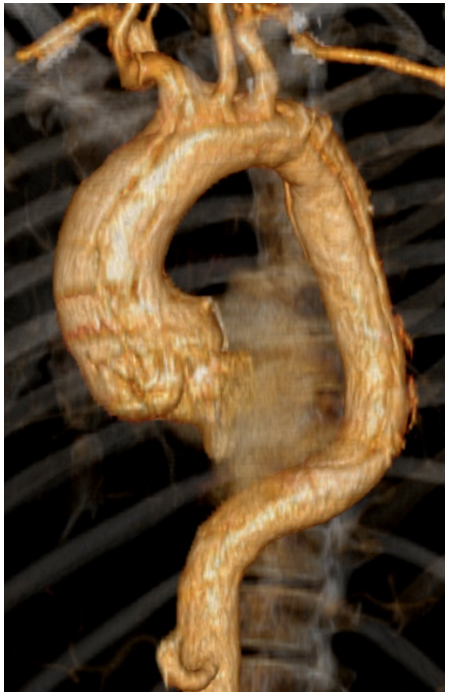
Ecocardiochirurgia
15-16 Ottobre 2015 - CASERTA

Arco Aortico ed Aorta Discendente: l'approccio chirurgico

Giampiero Esposito M.D.
Chief of Cardiac Surgery Unit
Humanitas Gavazzeni - Bergamo - Italy

HUMANITAS GAVAZZENI

EXTENSIVE AORTIC DISEASE (MegaAorticSyndrome)



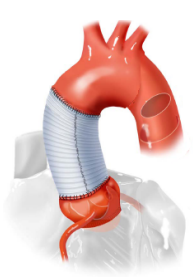

Extent and Type of Pathology determines "TAILORED" Approach

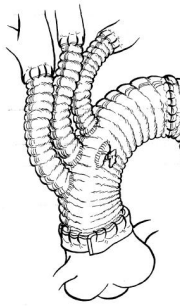
Complex Thoracic Aortic Aneurysms

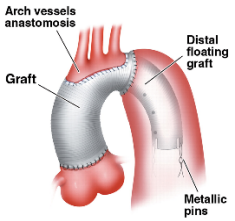
- Truly increasing incidence
- Better detection (Echo, CT-scan, MRI)
- Higher life expectancy
- Various available therapies (conventional surgery,hybrid surgery,endovascular techniques)
- Aortic Team should identify the best “tailored” approach in every single case analyzing patient & aortic disease characteristics.

Complex Thoracic Aortic Aneurysms: Tailored Approach

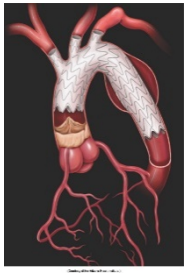
- Conventional Surgical Therapy



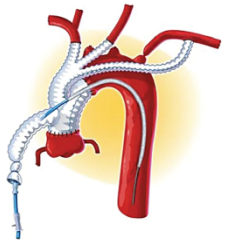


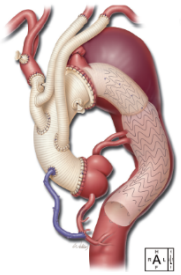


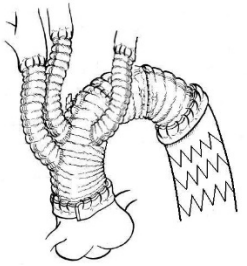
- Totally Endovascular Treatment



- Hybrid Surgical Therapy







Traditional Elephant Trunk Experience

ORIGINAL ARTICLES: CARDIOVASCULAR

The Elephant Trunk Technique for Staged Repair of Complex Aneurysms of the Entire Thoracic Aorta

Scott A. LeMaire, MD, Stacey A. Carter, BA, and Joseph S. Coselli, MD

Texas Heart Institute at St. Luke's Episcopal Hospital and the Division of Cardiothoracic Surgery, Baylor College of Medicine, Houston, Texas

Background. Extensive thoracic aortic aneurysms that involve the ascending, arch, and descending segments require challenging repairs associated with substantial morbidity and mortality. The purpose of this report is to evaluate contemporary outcomes after surgical repair of extensive thoracic aortic aneurysms using a two-stage approach with the elephant trunk technique.

Methods. During a 10½-year period, 168 consecutive patients underwent total aortic arch replacement using the elephant trunk technique. Seventy-six of these patients (51%, 76/148) returned for second-stage repair of the descending thoracic or thoracoabdominal aorta 4.9 ± 7.5 months after the first stage.

Results. Operative mortality after the proximal aortic stage was 12% (18/148). Seven patients (5%) had strokes. Among the patients who subsequently underwent distal aortic repair, operative mortality was 4% (3/76). Two patients (3%) developed paraplegia. Long-term survival after completing the second stage of repair was 70 ± 6% at 5 years and 59 ± 7% at 8 years.

Conclusions. Contemporary management of extensive thoracic aortic aneurysms using the two-stage elephant trunk technique yields acceptable short-term and long-term outcomes. This technique remains an important component of the surgical armamentarium.

(Ann Thorac Surg 2006;81:1561–8)

Extensive thoracic aortic aneurysms that involve the ascending, arch, and descending segments require challenging repairs associated with substantial morbidity and mortality. Since its introduction by Borst and colleagues in 1983 [1], staged repair using the elephant trunk technique has become the standard approach for managing these aneurysms. The key feature of this technique is that the distal anastomosis is constructed so that a portion of the graft is left suspended within the lumen of the proximal descending thoracic aorta; this "elephant trunk" is used during the subsequent distal aortic reconstruction, making aortic clamping safer and reducing aortic clamp time. The purpose of this report is to evaluate contemporary outcomes after open surgical repair of extensive thoracic aortic aneurysms using the two-stage approach with the elephant trunk technique.

Patients and Methods

Study Variables and Definitions

For this retrospective review, all preoperative, intraoperative, and postoperative data were retrieved from a prospectively maintained database. Among the preoperative variables, dissection was considered acute when patients underwent surgery within 14 days of the initial event; after 14 days, dissection was considered chronic. Aortic presentations were defined as patients requiring emergent or urgent operation because of acute dissection, free or contained rupture, or acute symptoms [2]. Preoperative renal failure was defined as patients receiving dialysis.

For distal aortic procedures, intraoperative variables included extent of repair, which was based on Crawford's original classification. Total clamp time was defined as the time between initial aortic clamping and the removal of all clamps, with restoration of normal blood flow to all vessels; this time was not adjusted when left heart bypass was used. Similarly, visceral and renal ischemic times were defined as the time between initial aortic clamping and the restoration of normal blood flow to the respective vessels; these times were not adjusted when left heart bypass or selective visceral-renal perfusion were used. As with all other continuous variables in this report, ischemic times are presented as mean ± standard deviation.

Regarding outcome variables, operative mortality was defined as death within 30 days of operation or during the initial hospitalization. Hospital-to-hospital transfer was not considered discharge; patients who died after being transferred were counted as operative deaths. Transfer to a nursing home or rehabilitation center was considered discharge, unless a patient died because of complications directly related to the operation [3]. Deaths and complications that occurred after distal repair but within 30 days of or during the initial hospitalization for proximal repair were counted against the second-stage procedure. All patients with postoperative neurologic deficits involving the lower extremities were included in

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Presented at the Fifty-first Annual Meeting of the Southern Thoracic Surgical Association, Cancun, Mexico, Nov 2–4, 2004.

Address correspondence to Dr LeMaire, Baylor College of Medicine, One Baylor Plaza, BCM 390, Houston, TX 77030; e-mail: slemaire@bcm.edu.

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doi:10.1016/j.athoracsur.2005.11.030

- **Despite acceptable outcomes, many patients fail to return for Stage 2 ET completion**
- ***39% did not complete distal aortic repair***
- **Mortality Stage 1→12%**
- **Mortality Stage 2→4%**

LeMaire ATS 2006

Outcomes regarding 148 patients that underwent Stage 1 ET repair

Mortality of Elephant Trunk

Cumulative Mortality Table Summary

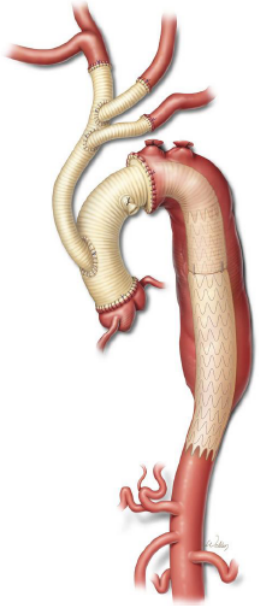
1st Stage Mortality	Interval or Nonreturning Mortality	2nd Stage Mortality	All Cause Total Mortality
2.3 – 13.9%	0 – 24.6%	0 – 10.0%	8.3 – 35.8%

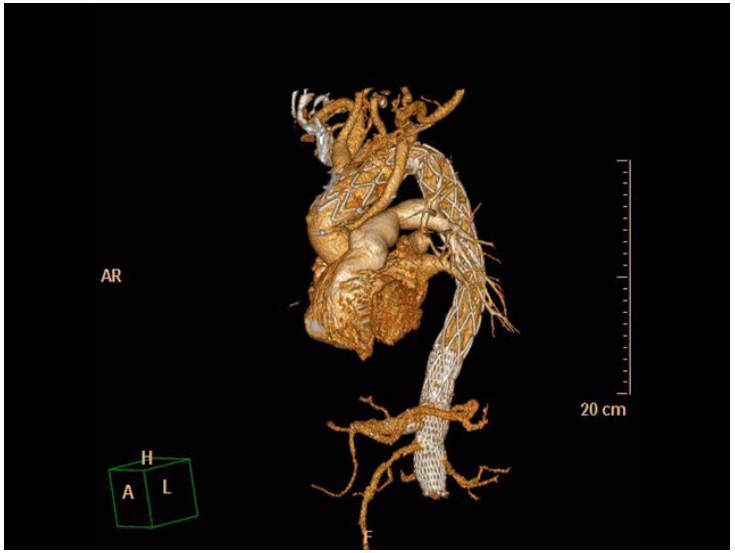
Etz et al, 2008
LeMaire et al, 2006
Svensson et al, 2004
Heinemann et al, 1995
Safi et al, 2005
Sundt et al, 2004

Contemporary Arch Series

- Elective Mortality 2 – 8%
- Stroke 2 – 7%
- 1-year survival 75-90%
- Typical perfusion times
  - Average cardiac ischemic time is 167minutes (range157-177)
  - Average cerebral ischemic time is 3 minutes (range 0-6)
  - Average ACP duration is 55 minutes (range 50-58)
  - Average bypass time is 261 minutes (range 242-280)

Kazui et al. J Thorac Cardiovasc Surg 2001;121:491-499
Strauch et al. Ann Thorac Surg 2004;77:581-590
Svensson et al. Ann Thorac Surg 2002; 74:2040-6
Safi et al. Circulation 2001;104:2938-2942
Spielvogel et al. Ann Thorac Surg 2005;80:90-95
Quinn et al. SCTS 2009





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

complications related to anticoagulation and reoperation, and life expectancy.[139]

For patients with aortic regurgitation associated with a bicuspid aortic valve, repair of the aortic valve with or without root remodeling or tailoring of the sinotubular junction is preferable if the valve is not severely fibrotic or calcified.[99,140] For patients with a dilated aortic root, particularly those with stenotic bicuspid valves, composite valve grafts containing either mechanical or biological valves are implanted.

Ascending aneurysms larger than 4.5 to 5.0 cm require repair or tube graft replacement when aortic valve repair or replacement is the primary indication for operation.[5] In elderly patients, ascending aortic aortoplasty when the aortic diameter does not exceed 5.0 cm may be an acceptable alternative.

Aortic Valve and Root: In pati
gitation and root dilatation, ao
sparing procedure may be the pr
with Marfan syndrome or with
gitation, a modification of the Da
may be considered. [94,95,97–99,447]
either biological or mechanical
option, particularly for valvular

9.2.2.2. Recommendations for A

Class IIa

1. **For thoracic aortic anei proximal aortic arch, pa gether with ascending ao clavian/axillary artery in culatory arrest is reas *Evidence: B)***
2. **Replacement of the entir for acute dissection when there is extensive aortic age.[222,450] (*Level of Eviden*)**
3. **Replacement of the entir for aneurysms of the enti tion when the arch is en aneurysms that also involv thoracic aorta, usually wi cedure.[451–453] (*Level of Ev*)**
4. **For patients with low o isolated degenerative or a the aortic arch is prese reasonable for asymptom ameter of the arch exc *Evidence: B)***
5. **For patients with isolated than 4.0 cm in diameter, using computed tomogra resonance imaging, at 12-month intervals, to detect enlargement of the aneurysm. (*Level of Evidence: C*)**
6. **For patients with isolated aortic arch aneurysms 4.0 cm or greater in diameter, it is reasonable to reimage using computed tomographic imaging or magnetic resonance imaging, at 6-month intervals, to detect enlargement of the aneurysm. (*Level of Evidence: C*)**

Aneurysms of the aortic arch are commonly associated with aneurysmal disease or dissection of the ascending aorta or the adjacent descending thoracic aorta, and the indications for operative intervention in these patients are those for the adjacent aortic segment. This relates to the need for hypothermic cardiopulmonary bypass and an interval of hypothermic circulatory arrest, and to higher operative mortality and stroke rates than those observed following operation for isolated aneurysms of the ascending or descending thoracic aorta.[451–459] As with ascending aneurysms, a growth rate of more than 0.5 cm/y in the absence of symptoms could be considered an indication for operation.

Symptoms associated with aortic arch aneurysms such as

The innominate, left carotid, and left subclavian arteries may require separate grafting. For short periods of circulatory arrest, the use of retrograde or antegrade brain perfusion has not conclusively been shown to add further brain protection; however, use of the subclavian or axillary artery bypass with a side graft reduces the risk of stroke.[449]

9.2.2.2.1. Open Surgery. At present, endovascular stent grafts have not been approved by the US Food and Drug Administration for treatment of aneurysms or other conditions of the aortic arch. For patients with large aneurysms who are not candidates for conventional open operation, experience is accumulating with operative procedures that involve translocation of the brachiocephalic arteries from the aortic arch using branch grafts from the proximal ascending aorta, and placement of an endovascular graft into the distal ascending aorta, the entire aortic arch, and a segment of the adjacent descending thoracic aorta.[371,460,461]

aortic graft are attached to normal segments of ascending and descending thoracic aorta.

An "elephant trunk" procedure has been used to reconstruct the arch and then provide a Dacron graft landing zone for endovascular stent graft treatment of descending thoracic aortic aneurysms (Figure 33).

2014 ESC Guidelines on the diagnosis and treatment of aortic diseases

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

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)

Authors/Task Force members: Raimund Erbel* (Chairperson) (Germany), Victor Aboyans* (Chairperson) (France), Catherine Boileau (France), Eduardo Bossone (Italy), Roberto Di Bartolomeo (Italy), Holger Eggebrecht (Germany), Arturo Evangelista (Spain), Volkmar Falk (Switzerland), Herbert Frank (Austria), Oliver Gaemperli (Switzerland), Martin Grabenwöger (Austria), Axel Haverich (Germany), Bernard Iung (France), Athanasios John Manolis (Greece), Folkert Meijboom (Netherlands), Christoph A. Nienaber (Germany), Marco Roffi (Switzerland), Hervé Rousseau (France), Udo Sechtem (Germany), Per Anton Sirnes (Norway), Regula S. von Allmen (Switzerland), Christiaan J.M. Vrints (Belgium).

**ESC Committee for Practice Guidelines (CPG): Jose Luis Zamorano (Chairperson) (Spain), Stephan Achenbach (Germany), Helmut Baumgartner (Germany), Jeroen J. Bax (Netherlands), Héctor Bueno (Spain), Veronica Dean (France), Christi Deaton (UK), Çetin Erol (Turkey), Robert Fagard (Belgium), Roberto Ferrari (Italy), David Hasdai (Israel), Arno Hoes (The Netherlands), Paulus Kirchhof (Germany/UK), Juhani Knuuti (Finland), Philippe Kolh

Recommendations for treatment of aortic dissection

Recommendations	Class[a]	Level[b]	Ref.[c]
In all patients with AD, medical therapy including pain relief and blood pressure control is recommended.	I	C	
In patients with Type A AD, urgent surgery is recommended.	I	B	1,2
In patients with acute Type A AD and organ malperfusion, a hybrid approach (i.e. ascending aorta and/or arch replacement associated with any percutaneous aortic or branch artery procedure) should be considered.	IIa	B	2,118, 202–204, 227
In uncomplicated Type B AD, medical therapy should always be recommended.	I	C	
In uncomplicated Type B AD, TEVAR should be considered.	IIa	B	218,219
In complicated Type B AD, TEVAR is recommended.	I	C	
In complicated Type B AD, surgery may be considered.	IIb	C	

[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting recommendations.
AD = aortic dissection; TEVAR = thoracic endovascular aortic repair.

Recommendations for surgical techniques in aortic disease

Recommendations	Class[a]	Level[b]	Ref.[c]
Cerebrospinal fluid drainage is recommended in surgery of the thoraco-abdominal aorta, to reduce the risk of paraplegia.	I	B	126–127
Aortic valve repair, using the re-implantation technique or remodelling with aortic annuloplasty, is recommended in young patients with aortic root dilation and tricuspid aortic valves.	I	C	
For repair of acute Type A AD, an open distal anastomotic technique avoiding aortic clamping (hemiarch/complete arch) is recommended.	I	C	
In patients with connective tissue disorders[d] requiring aortic surgery, the replacement of aortic sinuses is indicated.	I	C	
Selective antegrade cerebral perfusion should be considered in aortic arch surgery, to reduce the risk of stroke.	IIa	B	139,131, 134,141
The axillary artery should be considered as first choice for cannulation for surgery of the aortic arch and in aortic dissection.	IIa	C	
Left heart bypass should be considered during repair of the descending aorta or the thoraco-abdominal aorta, to ensure distal organ perfusion.	IIa	C	

[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting recommendations.
[d]Ehlers-Danlos IV -, Marfan- or Loeys-Dietz syndromes.

Hybrid Therapy: Definition

Combined endovascular and open surgical approach to the treatment of thoracic and thoracoabdominal aortic disease give the hope that these **"hybrid"** techniques might lower perioperative morbidity and mortality rates.

