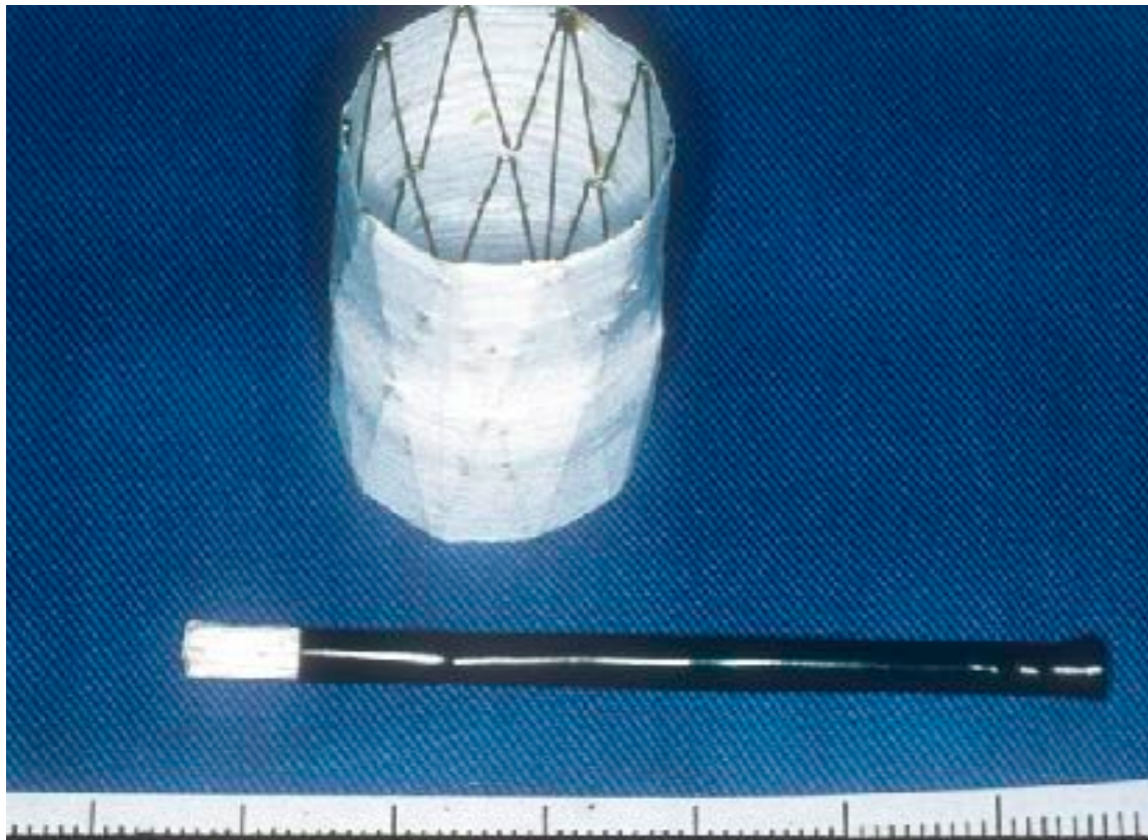
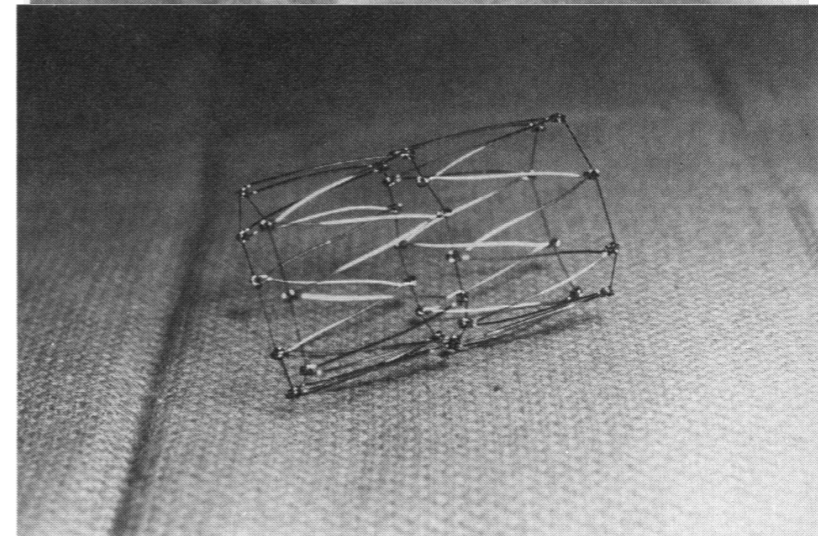
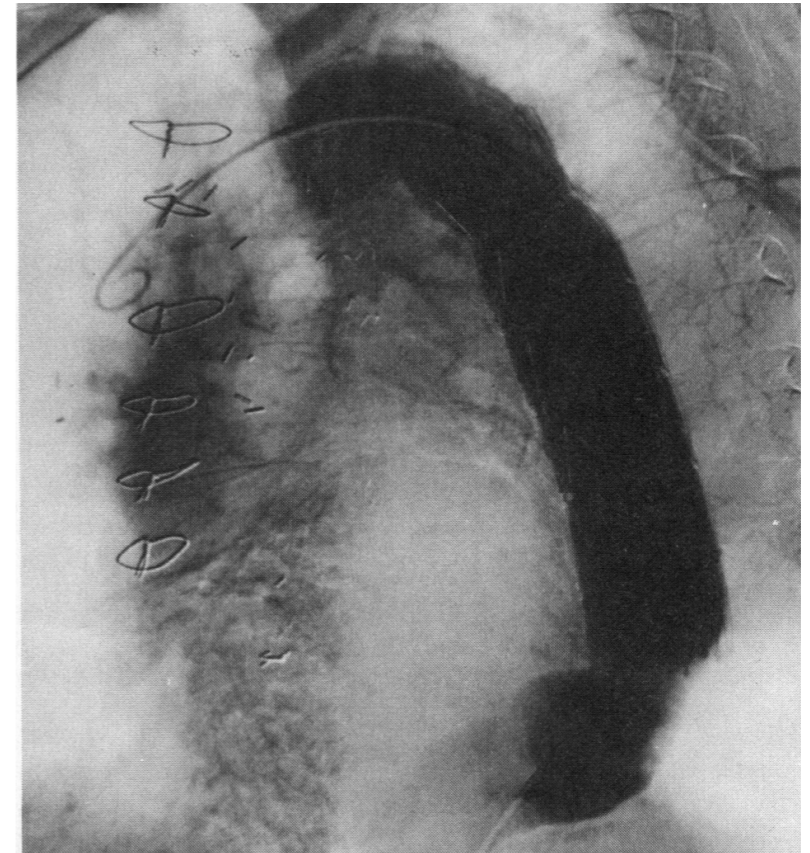


