



# La Crosse Aortique dans tous ses états

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# Rennes

University Hospital.  
Academic Department of Thoracic  
Cardiac and Vascular Surgery

1400 CPB / 30 Heart transplantations  
1000 arteries  
220 Aortas  
680 Lungs and thoracic  
160 TAVI / Year



Nous sommes en 50 avant Jésus-Christ. Toute la Gaule est occupée par les Romains. d'irréductibles Gaulois résistent encore et toujours à l'invasion. Et ce n'est pas facile pour les garnisons de légionnaires romains dans les camps retranchés de Babaorum, Aquarium, et Petibonum...

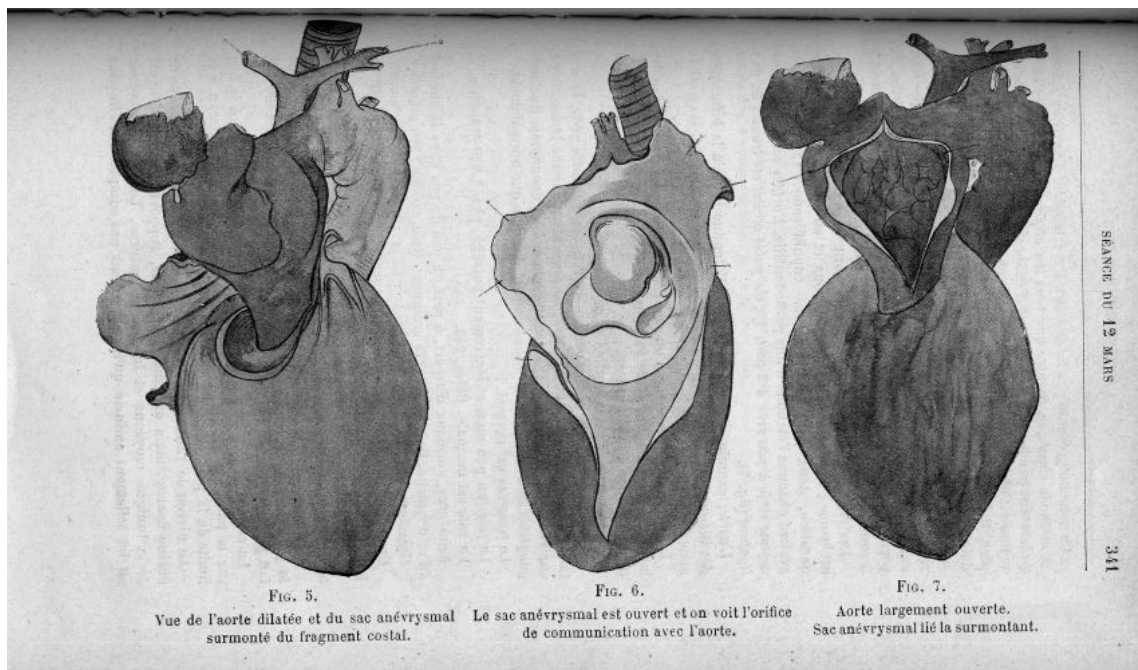
1947

*Intervention chirurgicale directe dans un anévrisme de la  
crosse de l'aorte. Ligature du sac.*

par M. TUFFIER.

Existe-t-il dans les anévrismes de la crosse de l'aorte des variétés anatomiques très rares qui soient justiciables d'une intervention chirurgicale directe? Ces variétés anatomiques admises, la clinique peut-elle les reconnaître? Telles sont les deux questions que je vais examiner devant vous à l'occasion d'un cas d'anévrisme de ce genre que j'ai observé récemment et traité chirurgicalement.

Voici l'histoire de ma malade, qui comprendra deux parties: l'une clinique, l'autre opératoire. La première est, à mon avis, beaucoup plus importante que la seconde.



PARIS

“There is no disease more conducive to clinical humility than aneurysms of the aorta”

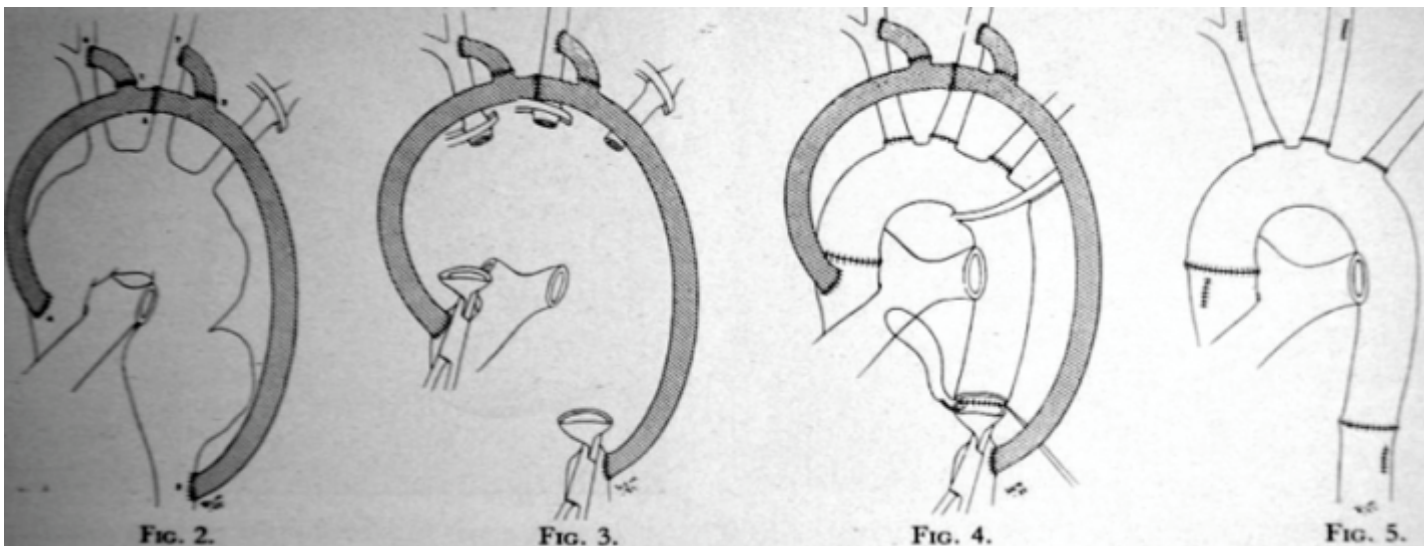
Sir William Osler, 1900

“... more progress has been made in the last 50 years than in the preceding 2000 years since Antyllus ligated, incised, and packed his cases of aneurysms.”

Jesse E. Thompson, 1998

# TOTAL EXCISION OF THE AORTIC ARCH FOR ANEURYSM

DENTON A. COOLEY, M.D., F.A.C.S., DANIEL E. MAHAFFEY, M.D., and  
MICHAEL E. DE BAKEY, M.D., F.A.C.S., Houston, Texas



# Open Surgical Repair and Hybrid approach

- **Open Surgical Repair**

- Hemi-arch repair
- Total Arch repair
- Elephant Trunk

- **Hybrid Approach**

- Surgical repair + TEVAR
- Frozen Elephant Trunk
  - Hybrid devices (*Non FDA approved*)
- Aortic debranching + stent graft

**Antegrade selective cerebral perfusion during operations on the thoracic aorta: factors influencing survival and neurologic outcome in 413 patients.**

Di Eusanio M<sup>1</sup>, Schepens MA, Morshuis WJ, Di Bartolomeo R, Pierangeli A, Dossche KM.

**TABLE 1. Overview of the extent of aortic replacement (n = 413)**

Extent of replacement	No.	%
Ascending aorta + hemiarch	214	51.8
Ascending aorta + total arch	138	33.4
Total thoracic aorta	18	4.4
Arch + descending aorta	13	3.1
Isolated arch	24	5.8
Others	6	1.5

**Di Eusanio 2002: 413 Arch Repairs**

**Open arch reconstruction in the endovascular era: analysis of 721 patients over 17 years.**

Patel HJ<sup>1</sup>, Nguyen C, Diener AC, Passow MC, Salata D, Deeb GM.

**Intraoperative variables**

Aortic valve/root replacement	403 (55.9%)
Aortic valve resuspension	222 (30.1%)
Isolated arch procedure	14 (1.9%)
Extended arch procedure	308 (42.7%)
Innominate artery bypass	296 (41.1%)
Left carotid artery bypass	216 (30.0%)
Left subclavian artery bypass	75 (10.4%)
Descending aortic repair	24 (3.3%)
Elephant trunk procedure	42 (5.8%)

**Patel 2011: 721 Arch repairs**

→ Multiple approaches to thoracic aortic repair are needed

Extent of the aortic pathology determines approach...

