

WHY I TRUST AV REIMPLANTATION

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Disclosure

Speaker name:

Ruggero De Paulis

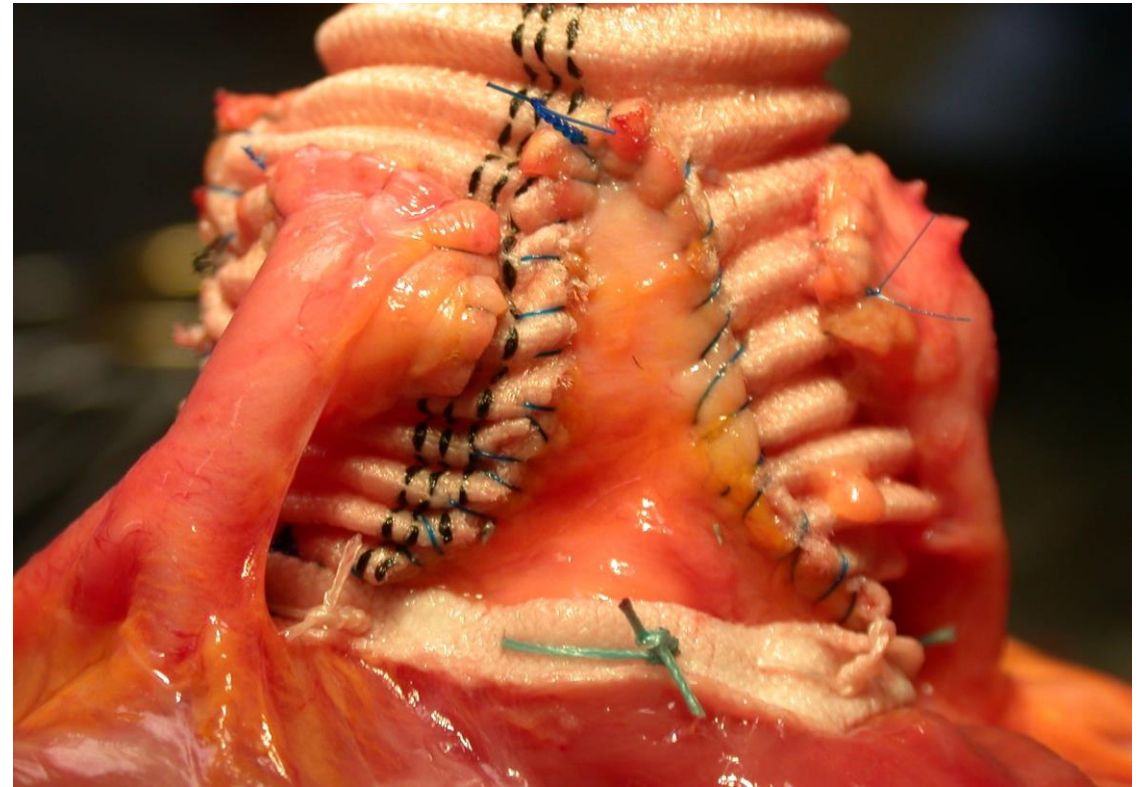
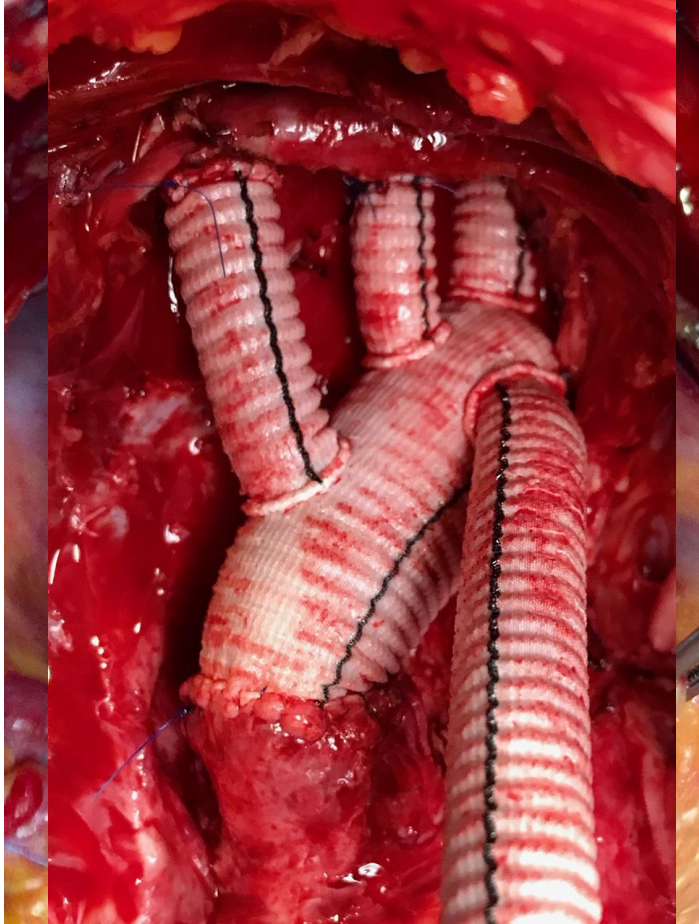
I have the following potential conflicts of interest to report:

- ☐ Consulting
- ☐ Employment in industry
- ☐ Stockholder of a healthcare company
- ☐ Owner of a healthcare company
- ☒ I receive royalties from Terumo Aortic
- ☐ I do not have any potential conflict of interest

I trust AV reimplantation because is:

1. a SAFE procedure that...
2. provide an optimal ANATOMICAL RECONSTRUCTION,
3. an excellent restoration of NORMAL ROOT and LEAFLET PHYSIOLOGY and
4. STABLE long-term results in
5. a REPRODUCIBLE and STANDARDIZED fashion

1. A safe procedure. Technical point of view



1. A safe procedure. Operative mortality

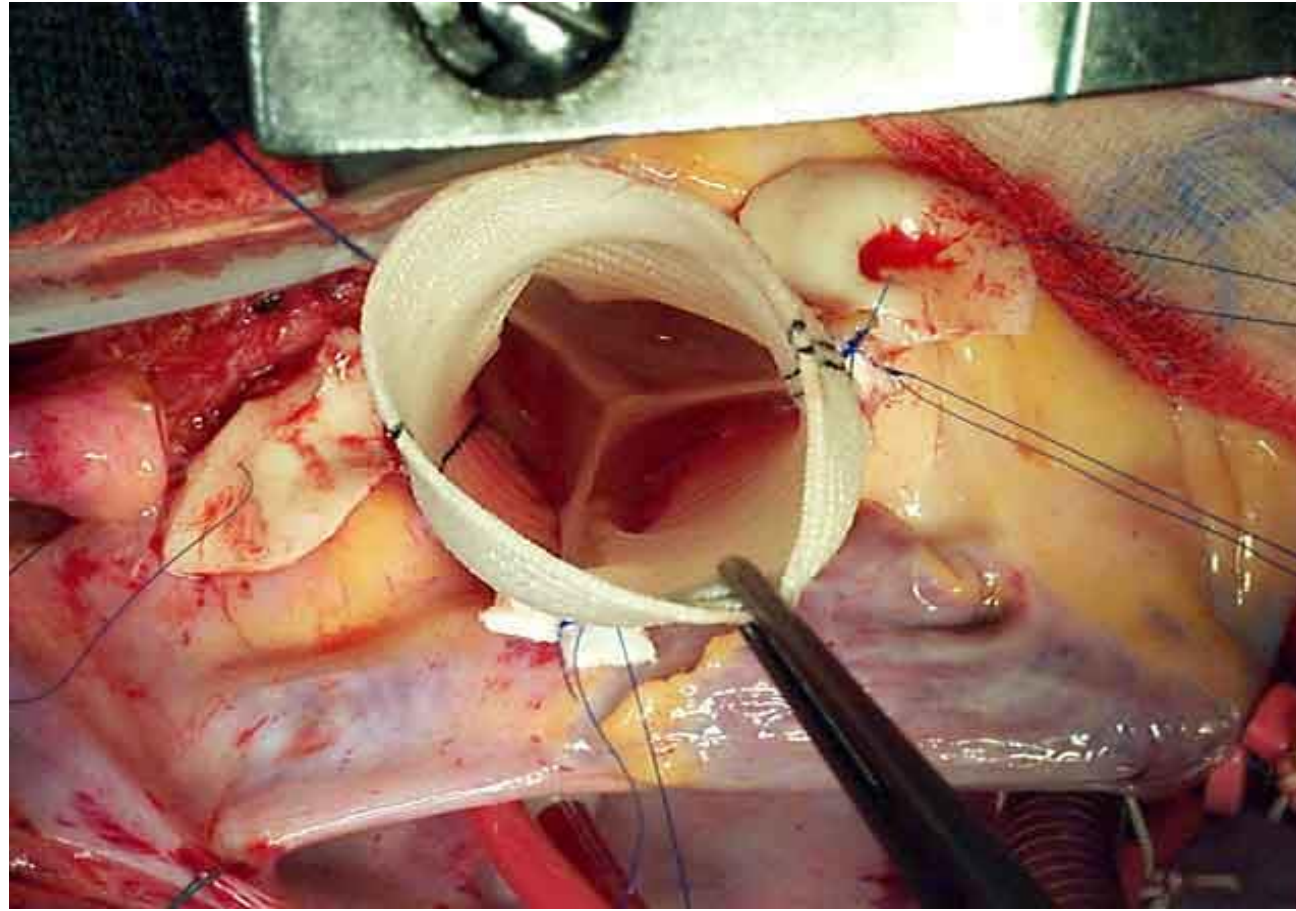
Authors	Patents	Mortality
Kallenbach et al. 2005	284	3.2%
David et al. 2007	289	1.7%
De Paulis et al. 2016	124 (203)	1.6% (0.9%)
Miller et al. 2012	233	0,9%

1. A safe procedure. Metanalysis

Author (Reference)	Year	Cusp repair (%)	Valve sparing root replacement technique (%)		Early mort. (%)	OVE (%/pt-yr)	Reop. (%/pt-yr) [‡]	Late mort. (%/pt-yr)
			Reimplantation	Remodelling				
Aicher (4)	2010	83	NR	NR	3.44	0.16	1.2	NR
Lansac (6)	2010	58.4	NR	100	2.8	0.32	2.5	1.6
Lansac (7)	2006	6.2	NR	100	3.6	NR	4.2	0
Boodhwani (8)	2009	†	NR	NR	1.14	0.10	0	1.1
DePaulis (9)	2010	9	100	NR	1.80	NR	1.4	0.42
Settapani (10)	2009	5	100	NR	1.67	NR	3.5	1.4
Urbanski (11)	2010	9.4	1	NR	0	NR	0	NR
Doss (12)	2010	100	25.8	NR	0	0.30	0	3.0
Badiu (13)	2010	60.8	72.5	27.5	0.98	NR	2.4	0.40
Cameron (14)	2009	NR	53	47	0	NR	0.47	0.16
Svensson (15)	2010	42	100	NR	0	0.78	1.0	0.26
David (16)	2010	38.1	78.9	21.1	1.73	0.14	0.33	1.2
Izumoto (17)	2006	80	NR	NR	2.5	NR	3.5	NR
Tanaka (18)	2011	8.4	88.3	11.7	0	NR	0	1.5
Oka (19)	2011	50.5	99	1	0	NR	1.9	2.0
Kallenbach (20)	2005	6.3	100	NR	3.17	0.41	1.5	2.1
Minakata (21)	2004	100	NR	NR	0.63	0	2.4	2.4

†, tailored to specific etiology; ‡ composite endpoint: late AVR and re-repair; NR, not reported; pt-yr, patient-year; mort., mortality; OVE, operated valve endocarditis

2. Optimal anatomical reconstruction



Valve sparing operation (David I)

theoretic problems

preservation of the leaflets. In the present technique, a straight tube graft without sinus components is used as a root replacement. This approach raises several theoretic

problems. With respect to fluid flow, the lack of sinuses in this graft may not allow for optimal opening and closure of the native valve. With no distinct sinus ridge, fluid flow eddies may not form as readily behind the leaflets.

On opening, the leaflets may be more likely to impact on the graft wall, subjecting them to potential damage. In addition, a delay in eddy formation would delay initiation of valve closure, and some regurgitation may result. With respect to stress sharing, a straight tube graft root replacement may not be geometrically suited to take up stress from the leaflets. Abnormal stress on the leaflets

may decrease the potential longevity of the repair. An optimal design for root replacement would incorporate sinuses and a sinus ridge to promote proper valve opening and closure, as well as decreased stress on the leaflets.

