STS/EACTS Latin America Cardiovascular Surgery Conference
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Aggressive Resection/Reconstruction of the Aortic Arch in Type A Dissection: *Con*

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Presenter Disclosures
Thomas G. Gleason, MD

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Unlabeled/unapproved uses disclosures: none.

Classically 3 (4?) phases of the reconstruction

1) Circulation management

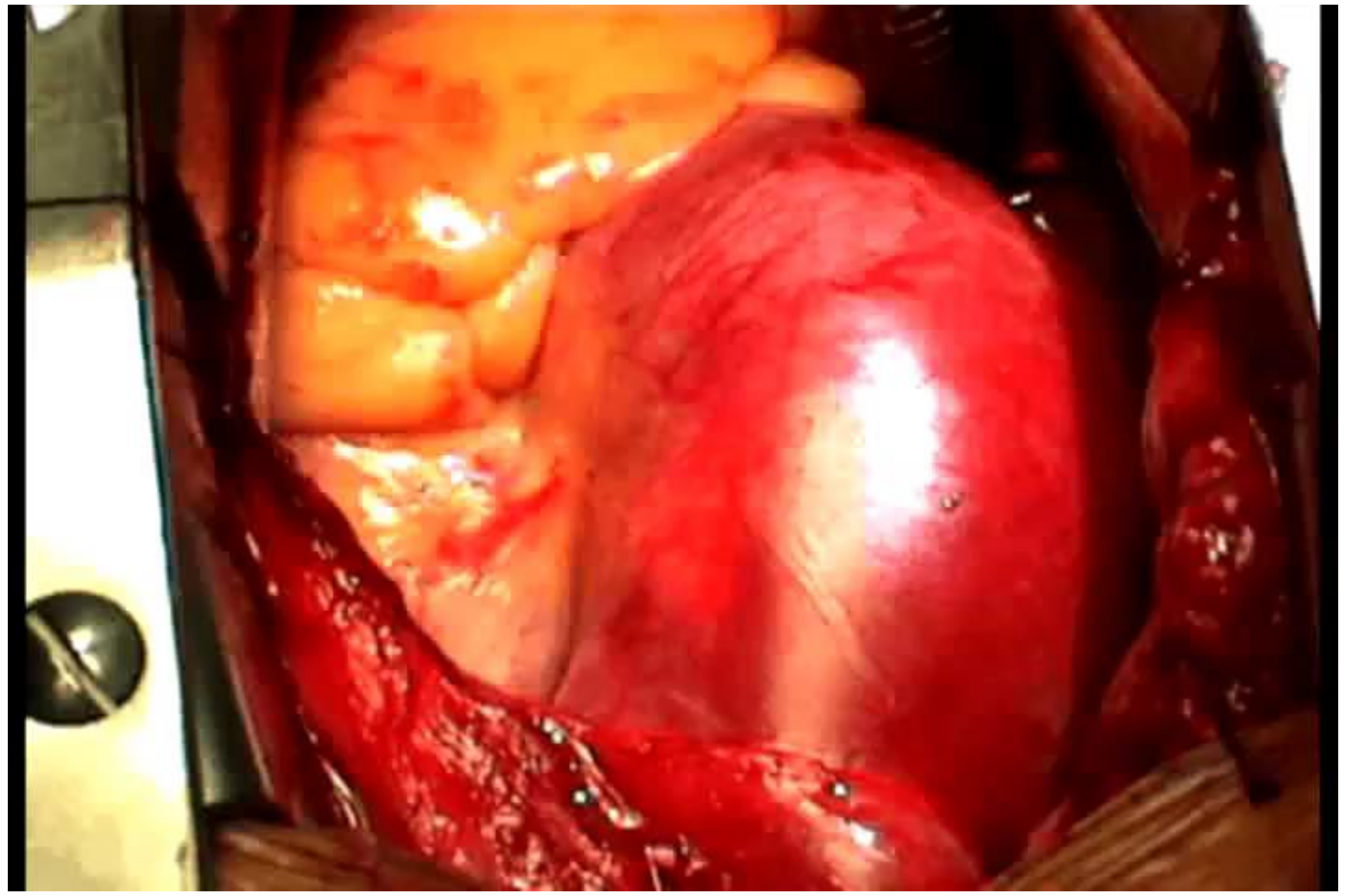
2) Root reconstruction

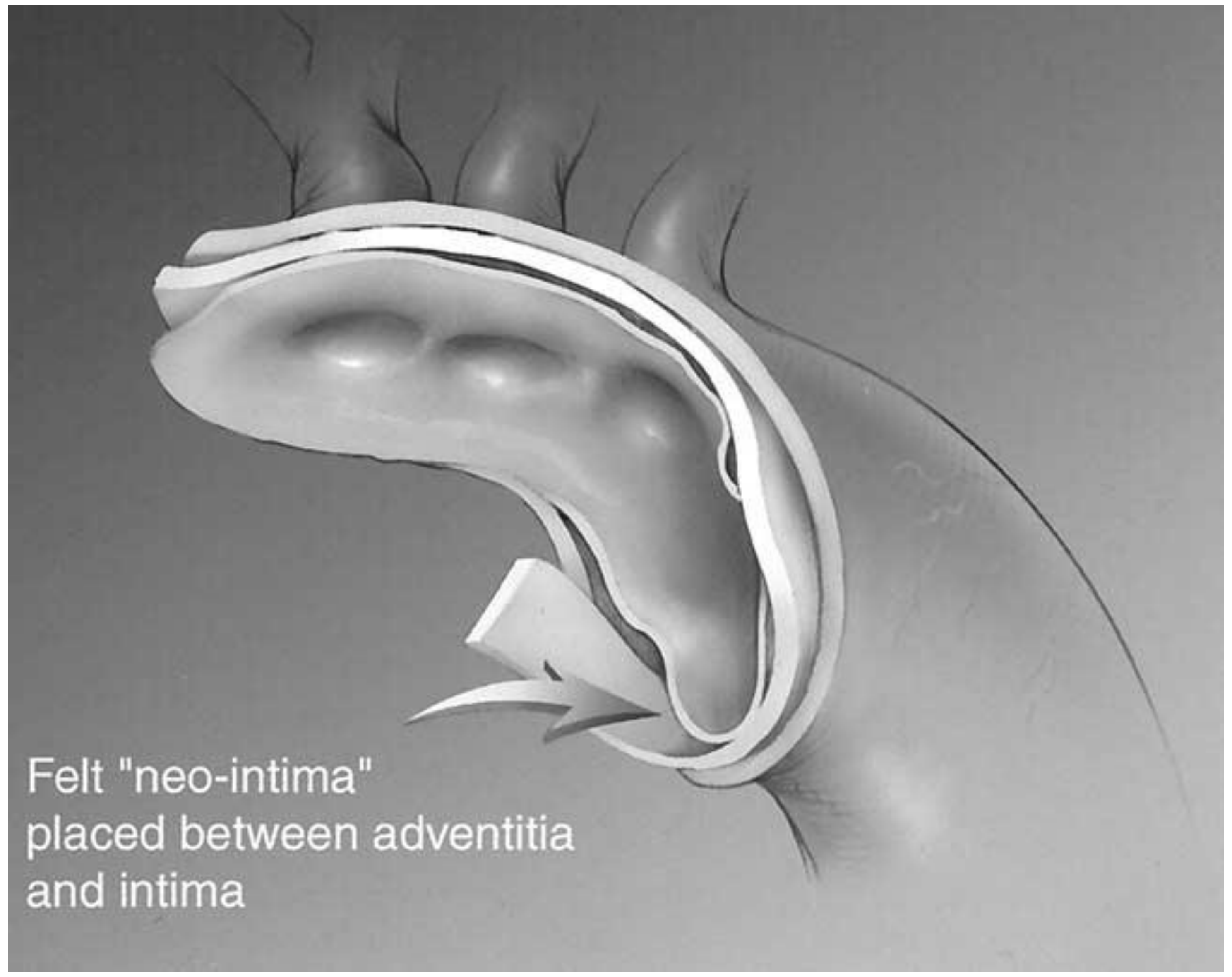
3) Arch reconstruction

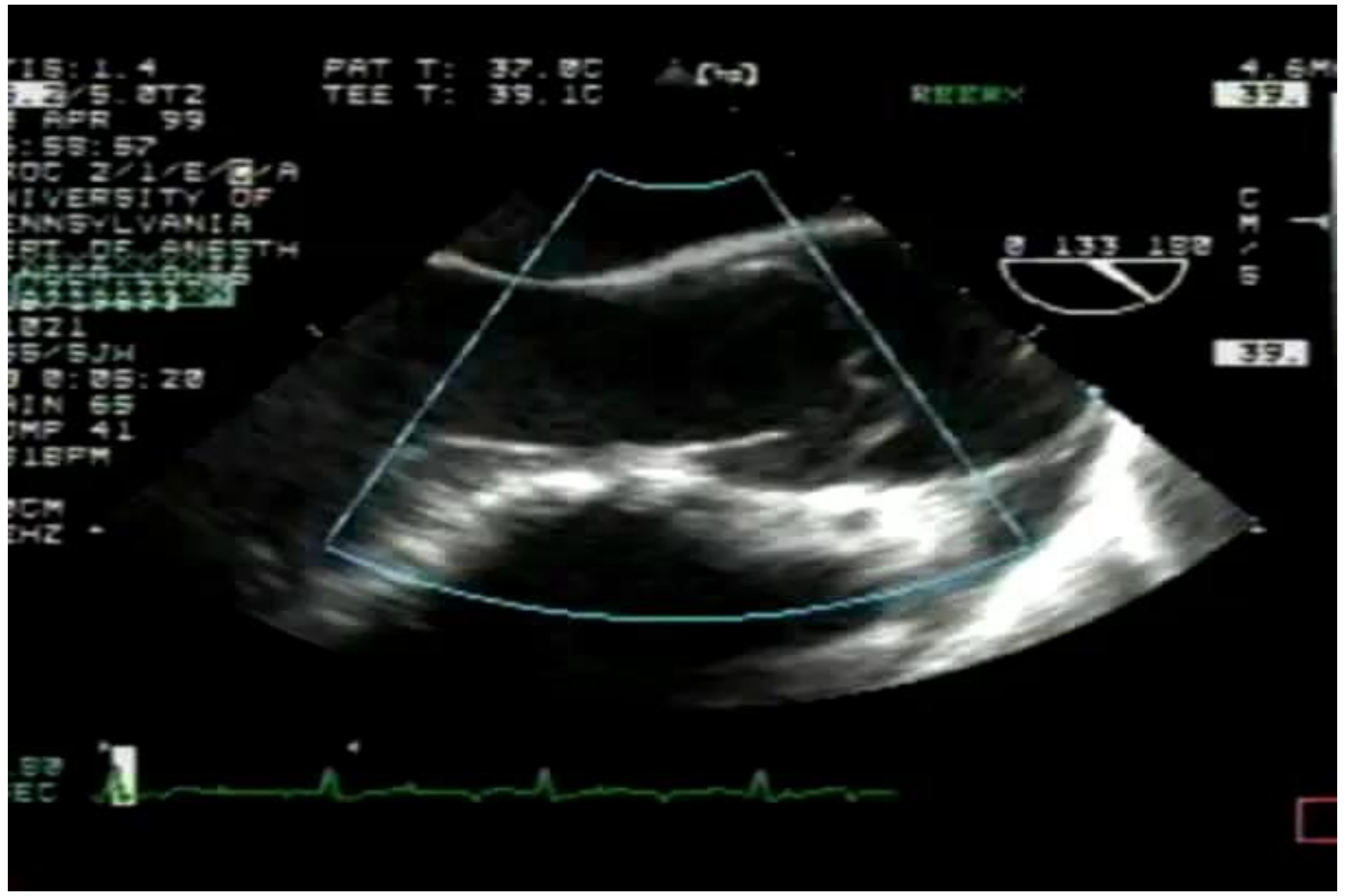
? 4) Descending stabilization ?

Acute type A dissection: new paradigm

1) Rapid transport and treatment
2) Sinus segment repair/root replacement
3) EEG monitoring to direct HCA
4) Hemiarch replacement using RCP
5) Antegrade graft perfusion
6) Routine use of TEE





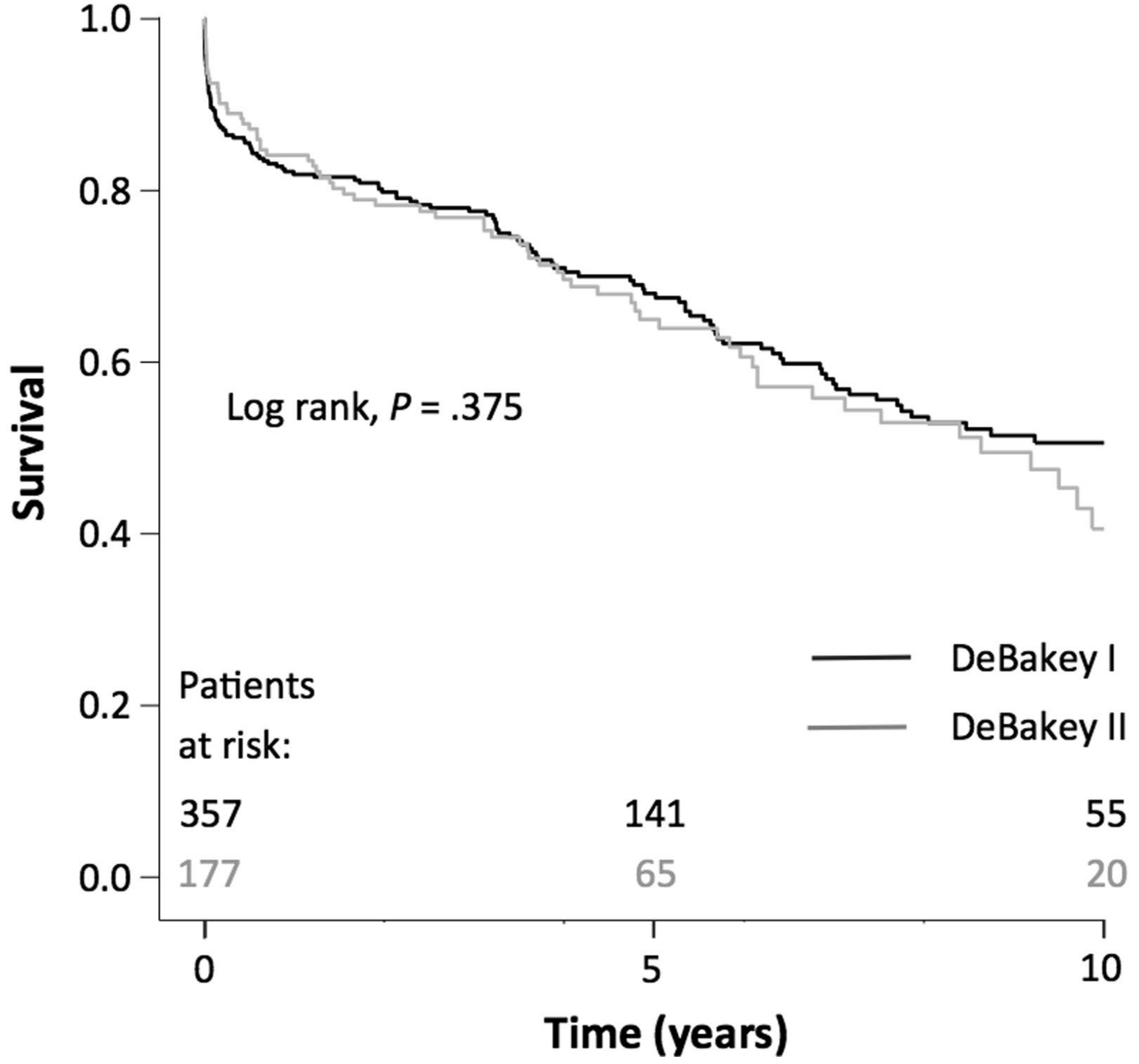


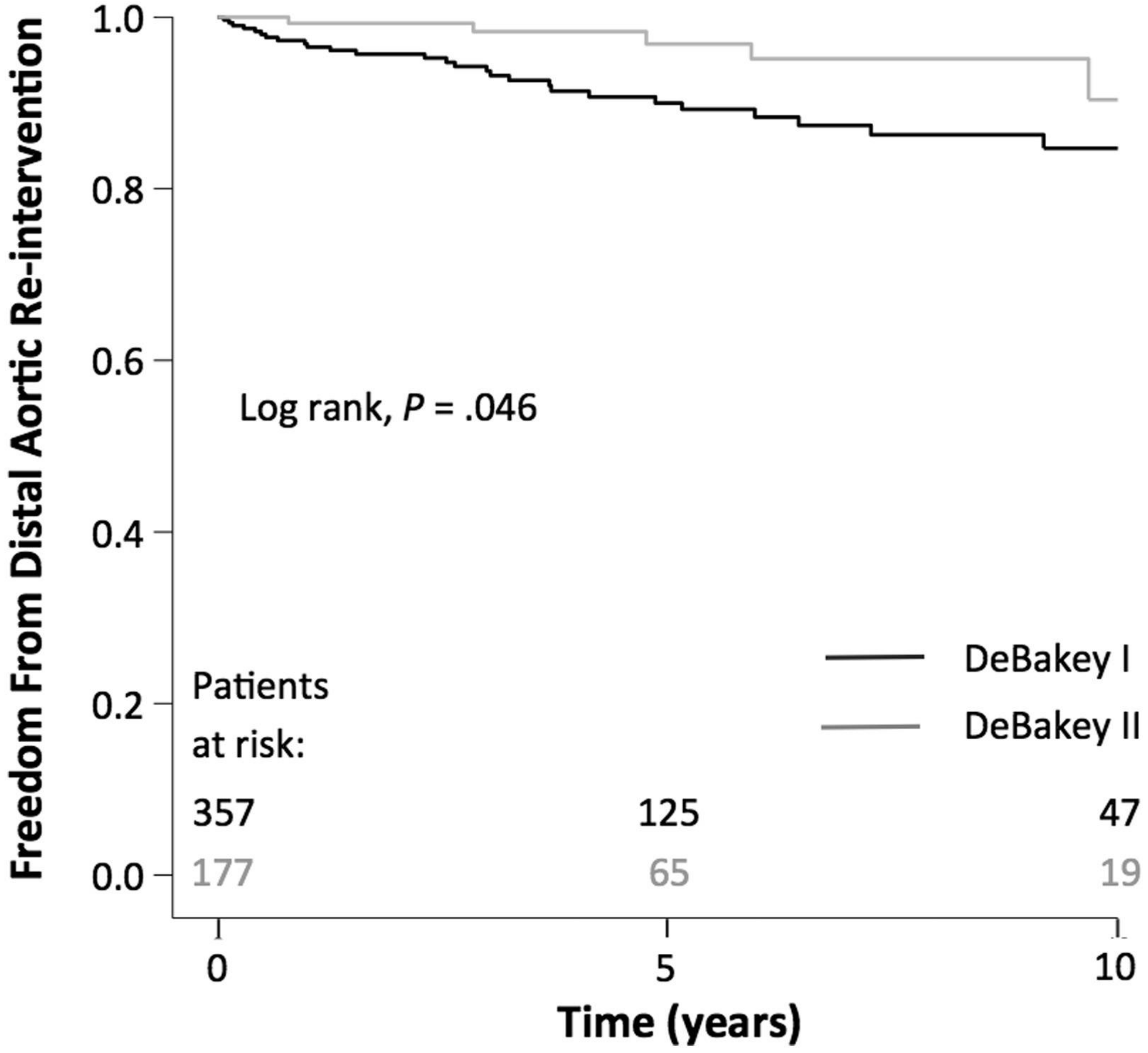
Mortality stats

Total	9/104 (8.6%)
30-day	7/104 (6.7%)
Preop. stroke	5/11 (45%)
Postop. stroke	1/5 (20%)
Without preop. stroke	4/93 (4.3%)

Presented at the 121st American Surgical Association
Ann Surg 2001 Sep;234(3):336-42.