# Development of Stent Graft

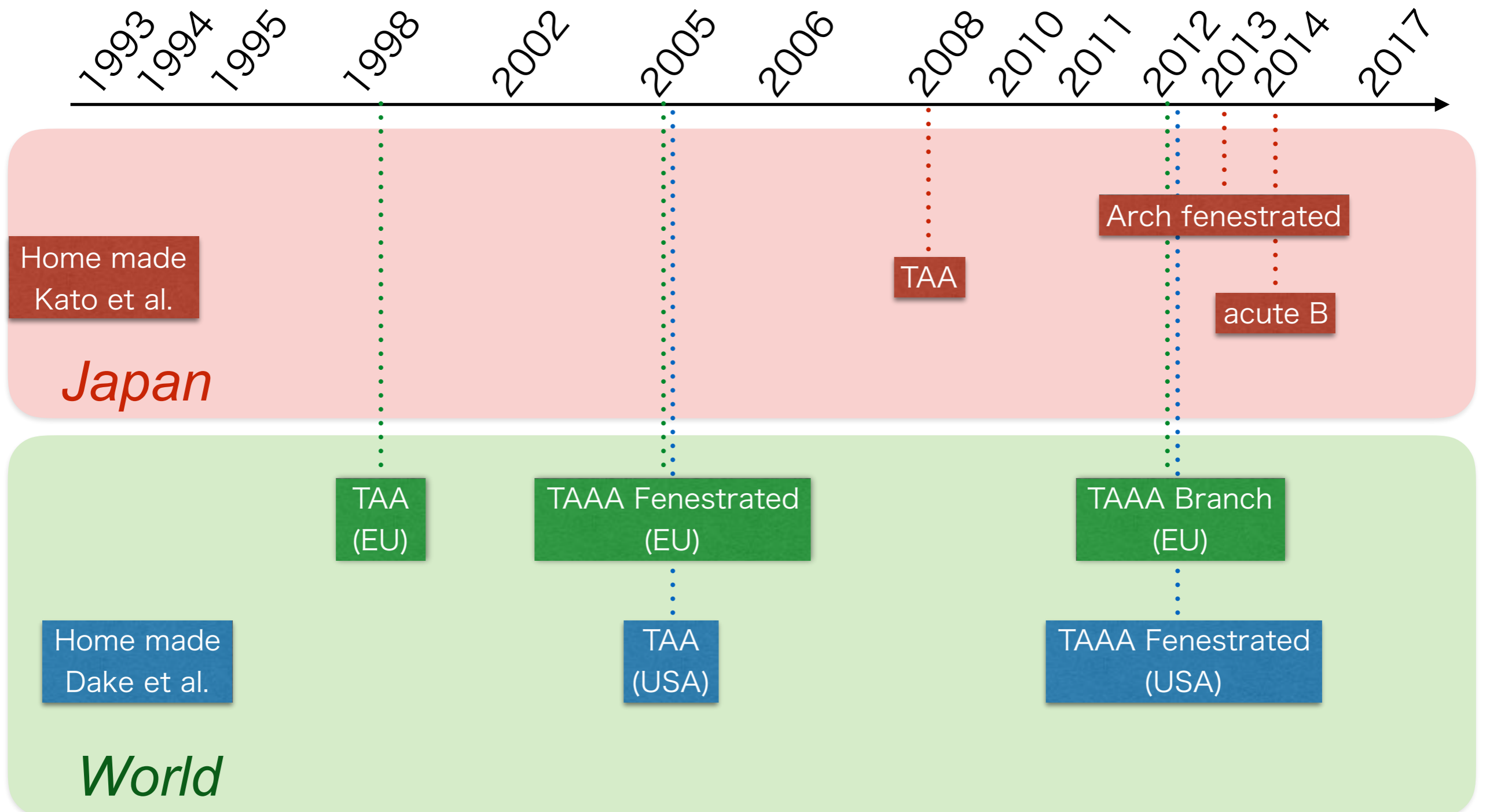


*Kato et al. Development of an expandable intra-aortic prosthesis for experimental aortic dissection. ASAIO J 1993*



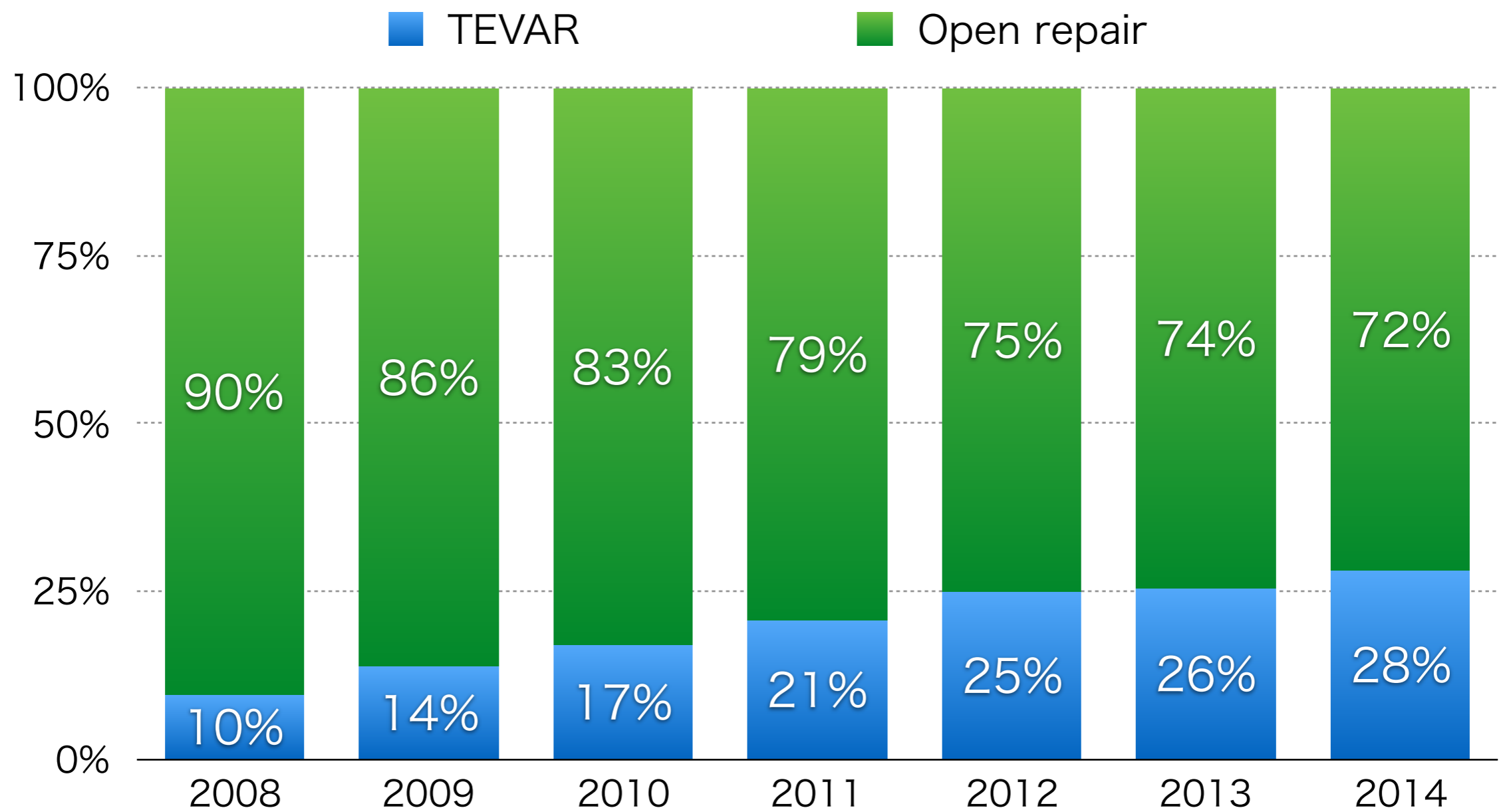
*Dake et al. Transluminal placement of endovascular stent-grafts for the treatment of descending thoracic aortic aneurysms. NEJM 1994*