... but not only

## ACCF/AHA Guideline

### **2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease**

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine



European Heart Journal (2014) **35**, 2873–2926  
doi:10.1093/eurheartj/ehu281

**ESC GUIDELINES**

## **2014 ESC Guidelines on the diagnosis and treatment of aortic diseases**

**Document covering acute and chronic aortic diseases of the thoracic  
and abdominal aorta of the adult**

**The Task Force for the Diagnosis and Treatment of Aortic Diseases  
of the European Society of Cardiology (ESC)**



## ACCF/AHA Guideline

### 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease

A Report of the American College of Cardiology Foundation/American Heart Association  
Task Force on Practice Guidelines, American Association for Thoracic Surgery, American  
College of Radiology, American Stroke Association, Society of Cardiovascular  
Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of  
Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine

**Aneurysms of the aortic Arch...** the indications for

operative intervention in the



patients are **those of the adjacent aortic segment**

2014 ESC Guidelines on the diagnosis and  
treatment of aortic diseases

Document covering acute and chronic aortic diseases of the thoracic  
and abdominal aorta of the adult

The Task Force for the Diagnosis and Treatment of Aortic Diseases  
of the European Society of Cardiology (ESC)

# Neurologic and endorgan protection

- Aortic arch surgery = neurologic and endorgan protection
- Consensus on hypothermia

Category	Nasopharyngeal temperature
Profound hypothermia	≤14 °C
Deep hypothermia	14.1-20 °C
Moderate hypothermia	20.1-28 °C
Mild hypothermia	28.1-34 °C

Tristan D. Yan, Paul G. Bannon, Joseph Bavaria et al: Consensus on hypothermia in aortic arch surgery  
Ann Cardiothorac Surg 2013;2(2):163-168

- Axillary cannulation, Antegrade SCP and moderate HCA > to DHCA in terms of strokes ++

Systematic Review

**A meta-analysis of deep hypothermic circulatory arrest versus moderate hypothermic circulatory arrest with selective antegrade cerebral perfusion**

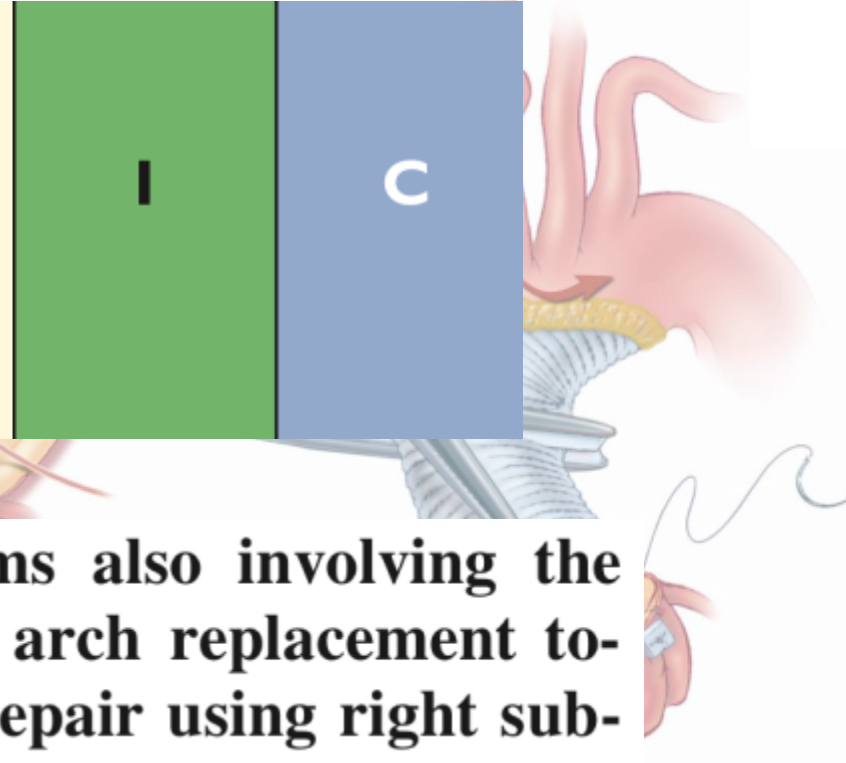
David H. Tian<sup>1</sup>, Benjamin Wan<sup>1</sup>, Paul G. Bannon<sup>1,2</sup>, Martin Misfeld<sup>3</sup>, Scott A. LeMaire<sup>4,5</sup>, Teruhisa Kazui<sup>6</sup>, Nicholas T. Kouchoukos<sup>7</sup>, John A. Elefteriades<sup>8</sup>, Joseph Bavaria<sup>9</sup>, Joseph S. Coselli<sup>10</sup>, Randall B. Griepp<sup>10</sup>, Friedrich W. Mohr<sup>1</sup>, Aung Oo<sup>11</sup>, Lars G. Svensson<sup>12</sup>, G. Chad Hughes<sup>13</sup>, Tristan D. Yan<sup>12</sup>

# Open surgical repair

## Hemiarch repair

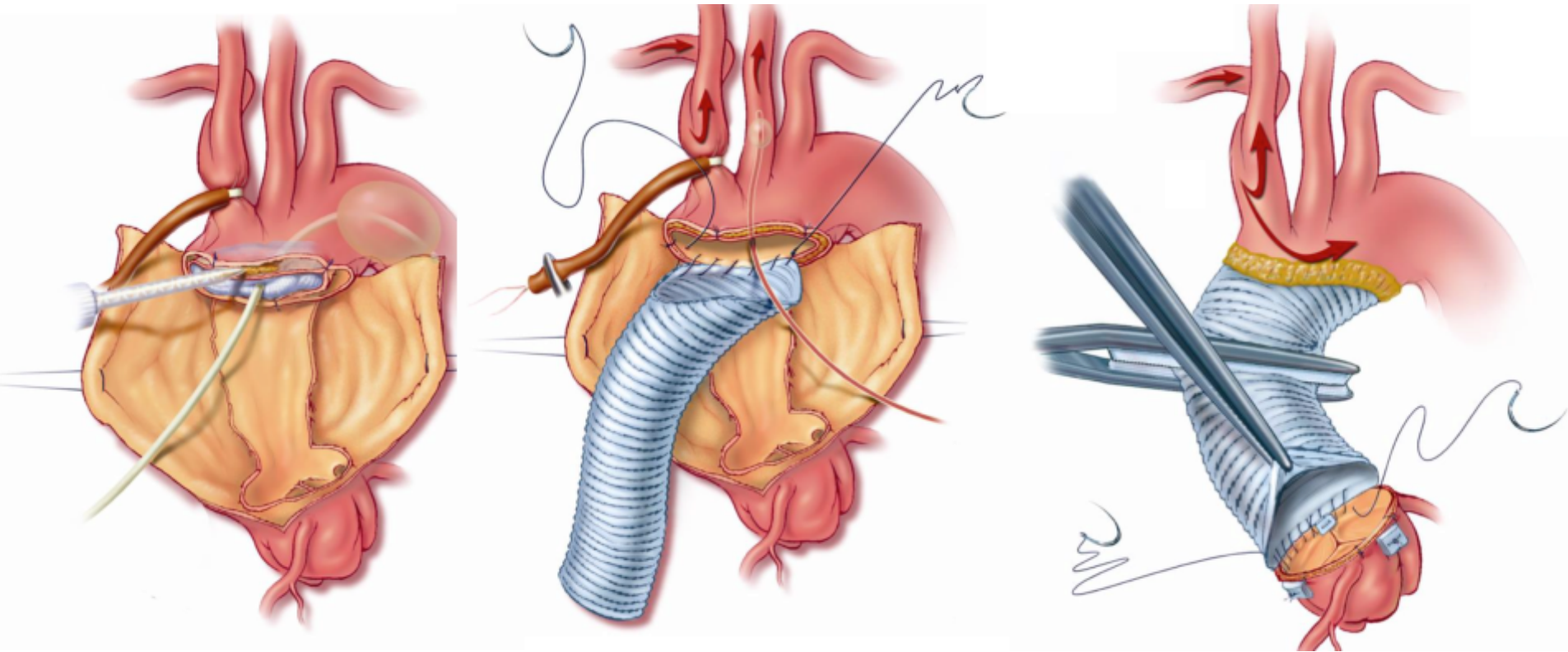
For repair of acute Type A AD, an open distal anastomotic technique avoiding aortic clamping (hemiarch/complete arch) is recommended.

**For thoracic aortic aneurysms also involving the proximal aortic arch, partial arch replacement together with ascending aorta repair using right subclavian/axillary artery inflow and hypothermic circulatory arrest is reasonable.<sup>222,449,450</sup> (*Level of Evidence: B*)**



# Open surgical repair

## Hemiarch repair



Acute Type A Dissection

Aneurysms involving the proximal aortic arch

# Open surgical repair

## Total Arch Repair

### ACCF/AHA Guideline

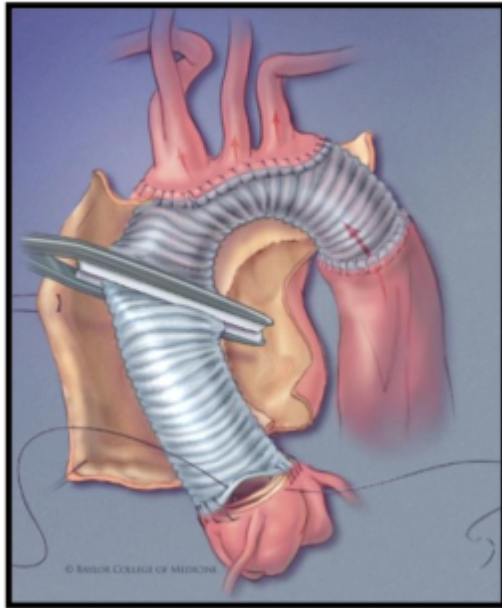
#### 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Interventional Radiology, Society of

