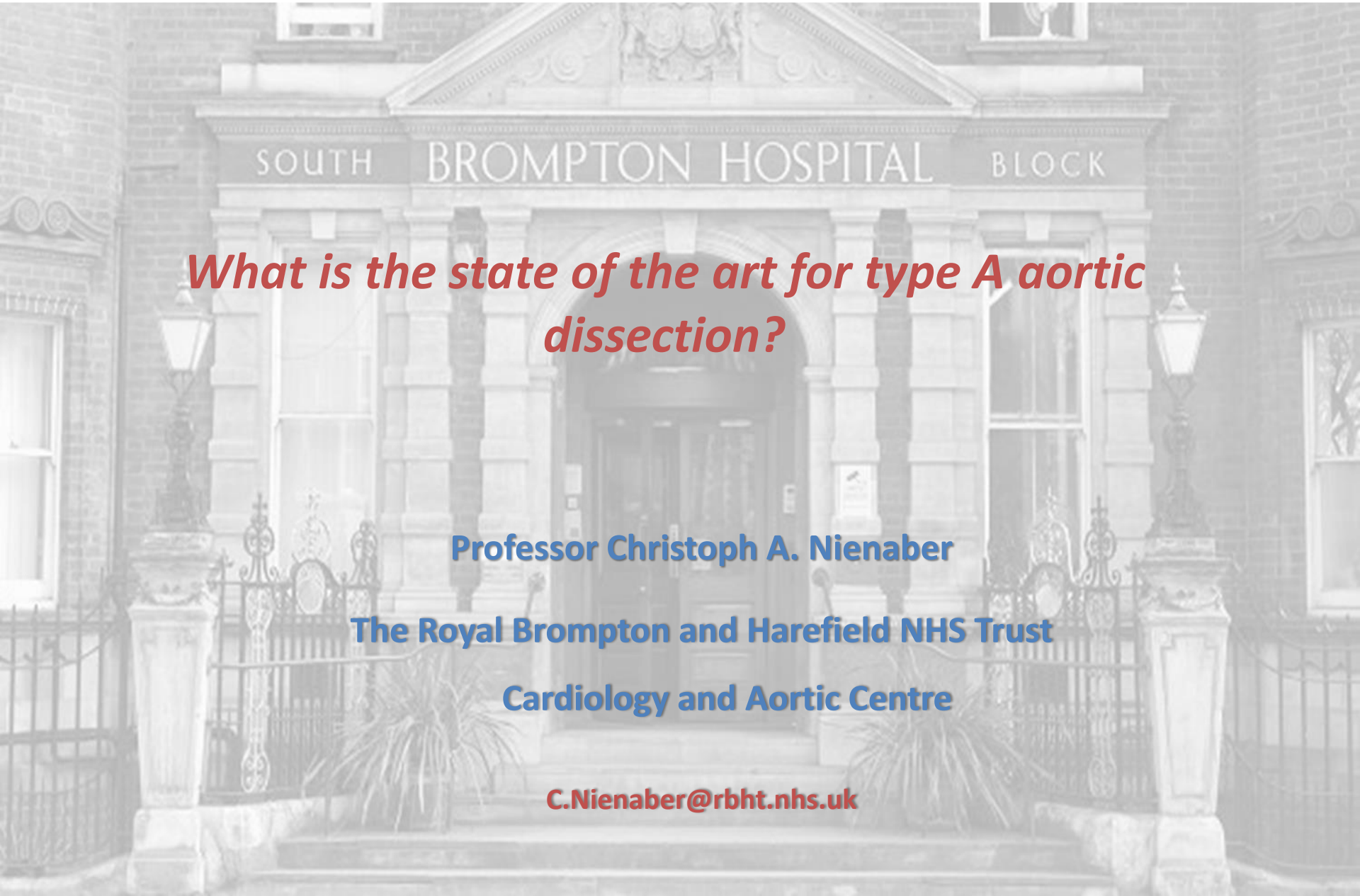
A lifetime of specialist care

Royal Brompton & Harefield NHS
NHS Foundation Trust




# *What is the state of the art for type A aortic dissection?*

**Professor Christoph A. Nienaber**

**The Royal Brompton and Harefield NHS Trust**

**Cardiology and Aortic Centre**

**C.Nienaber@rbht.nhs.uk**


CN: No relevant financial relationships to disclose.

On October 23, 1760 George II rose at 6 am, asked for his chocolate and repaired to his closet-stool. The valet heard a "noise louder than the royal wind and a groan." The King was

**...pericardium extended with coagulated blood and a transverse fissure on the inner side of the ascending aorta 3.75 cm...**

fissure on the inner side of the ascending aorta 3.75 cm long through which blood had passed to form an ecchymosis, which was interpreted as an incipient aneurysm

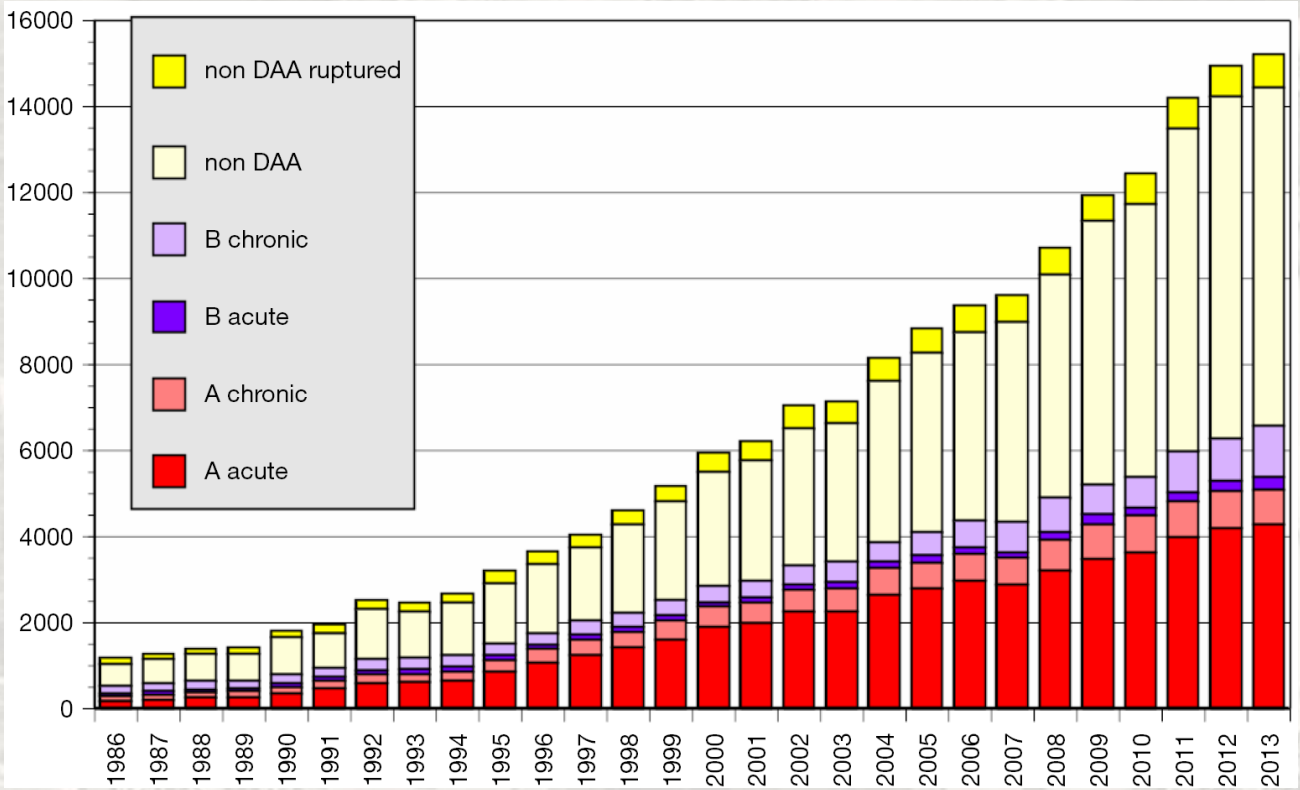



**Figure 1** Annual Survey of Cardio-aortic Surgery [1984–2013] by Japanese Association for Thoracic Surgery. Modified from reference (2). TAA, thoracic aorta; CAD, coronary artery disease; VHD, valvular heart disease; CHD, congenital heart surgery.

Yutaka Okita, Ann Cardiothorac Surg. 2016 Jul;5(4):368-76

# Surgical techniques

**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.

*Needs amendment:*

Recent surgical techniques (arch) not listed!

No mentioning of Frozen Elephant technique!

No mentioning of Hybrid (endo/open) approaches!

Little evidence, mostly expert opinion!

# *The ultimate goal: Dr. DeBakey at age 95 …had chest pain !*

- *Finally my 1st AMI…?*
- *No, a DeBakey Type II Dissection !*
- *Difficult decision to go for surgery!*
- *Intermittent loss of consionsness!*
- *Interposition graft as a simple solution!*

## Surgery on a Surgeon

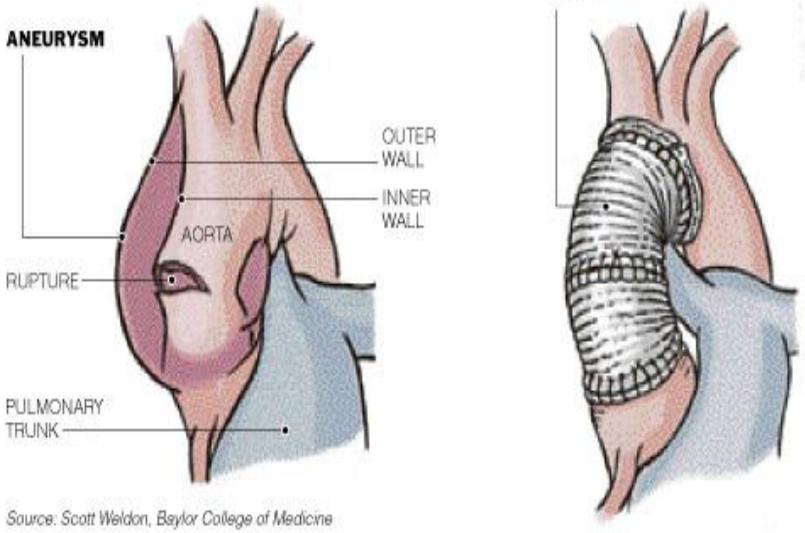
Surgeons operated in February on Dr. Michael E. DeBakey, repairing an aortic aneurysm using techniques that he had pioneered.

### The Problem

An aneurysm, or a ballooning, developed in Dr. DeBakey's aorta, the main artery leading from the heart. The wall of the aorta weakened and tore, allowing blood to seep into the inside layers of the artery, a problem that can lead to sudden death.

### The Repair

A Dacron graft, 6 to 8 inches long, was used to replace the damaged section of the aorta.