Medusa

Cerberus

Minotaurus

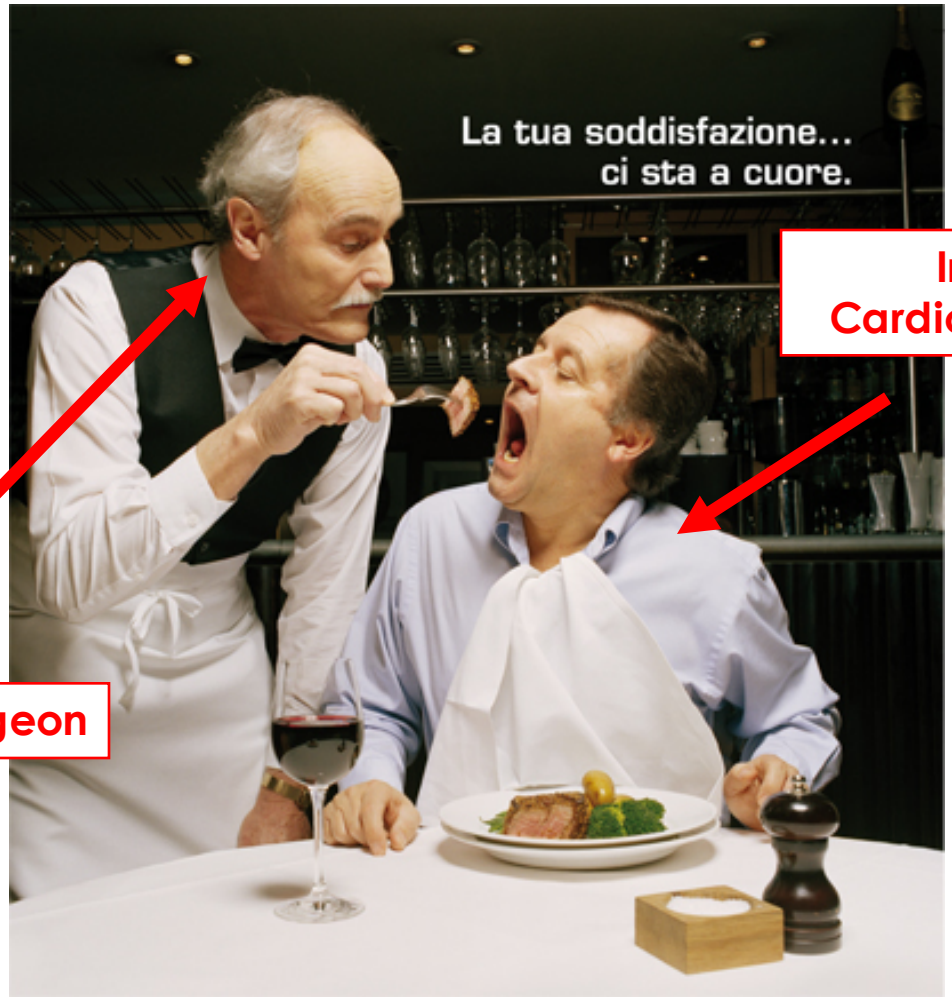
Centaurus

Progression 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?
M. Karck.
Eur. J. Cardiothorac. Surg. 2008; 33(6): 1007-13

Hybrid interventions for the treatment of the complex aortic arch.
Edward B. Diethrich.
Perspect Vasc Surg Endovasc Ther 2007; 19; 174

Hybrid Therapy: Definition

Complex aortic pathology could be amenable to easier thoracic aortic stentgraft after adequate and sometimes very hard "debranching" to create an optimal "landing zone"

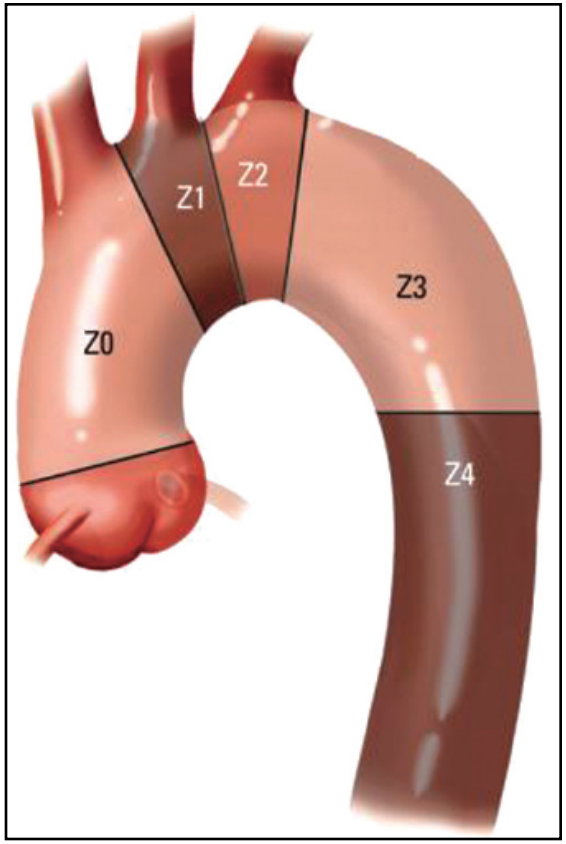


Interventional Cardiologist/Radiologist

Cardiovascular surgeon

Landing Zone Charateristics

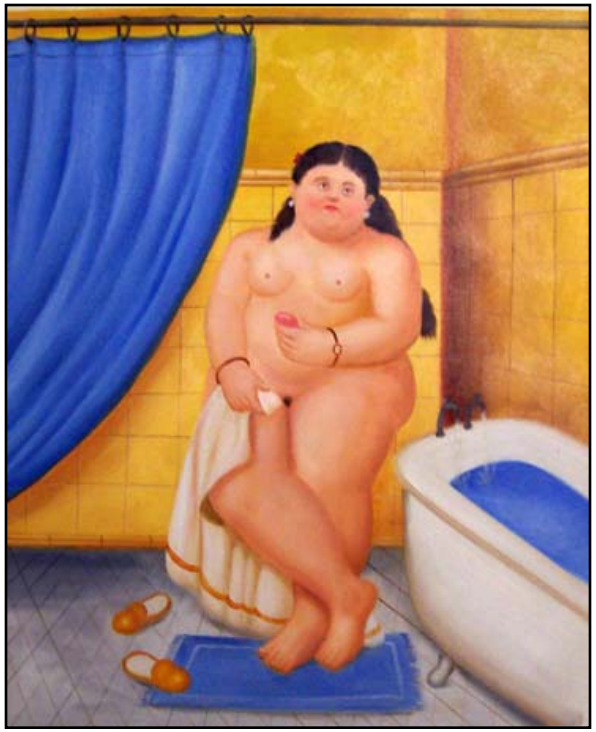
The quality of the ascending aorta as “proximal landing zone” and of the descending aorta as “distal landing zone” is a fundamental factor to consider in hybrid aortic repair.



Type II arch hybrid debranching procedure.
Vallabhajosyula P, Szeto WY, Bavaria JE et al.
Division of Cardiovascular Surgery, University of Pennsylvania Healt System, Philadelphia, USA.
Ann Cardiothorac Surg. 2013;2(3):378-86.

Landing Zone Charateristics

Short

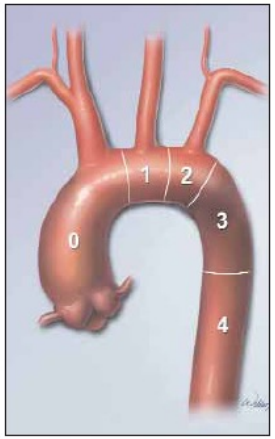


Unsafe

Ideal

1. More than **3,5 cm** in lenght
2. Less than **38 mm** in diameter
3. Good wall quality

1. **LONG**
2. **SAFE**
3. **STABLE**



Hybrid Therapy in MAS:

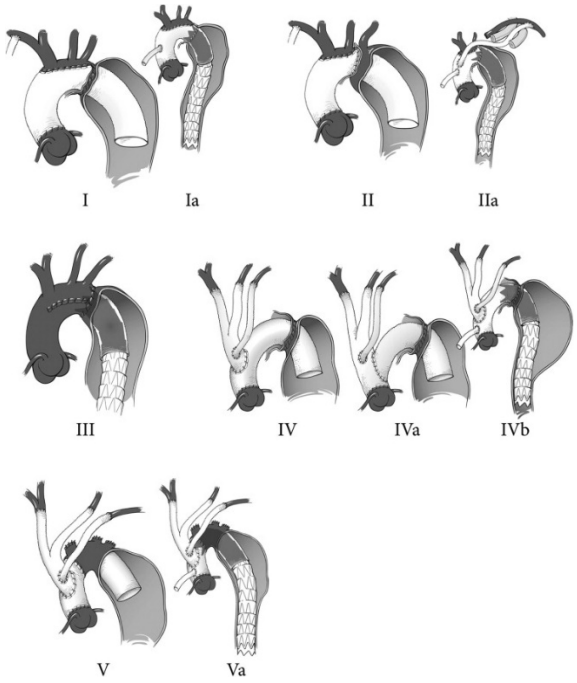
Cleveland Clinic Classification

Modifications, Classification, and Outcomes of Elephant-Trunk Procedures

Lars G. Svensson, MD, PhD, Gregory D. Rushing, MD, Edgardo Sepulveda Valenzuela, MD, Aldo E. Rafael, MD, Lillian H. Batizy, MS, Eugene H. Blackstone, MD, Eric E. Roselli, MD, A. Marc Gillinov, MD, Joseph F. Sabik, III, MD, and Bruce W. Lytle, MD

Department of Thoracic and Cardiovascular Surgery, Heart and Vascular Institute, Aorta Center, and Department of Quantitative Health Sciences, Research Institute, Cleveland Clinic, Cleveland, Ohio

(Ann Thorac Surg 2013;96:548–58)



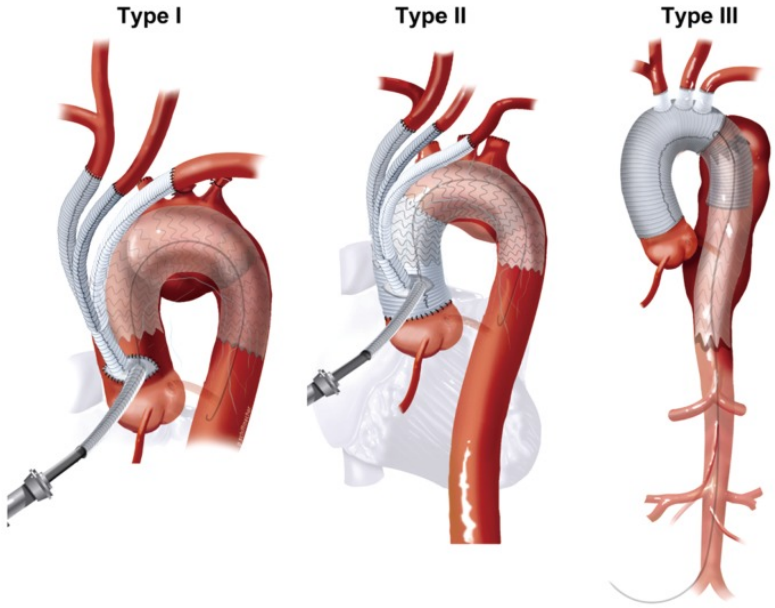
Penn University Classification

Type I and Type II hybrid aortic arch replacement: postoperative and mid-term outcome analysis

Prashanth Vallabhajosyula, Wilson Szeto, Nimesh Desai, Joseph E. Bavaria

Division of Cardiovascular Surgery, University of Pennsylvania Health System, Philadelphia, Pennsylvania, USA

Ann Cardiothorac Surg 2013;2(3):280-287



Hybrid Therapy in MAS:

Six-year experience with a hybrid stent graft prosthesis for extensive thoracic aortic disease: an interim balance[†]

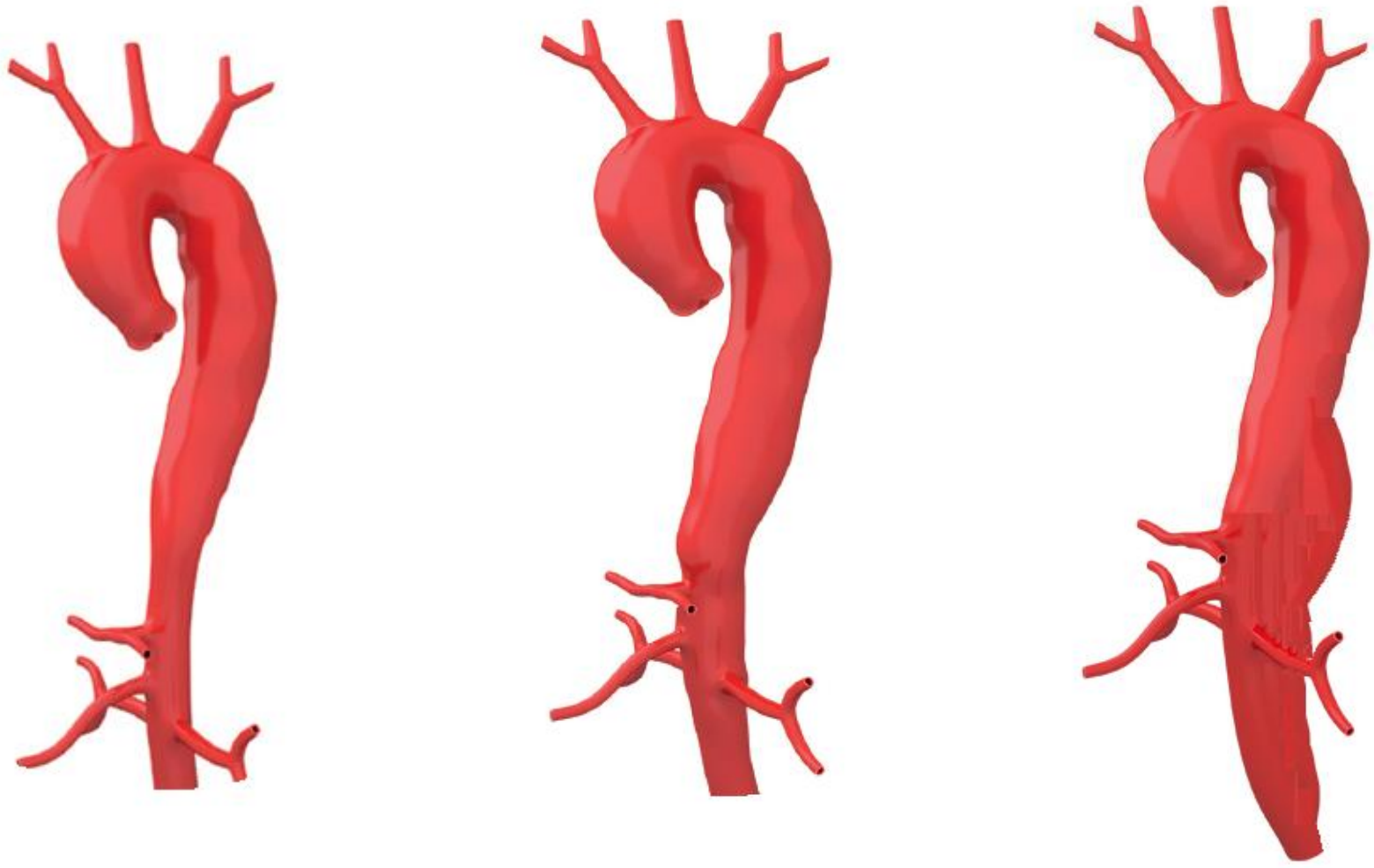
Heinz Jakob[a,*], Daniel-Sebastian Dohle[a], Jarowit Piotrowski[a], Jaroslav Benedik[a], Matthias Thielmann[a], Guenter Marggraf[a], Raimund Erbel[b] and Konstantinos Tsagakis[a]

[a] Department of Thoracic and Cardiovascular Surgery, West-German Heart Center, University of Duisburg-Essen, Essen, Germany
[b] Department of Cardiology, West-German Heart Center, University of Duisburg-Essen, Essen, Germany

* Corresponding author. Department of Thoracic and Cardiovascular Surgery, West-German Heart Center Essen, University Hospital Essen, Hufelandstr. 55, 45122 Essen, Germany. Tel: +49-201-7234900; fax: +49-201-7235451; e-mail: heinz.jakob@uk-essen.de (H. Jakob).