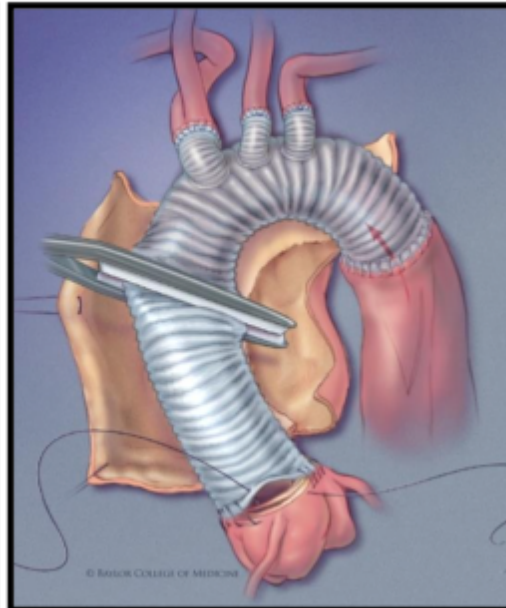
- 2. Replacement of the entire aortic arch is reasonable for acute dissection when the arch is aneurysmal or there is extensive aortic arch destruction and leakage.<sup>222,450</sup> (Level of Evidence: B)**
- 3. Replacement of the entire aortic arch is reasonable for aneurysms of the entire arch, for chronic dissection when the arch is enlarged, and for distal arch aneurysms that also involve the proximal descending thoracic aorta, usually with the elephant trunk procedure.<sup>451–453</sup> (Level of Evidence: B)**

