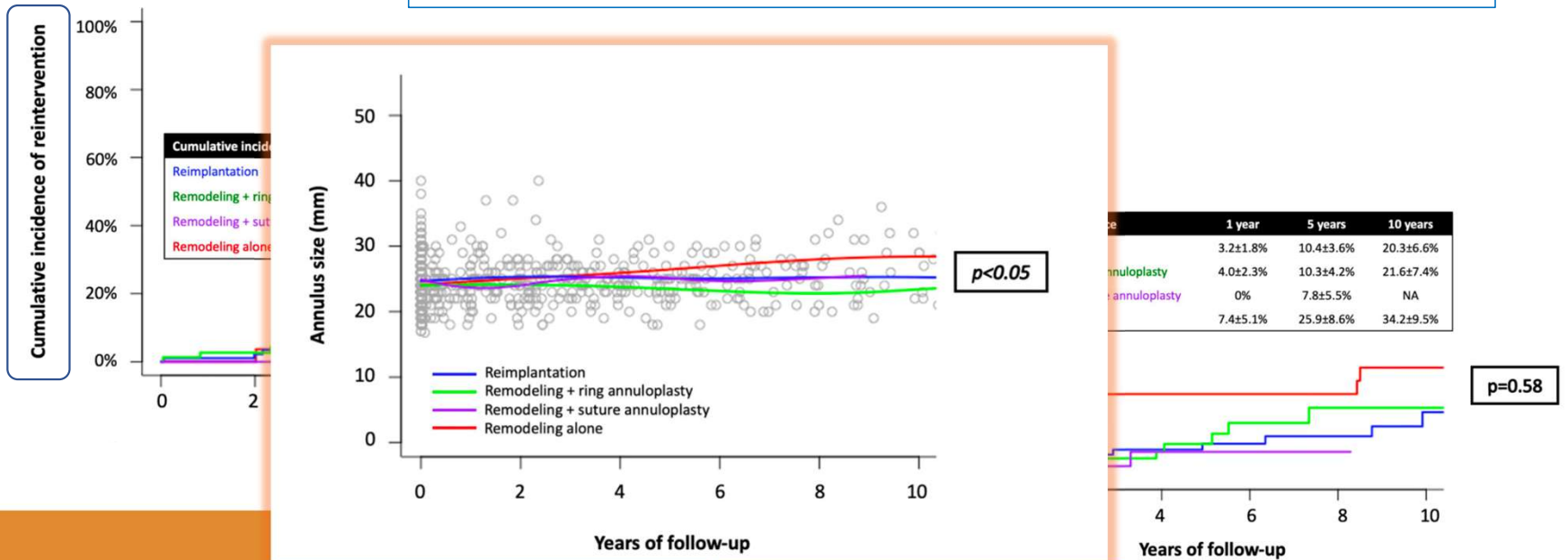
Vincent Chauvette^a, Jolanda Kluin^b, Laurent de Kerchove^c, Gebrine El Khoury^c, Hans-Joachim Schäfers^d, Emmanuel Lansac^e and Ismail El-Hamamsy^{f,*}

- ^a Department of Cardiac Surgery, Montreal Heart Institute, Université de Montreal, Montreal, QC, Canada
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- ^f Department of Cardiovascular Surgery, Mount Sinai Hospital, Icahn School of Medicine at Mount Sinai, New York, NY, USA

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Received 16 February 2022

Remodeling with annuloplasty results in similar incidence of reoperations, survival and changes in annulus size compared to reimplantation





Our Experience

Since 2002



Aortic Valve Sparing– Root Surgery



Conflict of Interest



Valsalva worked at S. Orsola Hospital and he was Professor of the Alma Mater Studiorum University of Bologna



Aortic Valve Sparing– Root Surgery



Patients Characteristics

Period 2002-2025

First Era 2002-2013

Second Era 2014-2025

290 Valve Sparing procedures

	First Era (n=141)	Second Era (n=149)	Overall (n=290)	<i>p</i>
Age (yrs)	48.9 ± 15.3	48.1 ± 14.8	48.5 ± 14.9	0.890
Male gender, n (%)	119 (84.4)	119 (79.9)	238 (82.1)	0.321
Cardiovascular Risk Factors				
Bicuspid Aortic Valve, n (%)	16 (11.3)	18 (12.1)	34 (11.7)	0.882
Marfan Syndrome, n (%)	29 (20.6)	42 (28.2)	71 (24.5)	0.144
Loeys-Dietz Syndrome, n (%)	1 (0.7)	10 (6.7)	11 (3.8)	0.017
NYHA III-IV, n (%)	26 (18.4)	3 (2.0)	29 (10.0)	<0.001

Values are reported as mean ± SD or number (percentage)

Pre-Op Aortic Regurgitation grade	First Era (n=141)	Second Era (n=149)	Overall (n=290)	<i>p</i>
None, n (%)	12 (8.5)	52 (34.9)	64 (22.1)	<0.001
Mild, n (%)	43 (30.5)	36 (24.2)	79 (27.2)	0.321
Moderate, n (%)	38 (27.0)	33 (22.1)	71 (24.5)	0.367
Severe, n (%)	48 (34.0)	28 (18.8)	76 (26.2)	0.006
Redo, n (%)	3 (2.1)	6 (4.0)	9 (3.1)	0.461
Acute Type A Aortic Dissection, n (%)	9 (6.4)	10 (6.7)	19 (6.6)	0.975
Chronic Type A Aortic Dissection, n (%)	3 (2.1)	3 (2.0)	6 (2.1)	0.986
Root Aneurysm, n (%)	134 (95.0)	133 (89.2)	267 (92.1)	0.046
Aortic Root Diameter max, mm	49.3 ± 6.2	48.0 ± 5.7	48.6 ± 6.0	0.070
Ascending Aorta Aneurysm, n (%)	109 (77.3)	84 (56.4)	193 (66.6)	<0.001
Ascending Aorta Aneurysm max, mm	45.8 ± 10.4	41.3 ± 9.3	43.5 ± 10.6	<0.001