Penn experience with TAAD and hemiarch





J Thorac Cardiovasc Surg 2014;148:2981-5.

Acute Type A Aortic Dissection

University of Pennsylvania (RCP favored) n=629/ 20 yrs

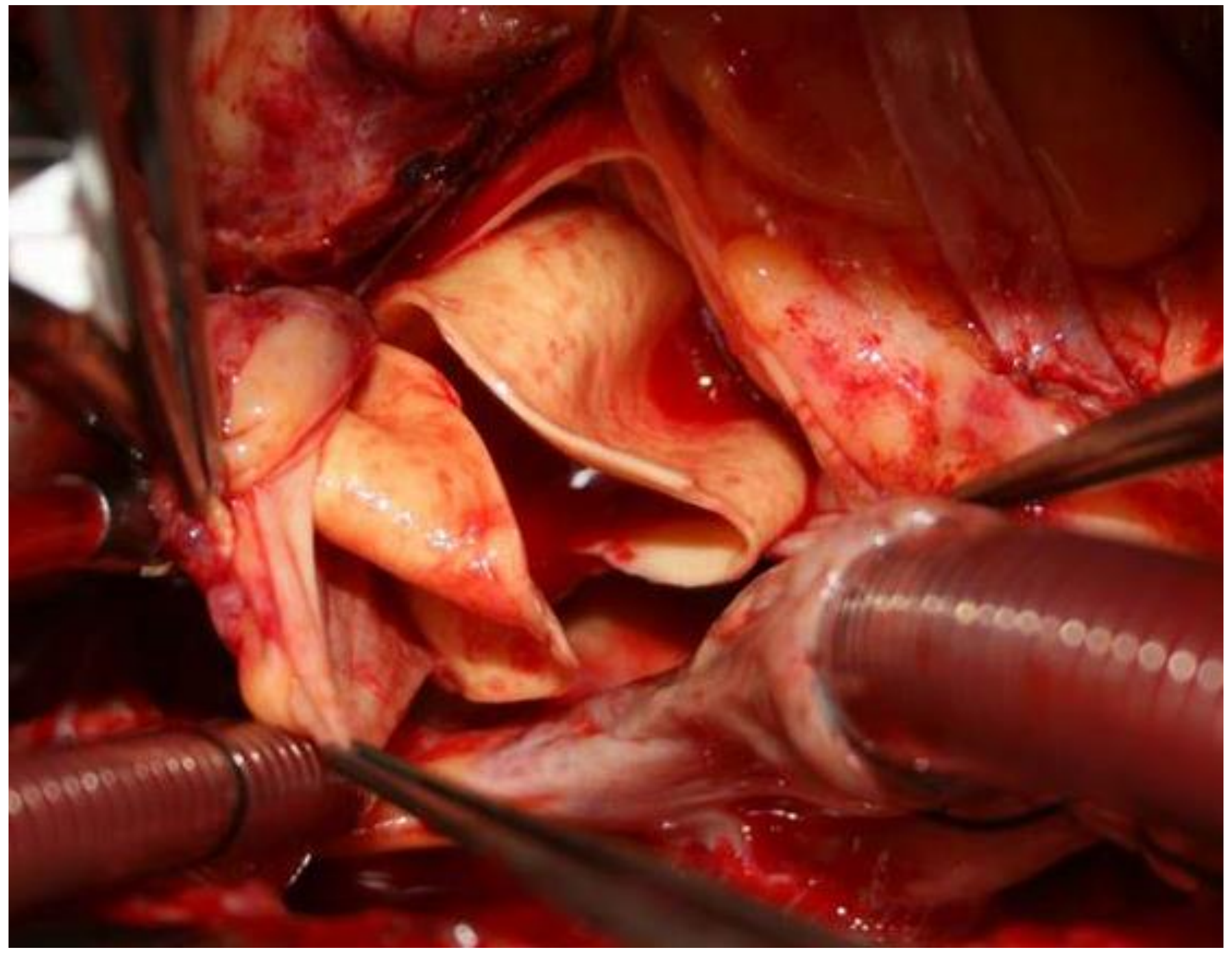
Hospital Mortality	13.2%
Postop Stroke	5.1%
Hemiarch Replacement	95.1%
Total Arch Replacement	4.3%

Emory University (MHCA/ ACP favored) n=346/ 10 yrs

Hospital Mortality	14.5%
Deep HCA	20.3%
Moderate HCA	9.8%
PND	10.4%
Hemiarch Replacement	90.7%
Total Arch Replacement	9.3%

Ann Thorac Surg 2014;97:1991-7
Ann Thorac Surg 2013;96:2135-41

Acute Type A Aortic Dissection



IRAD Registry n= 974

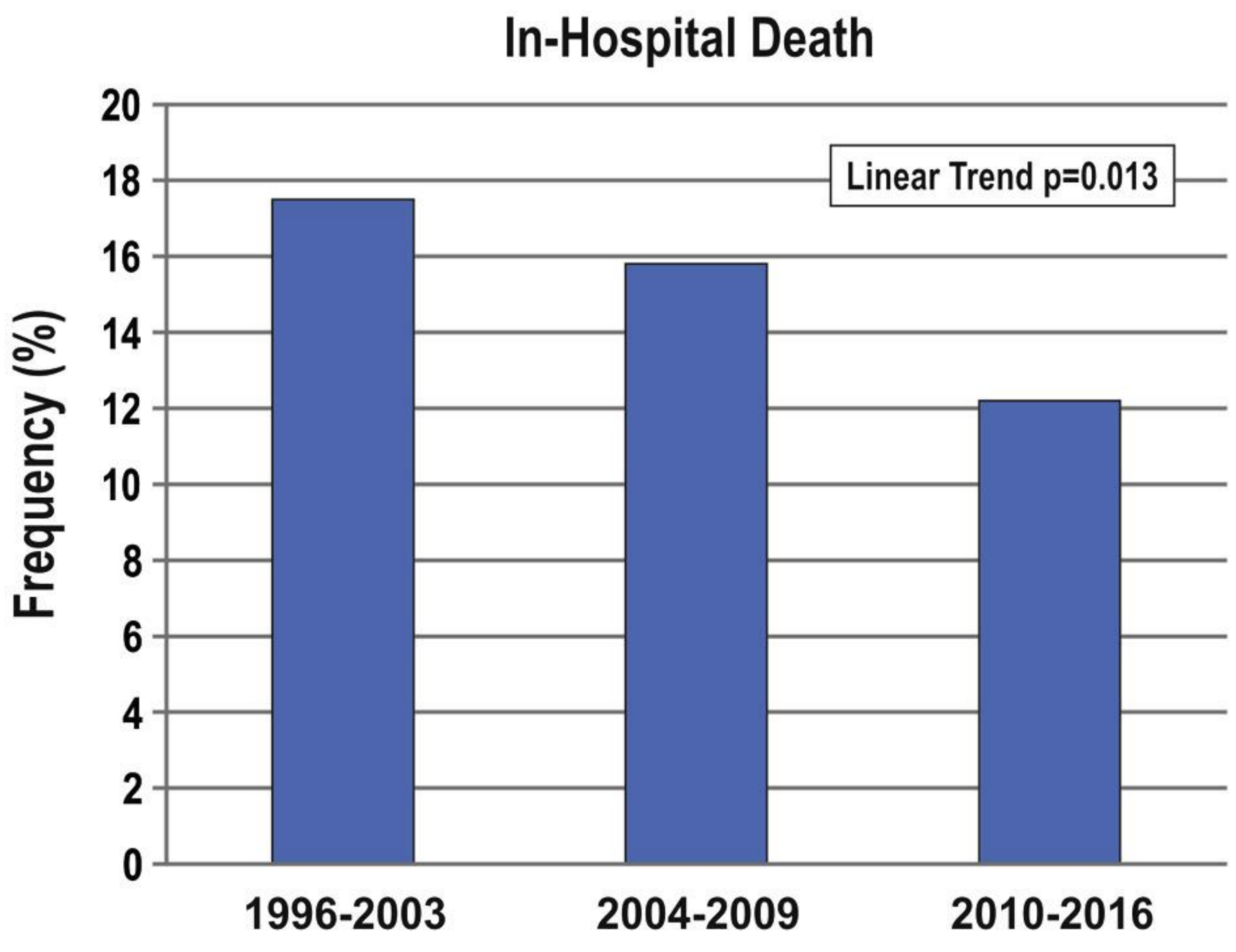
Hospital mortality	23.6%
Postop Stroke	N/A
All Neurological Deficit	22.7%
Total Arch Reconstruction	9.4%

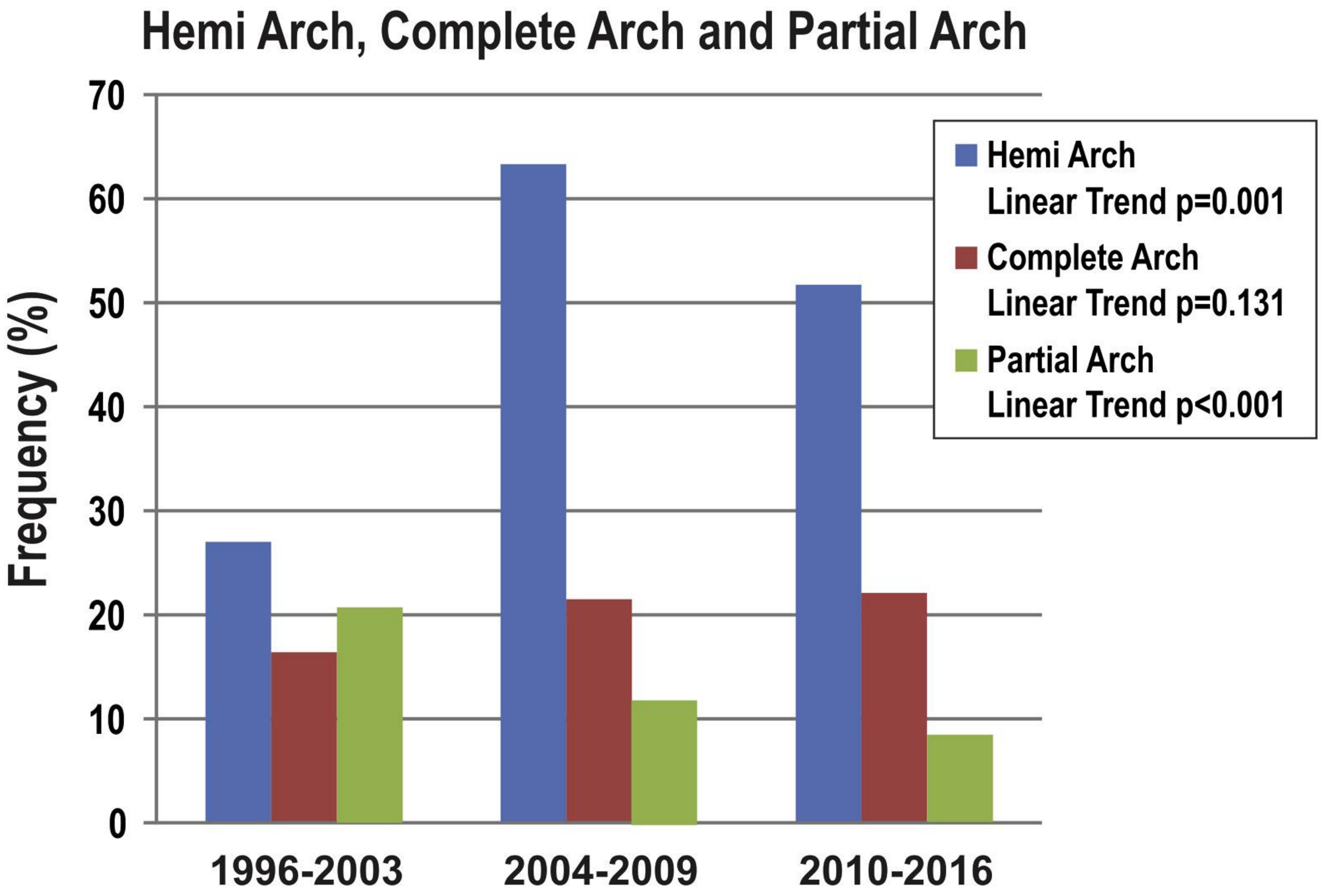
Japan Adult Cardiovascular Database n=4128

Hospital Mortality	8.6%
Postop Stroke	10.7%
ACP	11.2%
RCP	9.7%

Am J Med 2013 Aug;126(8):730
Circulation. 2006 Nov 21;114(21):2226-31
Circ J 2014;78:2431-38

IRAD data





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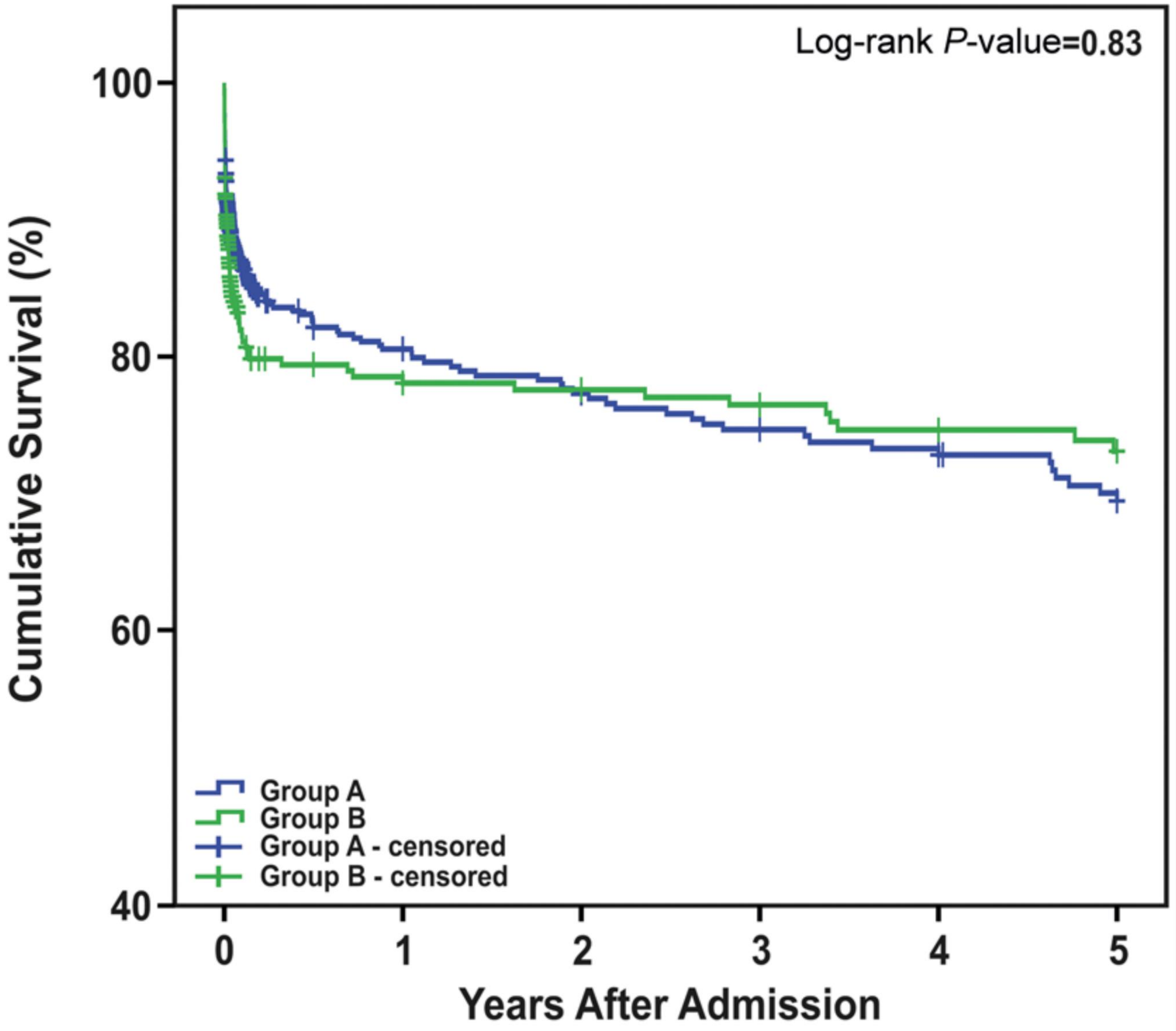
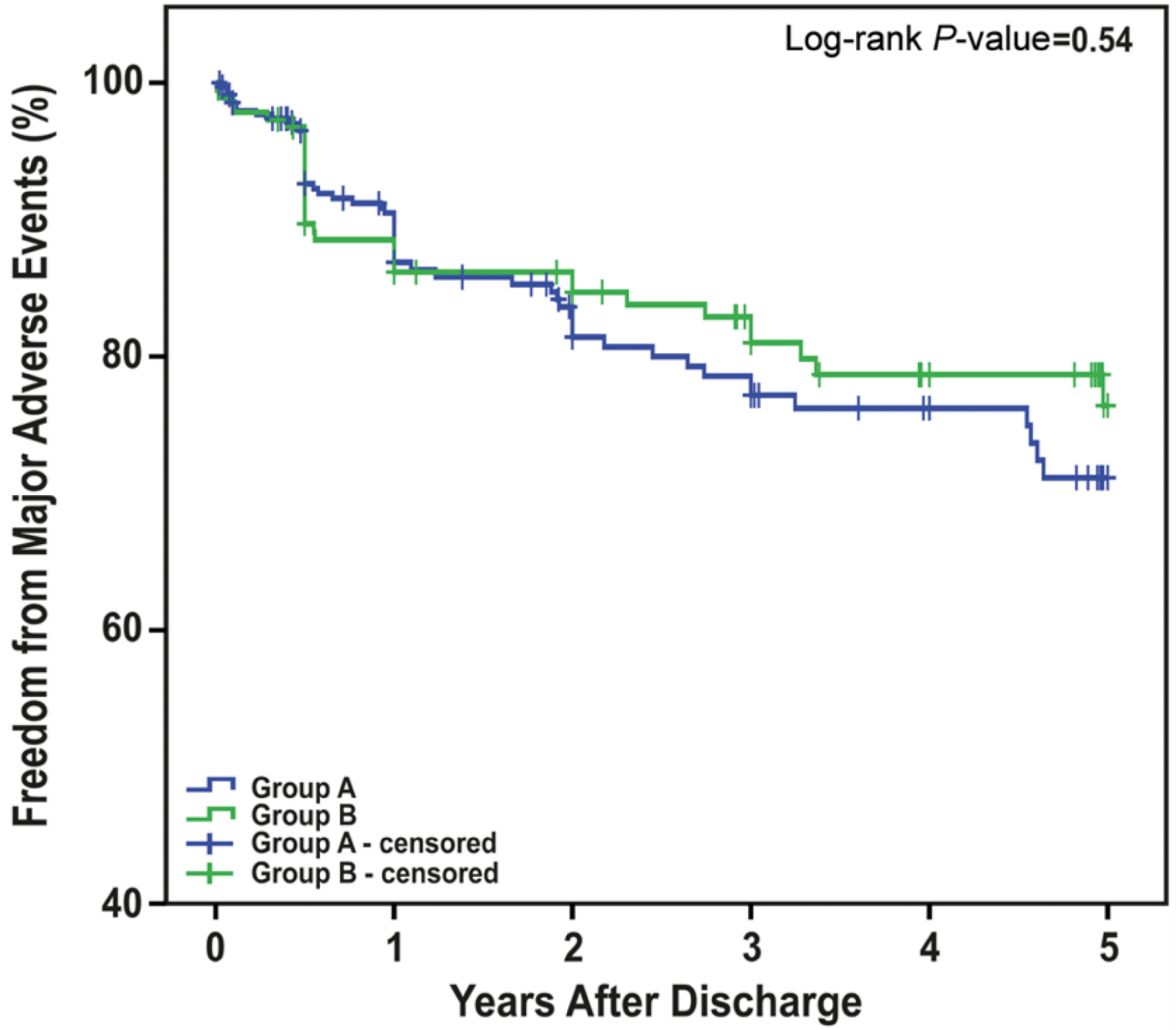
J Thorac Cardiovasc Surg. 2017 Apr;153(4):S74-S79.