# Open surgical repair

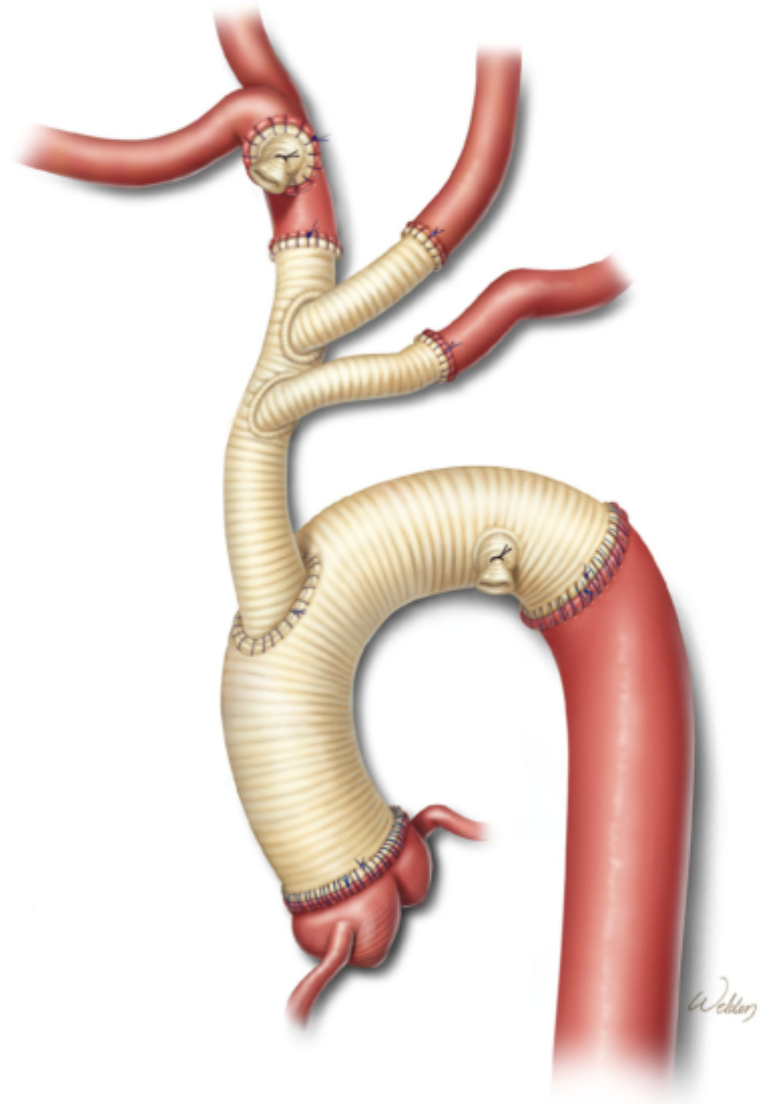
## Total Arch Repair



Island



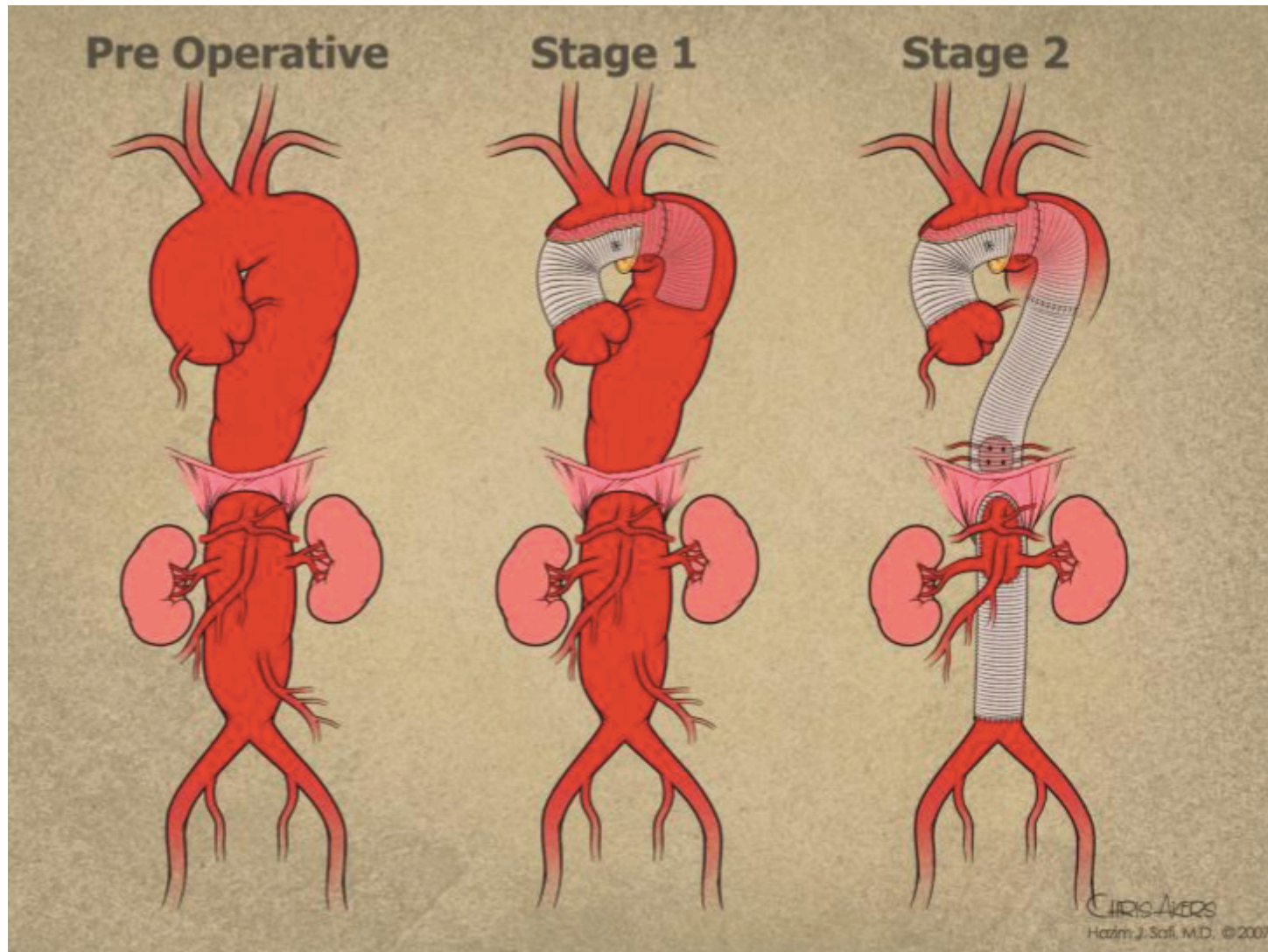
Branched



Y Graft

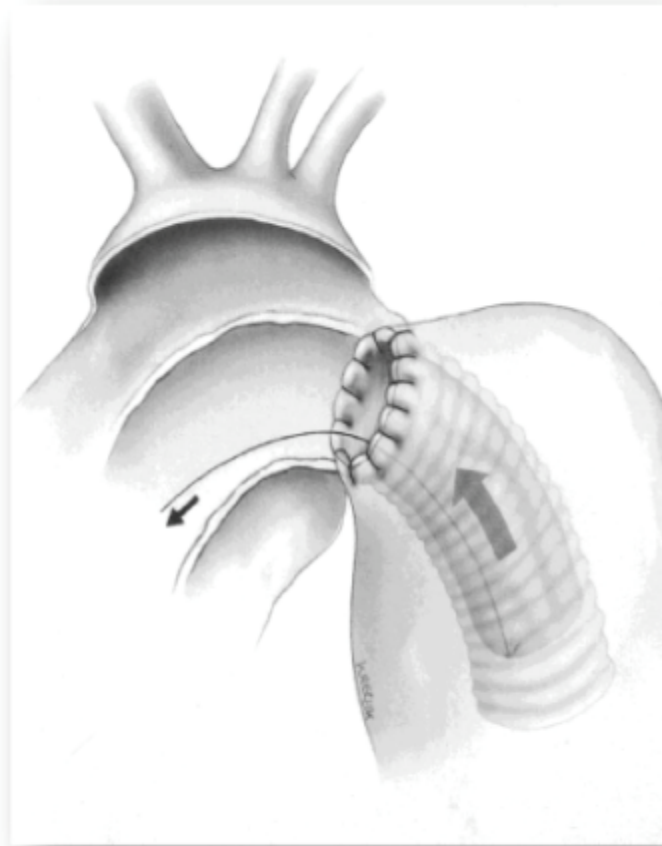
Open surgical repair

# Elephant Trunk Technique



# Open surgical repair

## Elephant Trunk Technique

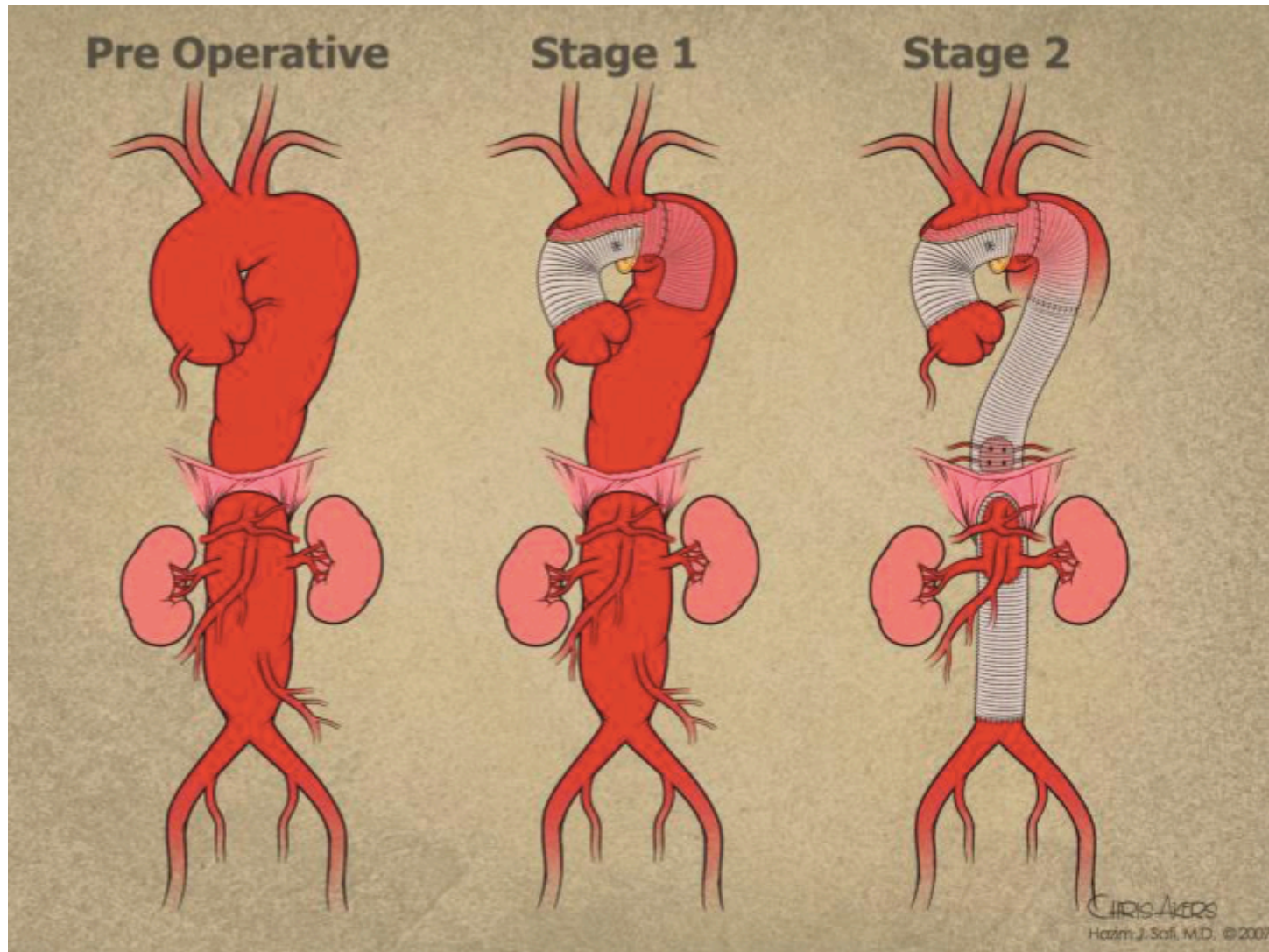


Borst HG et al. Extensive aortic replacement using the 'elephant trunk prosthesis' Thorac Cardiovasc Surg 1983; 31 (1): 37-40



Open surgical repair

# Elephant Trunk Technique



# Open surgical repair

## Elephant Trunk Technique

Review

Progress of the treatment for extended aortic aneurysms; is the frozen elephant trunk technique the next standard in the treatment of complex aortic disease including the arch?☆

Matthias Karck<sup>1,\*</sup>, Hiroyuki Kamiya

Table 1  
Surgical series of conventional elephant trunk technique

Author	Year	Mortality at first-stage ET	Patients underwent second-stage operation	Mortality at second-stage operation	Reference
Safi et al.	2007	16/254 (6.3%)	115/254 (45.3%)	11/115 (9.6%)	[3]
Coselli et al.	2006	18/148 (12.2%)	76/148 (51.4%)	3/76 (3.9%)	[4]
Svensson et al.	2005	2/94 (2.1%)	47/94 (50%)	4/47 (8.5%) including 7 pts. with stenting	[5]
Hanafusa et al. <sup>a</sup>	2002	1/12 (8.3)	0		[14]
Kuki et al.	2002	0/17 (0%)	9/17 (52.9%)	0/9 (0%)	[15]
Takahara et al.	2002	3/37 (8.1%)	0		[16]
Schepens et al.	2002	8/100 (8%)	44/100 (44%)	NA	[17]
Kirali et al. <sup>b</sup>	2002	9/28 (32.1%)	0		[18]
Naka et al.	1999	1/9 (11.1%)	6/9 (66.7%)	2/6 (33.3%)	[21]
Ando et al.	1998	2/15 (13.3%)	0		[22]
Heinemann, Borst et al.	1995	10/72 (13.9%)	24/72 (33.3)	NA	[12]
Total		70/786 (8.9%)	321/694 (46.3%)	20/268 (7.7%)	

<sup>a</sup> Ten patients with acute type A dissection, two with chronic type A dissection.

<sup>b</sup> All patients with acute type A dissection.

# Open surgical repair

## Elephant Trunk Technique

*Technical need for less invasive  
is  
A endo second stage...*

- In most recent series
  - Stage 1 Mortality: 0-32 %
  - Stage 2 Mortality: 0-10 %
  - Patients fail to return for stage 2
- **Significant difference** between stages 1 & 2 (20%)
- Many patients fail to return for stage 2 ET completion