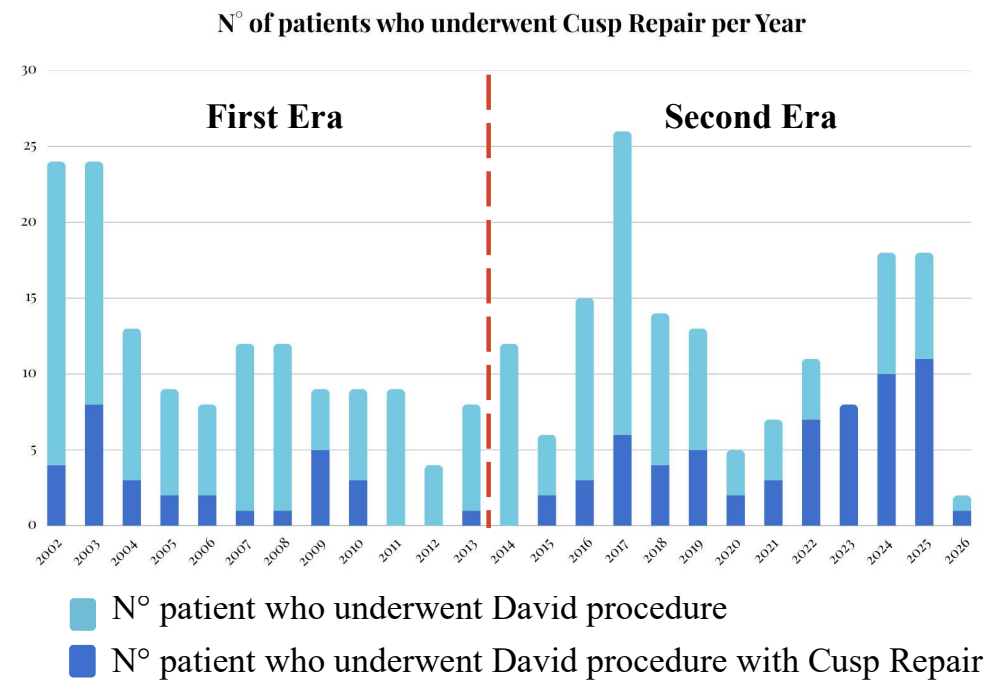
Values are reported as mean ± SD or number (percentage)



Operative Results

	First Era (n=141)	Second Era (n=149)	Overall (n=290)	<i>p</i>
CPB Time, min	162.5 ± 44.5	181.4 ± 45.3	172.2 ± 45.9	<0.001
Aortic Cross-Clamp Time, min	133.6 ± 31.1	152.0 ± 33.9	143.0 ± 33.8	<0.001
Additional Procedures, n (%)	35 (24.8)	34 (22.8)	69 (23.8)	0.349
Aortic Valve Repair				
Cusp Repair, n (%)	30 (21.3)	61 (40.9)	91 (20.0)	0.064
One-Cusp	18 (12.8)	42 (28.2)	60 (20.7)	0.033
Two-Cusps	10 (7.1)	15 (10.1)	25 (8.6)	0.825
Three-Cusps	2 (1.4)	4 (2.7)	6 (2.1)	0.399

Values are reported as mean ± SD or number (percentage)

