



Sezione Regione Piemonte

Con il patrocinio di:

TORINO - 4 GIUGNO 2026

**PERCORSO DIAGNOSTICO
DELLE INFEZIONI DEL TORRENTE CIRCOLATORIO:
FOCUS SULLE ENDOCARDITI**

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Endocarditi Destruenti e Cardiochirurgia

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sede Molinette**



No disclosure



ESC

European Society
of Cardiology

European Heart Journal (2023) 44, 3948–4042

<https://doi.org/10.1093/eurheartj/ehad193>

ESC GUIDELINES

2023 ESC Guidelines for the management of endocarditis

Developed by the task force for the management of endocarditis
of the European Society of Cardiology

12.3. Transcatheter prosthetic valve endocarditis

Urgent^d surgery is recommended in patients with uncontrolled infection (abscess, fistula, enlarging vegetation, new AVB).^{5,420,421,429,445}

The decision to proceed with surgery in IE post-TAVI patients should be individualized, balancing the surgical risks and the prognosis of medical treatment alone. In cases with local extension of the infection, surgery may be recommended in the absence of a prohibitive surgical risk.

ts with

I

B

ts with

I

C

ts with

I

C

transcatheter implanted aortic and pulmonary valvular prostheses.

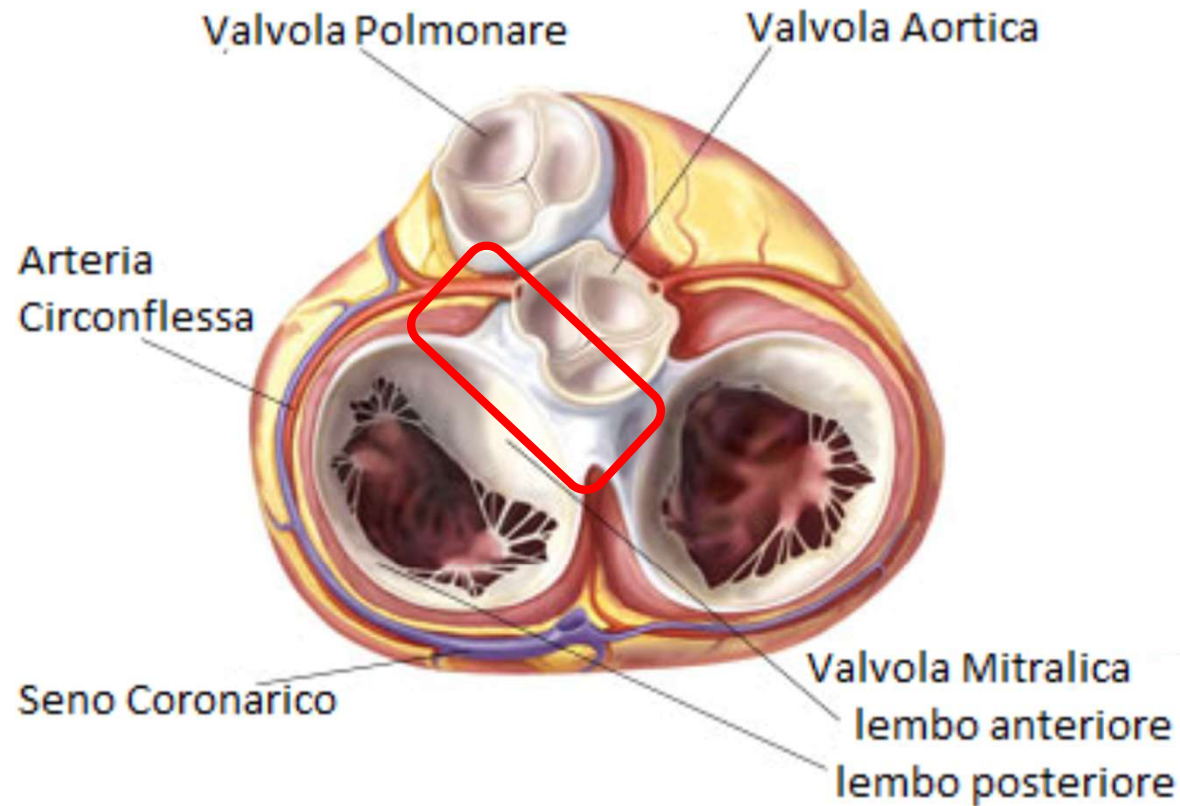
Antibiotic prophylaxis should be considered in patients with transcatheter mitral and tricuspid valve repair.

IIa

C

Complex aorto-mitral endocarditis

The intervalvular fibrosa (IVF) is the fibrous structure between the left and right fibrous trigones, connecting the base of the anterior mitral leaflet to the aortic annulus and aortic valve.

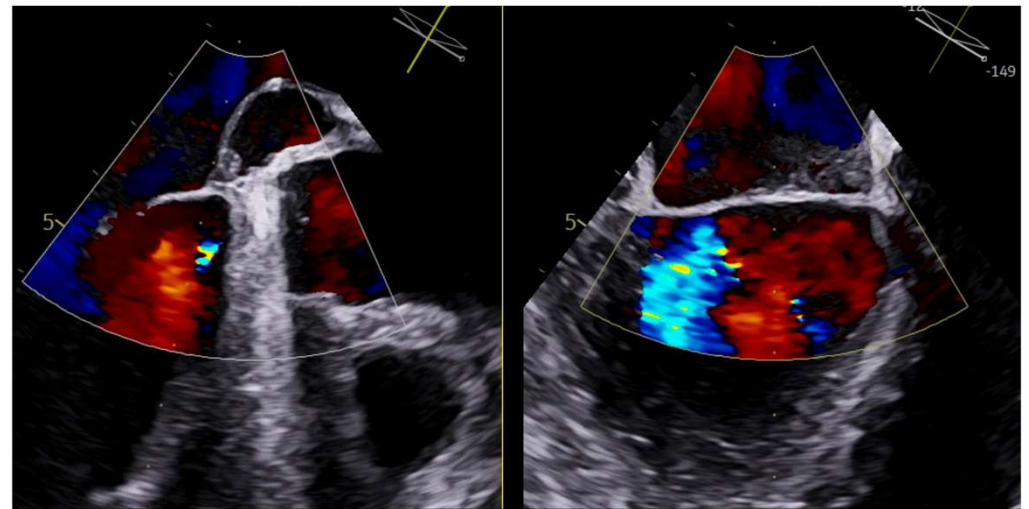


Complex aorto-mitral endocarditis

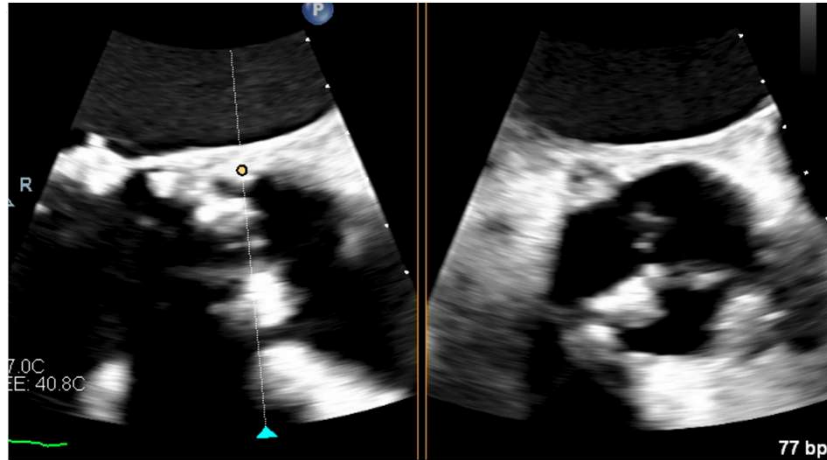
Defined by the presence of aortic root abscess, gross annular disruption, aorto-ventricular discontinuity, fistula, pseudoaneurysm, etc

Destruction of the IVF in infective endocarditis is caused by enzymatic degradation, with preference for connective tissue, and is most common when prosthetic valves in both the mitral and the aortic positions are infected.

**Aortic root abscess and gross
annular / IVF disruption**



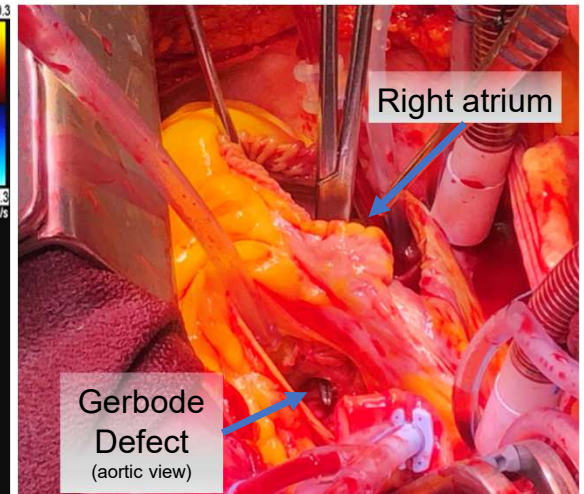
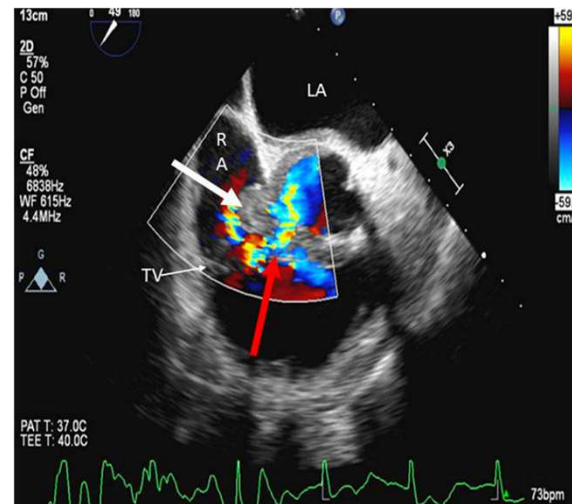
Complex aorto-mitral endocarditis



Prosthetic valve dehiscence

Fistulas – Gerbode's defect

Gerbode's defect describes as a fistula between left ventricular and right atrium; most often seen as a congenital defect or in association with aortic valve endocarditis



2016 AATS Expert Consensus on Endocarditis

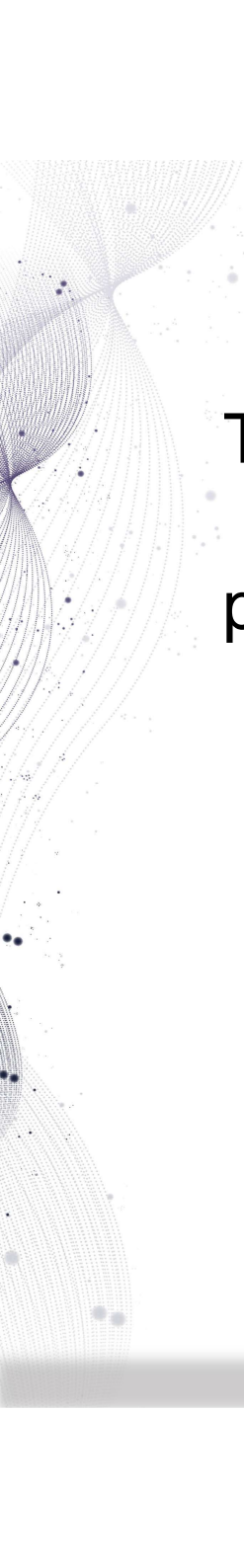
4. Choice of reconstruction and valve replacement: General considerations and recommendations			
For patients with NVE and infection limited to the valve cusps or leaflets, repair is performed whenever possible	I	B	3-6,43,152,188-198
When simple valve replacement is required, choice of valve—mechanical or tissue prosthesis—should be based on normal criteria: age, life expectancy, comorbidities, and expected compliance with anticoagulation	I	B	4-6,197,199-201
It is reasonable to avoid use of mechanical prostheses in patients with any intracranial bleeding or those who have suffered a major stroke	IIa	C	
For patients with invasive disease and destruction, reconstruction should depend on the involved valve, severity of destruction, and available options for cardiac reconstruction	I	B	6,43,44,85,111,202,203

The more extensive and destructive is the infection, the stronger is the argument in favor of an homograft over alternative conduits with prosthetic valves

6. Prosthetic aortic valve IE		
If the root and the annulus are preserved after radical debridement, it is reasonable to implant a new prosthetic valve—mechanical or tissue—based on normal criteria	IIa	B
If there is annulus destruction and invasion outside the aortic root and root reconstruction and replacement is required, an allograft or a biologic tissue root is preferable to a prosthetic valved conduit	IIa	B

