



The Ross Procedure: Outcomes at 20 Years

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A world map at night, showing city lights glowing against the dark background of the continents and oceans. The map is centered on the Atlantic Ocean, with North and South America on the left and Europe, Africa, and Australia on the right.

Conflict of Interest

None

The Ross Procedure

- 1990 to 2004
- 212 patients: ♂ 66% ♀ 34%
- Mean age: 34 years (16 - 63 years)
- Previous heart surgery - 17.5%
 AV surgery - 14.2%
- NYHA functional class:
 - I - 19.3%
 - II - 63.7%
 - III - 12.3%
 - IV - 4.7%

The Ross Procedure

Left ventricular ejection fraction

≥60% - 60.0%

40-59% - 31.6%

20-39% - 8.5%

Aortic valve lesion:

Stenosis - 50.4%

Insufficiency - 36.3%

Mixed lesion - 13.2%

Bicuspid aortic valve – 82%

The Ross Procedure

Operative technique:

Aortic annulus and pulmonary STJ measurements

Aortic annulus reduced to match PV annulus - 45%

Sinotubular junction aorta reduced - 28%

Implantation technique:

Inclusion or sub-coronary - 49.0%

Root replacement - 51%)

Other:

Replacement of the ascending aorta - 12%

Mitral valve repair - 2%

The Ross Procedure

Follow-up: annual with echocardiography

Median follow-up: 13.8 years

Completeness: 100% clinical

96% echocardiographic

Statistical analysis:

- Parametric models for time dependent variables

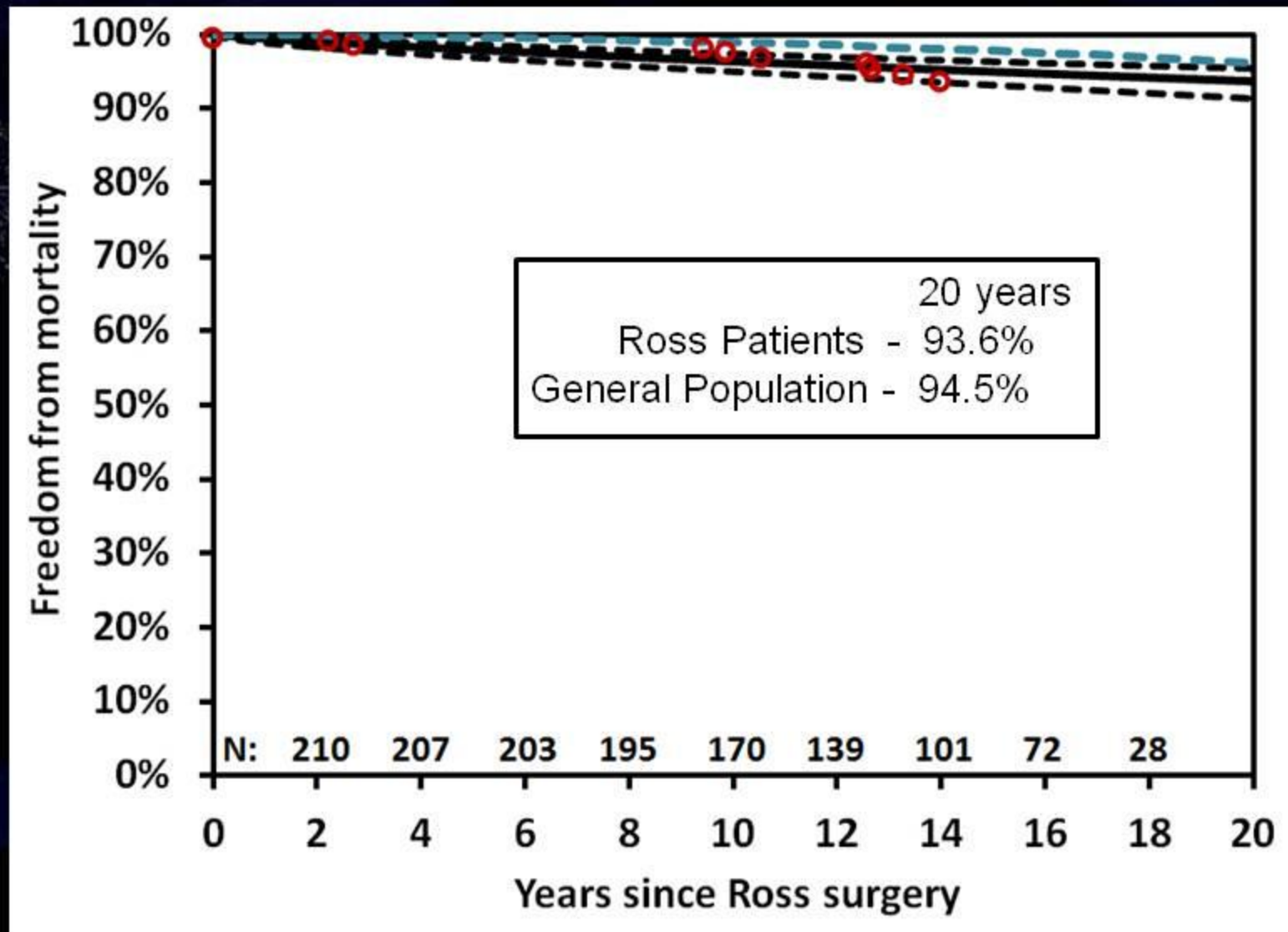
- Logistic regression models

- Univariable associations among variables

The Ross Procedure: Outcomes

- 1 operative death
- 9 late deaths: 3 cardiac and 6 non-cardiac
 - ↳ Late after reoperations on PA