# Development of Thoracic Stent Graft



# Thoracic aortic aneurysm surgery in Japan

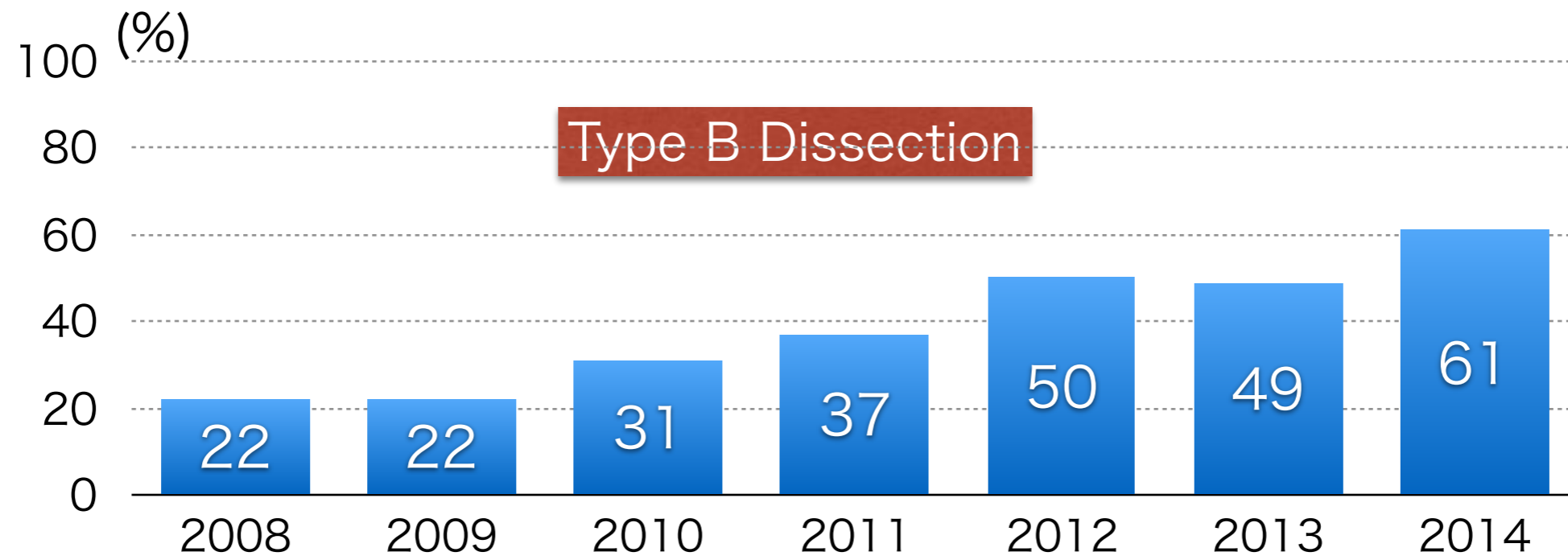
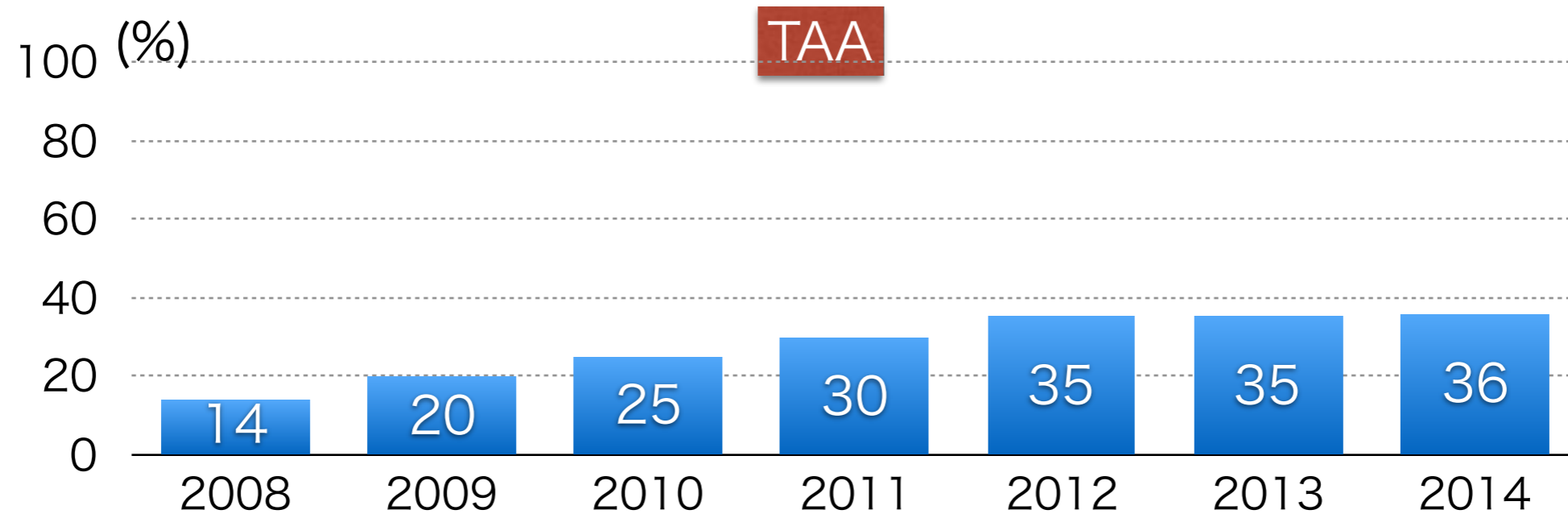
## Number of cases



*Annual report by The Japanese Association for Thoracic Surgery*

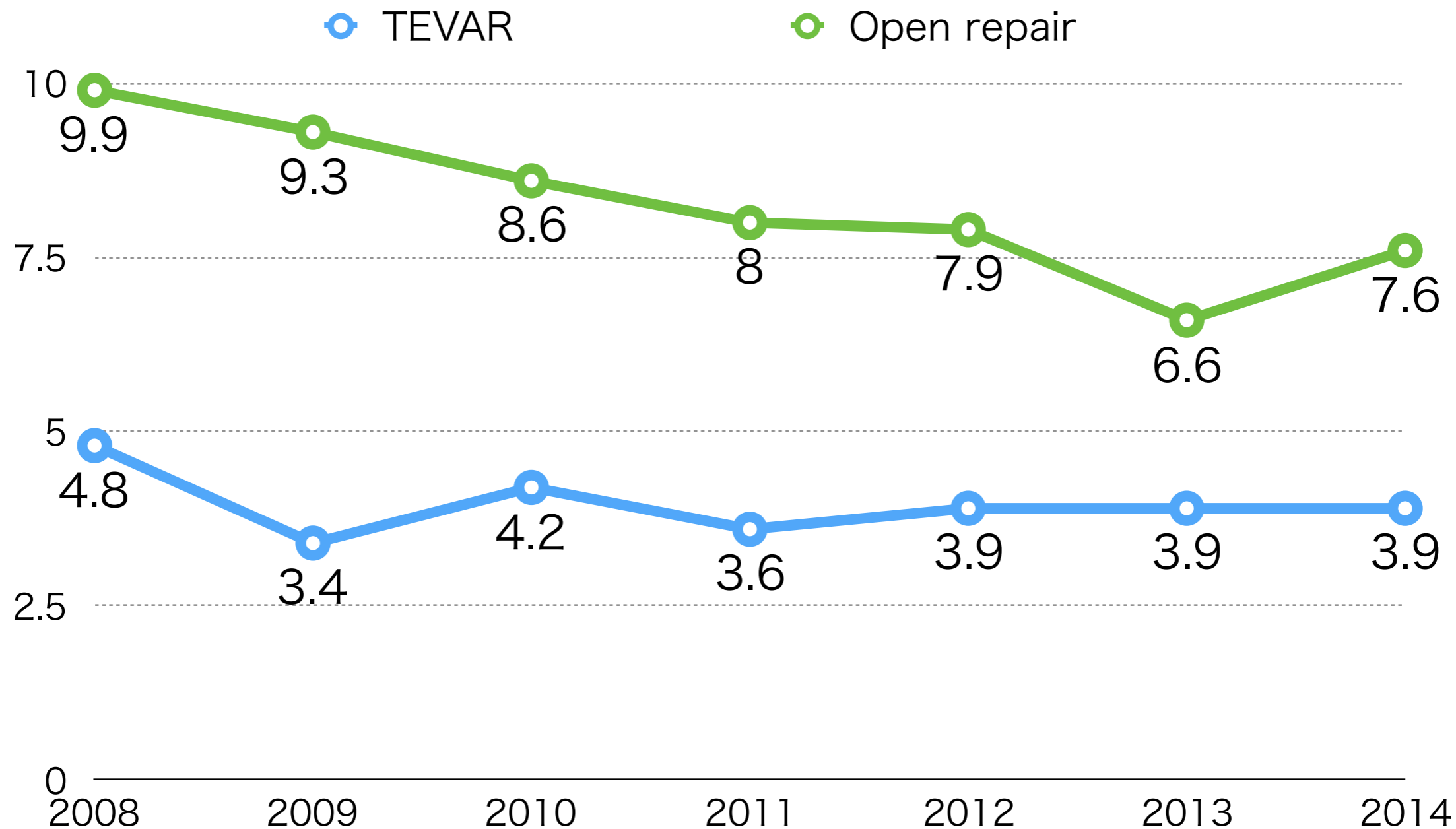
# Thoracic aortic aneurysm surgery in Japan

## Proportion of TEVAR



# Thoracic aortic aneurysm surgery in Japan

## 30day mortality



*Annual report by The Japanese Association for Thoracic Surgery*

# TEVAR versus Open repair

Low risk patient in 17 sites, total 140 TEVAR

	TEVAR (n=140)	Open (n=94)	p value
Mortality	0.021	0.117	0.004
Respiratory failure	0.04	0.2	<0.001
Renal failure	0.01	0.13	0.01
Cerebrovascular accident	0.04	0.04	n.s
spinal cord ischemia	0.03	0.14	0.03
Mean ICU length	2.6±14.6	5.2±7.2	<0.001
Mean length of hospital stay	7.4±17.7	14.4±12.8	<0.001

*Bavaria et al. Endovascular stent grafting versus open surgical repair of descending thoracic aortic aneurysms in low-risk patients: A multi center comparative trial. JTCVS 2007*