Modifications of straight grafts for a better root reconstruction

Uni-graft



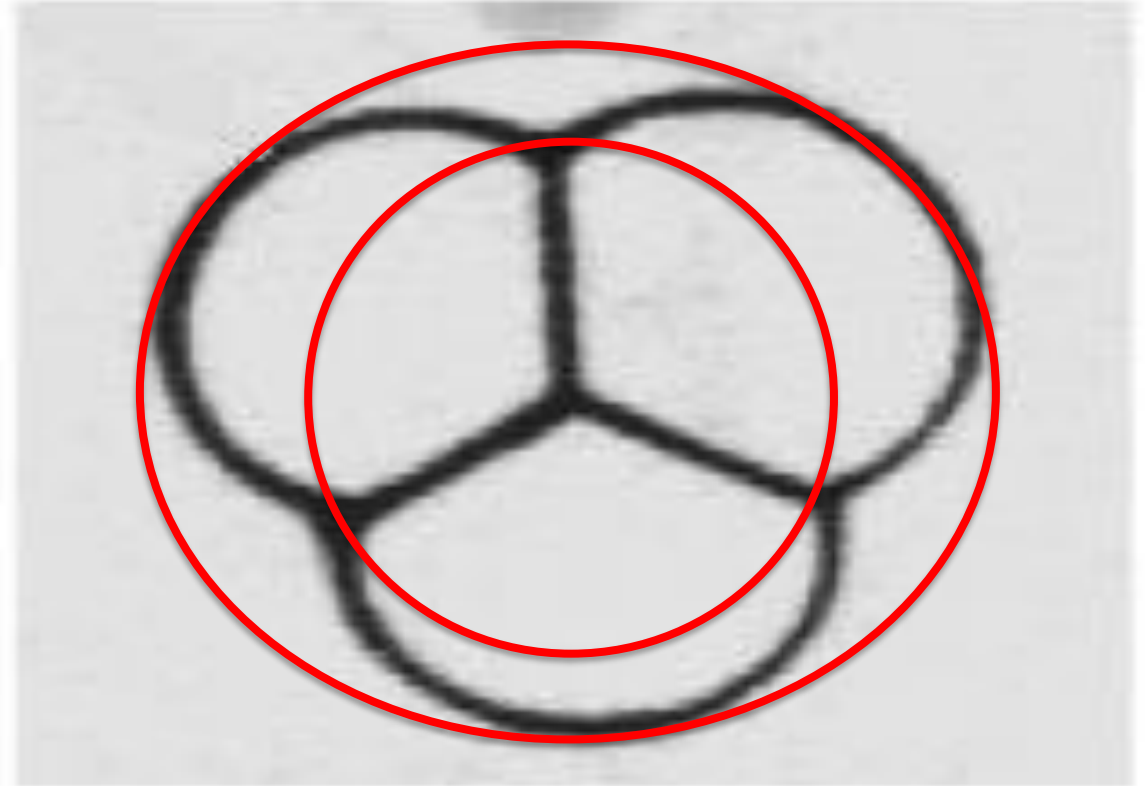
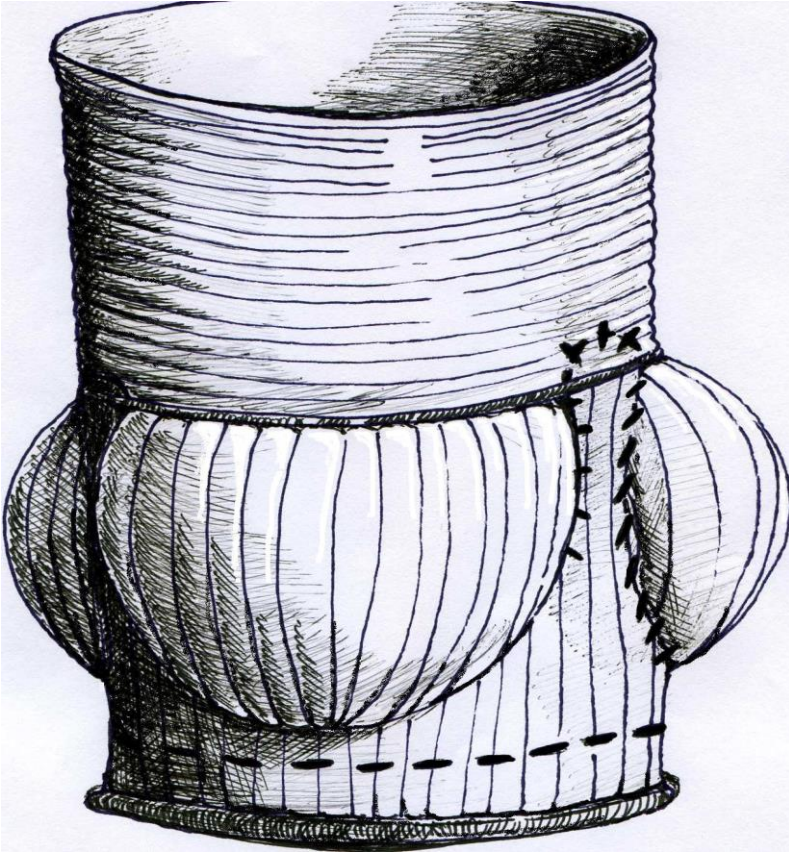
Valsalva graft



Cardioroot



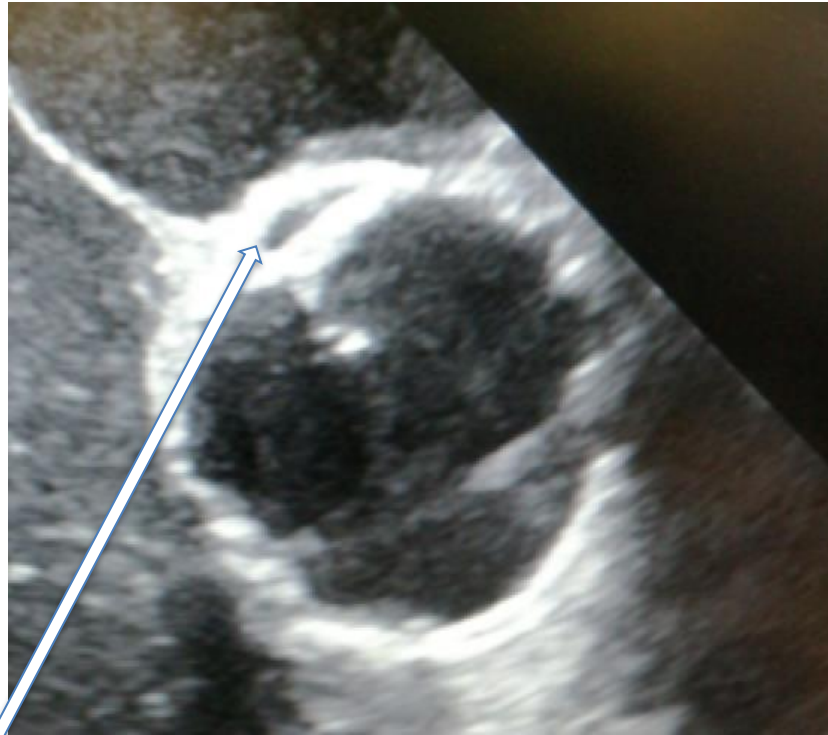
The ability of the graft to precisely repositioning of the commissures



Evidence of a trifoliate aspect of the root

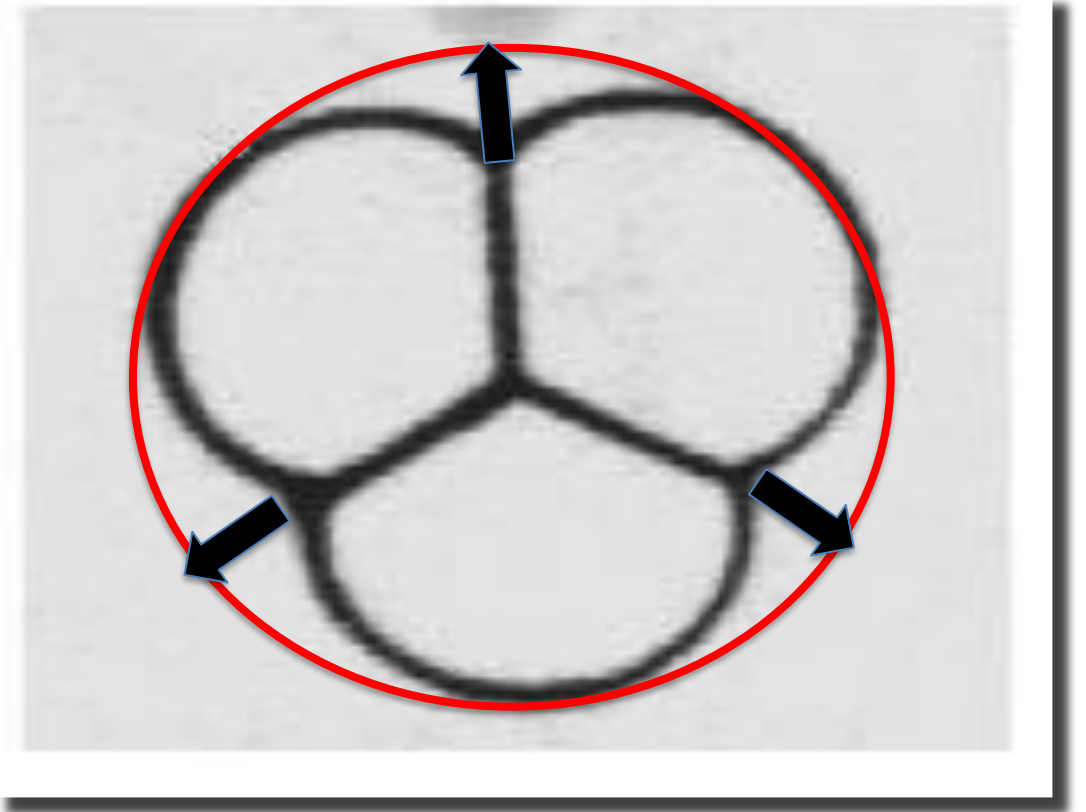
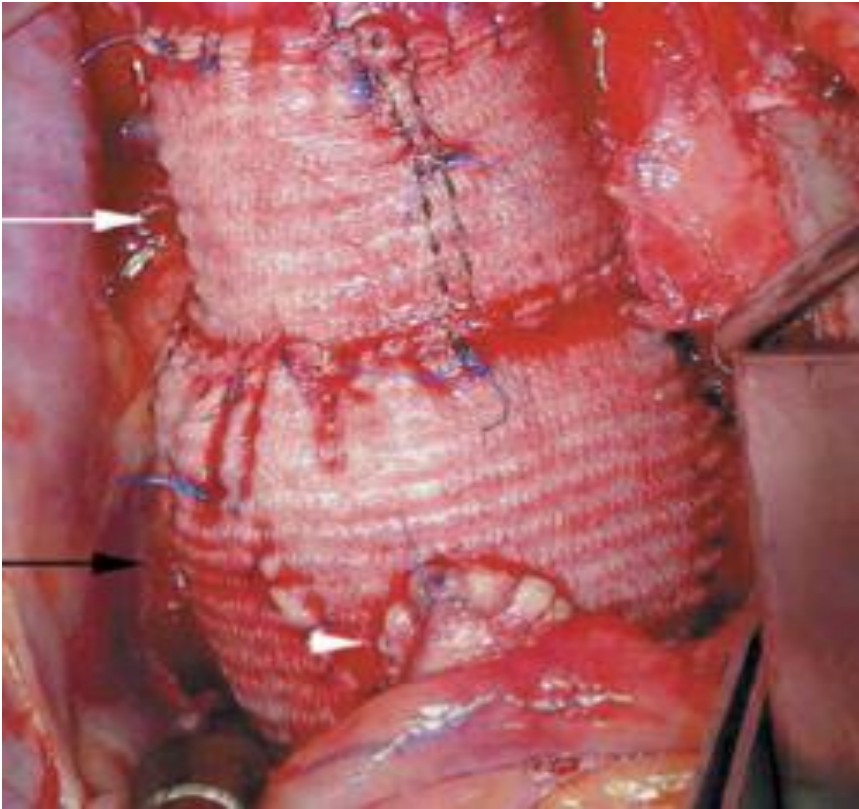
Immediate postop.

After a month

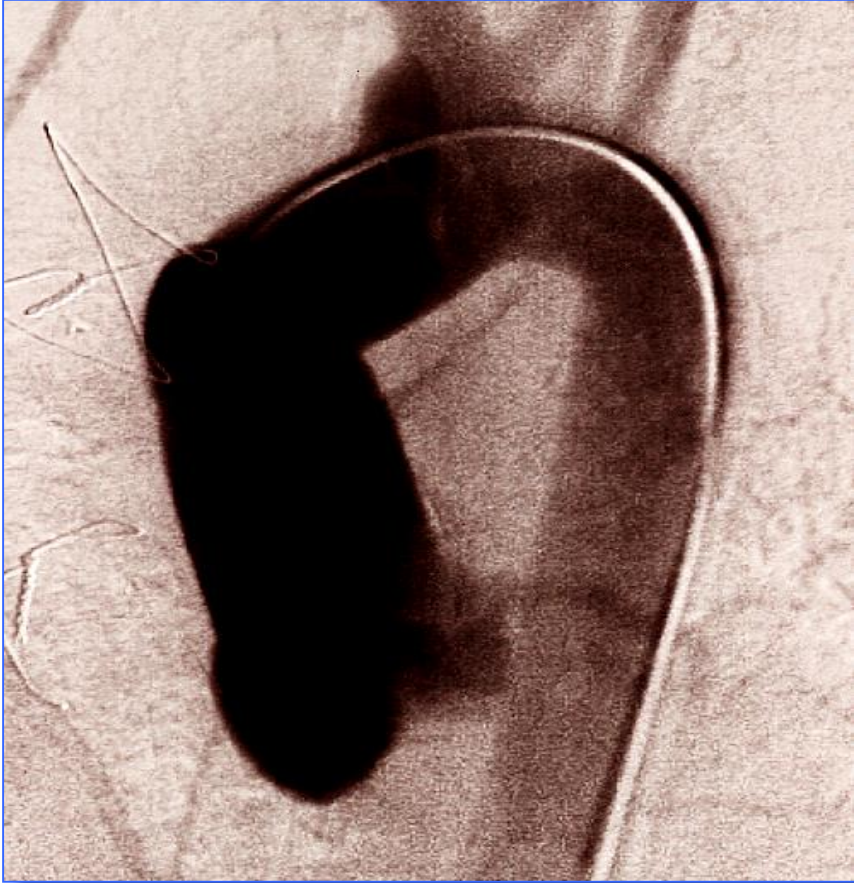


Empty space between Dacron and commissures

Impossibility to do the same
with a larger straight graft



Comparable with remodeling



Remodeling



Reimplantation

2. Optimal anatomical reconstruction

EDITORIAL COMMENTARY

Back to David I

Never

Tirone E. David, MD^{*,†}

In this issue of the *Seminars*, Mignosa and colleagues from the University of Catania, Italy, present an echocardiographic study on hemodynamics of the aortic valve at rest and exercise after reimplantation of the aortic valve into a cylindrical graft. Pertinent echocardiographic parameters of 13 patients who had reimplantation of the aortic valve more than 5 years ago were compared with those of 9 healthy individuals. Expectedly the mean and peak systolic gradients increased during exercise and were statistically higher than the values of healthy individuals but not clinically relevant. The mean systolic gradients were 6.1 ± 2.2 mm Hg and the maximum during the exercise increased to 13.2 ± 5.1 mm Hg. The aortic valve orifice area did not change during the exercise (3.1 ± 0.3 to 2.8 ± 0.8 cm², $P = 0.44$) whereas it did in normal individuals (3.0 ± 0.3 up to 4.0 ± 0.5 cm²). As stated by the authors the sample size was small but the mean of the variables measured had small standard deviations of the means, suggesting fairly consistent results across the 13 patients, including 4 who had bicuspid aortic valves.

D'Ancona et al¹ from Palermo (not too far from Catania in

Christopher Feindel, one of my associates and coauthor of the original description of aortic valve reimplantation,⁴ has always used a straight tubular Dacron graft because he does not believe that we should change what works well.