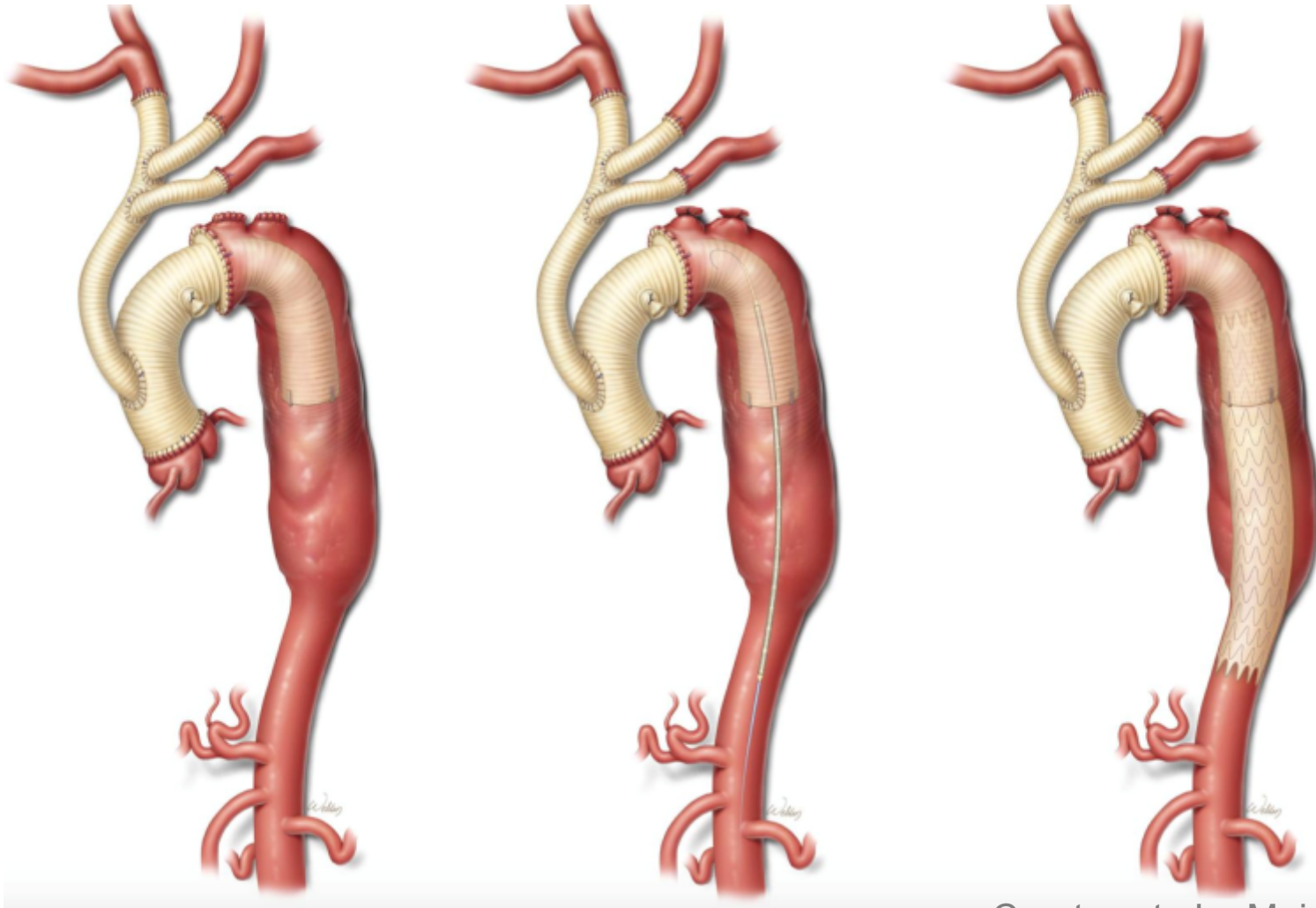
Open surgical repair

# Elephant Trunk Technique

*The First Idea*

*Hybrid Elephant Trunk*

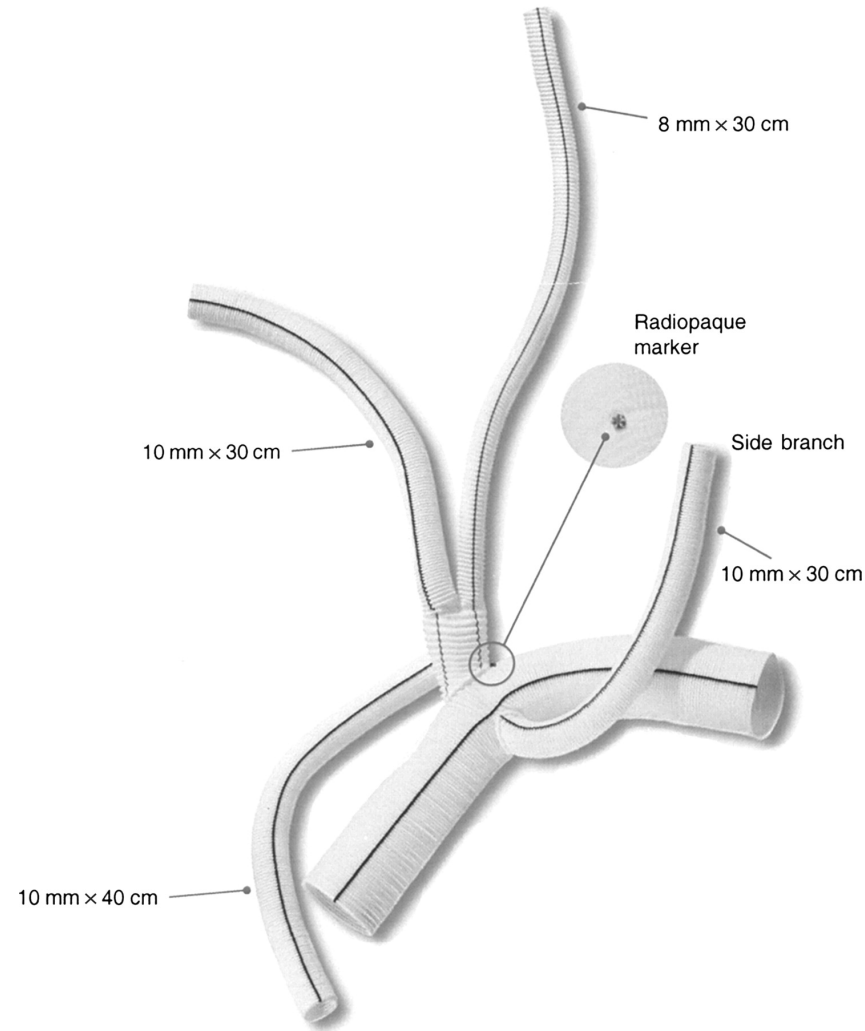
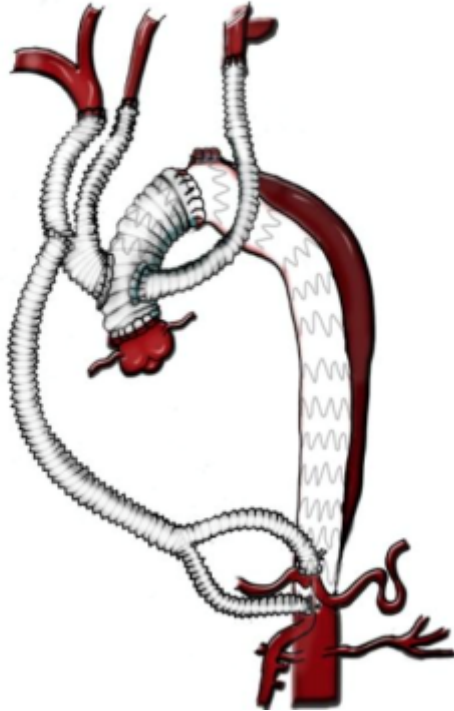
# Hybrid 2-stage Approach Elephant Trunk + TEVAR



Courtesy to Le Maire 2013

# Hybrid 2-stage Approach

## The Lupiae Technique



*Eur J Cardiothorac Surg.* 2012 Aug;42(2):242-7; discussion 247-8. doi: 10.1093/ejcts/ezr311. Epub 2012 Jan 30.

**Mid-term results of the Lupiae technique in patients with De Bakey Type I acute aortic dissection.**

Esposito G<sup>1</sup>, Cappabianca G, Ciano M, Gallo N, Labriola G, Pestrichella V, Contegiacomo G, Labriola C.

## Hybrid 2-stages approach

# Elephant Trunk + TEVAR

- 2<sup>nd</sup> Endo stage approach, presented as an interesting alternative to conventional ET
- However, descending thoracic aorta has a greater mobility
  - Endoleaks
  - Dacron injury related to the stent-graft
  - Infectious risk

# Hybrid 1-stage Approach

## Frozen Elephant Trunk Technique

J Thorac Cardiovasc Surg. 2015 Feb 7. pii: S0022-5223(15)00102-6. doi: 10.1016/j.jtcvs.2015.01.011

**The elephant trunk is freezing: The Hannover**

Shrestha M<sup>1</sup>, Beckmann E<sup>2</sup>, Krueger H<sup>2</sup>, [Fleissner](#) S<sup>2</sup>

Wartens A<sup>2</sup>.

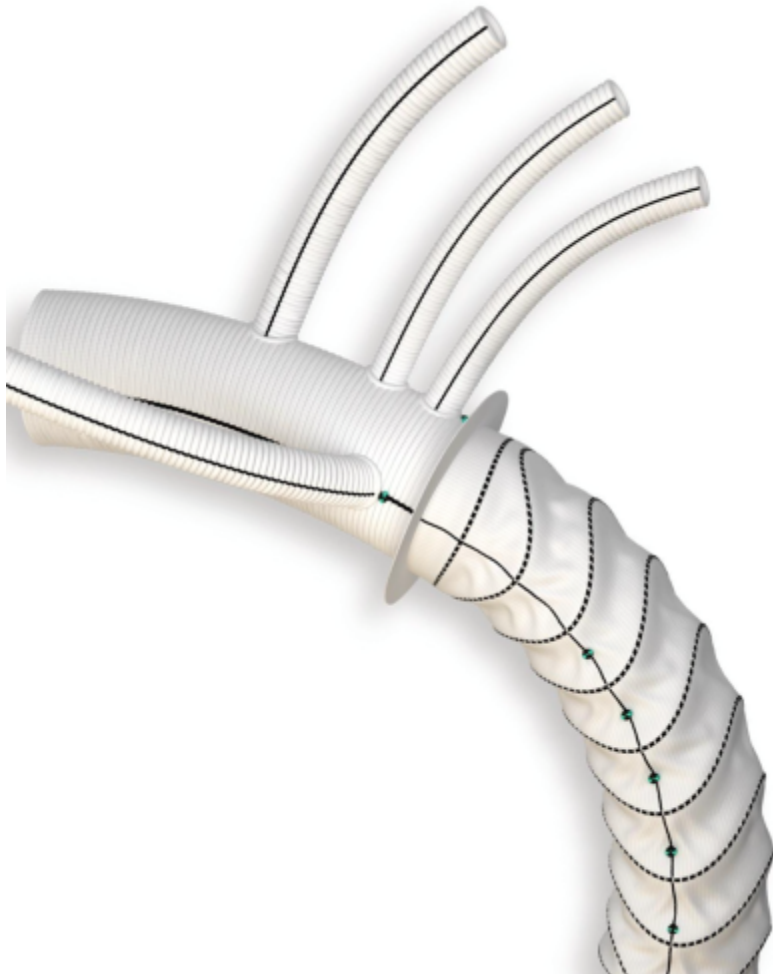
Finally a real one stage  
Technique...