IRAD data: Hemi vs Total



Group A	904	307	238	196	157	124
Group B	332	175	156	136	122	93

No. at risk



Group A	348	250	150	110	78	48
Group B	186	149	117	87	63	32

No. at risk

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Eur J Cardiothorac Surg. 2017;52(6):1104-1110.

Acute Type 1 Aortic Dissection

German Registry for Acute Aortic Dissection Type A:

GERAADA , n=2137

Hemi Arch Reconstruction	46%
Total Arch Reconstruction	16.2%
Ascending Reconstruction Alone	37.7%
Stroke Rate N/A	
Hemiplegia/ hemiparesis	9.4%
Coma	8.6%
30 Day Mortality	17%

Ann Surg. 2014 Mar;259(3):598-604.

Mortality

18.7% hemiarch

p=0.067

25.7% total arch

Influence of operative strategy for the aortic arch in DeBakey type I aortic dissection: Analysis of the German Registry for Acute Aortic Dissection Type A

Jerry Easo, MD,[a] Ernst Weigang, MD, PhD,[b] Philipp P. F. Hölzl, MD,[a] Michael Horst, MD,[a] Isabell Hoffmann, MS,[c] Maria Blettner, MS, PhD,[c] and Otto E. Dapunt, MD, PhD,[a] for the GERAADA study group

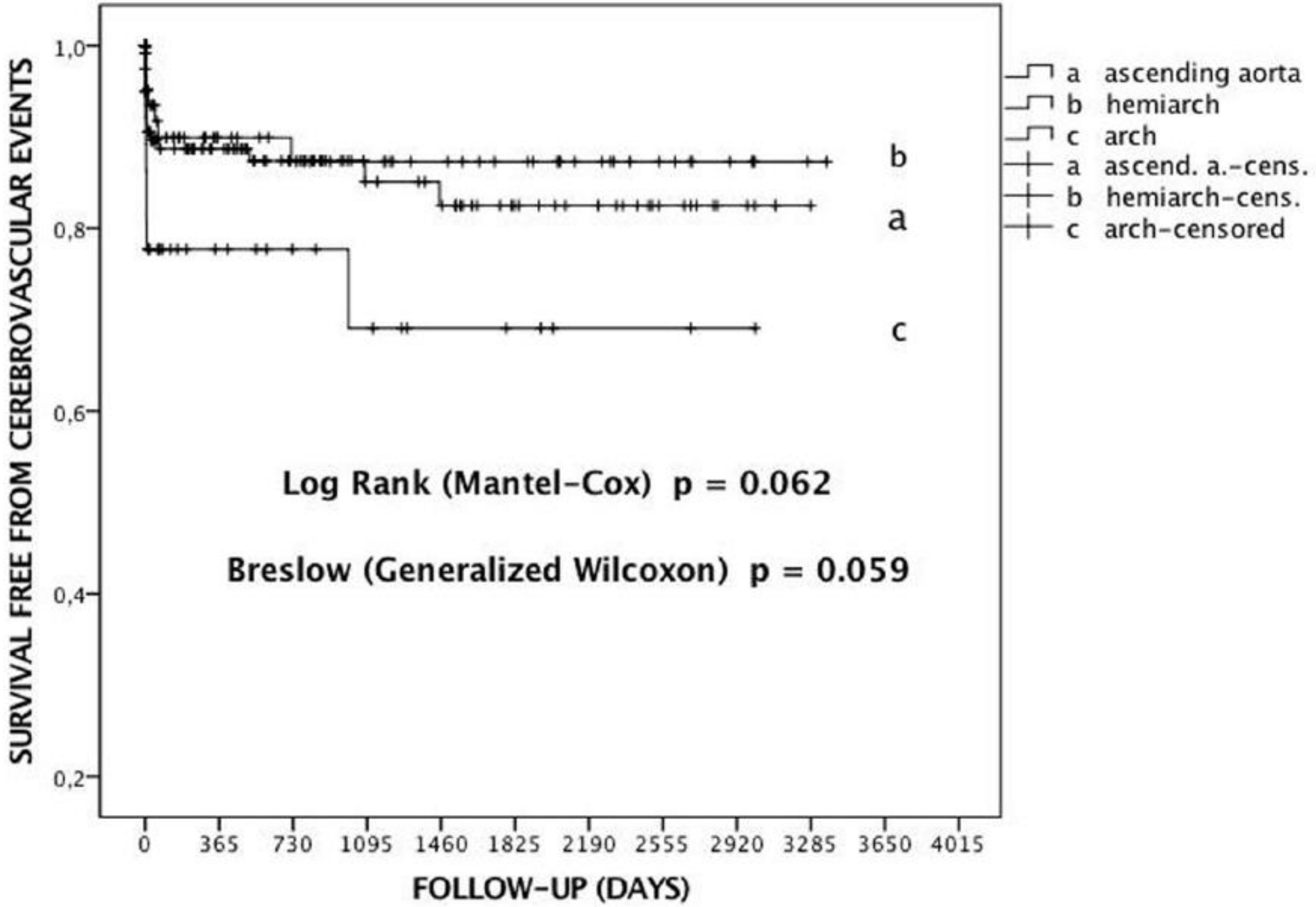
Objective: Patients treated with an extensive approach including total aortic arch replacement for acute aortic dissection type A may have a favorable long-term prognosis by treating the residual false lumen. Our goal was to analyze the operative strategy for treatment of type I DeBakey aortic dissection from the German Registry for Acute Aortic Dissection Type A (GERAADA) data.

Methods: A total of 658 patients with type I DeBakey aortic dissection and entry only in the ascending aorta were identified in the GERAADA. Patients in group A underwent replacement of the ascending aorta with hemiarch replacement. Patients in group B received extensive treatment with total arch replacement or conventional or frozen elephant trunk.

Results: A total of 518 patients in group A and 140 patients in group B were treated. There was an overall 30-day mortality of 20.2% (n = 133). Group A had a slightly lower rate of mortality with 18.7% (n = 97) compared with 25.7% for group B (n = 36), but with no statistical significant difference ($P = .067$). The onset of new neurologic deficit (13.6% in group vs 12.5% in group B, $P = .78$) and new malperfusion deficit (8.4% in group A vs 10.7% in group B, $P = .53$) showed no statistical difference.

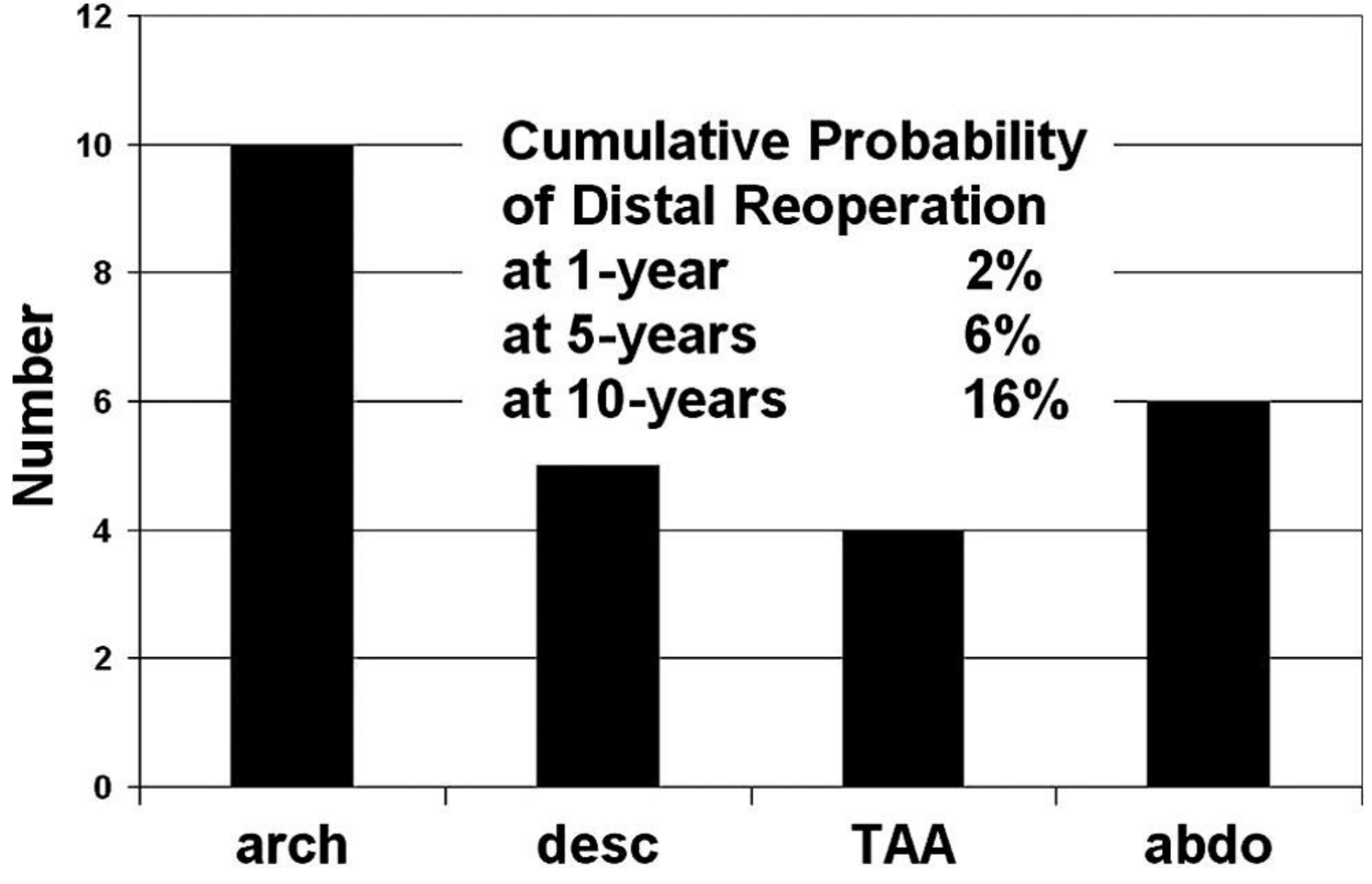
Conclusions: On analysis of the GERAADA data, it seems that a more aggressive approach of aortic arch treatment can be applied without higher perioperative risk even in the onset of acute aortic dissection type A. Long-term follow-up data analysis will be necessary to offer the optimal surgical strategy for different patient groups. (J Thorac Cardiovasc Surg 2012;144:617-23)

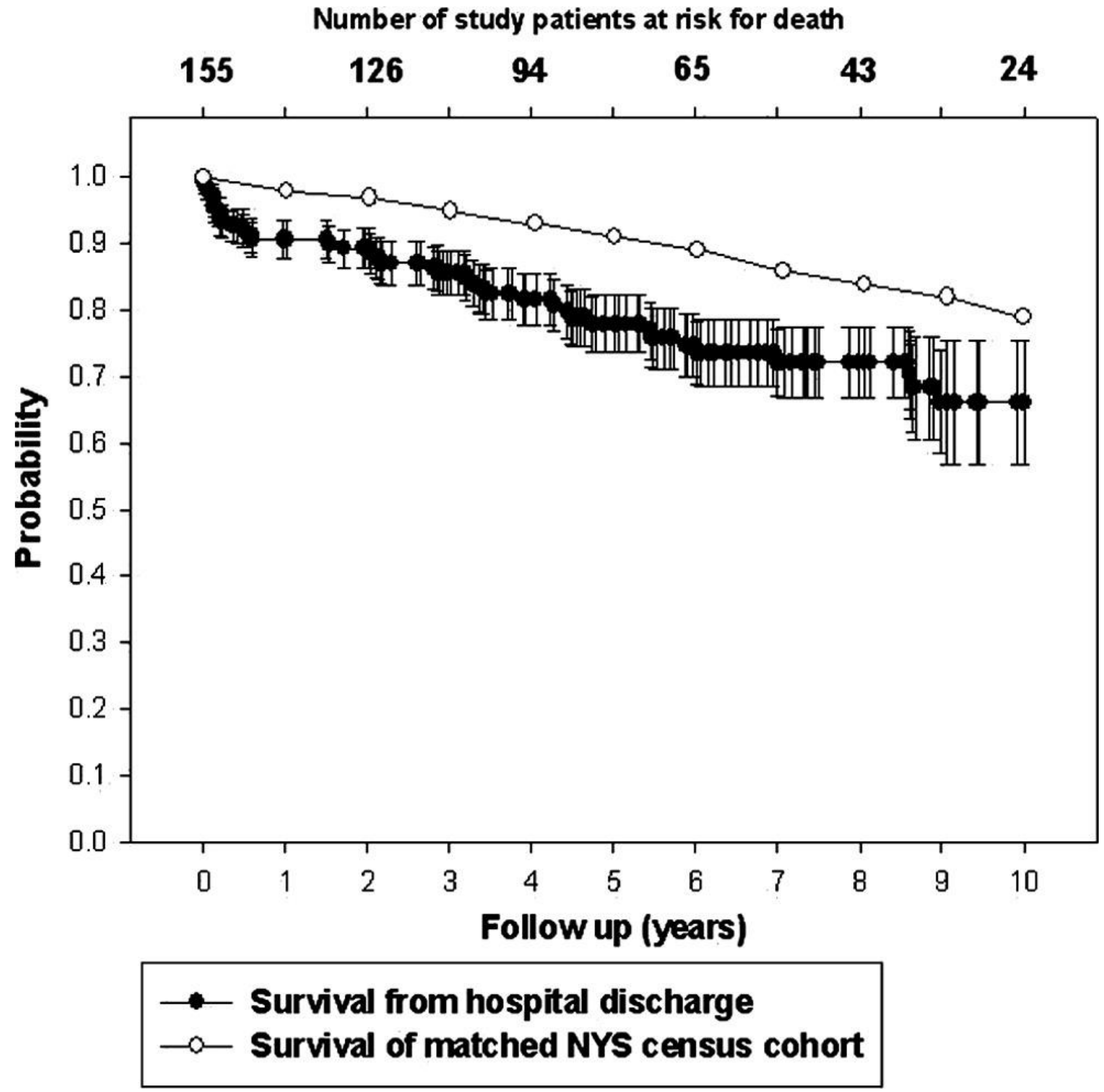
Cologne Experience



Ther Adv Cardiovasc Dis. 2018 Oct 8:1753944718801568.

Griepp data





J Thorac Cardiovasc Surg 2007;133:127-35.

Extended Arch Procedures for Acute Type A Aortic Dissection: A Downstream Problem?

Steven L. Lansman, MD, PhD,[*,†] *Joshua B. Goldberg, MD,*[*,†] *Masashi Kai,*[*,†] *Ramin Malekan, MD,*[*,†] *and David Spielvogel, MD*[*,†]

Current discussion regarding the management of acute type A aortic dissection is focused on whether to perform a standard hemiarch resection or perform an extended repair, in hopes of improving long-term outcomes by avoiding late, distal aortic sequelae. Critical to this discussion is an estimation of the short-term risks of an extended procedure and the magnitude of the late "downstream problem." Extension of the hemiarch to a total arch plus frozen elephant trunk does not improve survival; carries some increased perioperative risk, not the least of which is paraplegia; but decreases late aortic events, the most common of which is reoperation on the distal aorta. However, these reoperations are low frequency, primarily elective, low-risk events and it should be noted that extended index repairs do not eliminate or necessarily decrease the incidence of late reoperations. Routine extension of the index procedure puts 100% of patients at risk in order to protect a minority that may benefit. Therefore, it is important to select patients at high risk for reoperation if an extended repair is to be performed. Predictors that may identify this high-risk group include the size and location of the entry tear, aortic and luminal dimensions, degree of luminal flow and thrombosis, and the presence of a connective tissue disorder. Timing may also be important and, in patients at high risk for late events, early complications may be minimized by strategies that delay an extension of the proximal repair until the subacute period.