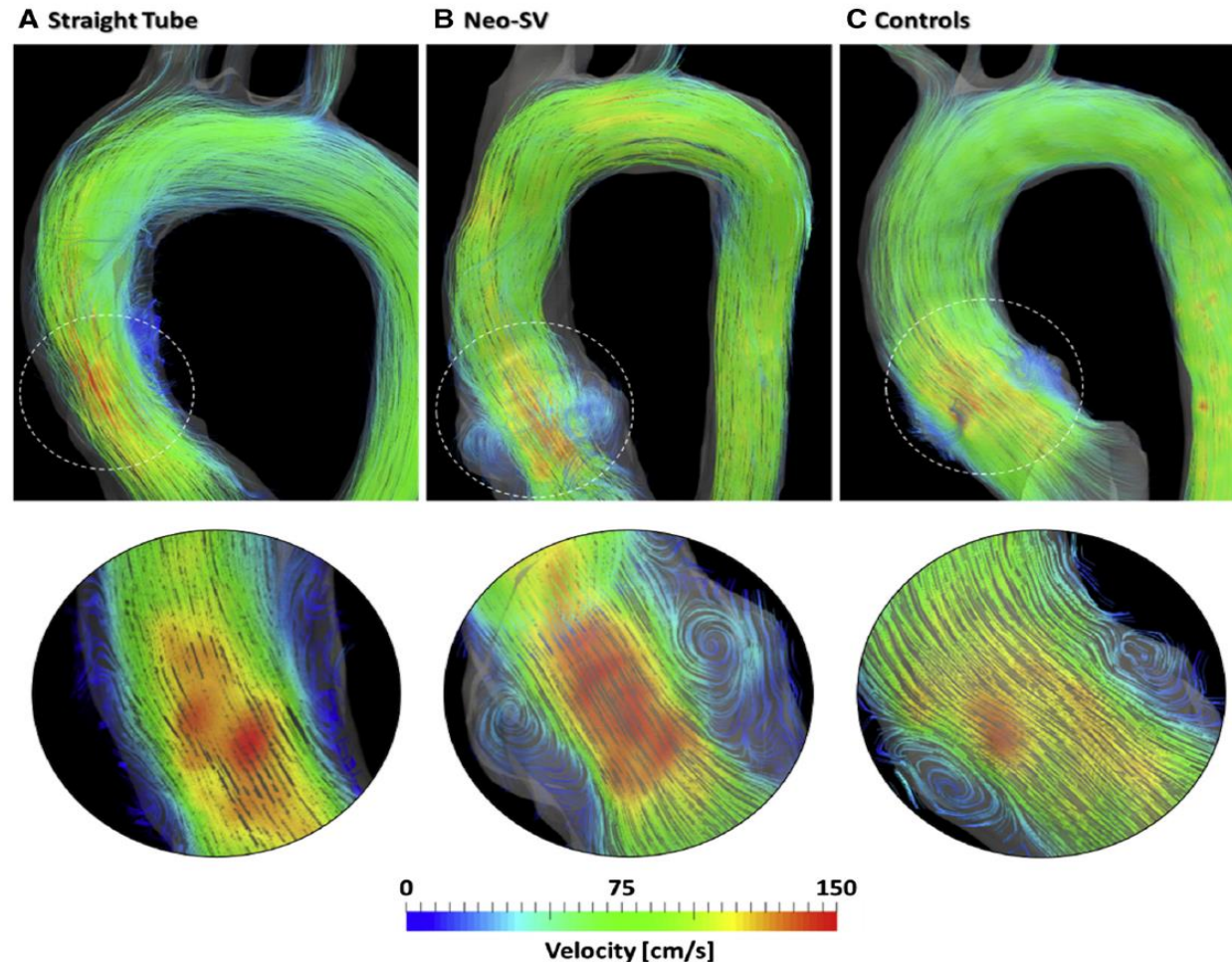
After 27 years of performing aortic valve-sparing operations, I have gone "back to David I" because the results in our first 89 patients (mean follow-up of 15 years) showed that only 3 have required reoperation (1 due to endocarditis and 2 because of aortic insufficiency) and the remaining patients had competent aortic valves with mild, if any, aortic insufficiency and an aortic valve orifice that is



Tirone David, MD

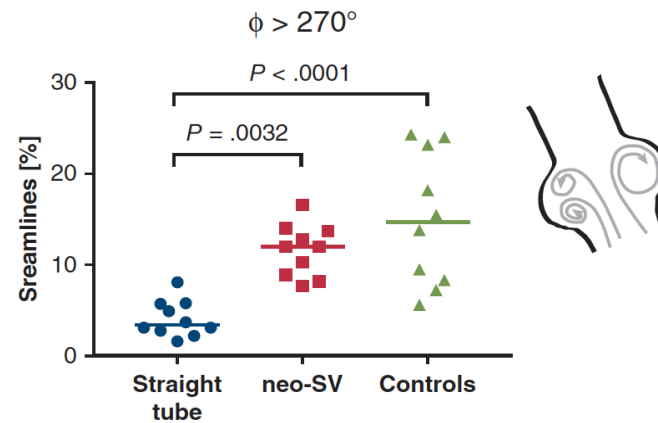
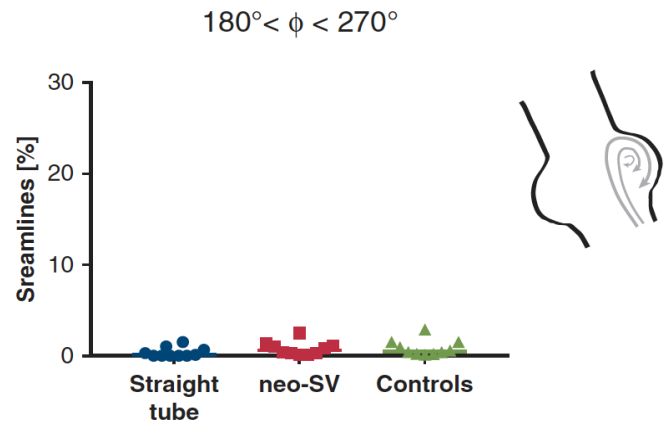
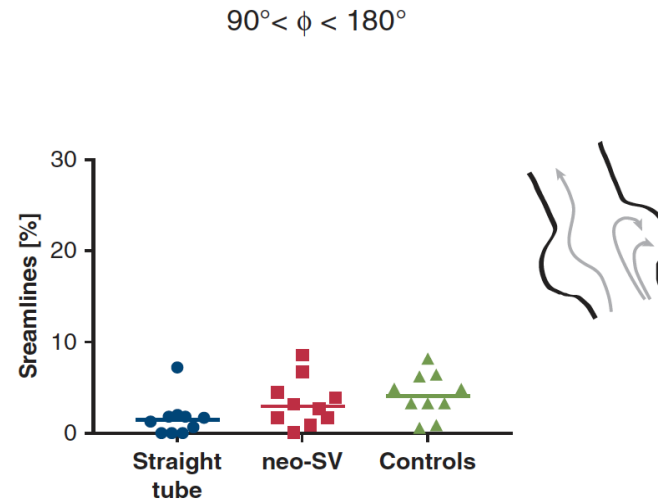
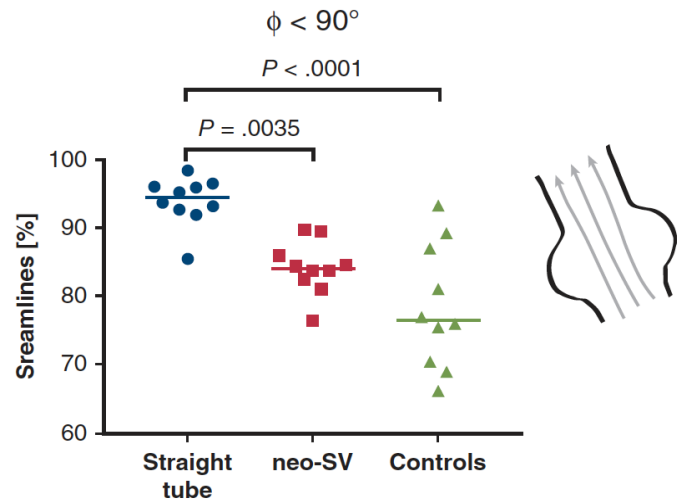
See related article on pages 257–263.

3. Restoration of root and leaflet physiology



4D MRI flow comparison of reimplantation with Straight graft, Valsalva graft, and controls

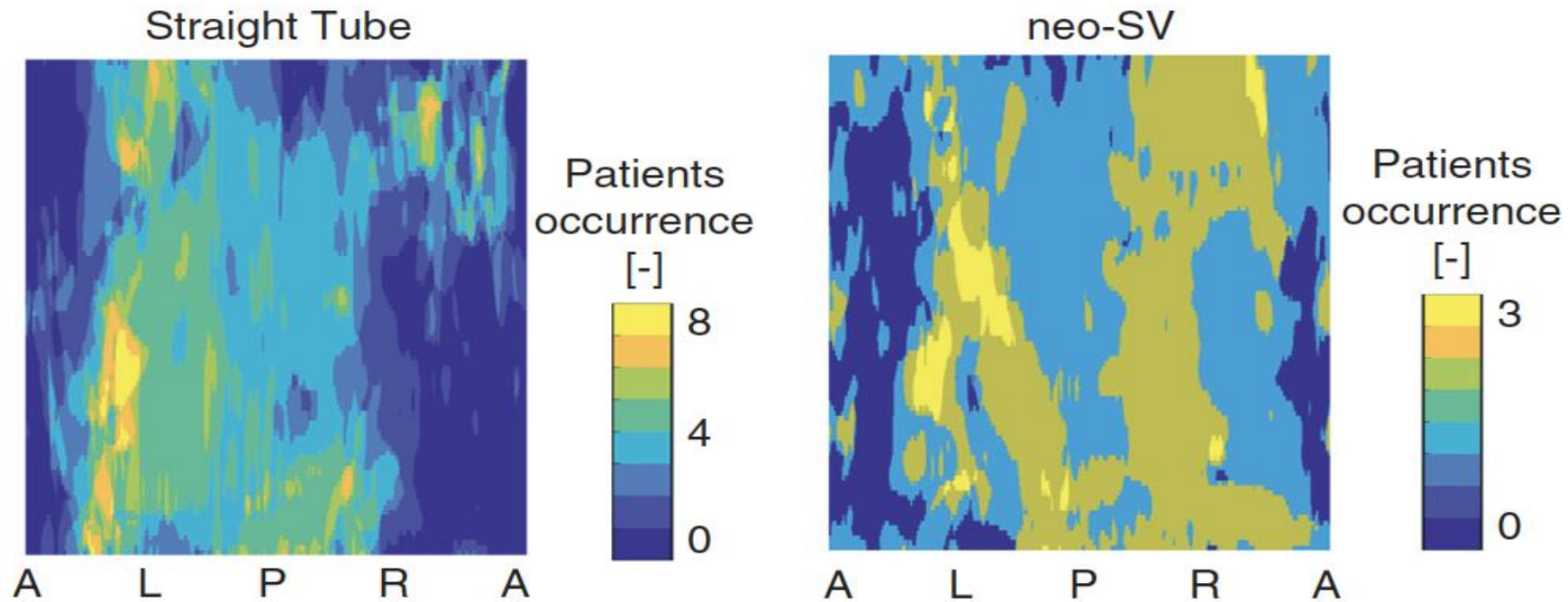
JTCVS 2018, in press



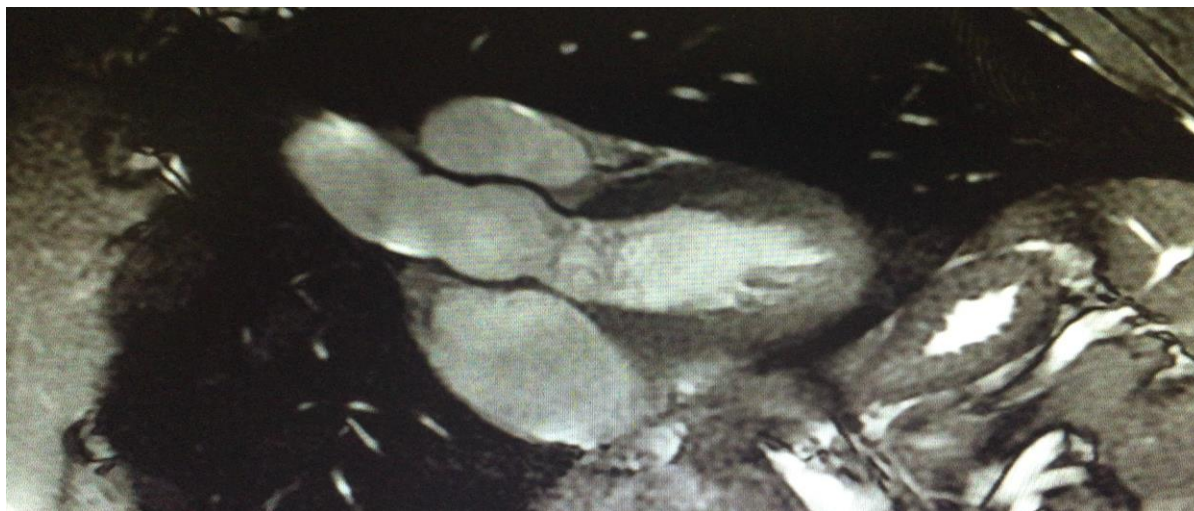
4D MRI rotational flow of
reimplantation with
Straight graft, Valsalva graft, or
controls