# Effect of TEVAR on outcomes after DTAA repair

Nationwide Inpatient Sample data 2006–2007

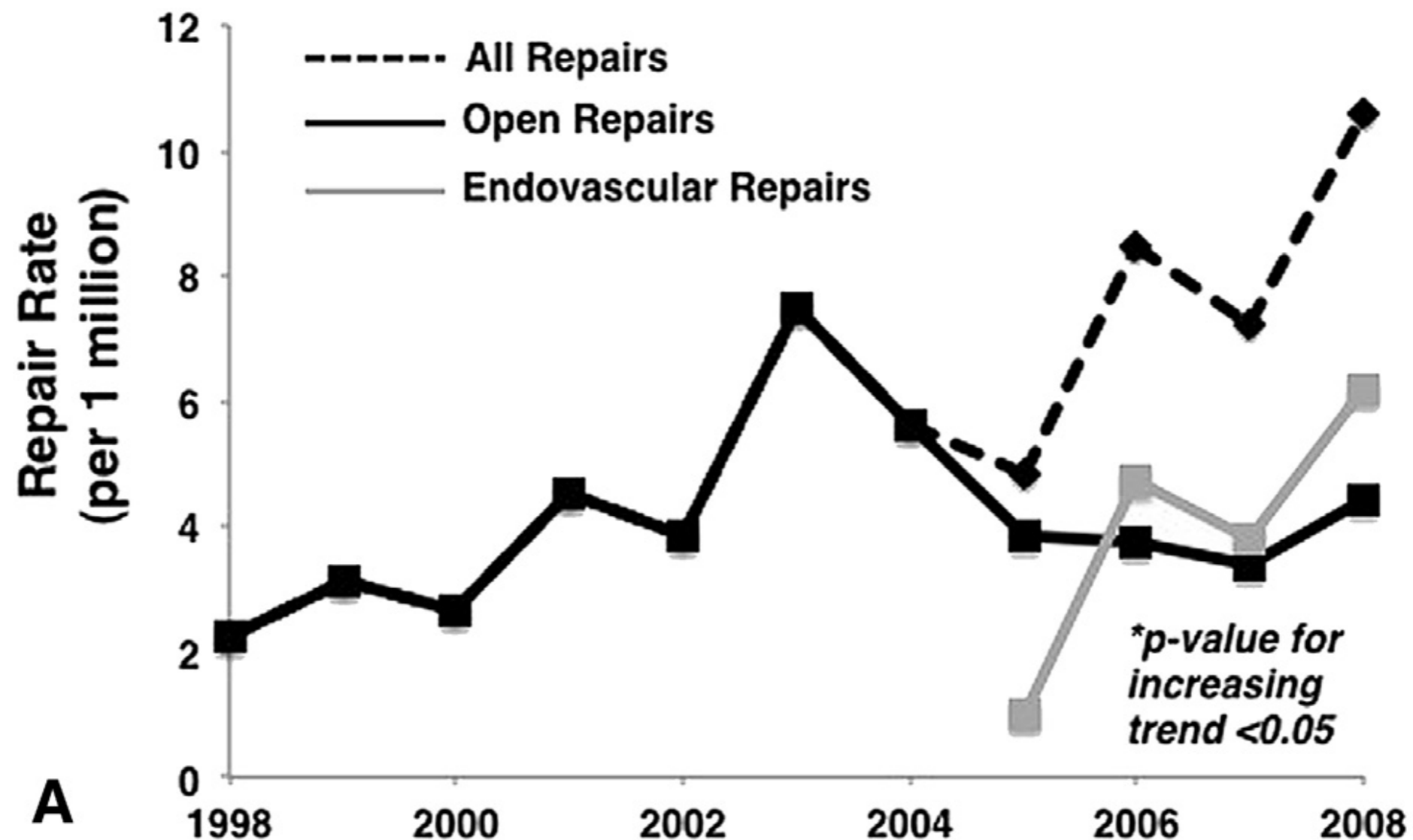
Open repair 9160 versus TEVAR 2563

Variable	<i>P</i> value	Odds ratio or Exp (B)	95% CI	R <sup>2</sup>
Intraoperative complications	< .001	0.41	0.35-0.50	0.14
Infections	.3	0.88	0.68-1.14	0.22
Neurologic complications	< .001	0.16	0.09-0.29	0.60
Renal complications	.3	0.87	0.67-1.14	0.26
Respiratory complications	< .001	0.28	0.21-0.36	0.18
Pulmonary embolism	.5	1.51	0.51-4.47	0.46
Any complication	< .001	0.39	0.26-0.58	0.93
Total complications/patient	< .001	−0.33*	−0.38 to −0.29	0.11
Died during hospitalization	.9	1.03	0.68-1.56	0.38
Length of stay (d)	< .001	−1.27*	−1.76 to −0.79	0.28
Routine home discharge	< .001	4.01	3.48-4.63	0.25

*Gopaldas et al. Superior nationwide outcomes of endovascular versus open repair for isolated descending thoracic aortic aneurysm in 11,669 patients. JTCVS 2010*

# Thoracic aortic aneurysm surgery in US

total 20,568 pts. from Nationwide Inpatient Sample



*Kilic et al. Trends in repair of intact and ruptured descending thoracic aortic aneurysm in the United States: A population-based analysis. JTCVS 2014*



# Results of Arch TEVAR (2007)

1999-2006, N=64, Italy

	Zone 0 n=14	zone 1 n=12	zone 2 n=38	total n=64
Technical success	92.9%	66.7%	89.5%	85.9%
30-day mortality	14.3%	0%	5.3%	6.3%
stroke	14.3%	0%	0%	3.1%
type I/III Endoleak	7.1%	33.3%	7.9%	12.5%

*Melissano et al. Results of Endografting of the aortic arch in different landing zones. Eur J Vas Endovasc Surg 2007*

# Results of Arch TEVAR (2014,2016)

2008-2012\*(2015\*\*), Osaka Univ. Commercial device

	Zone 0* n=40	Zone 1 and 2** n=101
Technical success	100.0%	100.0%
30-day mortality	3.0%	1.0%
stroke	0.0%	3.0%
type I/III Endoleak	3.0%	2.0%

\* Shirakawa et al. The efficacy and short-term results of hybrid thoracic endovascular repair into the ascending aorta for aortic arch pathologies. *Eur J Cardiothorac Surg* 2014

\*\* Shijo et al. Thoracic endovascular aortic repair for degenerative distal arch aneurysm can be used as a standard procedure in high-risk patients. *Eur J Cardiothorac Surg* 2016

# Hybrid vs Open for aortic arch

	Hybrid (n=50)	Open (n=143)	p value
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## Patient

Age	78.6	72.1	<0.001
EuroSCORE II	7.78%	4.35%	<0.001

## Outcomes

Mortality	2%	3%	n.s
PND	6%	2%	0.17
ICU stay	1.6	4.7	<0.001

*Iba et al. EJCTS 2014*

	Hybrid (n=45)	Open (n=274)	p value
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## Patient