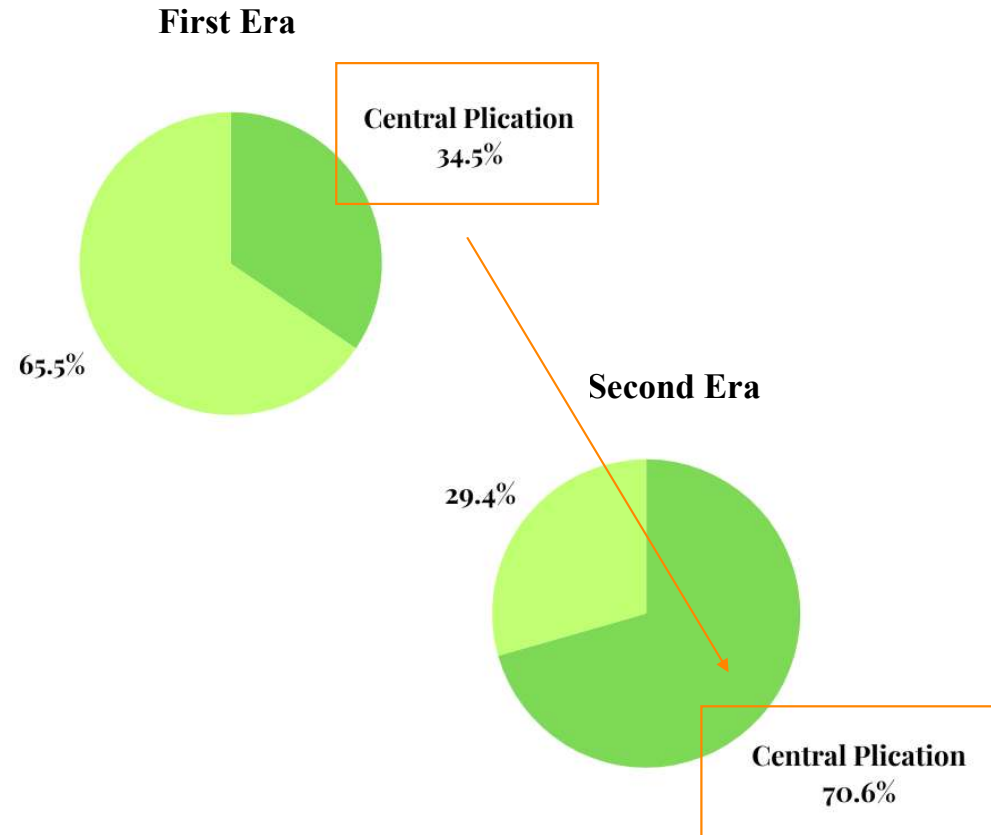




Operative Results

	First Era (n=141)	Second Era (n=149)	Overall (n=290)	<i>p</i>
Central Plication	10 (7.1)	42 (28.2)	52 (17.9)	<0.001
Leaflet's repair	17 (12.1)	9 (6.0)	26 (9)	0.029
Shaving	6 (4.3)	17 (11.4)	23 (7.9)	0.015

Values are reported as mean ± SD or number (percentage)





In Hospital Results

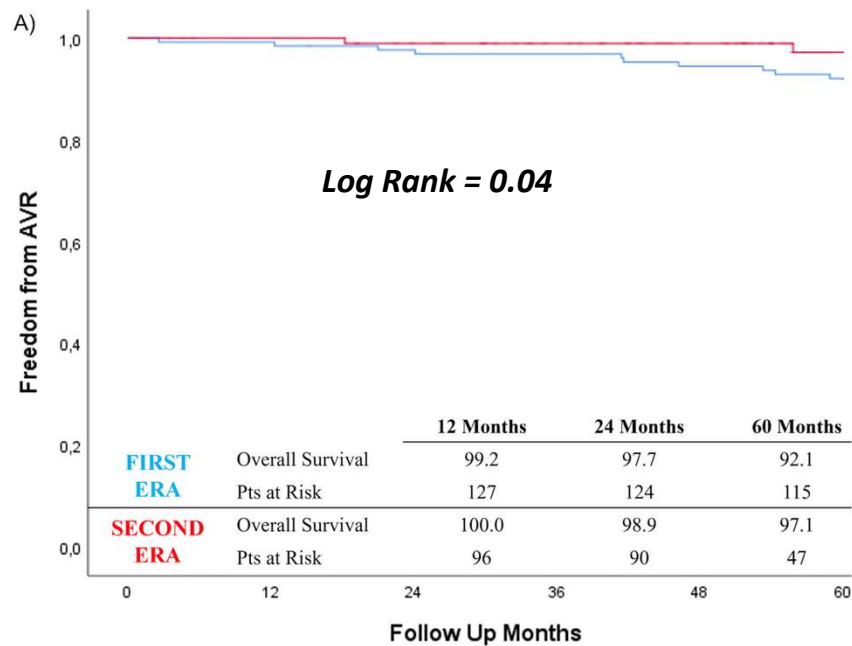
Post-Operative Echocardiography				
PO LVEF, %	61.2 ± 9.4	60.7 ± 6.0	61.0 ± 7.8	0.725
Aortic Valve Gradient max, mmHG	11.8 ± 7.0	8.0 ± 4.1	9.7 ± 5.9	<0.001
Aortic Regurgitation Grade				
None	75 (53.2)	121 (81.2)	196 (67.6)	<0.001
Mild	53 (37.6)	25 (16.8)	78 (26.9)	<0.001
Moderate	11 (7.8)	2 (1.3)	13 (4.5)	0.011
Severe	2 (1.4)	-	2 (0.7)	0.159
In Hospital Mortality				
Elective, n (%)	1 (0.8)	1 (0.7)	2 (0.8)	0.809
Emergency, (%)	3 (30.0)	2 (25.0)	5 (27.8)	0.809
Reintervention at Follow Up	32 (22.7)	2 (1.3)	34 (12.2)	<0.001

Values are reported as mean ± SD or number (percentage)



Follow-up

Freedom from AVR : First vs Second Era



Risk factor for REDO at Follow Up

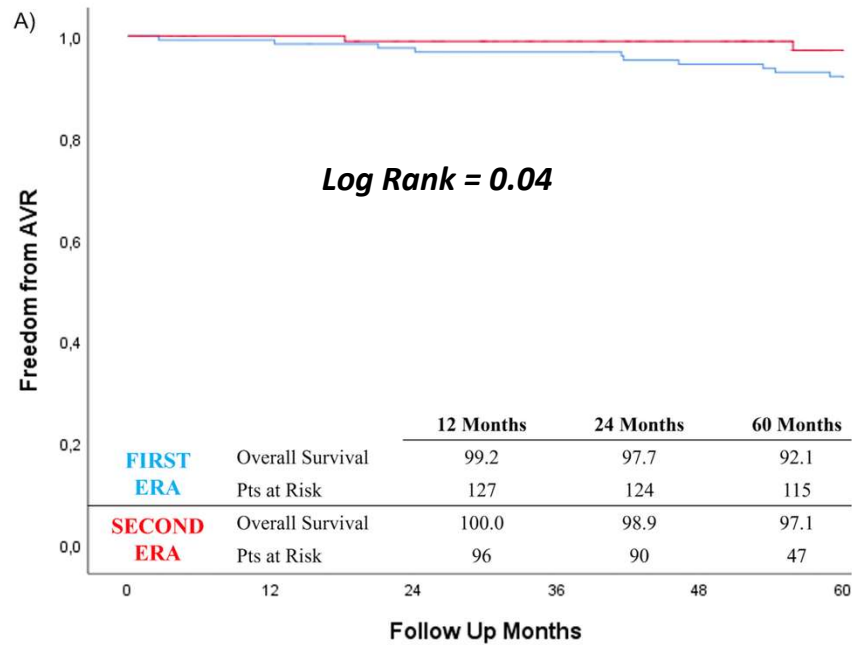
	Reop	<i>p</i>
Central Plication	3 (5.8)	0.185
Leaflet's repair	8 (30.8)	0.003
Shaving	1 (4.3)	0.232