European Journal of Cardio-Thoracic Surgery 42 (2012) 1018–1025

MegaAorticSyndrome: Our "Hybrid" Classification



Type I

up to Coeliac Trunk

Type II

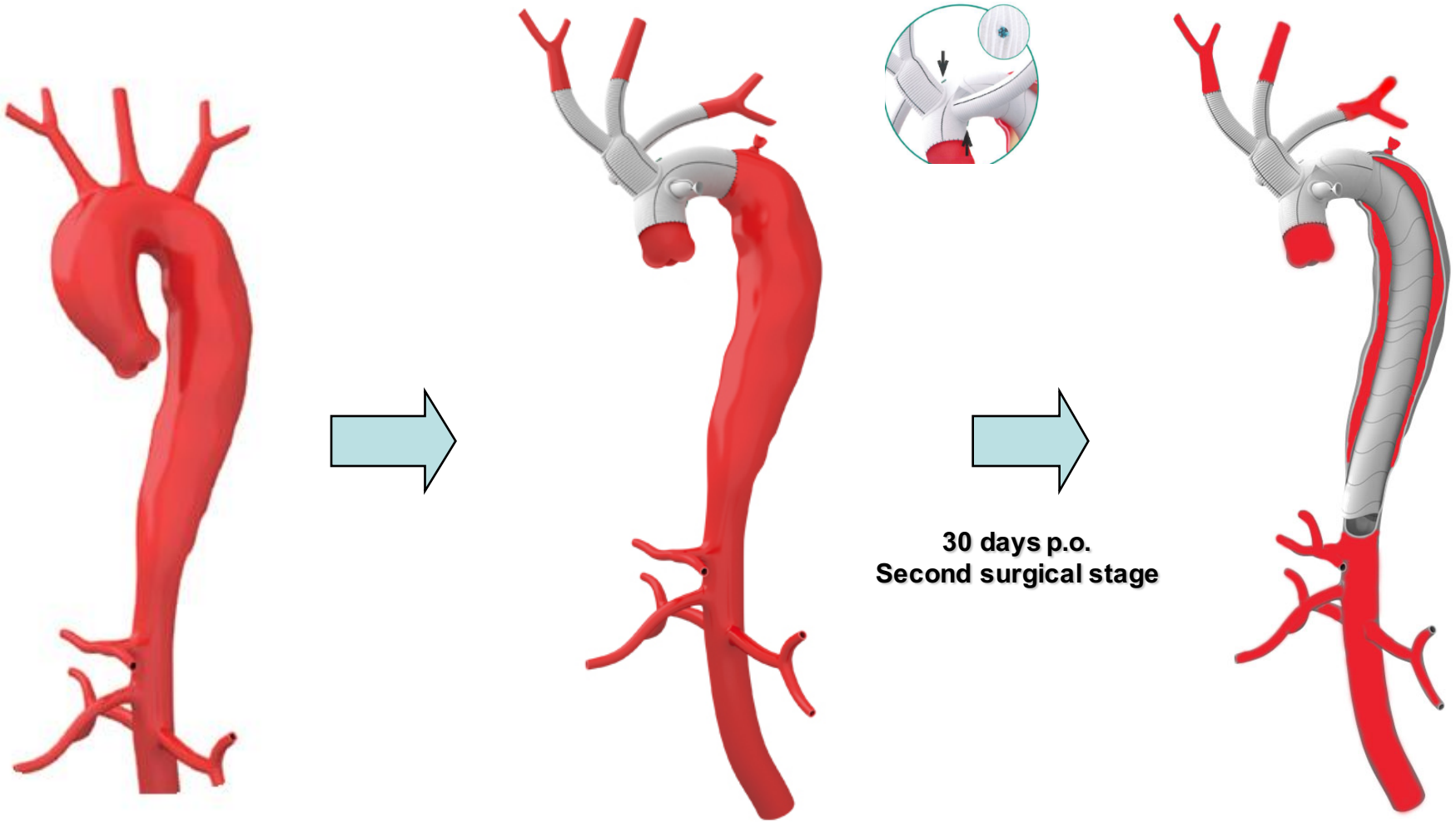
up to Renal Arteries

Type III

below to Renal Arteries

Esposito G. Cappabianca G et al: Innovations 2011; 6(6): 366-372

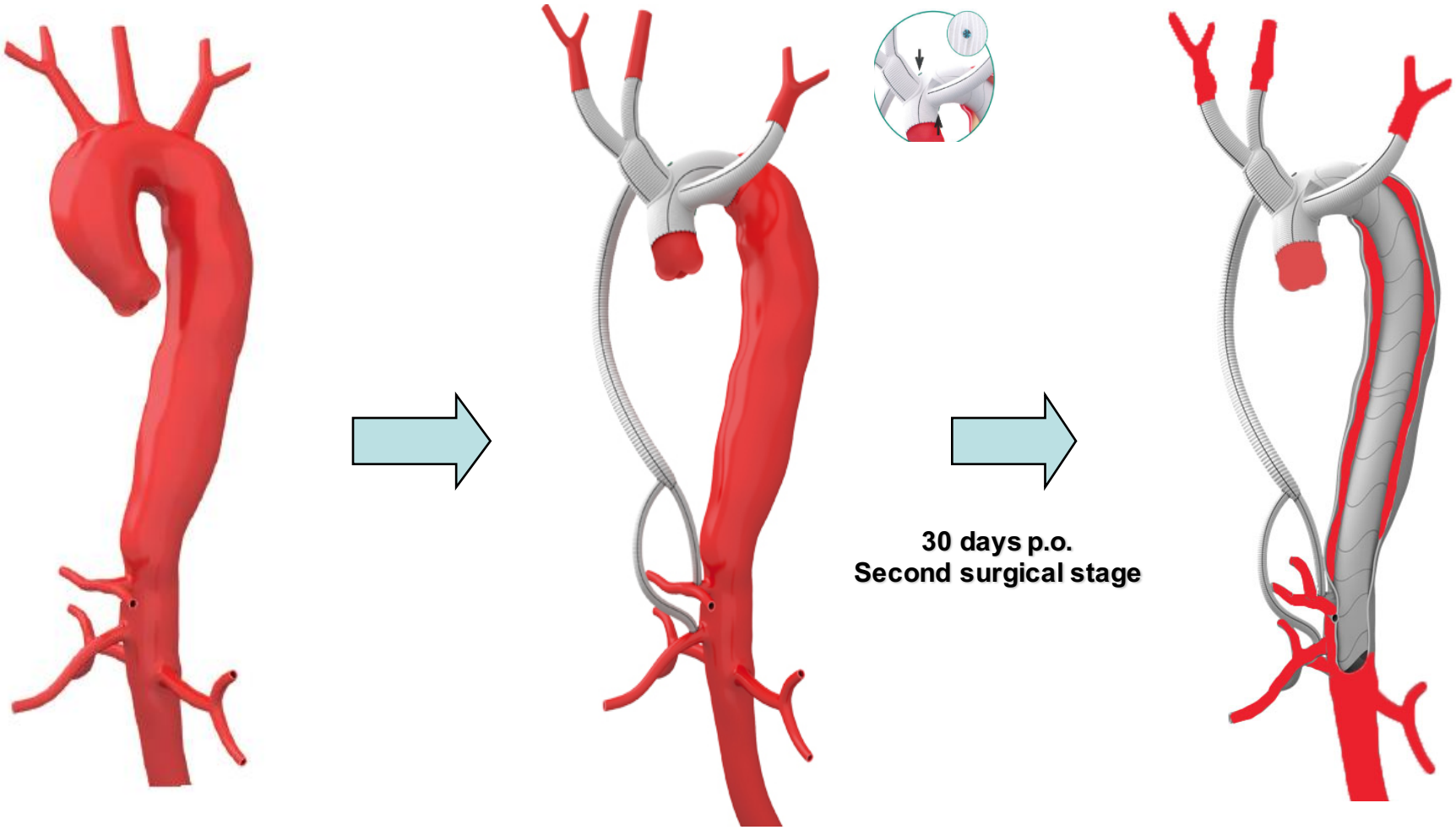
MAS I: Hybrid Two-Stage “Lupiae” Repair



1) Epiaortic vessels rerouting and ascending aorta ± arch replacement by Lupiae Graft™ implantation.
2) Subsequent Endograft repair.

Marullo AG, Bichi S, et al: Annals of Thoracic Surgery 2010; 90(6): 1847--1853

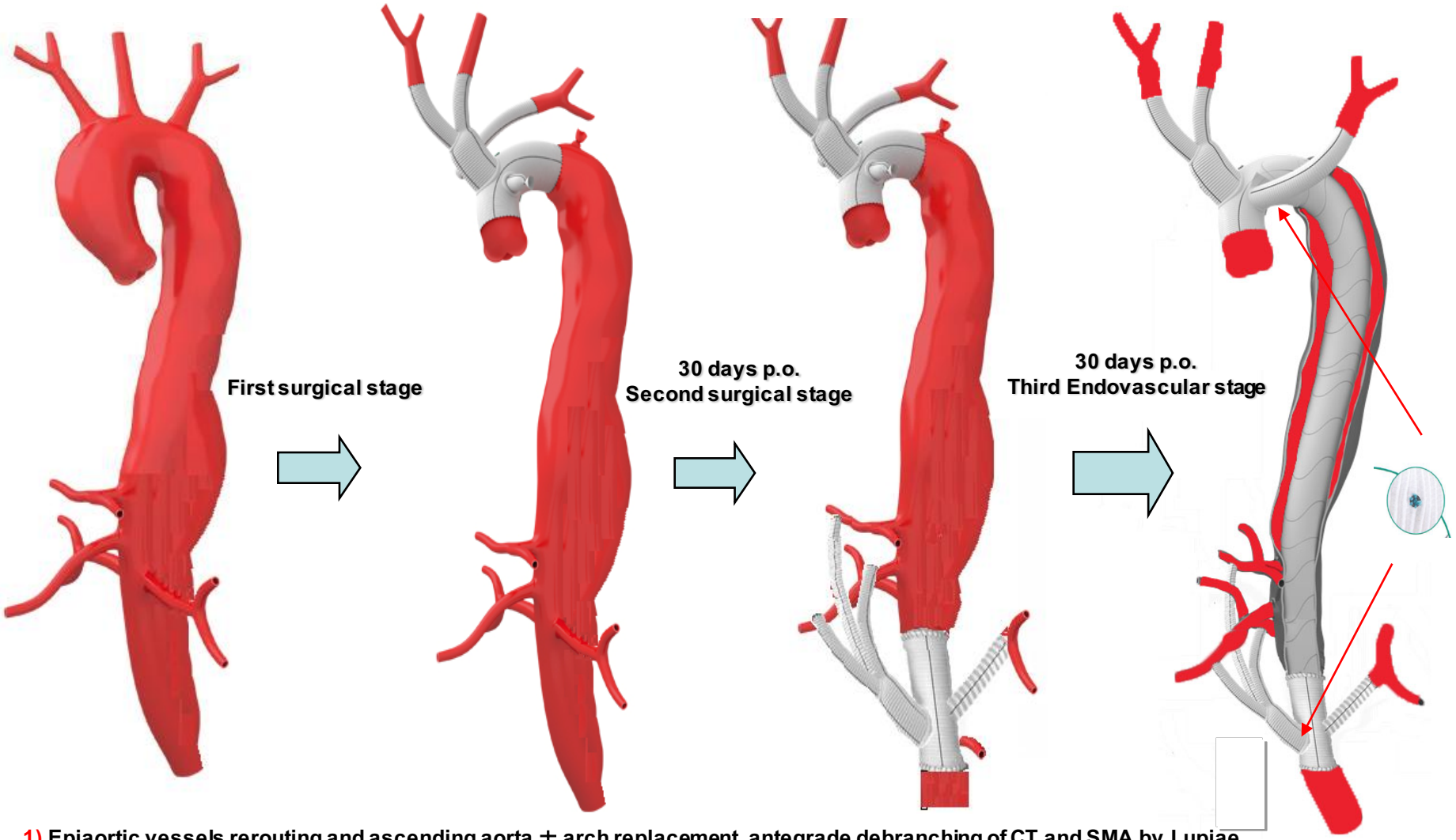
MAS II: Hybrid Two-Stage Repair



1) Epiaortic vessels rerouting and ascending aorta ± arch replacement, antegrade debranching of CT and SMA by Lupiae Graft™ implantation. 2) Subsequent Endograft repair

Esposito G, Bichi S et al: Annals of Thoracic Surgery 2008; 85:1443-5

MAS III: Hybrid Three-Stage Repair

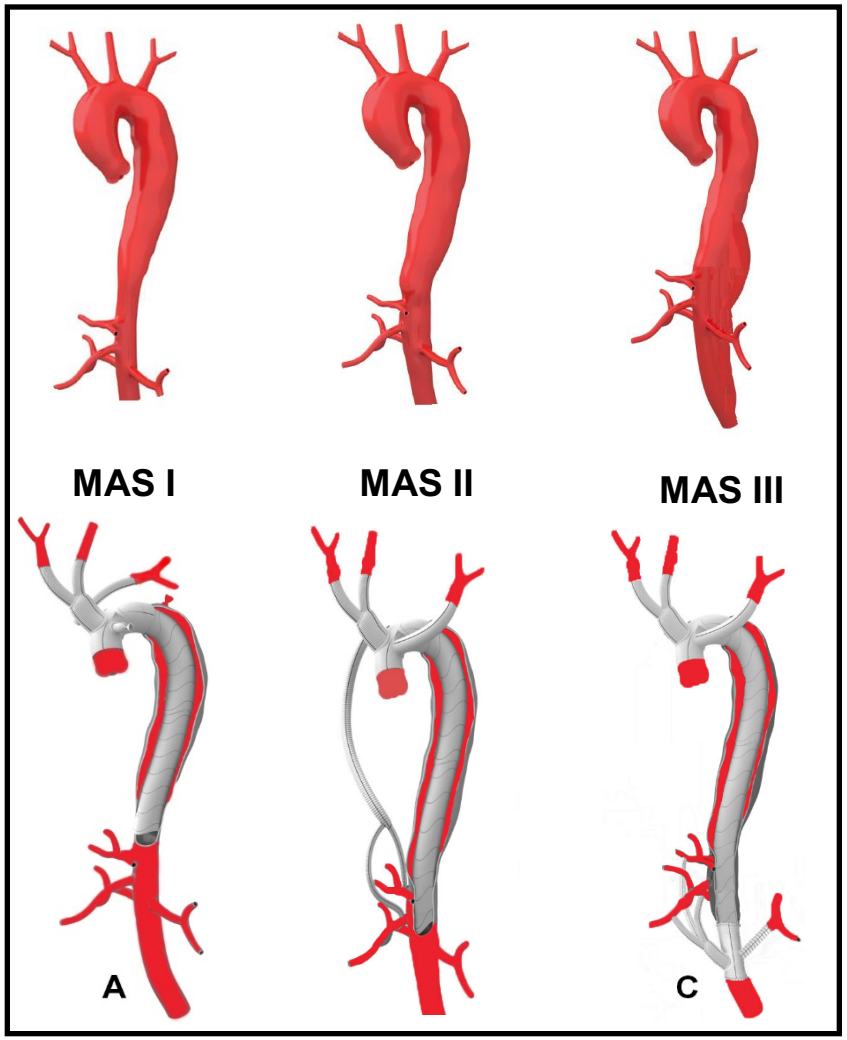


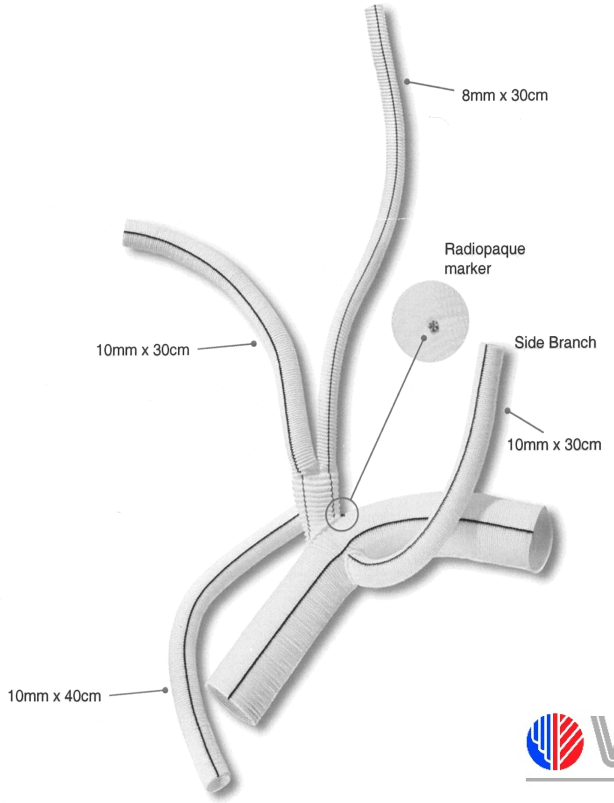
1) Epiaortic vessels rerouting and ascending aorta ± arch replacement, antegrade debranching of CT and SMA by Lupiae Graft™ implantation
2) Retrograde de-branching of visceral vessels and abdominal aorta replacement by Lupiae Graft™ implantation.
3) Subsequent Endograft repair

Troisi N, Esposito G, Bichi S et al: JTCS 2013;Mar 145(3 suppl):S171-7

Rationale of Hybrid strategy (Lupiae Technique) in MAS

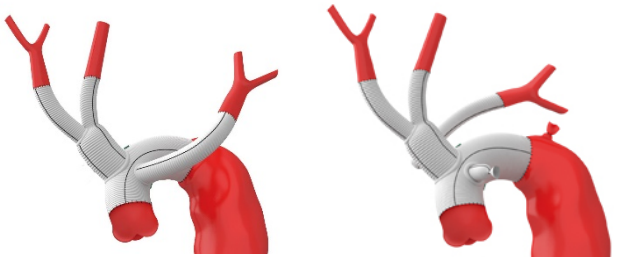
Hybrid approach performing a surgical aortic debranching (based on the extension & type of aortic disease) creates an **optimal proximal and distal landing zone to perform an easier and safer subsequent endograft deployment**



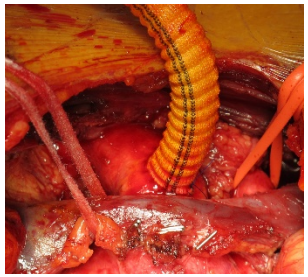


VASCUTEK
TERUMO

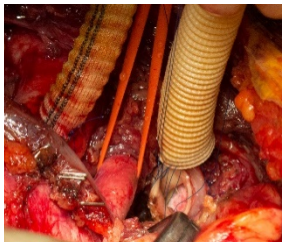
MAS I/Type A AD: Operative Methods



Sternotomy + Cervical Extesion

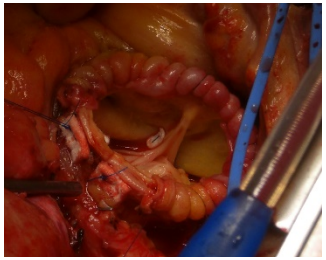


BCT/Axillary cannulation

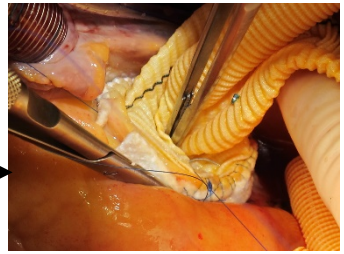


LSA debranching/perfusion

Asc Ao X-Clamp

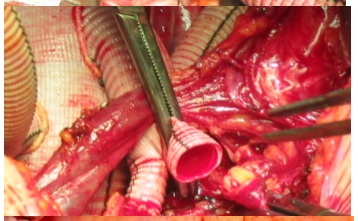


AV ± Root Repair



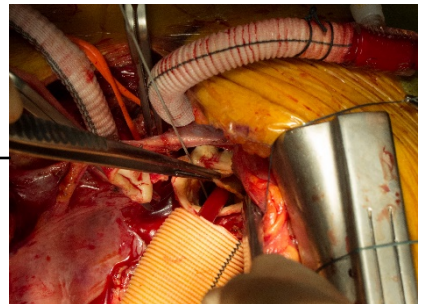
Proximal Aortic Anastomosis

LCA

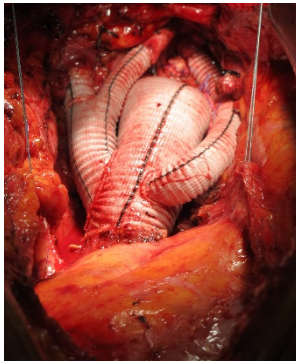


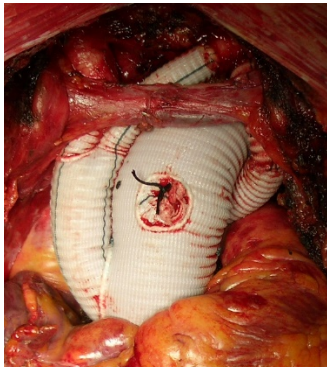
BCT

LSA

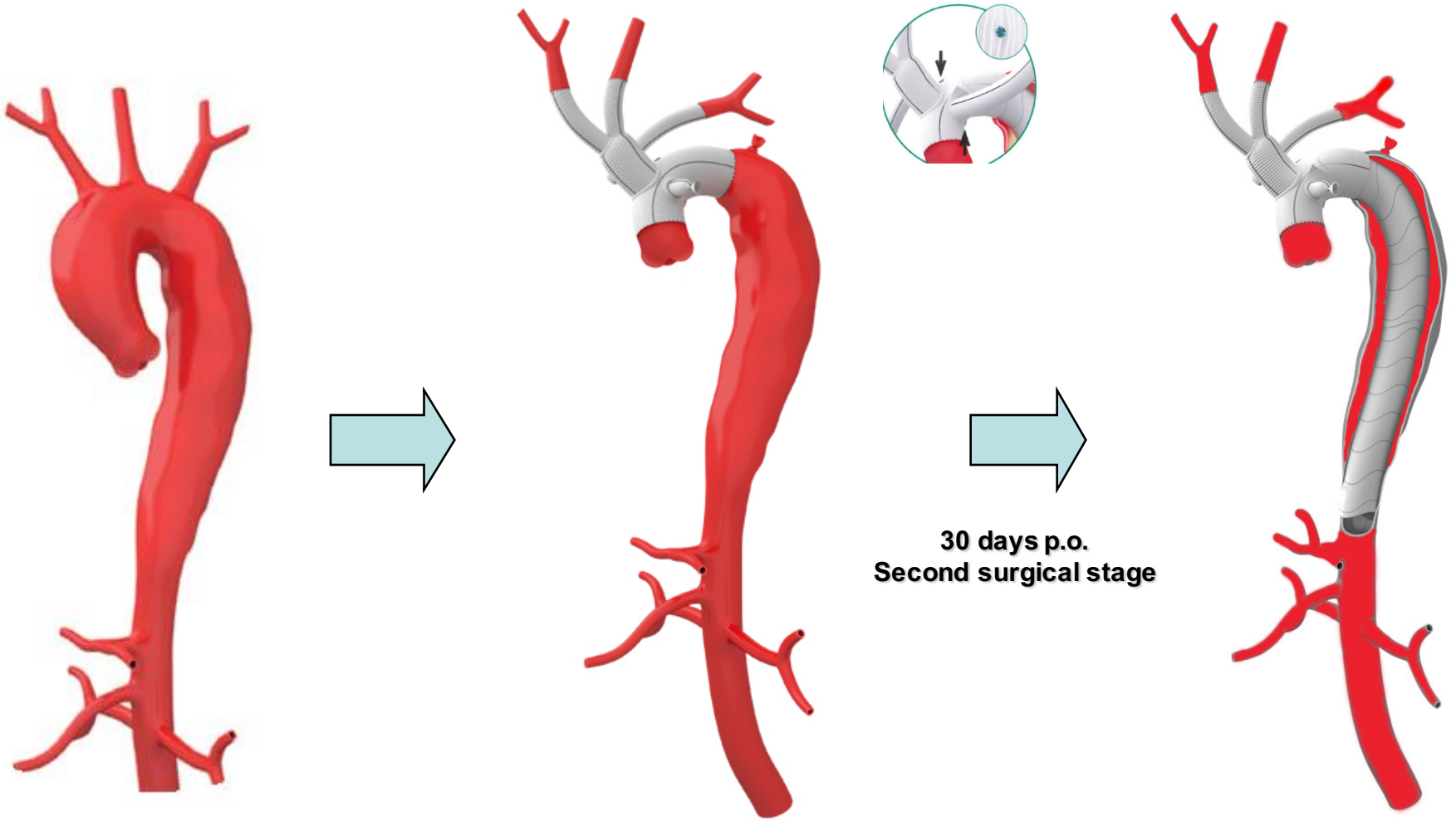


Distal Open Aortic Anastomosis/
X-Clamp End





MAS I: Hybrid Two-Stage “Lupiae” Repair (83 pts.)