Wall stress measured in the descending aorta

WSS risk stratification



3. Restoration of root and leaflet physiology



16 years after reimplantation
for acute dissection

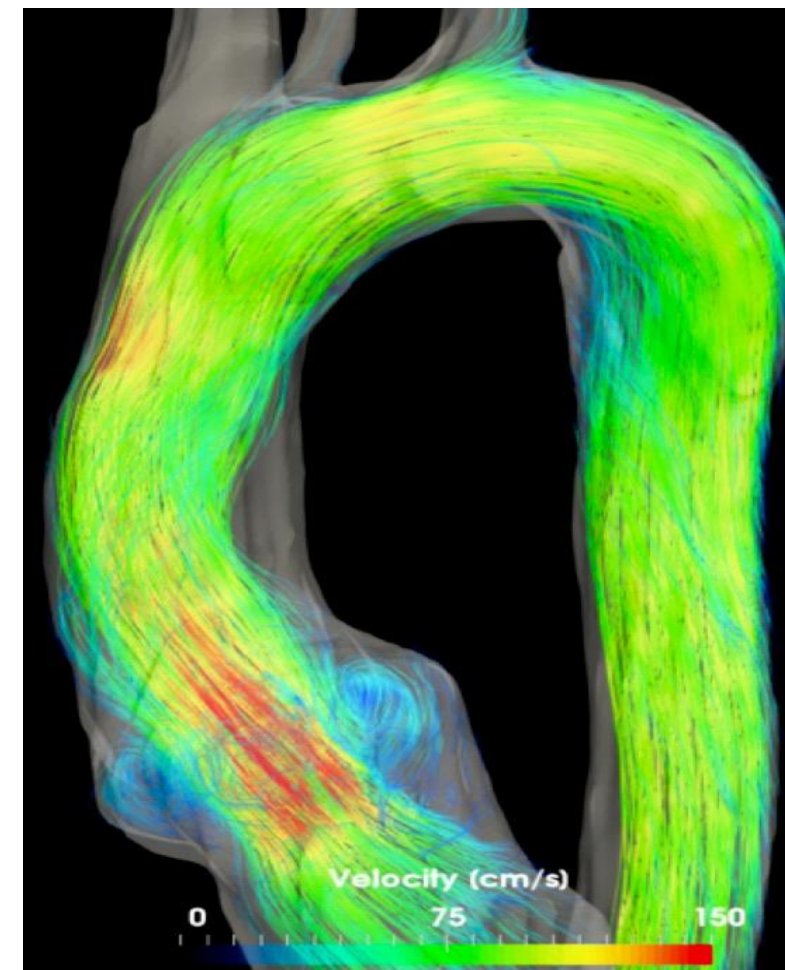


TABLE 1. Preoperative data: clinical and echocardiographic characteristics of patients	
No. of patients	203
Age (mean)(y)	53 ± 13
Male gender	176 (86,69%)
Associated diseases	
Marfan syndrome	25 (12,3%)
Loeys-Dietz syndrome	1 (0,5%)
Type A aortic dissection	10 (5%)
Bicuspid aortic valve	33 (16,2%)
Previous cardiac surgery	3 (1,47%)
Preoperative echocardiographic findings	
Aortic regurgitation	
• ≤ 2+	141 (69,45%)
• ≥ 3+	62 (30,54%)
Annulus (mm ± SD)	25 ± 2,7
Valsalva sinus (mm ± SD)	50 ± 4
STJ (mm ± SD)	44 ± 5,7
Ascending aorta (mm ± SD)	47 ± 7,2

Patient population

4. Stable long-term results

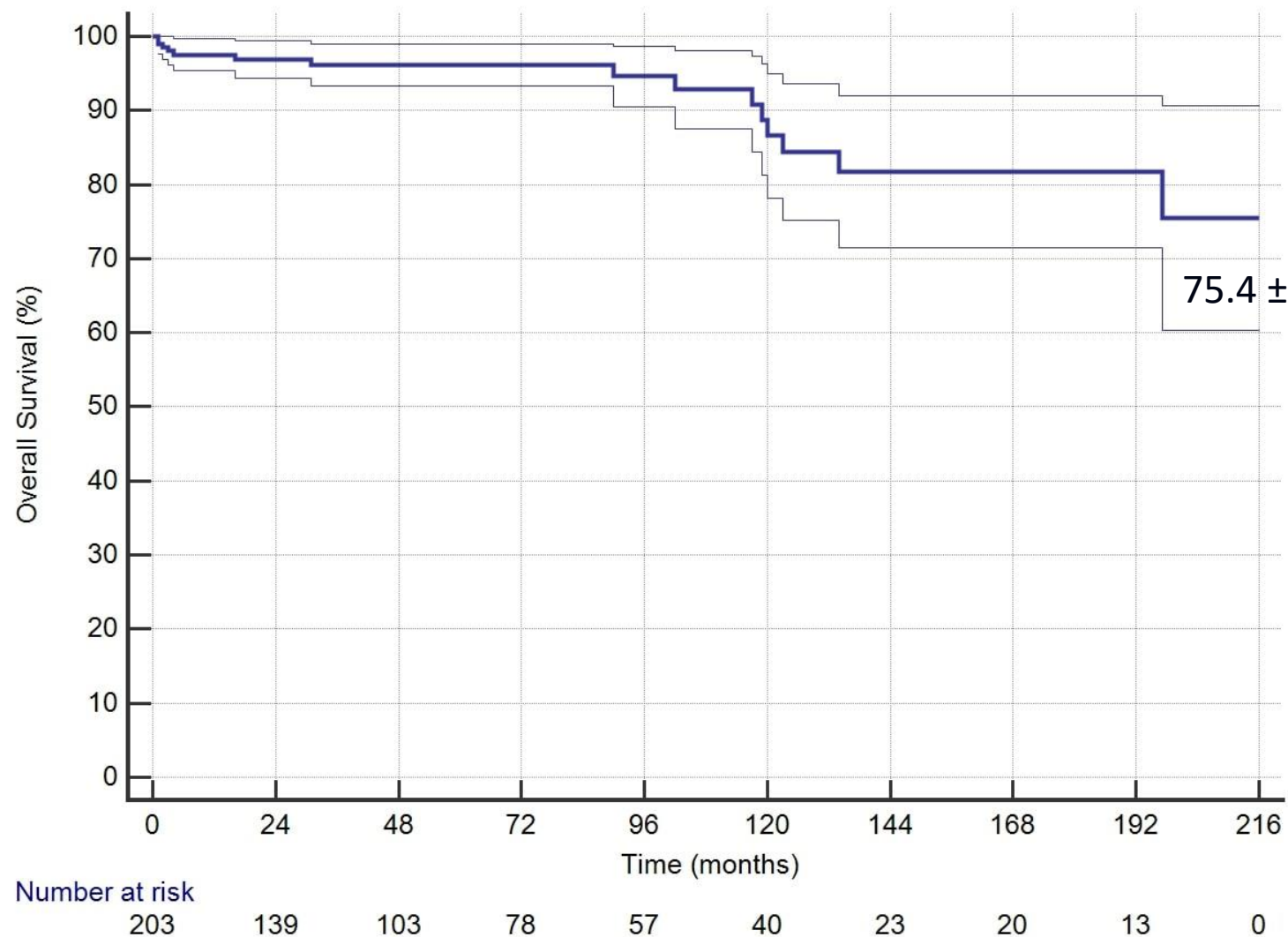
Operative data

TABLE 2. Operative data

Mean Dacron graft diameter	30,58 ± 1,3
Leaflet repair	68 (33,5%)
Mean cardiopulmonary bypass time ± SD (min)	123 ± 26
Mean aortic crossclamp time ± SD (min)	105 ± 18
Circulatory arrest (No pts)	8 (3,94%)
Number of sub-valvular annular stitches	
• BAV pts	8 ± 0,9
• TAV pts	6 ± 0,87