Age	68	63	0.098
COPD	68.9%	36.1%	<0.001

## Outcomes

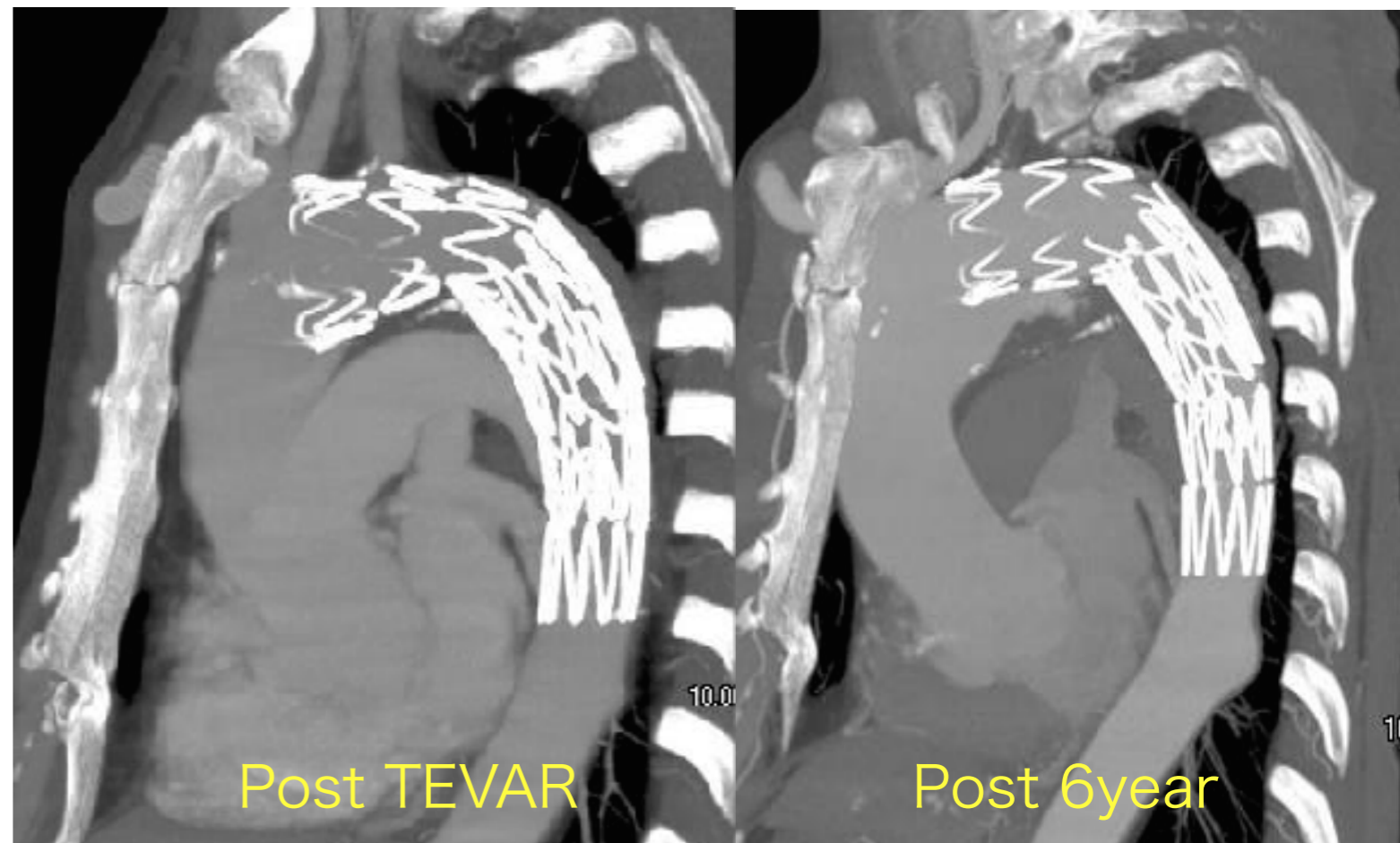
30-day Mortality	11.1%	8.4%	n.s
stroke	15.6%	7.7%	0.091
ARF	8.9%	20.3%	0.073
ICU stay (day)	6	5	n.s

*Preventza et al. JTCVS2015*

# Risk factor for late endoleak

type Ia endoleak after TEVAR=0~9%

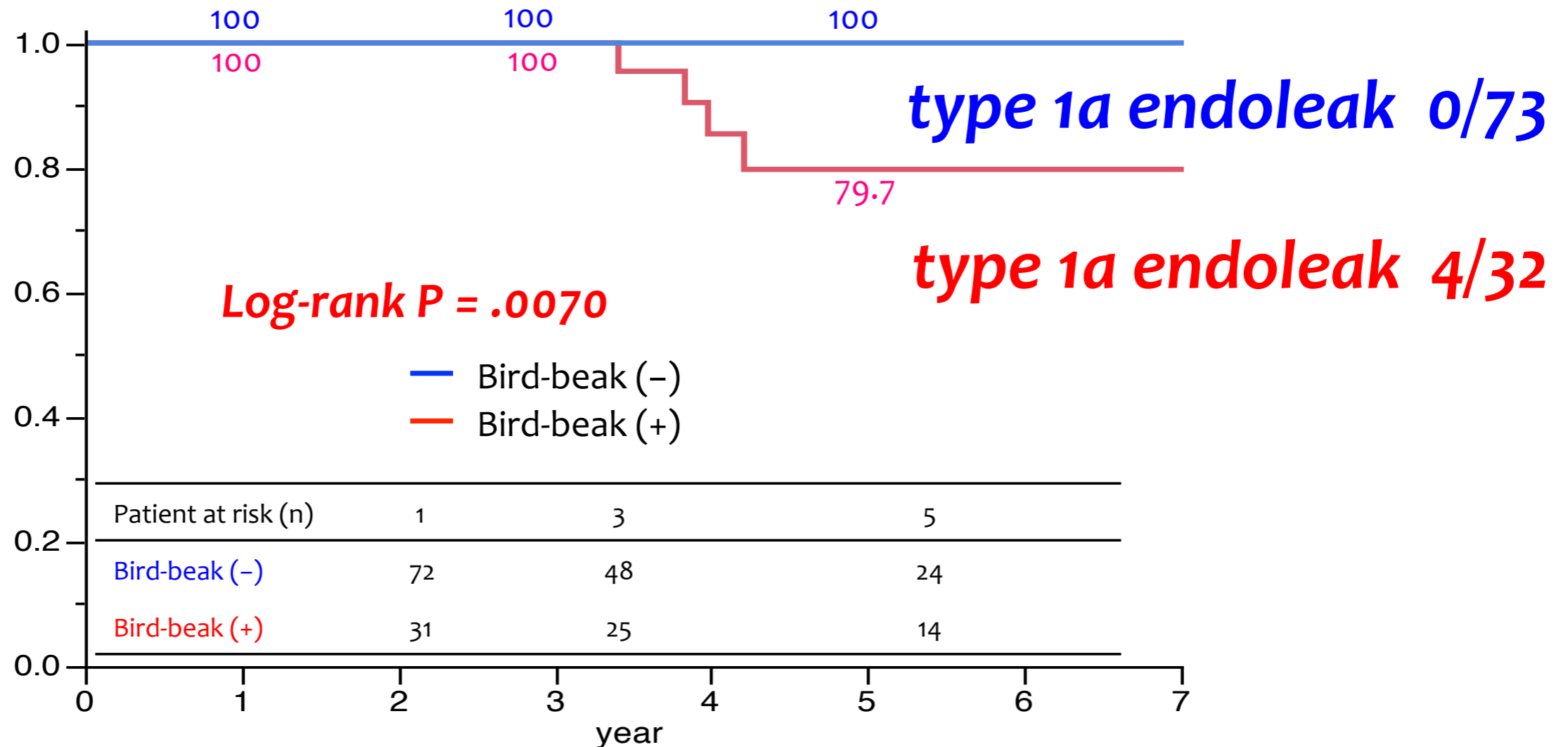
- ✓ sealing length
- ✓ aortic diameter
- ✓ bird beak