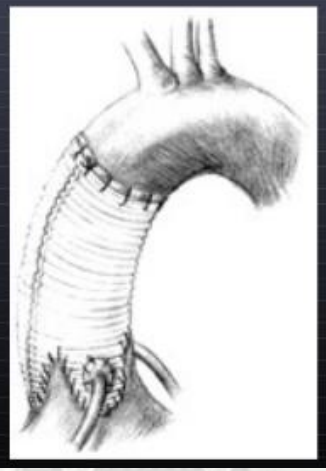

Source: Scott Weldon, Baylor College of Medicine

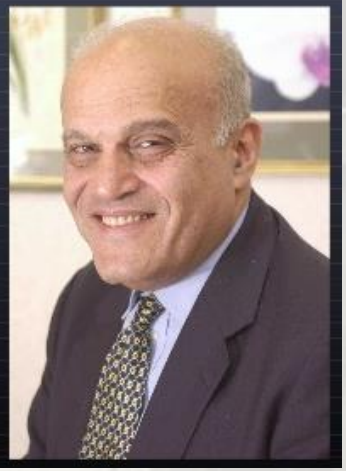
The New York Times

# *Standard surgical repair techniques in proximal AD*

## Valve sparing aortic replacement – root remodeling

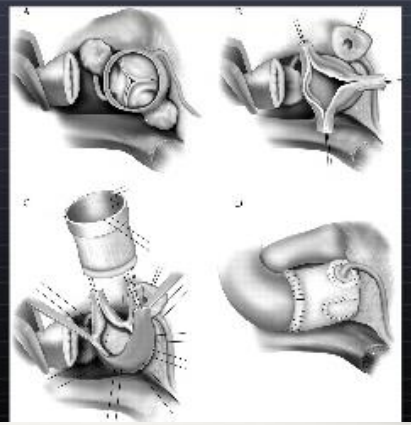
Operative Techniques in Thoracic and Cardiovascular Surgery 2005;10(4):246–258



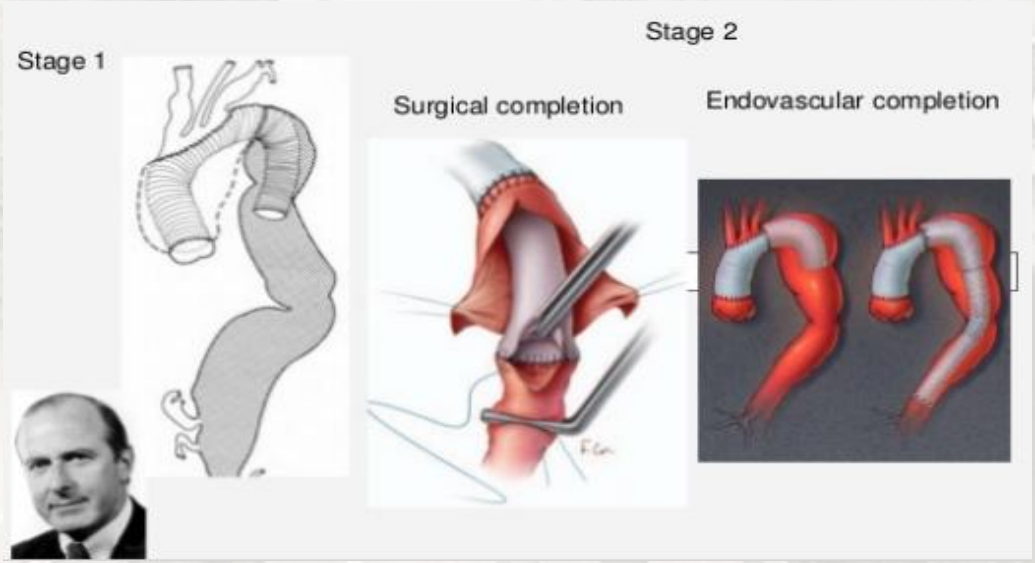


## Valve-sparing aortic root replacement: the inclusion (David) technique

Operative Techniques in Thoracic and Cardiovascular Surgery 2005;10(4):246–258
David TE, Feindel CM: An aortic valve-sparing operati(in for patients with aortic incompetence and aneurysm of the asrending aorta. J Thorac Cardiovasc Surg 103:617-622, 1992

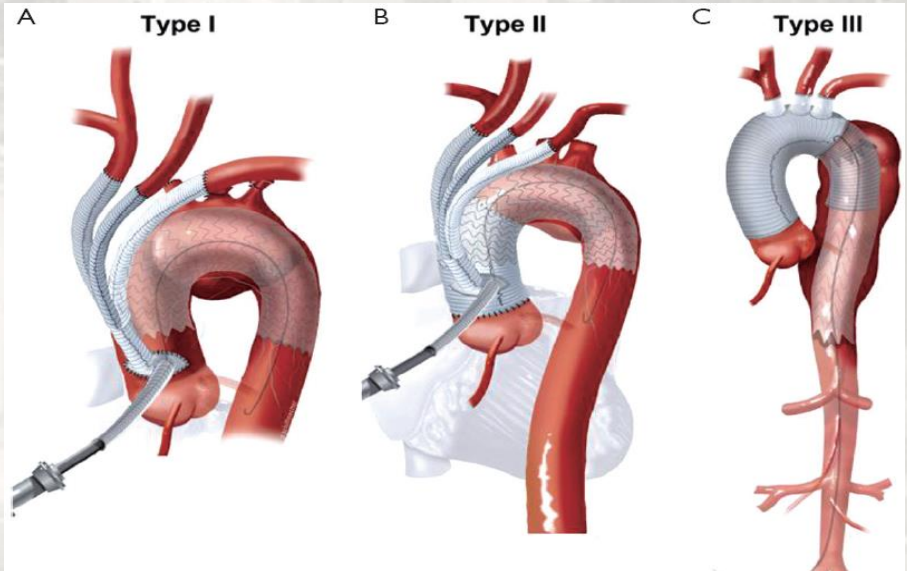


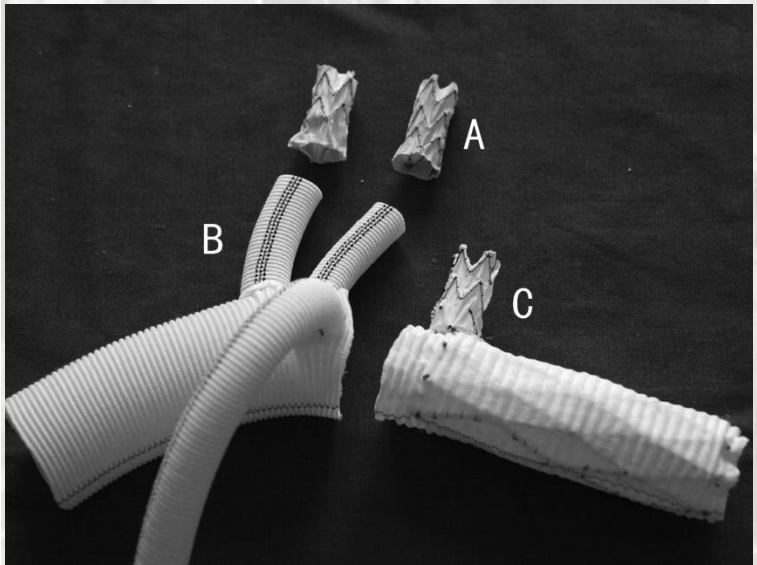
# *Hemiarch replacement & the evolution from E.T. to frozen E.T. technique*



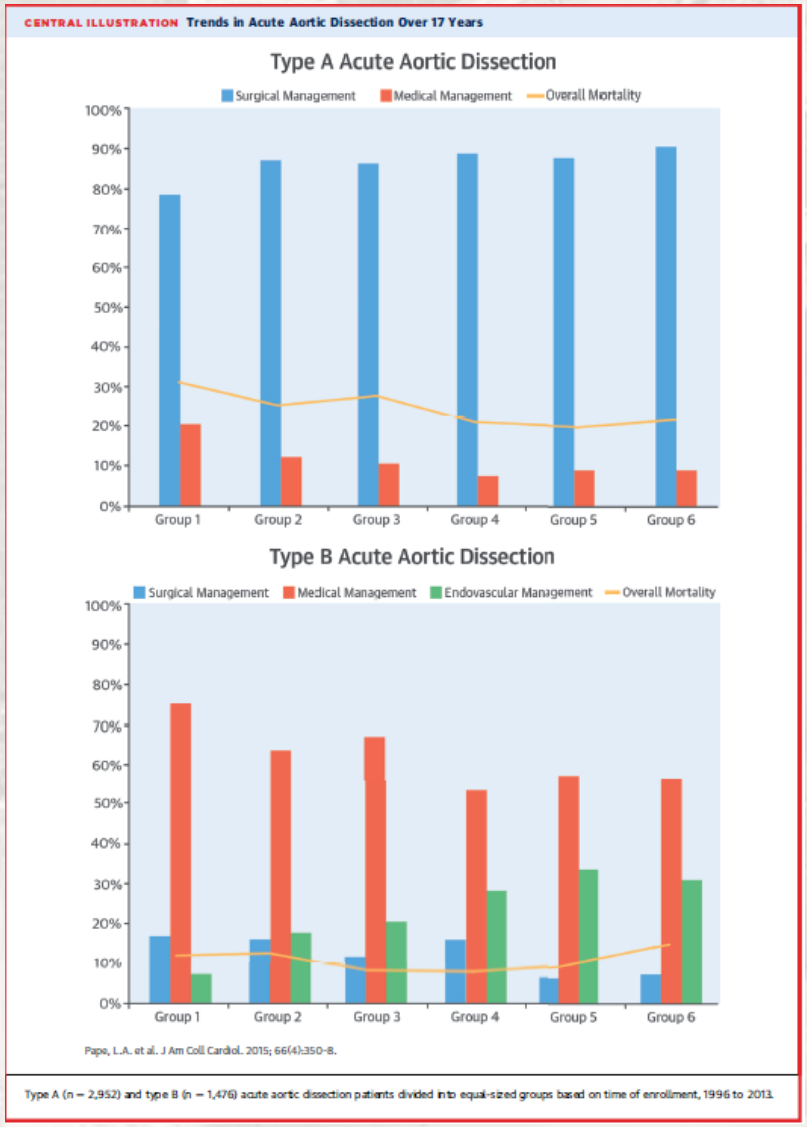

*Uncovered:*

Newly emerging surgical/interventional technology



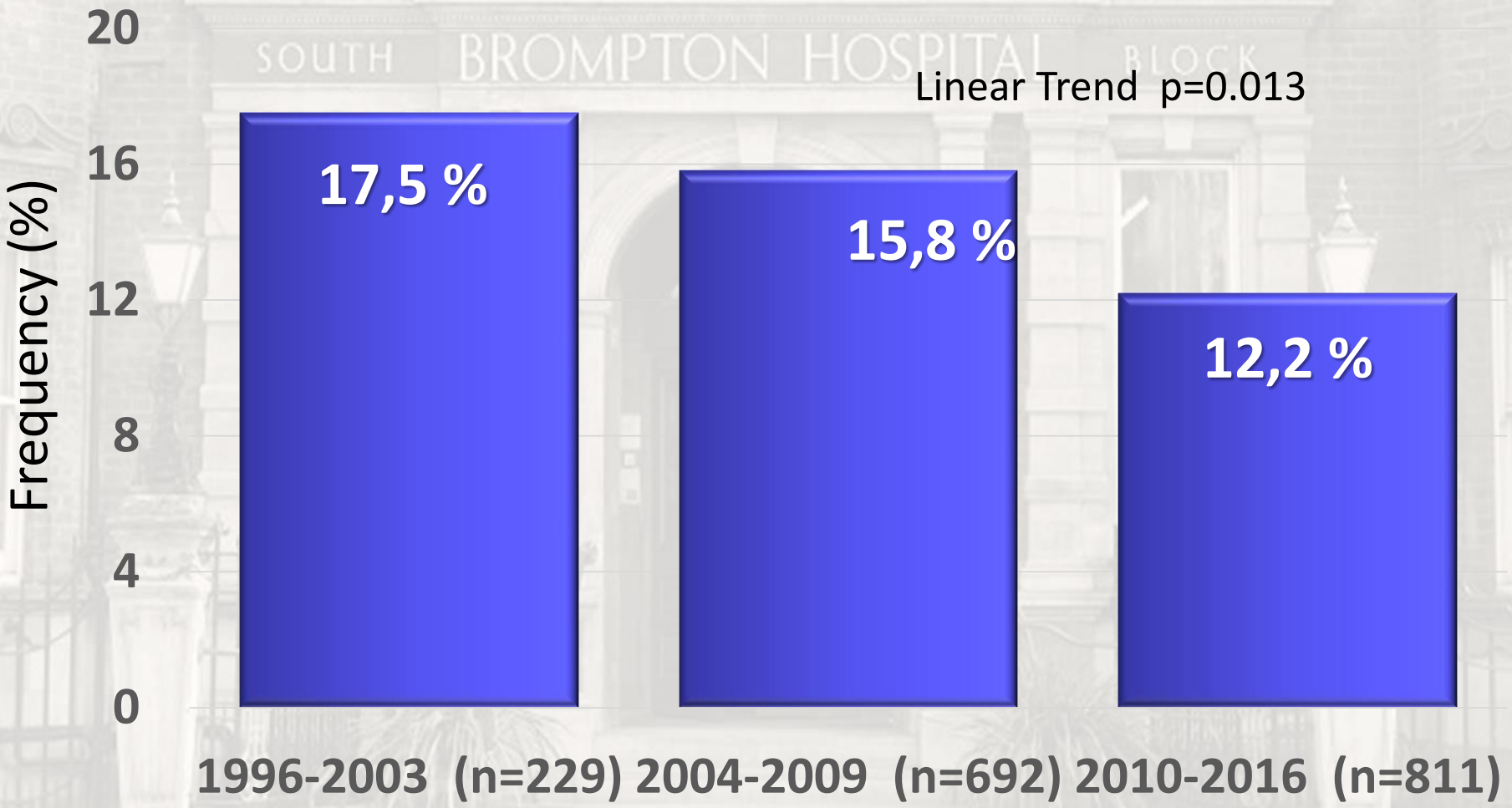
# *Recent trends in management in type A dissection*