Semin Thoracic Surg 00:1–4

Keywords: aorta, arch, frozen elephant trunk, type A dissection

Abbreviation: ATAAD, acute type A aortic dissection

Dr Steven L. Lansman

Central Message

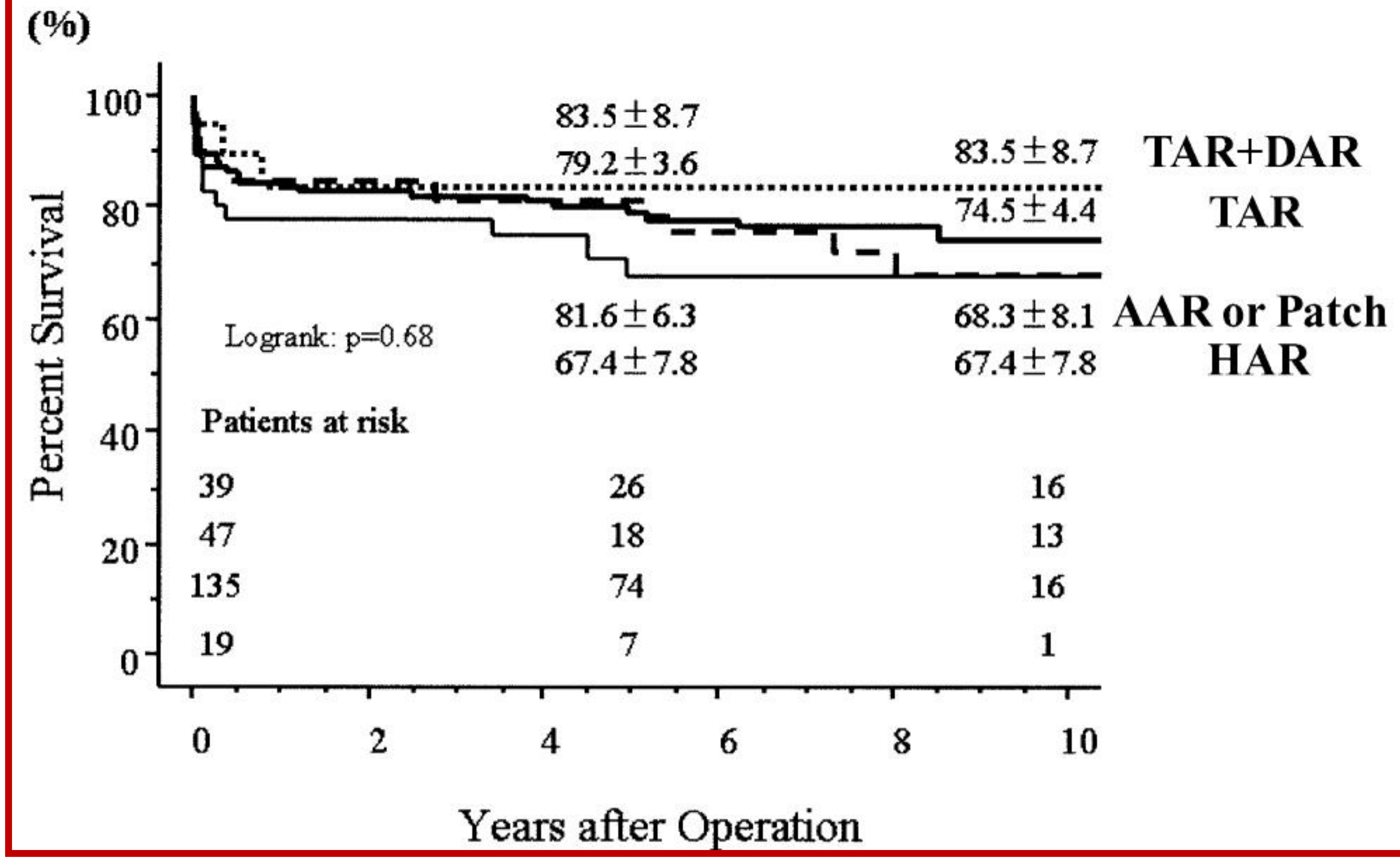
Distal aortic reoperation after a hemiarch repair for type A dissection is a low frequency, primarily elective, low risk event. Only patients at high risk for late events need extended index repairs

Perspective Statement

Current discussion regarding the management of acute type A aortic dissection is focused on whether to perform a standard hemiarch resection or an extended repair, in hopes of improving long term outcomes by avoiding late, distal aortic sequelae. Critical to this discussion is an estimation of the short term risks of an extended procedure and the magnitude of the late "downstream problem."

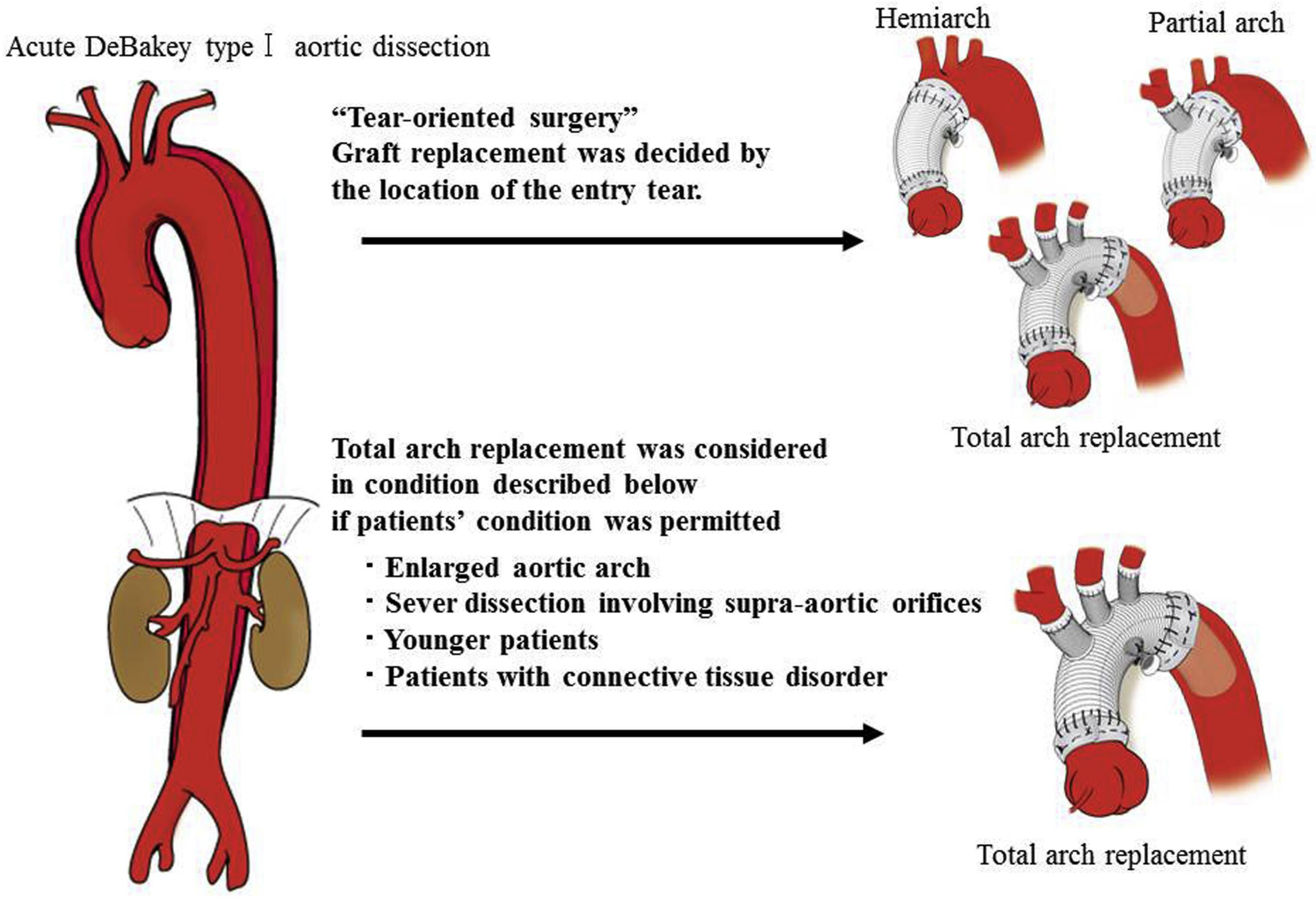
He points out that 80-90% of late re-interventions are elective with relatively low risk (4-12%).

Long-term survival not significantly affected by treatment distal arch



Ann Thorac Surg 2002;74:S1844 –7.

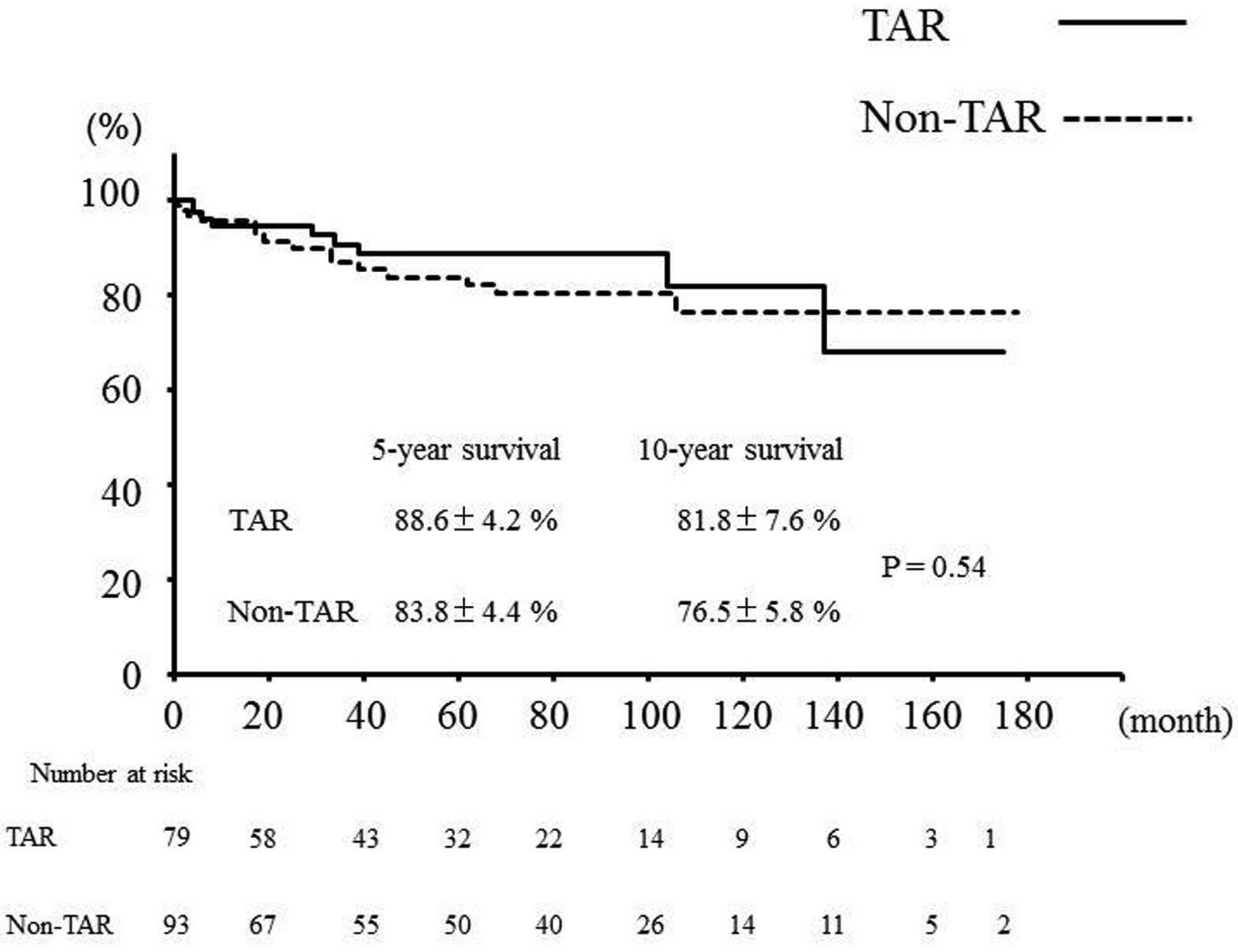
"Tear-oriented" surgery



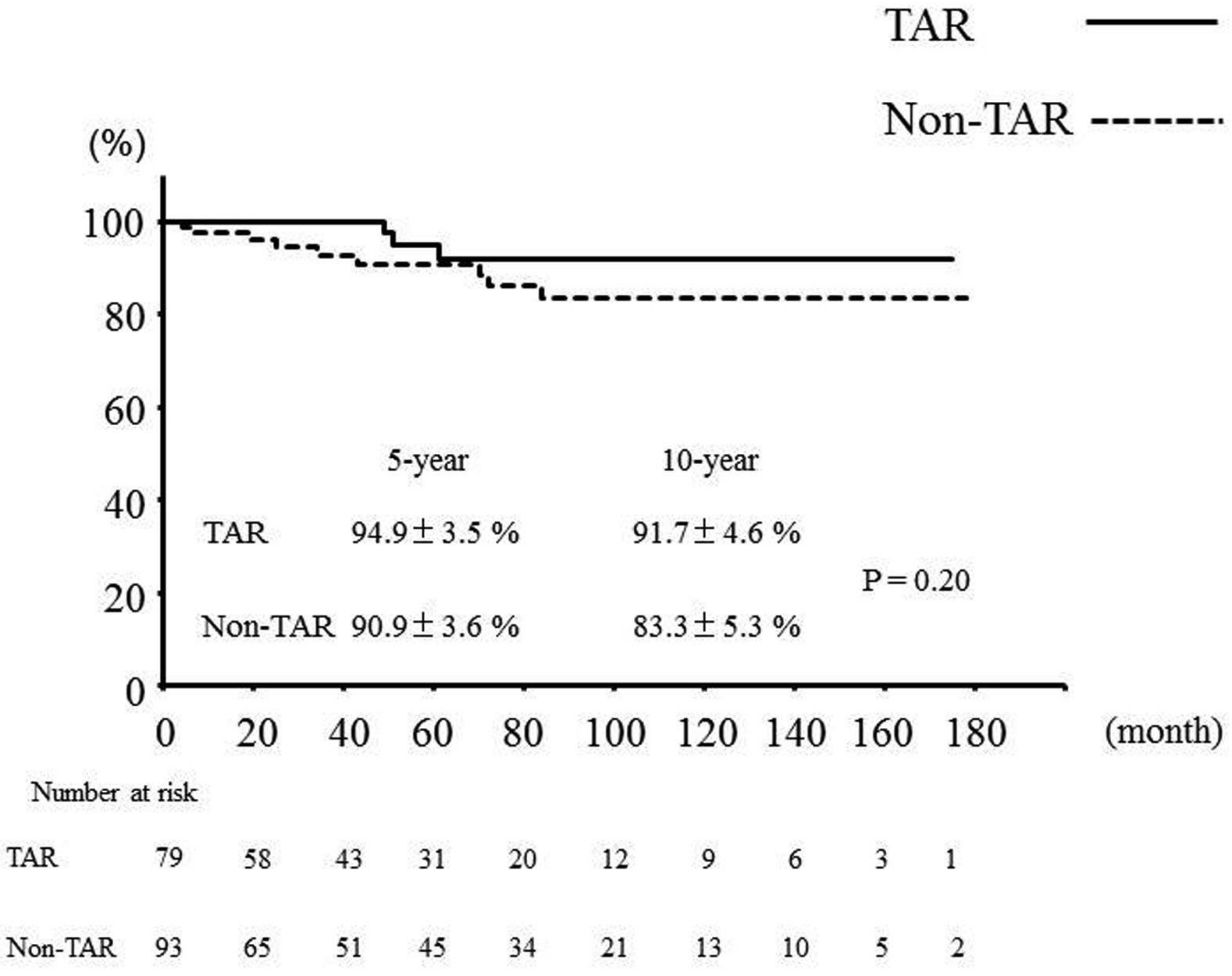
J Thorac Cardiovasc Surg 2016;151:341-8.