Values are reported as mean ± SD or number (percentage)

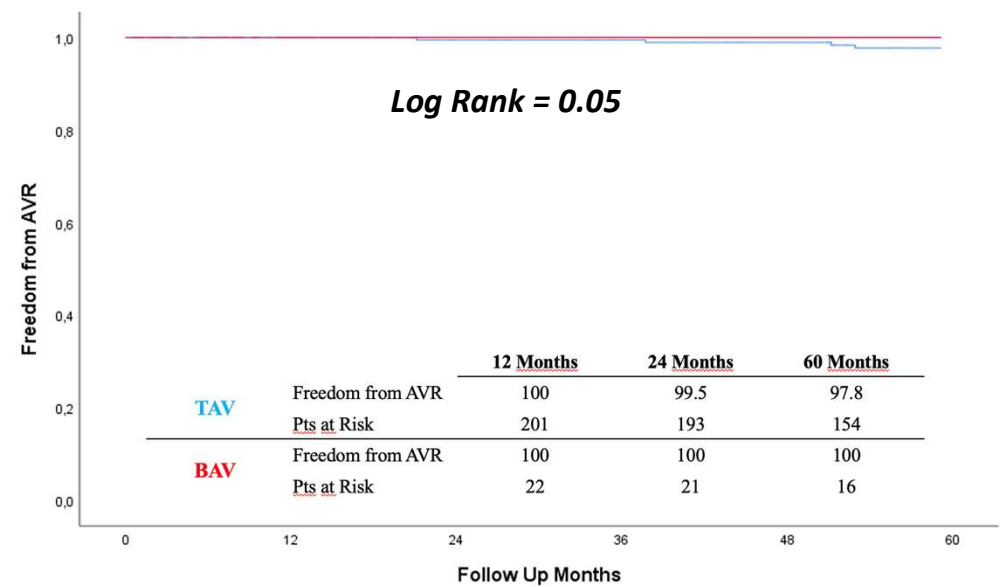


Follow-up

Freedom from AVR : First vs Second Era



Freedom from AVR :TAV vs BAV





Conclusions

- Aortic valve sparing procedures have excellent results in the long-term FU if an annulus stabilization is provided
- Advancements in surgeon expertise and patient selection have led to improve outcomes over time:
 - Complex valve repair should be avoided (multiple cusp prolapse, calcifications or extensive fibrosis of the leaflets)
 - According to our experience, a lower incidence of reoperation was observed above all in BAV



JUNE 15-16 2026 • AORTIC SURGERY IN BOLOGNA FROM NEONATES TO ADULTS

BHSS Bologna Heart Surgery Symposium

16:00 – 17:15 — Main Session 7

Houston Aortic Symposium @ BHSS

DESCENDING AND THORACO-ABDOMINAL

Moderators: Davide Pacini, Anthony Estrera

- 16:00 TAAA in Syndromic Patients - Open is More Durable!
Li-Zhong Sun
- 16:08 Open TAAA experience
Joseph Coselli
- 16:16 TAAA open repair with deep hypothermia: the Kyoto approach
Kenji Minatoya
- 16:24 Technical Pitfalls for Fenestrated- Branched Endovascular Repair Following Endovascular Repair Following PETTICOAT
Naveed Saqib
- 16:32 Proximal descending aortic aneurysm repair requiring hypothermic circulatory arrest: Technical aspects
Anil Apaydin
- 16:40 Predictors for recovery of spinal cord injury
Akiko Tanaka
- 16:48 Clinical update on thoracoabdominal hybrid device
Sabine Wipper
- 16:56 Does the new Hybrid ThoracoAbdominal device requires change in surgical approach?
Aung Oo

17:15 – 18:00

Panel Discussion

Clinical Thoracic Aortic Trials: A Review of the Data Most Important to Your Practice

Moderators: Joseph Bavaria, Anthony Estrera

Panelists: Hazim Safi, Joseph Coselli, Wilson Szeto, Akiko Tanaka, Maral Ouzonian, Naveed Saqib, Yutaka Okita, Roberto Chiesa

Topics: Aortic Root, Arch, TAAA, Acute and Chronic Aortic Dissection (Type A, B), Medical Therapy, Open, Endovascular, Hybrid Therapies, Life-Time Aortic Disease Management

Y IN
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TB



← YOU FOR YOUR
ATTENTION!