- Fewer rejection for type A surgery
- Trend to lower mortality
- Declining open surgery for type B dissection
- Increasing endovascular intervention

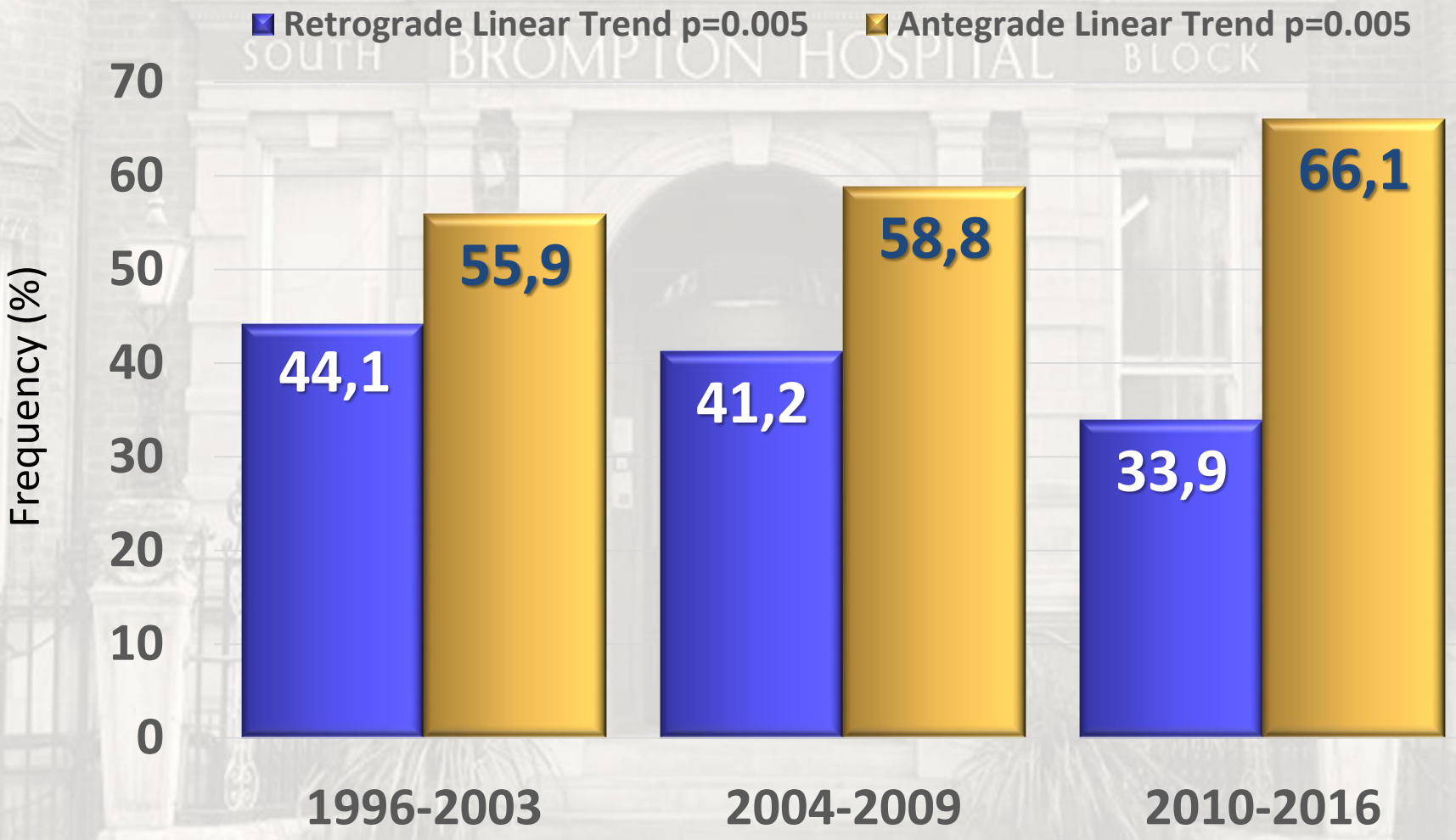
IRAD JACC 2015;66:350-8

# *Declining in-Hospital Mortality: Operated Type A Dissection*



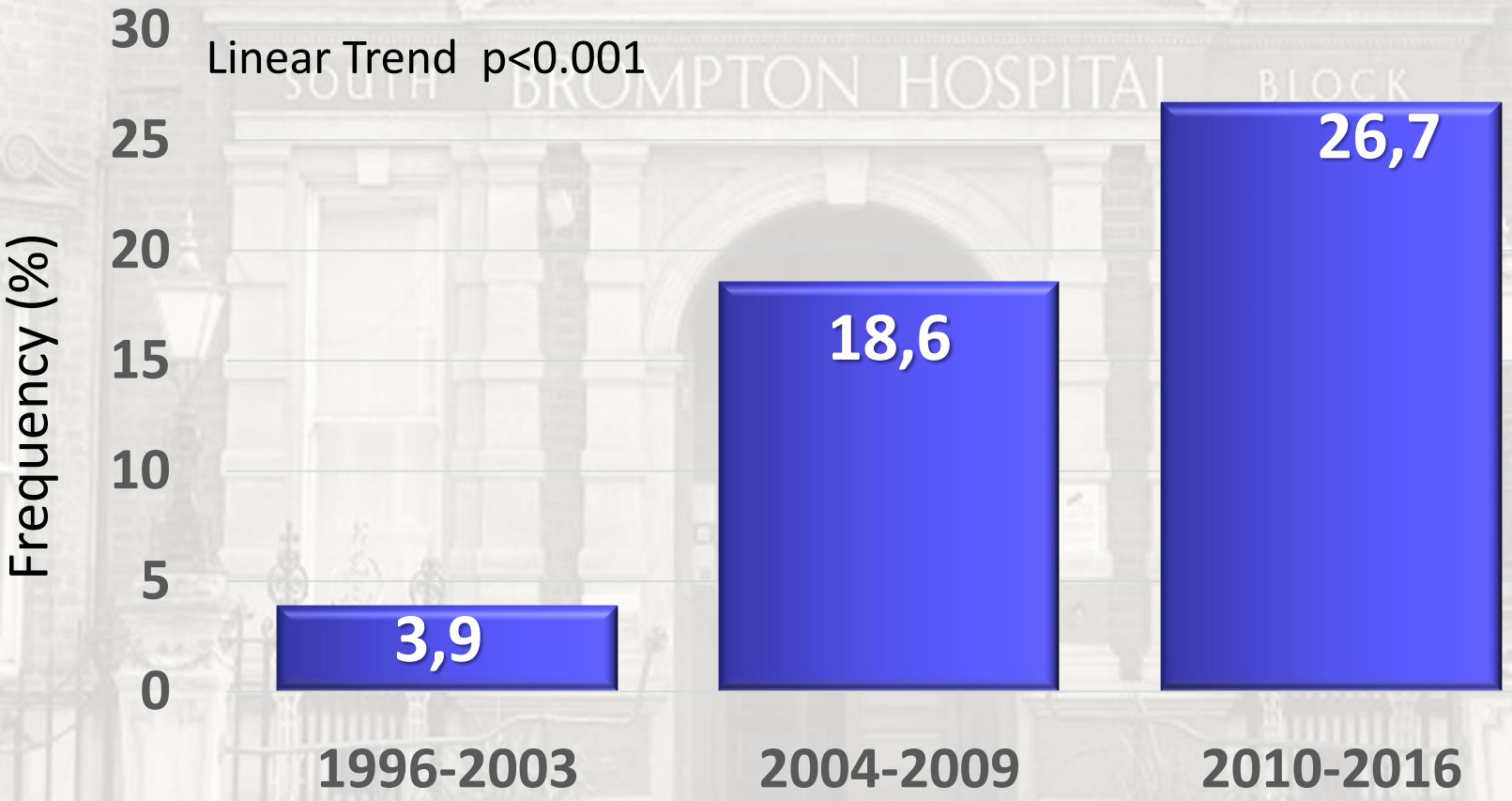

Parikh N et al. *IRAD* 2016.

# *More antegrade cerebral Perfusion Strategies*



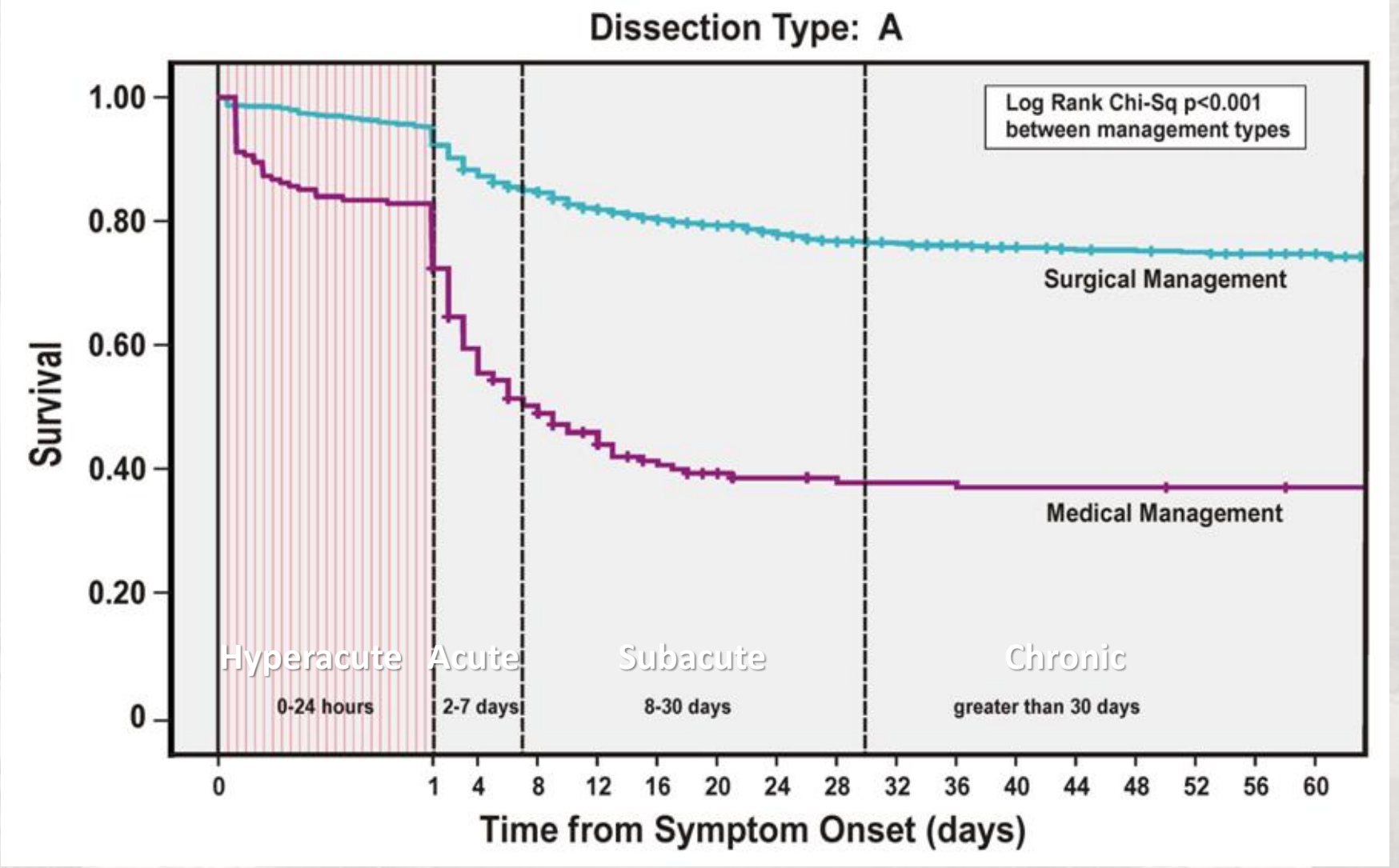

Parikh N et al. *IRAD* 2016.