4. Stable long-term results

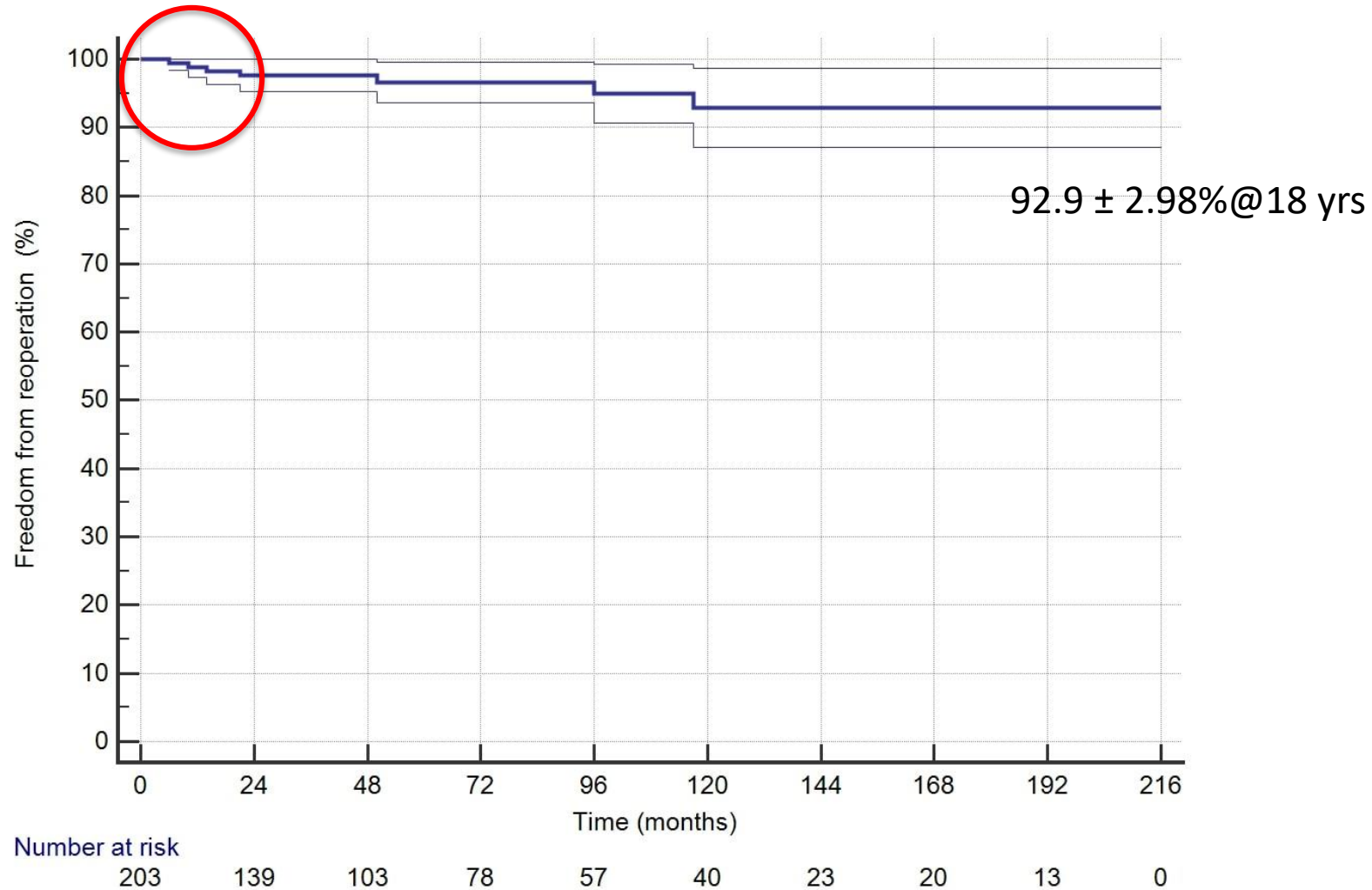
Overall Survival



15 deaths
1 HF
14 non cardiac
related

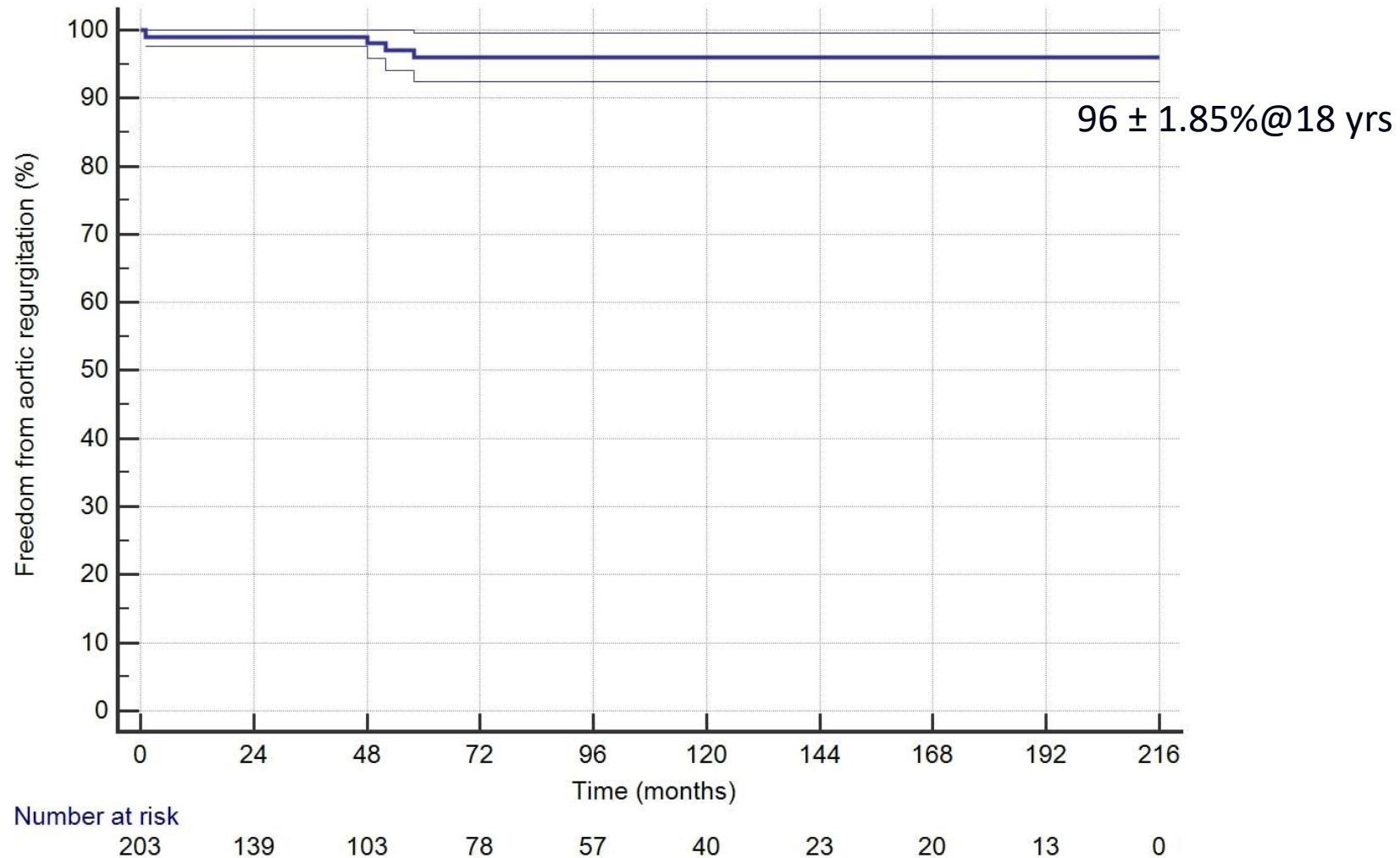
4. Stable long-term results

Freedom from Reoperation



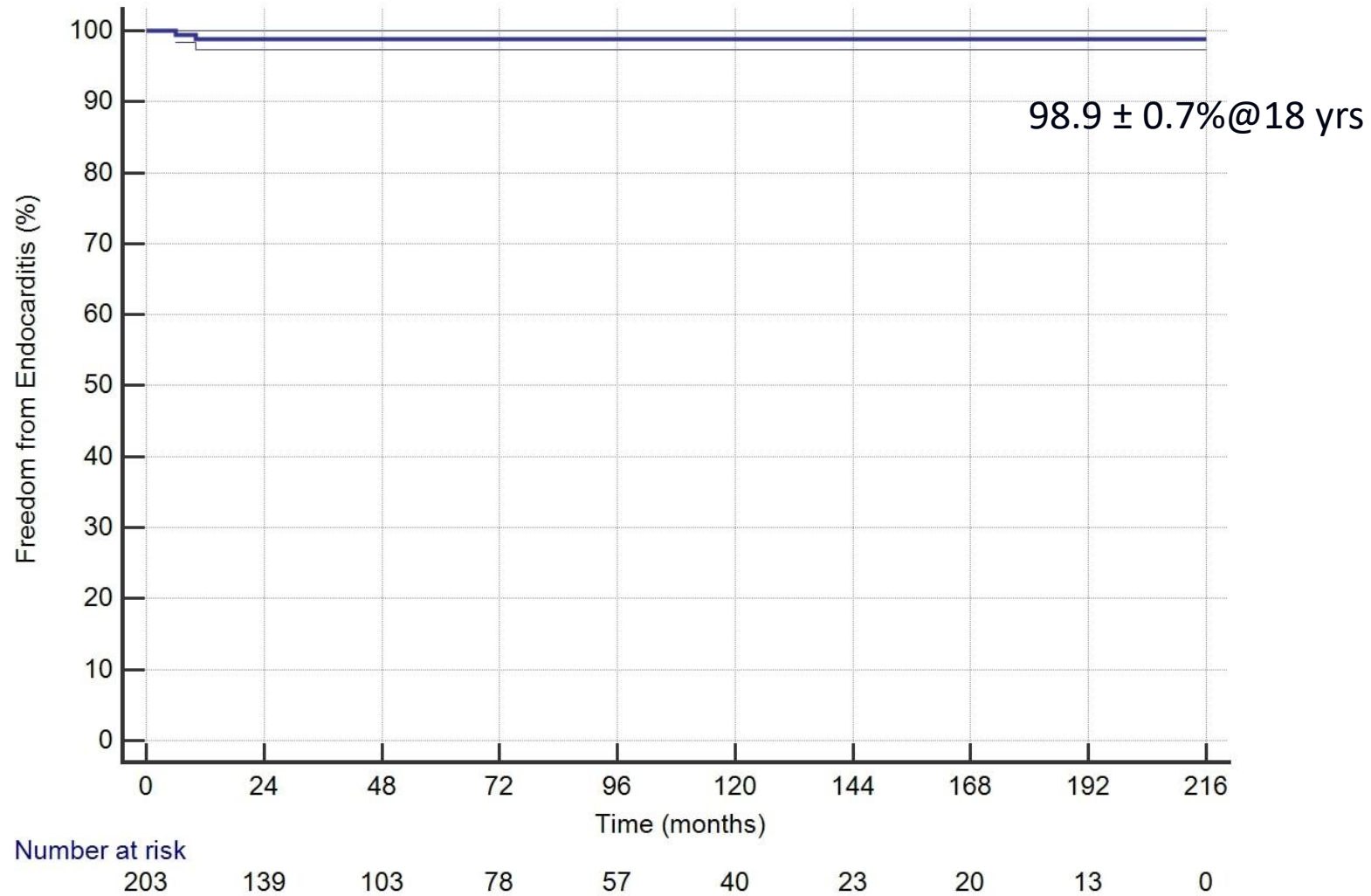
4. Stable long-term results

Freedom from Aortic Regurgitation (not reoperated)



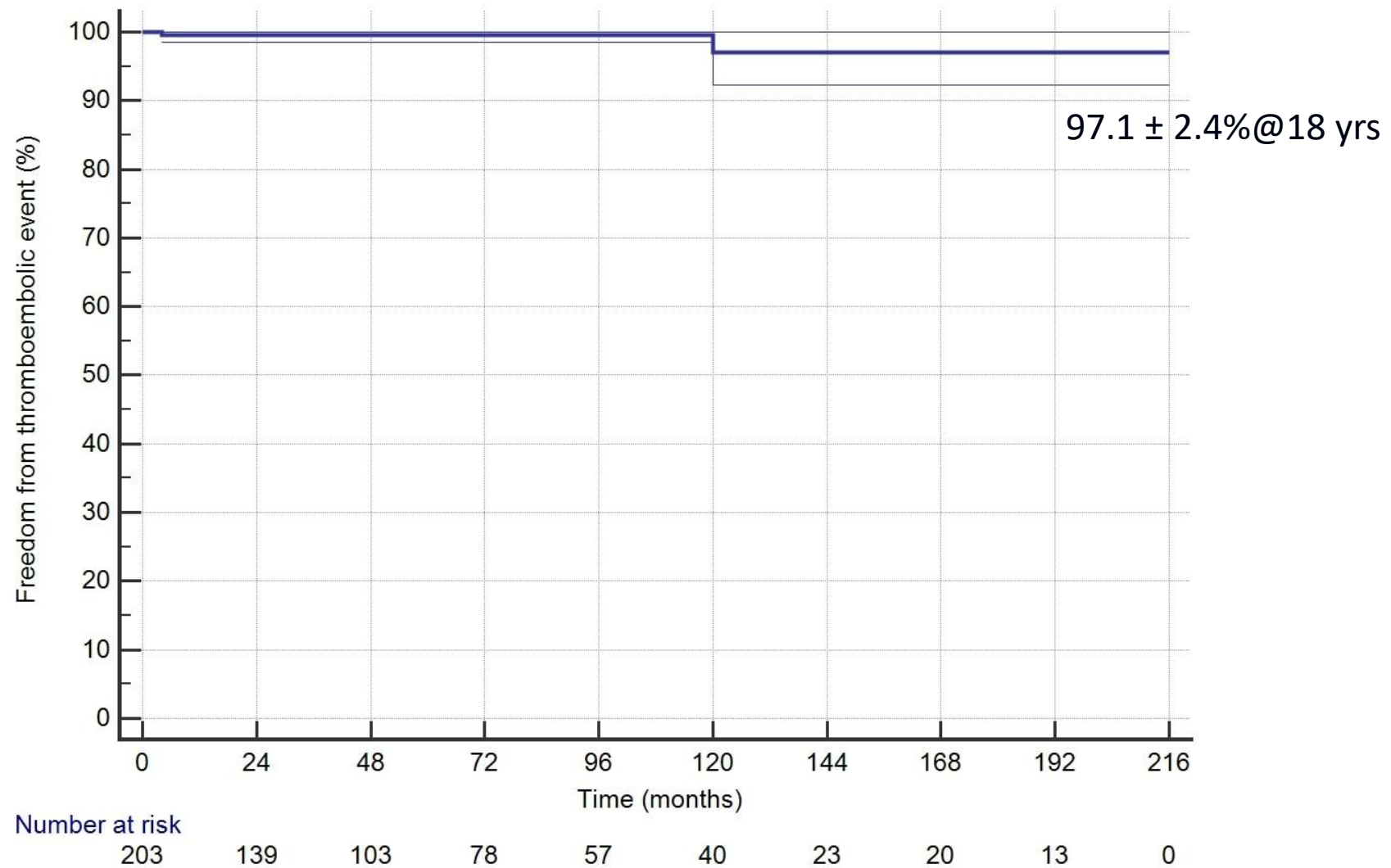
4. Stable long-term results

Freedom from Endocarditis



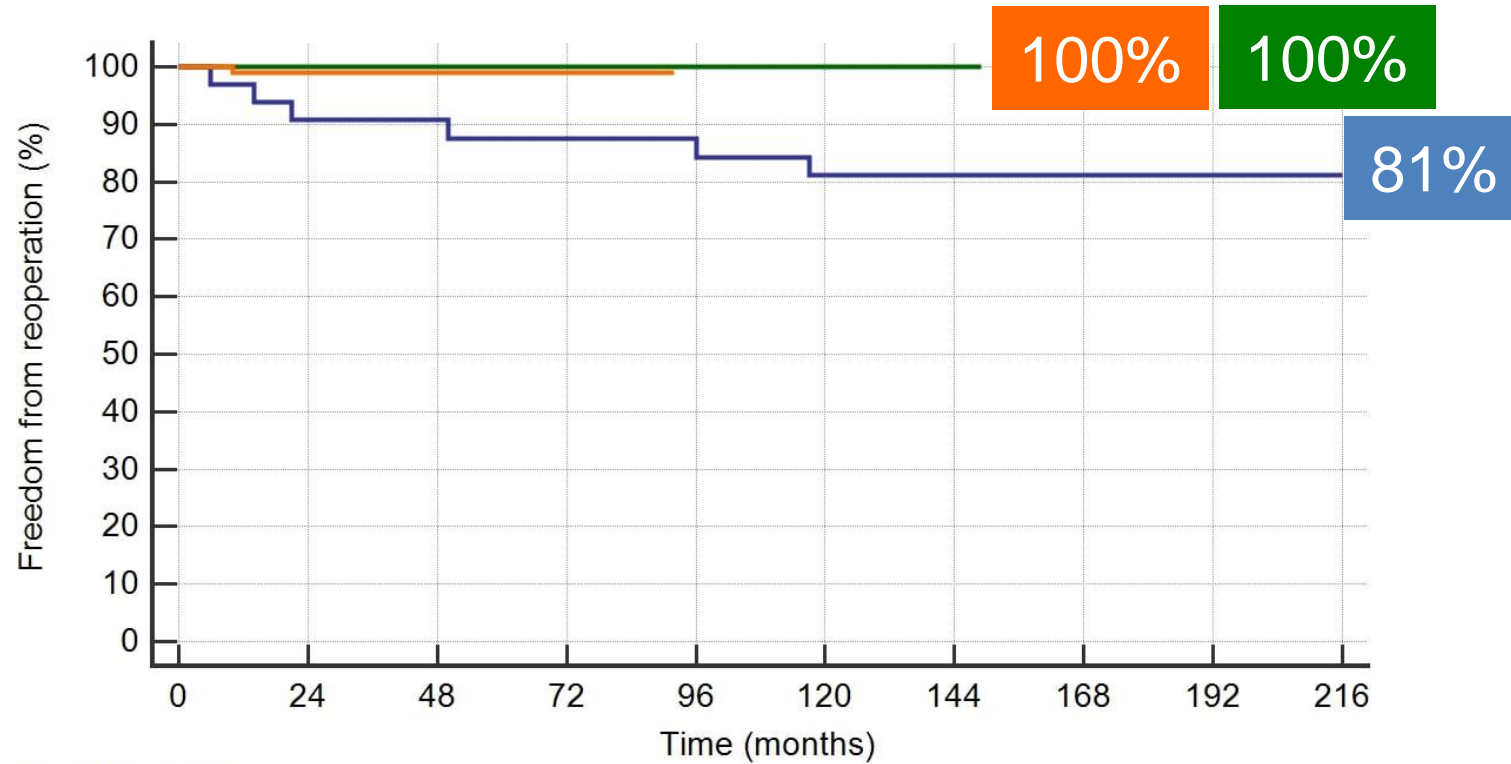
4. Stable long-term results

Freedom from Thromboembolic event



4. Stable long-term results

Learning curve effect (reoperation)



Number at risk

Group: 1- First 5 years of experience (Blue)

36 29 28 27 26 23 21 20 13 0

Group: 2- From 5 to 10 years of experience (Green)

36 35 34 34 31 17 2 0 0 0

Group: 3- Over 10 years of experience (Orange)

131 75 41 17 0 0 0 0 0 0

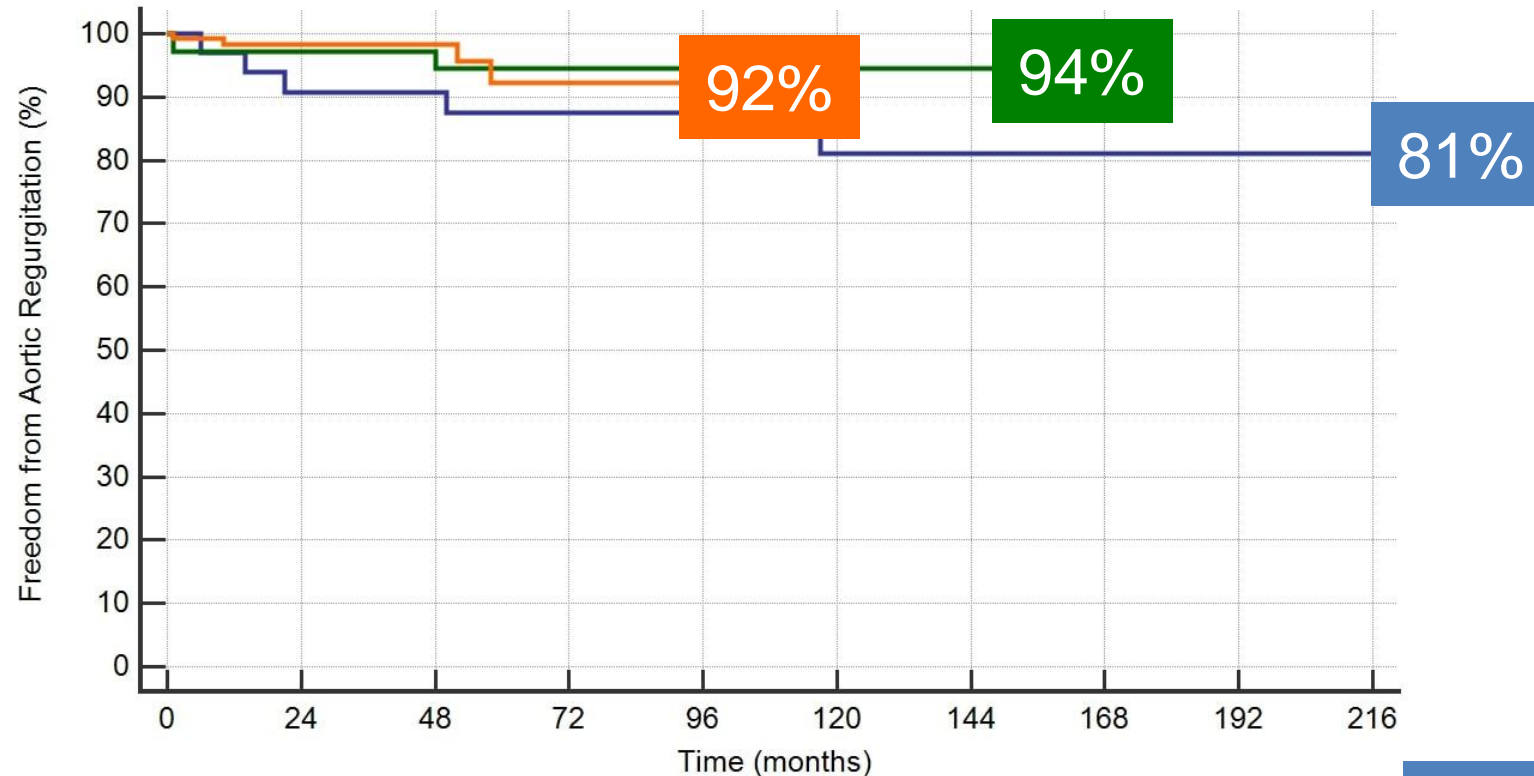
First 5 years

5 to 10 years

> 10 years

4. Stable long-term results

Learning curve effect (residual AR)