# Risk factor for late endoleak

## **Bird-beak and type 1a endoleak**

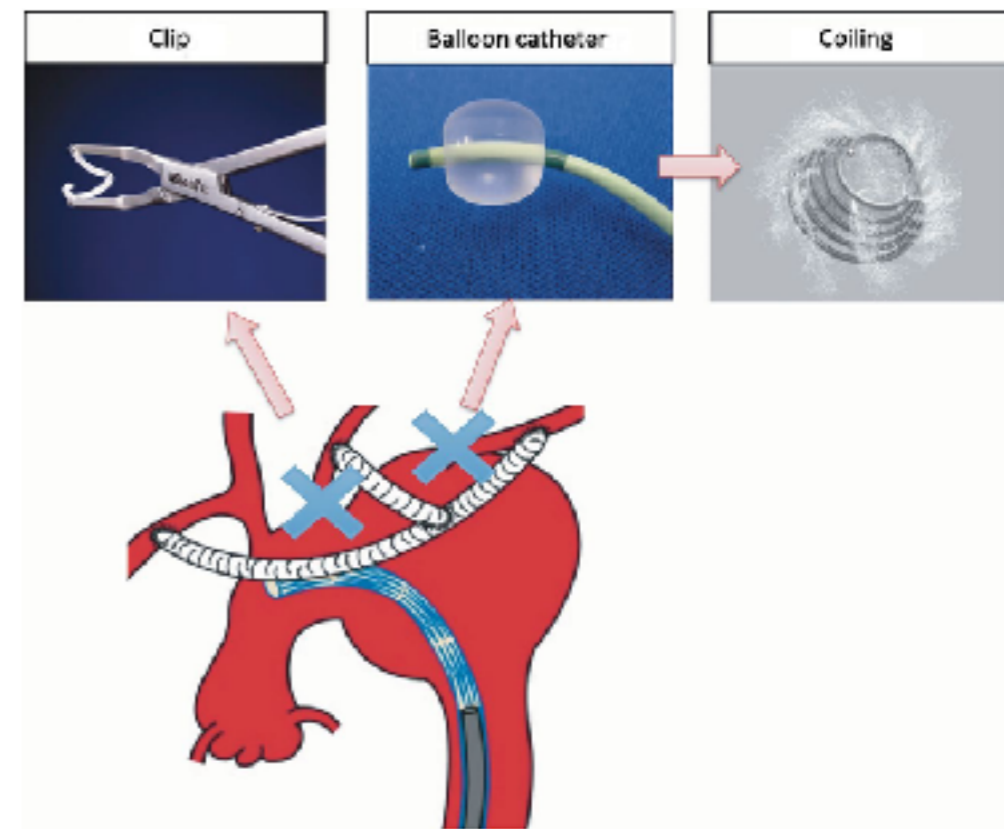
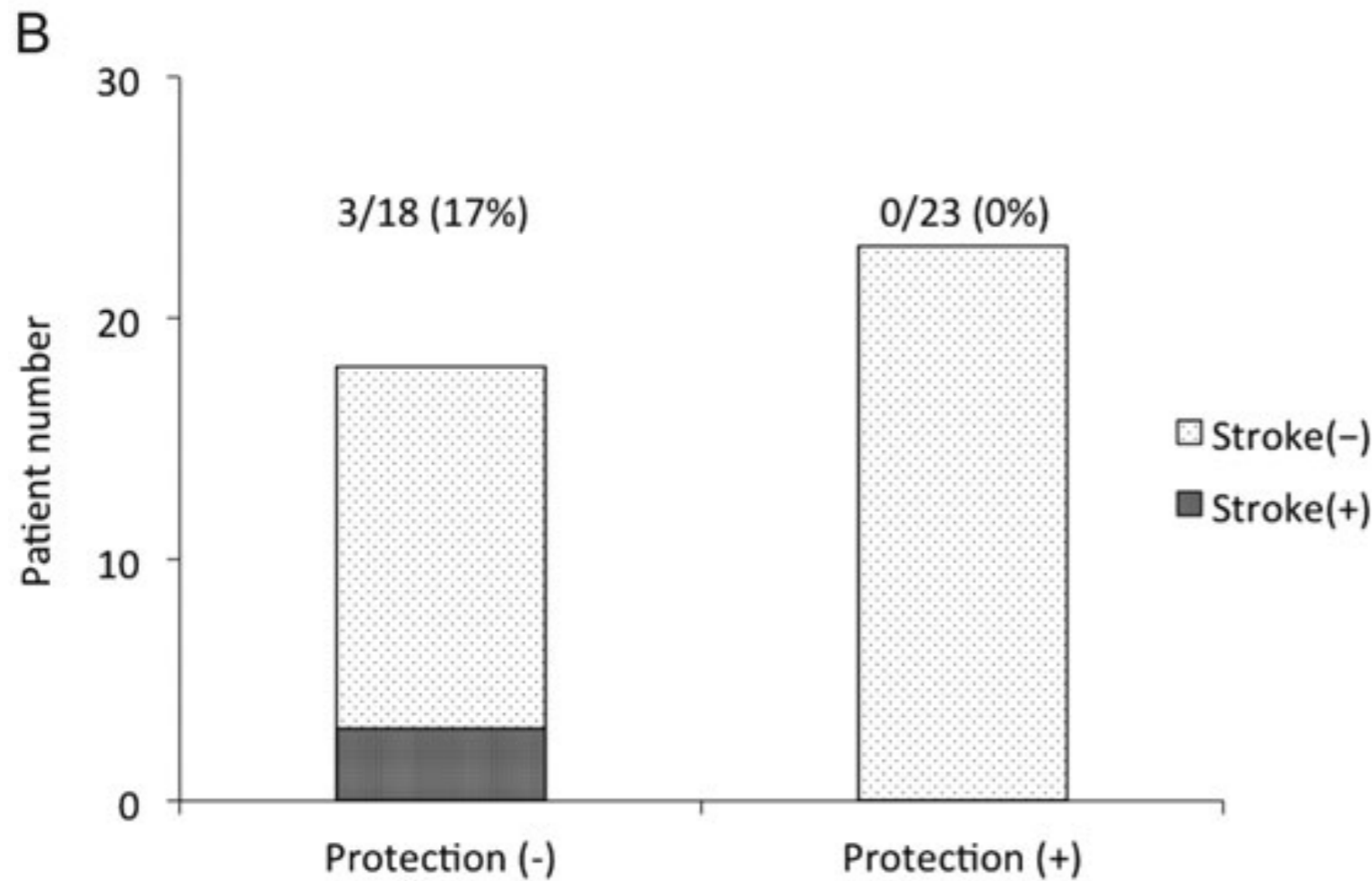
- **bird-beak (+)** vs **bird-beak (-)** -



*Kudo et al. Evaluation of late change in proximal neck anatomy using MDCT after TEVAR for aortic arch disease. EJCTS 2017 in press.*

# Effectiveness of LSA protection

Atheroma grade III/IV case (n=41)



*Shijo et al. Thoracic Endovascular aortic repair for degenerative distal arch aneurysms can be used as a standard procedure in High-risk patients. EJCTS 2016*

# Arch Branch System

## Zone 0



Number	38
technical success	84.2%
mortality	13.2%
stroke	15.8%
type I endoleak	13.2%

Haulon et al. Global experience with an inner branched arch endograft. JTCVS 2014



## Zone 2



Number	22
technical success	100.0%
mortality	0.0%
stroke	0.0%
type I endoleak	0.0%

Himanshu et al. Branched endovascular therapy of the distal aortic arch: preliminary results of the feasibility multi center trial of the Gore thoracic branch endoprosthesis. Ann Thorax Sure 2016




# Impact of Branch device

	branch device	total endovascular
procedure	 <i>n=23</i>	 <i>n=23</i>
age	79.0±5.9	74.5±7.9
Logistic EuroSCORE (%)	29.5*	22.6*
Technical success	100%	94.8%
stroke	8.6%	15.8% fene 42.8% chimney 0%
spinal cord ischemia	0	5.2%

\*  $p < 0.05$



# Impact of branch device: endoleak

	branch device	total endovascular
procedure	 <i>n=23</i>	  <i>n=23</i>
type 1a	0.0%*	21.0%* fene 15.2% chimney 25.0%
type 1b	0	0
type 2 (LSA)	0	0
type 3	0	0

\*  $p < 0.05$

# Dissection specific complication



retrograde type A dissection

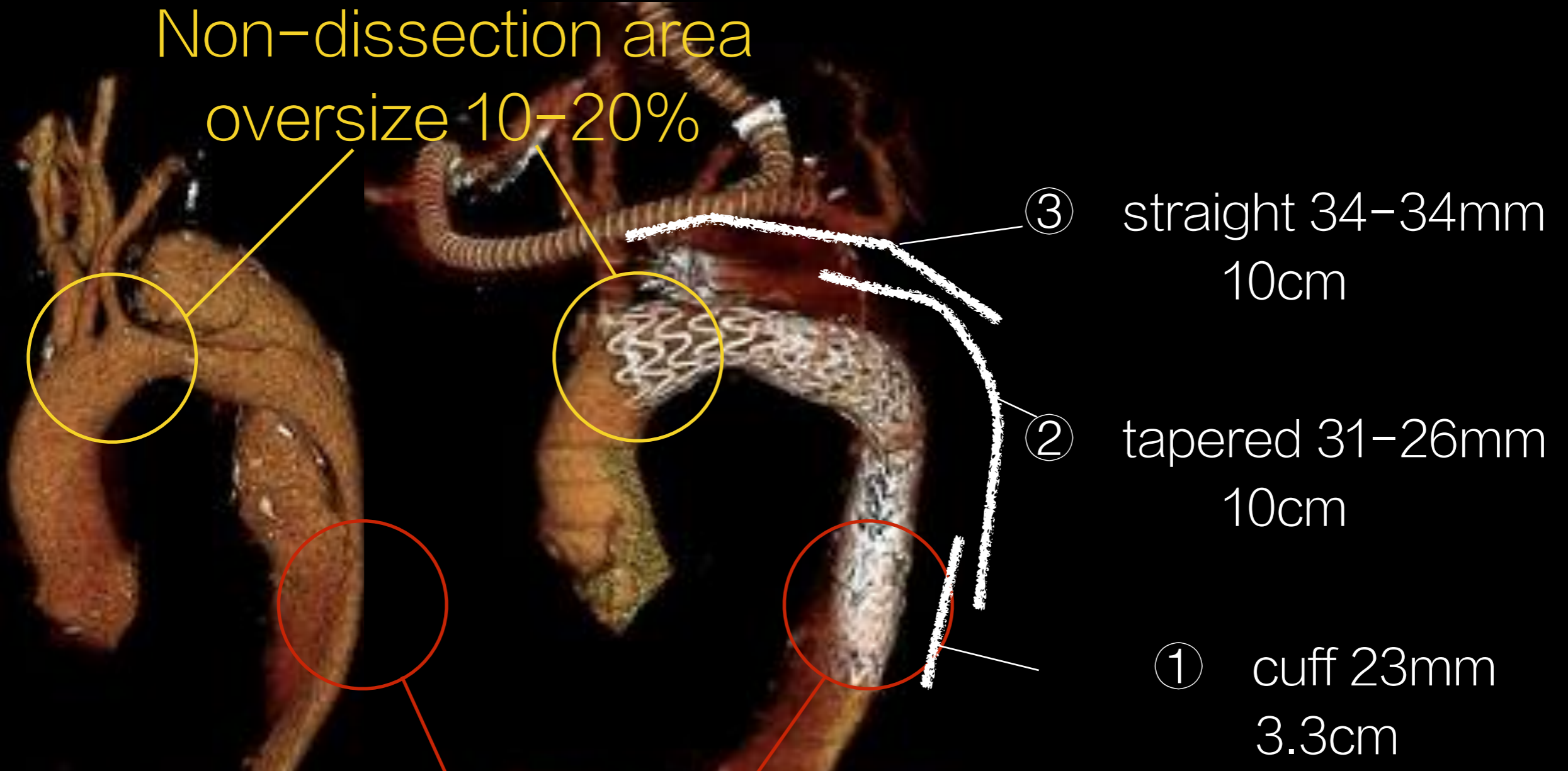
*Eggebrecht et al. 2009*



distal re-dissection (tear)