# *Increasing Use of Valve sparing Surgery*




Parikh N et al. *IRAD* 2016.

# *New (alternate) classification system for proximal dissection*




Booher AM, et al. Am J Med 2013;26:e19-24.

# *Guideline Recommendations to treat aortic dissection*

**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.

*Needs update:*

**No specific recommendation for surgical techniques in type A's!**

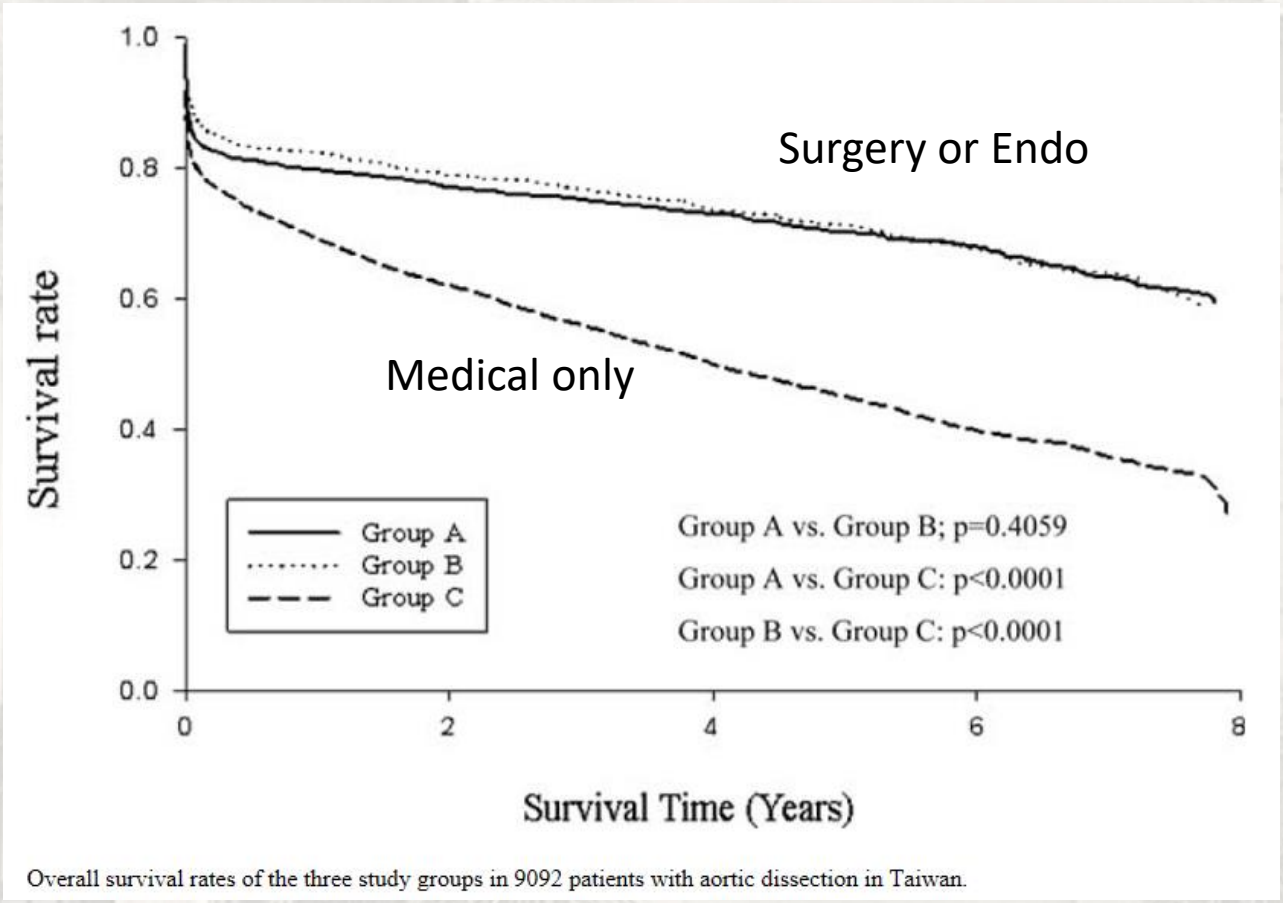
Which patient should be managed medically only?

What is the best endovascular strategy in survivors of type B dissection?

**Is there room for endovascular management of proximal aortic dissection?**

Should we generate a new classification system for dissection?

# *Survival pattern of Aortic Dissection*




Overall survival rates of the three study groups in 9092 patients with aortic dissection in Taiwan.

**Group A** included 2340 patients (25.74%) treated surgically for type A AD

**Group B** included 1144 patients (12.58%) treated endo/surgically for type B AD

**Group C** included 5608 patients (61.68%) with any type of AD treated with medical therapy only.

*Medical management* only may never be enough !

Ting-Yu Yeh, et al. Epidemiology and Medication Utilization Pattern of Aortic Dissection in Taiwan: A Population-Based Study. Medicine (Baltimore). 2016 Feb;95(8):e200b

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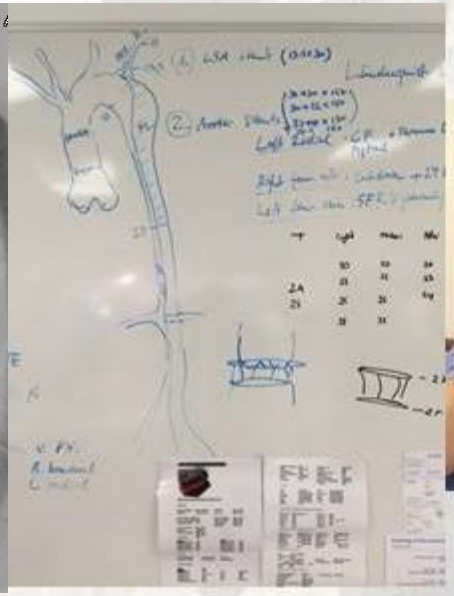
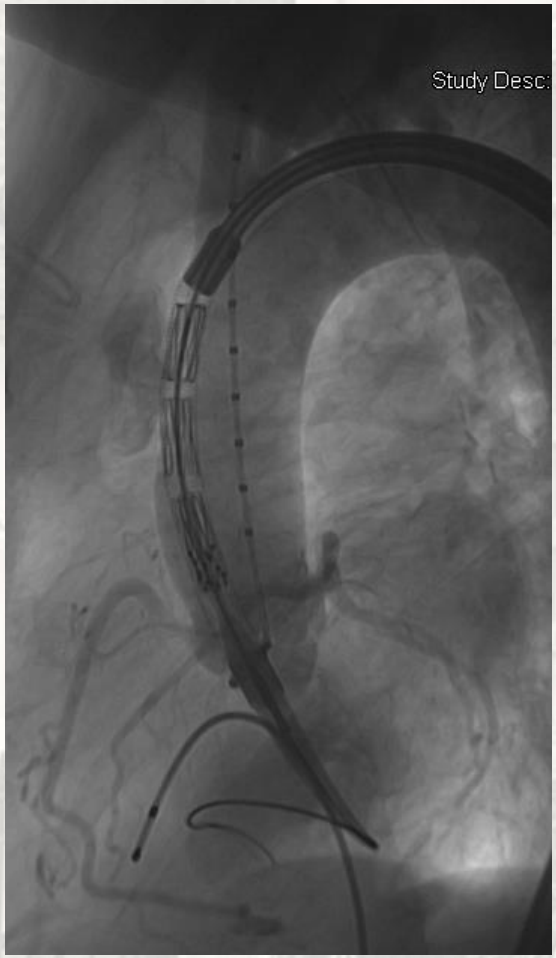
# *Workplace for endovascular procedures is Hybrid*



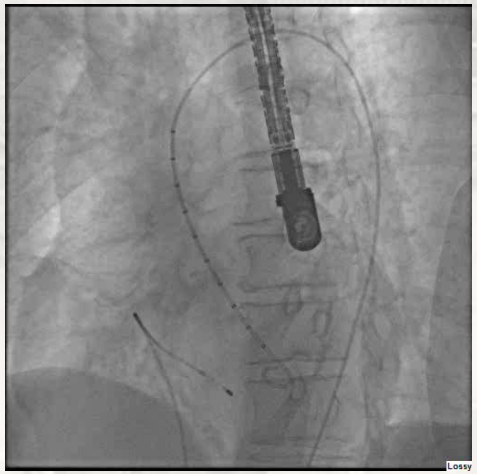
# *Acute Type A Dissection: proximal TEVAR ?*