The Ross Procedure: Patients' Survival



The Ross Procedure: Outcomes

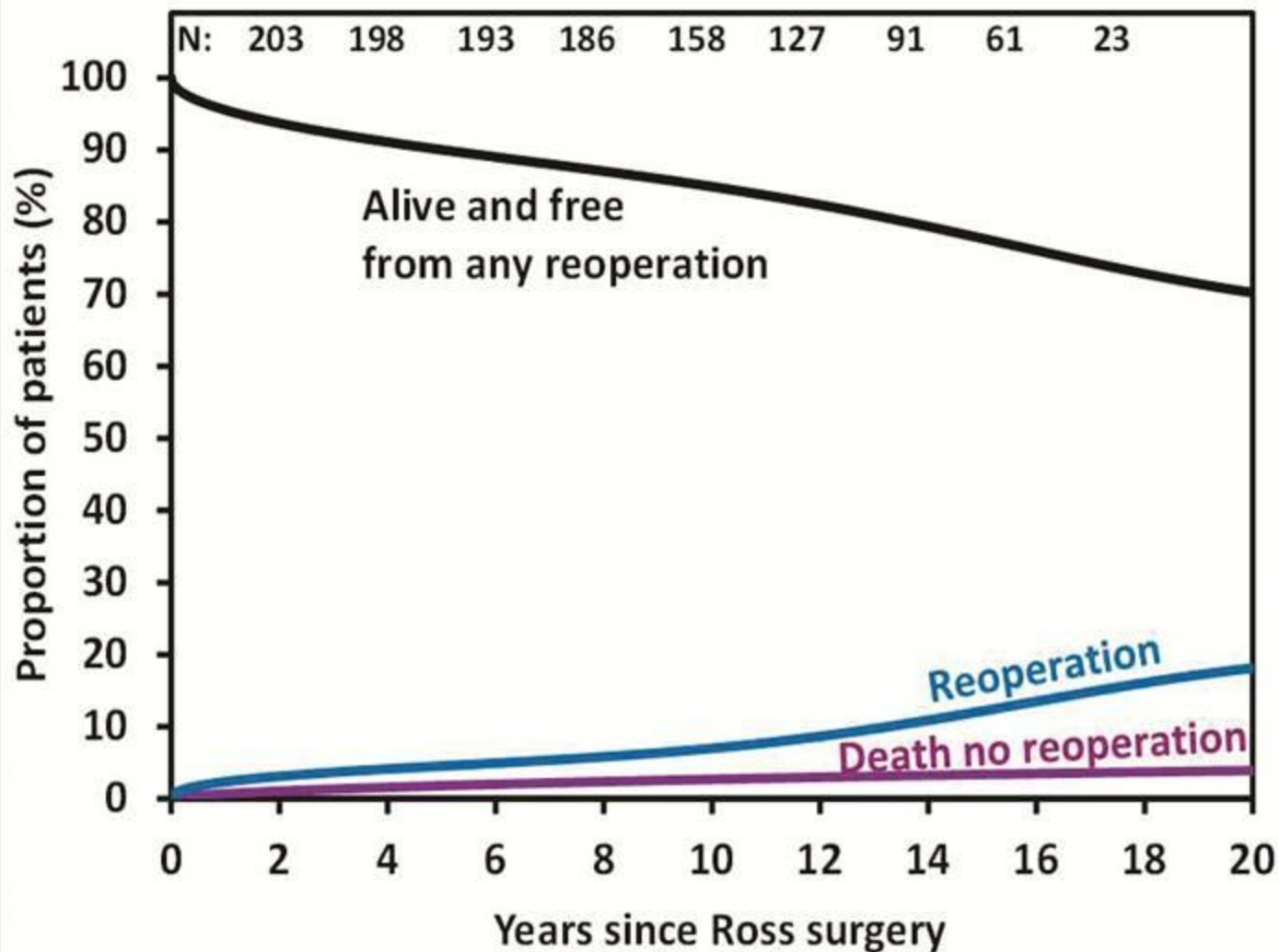
- 1 operative death
- 9 late deaths: 3 cardiac and 6 non-cardiac
 - ↳ Late after reoperations on PA
- 2 strokes (complete recovery) & 2 TIA
- 4 endocarditis on the pulmonary homograft
 - 2 reoperations & 2 antibiotics alone

The Ross Procedure: Reoperations

- 25 patients had reinterventions

15 pulmonary autograft	}	4 combined
8 pulmonary homograft		
3 CABG		
1 ascending aorta replacement		