2023 ESC Guidelines: management of endocarditis

- Urgent surgery is recommended when the infection is **locally uncontrolled**
- Surgery is recommended for PVE with **new valve replacement** and **complete debridement**

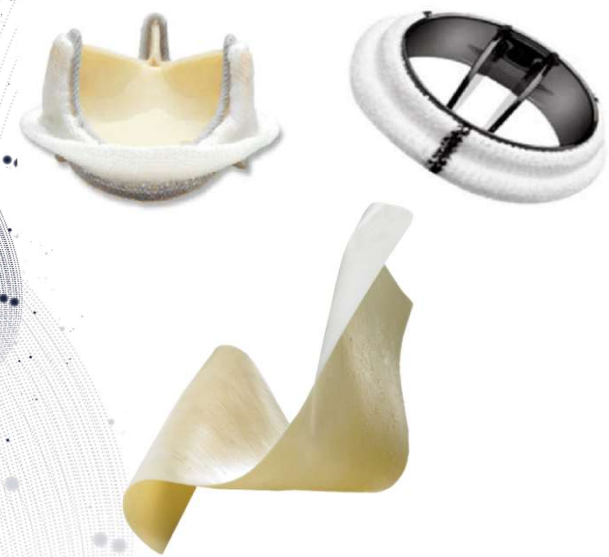


There is no evidence in literature that clearly supports any particular choice of aortic root conduit or valve for patients with prosthetic aortic valve or root endocarditis

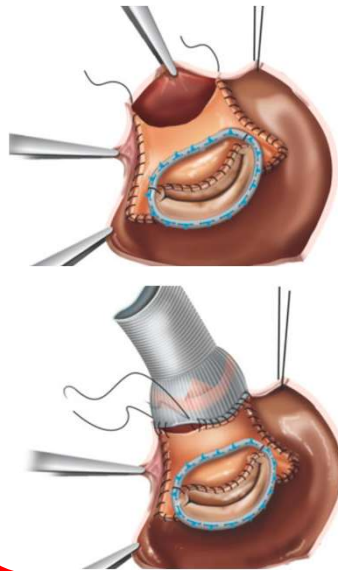
WHAT CAN THE SURGEON DO?

Complex infective endocarditis

Valves and Valved Conduit (Bio/Mech) ± Pericardial patch



1. Commando
2. Hemi-Commando
3. Root Commando



Xenograft



Homograft

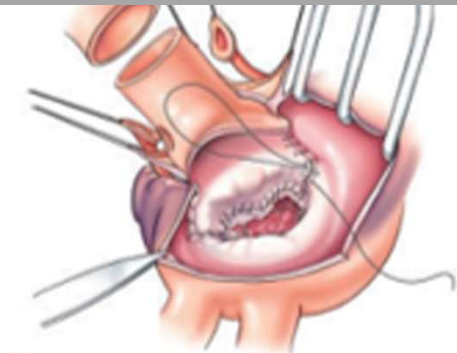


1. Commando procedures

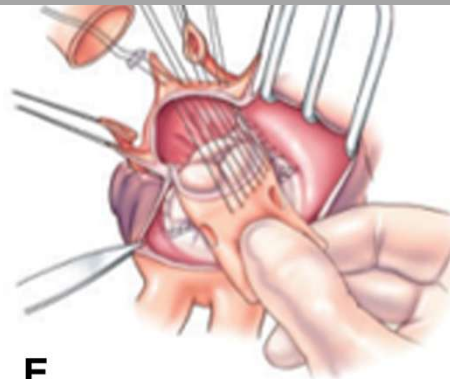
Radical debridement followed by reconstruction of the IVF and double valve replacement



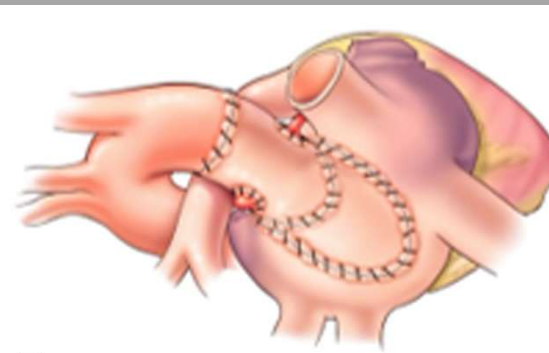
First published by **R.B. Griepp** in 1989 and than **T.E. David** in 1997; this approach was proposed not only in infective endocarditis, but also in degenerative calcification, in enlargement of aorto-mitral annuli or multiple previous heart valve operations making double valve replacement difficult



D



E



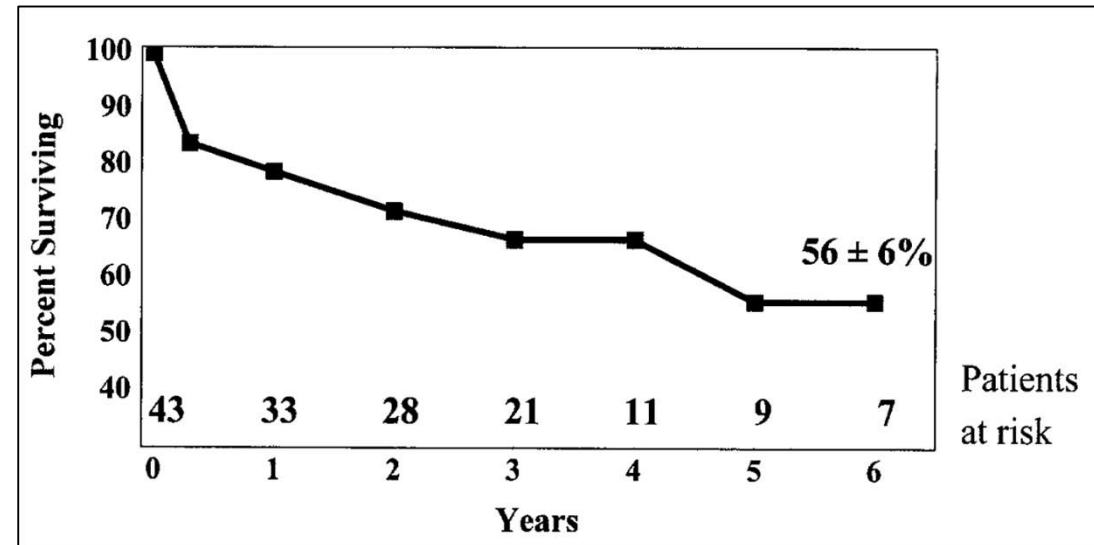
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Commando procedures

First published by **R.B. Griepp** in 1989 and than **T.E. David** in 1997; this approach was proposed not only in infective endocarditis, but also in degenerative calcification, in enlargement of aorto-mitral annuli or multiple previous heart valve operations making double valve replacement difficult

David series 1985-1996

- 43 patients (only 14 endocarditis)
- 7 operative deaths (16%)
- 2 early prosthetic valve endocarditis needed reoperation
- Mean follow up 38 months (4-108): 6 late deaths
- Survival at 6 years $56\% \pm 6\%$



Ergin et al., JTCVS 1989
David TE et al., JTCVS 1997

Commando (standard)

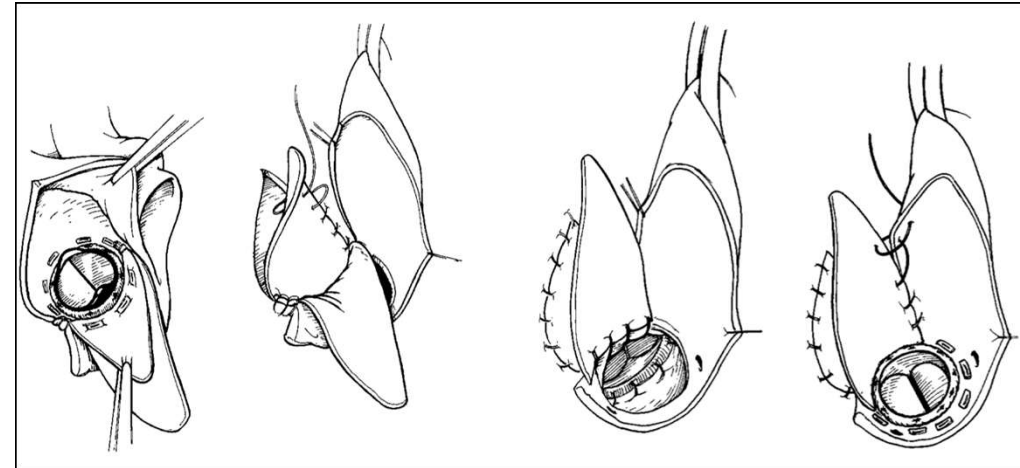
Leipzig group

Jan 1999 - March 2012: **25** patients (mean age 64.3 ± 10.5 yo)
with IE had double valve replacement and IVF reconstruction

- Log EuroSCORE $55.1 \pm 22.9\%$
- 60% NYHA III / IV
- 12% Cardiogenic shock
- 40% renal insufficiency, 20% cerebrovascular accident

Results

- 30-day mortality 32%
- 16% low cardiac output, 28% stroke, 56% acute renal failure
- 2-year survival $37 \pm 11.1\%$
- 5-year survival $24.6 \pm 12.5\%$

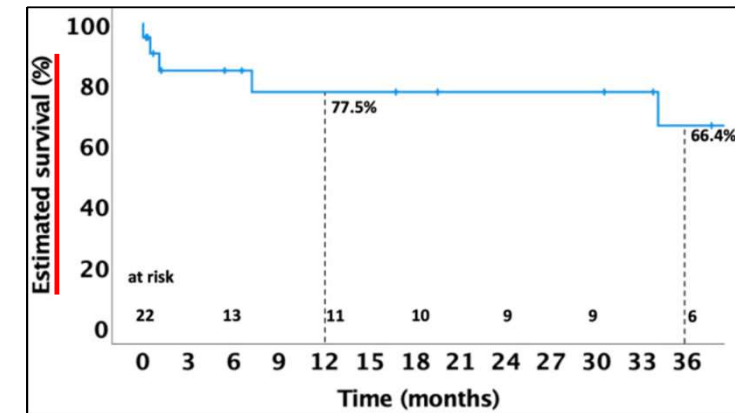
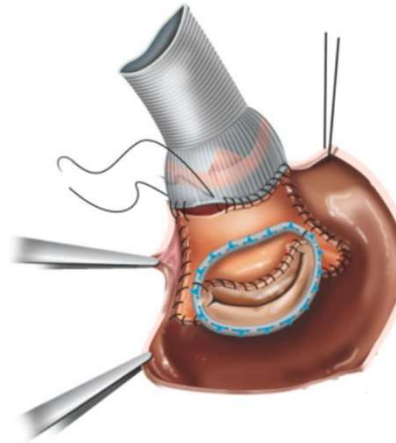


**Double valve replacement and IVF
reconstruction is the only available option in
such complex endocarditis with ~100%
mortality**

Hemi-Commando procedure

Hemi-Commando procedure is a mitral valve-sparing alternative to Commando.

No involvement of the free edge of the AML or the PML and posterior mitral annulus is mandatory for the Hemi-Commando procedure.



Leipzig group

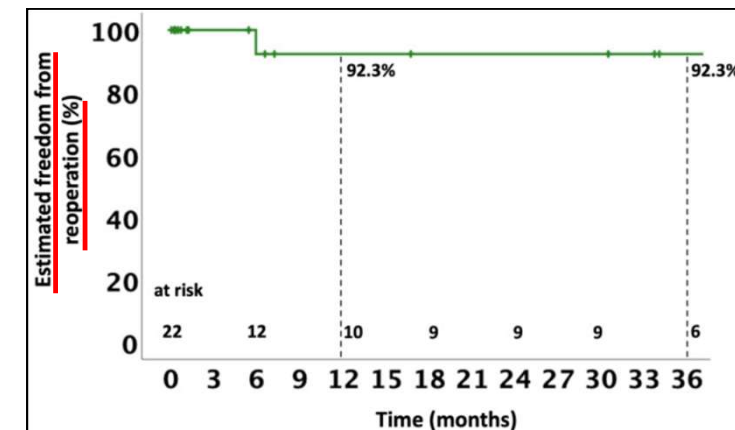
2015 - 2021: **22** patients (mean age 59.8 ± 18.3 yo) had

Hemi-Commando procedure

- EuroSCORE II 28.5%
- ~ 40% prosthetic endocarditis
- > 70% had paravalvular abscess

Results

- 30-day mortality 13.6%
- Estimated 1- and 3-year survival rates: 77.5% and 66.4%
- Estimated 1- and 3-year freedom from reoperation at 92.3%.