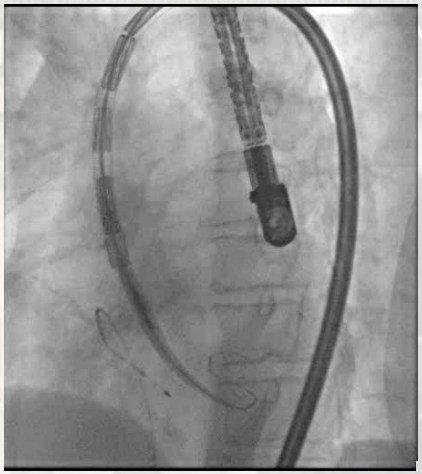


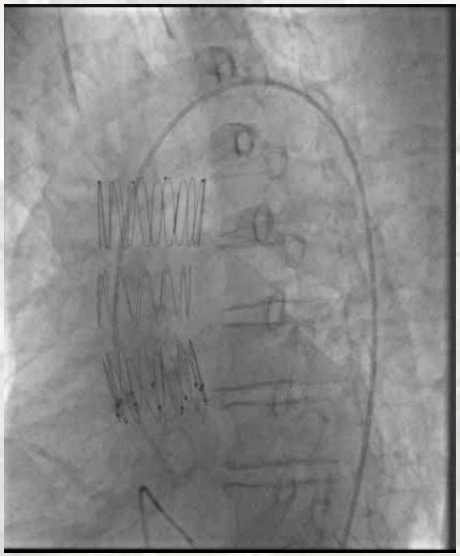



Implantation under rapid RV pacing
Delivery of 36 mm x 6.4 cm TX2 Graft

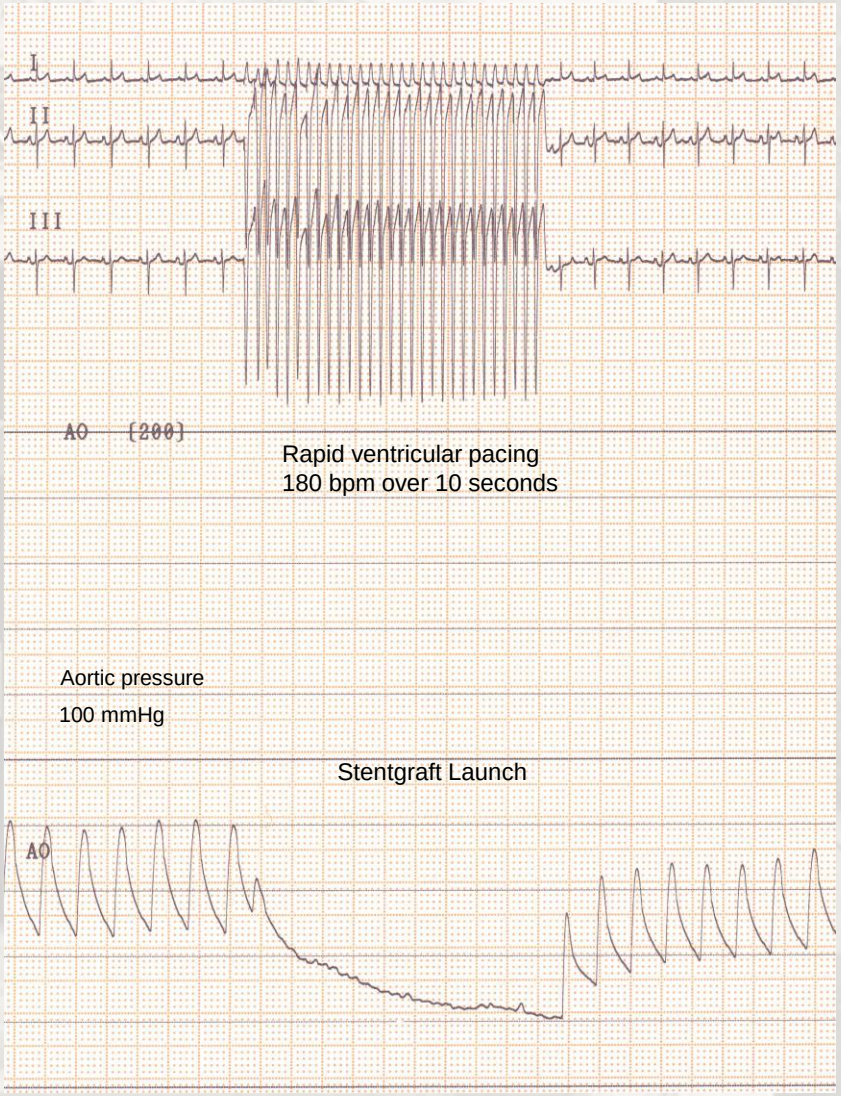
# *Hybrid: My 1st TEVAR in the ascending aorta*
# *Endovascular SG placement during cardiac arrest*





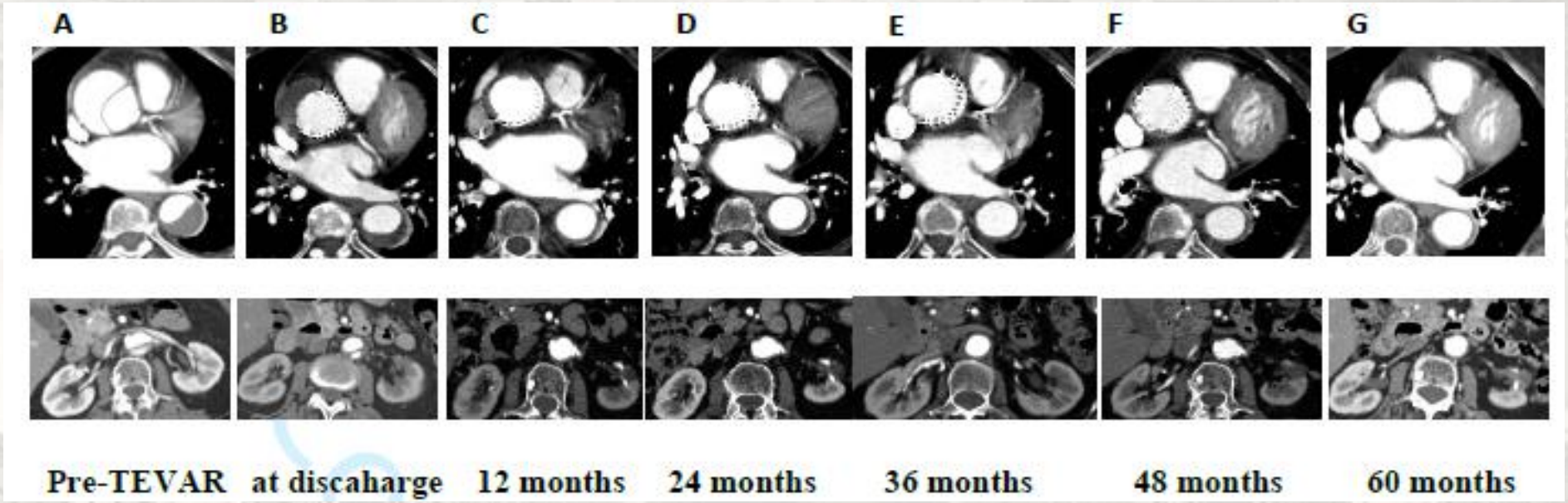


Successful SG placement in type a aortic dissection under Rapid Pacing for cardiac arrest



*The ultimate goal in treating any dissection is mending the layers and healing of the aorta which requires stent-graft induced FL thrombosis and remodelling*

TEVAR in type A dissection




Sakalihasan N, Nienaber CA et al. EHJ 2019

# *Series of 12 patients unfit for open surgery*



| Patient | Age & Sex | Diagnosis | Euroscore II | SG | Procedure duration (min) | Follow-up (months) | Complications |
|---|---|---|---|---|---|---|---|
| 1. | 74M | cTAAD | 6.9 | Cook | 90 | 32 | None |
| 2. | 75M | aTAAD | 8.1 | Bolton NBS | 140 | 29 | None |
| 3. | 87M | aTAAD | 13.4 | Bolton NBS | 79 | 35 | None |
| 4. | 89M | cTAAD | 15.0 | Cook | 149 | 15, † | None |
| 5. | 90M | cTAAD | 19.3 | Cook | 70 | 0, † | Ventricular rupture, tamponade |
| 6. | 69M | aTAAD | 3.9 | Cook | 61 | 36, † | None |
| 7. | 75M | cTAAD (PAH) | 4.9 | Bolton NBS | 70 | 24 | None |
| 8. | 87M | cTAAD | 9.4 | Cook | 49 | 15 | Minor Stroke |
| 9. | 87F | aTAAD post TAVR | 7 | Optimed | 120 | 23, † | None |
| 10. | 83M | cTAAD | 6.9 | Cook | 89 | 19, † | None |
| 11. | 75F | aTAAD | 5.9 | Cook | 60 | 5 | none |
| 12. | 75F | aTAAD | 8.9 | Gore + Viabahn in innominate artery | 60 | 0 | none |

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Address for reprints: Christoph A. Nienaber, MD, PhD, Cardiology and Aortic Centre Royal Brompton Hospital, Royal Brompton and Harefield NHS Foundation Trust, Sydney St, London SW3 6NP, United Kingdom (E-mail: c.nienaber@rbht.nhs.uk).
0022-5223/$36.00

http://dx.doi.org/10.1016/j.jtcvs.2016.07.078

Scanning this QR code will take you to the videos for the article.



## Characteristics

- 9 M, 3F, aged 81±7 years
- Proximal tear in ascending aorta
- EuroScore II 9.1±4.5
- Procedural success 91.7%
- 30 d mortality 8.3%

Nienaber C, Sakalihasan N, Clough R et al. JCTS 2017

# *Emerging Therapy for the ascending Aorta*

Journal of the American College of Cardiology
© 2013 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 61, No. 18, 2013
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2012.08.994

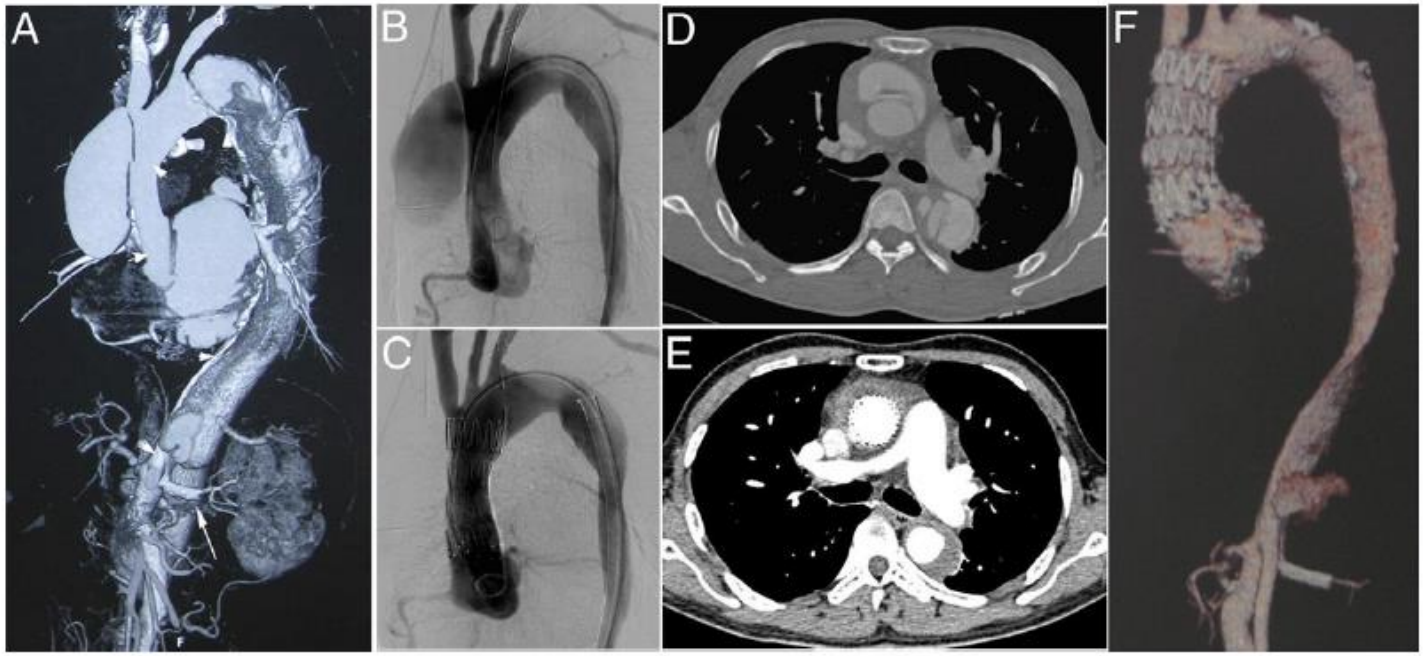



**Figure 1** **Ascending Aortic Dissection with Compromised Branch Artery**

**(A)** Computed tomography angiography (CTA) image obtained before stent grafting showing that the primary stent reopened the left renal artery, which had been compromised by the dissection **(arrows)**. **(B)** Pre-operative aortography showing the aneurysmal expansion of the ascending aortic dissection. **(C)** Completion aortography showing that the entry tear was completely excluded. Comparison between **(D)** pre-operative CTA image and **(E)** CTA image obtained at the 24-month follow-up at the same level of maximal ascending aorta showing that the diameter of ascending aorta shrank and the true lumen expanded. **(F)** Follow-up CTA image confirming complete thrombosis of the false lumen along the ascending aorta and the patency of the coronary arteries and the supra-arch branch arteries.