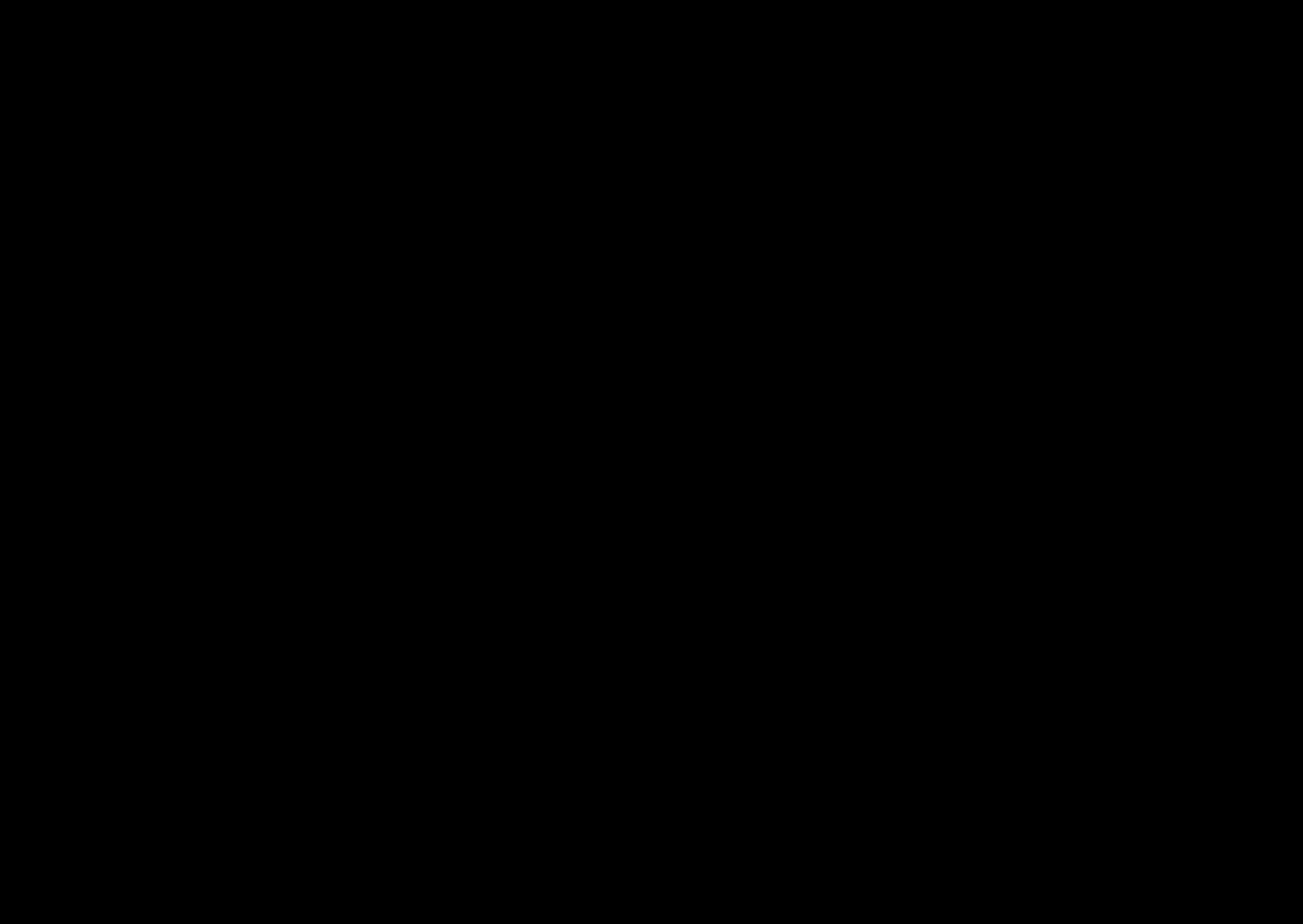
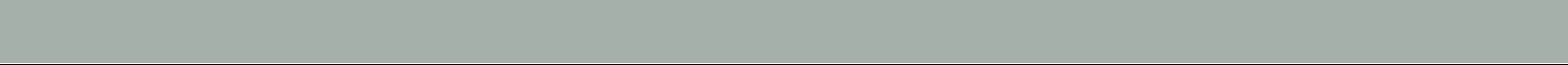
Hybrid 1-stage Approach

# Frozen Elephant Trunk Technique



JOTEC Evita Open Plus

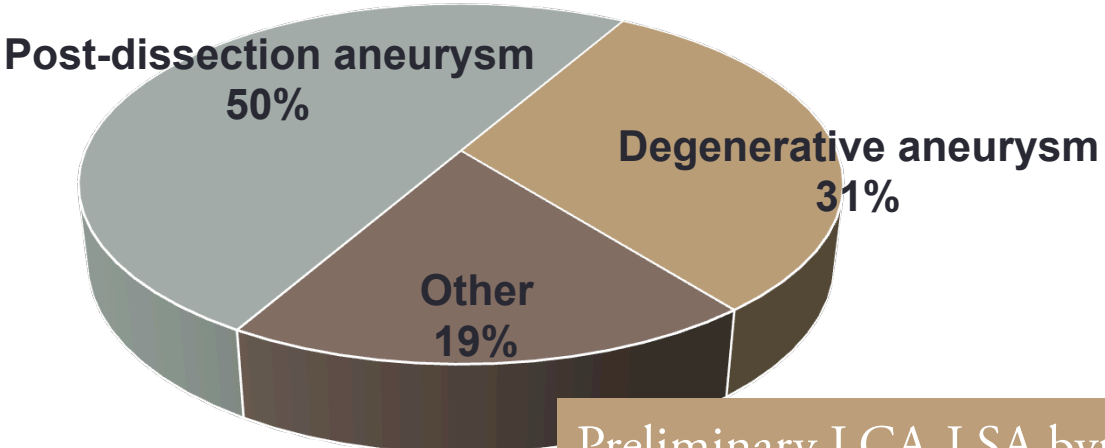
VASCUTEK Thoraflex



# ARCH New Open Evita

Single Center's experience in FET  
*part of the french NOE registry more  
than 90 patients between  
Feb. 2009 and Feb 2015.*

# Baseline (n =25)



**20 EVITA OPEN PLUS**  
**5 THORAFLEX**

Preliminary LCA-LSA bypass	4 (16%)
CPB time (min)	197 ± 44
SACP* time (min)	95 ± 29.5
Reimplantation of epiaortic vessels:	
- En bloc	18 (72%)
- Interposition graft	7 (28%)
Associated procedures	12 (48%)

\*SACP: Selective Antegrade Cerebral Perfusion.

# Early Clinical Results

✓ No cases of operative mortality

Revision for bleeding	4 (16%)
Delayed extubation	4 (16%)
Acute renal failure (transient)	5 (20%)
Recurrent nerve injury	2 (8%)
Sepsis	1 (4%)

➤ Cerebral Strokes: 0

➤ Spinal Cord Injuries: 3 (12%)

- Transient Paraparesis: 2

*Transient*

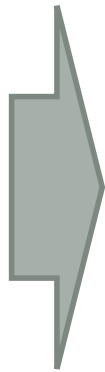
- Brown-Séquard syndrome: 1

*Permanent*

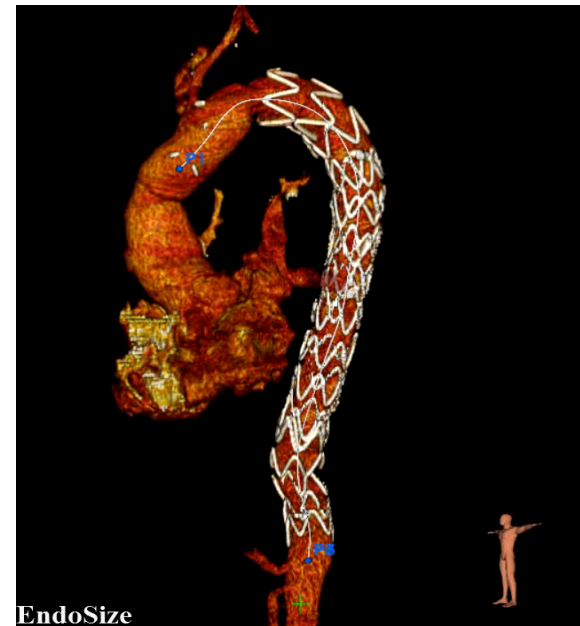
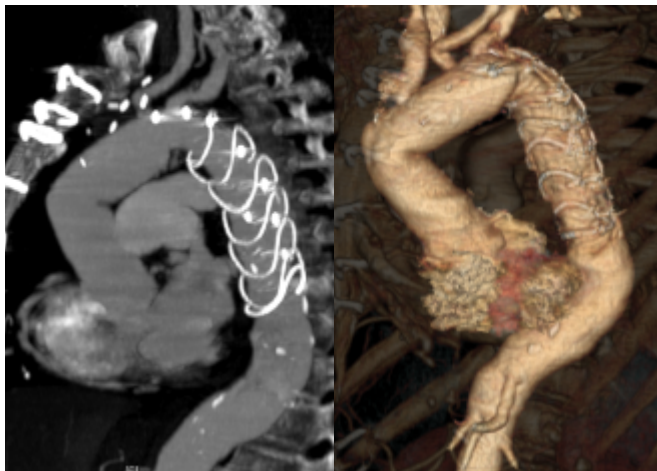
4% All Permanent  
Spinal Cord Injuries

# Follow-up Results

- ✓ Average FU duration:  $18 \pm 8.6$  months
- ✓ No cases of late mortality
- ✓ No cases of endoleak / endotension
- ✓ One late aortic reoperation



- ✓ FET is confirmed feasible and reliable for the treatment of extensive aortic pathology.
- ✓ Availability of alternative devices allow better adaptation to each patient's characteristics.