Commando / Hemi-Commando comparison

Cleveland Clinic experience 1988-2017

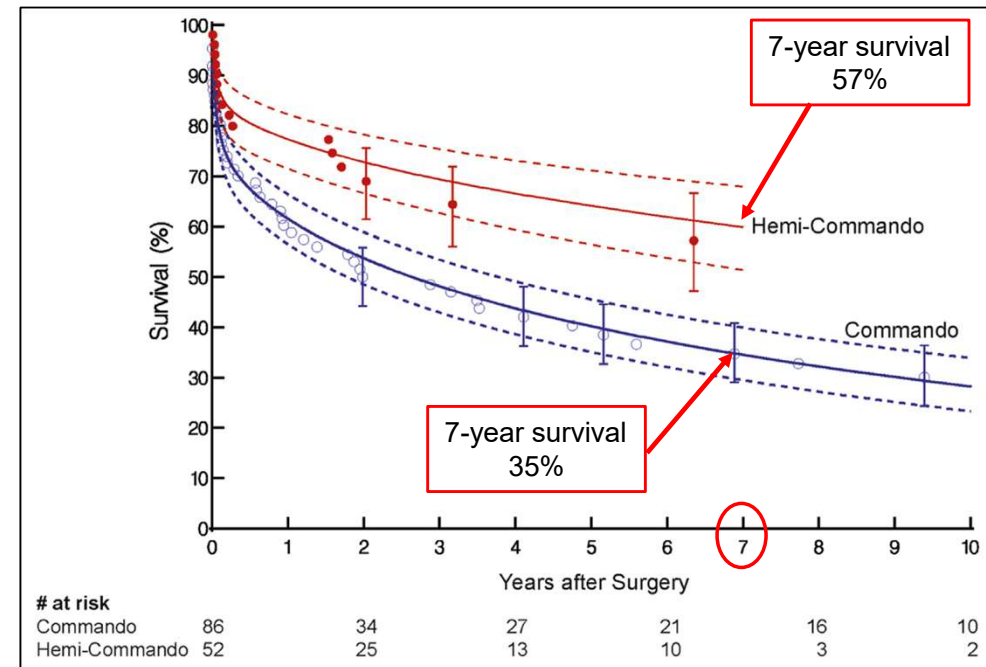
138 pts underwent surgery involving IVF:

86 had a Commando, **52** had a Hemi-Commando.

- 75% prosthetic endocarditis - 33% mitral annular abscess
- 78% aortic root abscess - 12% acquired intracardiac fistula

Results

- Intraop mortality: 4 pts, all Commando
- In-hospital mortality: Commando 24%, Hemi-Commando 13%
- 7-year survival: Commando 35%, Hemi-Commando 57%
- Freedom from recurrent IE at 1, 5, and 8 years:
 - Commando group 87%, 77%, and 70%
 - Hemi-Commando group 95%, 82%, and 41%



Take home messages:

1. Good clinical outcomes

2. Preserve mitral valve = better outcomes

Commando / Hemi-Commando comparison

Sparing the mitral valve in aortic root endocarditis involving the intervalvular fibrosa: appealing and intuitively right

Eduard Quintana ^{a,*}, Alberto Forteza^b and Carlos-A. Mestres^c

«Less experienced surgeon may find in a **mitral replacement** option a more **reliable and reproducible solution**»

In **Hemi-commando procedure**, **sparing the mitral valve**, «an early survival of 86%, in patients that would have faced a dismal prognosis, calls for an applause to the authors»

Theoretical benefits:

- **decreased risk of recurrent endocarditis**
- **less thromboembolic events**
- **preservation of the subvalvular apparatus impacting systolic function**

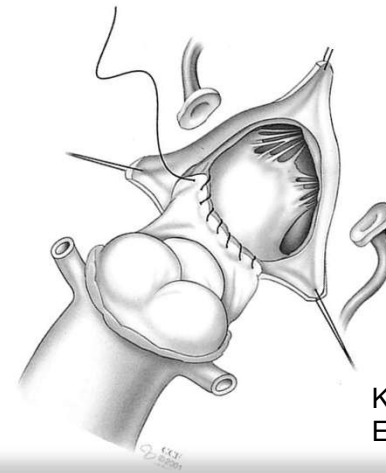


2. Aortic homograft



The first orthotopic insertions of an homograft valve were performed by Barratt-Boyes and Ross in 1962

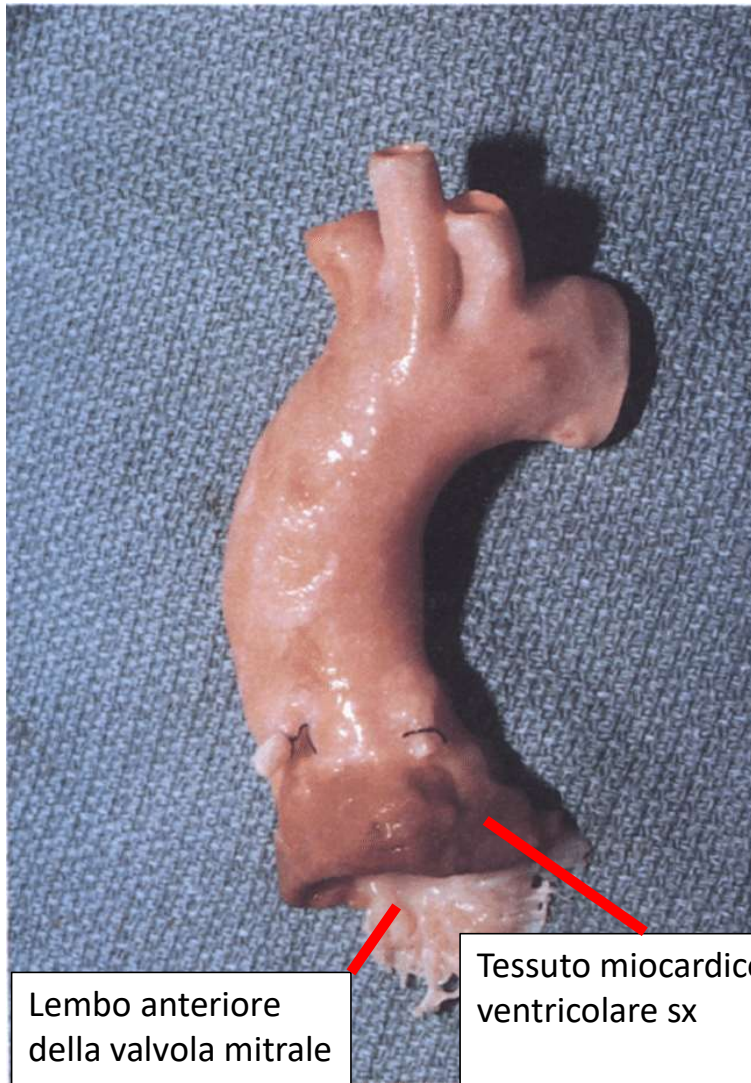
- Allows total aortic root replacement
- Allows adjustment for annular destruction
- Homograft's anterior mitral leaflet can be used to patch defects
- Low transvalvular gradient
- Good resistance to infections
- Late degeneration
- Limited availability



Kirklin, JTCVS 2016
El-Hamamsy et al, JACC 2010

HOMOGRAFT AORTICO

- Comprende l'aorta ascendente, la radice aortica, la valvola aortica, una porzione del setto interventricolare ed il lembo anteriore della valvola mitrale espiantati da cadavere e crioconservati
- Ottima performance emodinamica
- Intervento radicale
- Maggiore resistenza alla re-infezione
- Disponibilità limitata

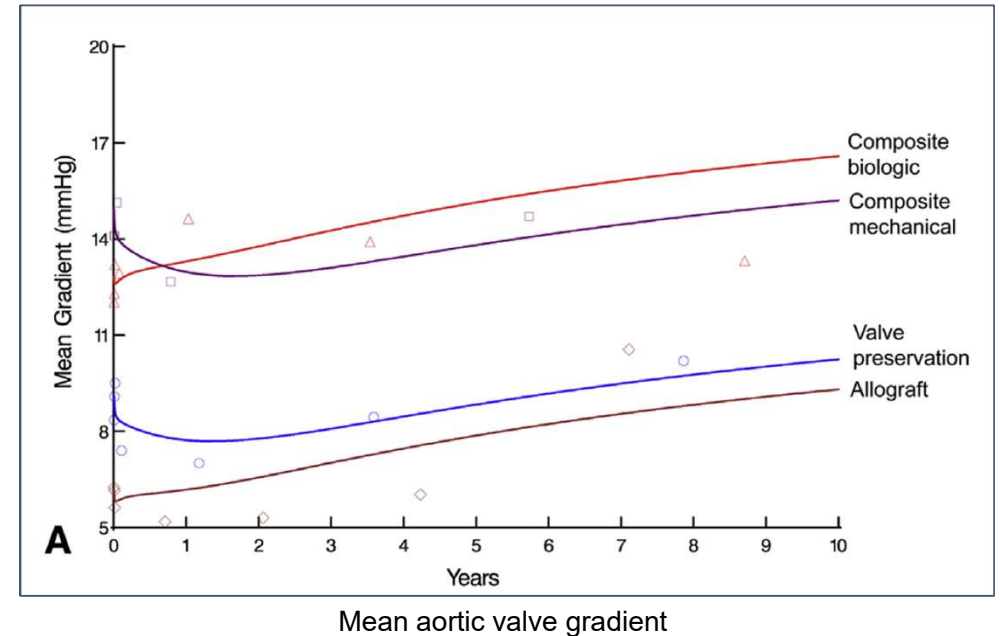
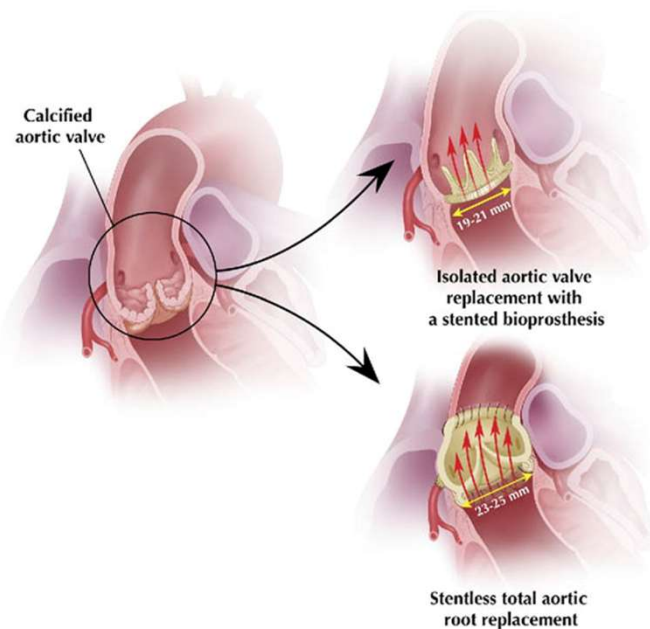


Lembo anteriore
della valvola mitrale

Tessuto miocardico
ventricolare sx

Il primo utilizzo di un Homograft fu descritto da Barratt-Boyes and Ross in 1962

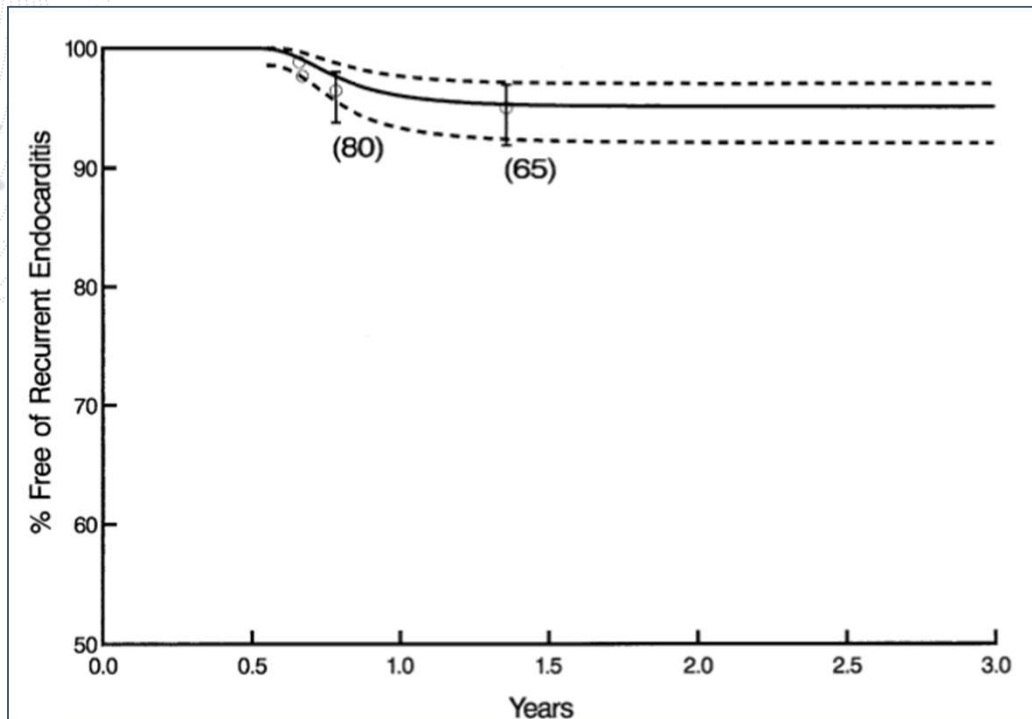
Low transvalvular gradient



January 1995 - January 2011: **957 patients** underwent 1 of 4 aortic root procedures for IE.