Aortic Valve Sparring– Root Surgery

Reimplantation vs Remodeling: state of the art



Aorta: Research

Valve-Sparing Aortic Root Replacement With Reimplantation vs Remodeling

A Meta-

Michel Pom
James A. Br
Fabian A. Ka

ABSTRACT

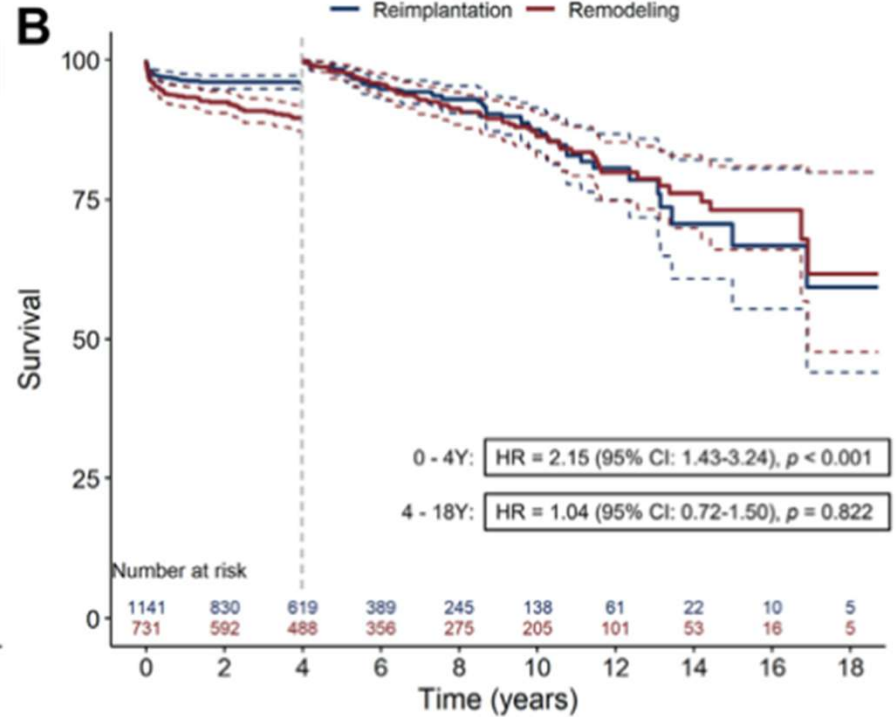
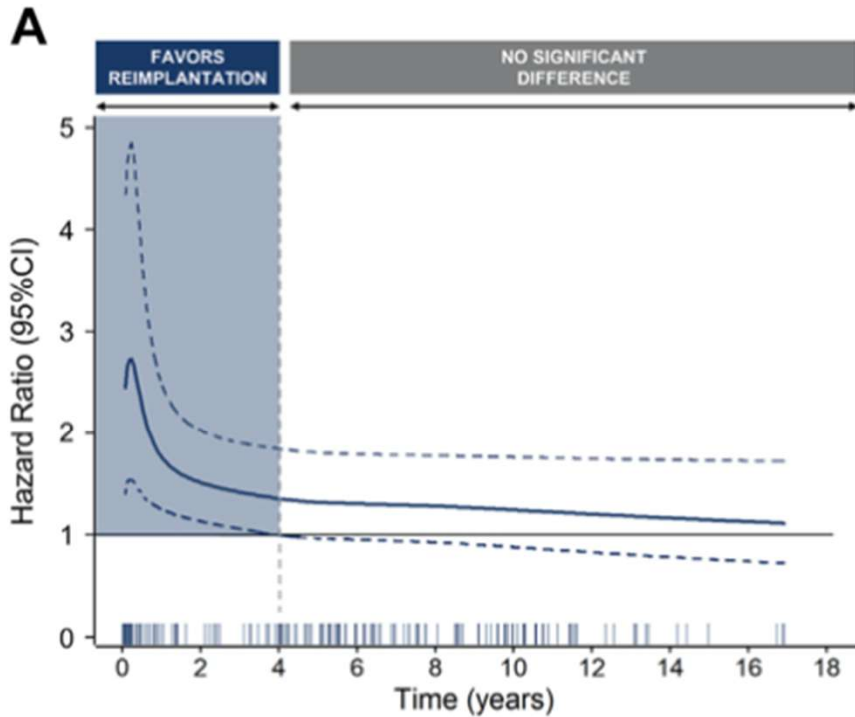
BACKGROUND remodeling in

METHODS Th
by December

RESULTS Fift
2018 in the re
(hazard ratio [landmark time
95% CI, 1.43-3
1.04; 95% CI,
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CONCLUSION
tervention ove
effect that fav

No significant differences in survival after 4 y





Current available neosinuses grafts

Our experience started during Covid pandemic due to scarce supply of prosthesis

GETINGE ✱

Cardioroot



UNCRIMPED

✓ **PROS**

- One piece, collagen-coated woven vascular graft
- Stiffer fabric, easier to pierce when performing the reimplantation procedure



TERUMO
Aortic Gelweave™



CRIMPED

✓ **PROS**

- The "Valsalva graft" - 20 yr clinical history (more data available)
- «skirt» and «collar» design