Outcomes were the same…

Survival

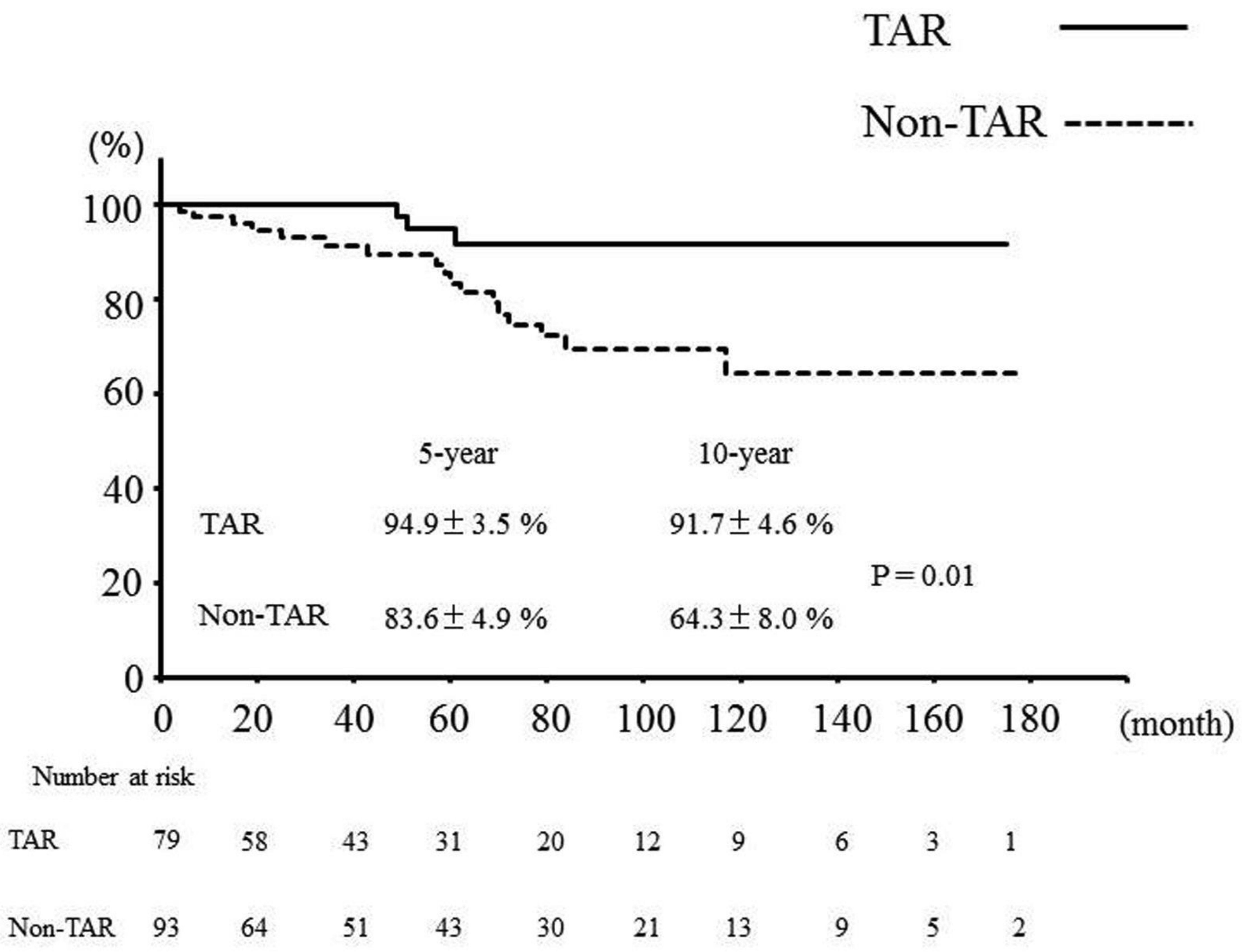


Reintervention



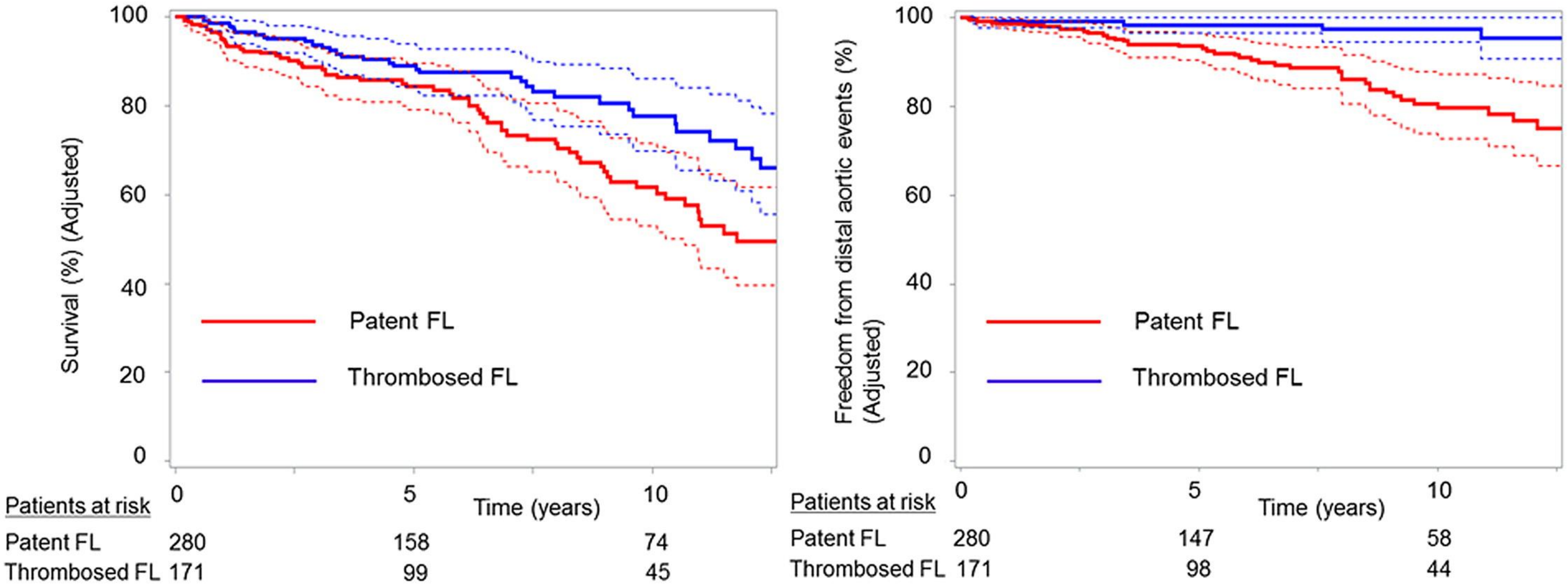
J Thorac Cardiovasc Surg 2016;151:341-8.

Freedom from distal aortic events: Okita group



J Thorac Cardiovasc Surg 2016;151:341-8.

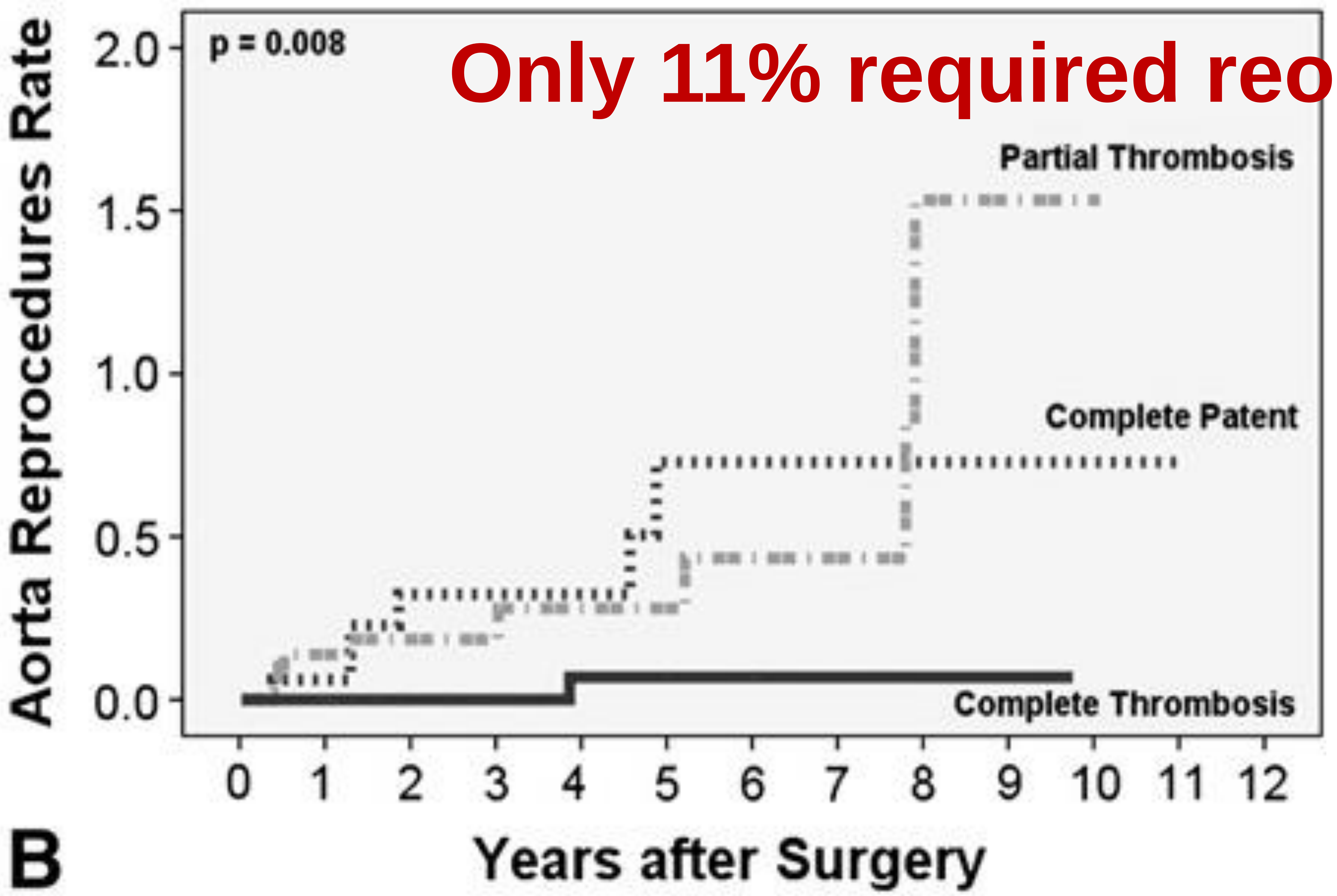
False lumen patency impacting late outcome



J Thorac Cardiovasc Surg 2015;149:S91-8.

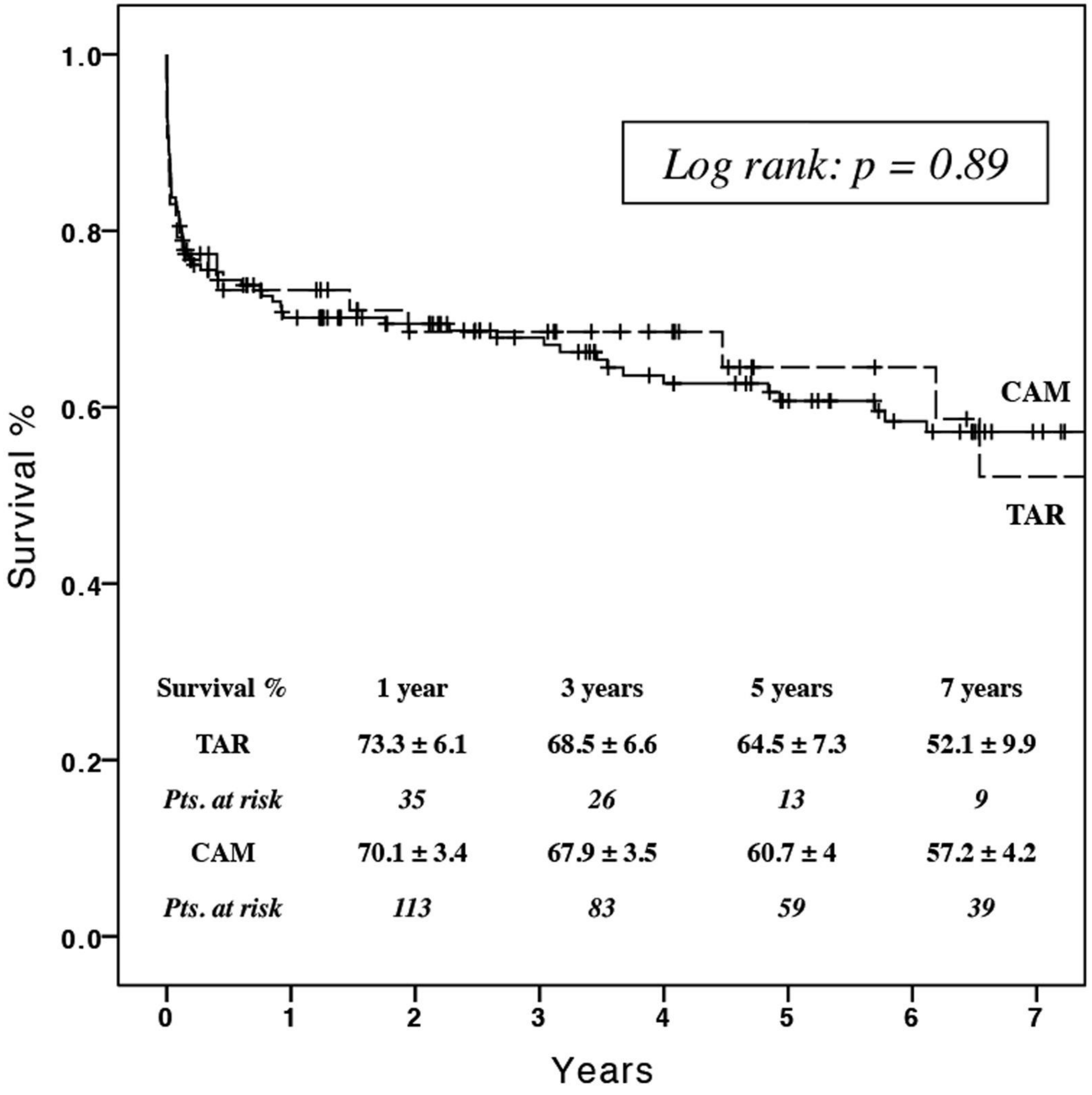
Reoperation rate

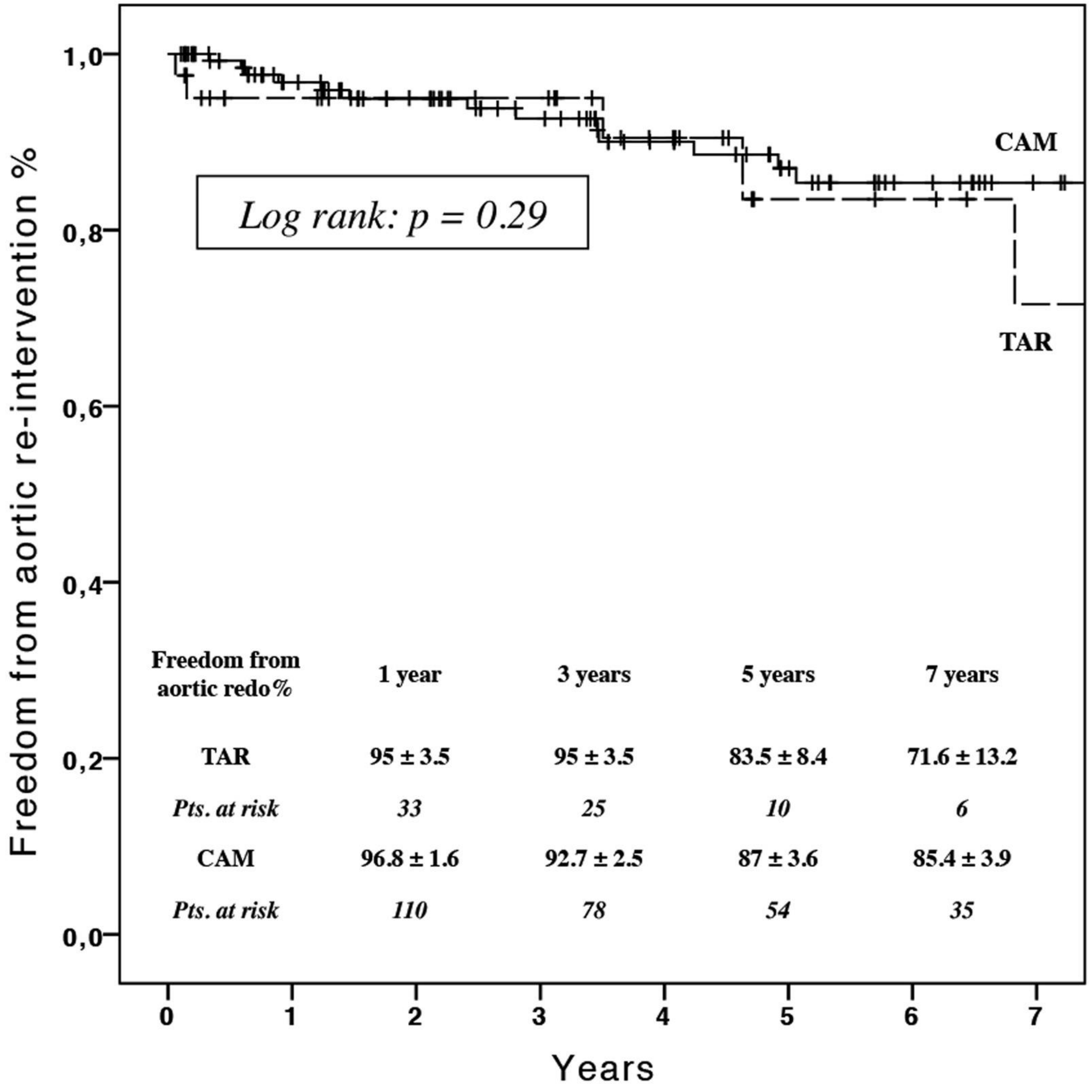
Only 11% required reoperations



J Thorac Cardiovasc Surg 2010;139:841-847.