1) Epiaortic vessels rerouting and ascending aorta ± arch replacement by Lupiae Graft™ implantation.
2) Subsequent Endograft repair.

Marullo AG, Bichi S, et al: Annals of Thoracic Surgery 2010; 90(6): 1847--1853

Hybrid Aortic Arch Debranching With Staged Endovascular Completion in DeBakey Type I Aortic Dissection

Antonino G.M. Marullo, MD, PhD, Samuele Bichi, MD, Rocco A. Pennetta, MD, Gerardo Di Matteo, MD, Antonio M. Cricco, MD, Luigi Specchia, MD, Fausto Castriota, MD, and Giampiero Esposito, MD

(Ann Thorac Surg 2010;90:1847–53)

Hybrid multistep approach to mega-aortic syndrome: the Lupiae technique†

Giampiero Esposito*, Matteo Pennesi, Samuele Bichi, Davide Patrini, Pasquale Pellegrino, Marianna Redaelli, Camillo Poloni, Piersilvio Gerometta, Franco Gentinetta and Giangiuseppe Cappabianca

European Journal of Cardio-Thoracic Surgery 47 (2015) 126–133

Hybrid Repair of Thoracic and Thoracoabdominal Aortic Aneurysms (Mega Aortic Syndrome) With Lupiae Technique

(*Innovations* 2011;6:366–372)

Hybrid repair of type A acute aortic dissections with the Lupiae technique: Ten-year results

Giampiero Esposito, MD, Giangiuseppe Cappabianca, MD, Samuele Bichi, MD, Antonio Cricco, MD, Giovanni Albano, MD, and Angelo Anzuini, MD

(J Thorac Cardiovasc Surg 2015;149:S99-104)

Hybrid three-stage repair of mega aorta syndrome with the Lupiae technique

Nicola Troisi, MD,[a] Samuele Bichi, MD,[b] Davide Patrini, MD,[b] Vincenzo Arena, MD,[b] Marco Setti, MD,[a] Antonino Pitì, MD,[c] and Giampiero Esposito, MD[b]

(J Thorac Cardiovasc Surg 2013;145:S171-7)

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

Giampiero Esposito, Giangiuseppe Cappabianca*, Michele Ciano, Nunzio Gallo, Giuseppe Labriola, Vincenzo Pestrichella, Gaetano Contegiacomo and Cataldo Labriola

European Journal of Cardio-Thoracic Surgery 42 (2012) 242–248

Pitfalls in the hybrid approach of type B aortic dissection with arch involvement

Giampiero Esposito, Samuele Bichi

Ann Cardiothorac Surg 2014;3(4):431–435

Hybrid repair of type A acute aortic dissections with the Lupiae technique: Ten-year results

Giampiero Esposito, MD, Giangiuseppe Cappabianca, MD, Samuele Bichi, MD, Antonio Cricco, MD, Giovanni Albano, MD, and Angelo Anzuini, MD

The Journal of Thoracic and Cardiovascular Surgery • Volume 149, Number 2S

TABLE 2. Intraoperative procedures

Patients	89
Proximal procedures	
Isolated AV resuspension	55 (61.8%)
AV resuspension + NCS replacement	13 (14.6%)
Aortic root replacement	11 (12.3%)
Valve sparing root replacement	10 (11.3%)
LSA rerouting	38 (42%)
Position of intimal tear	
Ascending aorta	18 (20.2%)
Aortic arch	56 (62.9%)
Descending aorta	15 (16.9%)
CPB time	
- with isolated AVR (min)	112 ± 19
- with root surgery (min)	184 ± 12
Crossclamp time	
- with isolated AVR (min)	51 ± 12
- with root surgery (min)	103 ± 15
Distal circulatory arrest (min)	28 ± 7

AV, Aortic valve; *AVR*, aortic valve replacement; *CPB*, cardiopulmonary bypass; *LSA*, left subclavian artery; *NCS*, noncoronary sinus.

TABLE 3. Thoracic endovascular aortic repair results

Patients	65
Urgent procedure	3 (4.6%)
Elective procedure	62 (95.4)
In-hospital mortality	1 (1.5%)
Stroke, TIA, paraplegia, paraparesis	0
AKI	0
Endoleak type I	1 (1.5%)
Endoleak type II	4 (6.3%)
False lumen thrombosis	59 (92.1%)

AKI, Acute kidney injury; *TIA*, transient cerebrovascular accident.

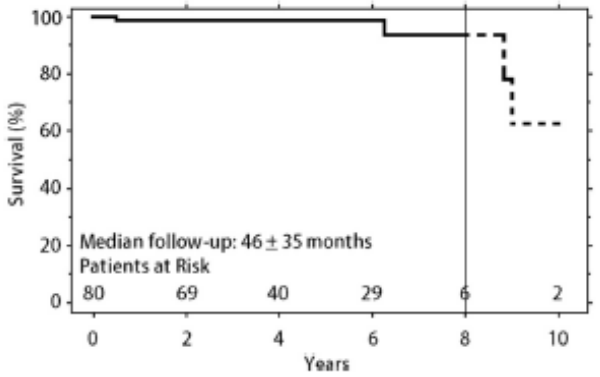


FIGURE 3. Ten-year survival of the entire cohort (80 patients); 64 patients underwent TAAAD repair + TEVAR, and 16 patients underwent TAAAD repair only.

Supplement to
THE JOURNAL OF
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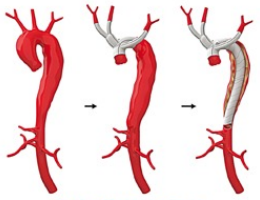
New York, NY
April 24–25, 2014



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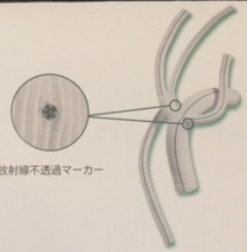
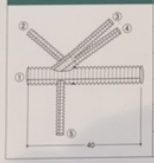


ステントグラフトに適した分枝デザイン
(3つの分枝を1つに集約)のマーカー付人工血管。

形状	主管直径 (mm)	主管使用可能長 (cm)	側枝直径 (mm)	側枝長 (cm)	カタログ番号	共通商品コード (JAN)	コード番号	受注生産品
	20	40	10/10/8/10	40/30/30/30	734020CX4RMS	4987350283931	WE-4020CX4L	○
	22				734022CX4RMS	4987350286130	WE-4022CX4L	○
	24				734024CX4RMS	4987350286215	WE-4024CX4L	
	26				734026CX4RMS	4987350286833	WE-4026CX4L	
	28				734028CX4RMS	4987350287519	WE-4028CX4L	
	30				734030CX4RMS	4987350287571	WE-4030CX4L	

一般的名称：ゼラチン使用人工血管　販売名：ゼルウィーブ Lupiae　医療機器承認番号：22600BZX00318

VASCUTEK
TERUMO

TERUMO

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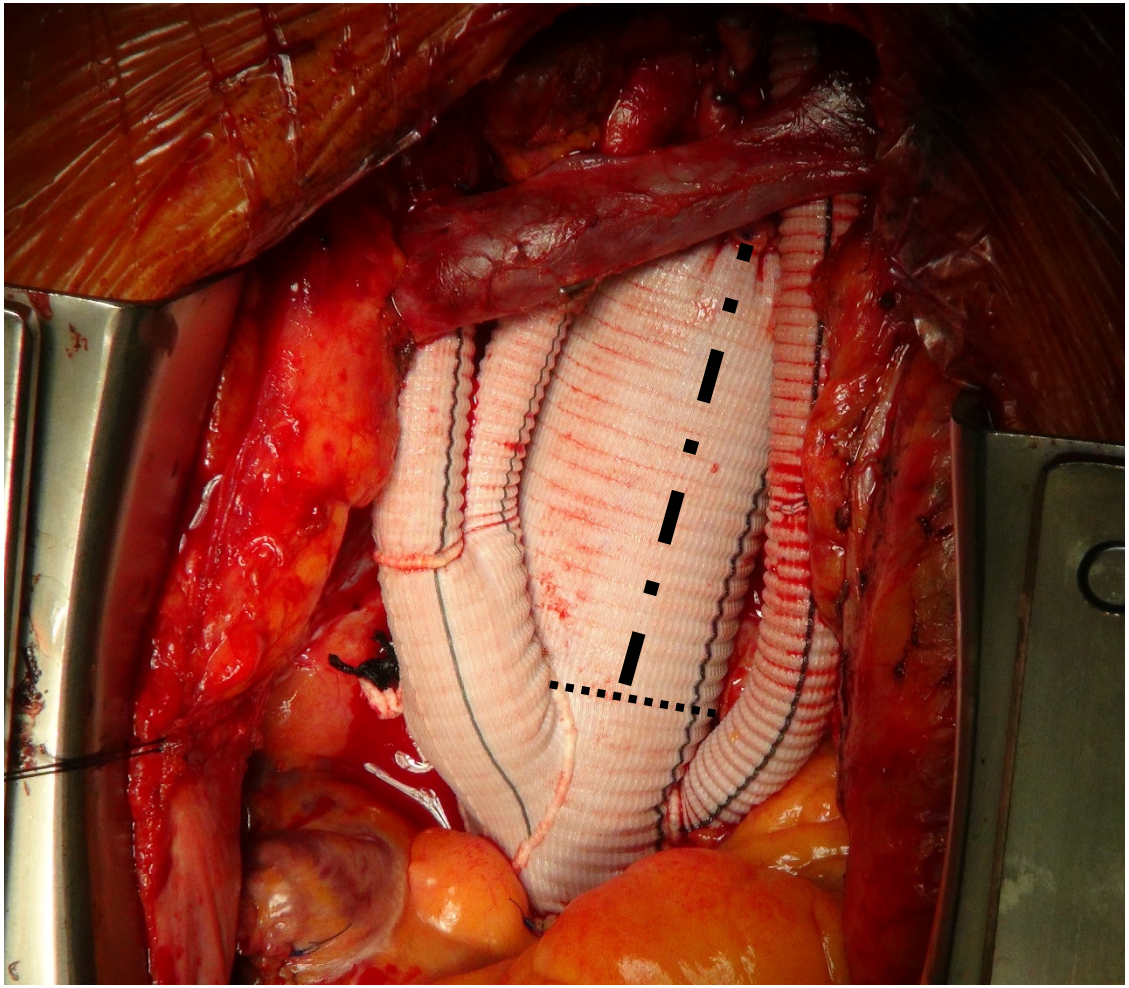
Gelweave® Lupiae

日本初の
ステントグラフト用
人工血管。

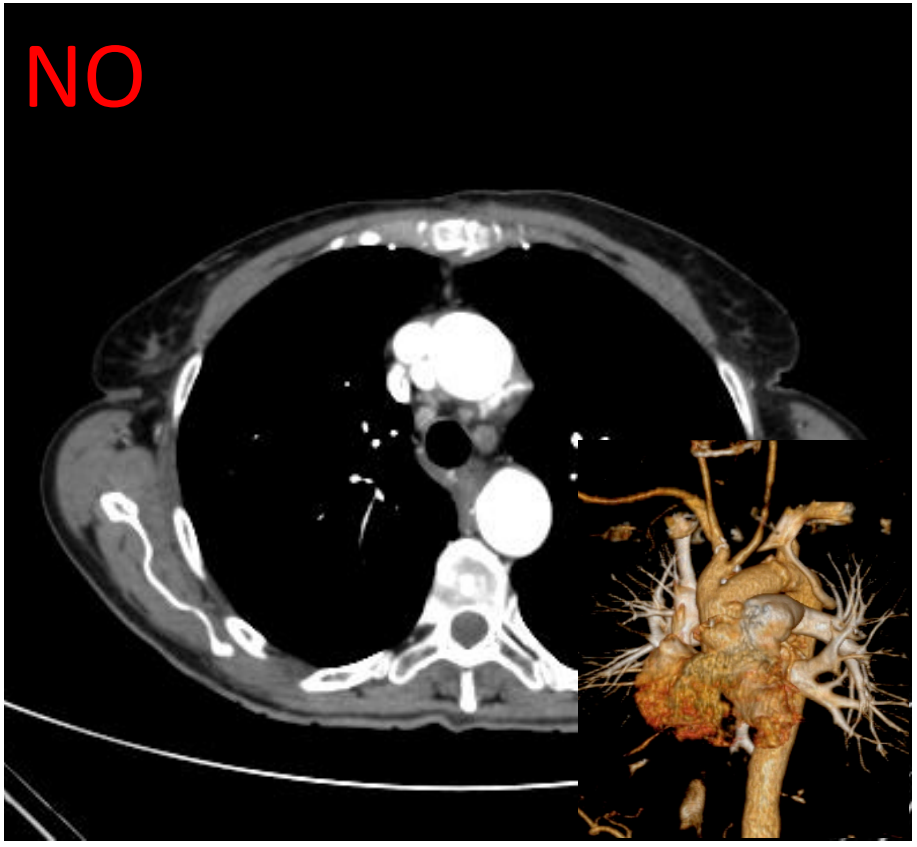
TERUMO

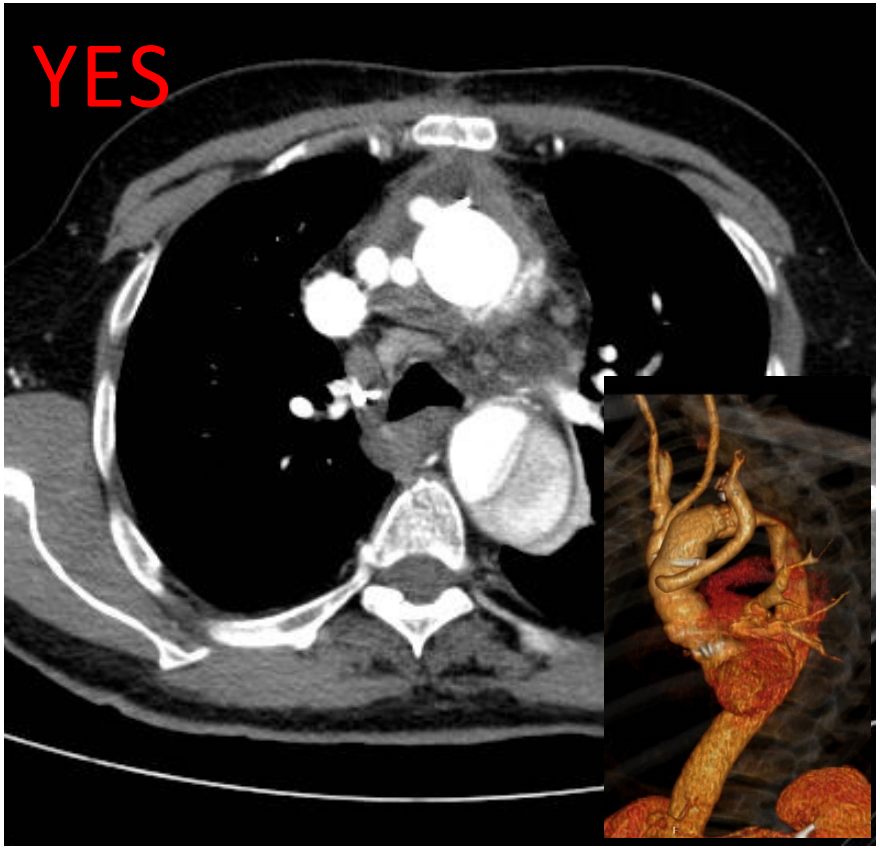
MAS I: Lupiae Technique – Optimal Landing Zone (> 4 cm)