Valve-preserving and **homograft** procedures have the lowest gradients and best ventricular remodeling, and likely, less risk of valve-related complications, such as thromboembolic and endocarditis

Low rate of recurrent endocarditis



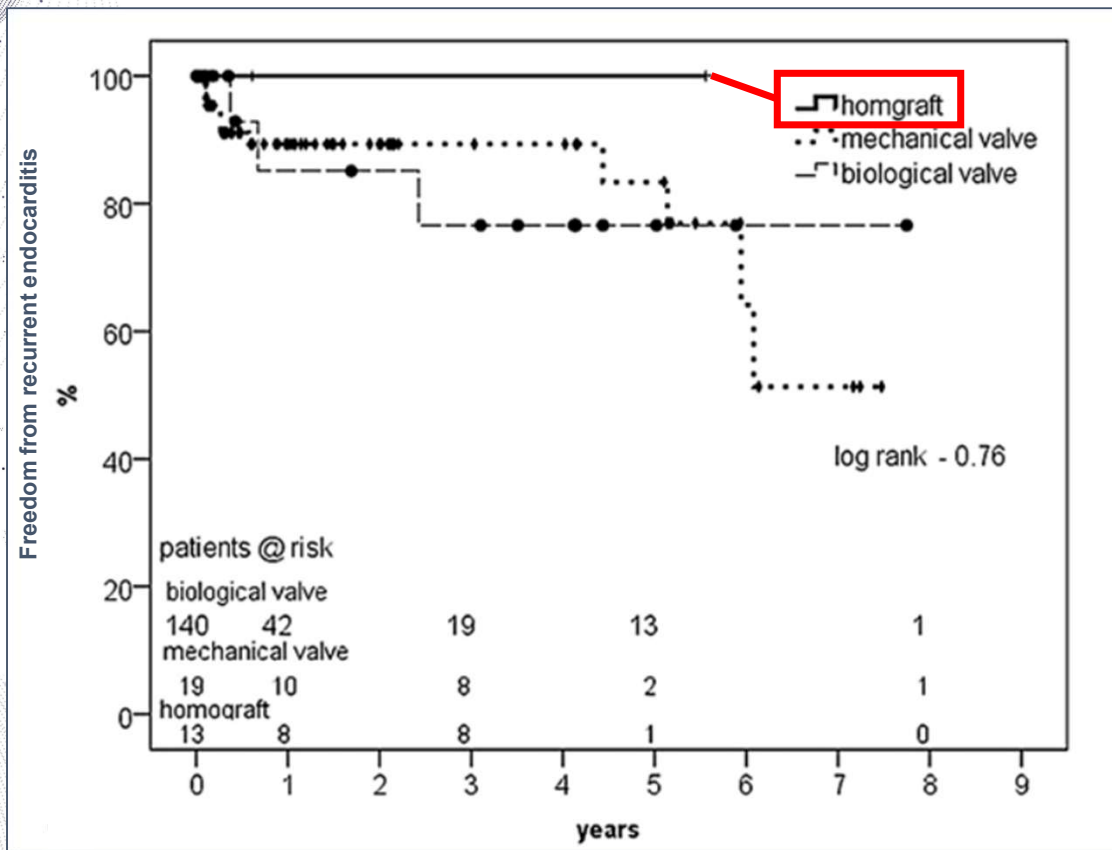
Cleveland Clinic experience 1988 - 2000

103 patients with aortic PVE undergone root replacement with **cryopreserved aortic homograft**

Free from recurrent endocarditis

- 1 year: 96%
- 2 years: 95%
- 5 years: 95%

Low rate of recurrent endocarditis



Leipzig's 13-years-experience

- **172 patients** undergoing surgery for paravalvular **aortic abscesses complicating IE** (NVE 55.8%; PVE 44.2%)
- 5-year freedom from recurrent endocarditis was 80% +/- 4%
- no cases of recurrent endocarditis in homograft patients

Freedom from reoperation after homograft placement

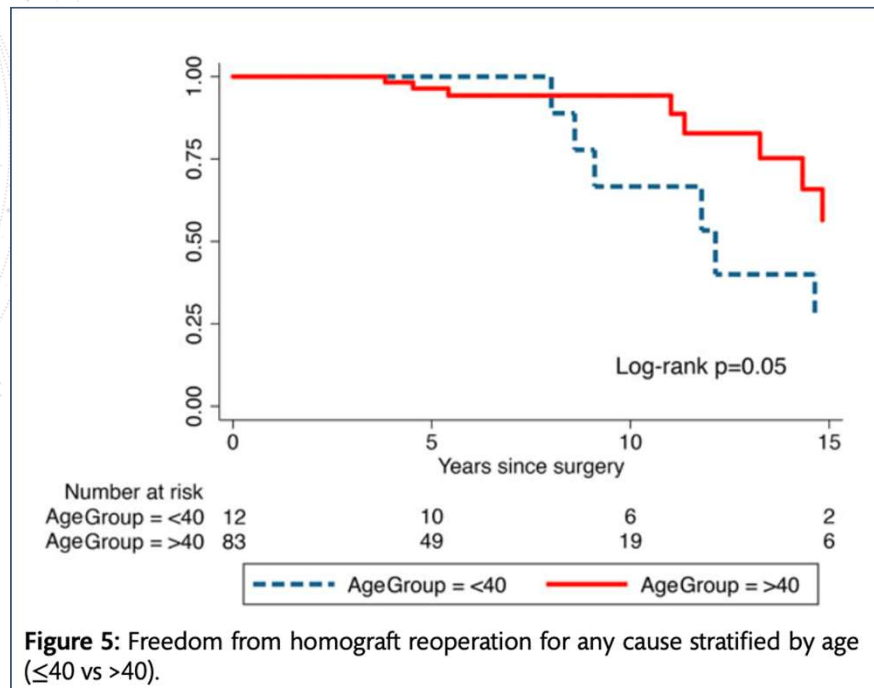


Figure 5: Freedom from homograft reoperation for any cause stratified by age (≤ 40 vs > 40).

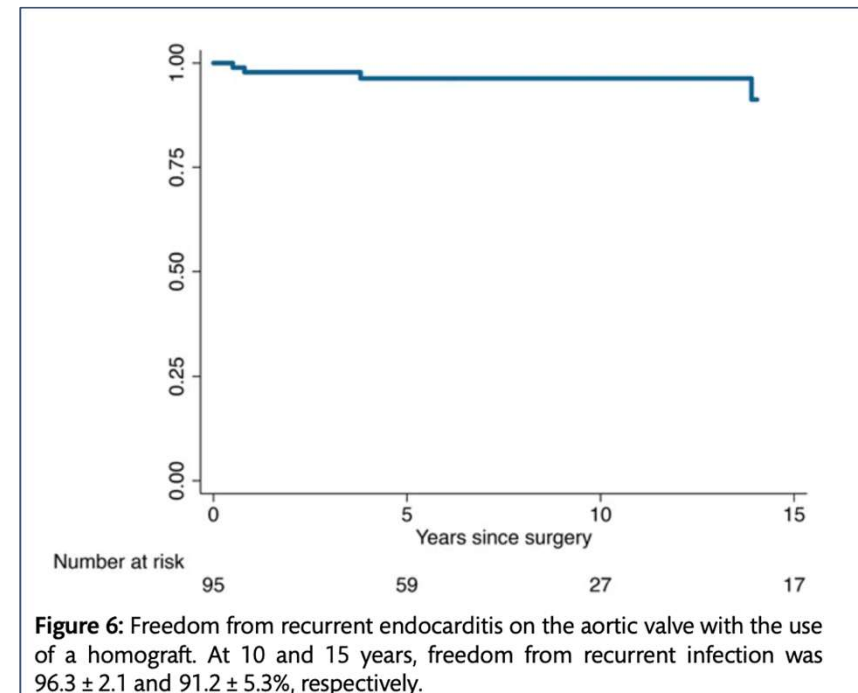


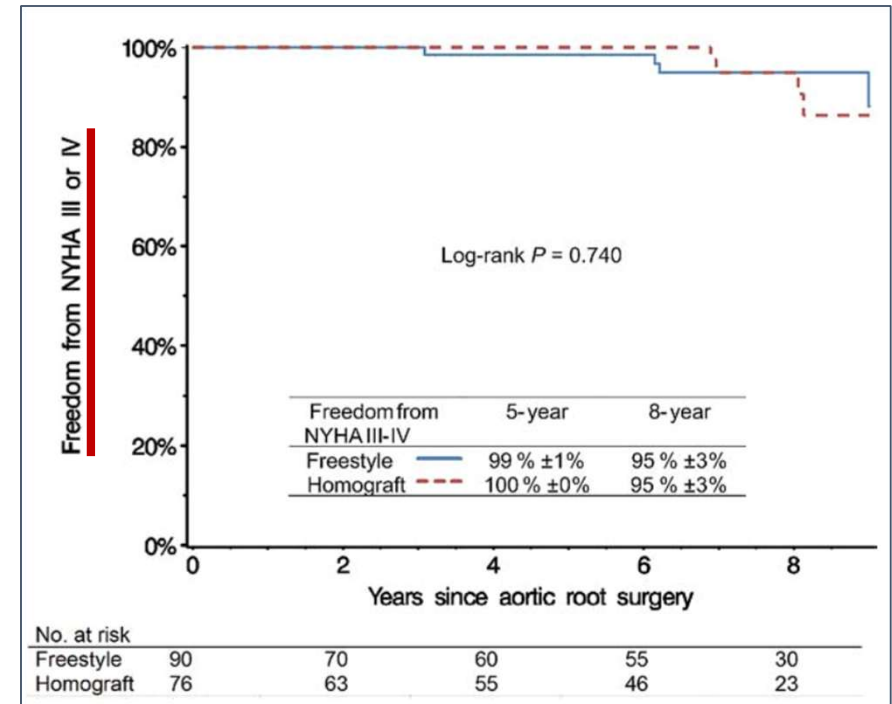
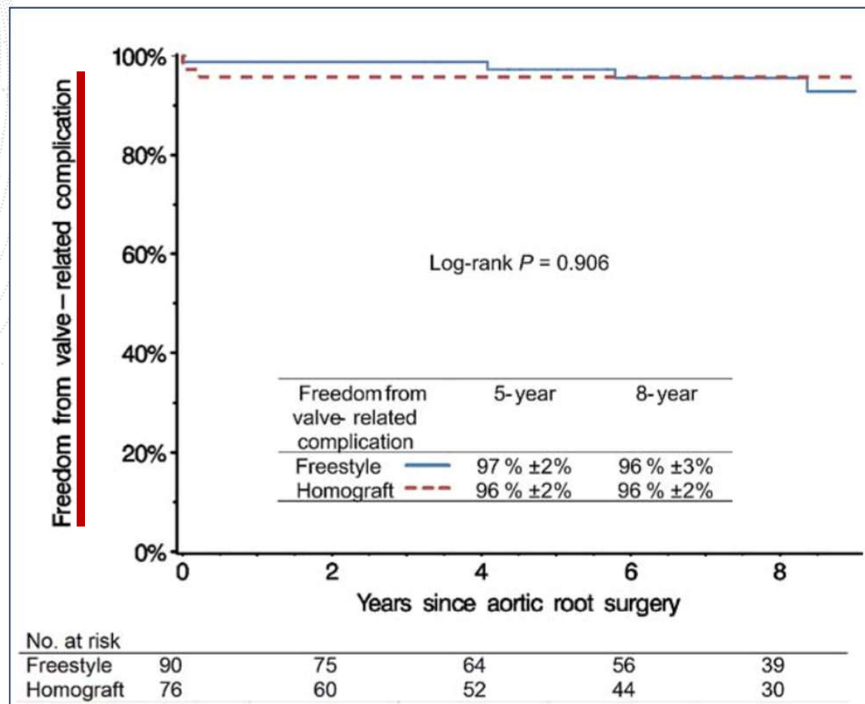
Figure 6: Freedom from recurrent endocarditis on the aortic valve with the use of a homograft. At 10 and 15 years, freedom from recurrent infection was 96.3 ± 2.1 and $91.2 \pm 5.3\%$, respectively.