Number at risk

Group: 1- First 5 years of experience (Blue)

36 29 28 27 26 23 21 20 13 0

Group: 2 - From 5 to 10 years of experience (Green)

36 35 34 34 31 17 2 0 0 0

Group: 3- Over 10 years of experience (Orange)

131 75 41 17 0 0 0 0 0 0

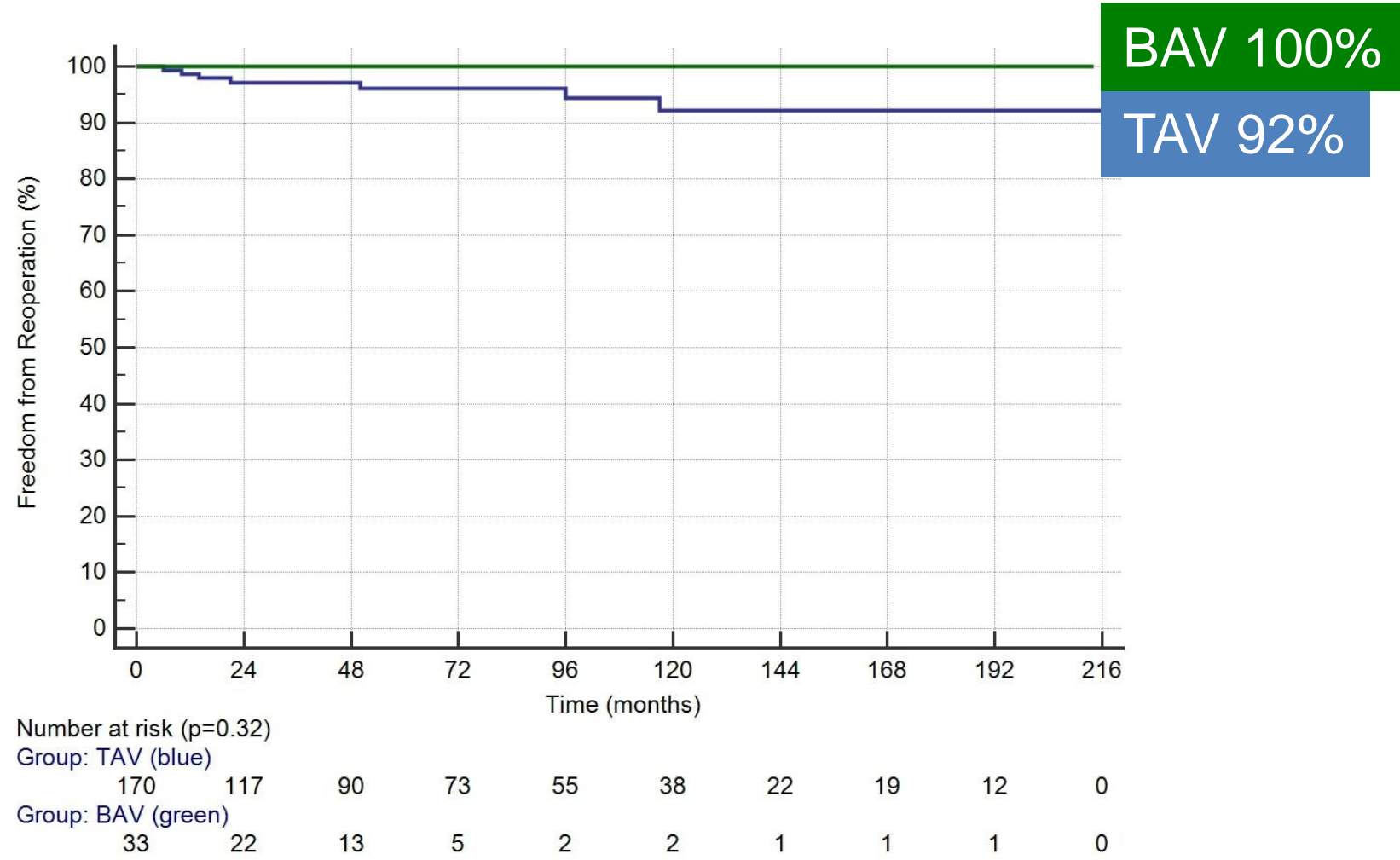
First 5 years

5 to 10 years

> 10 years

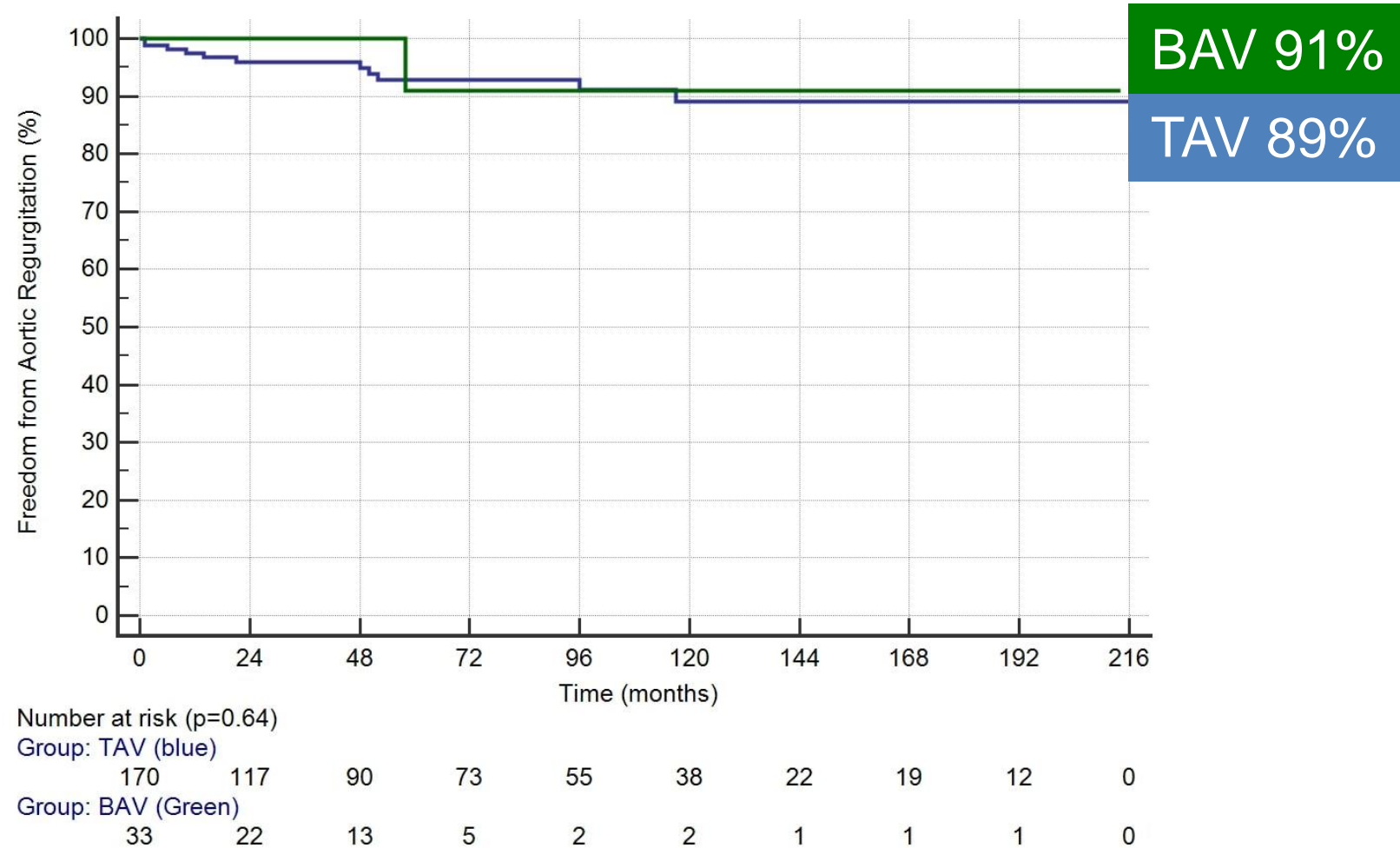
4. Stable long-term results

Freedom from Reoperation (BAVs vs. TAVs)

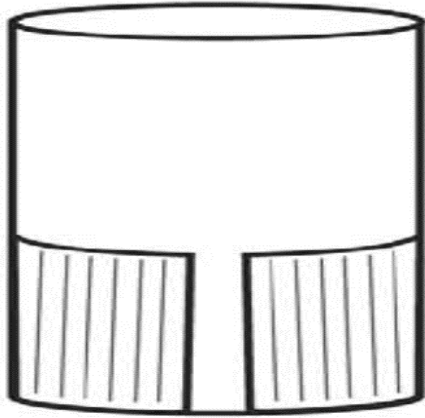


4. Stable long-term results

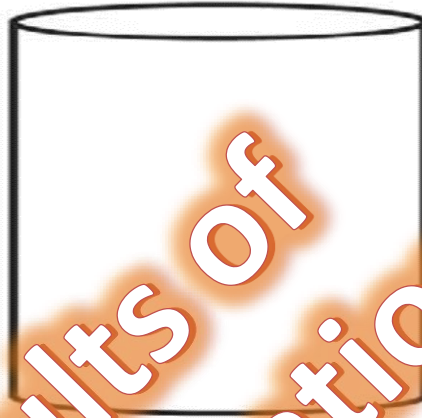
Freedom from Aortic Regurgitation (BAVs vs. TAVs)



4. Stable long-term results



d



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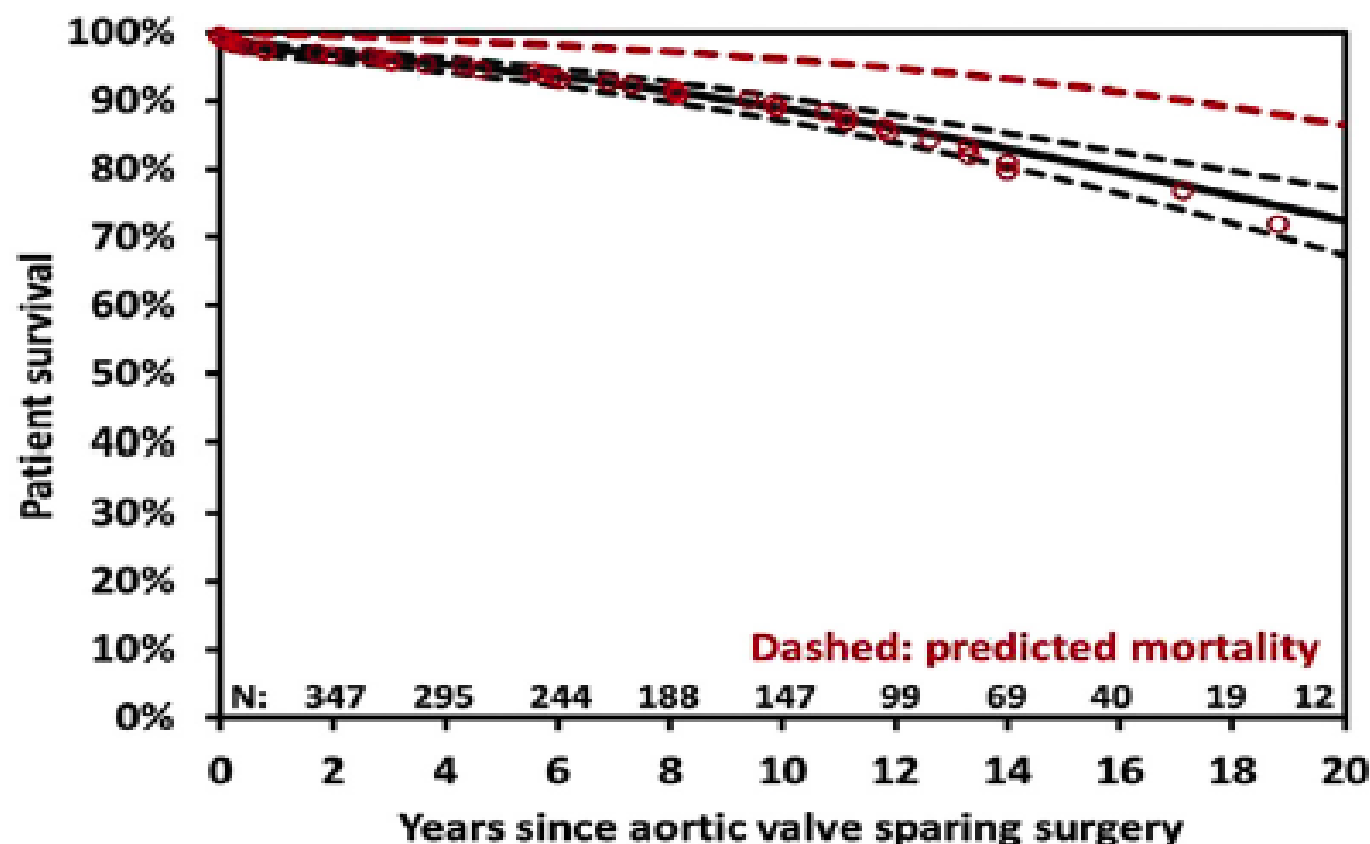