The Ross Procedure: Outcomes



78%

15.7%

6.3%

The Ross Procedure: Reoperations

25 patients had reinterventions

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15 pulmonary autograft

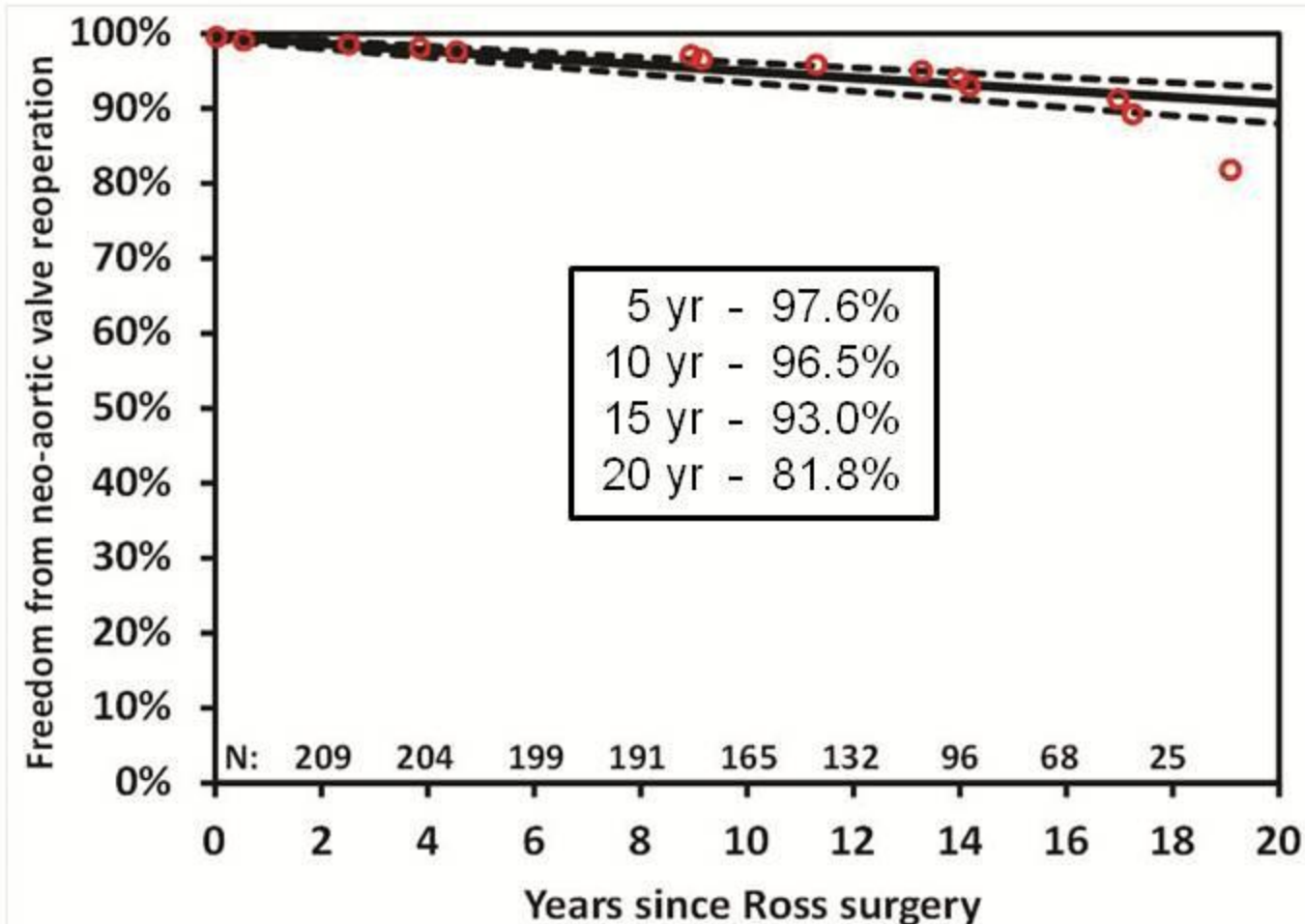
12 for AI – all had AVR

1 for aneurysm – had aortic valve sparing

2 for sub-aortic false aneurysm – both repaired

The Ross Procedure

Freedom From REOP on Pulmonary Autograft



The Ross Procedure

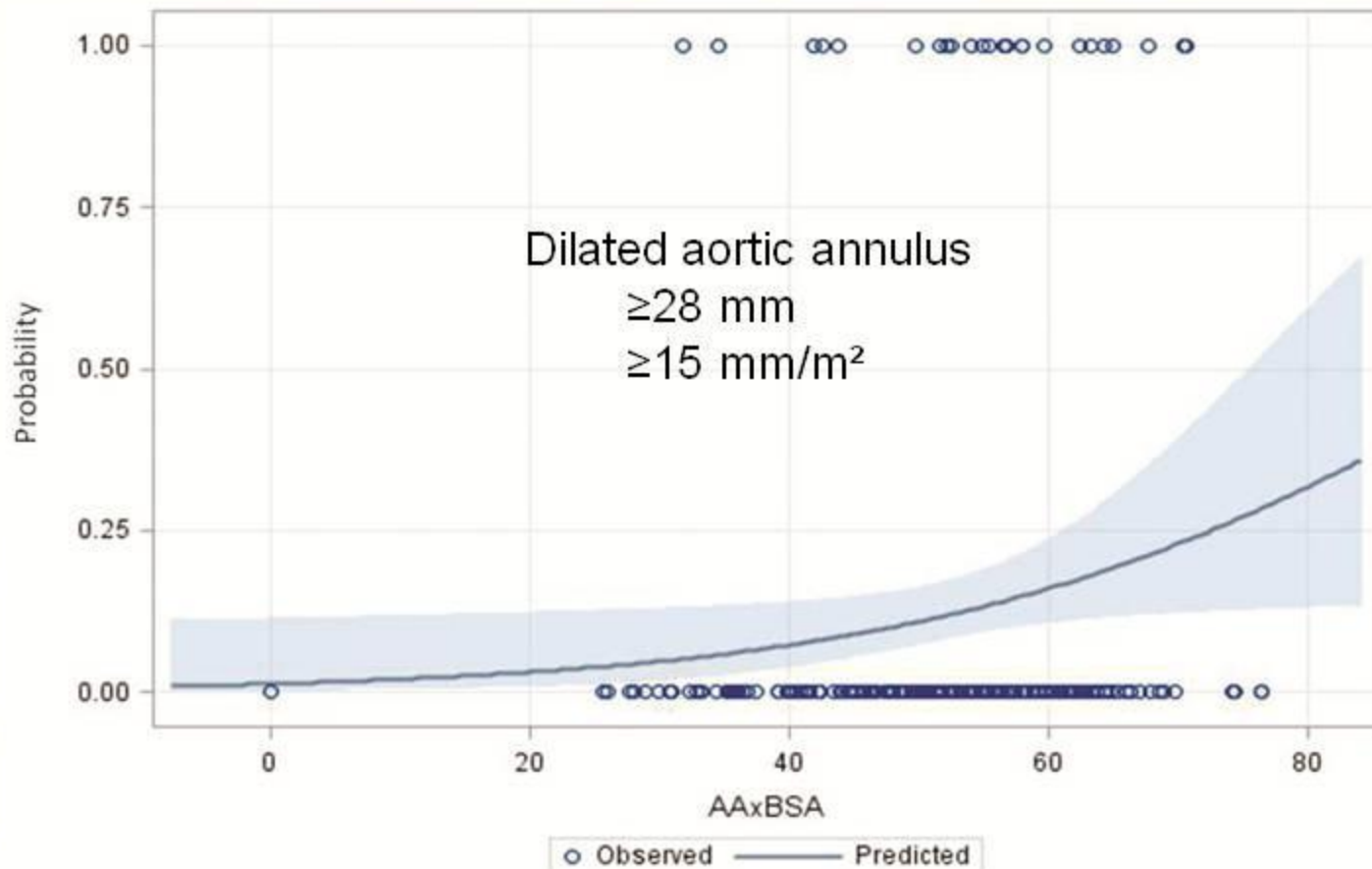
Reoperations on the Pulmonary Autograft

Multivariable Analysis:

	H.R.	95% C.I.	p value
<i>Dilated aortic annulus</i>	<i>1.4/mm</i>	<i>1.2-1.6</i>	<i><0.001</i>
<i>Preoperative AI</i>	<i>6.3</i>	<i>1.3-29.4</i>	<i>0.02</i>
<i>Male sex</i>	<i>4.8</i>	<i>1.6-14.4</i>	<i>0.005</i>

The Ross Procedure

Reoperations on the Pulmonary Autograft



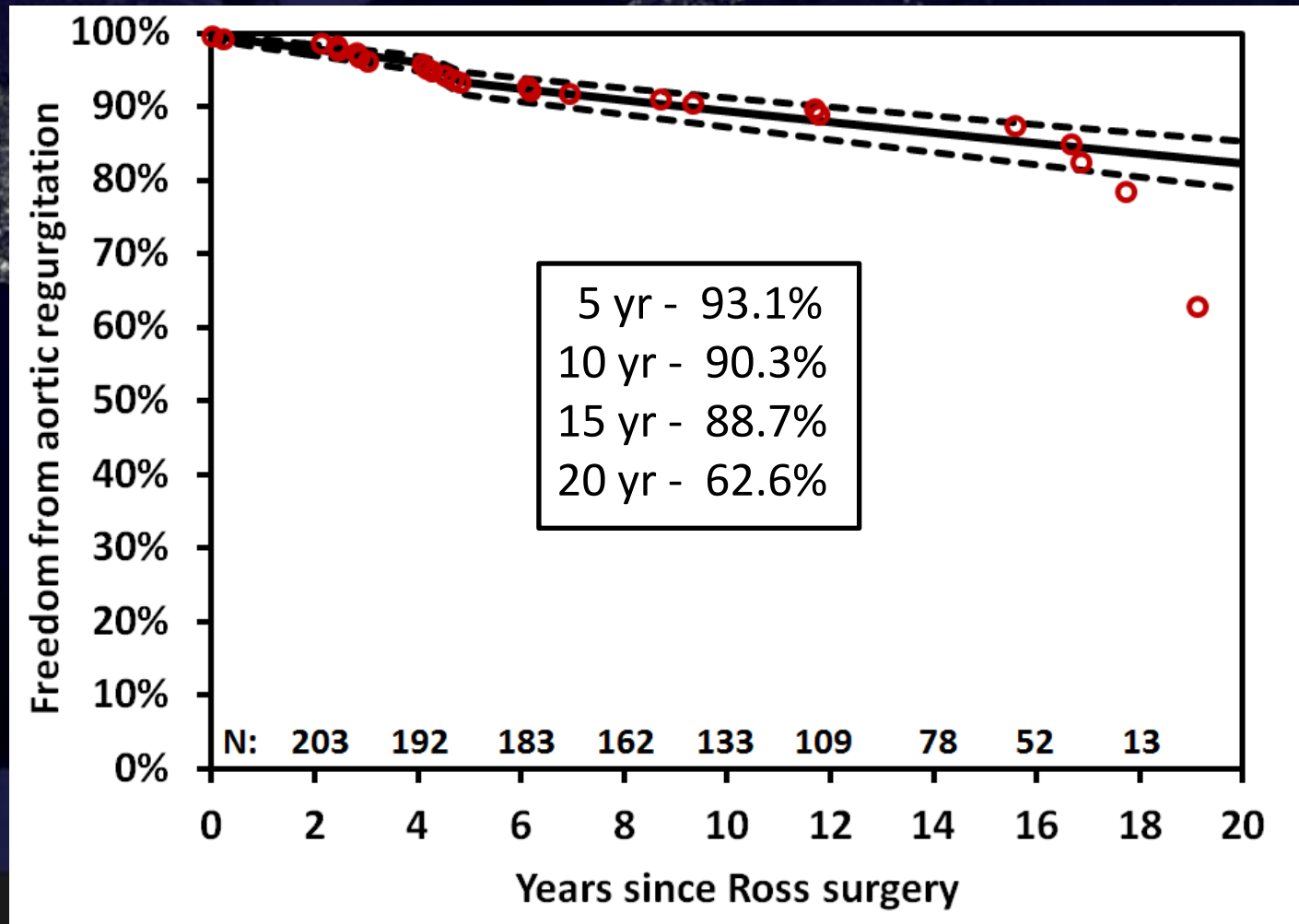
The Ross Procedure

A world map with a dark blue background, where landmasses are highlighted with a glowing yellow-green light, representing city lights or patient locations. The map shows a high density of lights in North America, Europe, and East Asia, with fewer lights in South America, Africa, and Australia.