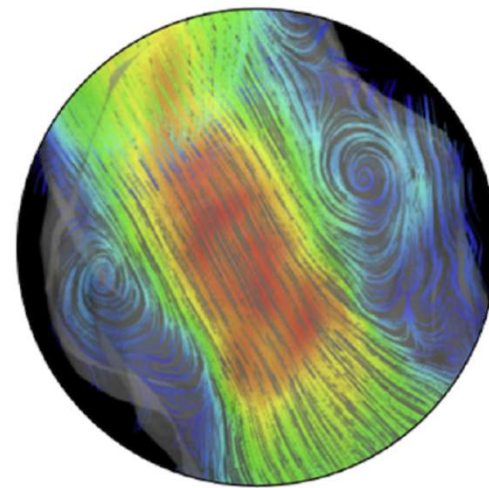
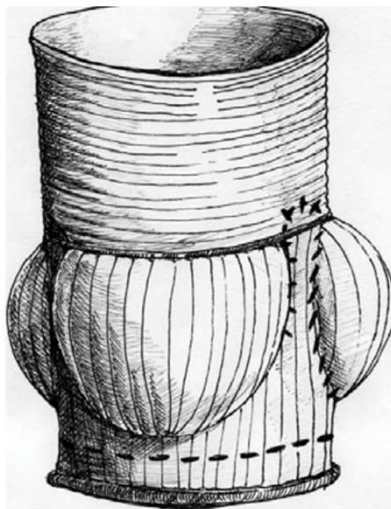
✗ **CONS**

- Elastic on the crimped portion. More challenging when adapting the aortic valve inside the graft