Lu Q, et al. J Am Coll Cardiol 2013;61:1917–24

# *Surprise…?*

## Anatomic Feasibility of an Endovascular Valve-Carrying Conduit for the Treatment of Type A Aortic Dissection

**167 patients**

With high quality CT scans were screened for anatomic feasibility

**3 landing zones**


① distal sealing zone
② proximal sealing zone
③ transcatheter valve

**113 patients (68 %)**

Are potential candidates, but most would require tapered stent-grafts

Kreibich M et al., JTCVS 2018

# *Ongoing study using an adaptable/compliant SG*

PRESS RELEASES > BUSINESS WIRE

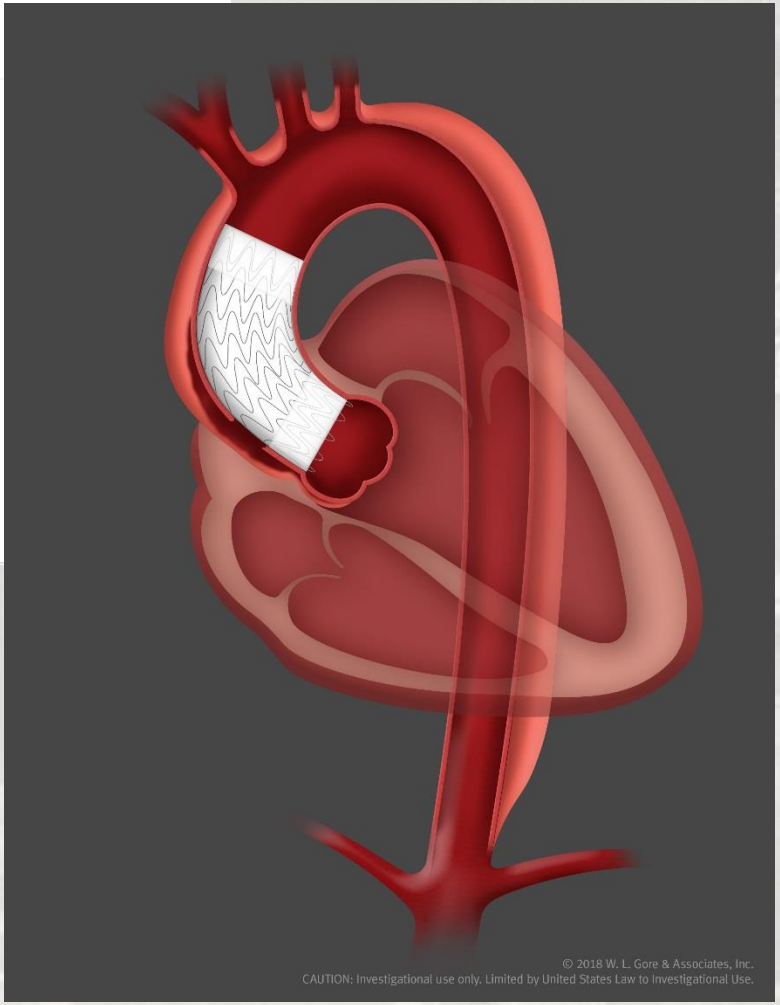
## Gore Announces Successful Patient Implant of Endovascular Stent Graft for the Ascending Aorta

Aug 27, 2018, 8:30am EDT

*GORE® Ascending Stent Graft, an investigational device, is an off-the-shelf endovascular solution designed to treat life-threatening Type A dissections of the ascending aorta*

FLAGSTAFF, Ariz.--(BUSINESS WIRE)

W. L. Gore & Associates, Inc. (Gore) today announced the first implant in conjunction with the Gore ARISE Study of the GORE® Ascending Stent Graft, an investigational device and the only endovascular stent graft specifically designed to treat Type A dissections of the ascending aorta. The successful procedure took place on August 14, 2018 at Memorial Hermann Medical Center in Houston, Texas by Anthony Estrera, MD. and Bruce Tiaden, MD. as part of the Gore ARISE Study.

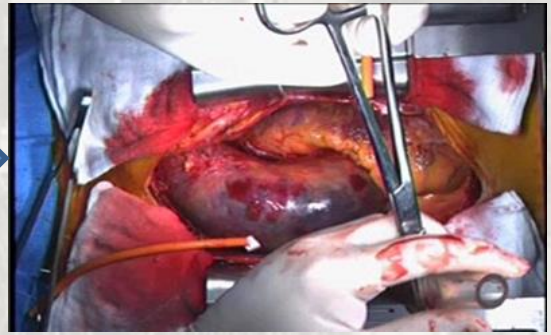



Single arm study close to completion…no data released yet.

# *Evolution after successful proximal stent-grafting*

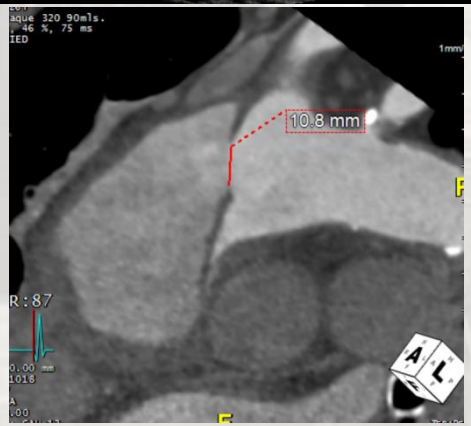
Pre-TEVAR At discharge 16 months F/U

2- and 3-dimensional images of proximal aortic dissection before (A) and after stent-graft (B) with successful remodelling, but later total erosion of distal stent-edge at 16 months (C).



Yuan X et al. Cath Cardiovasc Int 2018

*This time another strategy…why not a dual lumen intervention this time?*



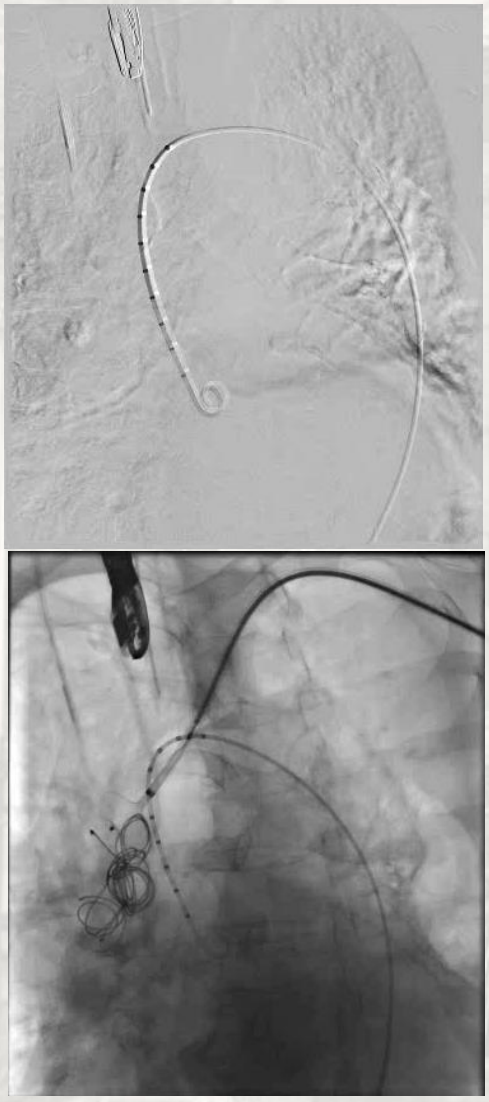

**CASE M.P**

**Inoperable**
**Euroscore II 21%**

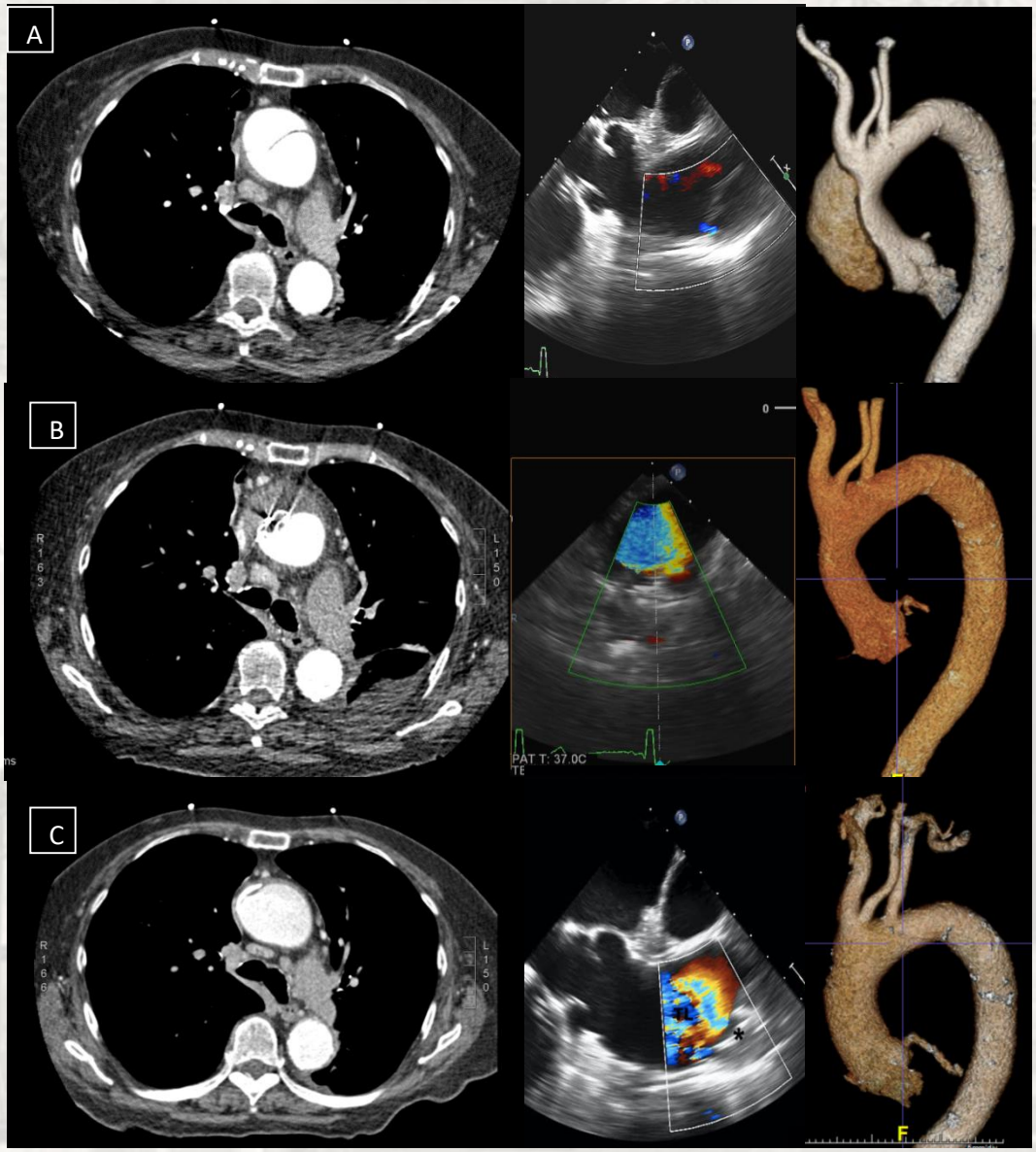
A lifetime of specialist care

Royal Brompton & Harefield NHS
NHS Foundation Trust

# CASE M.P



# *Interventional Repair of type a aortic dissection*




pre procedure
(FLIRT)

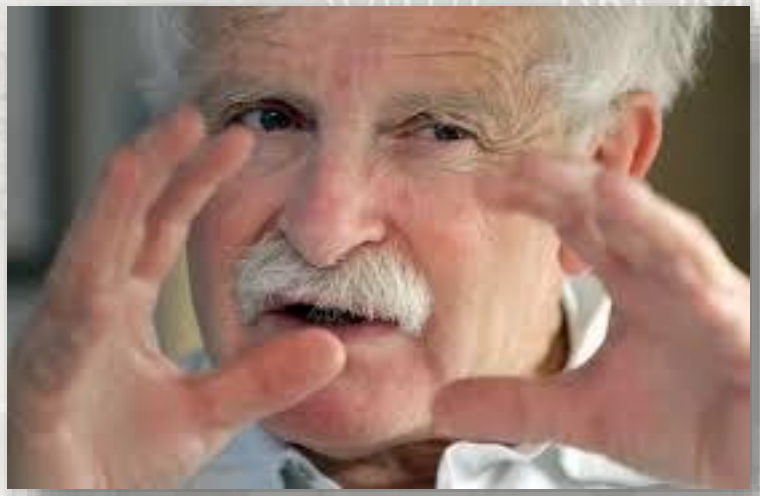
CT and echo images pre-procedure (A), at discharge (B) and 6-month follow-up (C) showing entry closure false lumen thrombus and shrinkage with true lumen expansion (remodelling) (patient no.2). Star shows the ASD occluder.