Brussels group: 112 patients who underwent aortic valve replacement with an **aortic homograft** for acute **endocarditis** between Jan 1990 and Dec 2014

- 16 pts (16.8%) needed reoperation, but **only 2 for recurrent endocarditis**

- Aortic homograft is associated with a **low risk of relapsing infection** and very acceptable long-term survival

Homograft - Xenograft comparison



From 1997 to 2005, **166 patients without endocarditis** undergoing total aortic root replacement were **randomized to receive a homograft (76 pts) or a Freestyle bioprosthesis (90 pts) with comparable good short- and mid-term results**

> [Aorta \(Stamford\)](#). 2022 Apr;10(2):43-51. doi: 10.1055/s-0042-1743110. Epub 2022 Aug 7.

Homograft Versus Valves and Valved Conduits for Extensive Aortic Valve Endocarditis with Aortic Root Involvement/Destruction: A Systematic Review and Meta-Analysis

Michael L Williams ¹, John D L Brookes ¹, Joseph S Jaya ², Eren Tan ³

A systematic review and meta-analysis was performed about the use of Homograft as replacement options in complex aortic valve endocarditis:

- Aortic root abscess
- Aorto-ventricular discontinuity
- Gross annular disruption
- Fistula

No statistically significant differences in terms of **mortality, reoperation or reinfection** rates between homografts and other valve or valved conduits in management of complex aortic endocarditis

Homograft vs. Valve/Valved conduits

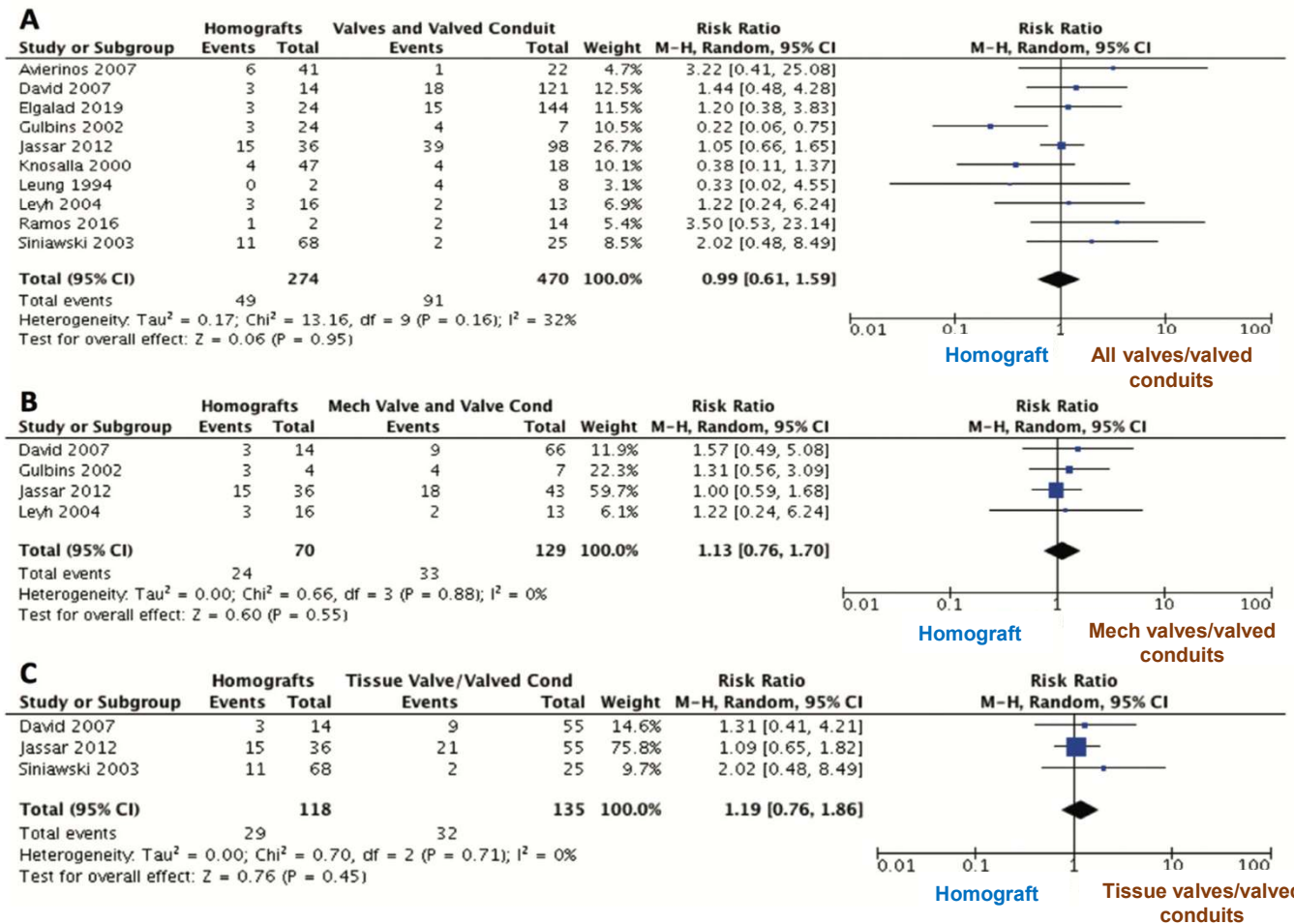


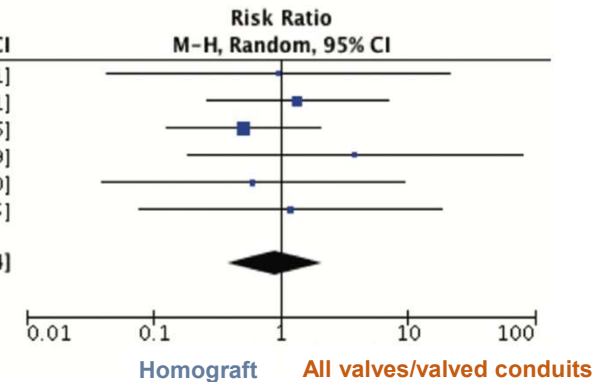
Fig. 2 Total mortality rates of (A) homograft vs. all valves and valved conduits, (B) homograft vs. mechanical valves and mechanical valved conduits, and (C) homograft versus tissue valves and tissue valved conduits.

Mortality

Homograft vs. Valve/Valved conduits

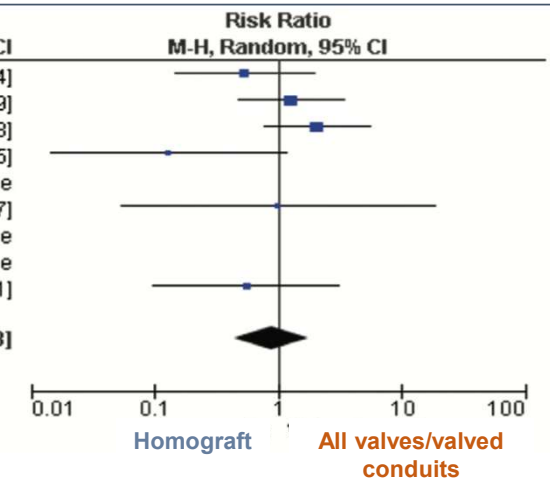
Reoperation

Study or Subgroup	Homografts		Valve and Valved Conduits		Weight	Risk Ratio M-H, Random, 95% CI
	Events	Total	Events	Total		
Gulbins 2002	1	24	0	7	7.7%	0.96 [0.04, 21.31]
Jassar 2012	2	36	4	98	26.9%	1.36 [0.26, 7.11]
Knosalla 2000	4	47	3	18	37.9%	0.51 [0.13, 2.06]
Lee 2014	0	3	1	45	8.0%	3.83 [0.18, 79.59]
Leung 1994	0	2	2	8	9.8%	0.60 [0.04, 9.30]
Leyh 2004	1	4	0	1	9.7%	1.20 [0.08, 18.75]
Total (95% CI)		116		177	100.0%	0.91 [0.38, 2.14]
Total events	8		10			
Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 1.88$, $df = 5$ ($P = 0.87$); $I^2 = 0\%$						
Test for overall effect: $Z = 0.23$ ($P = 0.82$)						



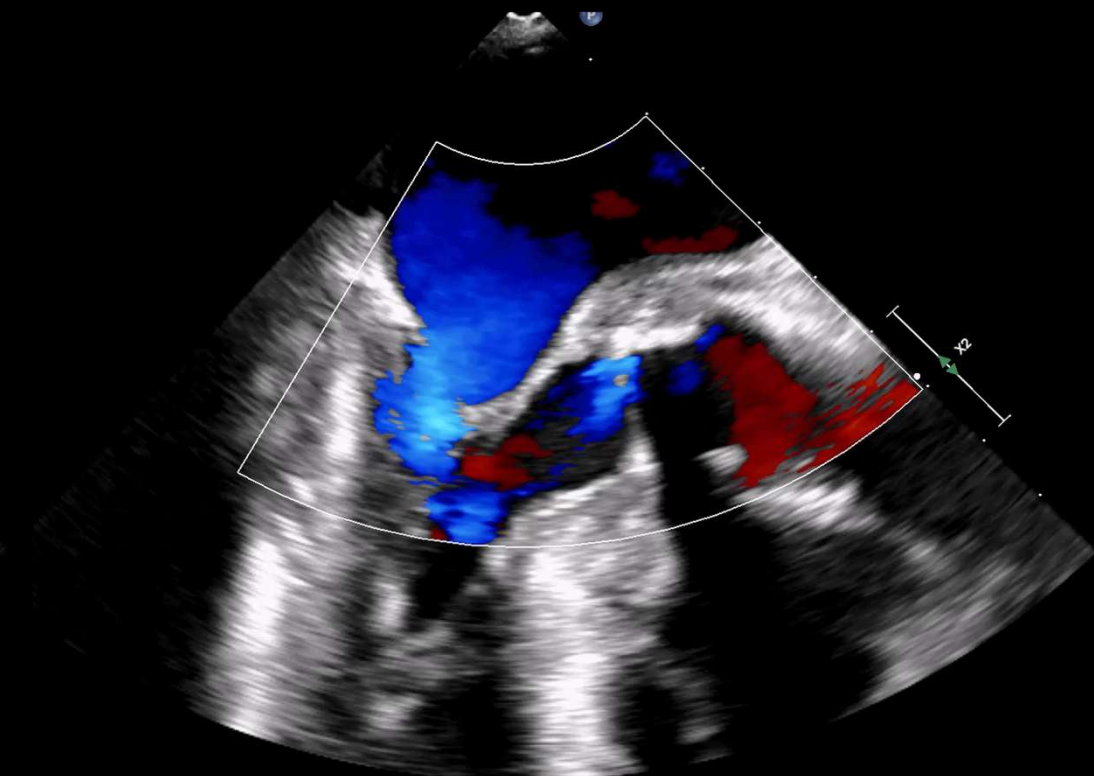
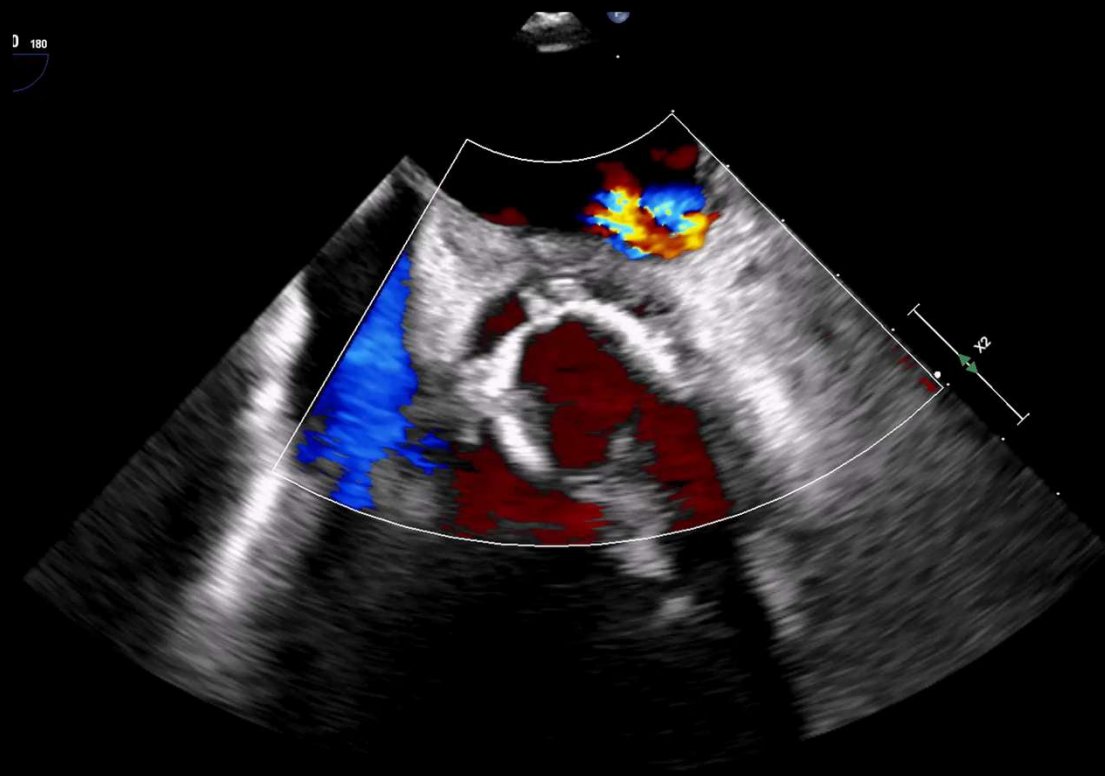
Reinfection