How we standardized David in Bologna

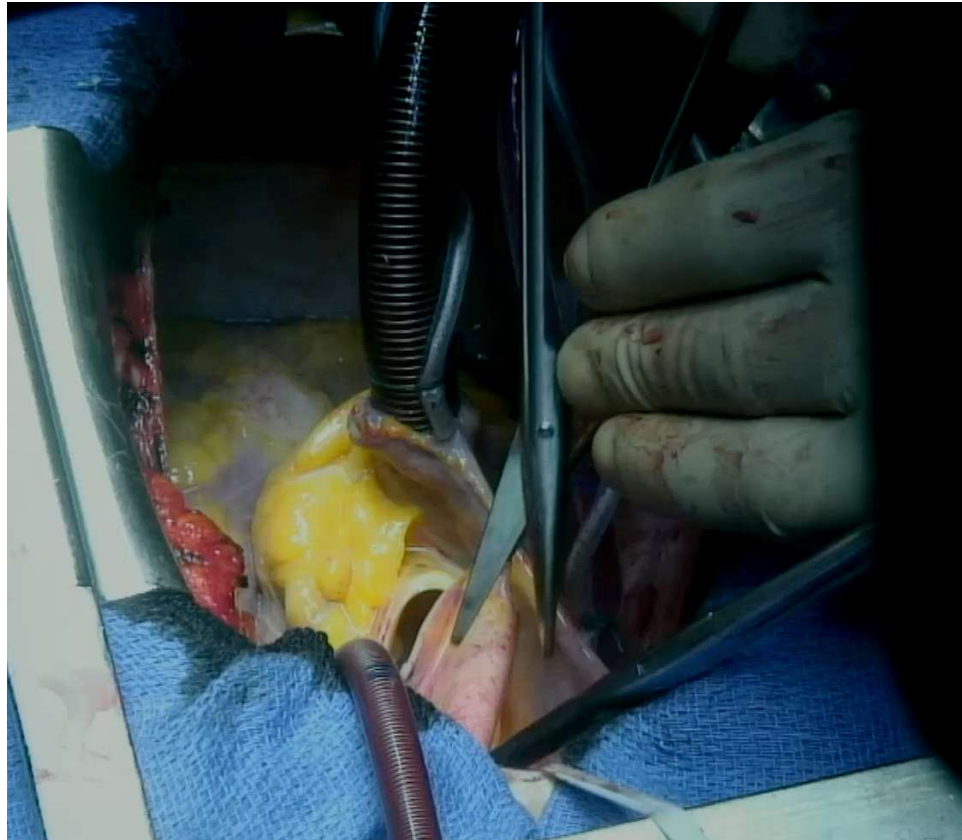
Step by Step





How we standardized David in Bologna

Step 1

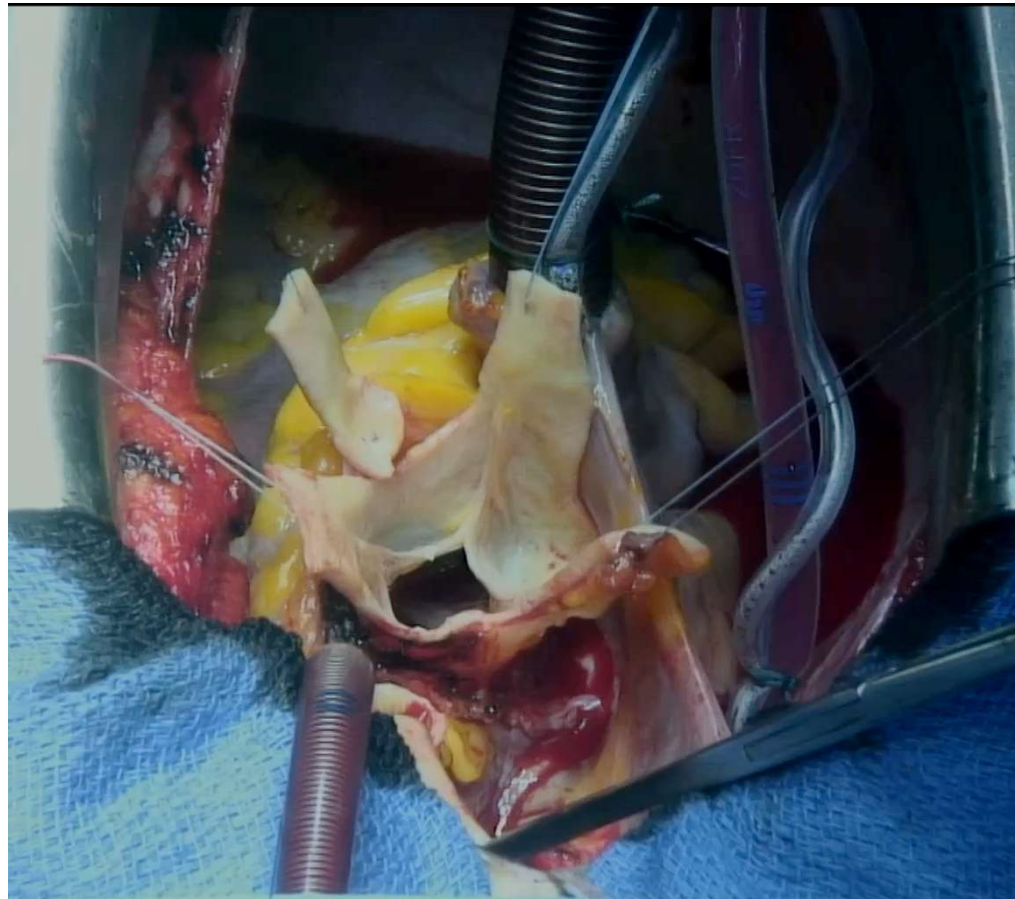


**Aortic Root
Isolation**



How we standardized David in Bologna

Step 2

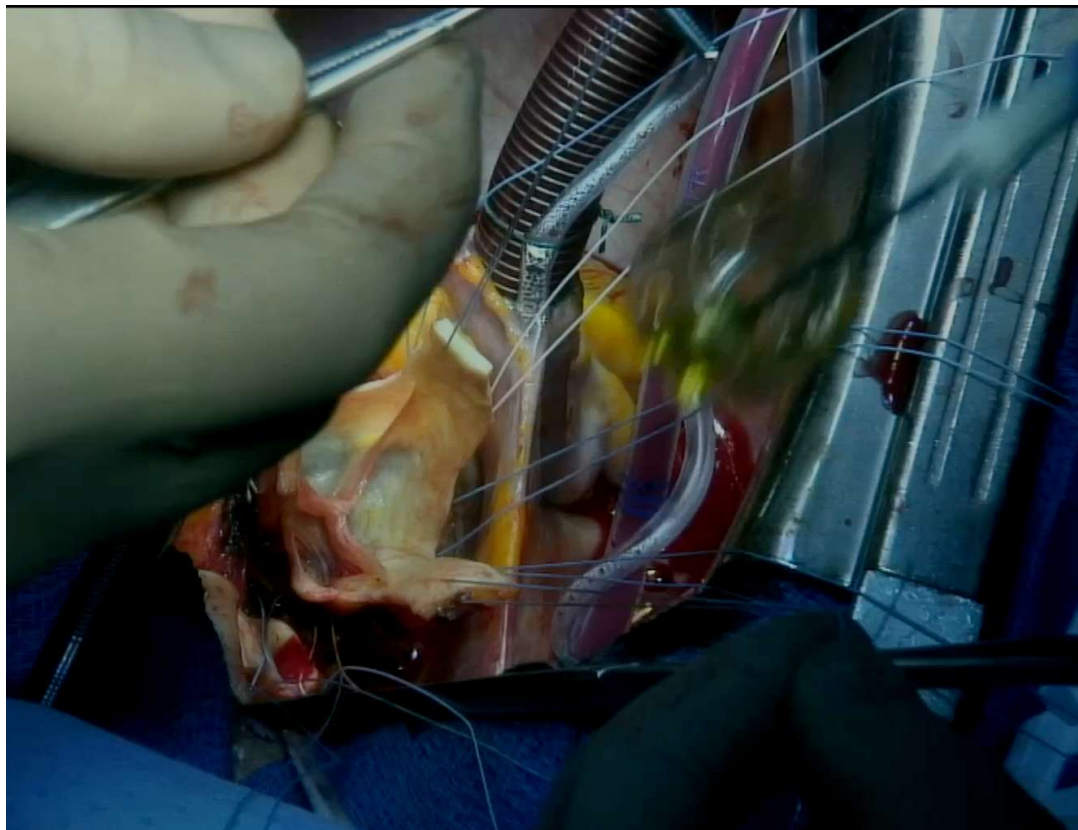
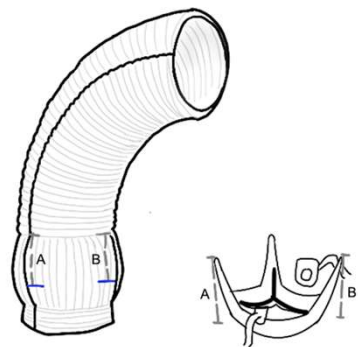