At discharge

6 months F/U

Yuan X et al. CCI 2018

# *Take home message*



Proximal dissection is a surgical domaine using various resection techniques!

Bruce Lytle, MD
Cleveland Clinic

*"As neither TAVR is real surgery…*
*…nor TEVAR a surgical procedure*
*…let the wire guys do it!"*

A lifetime of specialist care

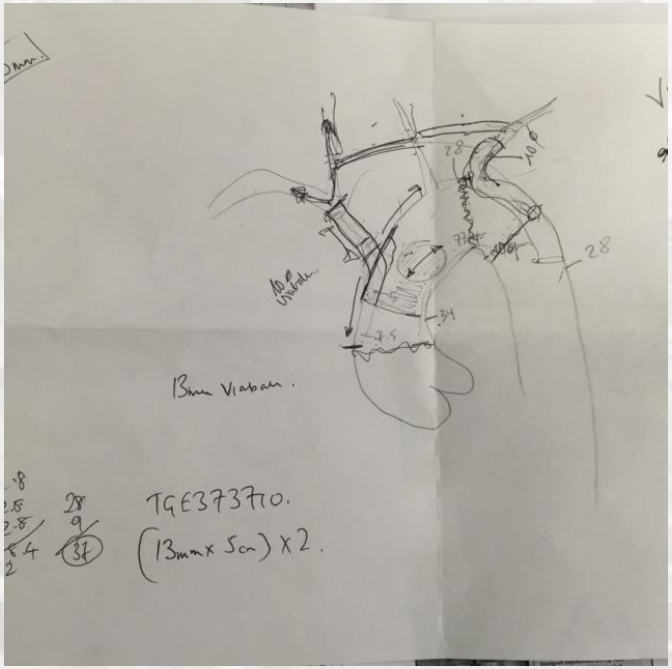
Royal Brompton & Harefield NHS
NHS Foundation Trust

# *Multidisciplinary Brompton Aortic Centre 2019*

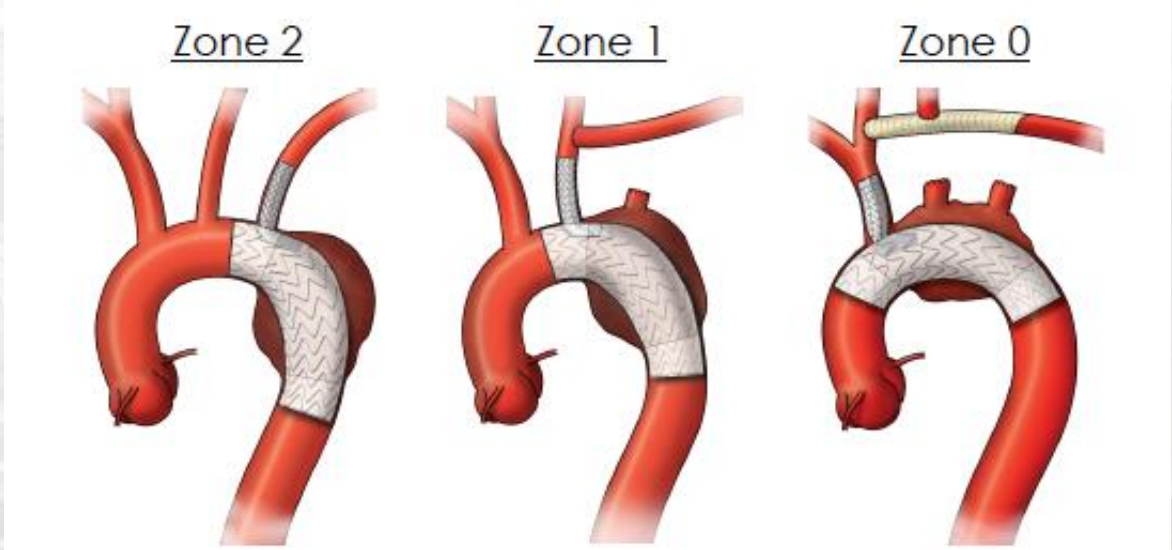
# Personalized management in case of arch involvement

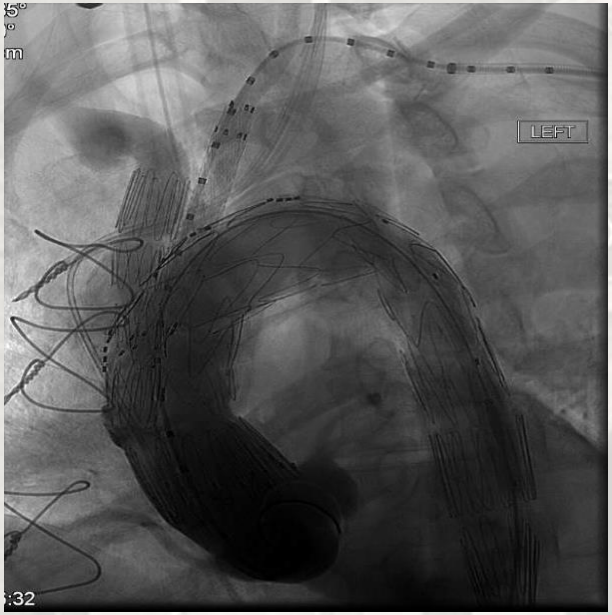
*Uncovered:*

Newly emerging surgical/interventional technology

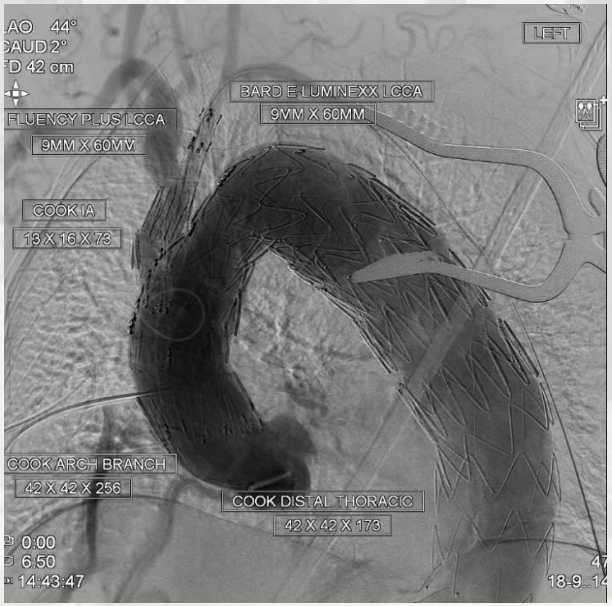



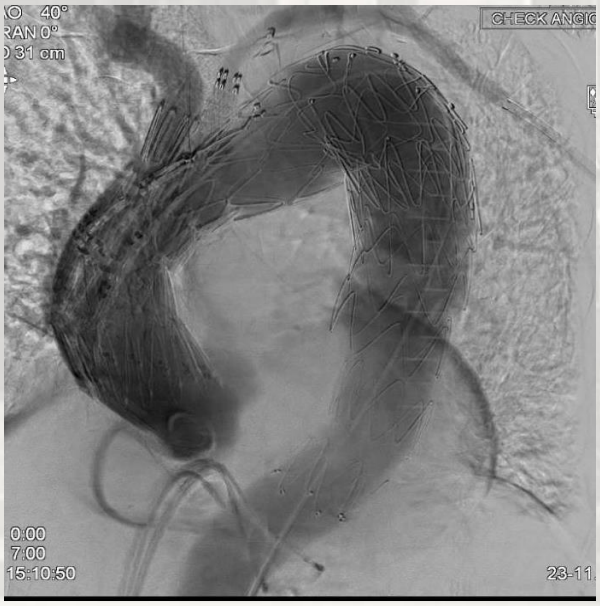
*fTEVAR in chronic aortic dissection in Marfan's syndrome*




LEFT

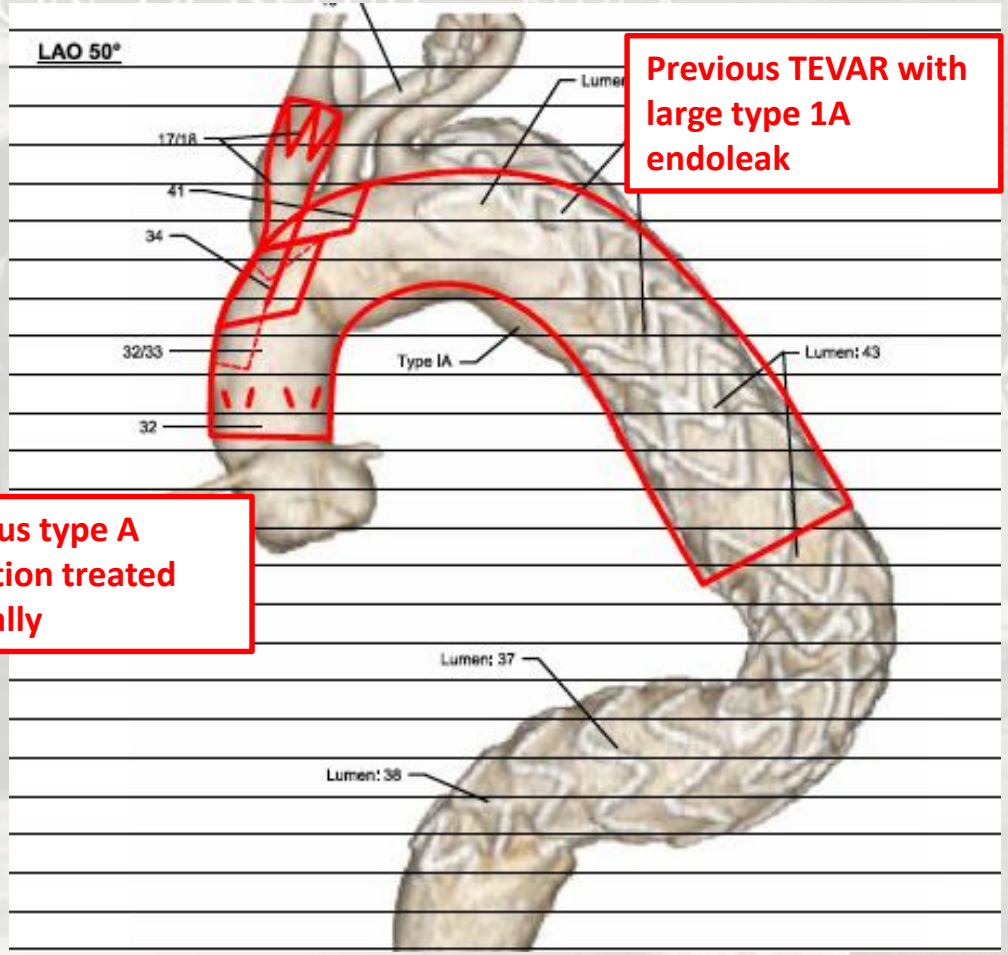

12MMX40MM
FLUENCY 9MMX60MM
LUMINEXX 9MMX60MM
MX80MM
2MMX60MM


AO 44°
AUD 2°
D 42 cm
LEFT
BARD E-LUMINEXX LCCA
9VM X 60MM
FLUENCY PLUS LCCA
9MM X 60MM
COOK IA
13 X 16 X 73
COOK ARCH BRANCH
42 X 42 X 256
COOK DISTAL THORACIC
42 X 42 X 173
0:00
6:50
14:43:47


40°
RAN 0°
31 cm
CHECK ANGIO
0:00
7:00
15:10:50

# *Future case*

- Patients turned down for surgery for frailty or old age at MDT
- Special cases
  - Previous TEVAR



# Ascending Aorta + TEVAR

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**Vascular Disease**

## Endovascular Repair of Ascending Aortic Dissection

### A Novel Treatment Option for Patients Judged Unfit for Direct Surgical Repair

Qingsheng Lu, MD, Jiaxuan Feng, MD, Jian Zhou, MD, Zhiqing Zhao, MD, Junmin Bao, MD, Rui Feng, MD, Liangxi Yuan, MD, Xiang Feng, MD, Lefeng Qu, MD, Yifei Pei, MD, Zhijun Mei, MD, Zaiping Jing, MD, PHD

*Shanghai, China*

**Objectives** This paper sought to report the outcomes of patients who are considered unfit for urgent surgical repair of ascending aortic dissections (AADs) who were treated using a novel endovascular repair strategy.