Study or Subgroup	Homograft		All Valve Conduits		Weight	Risk Ratio M-H, Random, 95% CI
	Events	Total	Events	Total		
Avierinos 2007	4	41	4	22	19.6%	0.54 [0.15, 1.94]
Elgalad 2019	4	24	19	144	27.1%	1.26 [0.47, 3.39]
Jassar 2012	6	36	8	98	27.1%	2.04 [0.76, 5.48]
Knosalla 2000	1	47	3	18	8.5%	0.13 [0.01, 1.15]
Lee 2014	0	3	0	45		Not estimable
Leung 1994	0	2	1	8	5.1%	1.00 [0.05, 18.57]
Leyh 2004	0	16	0	13		Not estimable
Ramos 2016	0	2	0	14		Not estimable
Siniawski 2003	3	68	2	25	12.7%	0.55 [0.10, 3.11]
Total (95% CI)		239		387	100.0%	0.89 [0.45, 1.78]
Total events	18		37			
Heterogeneity: $\tau^2 = 0.21$; $\chi^2 = 7.00$, $df = 5$ ($P = 0.22$); $I^2 = 29\%$						
Test for overall effect: $Z = 0.33$ ($P = 0.74$)						

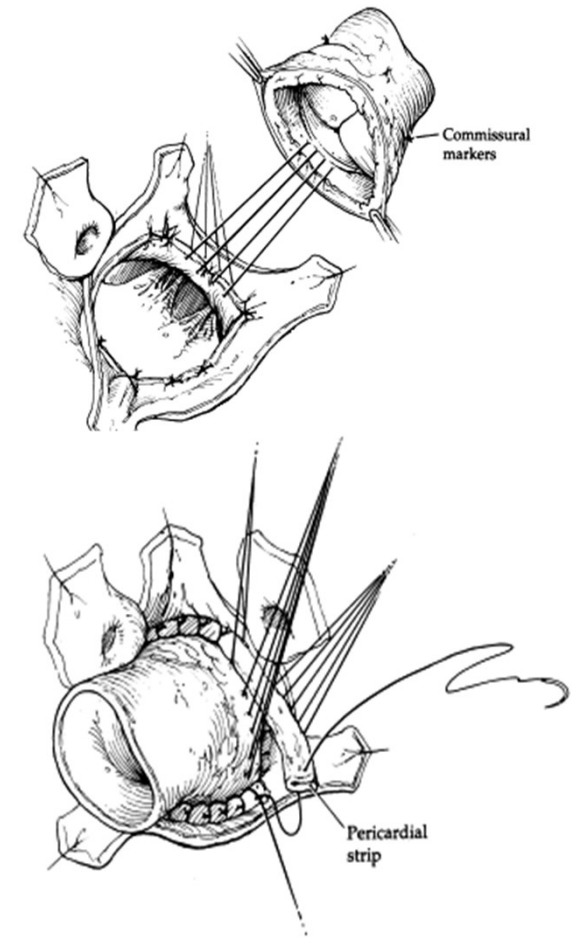
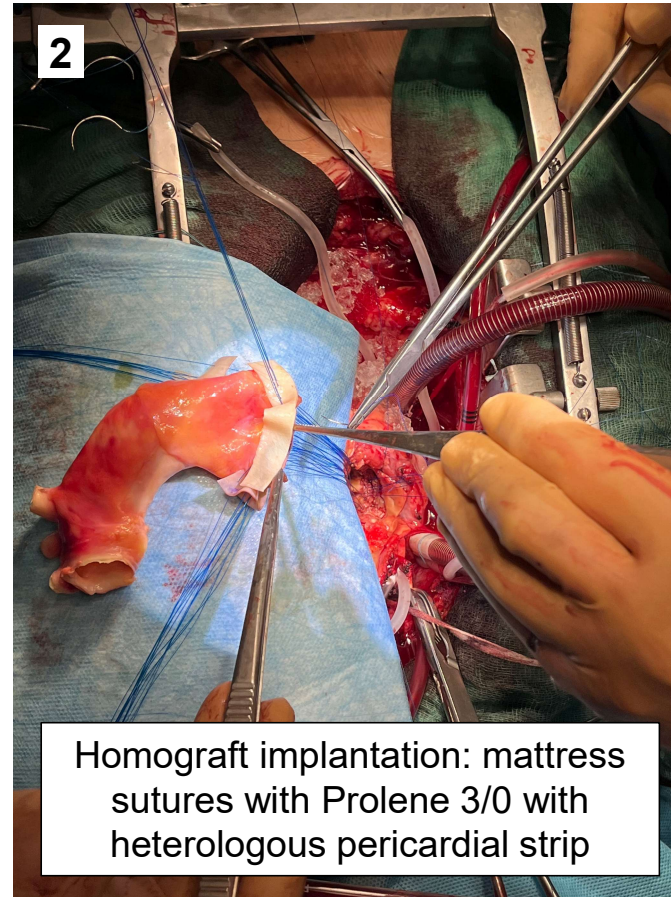
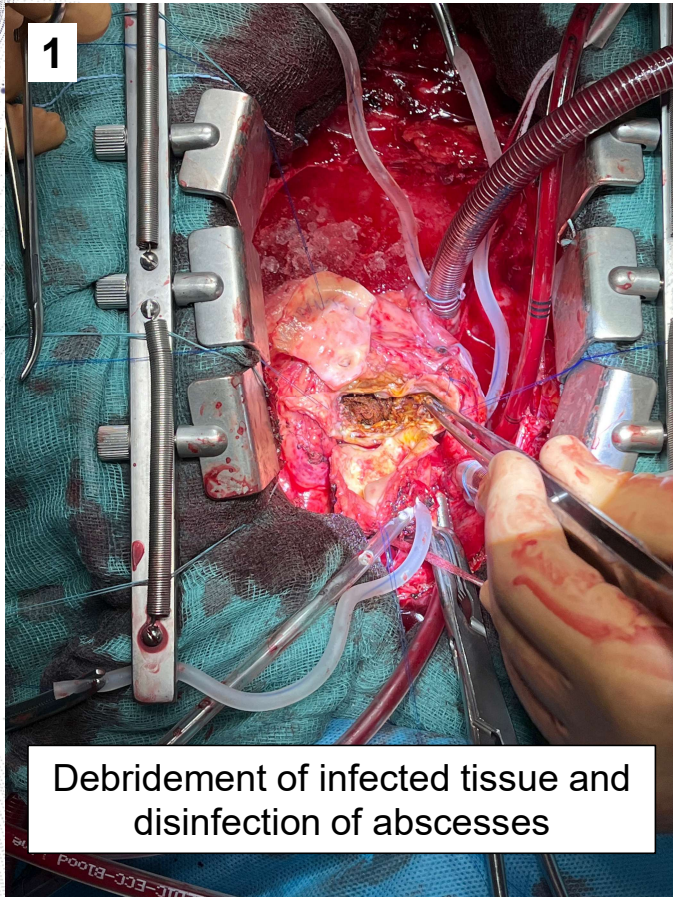


Homograft implantation technique

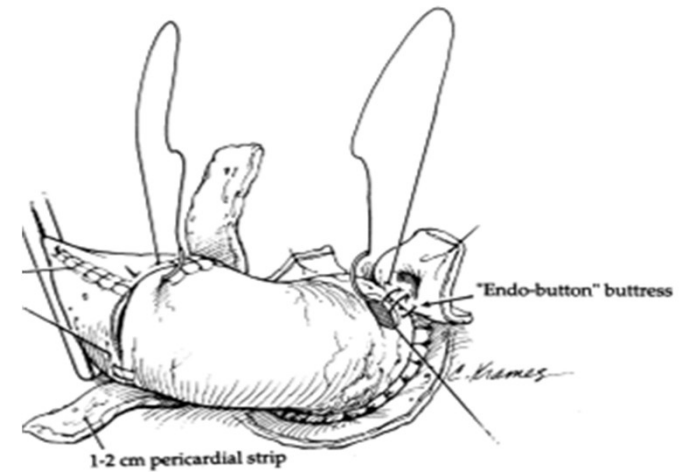
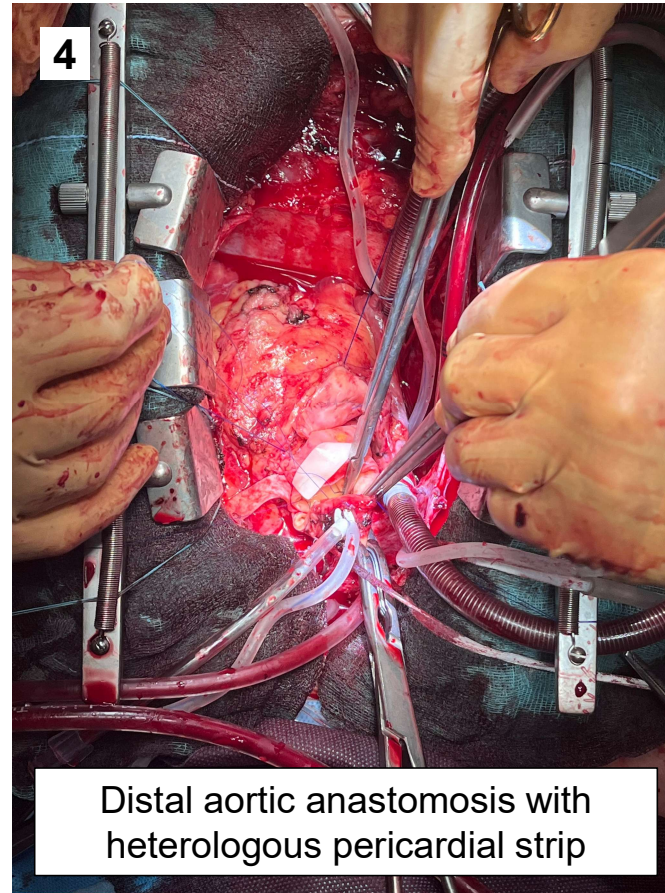
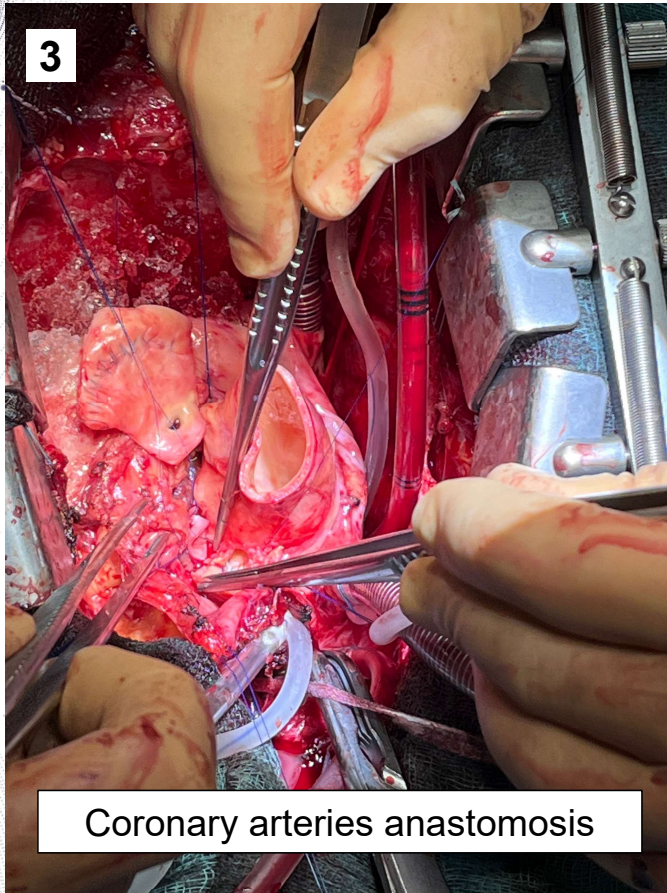