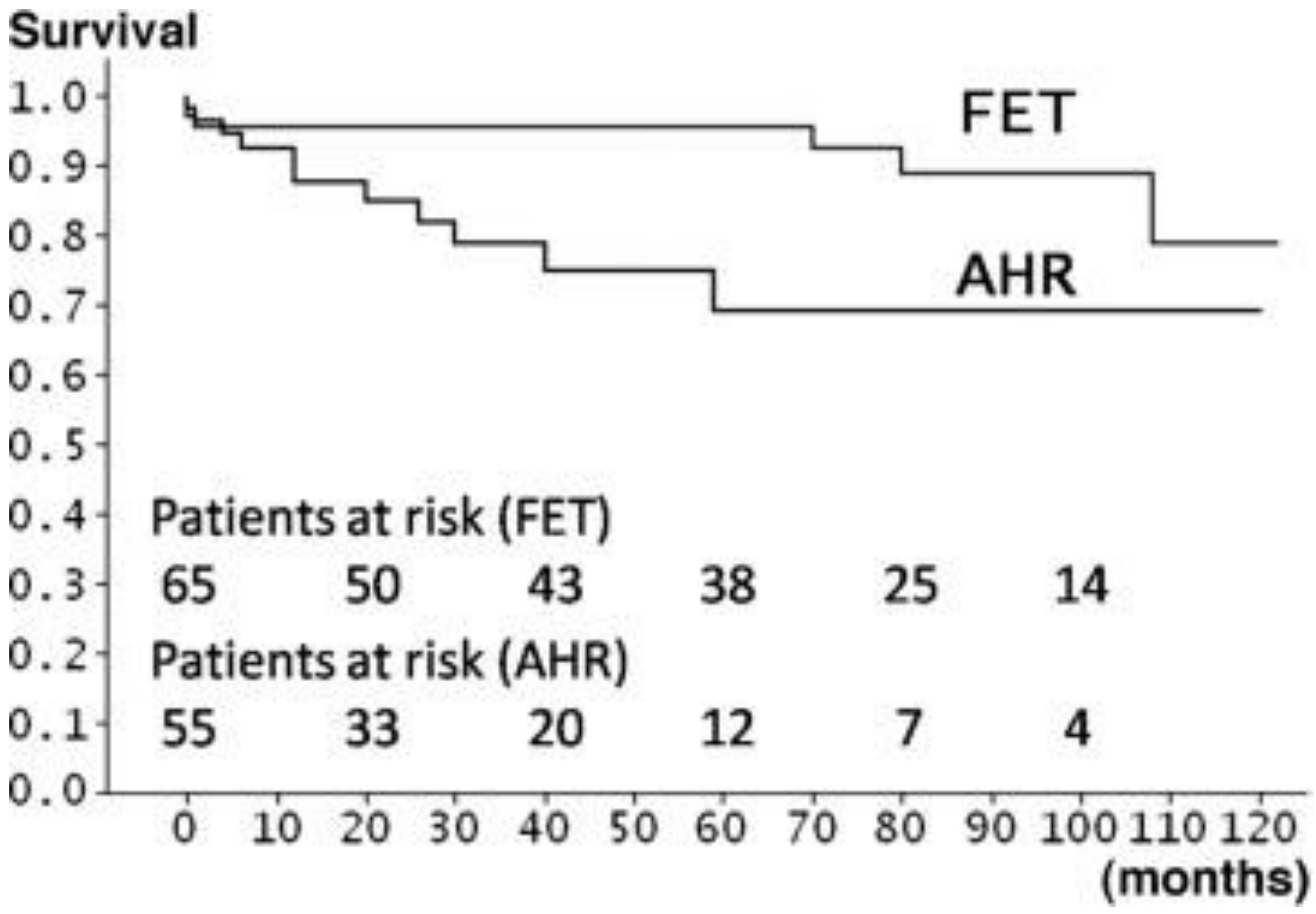
Bologna Hemi vs. Total

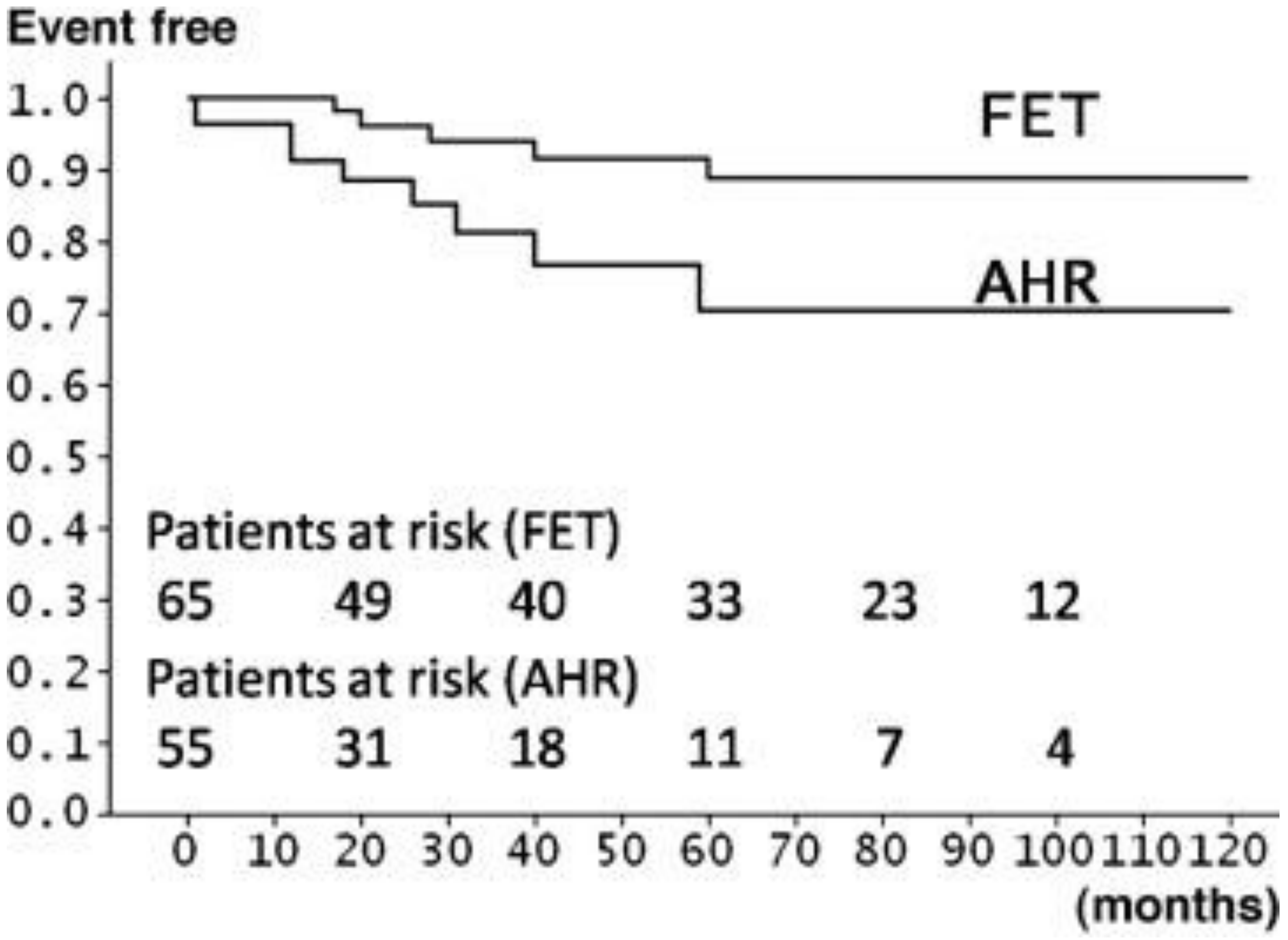




Ann Thorac Surg 2015;100:88–94.

Hiroshima Hemiarch vs. FET





Ann Thorac Surg 2009;87:773–7.

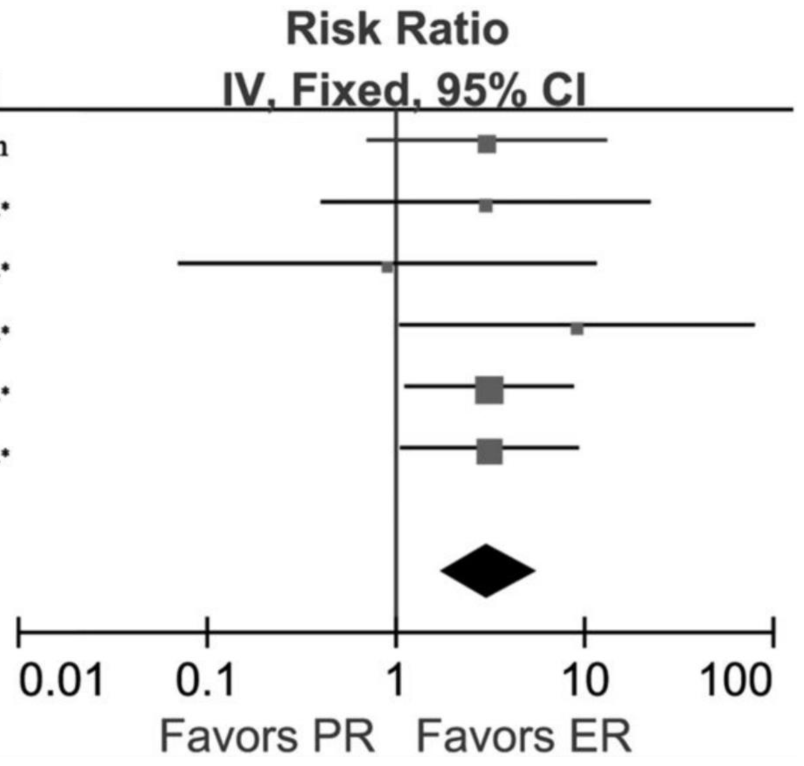
Meta-analysis

Aortic Events

B

Study or Subgroup	log[Risk Ratio]	SE	Weight	Risk Ratio IV, Fixed, 95% CI
Kim et al. (2011)	1.1086	0.7476	16.3%	3.03 [0.70, 13.12]
Rylski et al. (2014)	1.0953	1.0263	8.7%	2.99 [0.40, 22.35]
Shi et al. (2013)	-0.1054	1.303	5.4%	0.90 [0.07, 11.57]
Sun et al. (2011)	2.2083	1.1067	7.4%	9.10 [1.04, 79.63]
Uchida et al. (2009)	1.1378	0.5273	32.8%	3.12 [1.11, 8.77]
Zhang et al. (2013)	1.141	0.5573	29.4%	3.13 [1.05, 9.33]
Total (95% CI)			**100.0%**	**3.14 [1.74, 5.67]**

Heterogeneity: Chi² = 1.85, df = 5 (P = 0.87); I² = 0%
Test for overall effect: Z = 3.78 (P = 0.0002)

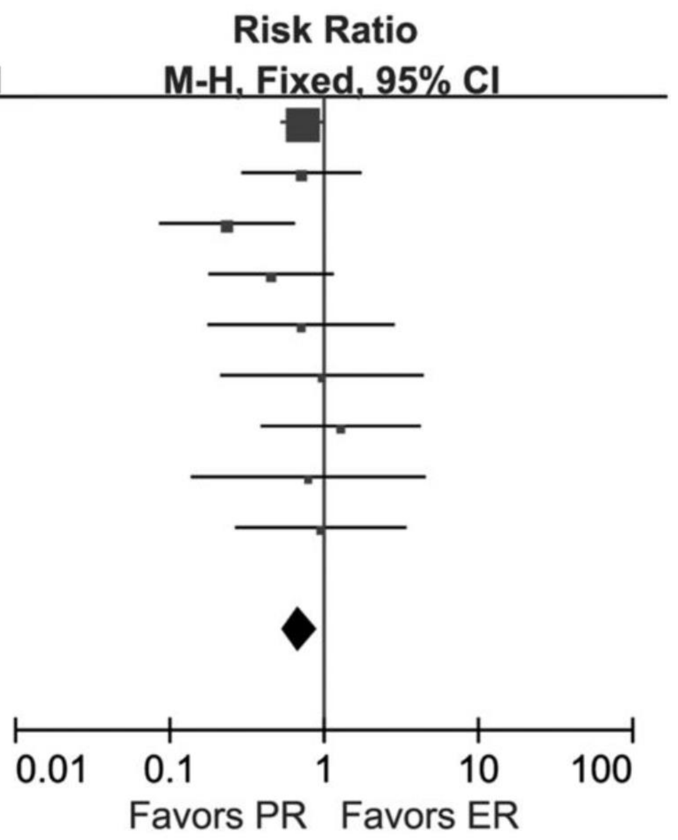


Early survival

A

Study or Subgroup	PR Events	PR Total	ER Events	ER Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Easo et al. (2012)	97	518	36	140	54.4%	0.73 [0.52, 1.02]
Kim et al. (2011)	14	144	6	44	8.8%	0.71 [0.29, 1.74]
Ohtsubo et al. (2002)	5	64	8	24	11.2%	0.23 [0.09, 0.65]
Rylski et al. (2014)	18	139	4	14	7.0%	0.45 [0.18, 1.15]
Shi et al. (2013)	3	71	5	84	4.4%	0.71 [0.18, 2.87]
Shiono et al. (2006)	7	105	2	29	3.0%	0.97 [0.21, 4.41]
Sun et al. (2011)	4	66	7	148	4.1%	1.28 [0.39, 4.23]
Uchida et al. (2009)	2	55	3	65	2.6%	0.79 [0.14, 4.55]
Zhang et al. (2013)	4	74	5	88	4.4%	0.95 [0.27, 3.41]
Total (95% CI)		**1236**		**636**	**100.0%**	**0.69 [0.54, 0.90]**
Total events	154		76			

Heterogeneity: Chi² = 6.74, df = 8 (P = 0.57); I² = 0%
Test for overall effect: Z = 2.79 (P = 0.005)

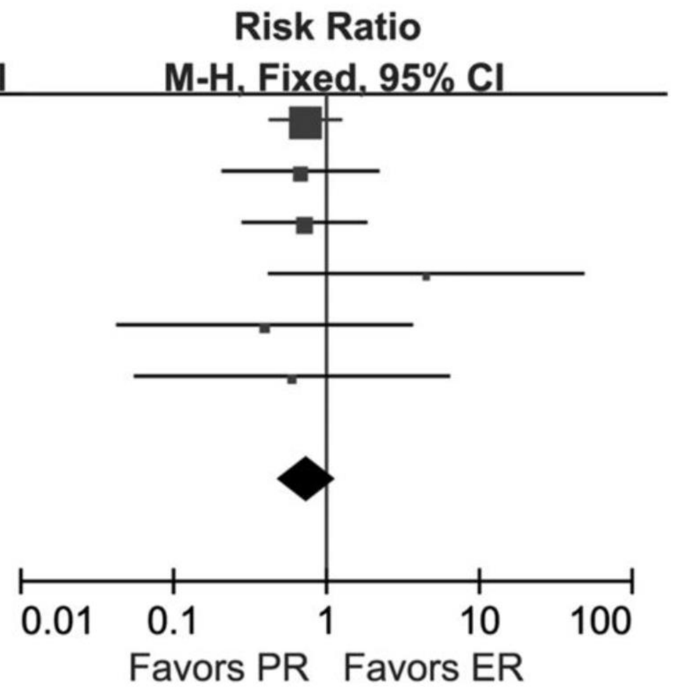


Renal failure

B

Study or Subgroup	PR Events	PR Total	ER Events	ER Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Kim et al. (2011)	31	144	13	44	50.6%	0.73 [0.42, 1.27]
Shi et al. (2013)	4	71	7	84	16.3%	0.68 [0.21, 2.22]
Shiono et al. (2006)	13	105	5	29	19.9%	0.72 [0.28, 1.85]
Sun et al. (2011)	2	66	1	148	1.6%	4.48 [0.41, 48.60]
Uchida et al. (2009)	1	55	3	65	7.0%	0.39 [0.04, 3.68]
Zhang et al. (2013)	1	74	2	88	4.6%	0.59 [0.06, 6.43]
Total (95% CI)		**515**		**458**	**100.0%**	**0.75 [0.49, 1.14]**
Total events	52		31			

Heterogeneity: Chi² = 2.57, df = 5 (P = 0.77); I² = 0%
Test for overall effect: Z = 1.36 (P = 0.17)

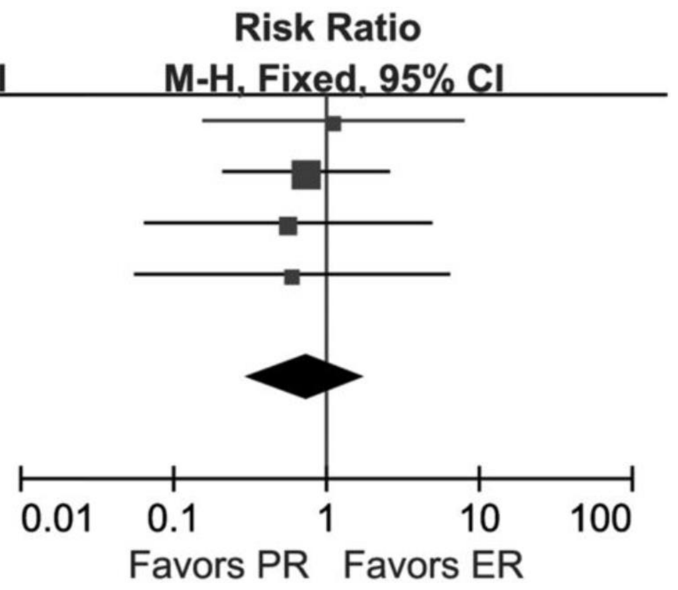


Stroke

C

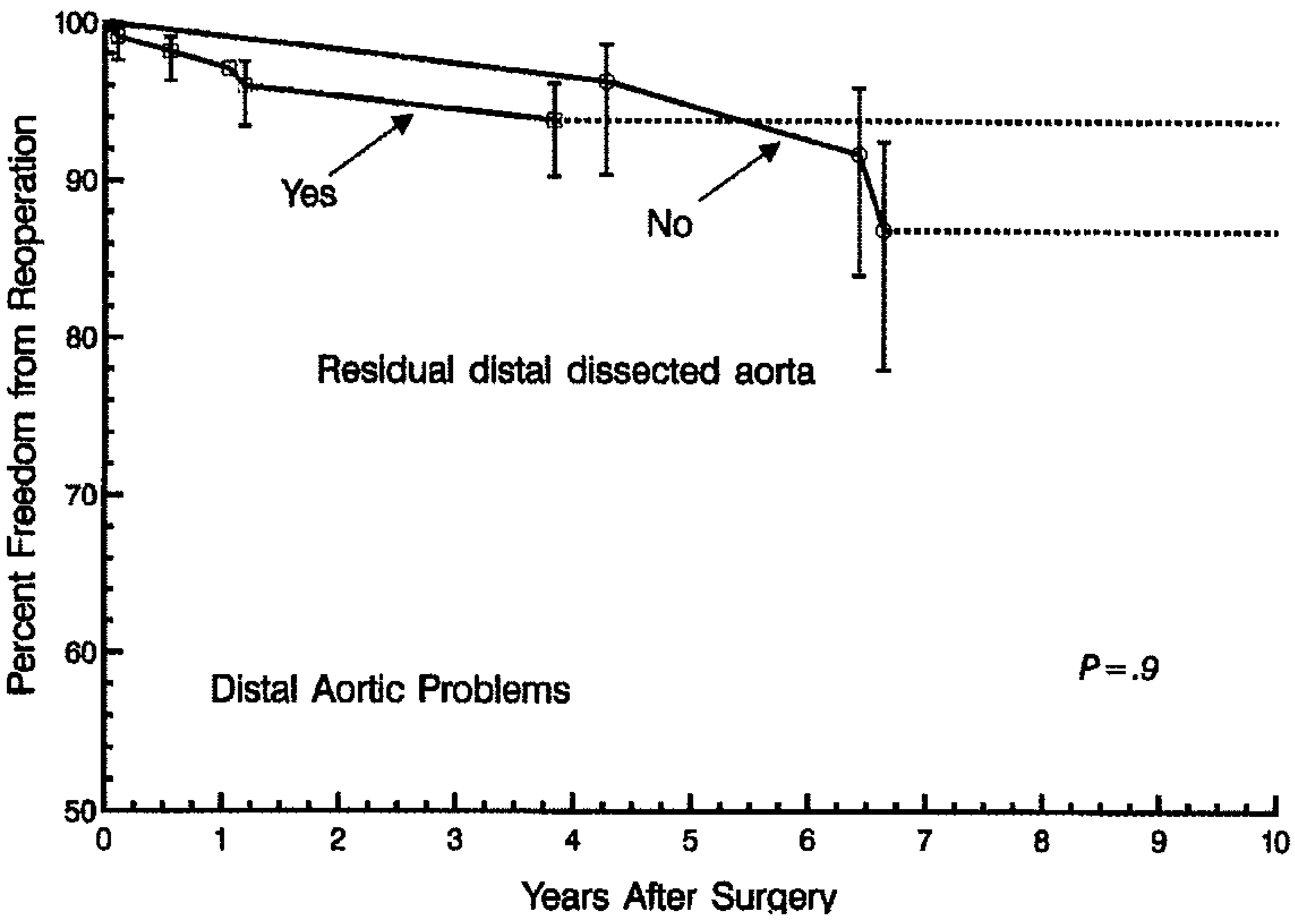
Study or Subgroup	PR Events	PR Total	ER Events	ER Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Rylski et al. (2014)	11	139	1	14	16.8%	1.11 [0.15, 7.96]
Shiono et al. (2006)	8	105	3	29	43.5%	0.74 [0.21, 2.60]
Sun et al. (2011)	1	66	4	148	22.8%	0.56 [0.06, 4.92]
Zhang et al. (2013)	1	74	2	88	16.9%	0.59 [0.06, 6.43]
Total (95% CI)		**384**		**279**	**100.0%**	**0.73 [0.30, 1.78]**
Total events	21		10			

Heterogeneity: Chi² = 0.26, df = 3 (P = 0.97); I² = 0%
Test for overall effect: Z = 0.68 (P = 0.50)