Results of
Reimplantation in
the literature

A quarter of a century of experience with aortic valve-sparing operations

Tirone E. David, MD, Christopher M. Feindel, MD, Carolyn M. David, BN, and Cedric Manlhiot, BSc

The Journal of Thoracic and Cardiovascular Surgery • September 2014



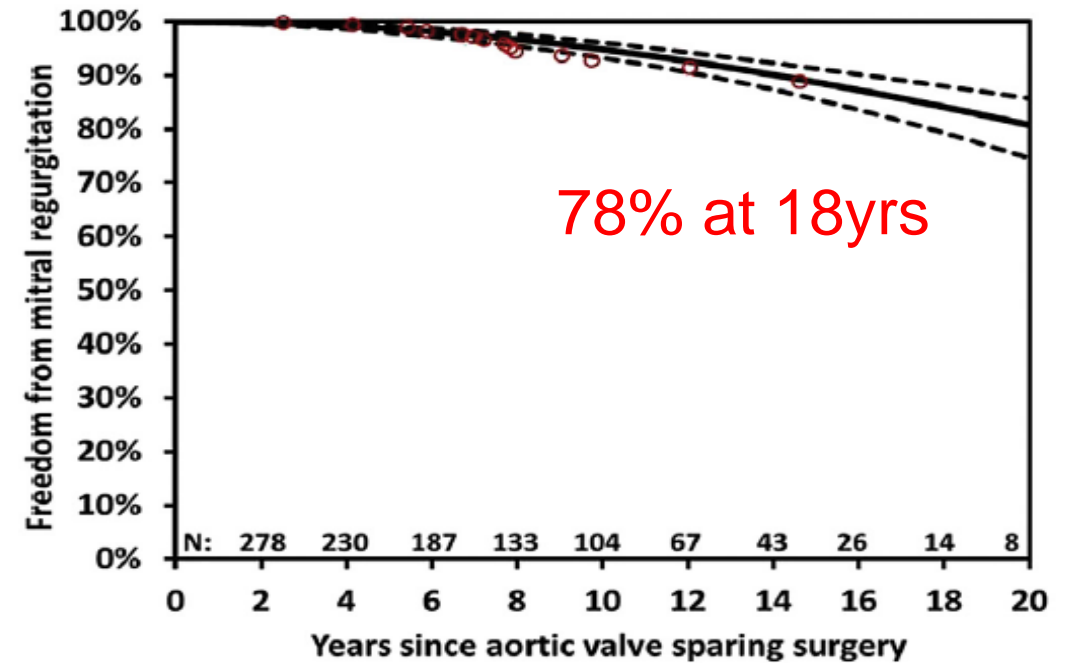
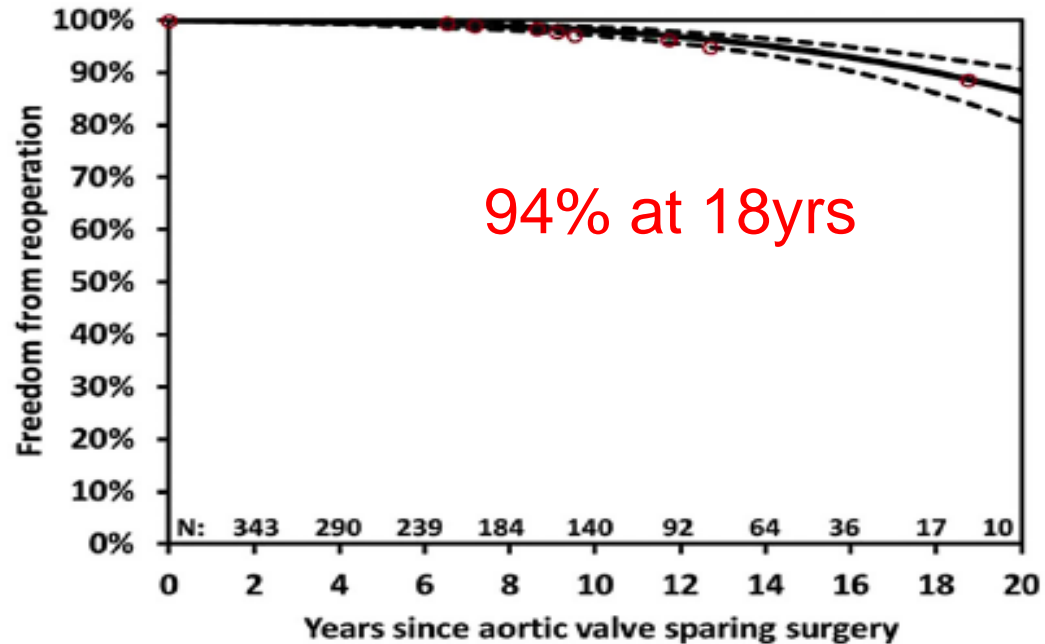
77% @18yrs

Long-term results in the literature

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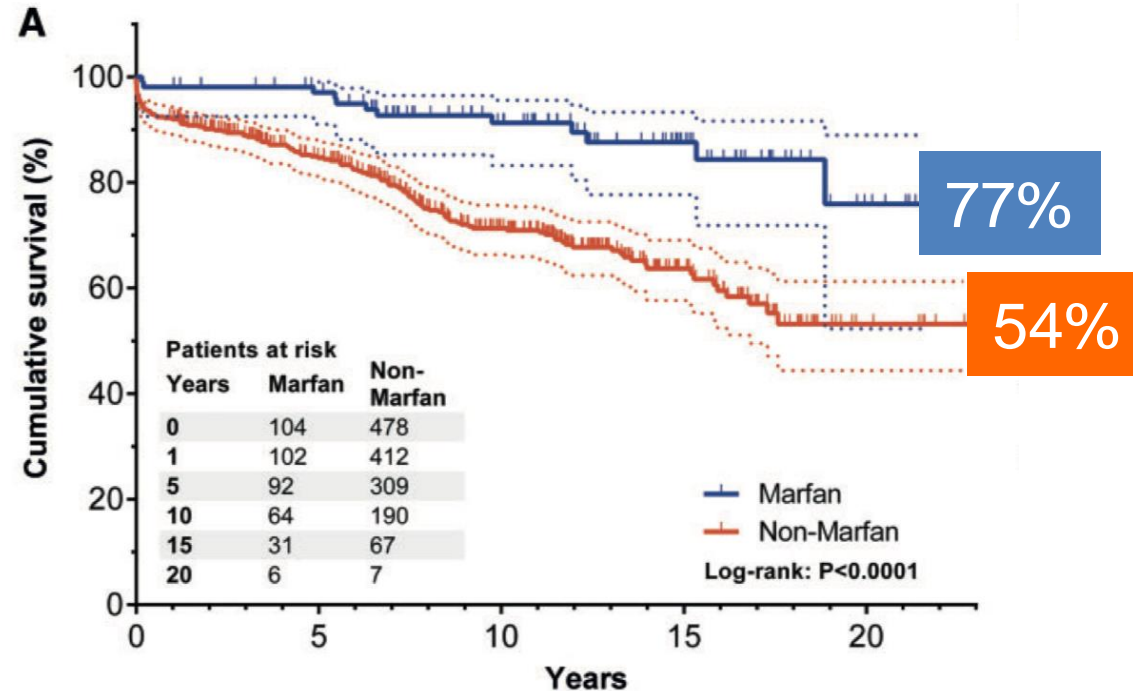
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Long-term results in the literature

Valve-sparing aortic root replacement (David I procedure) in Marfan disease: single-centre 20-year experience in more than 100 patients[†]

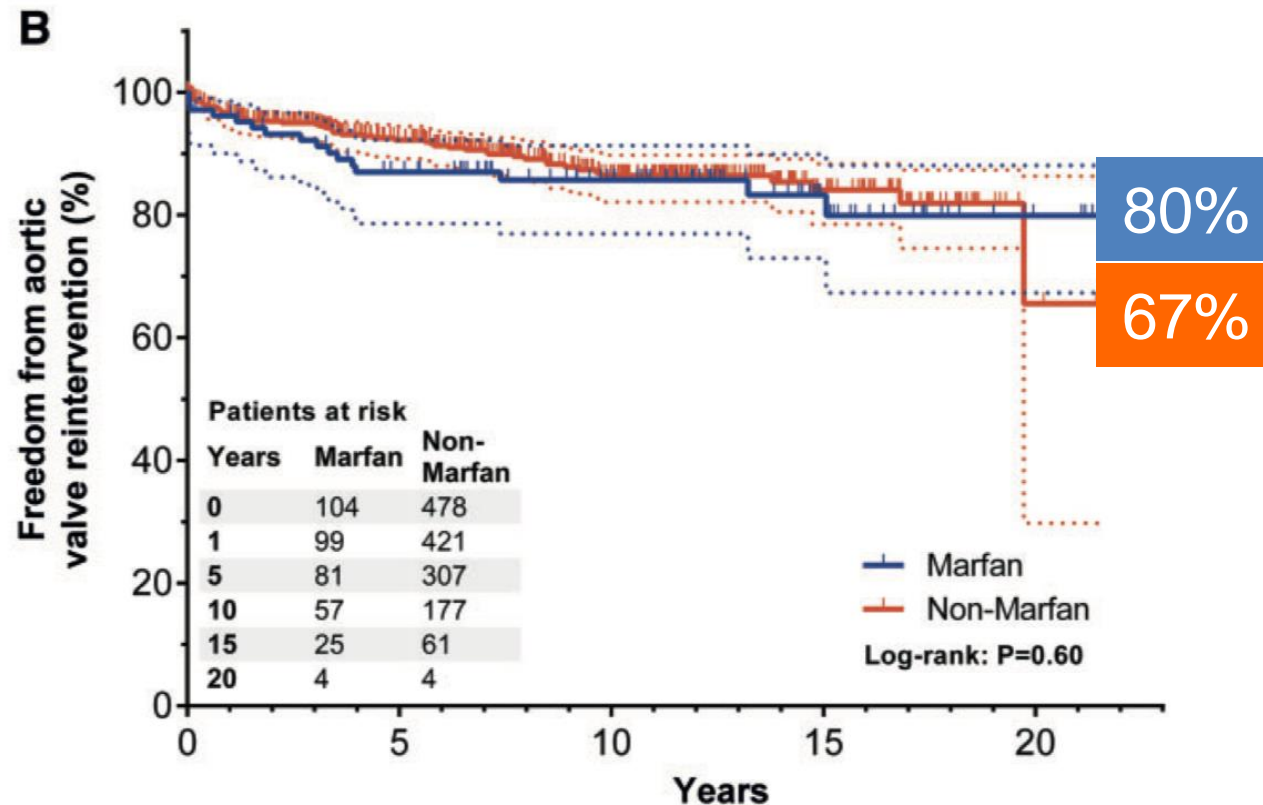
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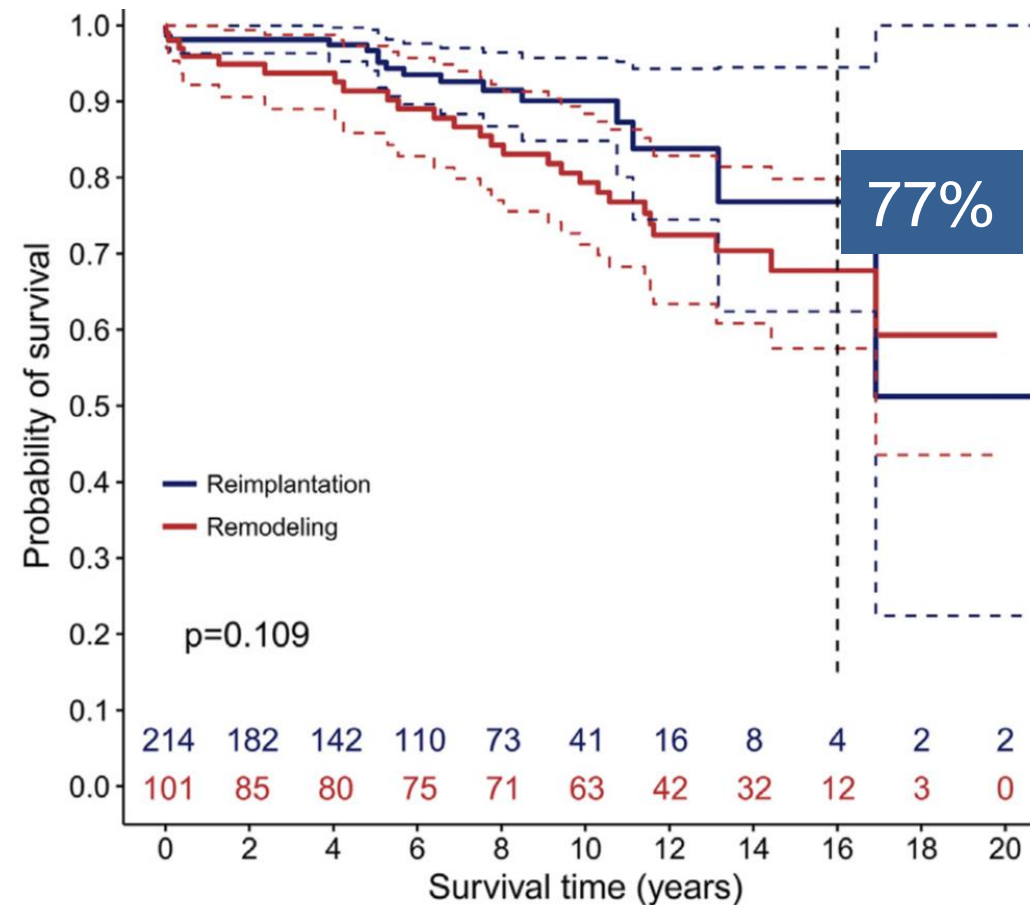


Long-term results in the literature

Survival and reoperation pattern after 20 years of experience with aortic valve–sparing root replacement in patients with tricuspid and bicuspid valves