# Hybrid Approach

## Frozen Elephant Trunk Technique

Eur J Cardiothorac Surg. 2014 May;45(5):812-7. doi: 10.1093/ejcts/ezt477. Epub 2013 Sep 26.

**Mid-term results of elective repair of extensive thoracic aortic pathology by the Evita Open Plus hybrid endoprosthesis only.**

Verhoye JP<sup>1</sup>, Anselmi A, Kaladji A, Flécher E, Lucas A, Heautot JF, Beneux X, Fouquet O.

Ann Vasc Surg. 2015 Feb 26. pii: S0890-5096(15)00126-0. doi: 10.1016/j.avsg.2014.12.023. [Epub ahead of print]

**Combined Frozen Elephant Trunk and Endovascular Repair for Extensive Thoracic Aortic Aneurysms.**

Anselmi A<sup>1</sup>, Ruggieri VG<sup>1</sup>, Harmouche M<sup>1</sup>, Fouquet O<sup>2</sup>, Kaladji A<sup>1</sup>, Flécher E<sup>1</sup>, Beneux X<sup>3</sup>, Lucas A<sup>1</sup>, Verhoye JP<sup>4</sup>.

J Thorac Cardiovasc Surg. 2015 Mar 19. pii: S0022-5223(15)00431-6. doi: 10.1016/j.jtcvs.2015.03.018. [Epub ahead of print]

**Multibranched hybrid device for frozen elephant trunk: What does it change?**

Ruggieri VG<sup>1</sup>, Vola M<sup>2</sup>, Anselmi A<sup>2</sup>, Verhoye JP<sup>2</sup>.



# European Registry on Acute Complicated Type B

Eur J Cardiothorac Surg. 2015 Jan;47(1):106-14; discussion 114. doi: 10.1093/ejcts/ezu067. Epub 2014 Mar 5.

## The frozen elephant trunk technique for the treatment of complicated type B aortic dissection with involvement of the aortic arch: multicentre early experience.

Weiss G<sup>1</sup>, Tsagakis K<sup>2</sup>, Jakob H<sup>2</sup>, Di Bartolomeo R<sup>3</sup>, Pacini D<sup>3</sup>, Barberio G<sup>3</sup>, Mascaro J<sup>4</sup>, Mestres CA<sup>5</sup>, Sioris T<sup>6</sup>, Grabenwoger M<sup>7</sup>.

### Author information

#### Abstract

**OBJECTIVES:** Providing effective treatment for complicated type B aortic dissection (AD) with concomitant pathologies of the aortic arch or ascending aorta is challenging, especially if the aortic anatomy is contraindicated for thoracic endovascular aortic repair (TEVAR). We present the early results of a multicentre study using the frozen elephant trunk (FET) technique for type B AD.

**METHODS:** From January 2005 to March 2013, data from 465 patients who had undergone treatment with the FET technique were collected in the database of the International E-vita Open Registry. From this cohort, 57 patients who had a primary indication for surgery for type B AD were included in the present study. Their mean age was 58±12 years, and 72% had a chronic dissection. All operations were performed in circulatory arrest and bilateral antegrade cerebral perfusion. Computed aortic imaging was performed for false lumen (FL) evaluation during the follow-up.

**RESULTS:** The in-hospital mortality rate was 14% (8/57). Stroke and spinal cord injury occurred in 6 (10%) and 2 patients (4%), respectively. The rate of immediate FL thrombosis at the level of the stent graft was 75% (40/53) and increased to 97% (41/42) during the follow-up period (23±19 months). Distally, at the level of the abdominal aorta, the FL remained patent in 50% (21/42) of patients. The 1- and 3-year survival was 81 and 75%, respectively.

**CONCLUSION:** The FET technique is a feasible therapeutic option for complicated type B AD with involvement of the aortic arch if TEVAR is contraindicated. In contrast to conventional aortic surgery via a lateral thoracotomy, the FET procedure can provide simultaneous treatment of the ascending aorta and aortic arch.

# European Registry for Chronic Diseases

*Ann Thorac Surg.* 2011 Nov;92(5):1663-70; discussion 1670. doi: 10.1016/j.athoracsur.2011.06.027. Epub 2011 Oct 31.

## The frozen elephant trunk for the treatment of chronic dissection of the thoracic aorta: a multicenter experience.

Pacini D<sup>1</sup>, Tsagakis K, Jakob H, Mestres CA, Armaro A, Weiss G, Grabenwoger M, Borger MA, Mohr FW, Bonser RS, Di Bartolomeo R.

### Author information

#### Abstract

**BACKGROUND:** Because of the extensive involvement of the aorta, surgical treatment of its chronic dissection continues to represent a surgical challenge. We conducted a study of a multicenter experience to describe a multicenter experience in the treatment of this complex pathology, using the frozen elephant trunk (FET) technique.

**METHODS:** Between January 2005 and May 2010, 240 patients underwent treatment with the FET technique and had their clinical data collected in the International E-vita Open Registry. Ninety of the patients, who were the population in the present study, underwent operations for chronic dissection of the aorta (type A, 77%). The mean age of these 90 patients was  $57 \pm 12$  years, and 72 (80%) of the patients were male. Sixty-two patients (69%) had undergone a previous aortic operation. All of the procedures in the study were performed with the aid of antegrade selective cerebral perfusion.

**RESULTS:** Total replacement of the aortic arch was done in 84 patients (93%). Cardiopulmonary bypass, myocardial ischemia, cerebral perfusion, and visceral ischemia times were  $243 \pm 65$ ,  $145 \pm 48$ ,  $86 \pm 24$ , and  $75 \pm 22$  minutes, respectively. In-hospital mortality was 12% (11 patients). One patient died from a stroke and 8 patients (9%) died from ischemic spinal cord injury. The false lumen (FL) in the patients' aortae was evaluated with computed tomography after operation and during follow up. The rates of complete thrombosis of the FL around the elephant trunk were 69% and 79% at the first and last postoperative examinations, respectively. The rates of 4-year survival and freedom from aortic reoperation were  $78\% \pm 5\%$  and  $96\% \pm 3\%$ , respectively.

**CONCLUSIONS:** The treatment of chronic aortic dissection (AD) with the FET technique is feasible, with respectable results. The rate of aortic reoperation with the use of this technique appears to be lower than that with a conventional approach to the repair of chronic AD. Ischemic spinal cord injury represents a concerning complication of the FET technique but seems to be unrelated to thrombosis of the FL.

## **Current status and recommendations for use of the frozen elephant trunk technique: a position paper by the Vascular Domain of EACTS<sup>†</sup>**

Malakh Shrestha<sup>a</sup>, Jean Bachet<sup>b</sup>, Joseph Bavaria<sup>c</sup>, Thierry P. Carrel<sup>d</sup>, Ruggero De Paulis<sup>e</sup>, Roberto Di Bartolomeo<sup>f</sup>, Christian D. Etz<sup>g</sup>, Martin Grabenwöger<sup>h</sup>, Michael Grimm<sup>i</sup>, Axel Haverich<sup>a</sup>, Heinz Jakob<sup>j</sup>, Andreas Martens<sup>a</sup>, Carlos A. Mestres<sup>k,l</sup>, Davide Pacini<sup>f</sup>, Tim Resch<sup>m</sup>, Marc Schepens<sup>n</sup>, Paul P. Urbanski<sup>o</sup> and Martin Czerny<sup>p,q,\*</sup>

# Hybrid Approach

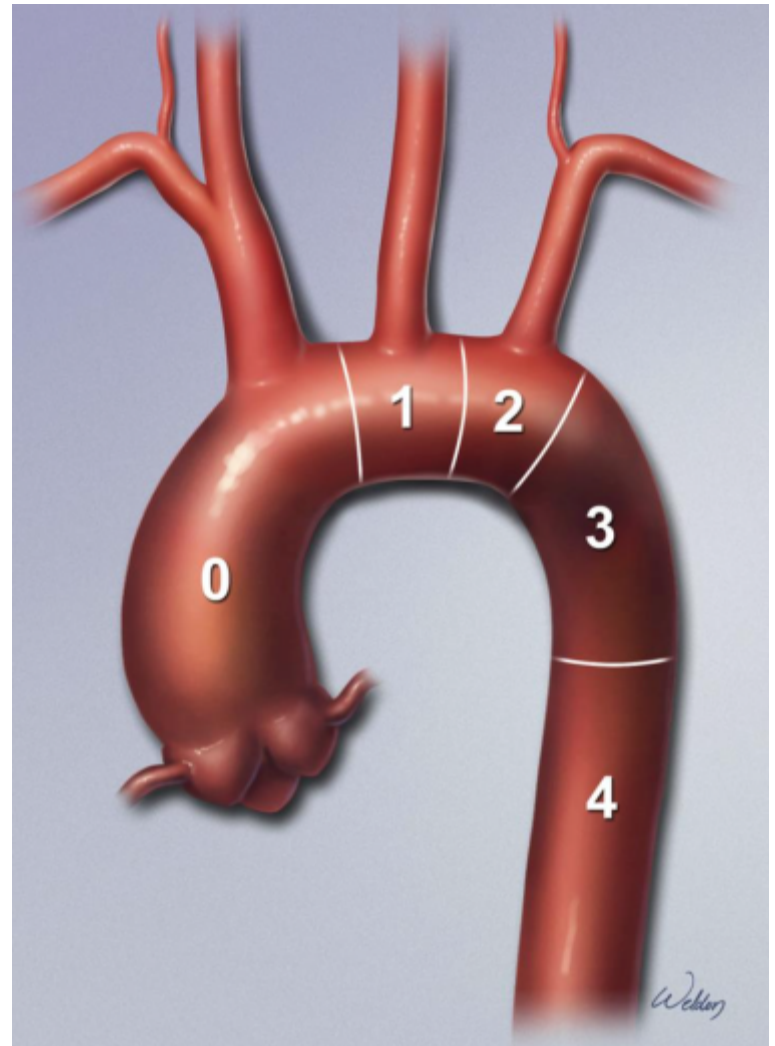
## Debranching Arch and Endovascular Procedures