26 patients developed AI greater than mild

The Ross Procedure

Freedom From AI >Mild



The Ross Procedure

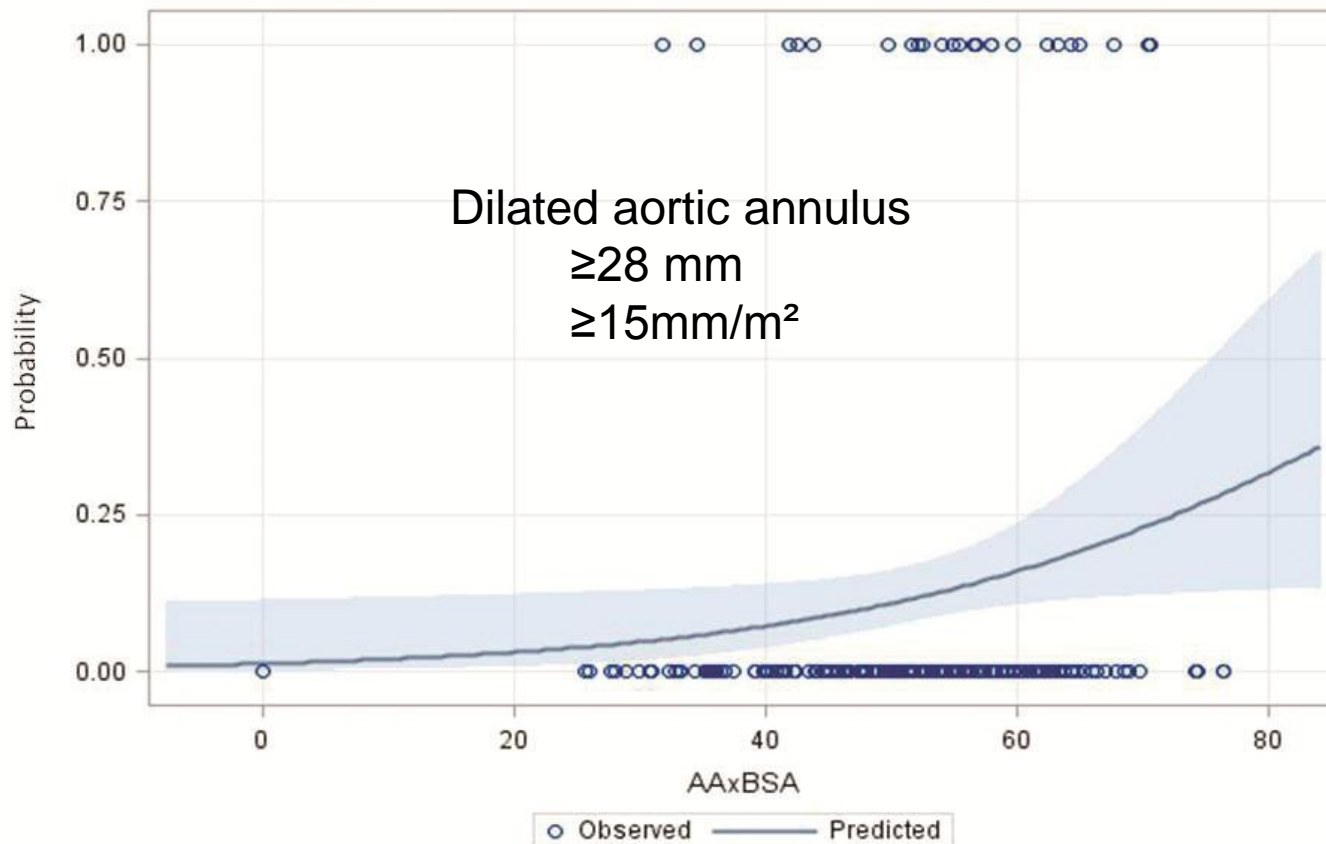
Postoperative AI Greater Than Mild

Multivariable analysis

	H.R.	95% C.I.	p value
Preop AI	2.3	0.9-5.5	0.06
Dilated aortic annulus	1.04/mm	1.02-5.52	0.02

The Ross Procedure

Postoperative AI Greater Than Mild



The Ross Procedure: Reoperations

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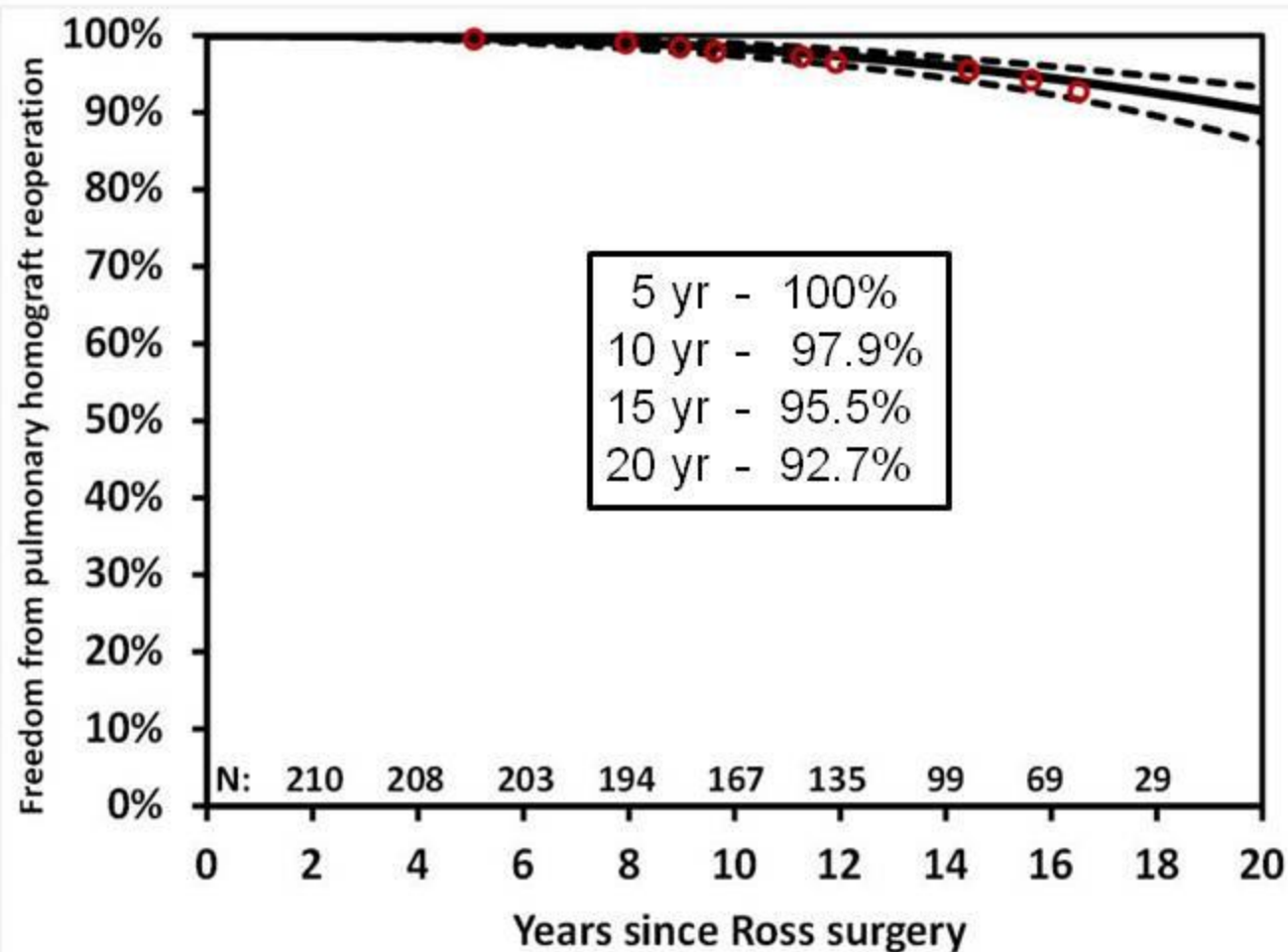
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The Ross Procedure