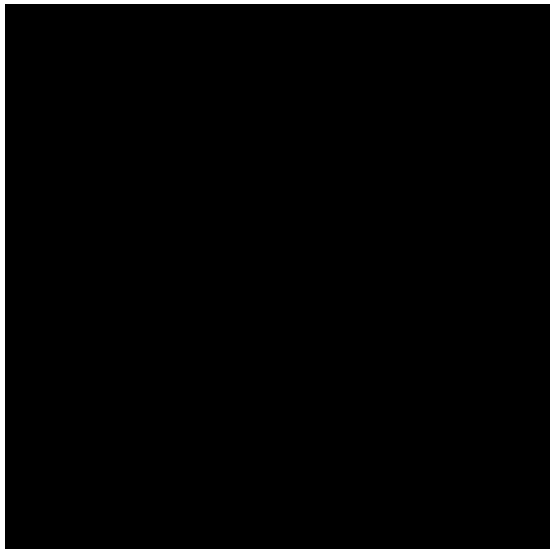
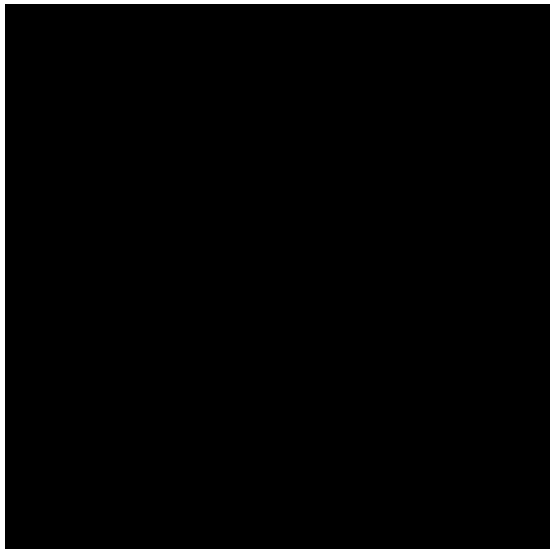
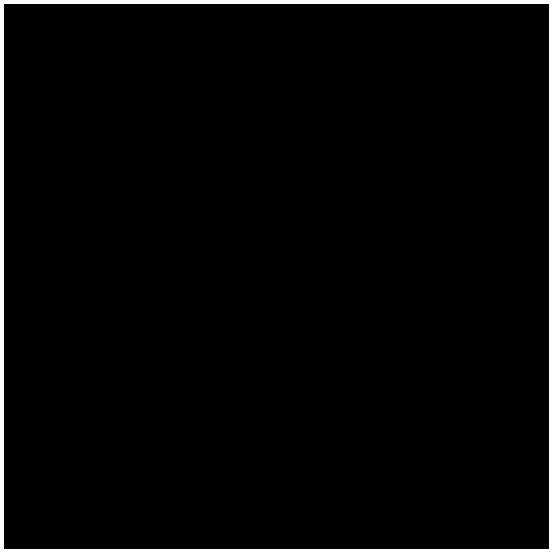
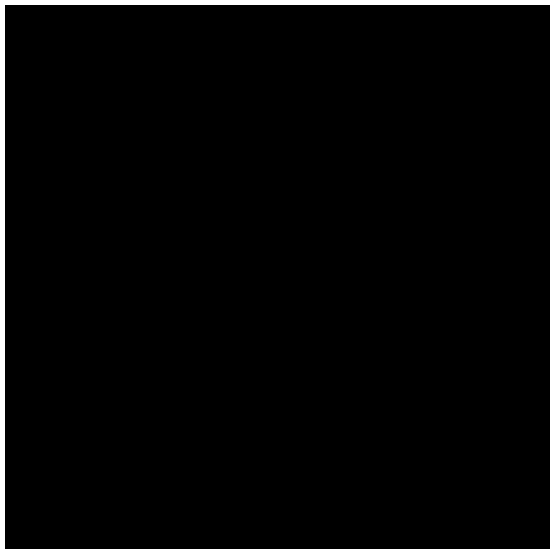
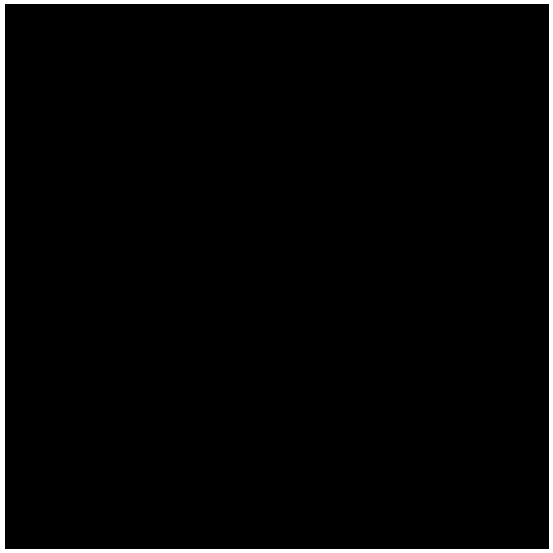
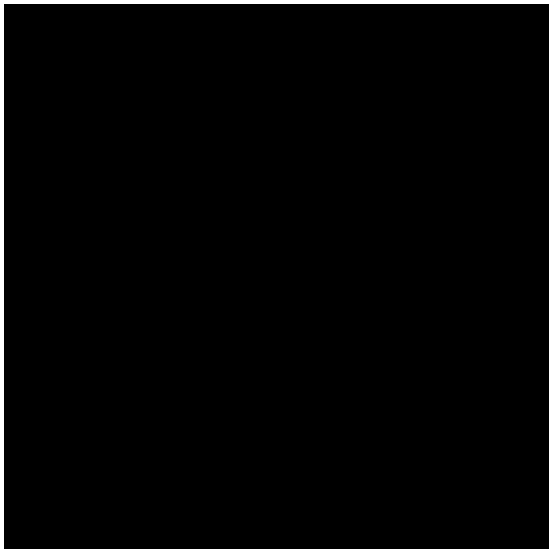
Selective criteria for second Endovascular Stage after "Lupiae" Surgical Procedure in Type A AD

- Patent False Lumen > 70% of Total Aortic Ø
- False Lumen Ø > 22 mm
- Partial False Lumen Thrombosis
- Descending Thoracic Aorta at Surgery > 40 mm
- Age < 65

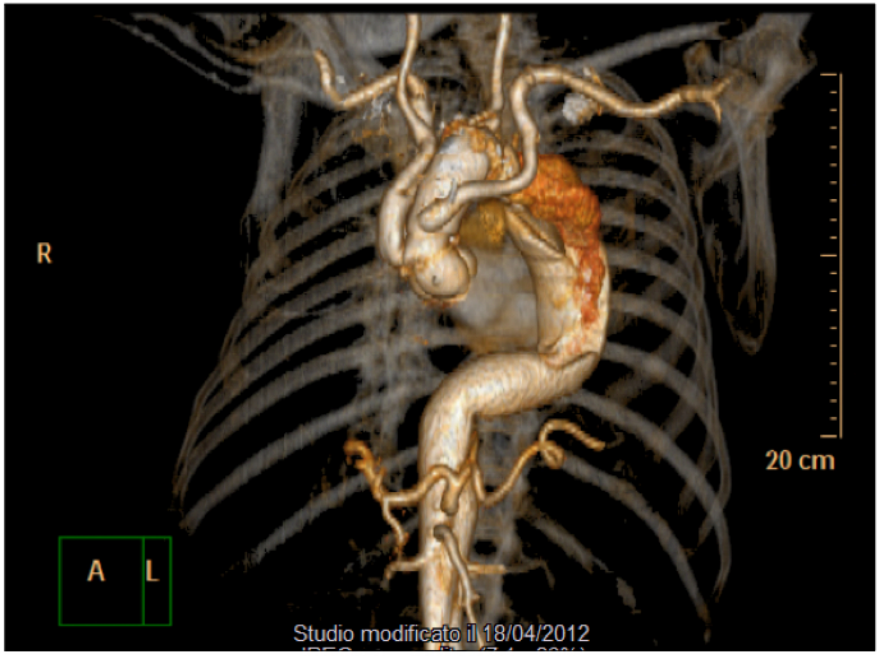




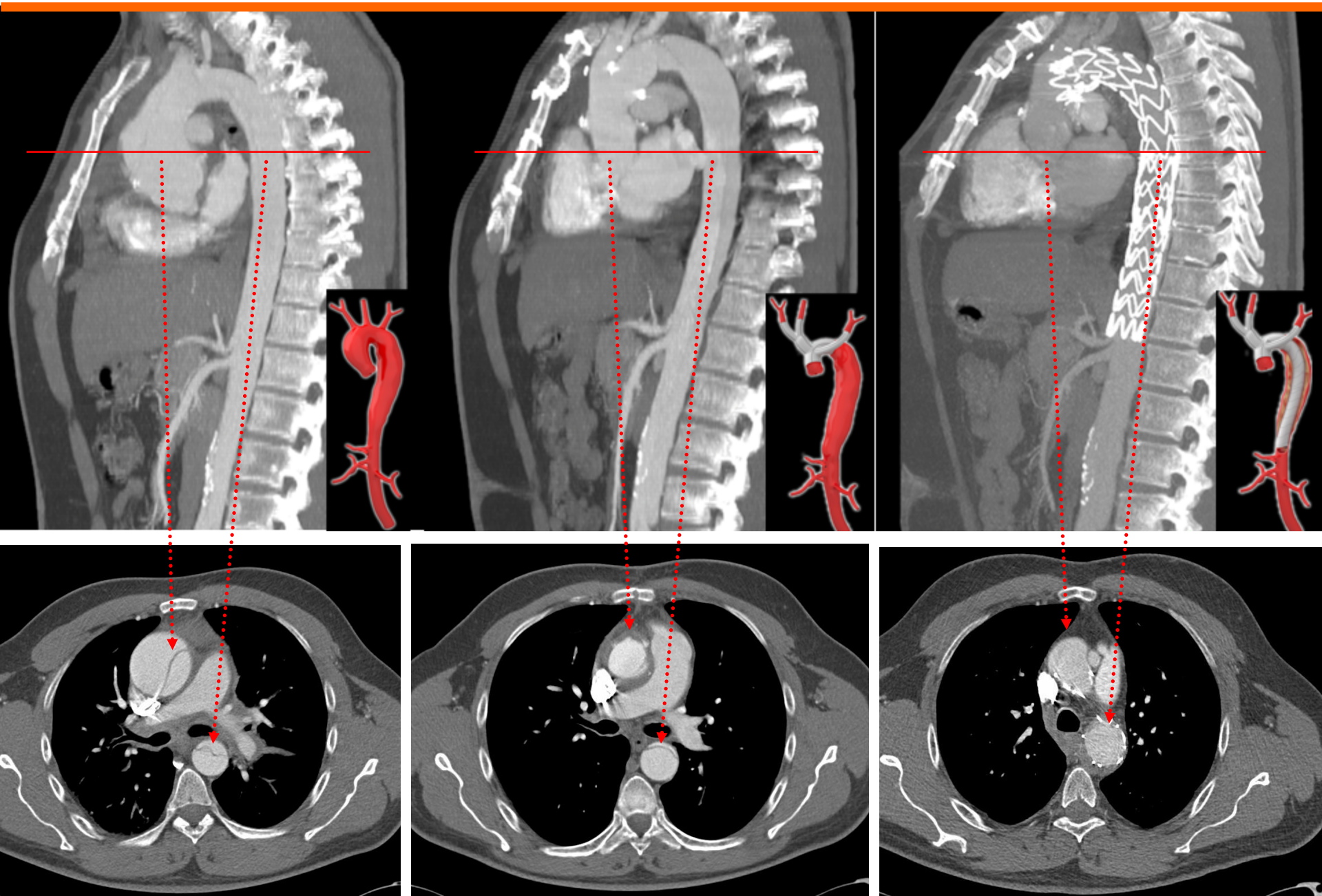
Lupiae Technique in TAAD: Second Endovascular Stage

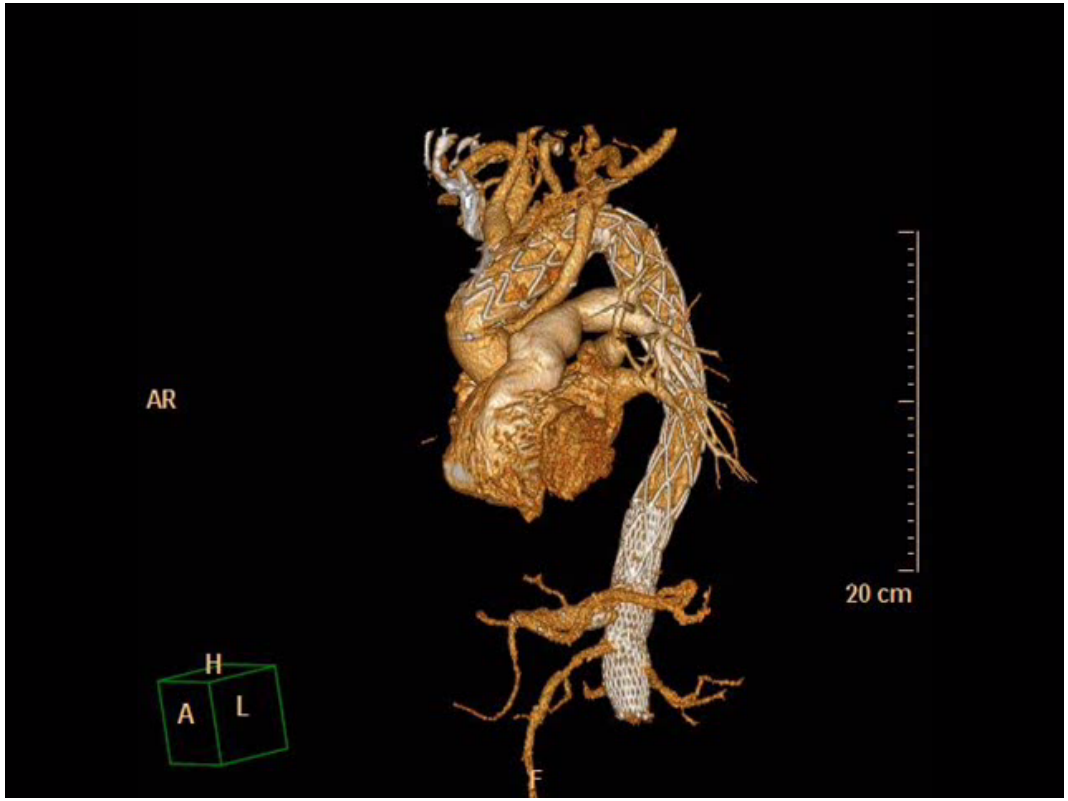
Lupiae Technique in TAAAD: Final Result



Lupiae Technique in TAAAD: Total False Lumen Thrombosis

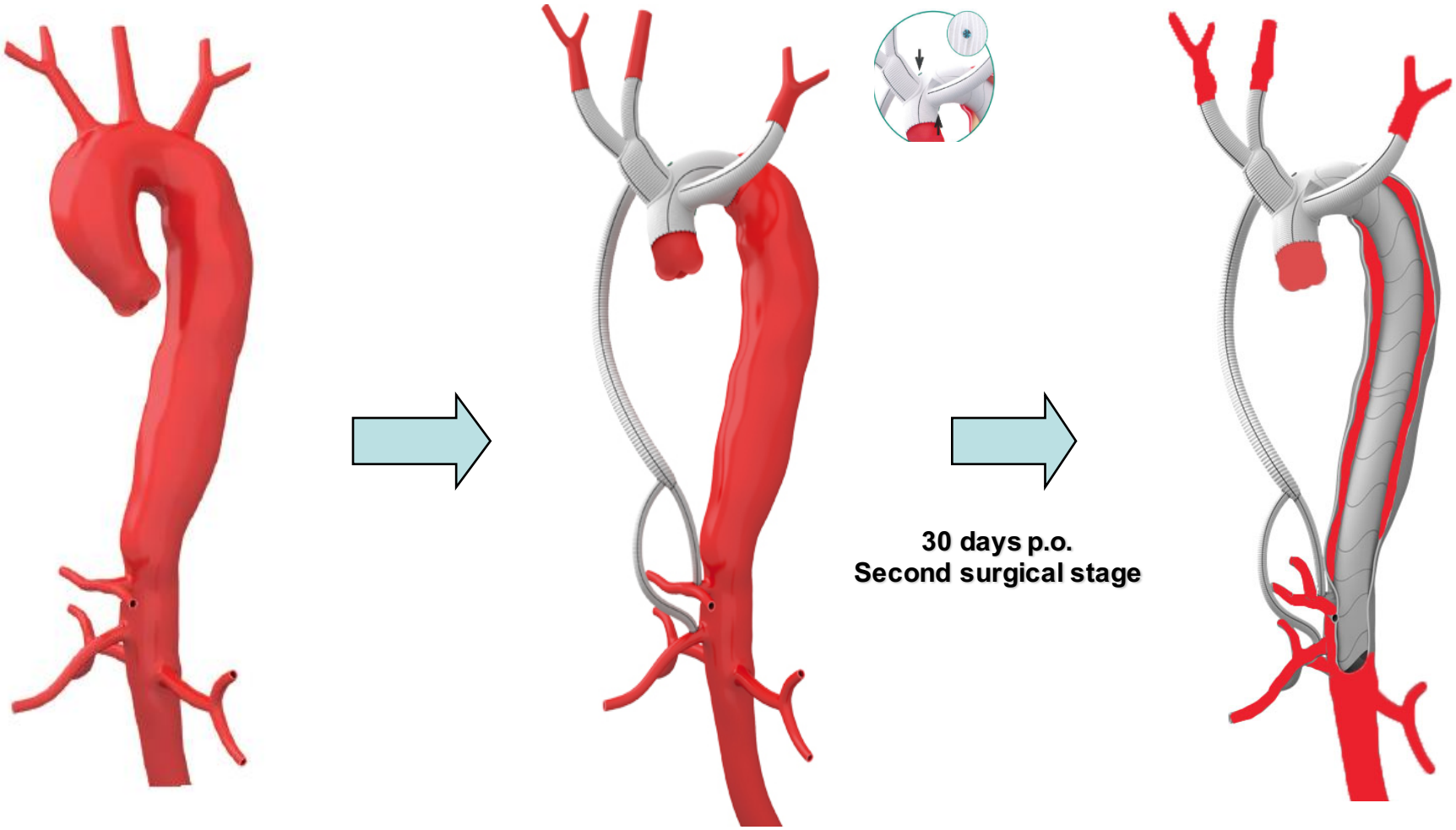


LUPIAE Technique in MAS I (Endovascular Stage)