### Plus

- Less invasive
- May reduce cardiac ischemia
- Facilitate extensive repair
- Flexibility

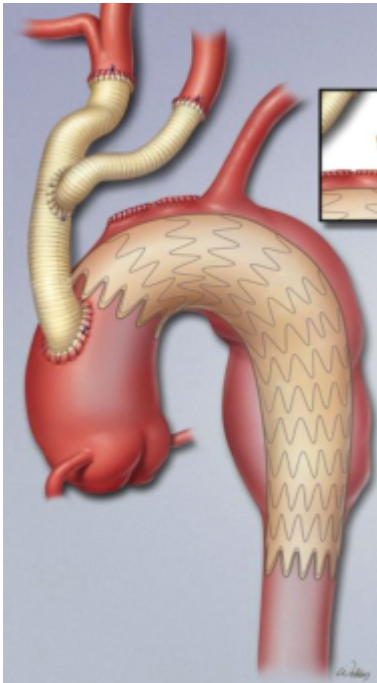
*Select landing zone*

*Antegrade or retrograde deployment*



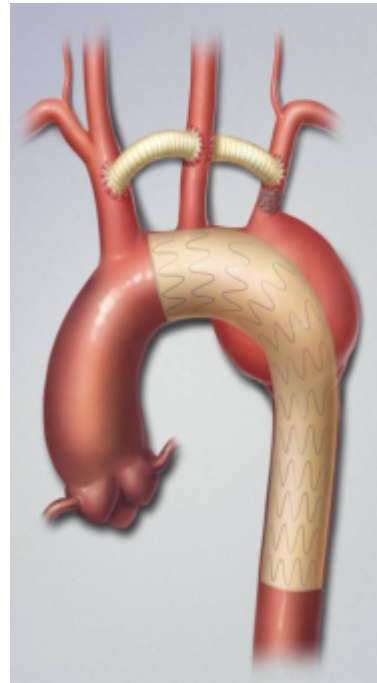
# Arch Landing Zone

## Zone 0



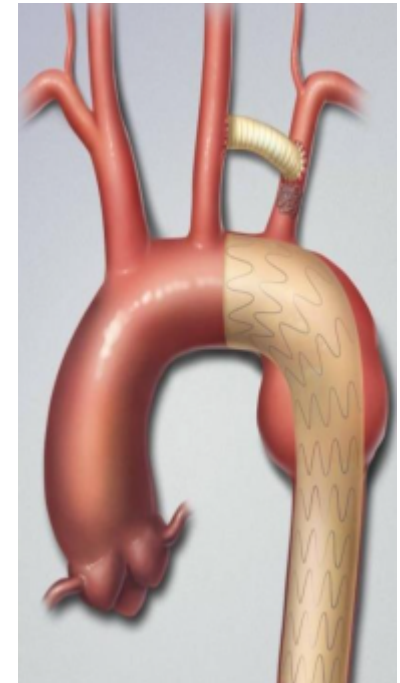
*Full debranching*  
*Median sternotomy*  
*May be done off-pump and*  
*without HCA*

## Zone 1

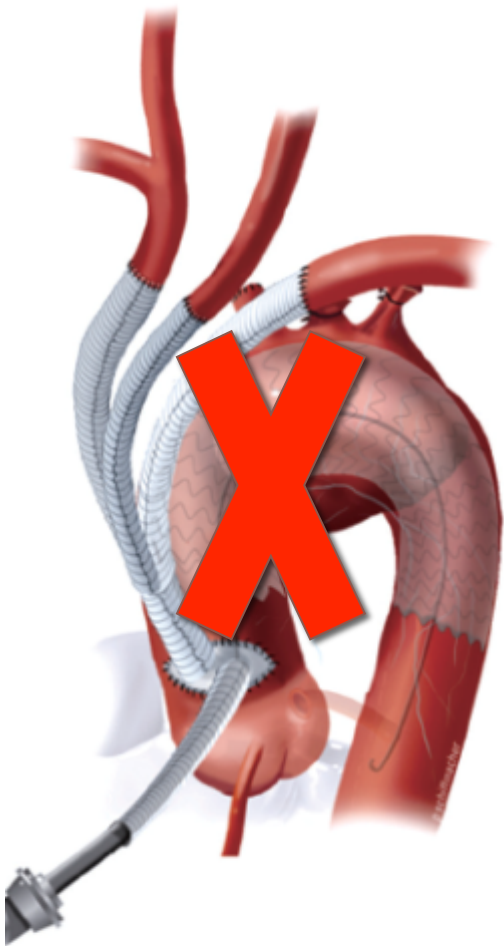


*Part debranching approach*  
*Usually no sternotomy*  
*May be done Off pump without*  
*HCA*

## Zone 2



*Revascularize LSCA*  
*No Sternotomy*  
*No CPB / HCA*



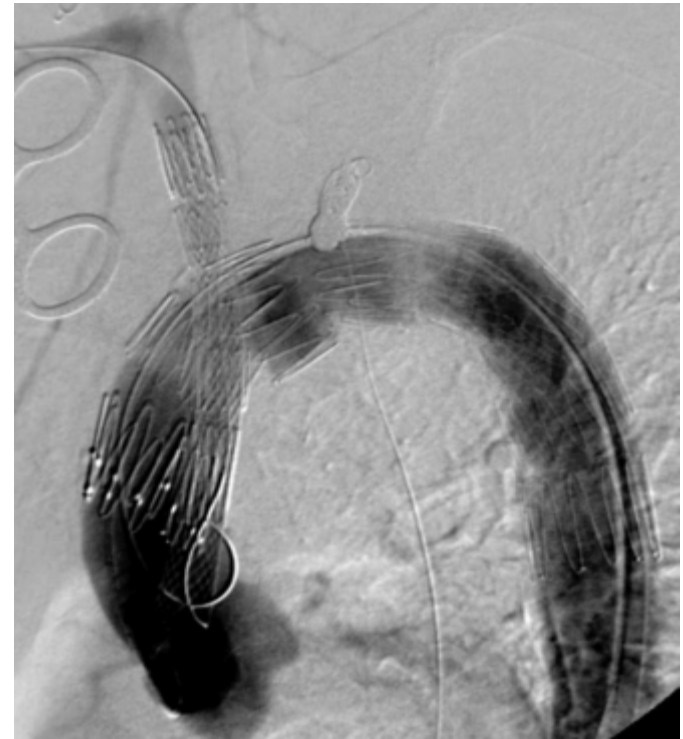
# Complete Endovascular Approaches for the Aortic Arch

- *Chimney grafts*

For High risk patients

Type I Endoleaks ++

Long term Fup



Thoracic endovascular aortic repair with the chimney graft technique

Wouter Hogendoorn, MD,<sup>a,b</sup> Felix J. V. Schlösser, MD, PhD,<sup>a</sup> Frans L. Moll, MD, PhD,<sup>b</sup>  
Bauer E. Sumpio, MD, PhD,<sup>a,c</sup> and Bart E. Muhs, MD, PhD,<sup>a,c</sup> New Haven, Conn; and Utrecht,

# Complete endovascular approaches for the aortic arch

- In situ Fenestration
  - Case reports ++
- Fenestrated / Branched Stent Grafts
  - Under investigation

## GLOBAL EXPERIENCE WITH AN INNER BRANCHED ARCH ENDOGRAFT

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# Conclusions

- Aortic arch surgery need to be practiced by very trained teams.
- A perfect approach of cerebral and spinal chord protection is mandatory.
- The current evolution of aortic arch surgery needs a smart knowledge of endovascular practice in order to limit a 2 stage surgery into a 1 secure and efficient procedure.
- More than ever, patient selection, clinical judgement and comorbidities evaluation are needed.
- hybride approach is now recommanded

# Je vous remercie

Should it rupture, it can cause uncontrollable bleeding. But fortunately, Mount Sinai is the recognized leader in the minimally invasive repair of aortic aneurysms. In fact, our team of specialists train doctors from all over the world to perform this groundbreaking procedure, which

enables patients to leave the hospital after only two days. So in addition to saving your life, there's an added bonus: You can get on with it almost immediately. 1-800-MD-SINAI. For a list of doctors, log onto [www.mountsinai.org](http://www.mountsinai.org). **Another day, another breakthrough.**

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AN ANEURYSM  
IS A DEATH SENTENCE.  
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YOU A PARDON.