Freedom From Reintervention on the PV Homograft



A dark blue world map with city lights glowing in yellow and white, serving as a background for the text.

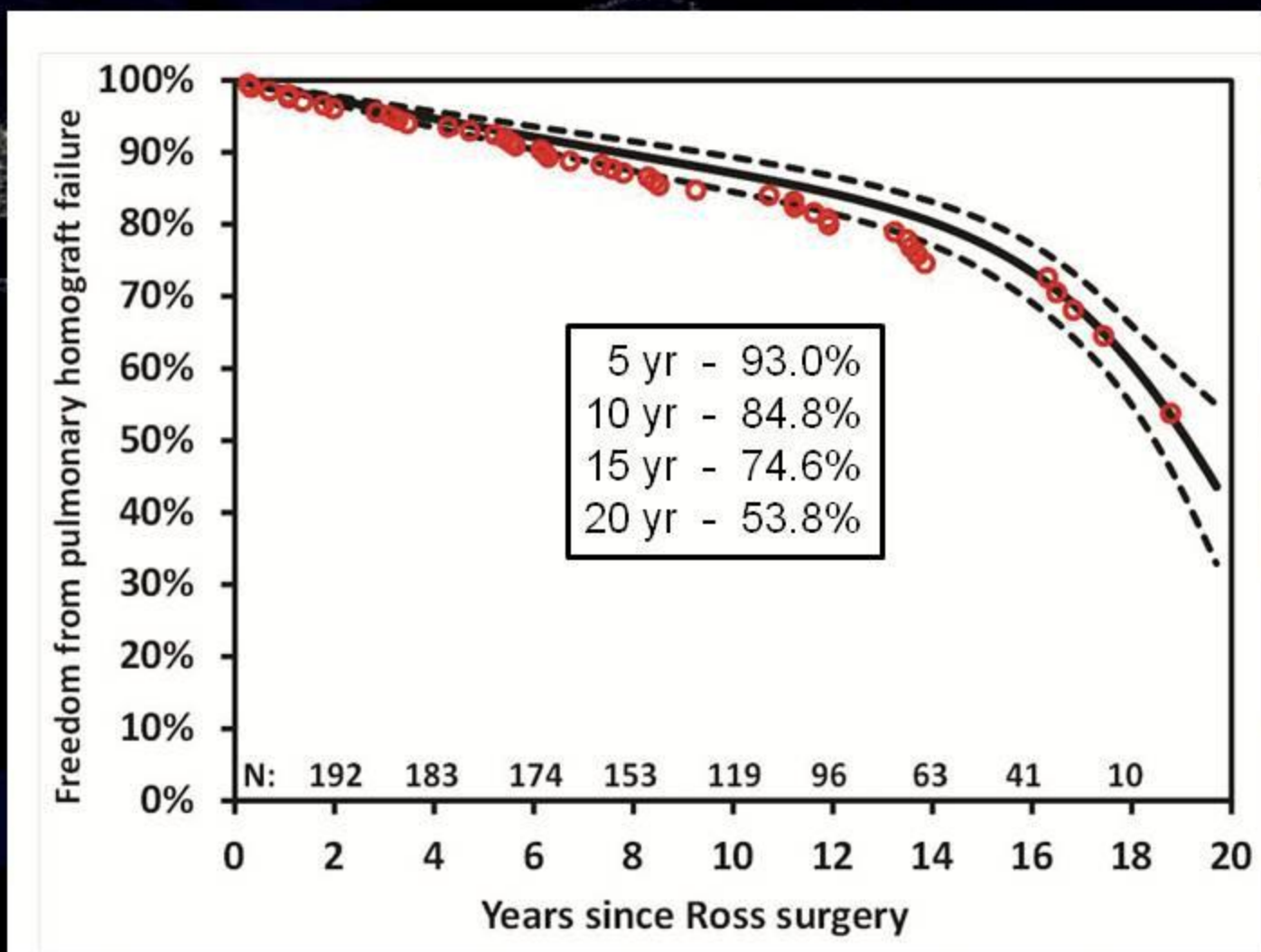
The Ross Procedure PV Homograft Dysfunction

PV homograft dysfunction:
PI moderate or severe
PV gradient $>40\text{mmHg}$

25 patients developed PV dysfunction

The Ross Procedure

Freedom From PV Homograft Dysfunction



The Ross Procedure

Dilation of the Aortic Root

Dilatation $\geq 39 - 49$ mm \rightarrow 31 patients

Dilatation >49 mm \rightarrow 4 patients

Operative technique:

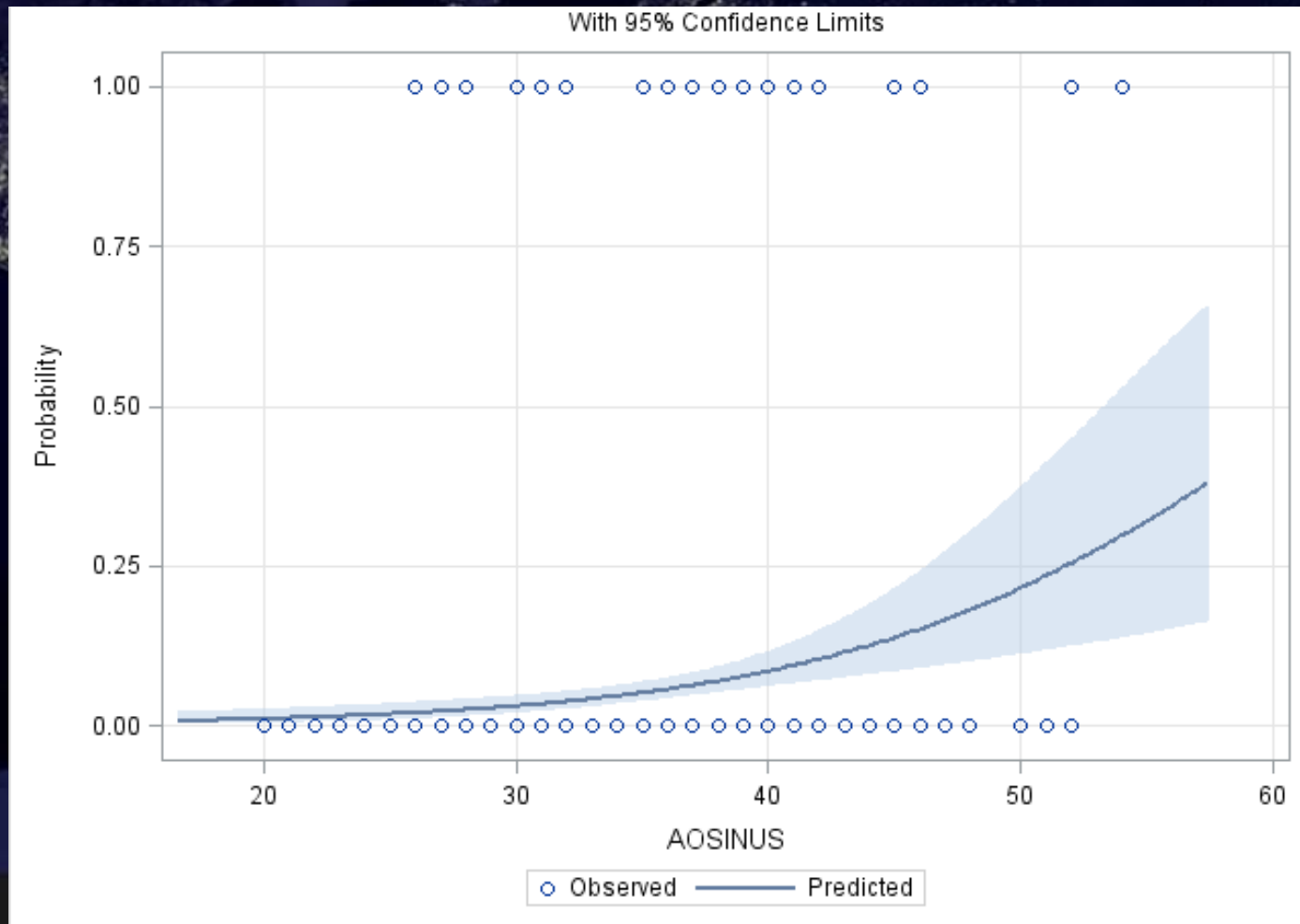
Aortic root replacement: 0.149 ± 0.058 mm/year