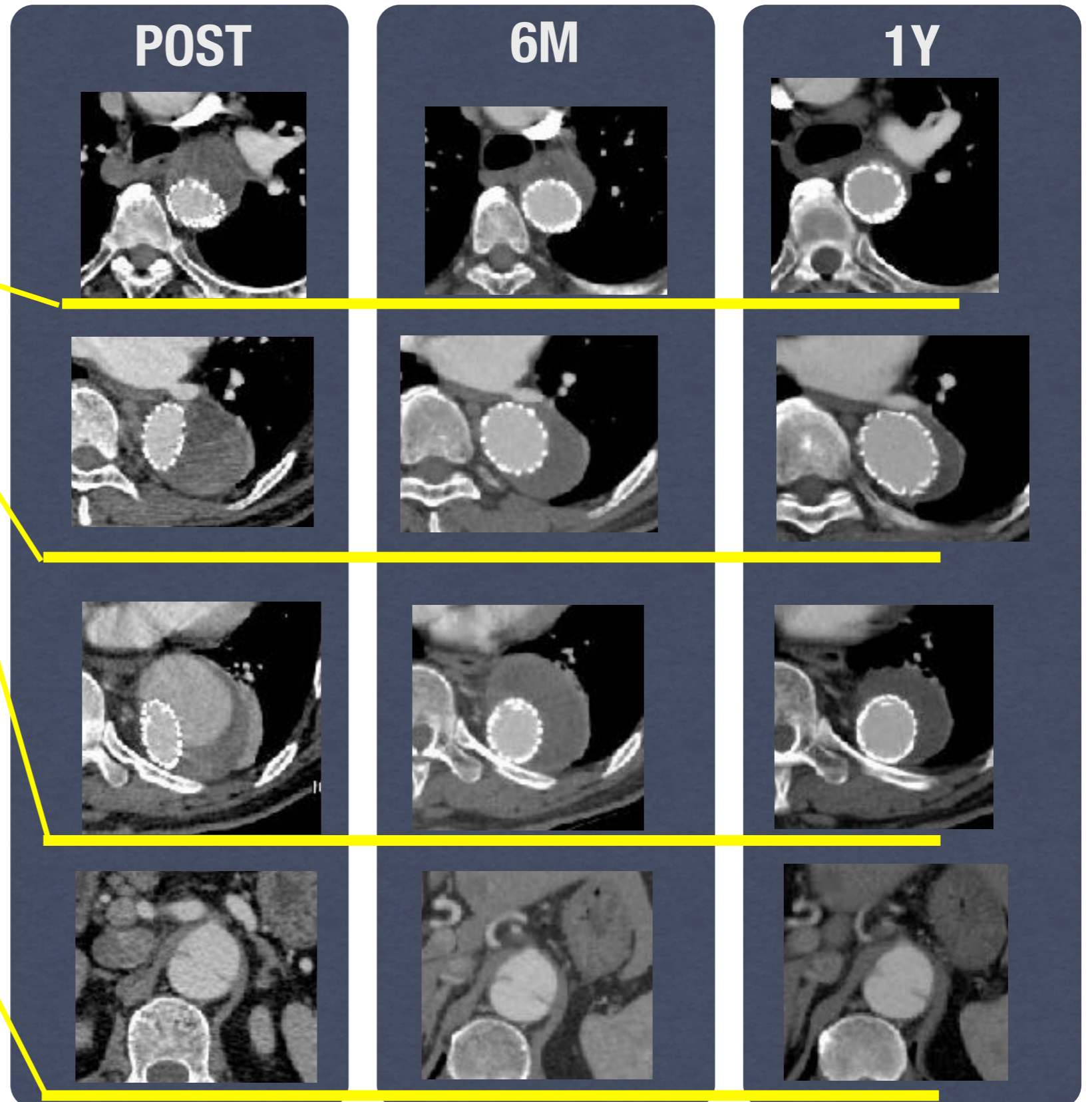
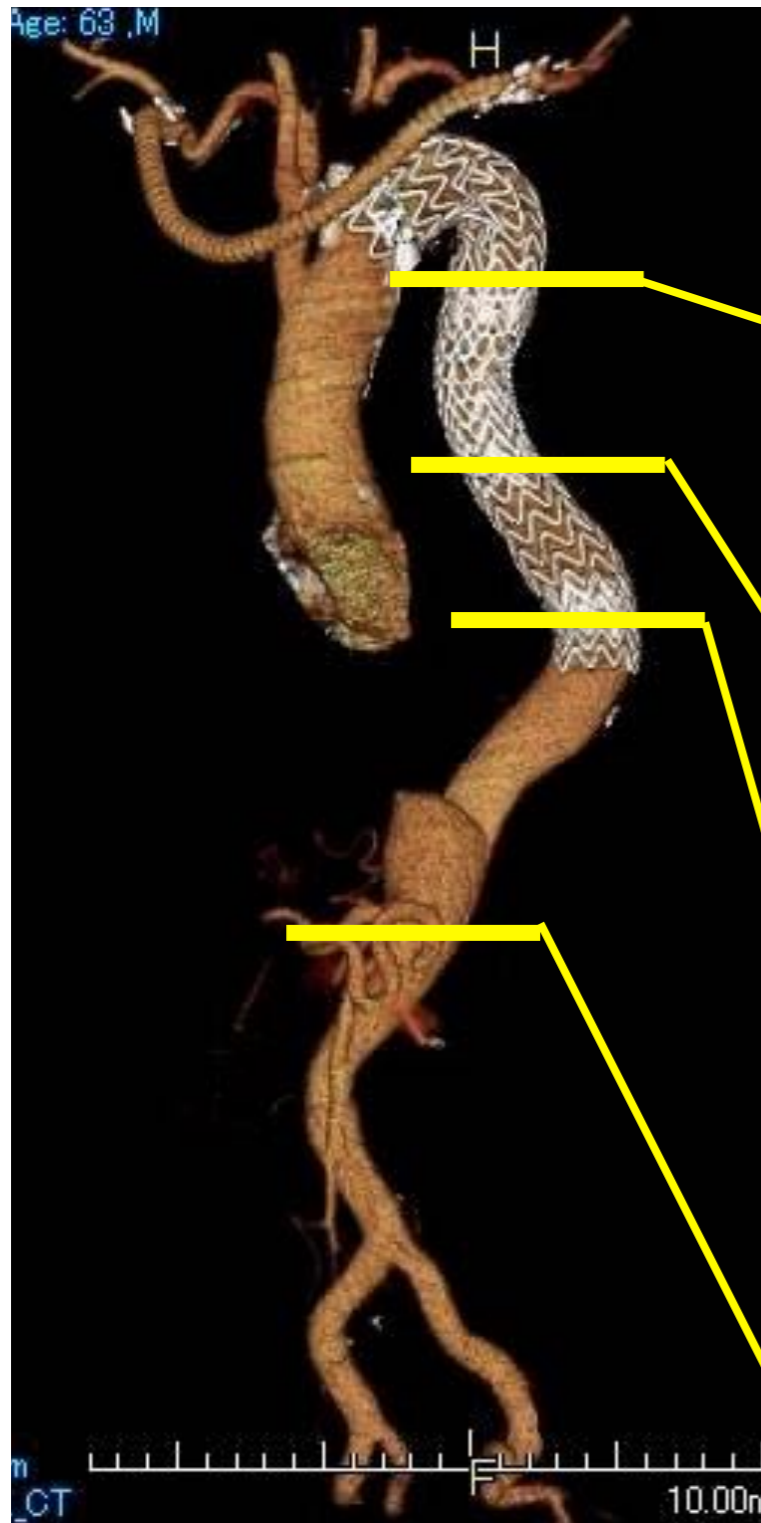
*Feng et al. 2013*