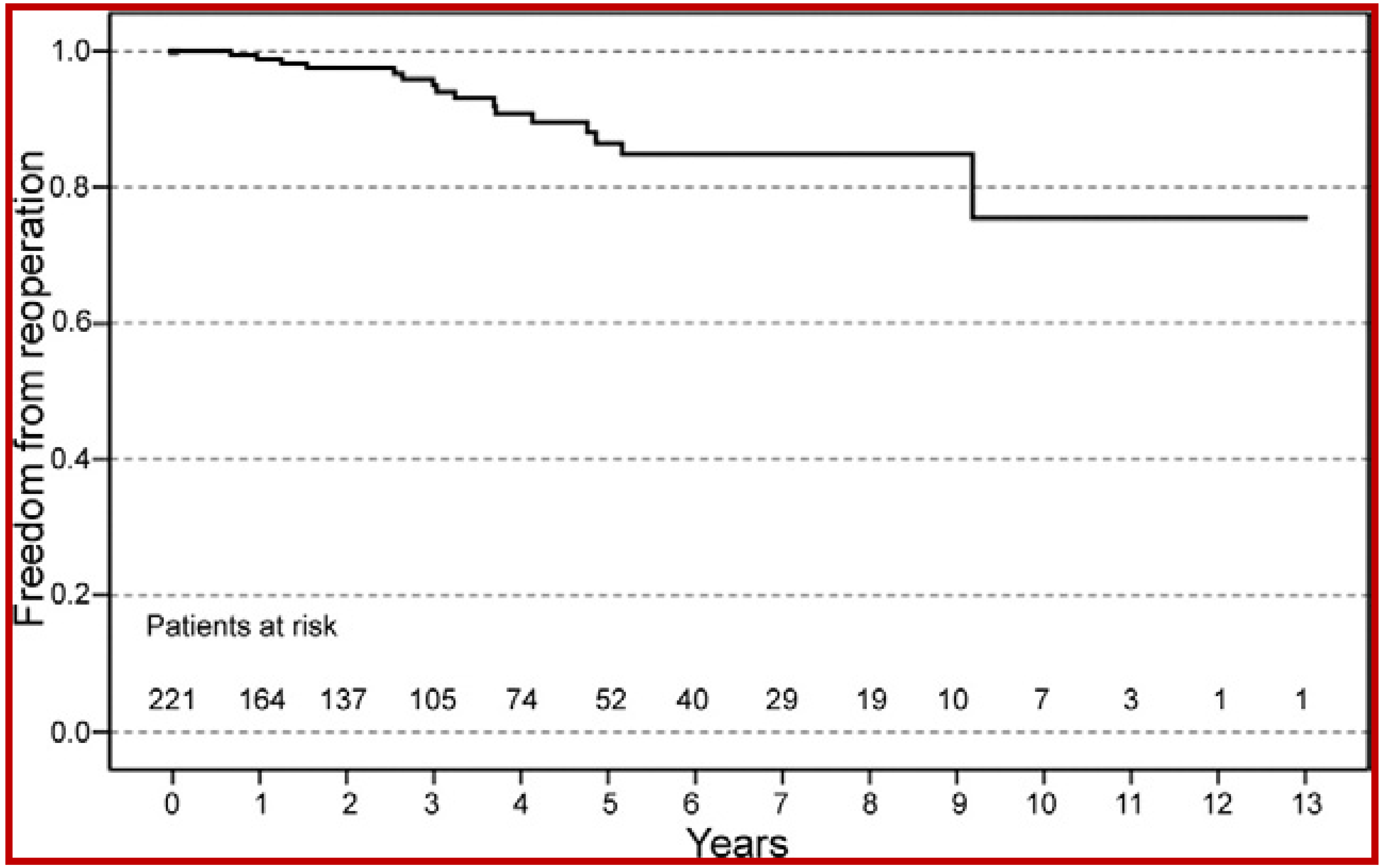
Eur J Cardiothorac Surg. 2015;49(5):1392-1401.

Freedom from distal reoperation



J Thorac Cardiovasc Surg 2000;119:946-62.

Freedom from distal reoperation



Ann Thorac Surg 2007;84:1955– 64.

Extent of reconstruction over 17 year experience

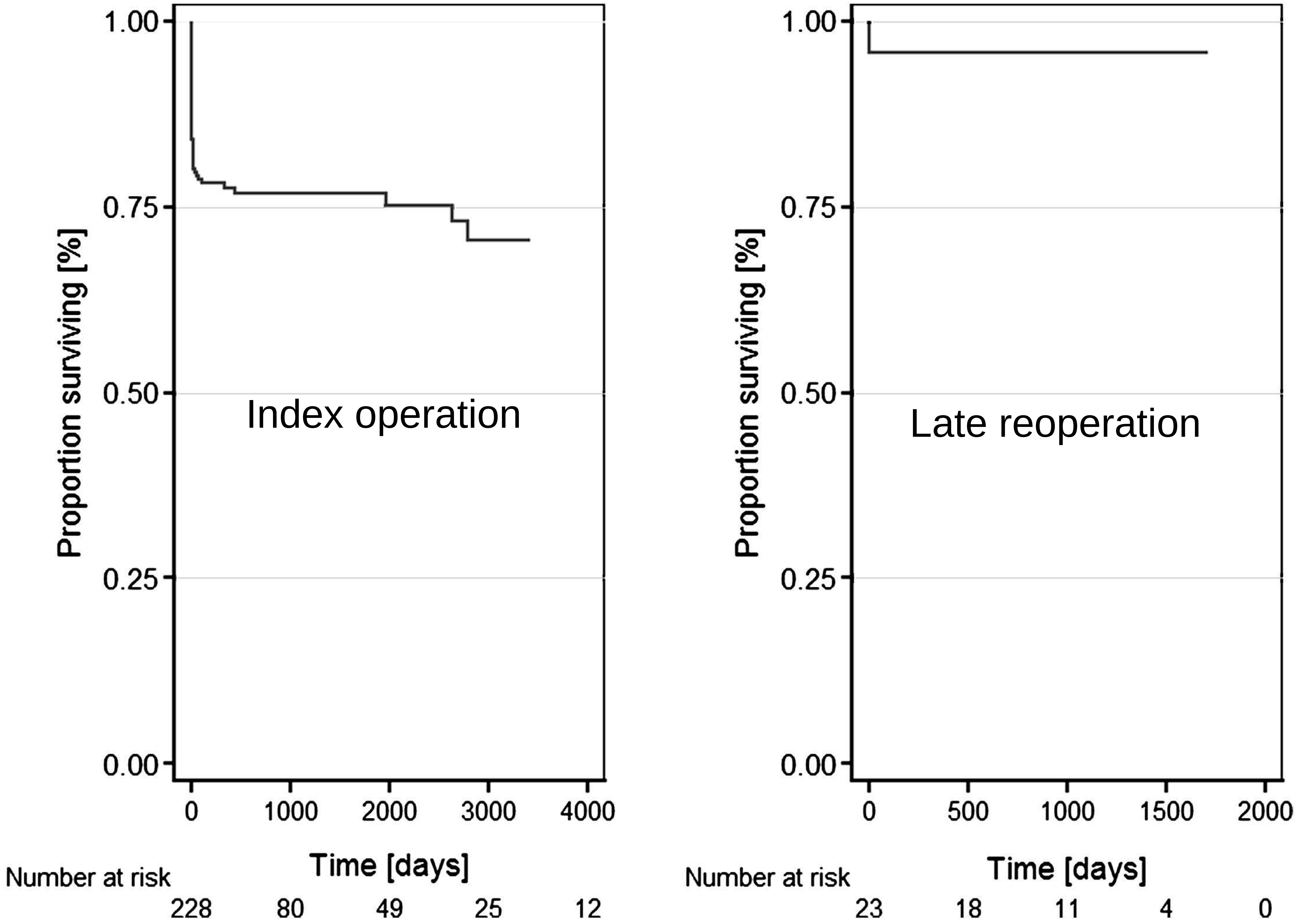
Extent of replacement		
Ascending aorta only	65	36%
Ascending aorta and hemiarch	97	54%
Ascending aorta and total arch	11	6%
Ascending, arch and proximal descending	6	3%

8.9% out of 179 cases over 17 years had more than hemiarch

16% risk of reoperation at 10 years

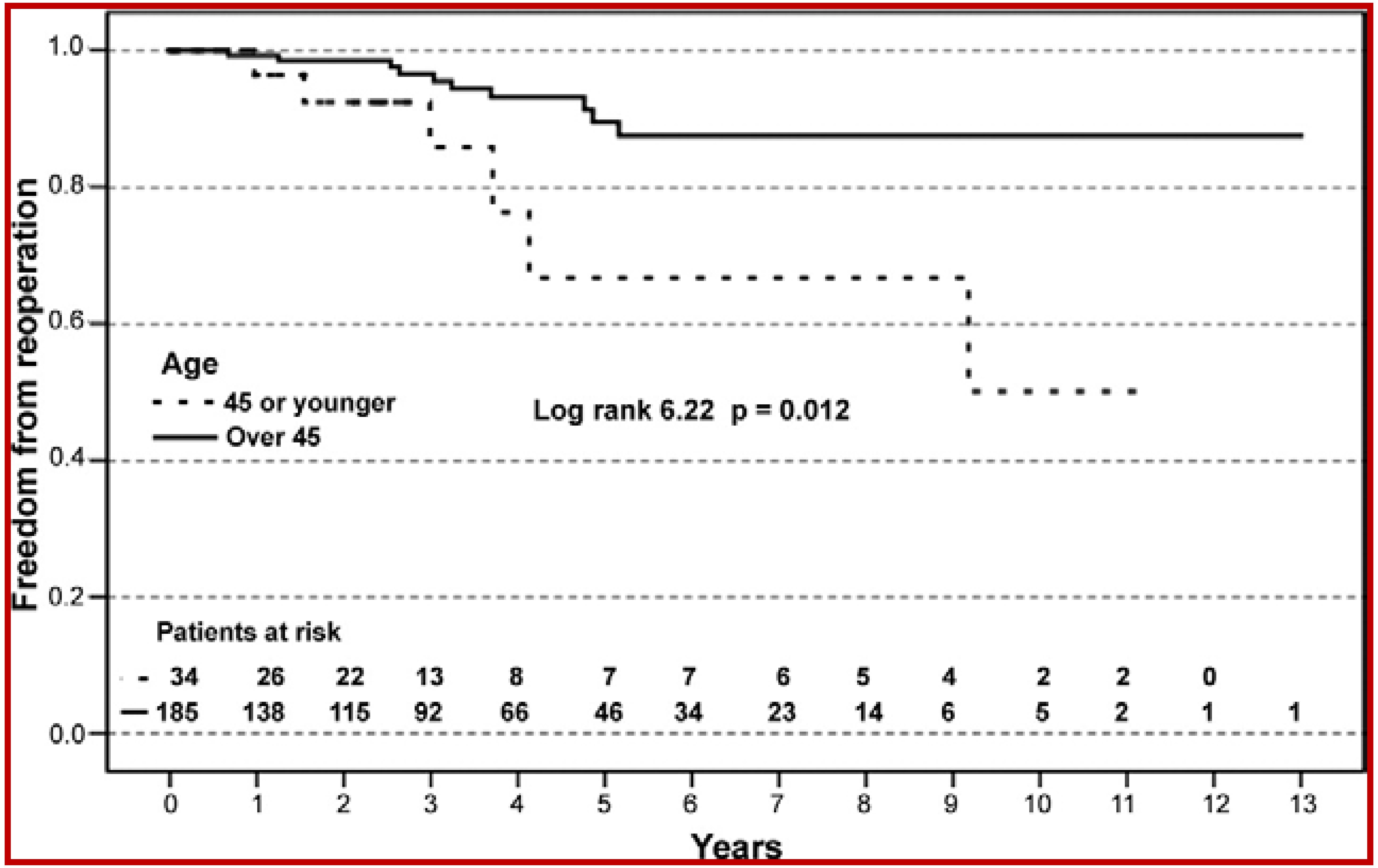
J Thorac Cardiovasc Surg 2007;133:127-35.

Late reoperation risk low



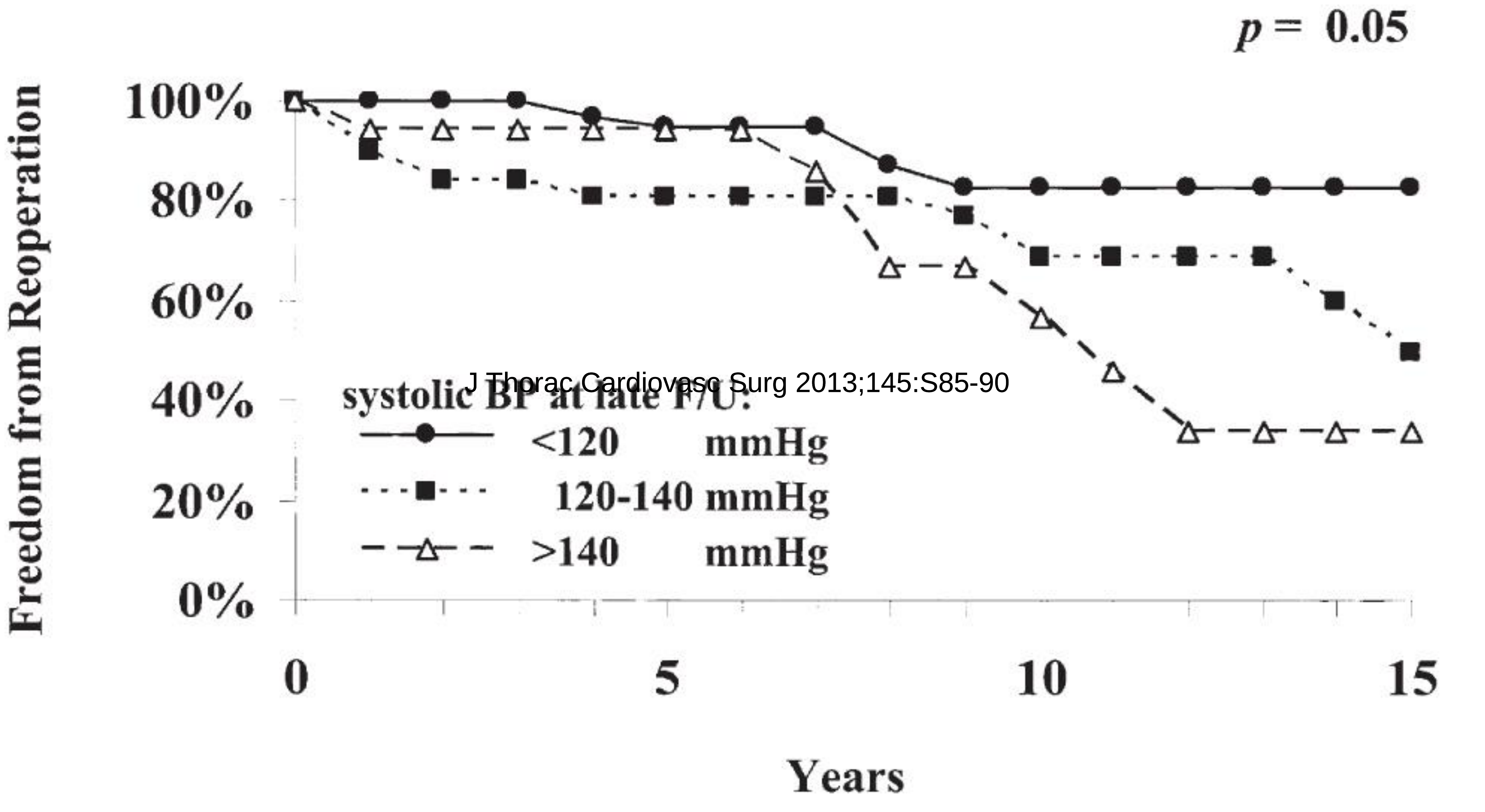
J Thorac Cardiovasc Surg 2012;144:300-7.

Freedom from distal reoperation



Ann Thorac Surg 2007;84:1955– 64.

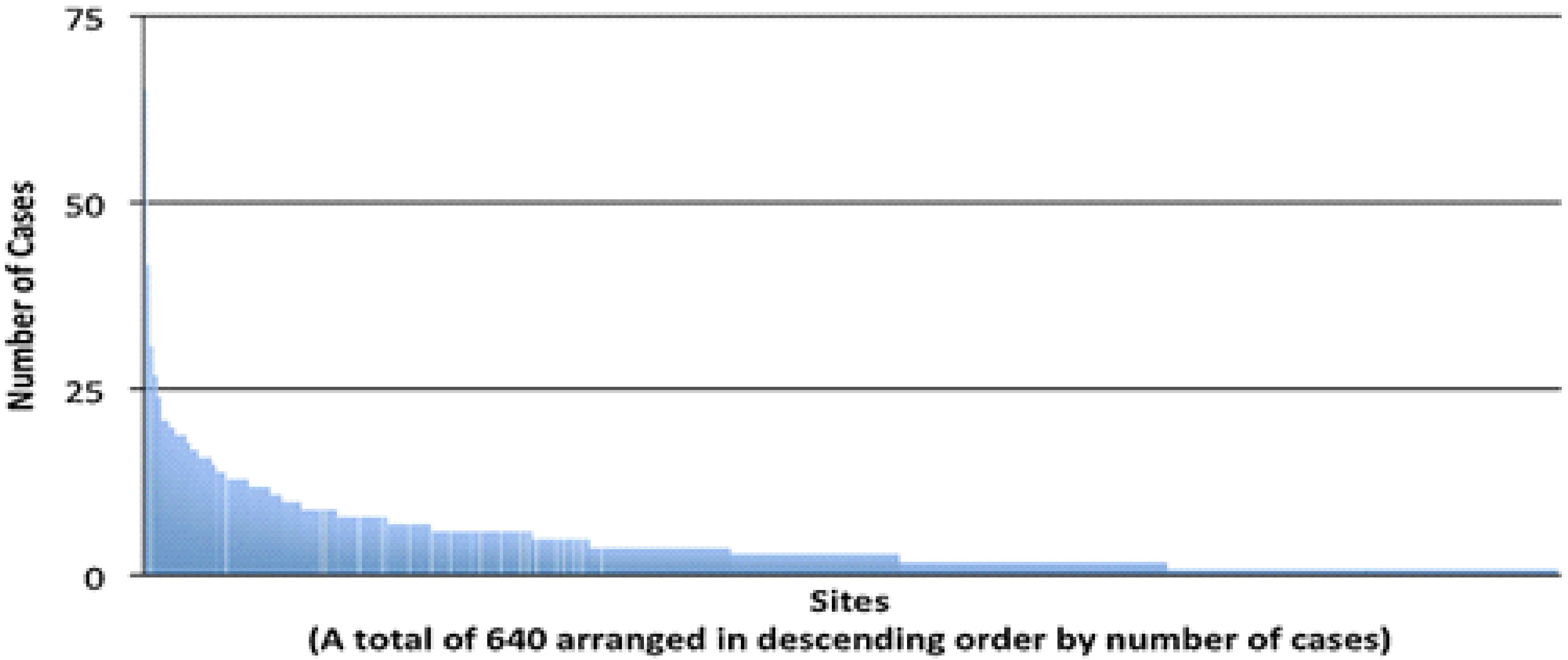
Reoperation correlates with hypertension



<120 mmHg	54	32	14	4
120-140 mmHg	41	22	11	2
>140 mmHg	16	13	6	2

Ann Thorac Surg 2007;84:479–87.

Number of TAAD repairs by site: STS data



J Card Surg 2018;33:7-18.