Stefan Klotz, MD, Sina Stock, MD, Hans-Hinrich Sievers, MD, Michael Diwok, Michael Petersen, MD, Ulrich Stierle, MD, and Doreen Richardt, MD

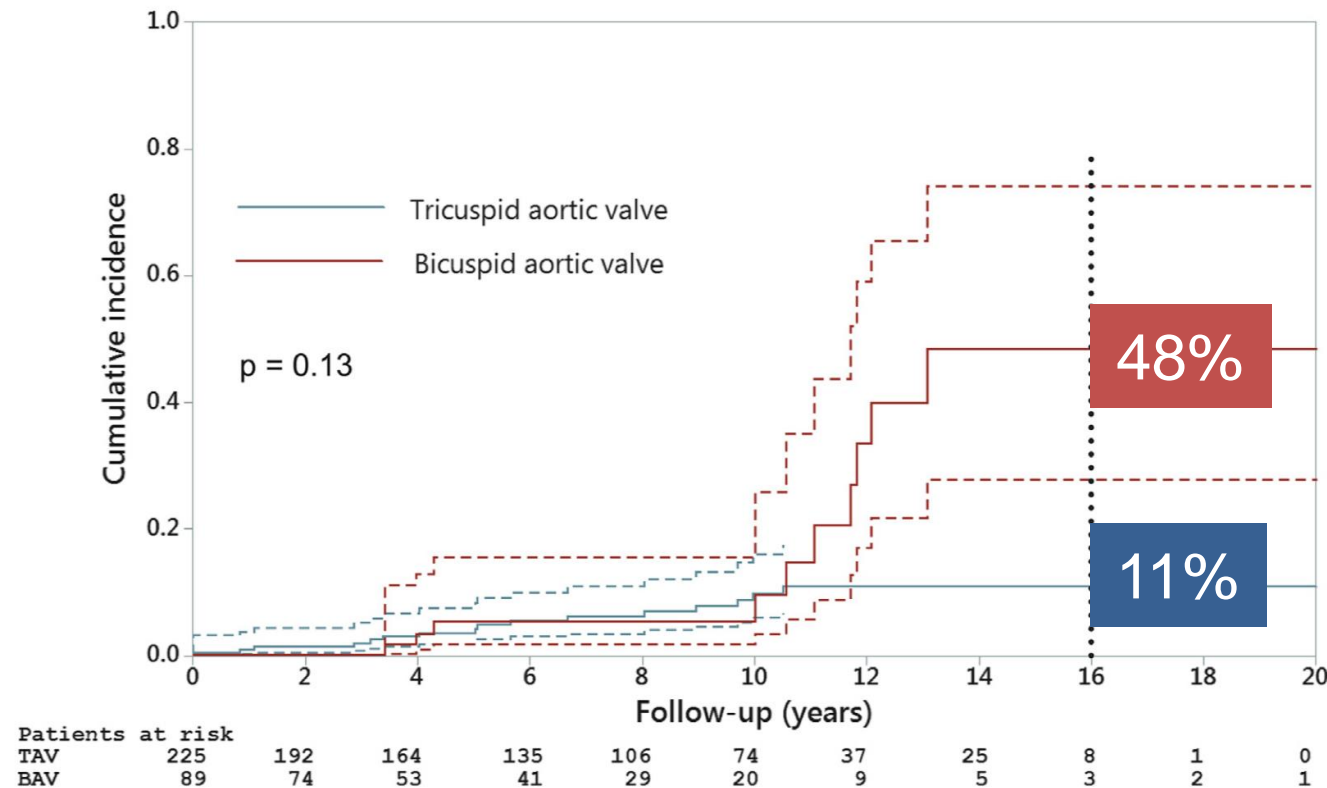


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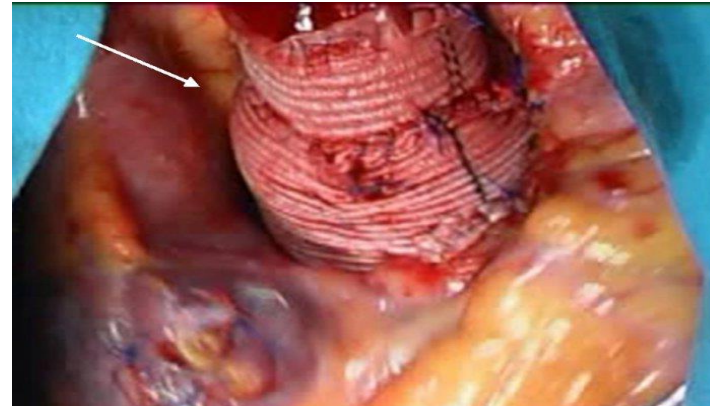
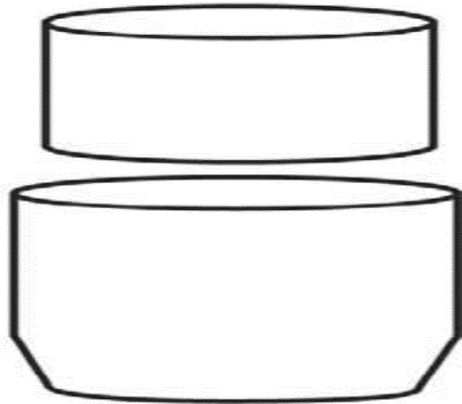
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Long-term results in the literature

Rationale and results of the Stanford modification of the David V reimplantation technique for valve-sparing aortic root replacement

D. Craig Miller, MD



David valve-sparing aortic root replacement: Equivalent mid-term outcome for different valve types with or without connective tissue disorder

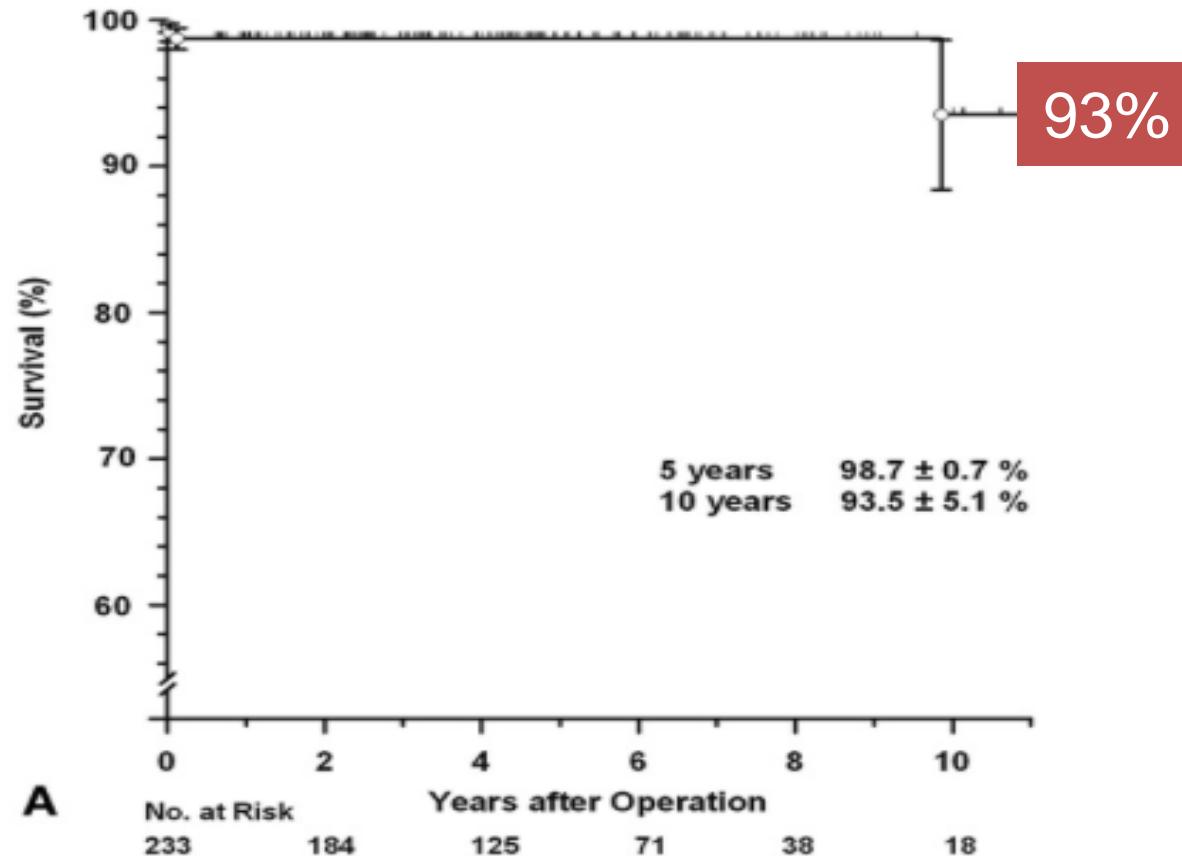
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The Journal of Thoracic and Cardiovascular Surgery • January 2013

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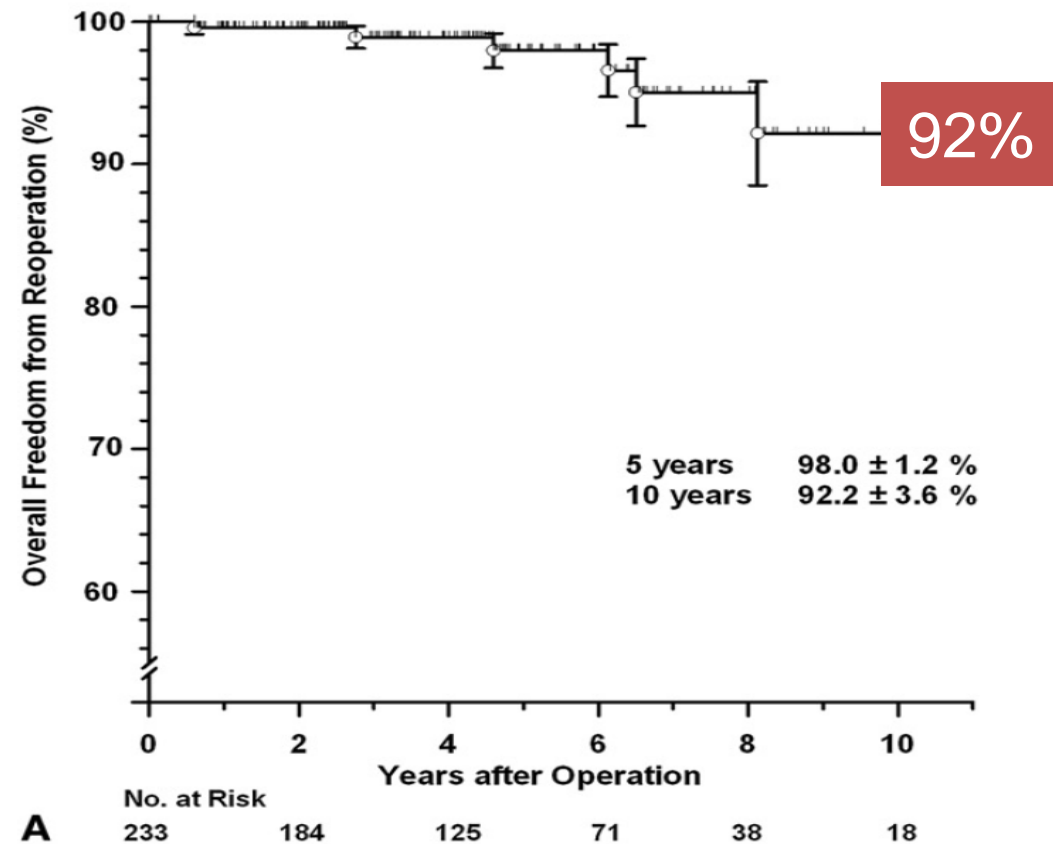
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Long-term results in the literature

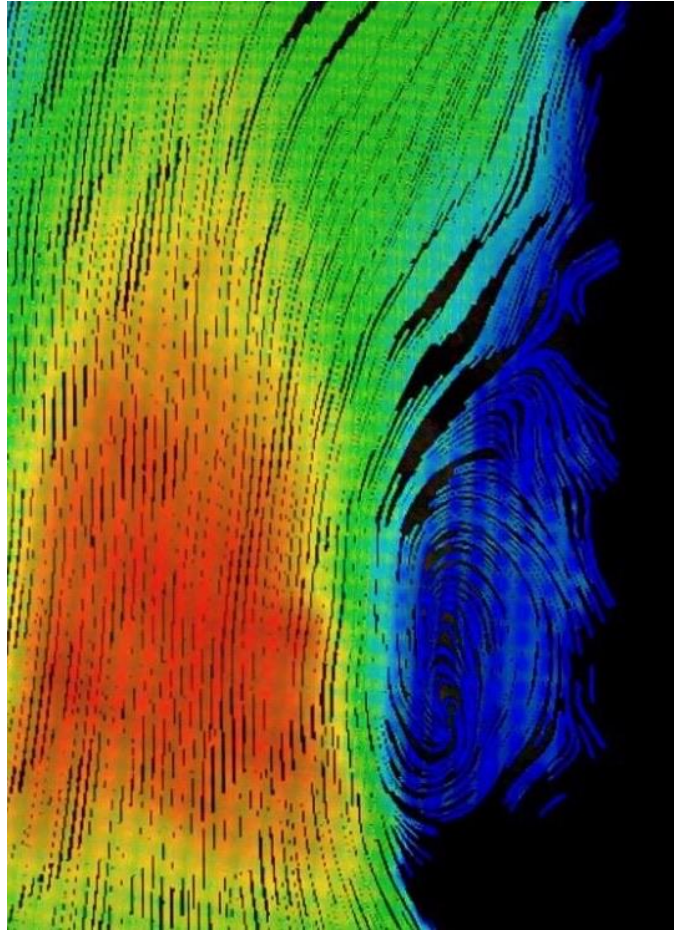
Why I trust reimplantation

1. It is a significantly very hemostatic procedure
 1. It is performed in a standard and reproducible fashion
 1. It allows to observe and maintain good geometry while suturing
 1. It provides a complete annular and root support (behind the commissure is particularly useful in case of acute dissection)
-

Why I trust reimplantation

4. When approaching 20 years of follow-up the results appear to be stable
 5. Non invasive assessment of aortic flow reveal a re-established root anatomy and physiology
 6. Resistance to endocarditis and thromboembolism is striking
 7. Improvements in the ability of leaflets plasty are broadening the indications
-

Aortic Live @ Essen 2018



Thank
you