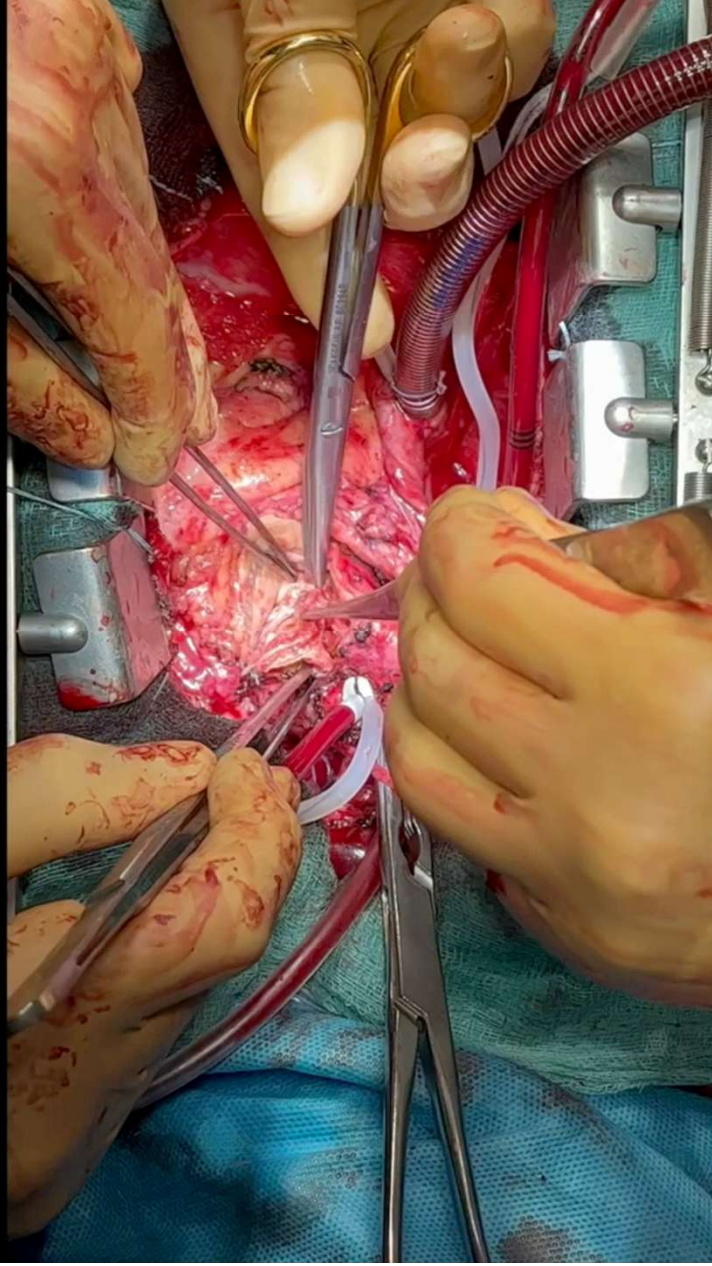


Homograft implantation technique



Homograft implantation technique





University of Turin - Homograft experience

Homograft Aortic Root Replacement for Destructive Prosthetic Valve Endocarditis: Current Era Results

Marco Pocar ^{1,2,3,*†}, Cristina Barbero ^{1,2,*†}, Matteo Marro ^{1,2}, Luisa Ferrante ^{1,2}, Andrea Costamagna ^{2,4}, Luigina Fazio ⁵, Michele La Torre ^{1,2}, Massimo Boffini ^{1,2}, Stefano Salizzoni ^{1,2†} and Mauro Rinaldi ^{1,2,†}

From January 2010 to December 2023

76 consecutive patients with **destructive NVE** and **PVE**

undergone aortic root replacement/reconstruction

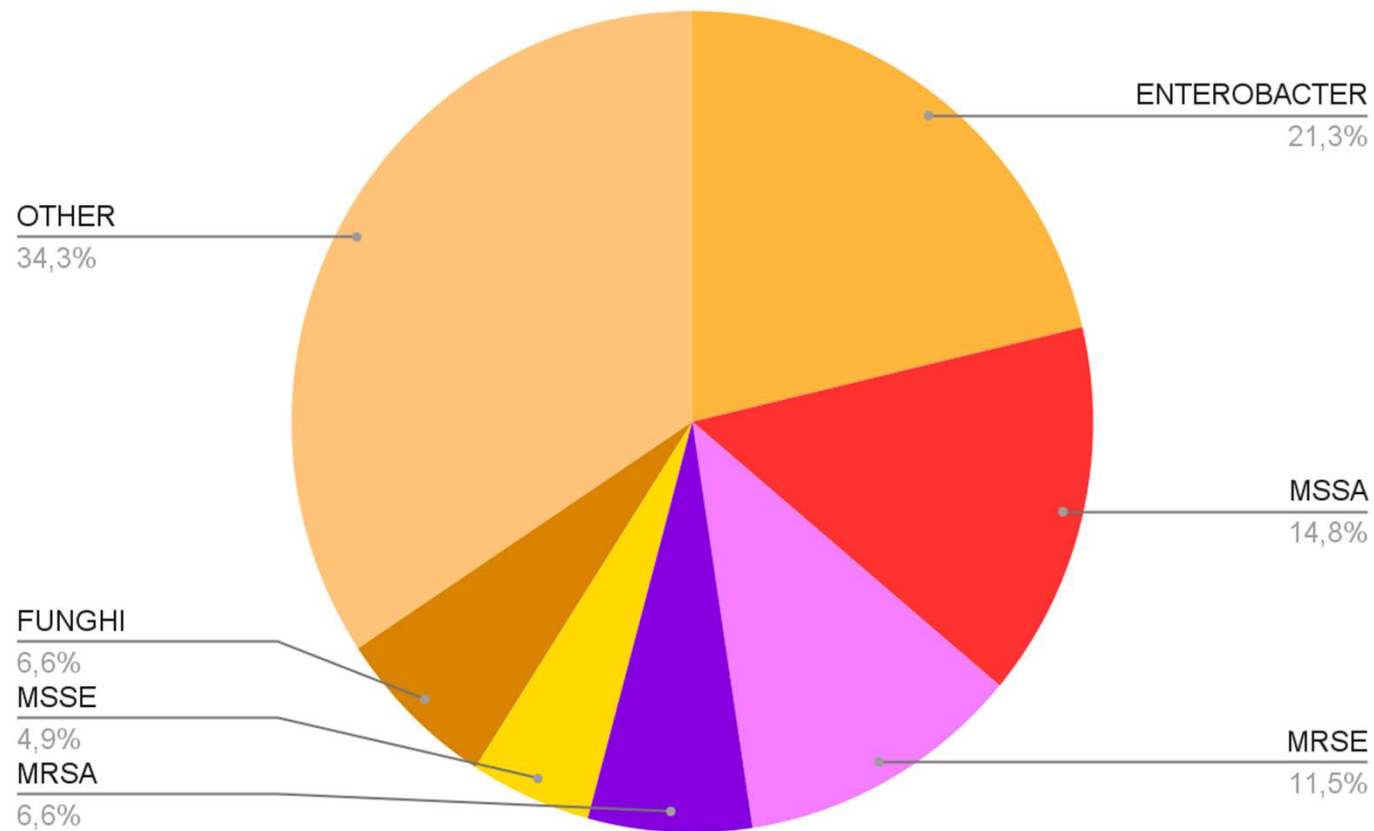
with **Homograft** at our Institution

Baseline characteristics

	N/Median	IQR/%
Age	68	56-75
Female	14	21
BMI (Kg/m2)	24,95	22,88-26,82
Smoking	34	56
Drug addiction	8	13
EuroSCORE II	15,8	9,60-23,58
Urgent operation	19	25
Redo	70	92,15
Mechanical aortic prothesis	22	28,95
CAD	18	23,69
Dialysis	5	6,6

	N/Median	IQR/%
Ejection Fraction	60	55-60
Aortic regurgitation ≥ 3+	41	53,9
Mitral regurgitation ≥ 3+	9	11,84
Abscess	52	68,42
Ventricular septal defect	6	7,9
Stroke	16	21,05
Intracerebral Hemorrhage	7	9,21
White blood cell count(x 109/L)	9,63	6,59-11,82
eGFR (ml/min)	63	45,35-87,9
AST	21	13-30
ALT	19	13-27,5
Procalcitonin	0,26	0,08-0,535
Culture negative	10	13,16
MRSA or MRSE	16	21,05
Fungus	5	6,56

Preoperative isolated microorganism

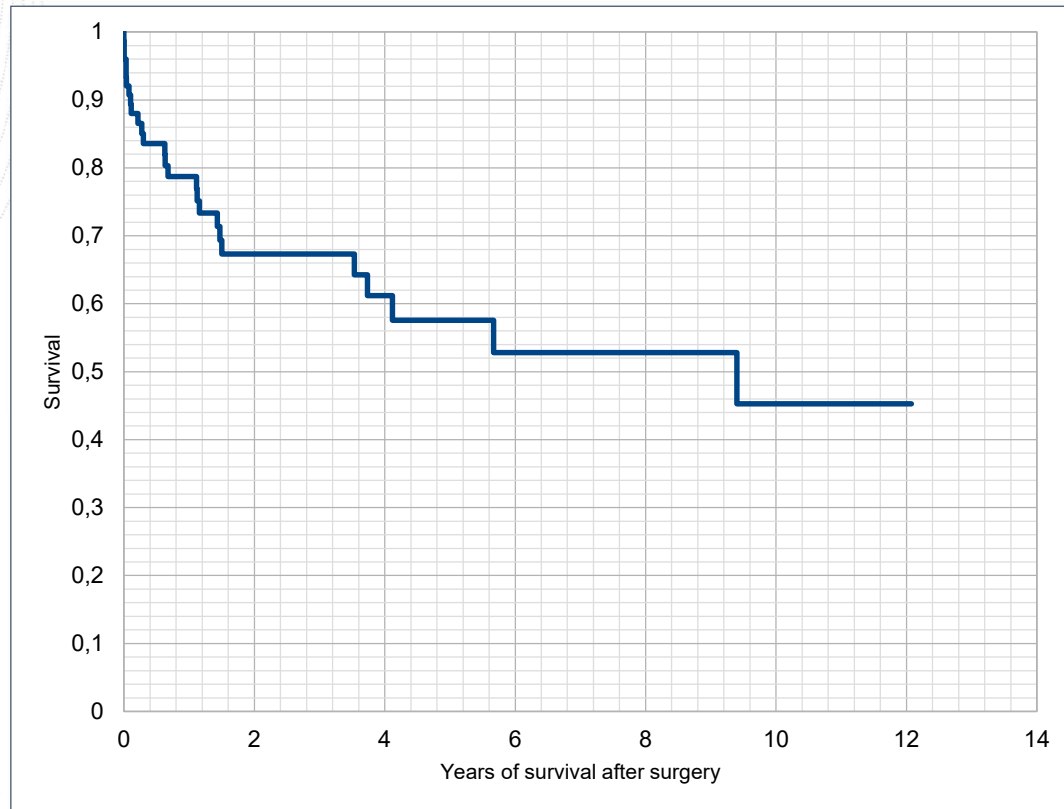


Intraoperative and perioperative characteristics

	N/Median	IQR/%
Homograft diameters	24	23-25
Mitral valve repair	25	32,89
Mitral valve replacement	7	9,21
Tricuspid valve repair	3	3,95
Sub-aortic patch repair	8	10,53
Aortic cross-clamp (min)	183	161,5-206