**Subannular
Stitches (6-9)**



How we standardized David in Bologna

Step 3

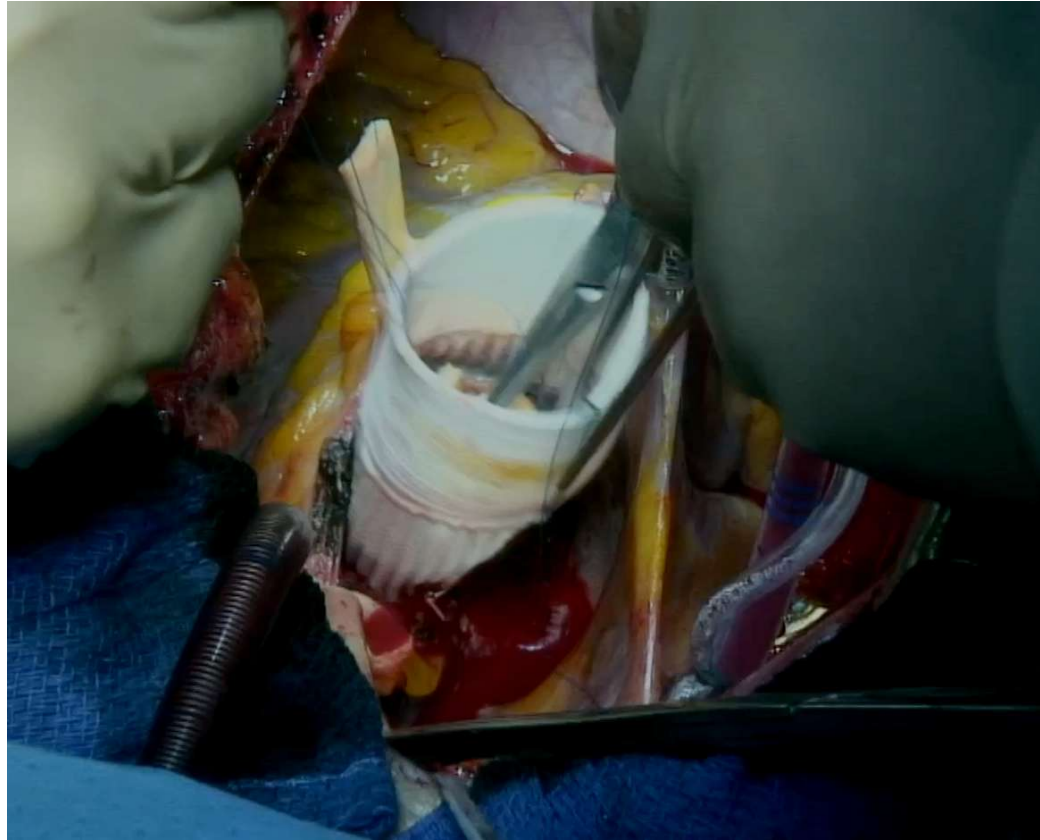


Graft selection
+ measuring the
commissures +
matching with
the Valsalva



How we standardized David in Bologna

Step 4



Commissures
Resuspensions
at the STJ
+
Suturing the
valve



How we standardized David in Bologna

Step 5

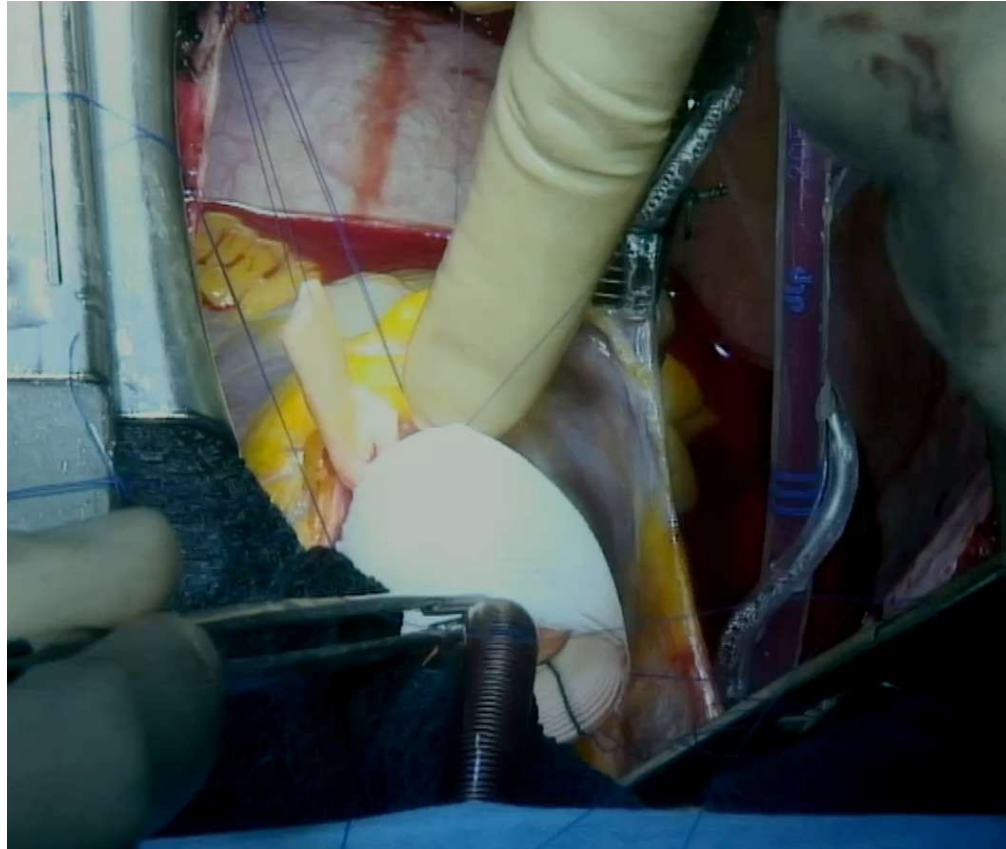


**Cusp plication
+
Caliper**



How we standardized David in Bologna

Step 6



**Coronary
Ostia
Reimplantation
+
Testing the
Root with
cardioplegia**