UPMC focus: neurologic outcomes

Stroke rate-reduction and standardization to improve overall outcomes

1. Rapid transport to incision to CPB
2. Central cannulation
3. Neurocerebral protection including

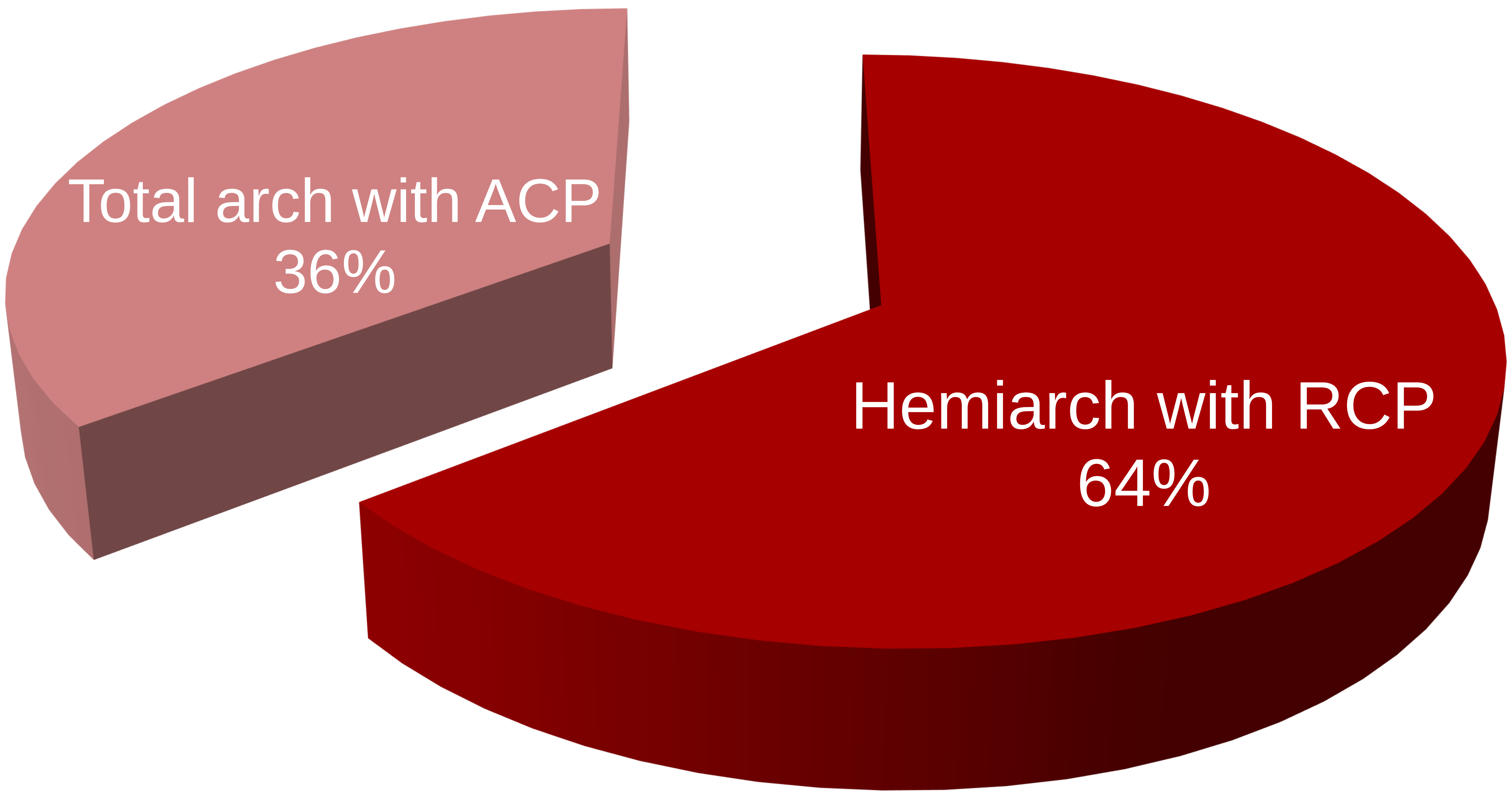
   liberal use total arch/carotid replacement
4. Reduce use of blood products

Neurocerebral Protection/ Perfusion Protocol

1. 100% use EEG/SSEP monitoring
   - Steroids, lidocaine, $MgSO_4$, mannitol use
   - DHCA initiation 4 min after electrocerebral silence (ECS)
2. Standardized cannulation:
   - aortic arch tear status and carotid malperfusion
3. Central aortic cannulation is default
4. RSCA cannulation for bad intra-arch tears
5. RCP for Hemiarch reconstruction (DHCA <30 min)
6. ACP for Total Arch reconstruction (DHCA >30 min)
7. Common carotid replacement when dissected

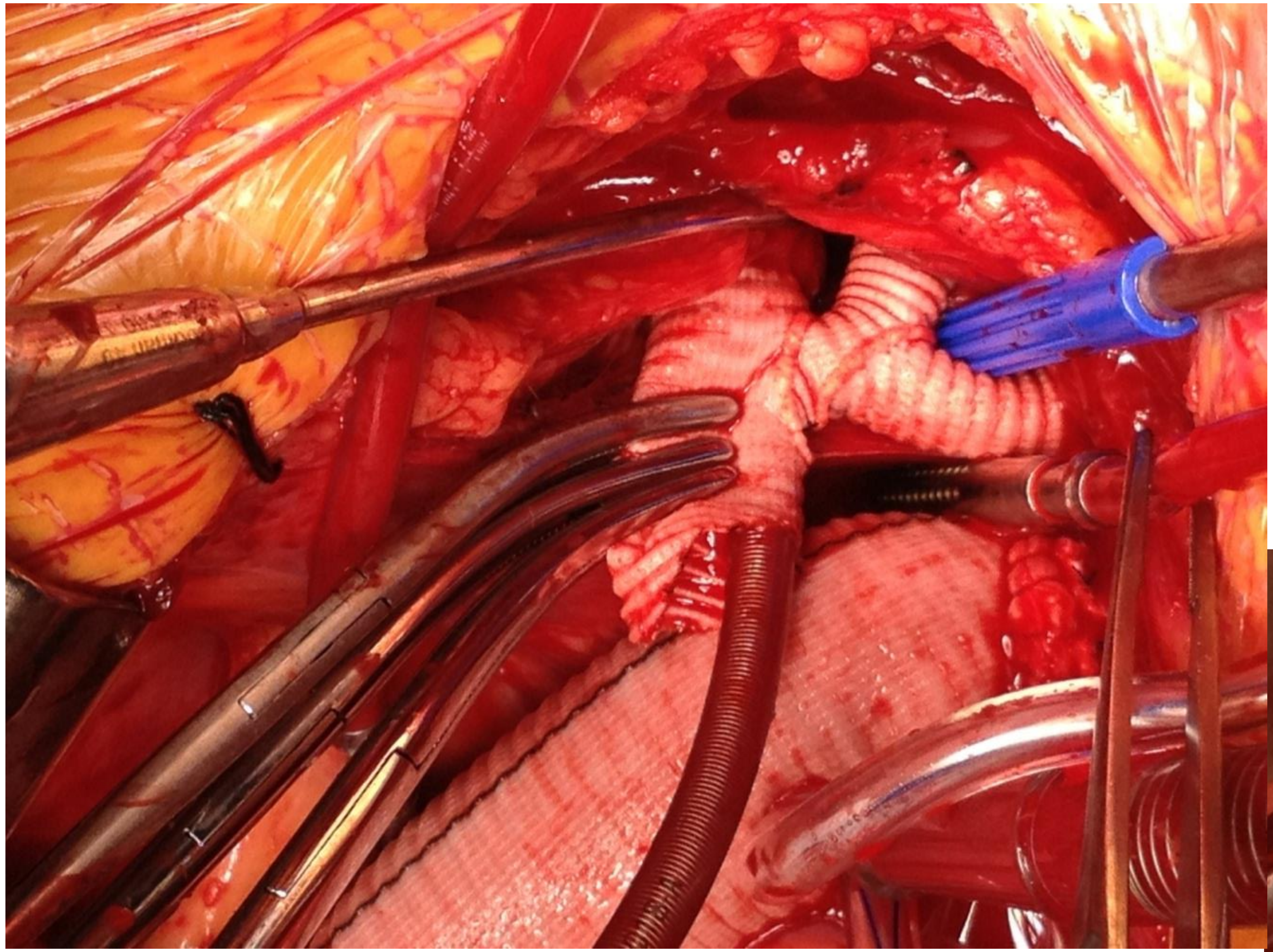

1°or 2°Arch Tear
Carotid Dissection
Indications for Total Arch
Circumferential Arch Dissection
Aneurysmal Arch

Arch Reconstruction



Complete Common Carotid Replacement in 33 patients using separate neck counter incisions

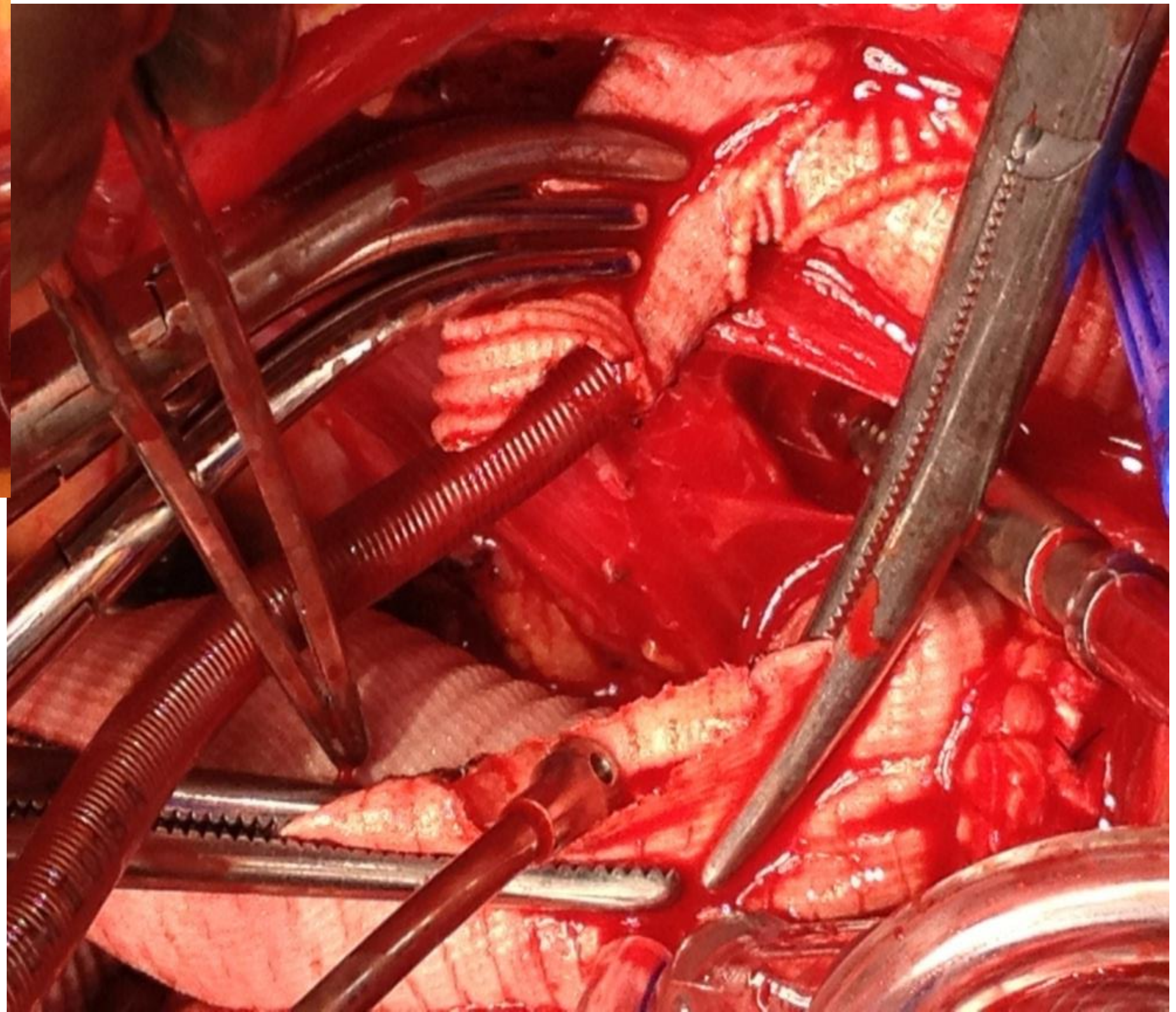
Uninterrupted Central ACP Technique



Innominate, RCC or LCC grafting during cooling

2° arterial inflow

No interruption of ACP



Custom 3-branched brachiocephalic graft separately perfused

Outcomes with standardized protocol

Hospital mortality	9.1%
Postop stroke	3.4%

Consecutive Acute Type A Dissection Repairs n=264 (2007-2014)

Ann Thorac Surg. 2016 Mar;101(3):896-903; Discussion 903-5.

Outcomes
Hemi (64%) versus Total Arch (36%) Reconstructions*

	Hemiarch N= 167	Total Arch N= 92	Overall	P value
Postop CVA	6(4%)	3(3%)	9(3.5%)	1.000
Hospital Mortality	11(7%)	13(14%)	24(9%)	0.071
30 Day mortality	14(8%)	13(14%)	27(10%)	0.201
1-yr mortality	23(15%)	21(27%)	44(19%)	***0.033***
No Intraop use				
PRBC	52%	50%	51%	0.796
FFP	63%	80%	69%	***0.003***
Platelets	41%	45%	42%	0.600
Intraop Factor VII	61(37%)	54(59%)	115(44%)	***0.001***

*5 patients with limited Debakey II dissections required neither hemi nor total arch; all survived without stroke.

Value of Neurocerebral Monitoring

- 15% EEG/SSEP changes
  - Changes prompt intraop adjustments and immediate postop CTA with immediate neurointervention when feasible

- EEG/SSEP independent predictor of postop CVA

  - OR 8.7, 95% CI [2.26- 34.8]   p=0.002

Negative Predictive Value 98.2%

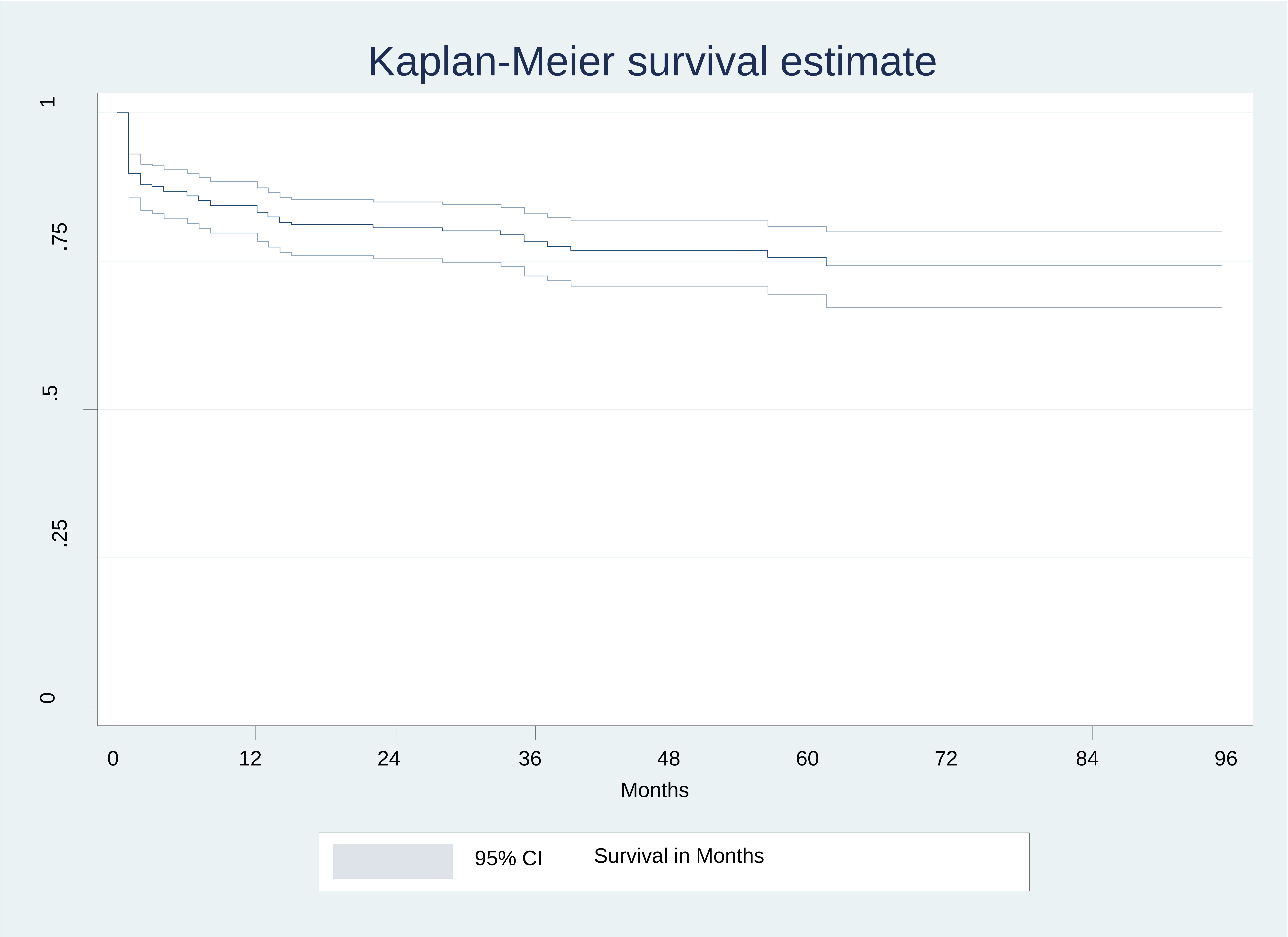
Multivariate Predictors of Hospital Mortality

	OR [95% CI]	
Pre-op CVA	21.3 [6.2-73]	$p<0.001$
Intra-op EEG Change	5.2 [1.6-16.5]	$p=0.005$
Frozen Trunk	14.5 [3.4-62.3]	$p<0.001$
Concomitant CABG	6.6 [1.7-24.8]	$p=0.005$

Multivariate Predictors of 1-yr Mortality

1 Year	OR [95% CI]	
Age ≥65	3.0 [1.3-7.2]	p=0.013
Pre-op CVA	12.3 [3.7-41.5]	p=0.000
RBC Transfusion ≥5 Units	5.9 [1.8-19.0]	p=0.001
Frozen Trunk	14.9 [4.3-52.1]	p=0.000
Concomitant CABG	2.8 [1.2-6.9]	p=0.023

Long-term Survival



Conclusions

1. Expeditious restoration of perfusion and proximal stabilization saves lives.

2. Hemiarch replacement meets the primary goal most of the time.

3. Reoperation rate is low after hemiarch, and the reoperations can be done safely, with low risk in experienced hands.

4. Results with TAAD management have improved over time, particularly in-hospital results--hemiarch remains the most widely used strategy.

5. Late event rates can be reduced by more aggressive approach, but may be at the cost of higher in-hospital mortality and complications.

THANK YOU