E-XL
Endoluminal Aortic Stent Prosthesis

MAS II: Hybrid Two-Stage Repair

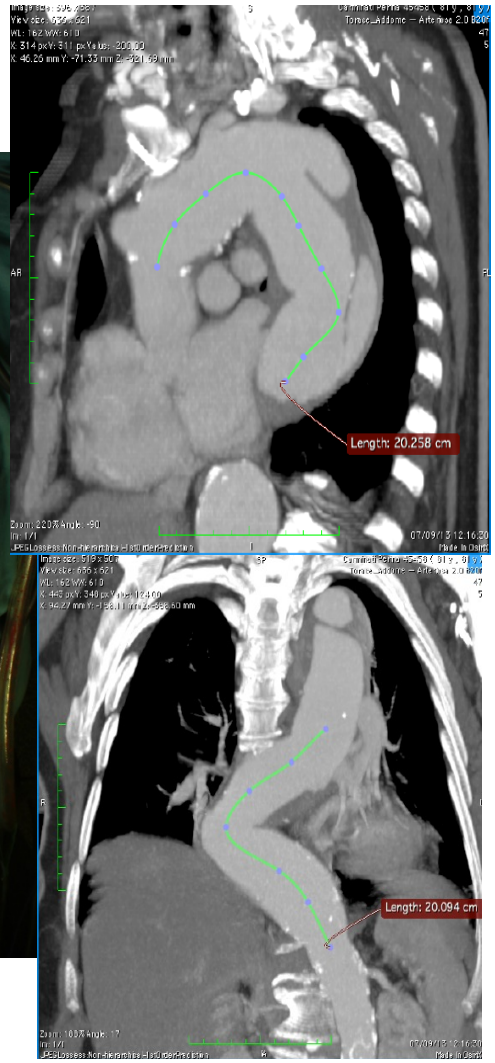


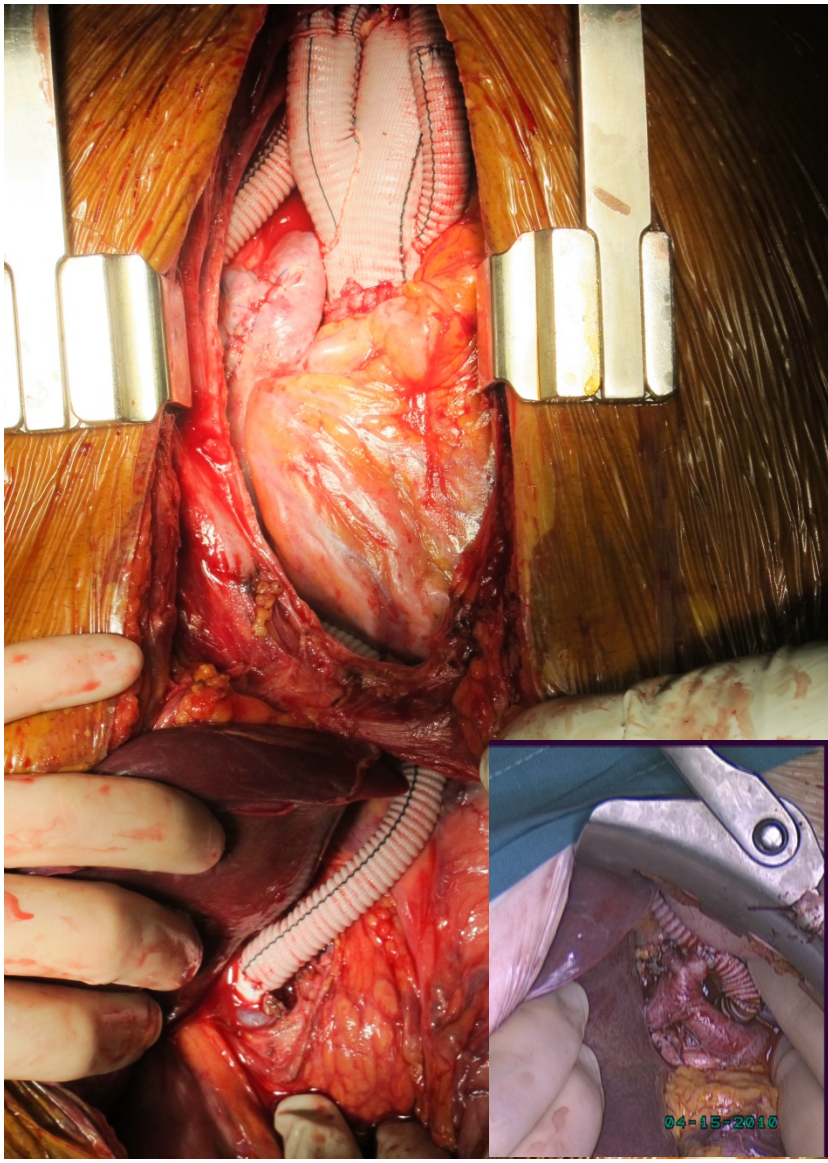
1) Epiaortic vessels rerouting and ascending aorta ± arch replacement, antegrade debranching of CT and SMA by Lupiae Graft™ implantation. 2) Subsequent Endograft repair

Esposito G, Bichi S et al: Annals of Thoracic Surgery 2008; 85:1443-5

MAS II: Stage I

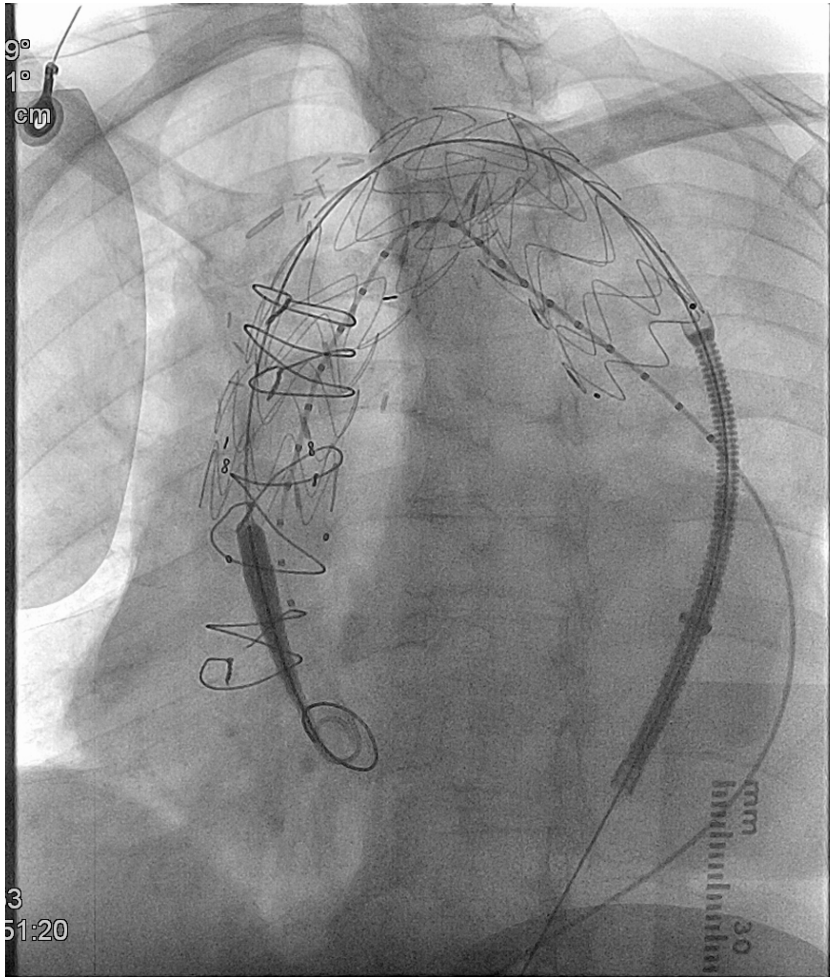
(Ascending Ao + Arch + Epiaortic Vessels Rerouting + TC and SMA debranching)



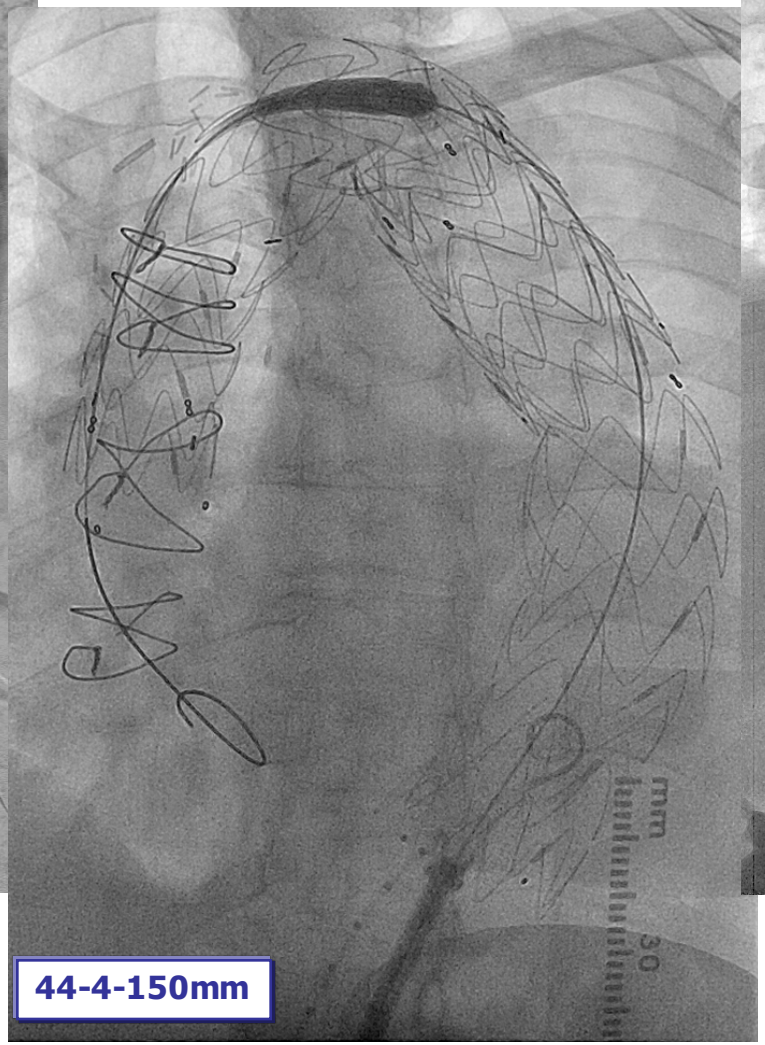


LUPIAE Technique in MAS II (20 pts) (Endovascular Stage)

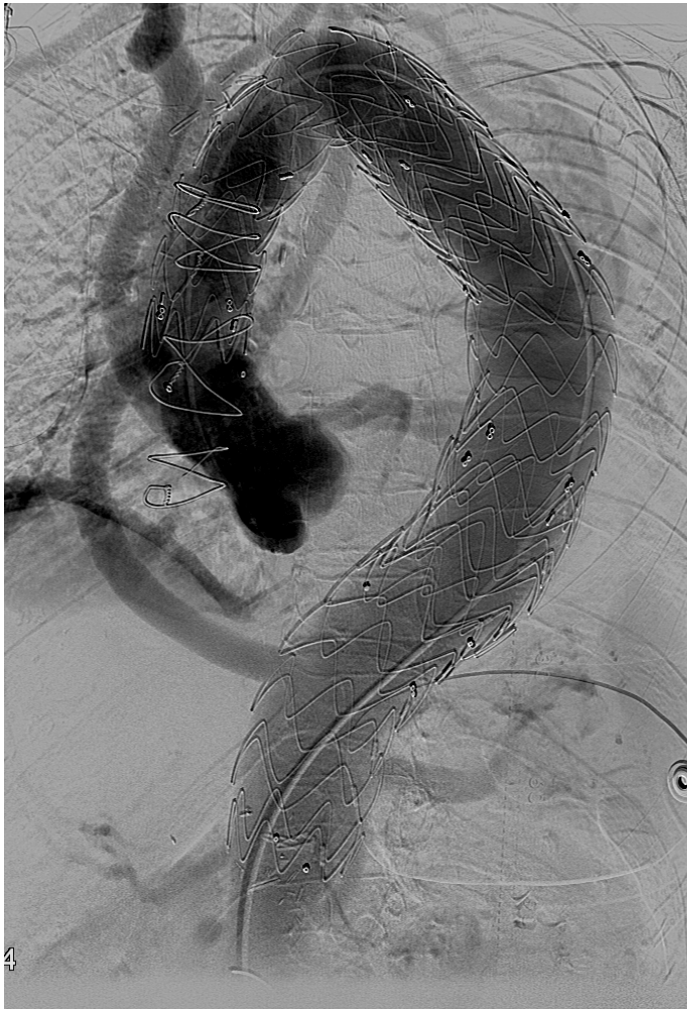
LUPIAE Technique in MAS II (Endovascular Stage)



LUPIAE Technique in MAS II (20 pts) (Endovascular Stage)

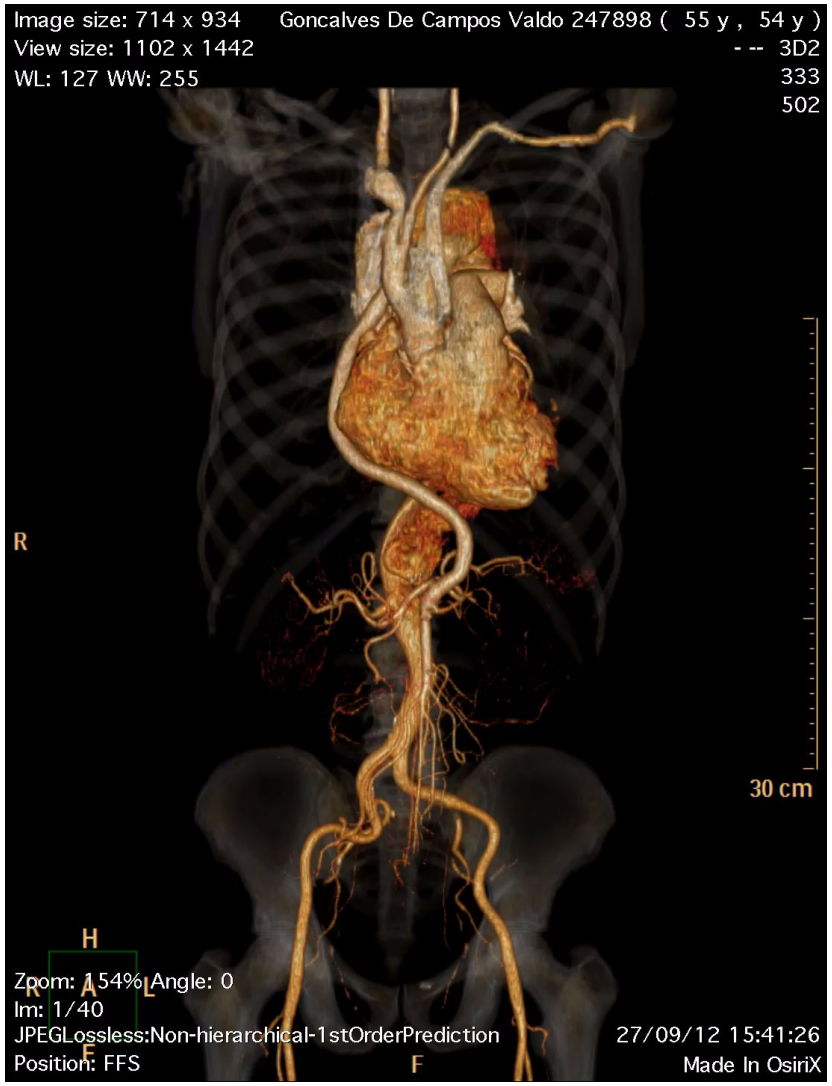


LUPIAE Technique in MAS II (20 pts) (Endovascular Stage)



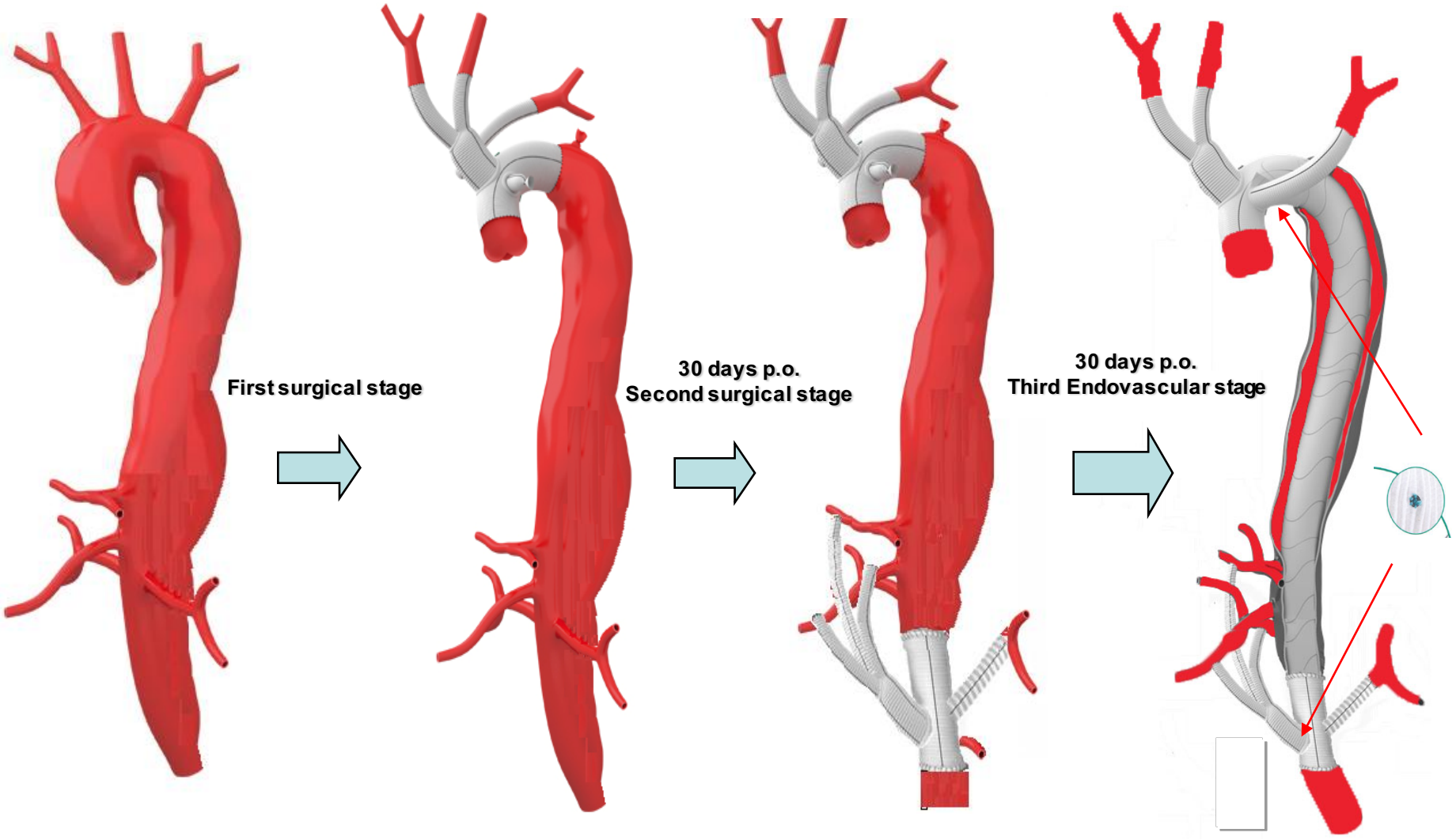
MAS II:

First Surgical Stage



Second Endovascular Stage

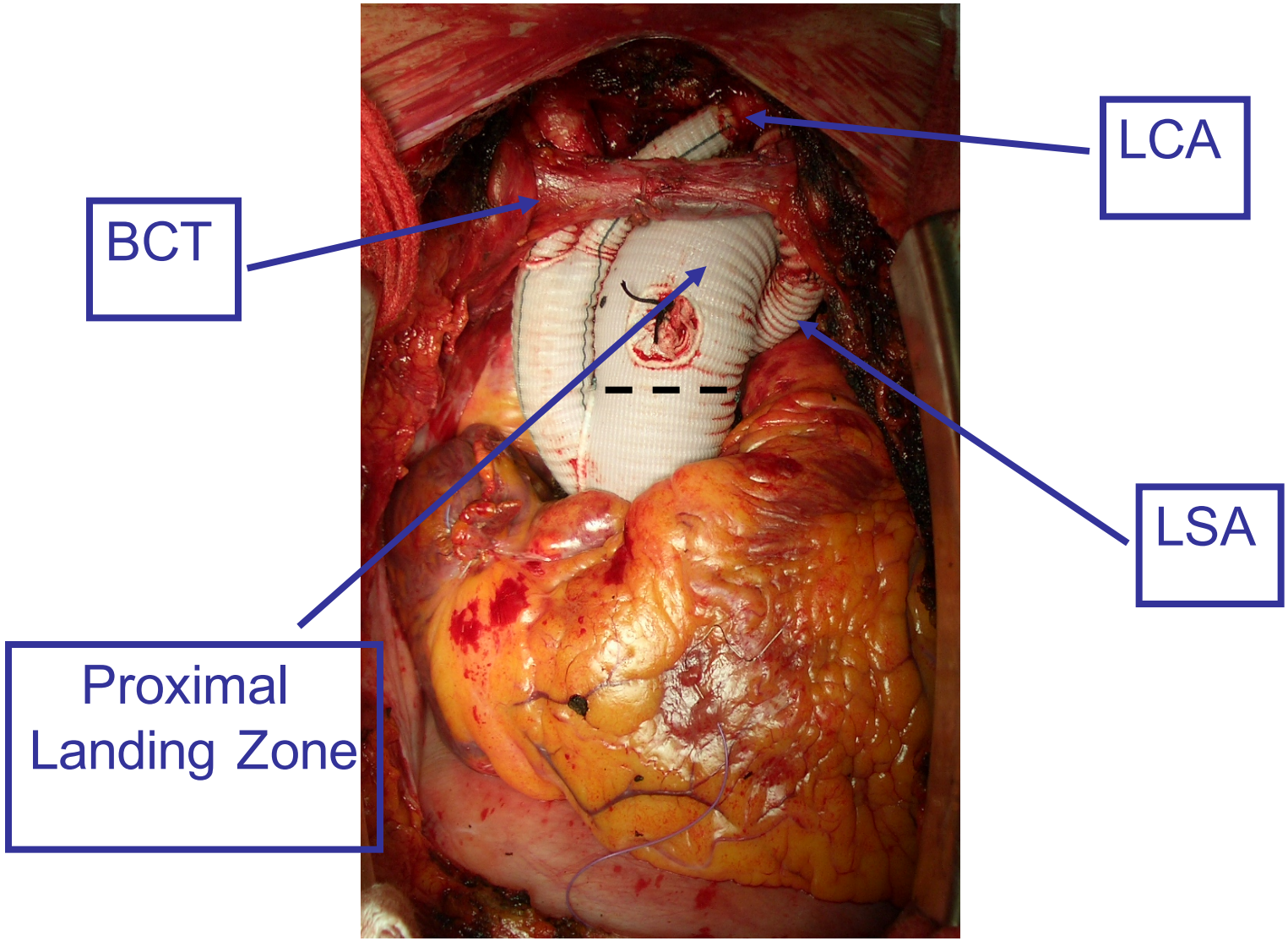
MAS III: Hybrid Three-Stage Repair



1) Epiaortic vessels rerouting and ascending aorta ± arch replacement, antegrade debranching of CT and SMA by Lupiae Graft™ implantation
2) Retrograde de-branching of visceral vessels and abdominal aorta replacement by Lupiae Graft™ implantation.
3) Subsequent Endograft repair

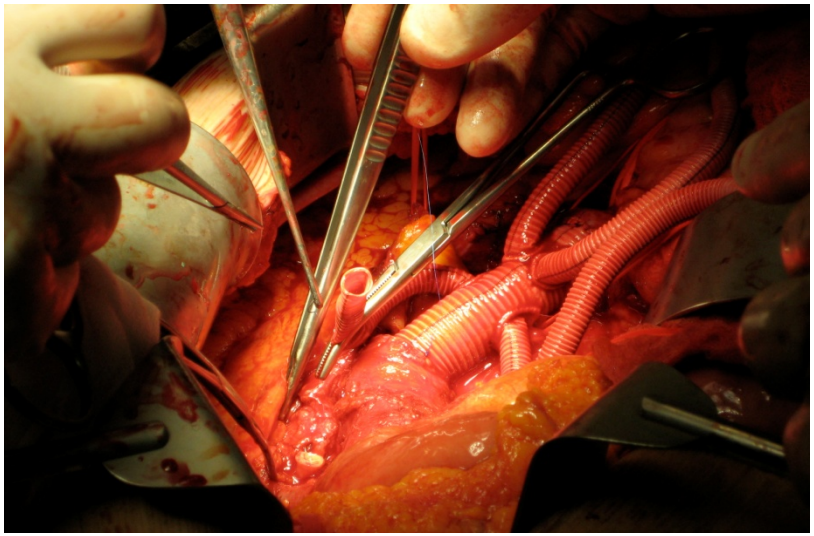
Troisi N, Esposito G, Bichi S et al: JTCS 2013;Mar 145(3 suppl):S171-7

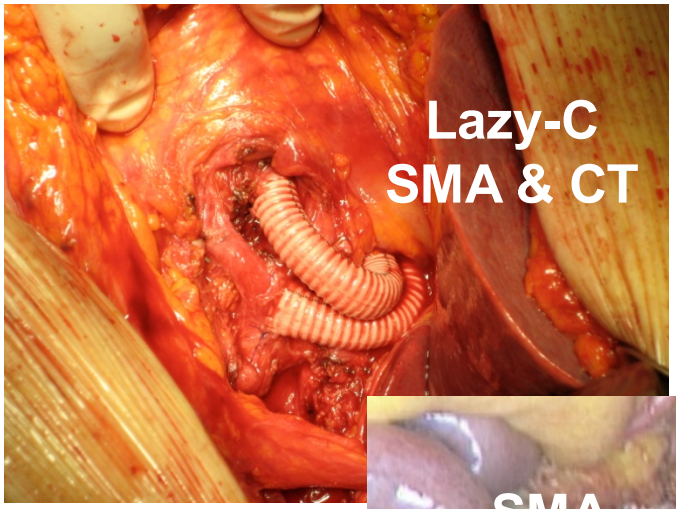
LUPIAE Technique in MAS III
(First Surgical Stage → Asc Ao + Arch + Epiaortic Vessels Rerouting)

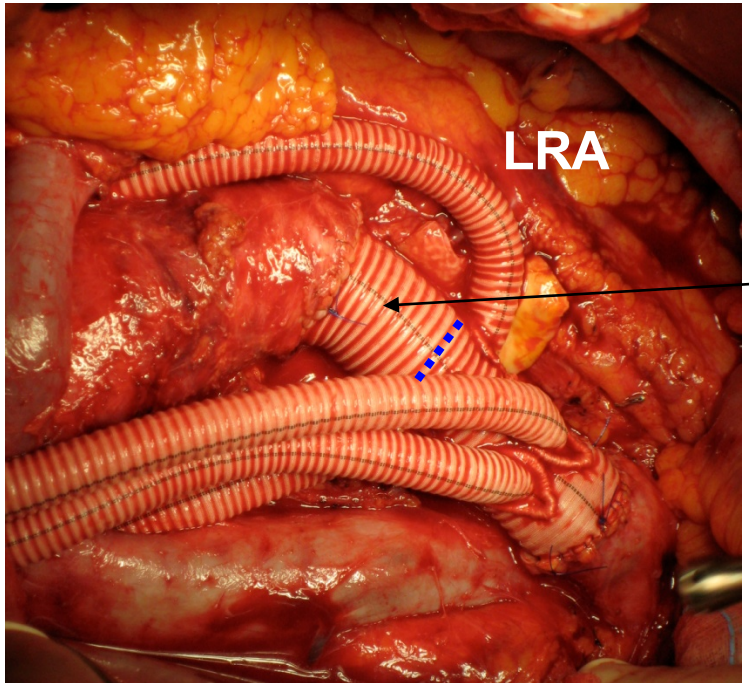


MAS III: Stage II (After 4 ± 1 weeks)

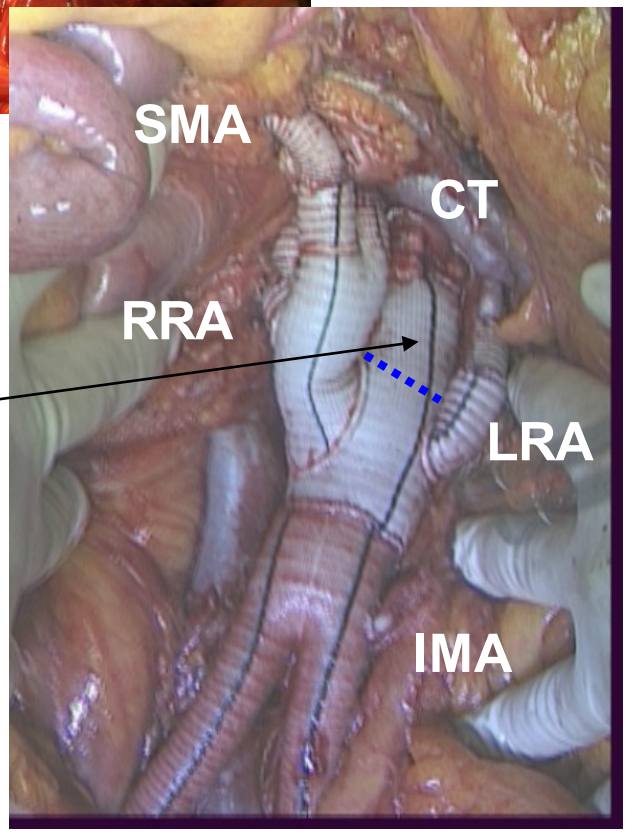
(Abdominal Aorta Replacement + visceral/renal vessels rerouting)





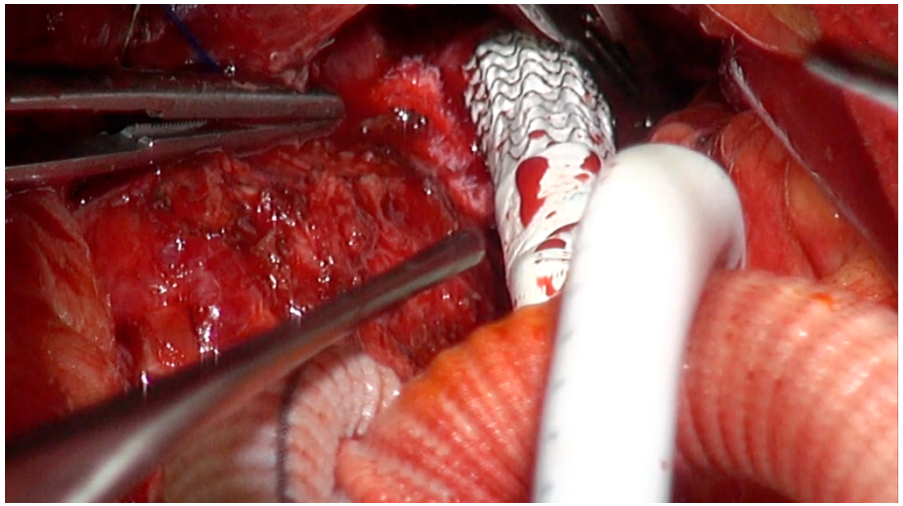


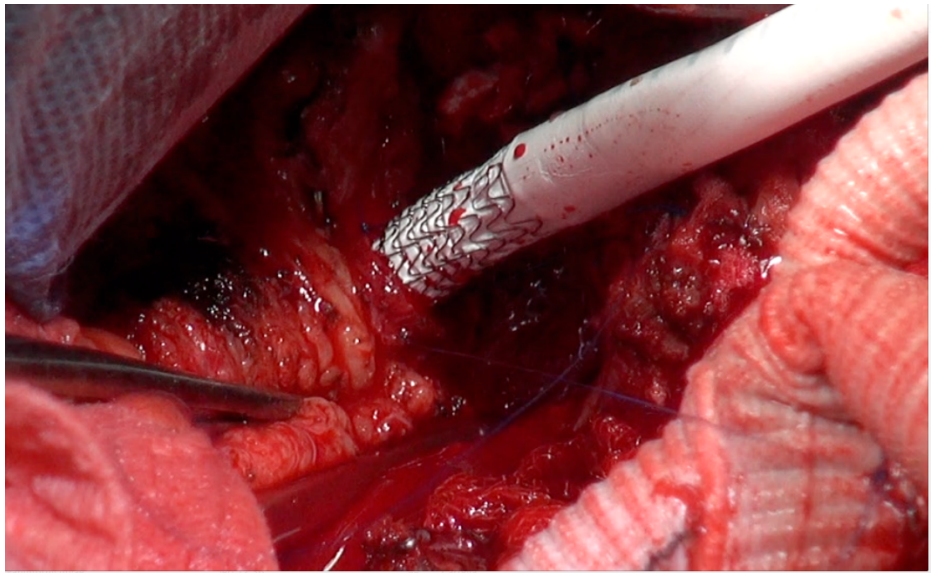
Distal
L.Z.

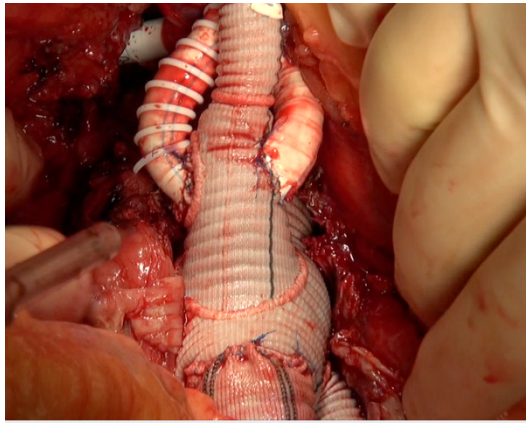


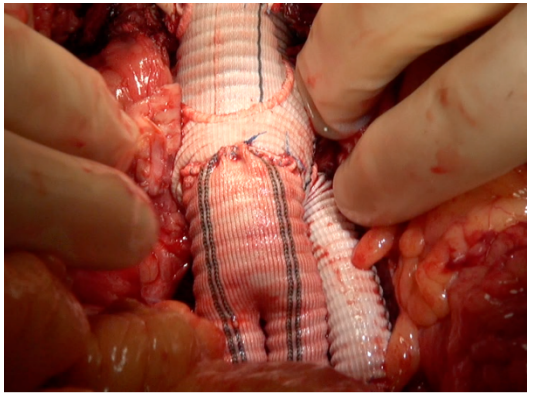
MAS III

GORE Hybrid Grafts in Renal Arteries





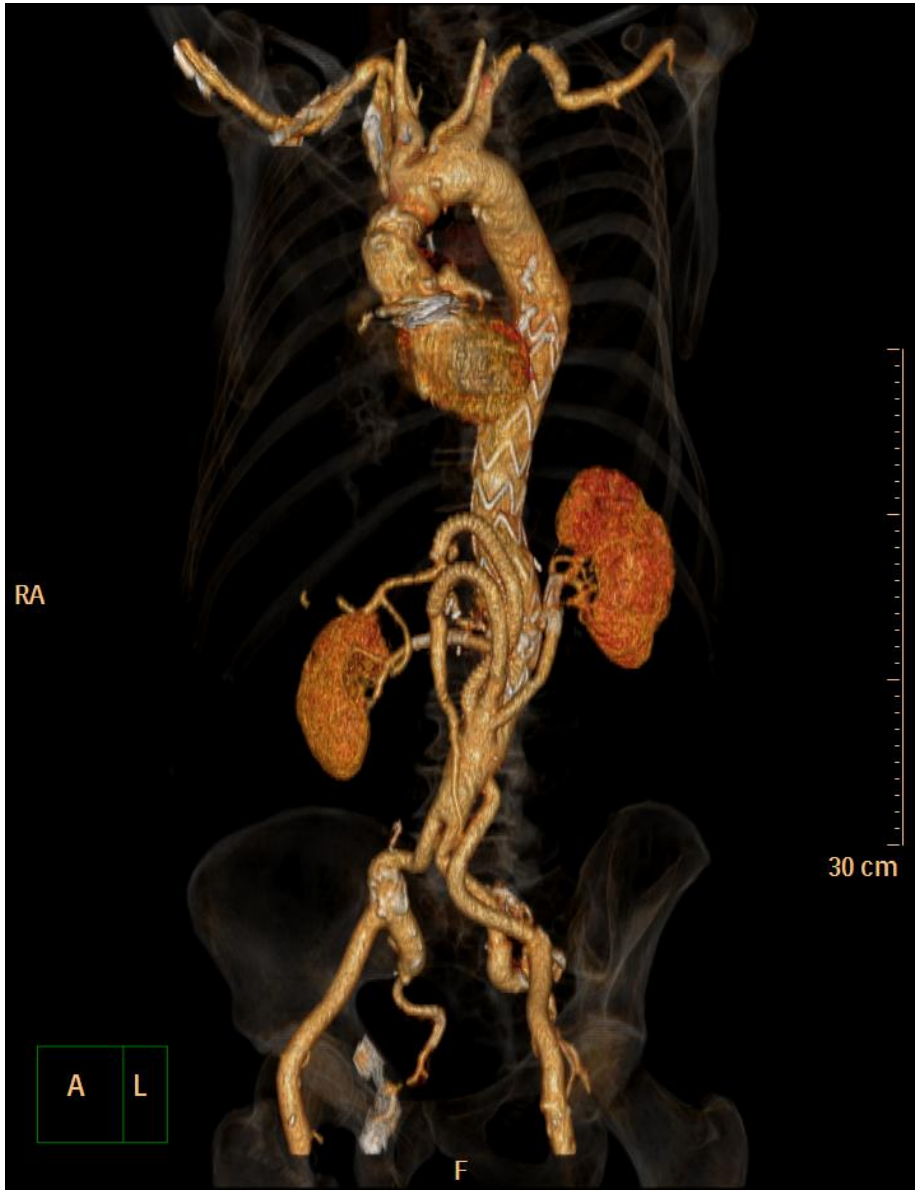




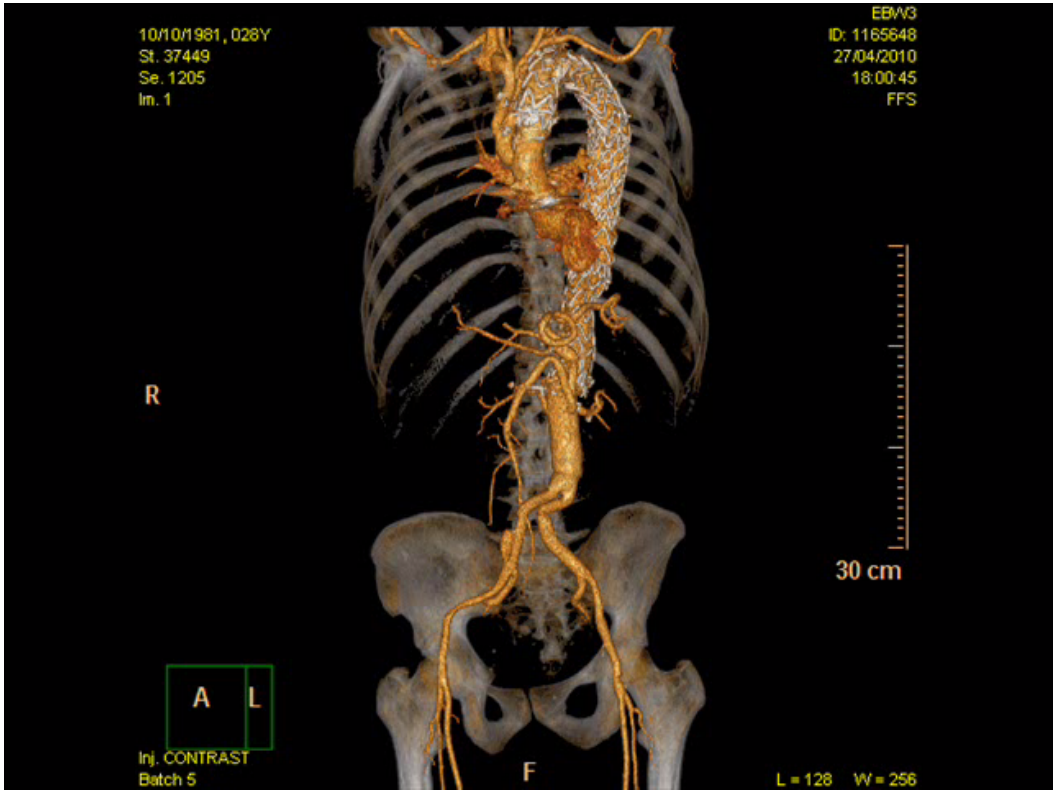
MAS III:

First Surgical Stage

Second Endovascular Stage

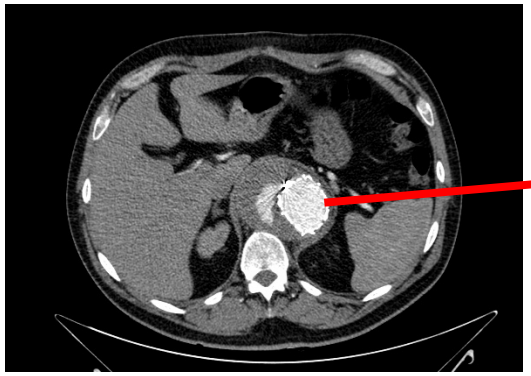


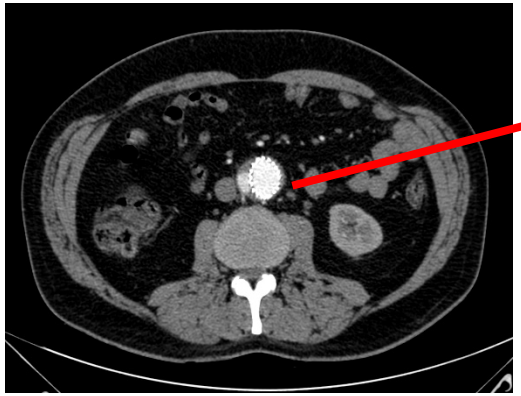
MAS III: Final 3D CT-Scan

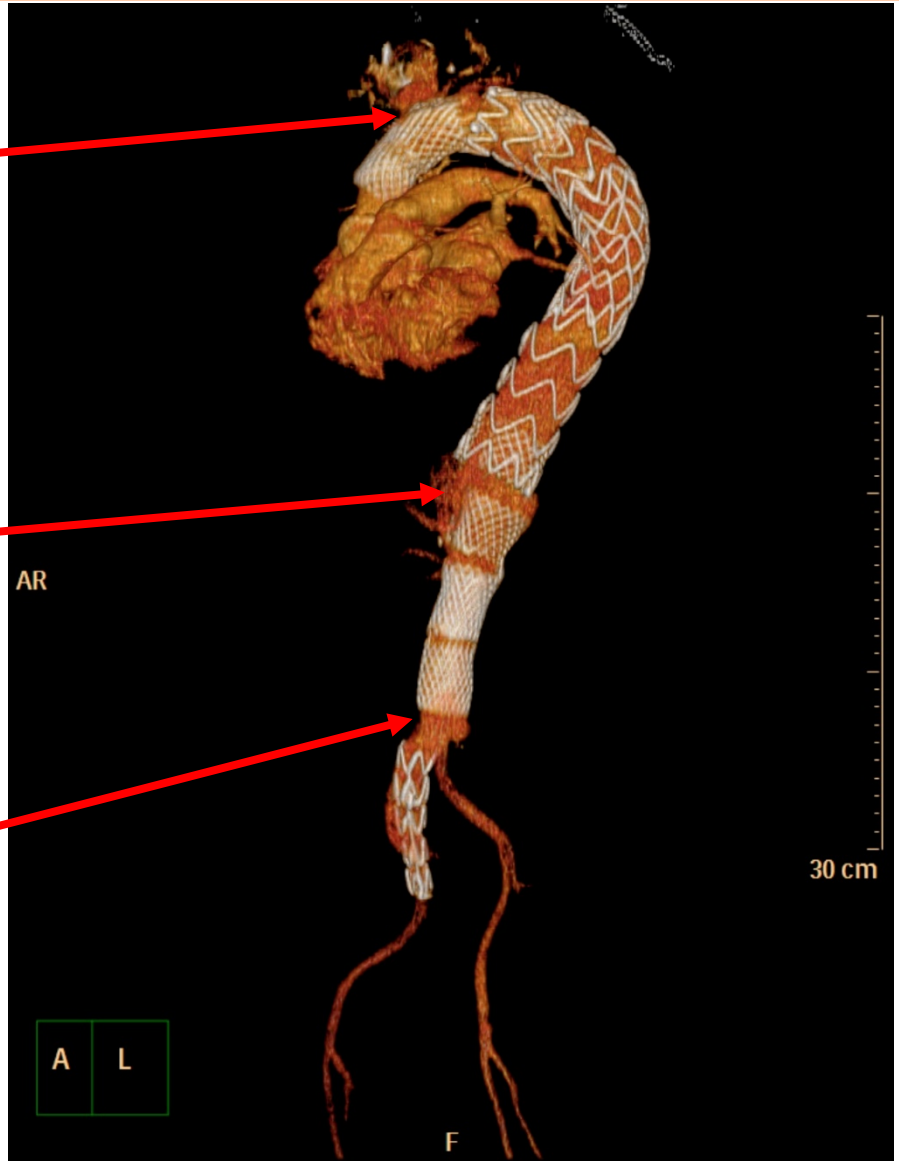


LUPIAE Technique in MAS III

57 year-old male: 1998 TypeA AD—Asc Ao Repl./ False Lumen Patency Increase---TEVAR + EVAR+ R iliac a.Stent-graft --- MultipleType I Endoleaks + severe Ao Regurg

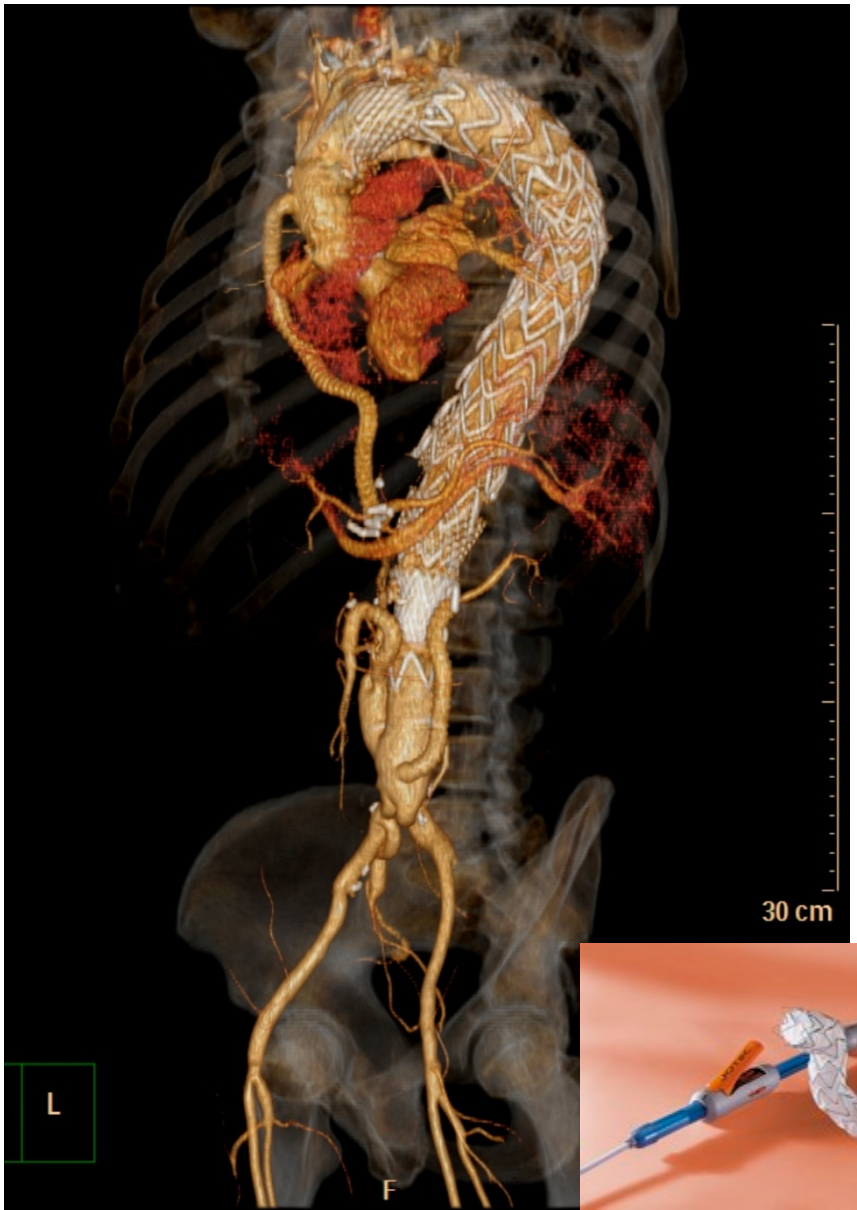






LUPIAE Technique in MAS III

Three-Stage correction 1) Bio-Bentall+Lupiae Graft with Epiaortic+Celiac+Mesenteric art Rerouting 2) Aorto-bisiliac art Bypass + Renal art rerouting 3) Endovascular Arch-Desc-Abdominal Aortic Repair



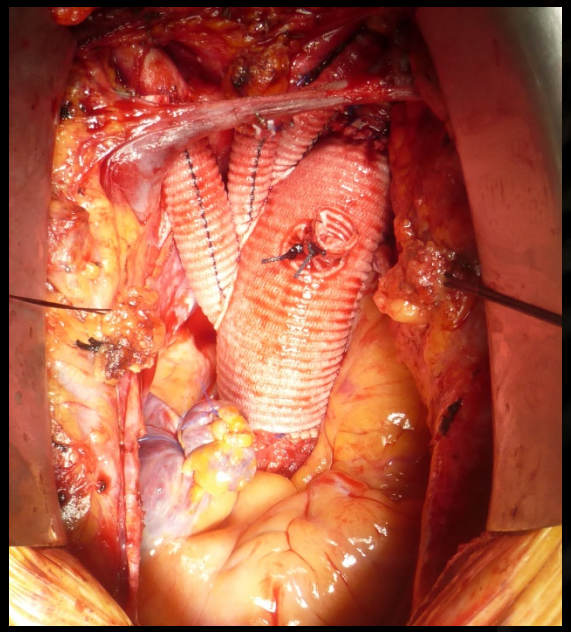
…with E-vita by Jotec endovascular stent grafts:

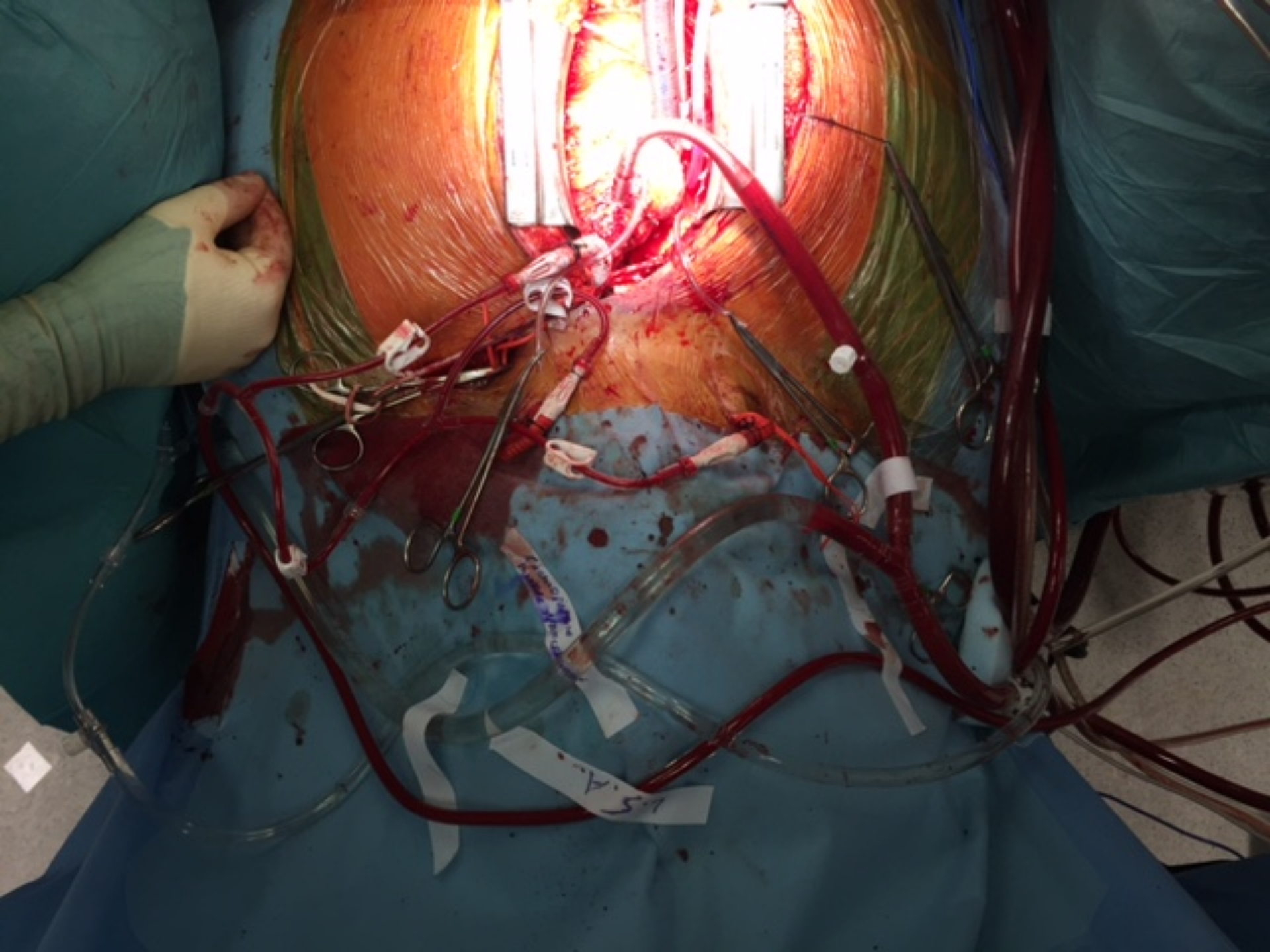
- Proximal 33x36x17
- Distal 44x40x17

CHALLENGING CASE!!!!!!

“Camel” Aorta

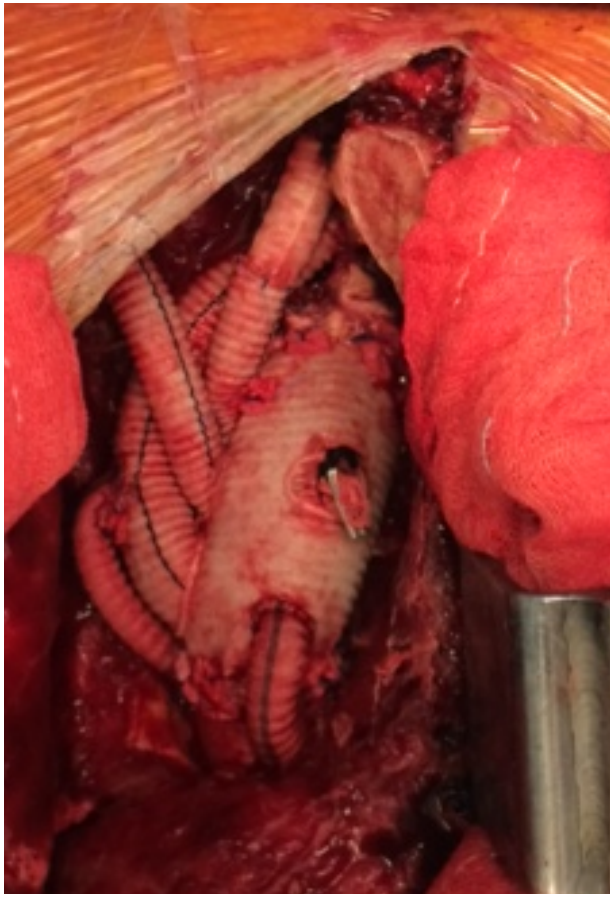
The “Camel” Aorta





Hemashield Aortic Arch Angled 4 branches

Tailored Use of a Multibranch Dacron Prosthesis



Hybrid Therapy in MAS:

Six-year experience with a hybrid stent graft prosthesis for extensive thoracic aortic disease: an interim balance[†]

Heinz Jakob[a,*], Daniel-Sebastian Dohle[a], Jarowit Piotrowski[a], Jaroslav Benedik[a], Matthias Thielmann[a], Guenter Marggraf[a], Raimund Erbel[b] and Konstantinos Tsagakis[a]

[a] Department of Thoracic and Cardiovascular Surgery, West-German Heart Center, University of Duisburg-Essen, Essen, Germany
[b] Department of Cardiology, West-German Heart Center, University of Duisburg-Essen, Essen, Germany

* Corresponding author. Department of Thoracic and Cardiovascular Surgery, West-German Heart Center Essen, University Hospital Essen, Hufelandstr. 55, 45122 Essen, Germany. Tel: +49-201-7234900; fax: +49-201-7235451; e-mail: heinz.jakob@uk-essen.de (H. Jakob).

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Conclusions

- Hybrid procedures with concomitant or subsequent endovascular treatment, using different grafts, have emerged as treatment option for complicated aortic pathologies (TAAAD & MAS)

- This approach require an adequate choice of surgical management in order to create the “ideal” landing zones for perfect and easier endovascular placement, reducing the incidence of Endoleaks

- AORTIC TEAM : Anesthesiology, Interventional Cardiology, Radiology, Perfusion, Surgical Nurses, Cardiac & Vascular Surgery.