# How to improve the Quality of TEVAR?

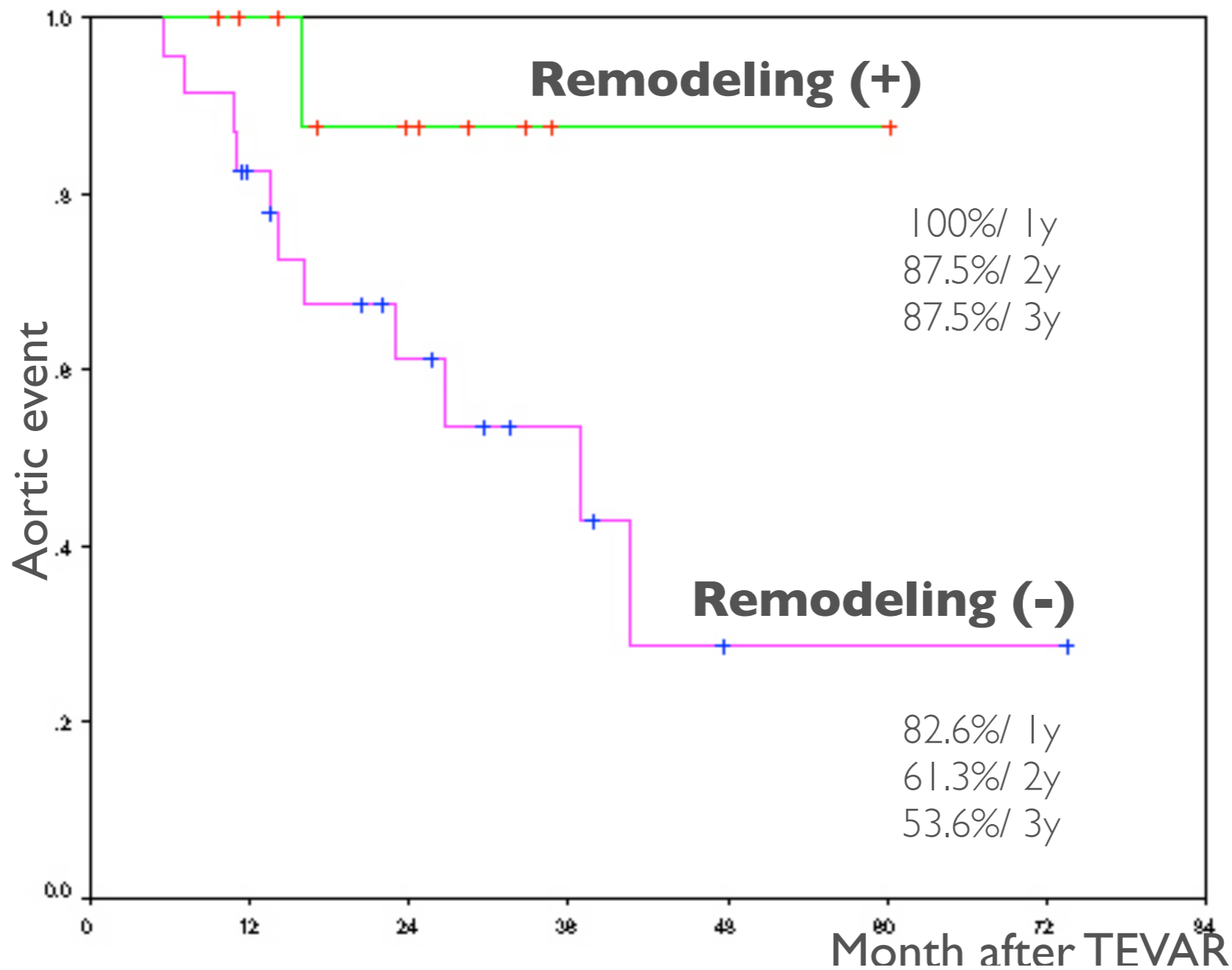


Straight part of DTA  
oversize 5-10% of TL

# Aortic remodeling after TEVAR



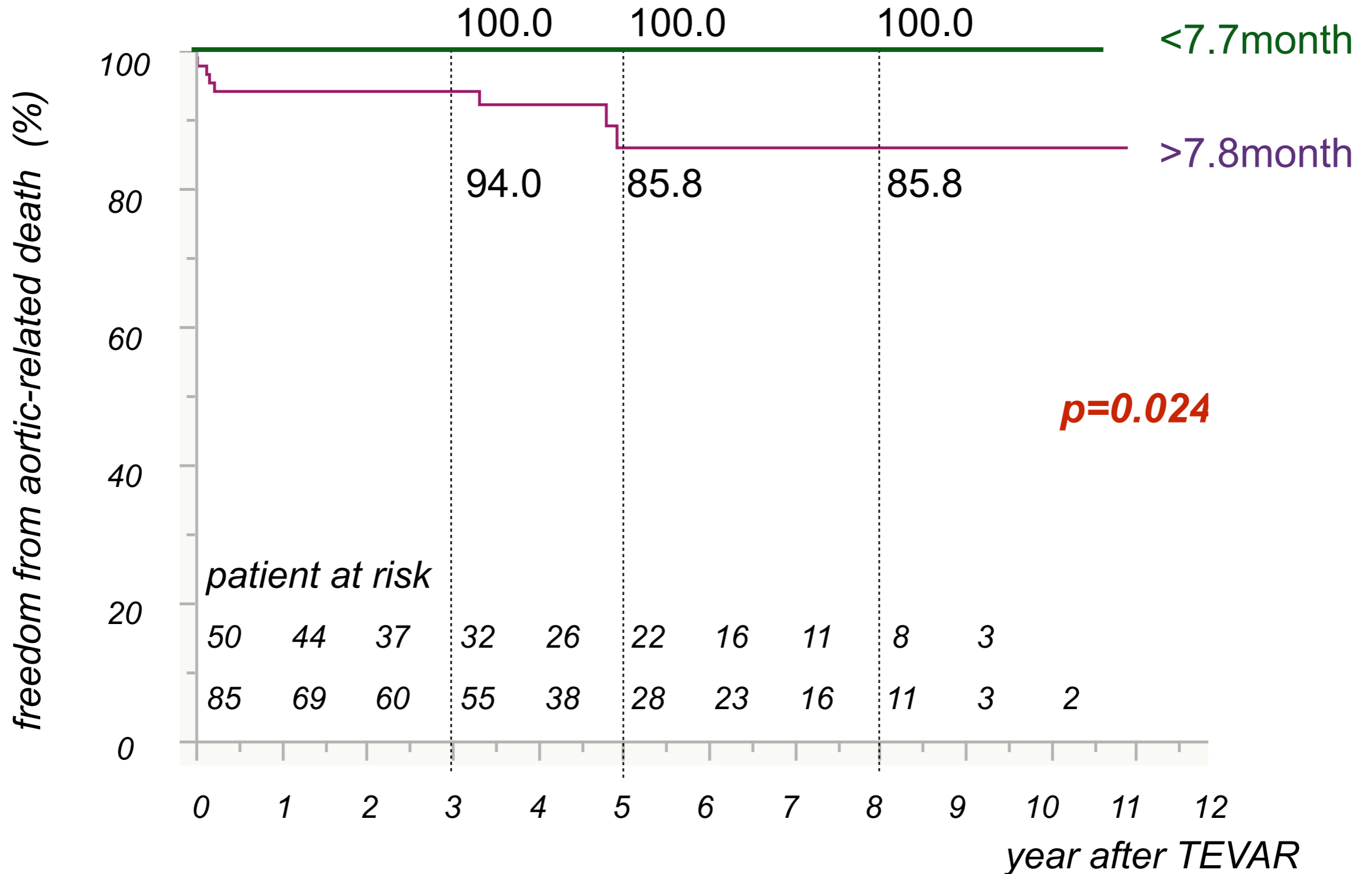
# Aortic remodeling prevents aortic event



Watanabe et al. Aortic remodeling as a prognostic factor for late aortic events after thoracic endovascular aortic repair in type B aortic dissection with patent false lumen. *J Endovasc Ther* 2014

# Freedom from aortic-related death

## In relation to early and late intervention



# Freedom from aortic event

In relation to early and late intervention