Aortic root inclusion: 0.122 ± 0.060 mm/year

$p=0.01$

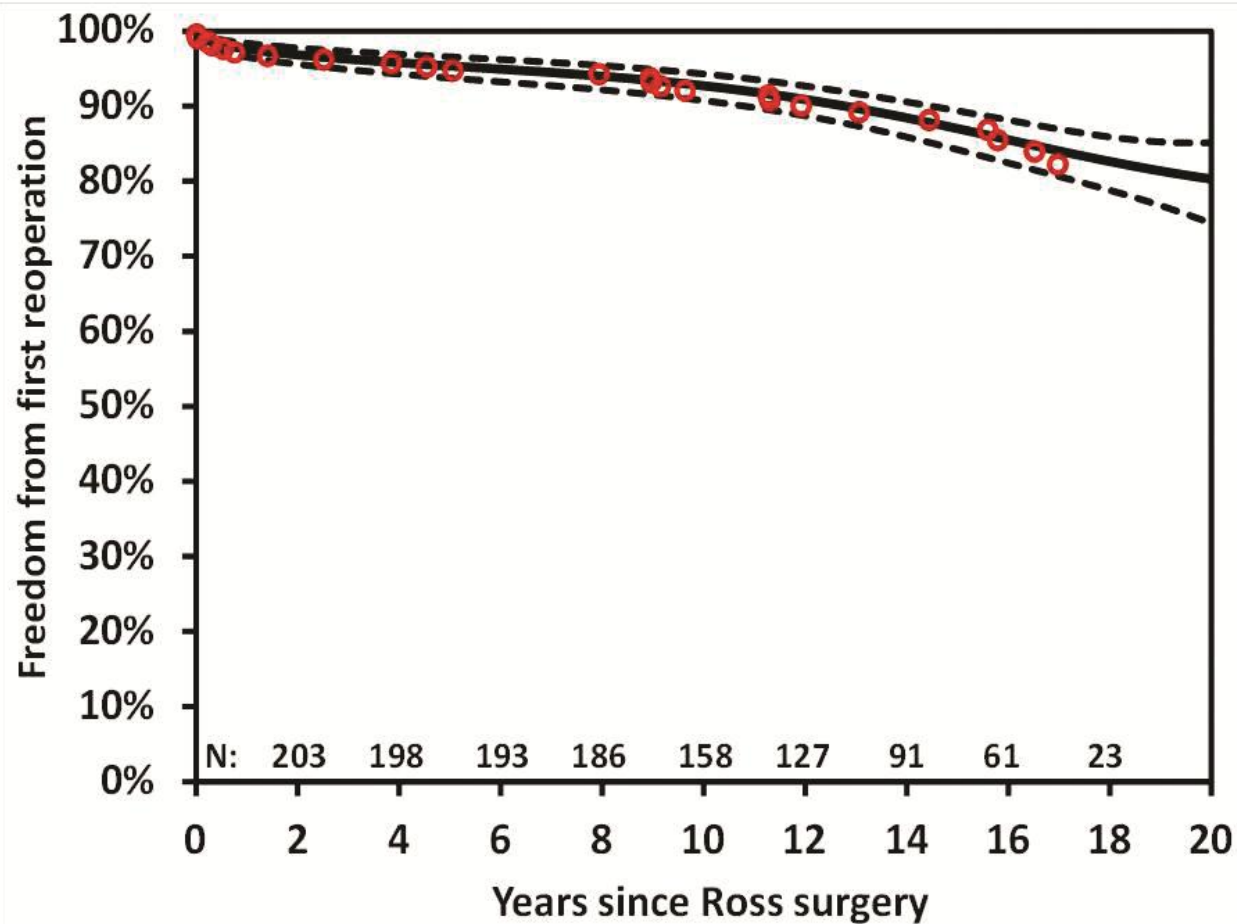
The Ross Procedure

Dilation of the Aortic Root and Late AI



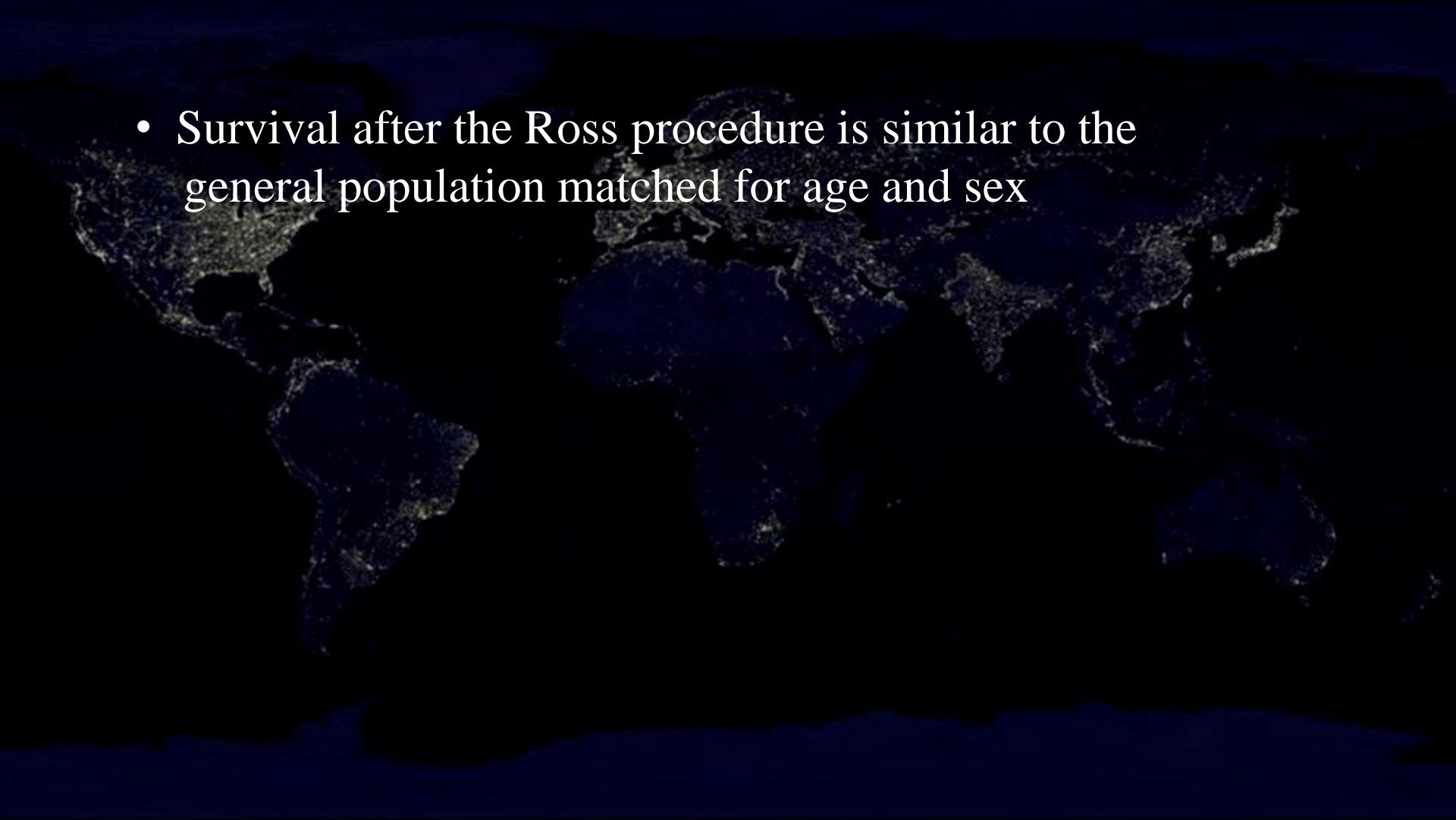
The Ross Procedure

Freedom From Any Reoperation



The Ross Procedure: Conclusions

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- Dilated aortic annulus (≥ 28 mm or ≥ 15 mm²) is associated with increased risk of postoperative AI and reoperation
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- The technique of implantation had no effect on reoperation or on the development of AI but the technique of aortic root replacement was associated with higher risk of dilatation of the aortic root

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Thank you