	N/Median	IQR/%
ICU stay (day)	3	2-6,75
Mechanical ventilation (days)	1	1-3
Stroke post	5	6,6
AKI post	16	21,05
Pacemaker post	23	30,26
Hospital stay (days)	13,5	8-22
In-hospital and 30-days survival	65	85,5

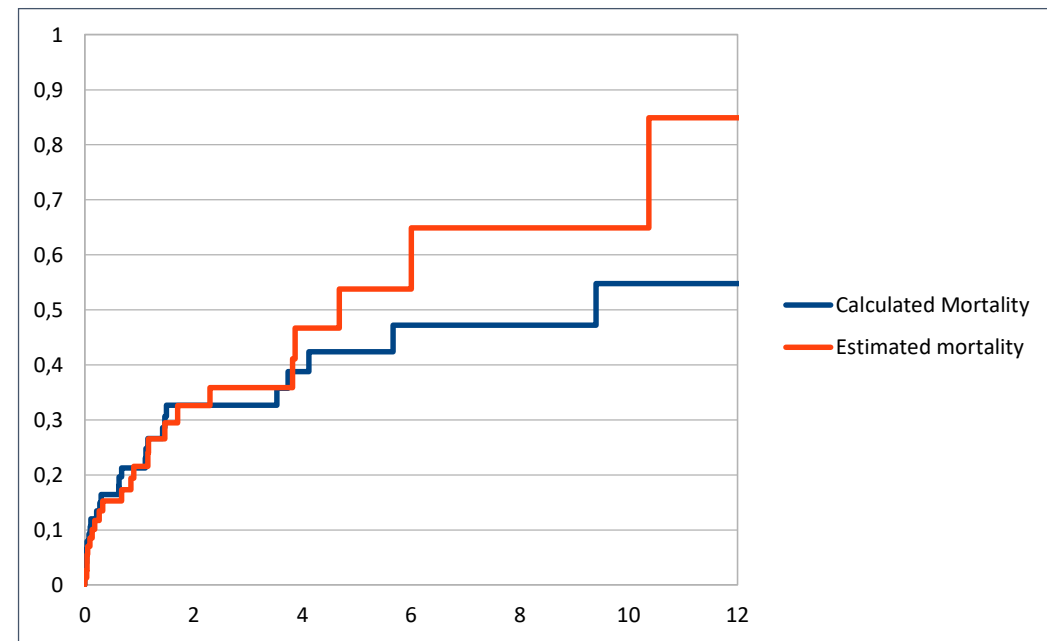
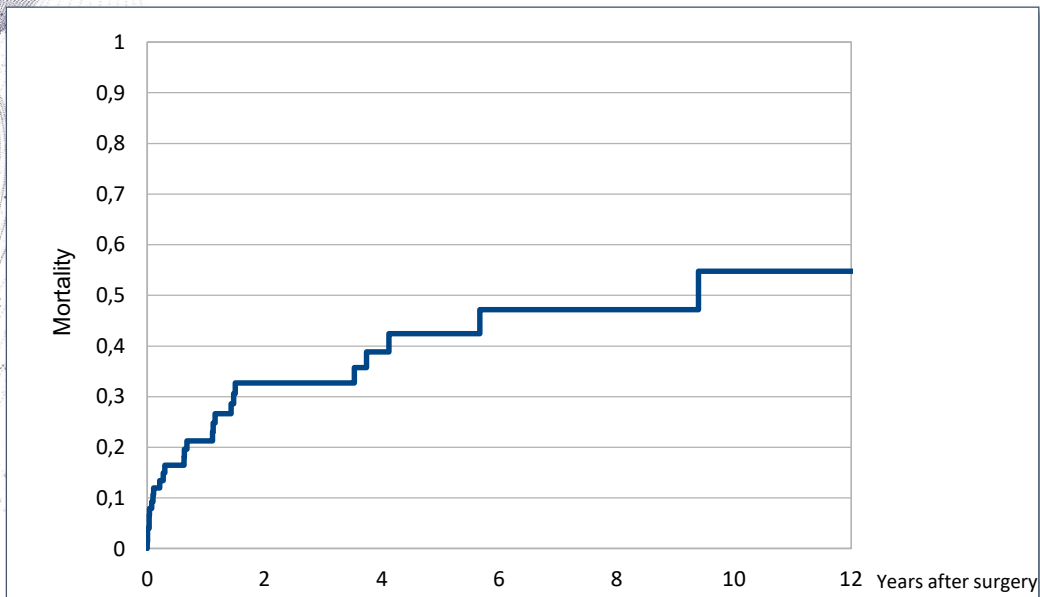
Long-term results



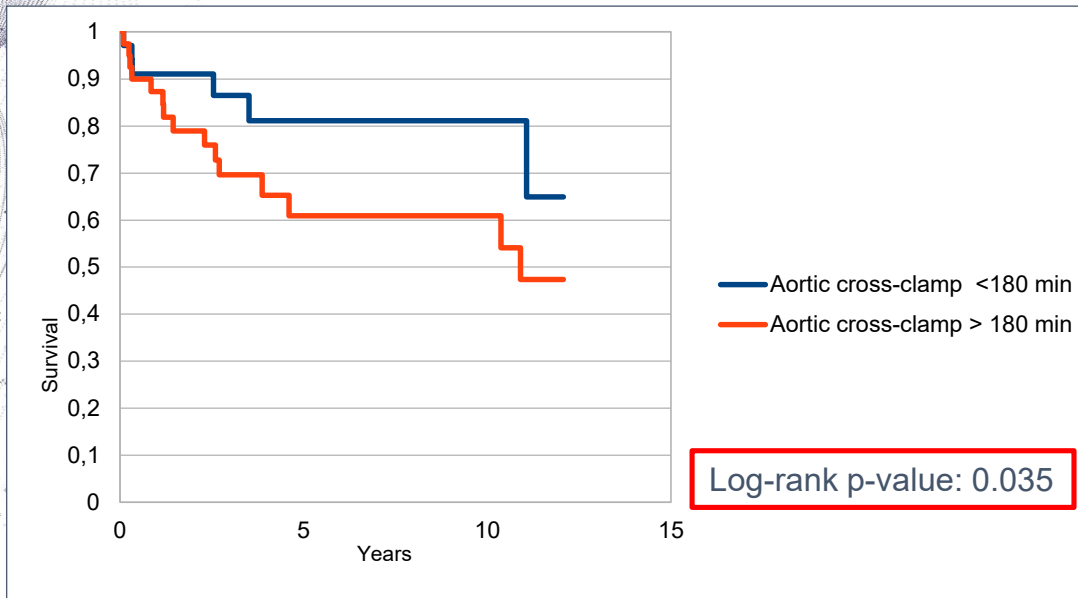
Survival

- **67%** after **3 years**
- **58%** after **5 years**
- **45%** after **12 years**

Long-term results

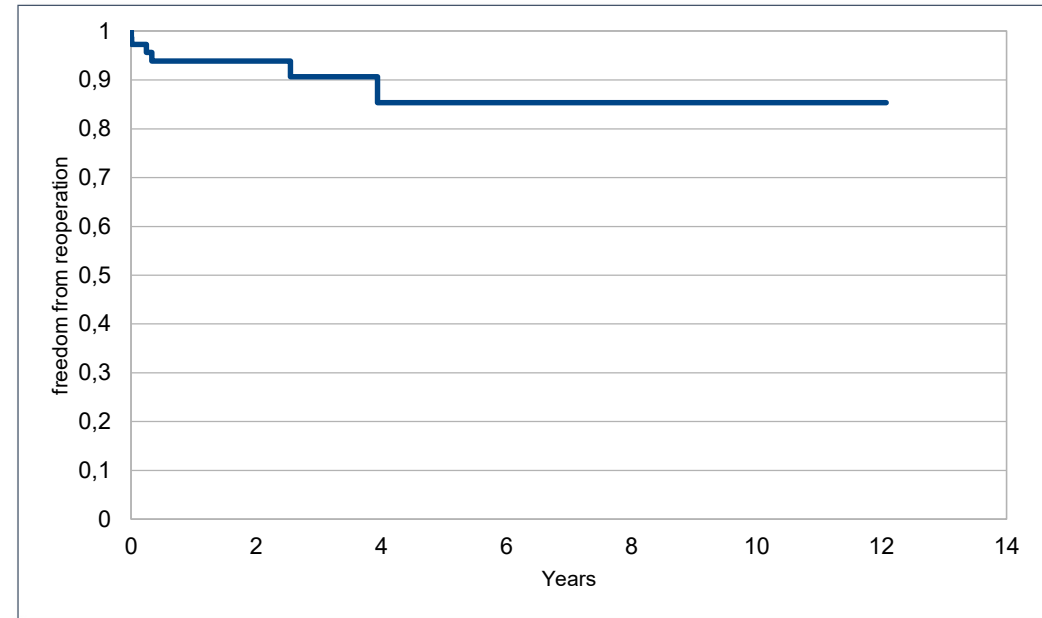


Long-term results



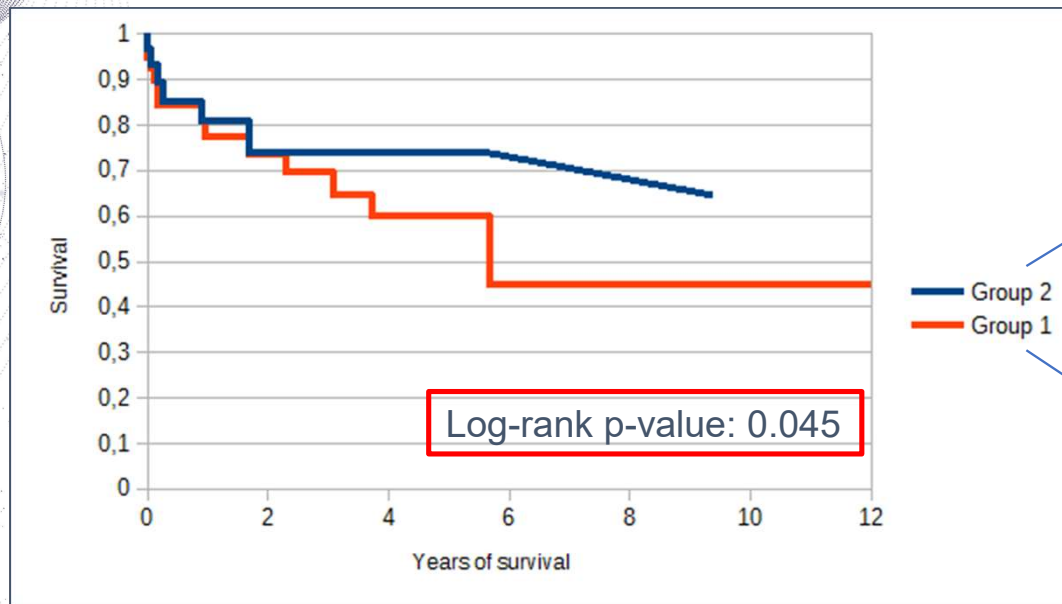
Survival vs. cross-clamp time

- >180 min: 61% after 5 and 10 years
- <180 min: 82% after 5 and 10 years



**Freedom from Reop
85.3% at 12 years**

Long-term results - Pathogenes



Gruppo 2
other (e.g. Klebsiella P., Enterococcus, Enterobacteriaceae, S. Gallolyticus)

Gruppo 1
MSSA, MRSA, MSSE, MRSE, Fungi

Survival vs. pathogenes

- **Group 1:** 74% after 2 years and 60% after 5 years
- **Group 2:** 74% after 2 years and 73% after 5 years

Conclusions

- **Complex aorto-mitral infective endocarditis** remains among the most complex, challenging and high-risk cardiac operations
- **Aortic homograft** and **Commando procedures** had good results, compared to an early ~100% mortality in untreated patients
- Both procedures can be tailored on extensive and destructive infections
- Sparing the mitral valve improves results

Conclusions

- In our experience Homograft is an excellent root substitute:

85% in-hospital survival, low recurrent endocarditis and reoperation rate, excellent durability

- Homograft has limitations: not available 24/7, not available adequate size sometimes
- **Surgical techniques and substitute choice are complex** and depends on:
 - patients' characteristics
 - degree of tissue to be replaced
 - the availability of various conduit types
 - technical considerations
 - surgeon skills and preferences



Thank you for the attention