**Background** AAD is best treated by direct surgical repair. Patients who are unable to undergo this form of treatment have poor prognoses. Previously, clinical case reports related to endovascular repair of AAD have been controversial.

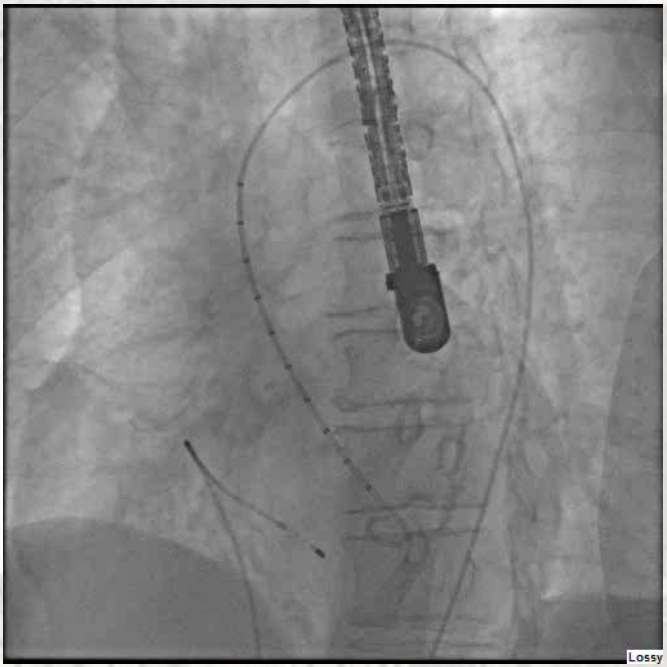
**Methods** Between May 2009 and January 2011, 41 consecutive patients with AAD were treated in our institution. Fifteen patients were considered poor candidates for direct surgical repair and subsequently underwent the endovascular repair.

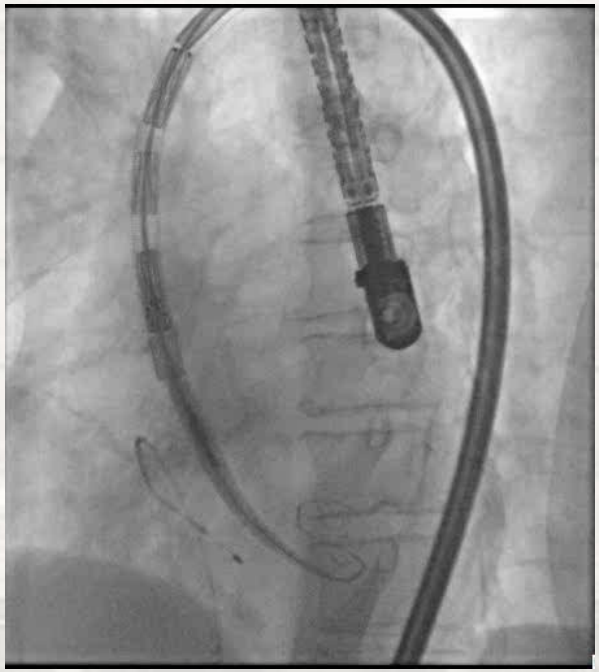
**Results** The nature of the referral process to our tertiary care facility made the median time from aortic dissection onset to treatment 25.5 days (range: 6 to 353 days). Dissections in 5 patients (33.3%) were considered acute, and those in 10 patients (66.7%) were considered chronic. The rate of successful stent-graft deployment was 100%, and there were no major morbidities or deaths in the perioperative period. Median follow-up was 26 months (range: 16 to 35 months). One new dissection occurred in the aortic arch at 3 months and was treated with a branched endograft. Significant enlargements of true lumens and decreases of false lumens and overall thoracic aorta were noted after the procedures.

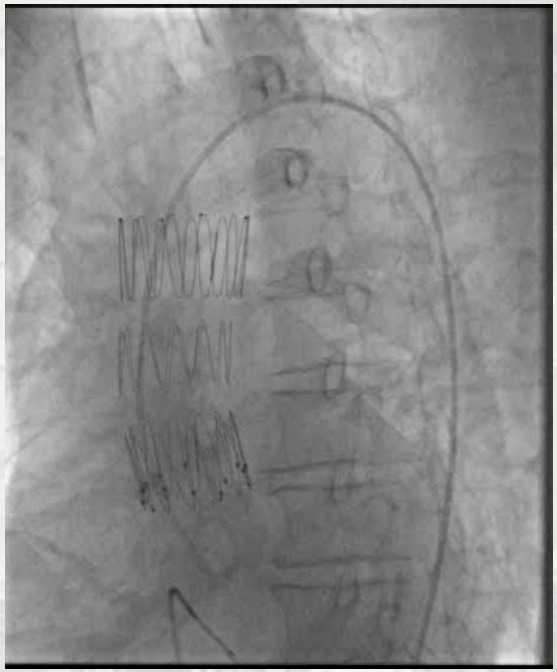
**Conclusions** Endovascular repair of AAD was an appropriate treatment option in patients who were considered poor candidates for traditional direct surgical repair by the clinical criteria used in our institution. A larger series of cases with longer follow-up is needed to substantiate these results. (J Am Coll Cardiol 2013;61:1917–24)


Lu Q, et al. J Am Coll Cardiol 2013;61:1917–24

# *The opposite of FLIRT: True Lumen Intervention…nice initial Results!*





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# *True Lumen Intervention…lasting 15 months.*

# *Is it worth a FLIRT ?*



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# *Another FLIRT: Subacute/Chronic dissection to induce remodelling?*

64 y/o male patient

- Sudden onset of chest/back pain

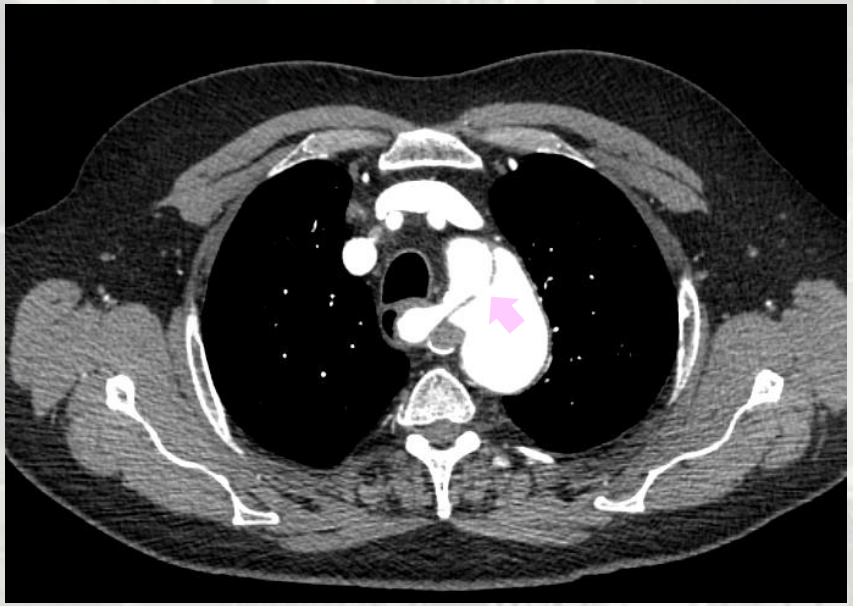
- History of chronic HTN
- Triple rule out CT diagnosis:

Acute type B dissection

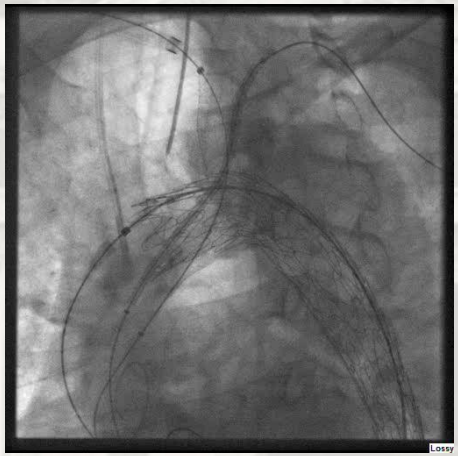
Lusoria anatomy

Distal malperfusion

- Right arm claudication/ischemia
- Lower extremity hypotension

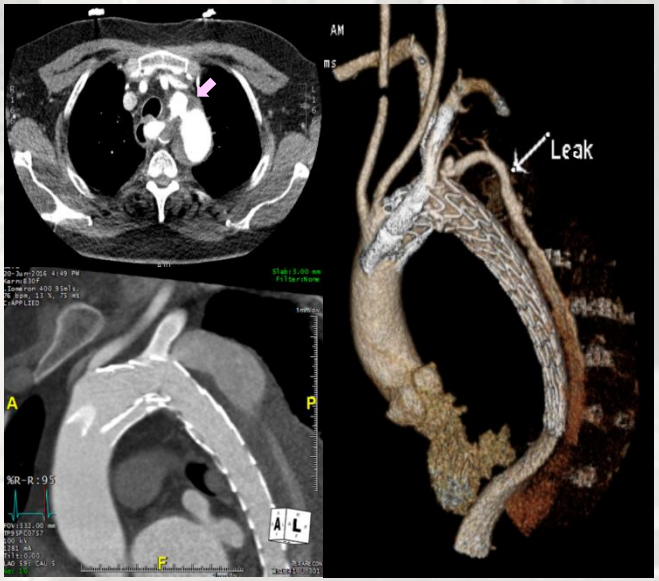


# *Subacute/Chronic dissection…induced remodelling!*



1st TEVAR with stent-graft and chimney technique

Sequential follow-up CT scans after the 1st procedure

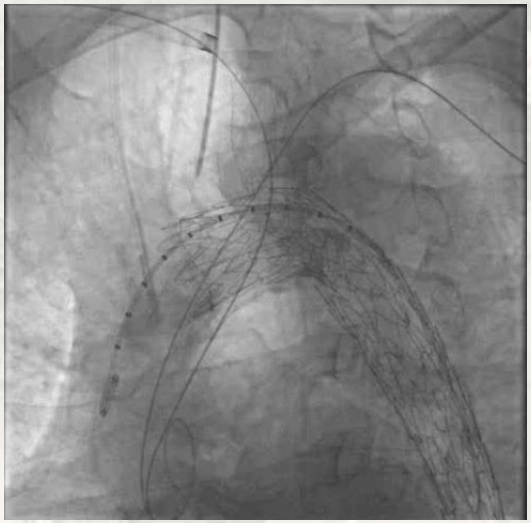


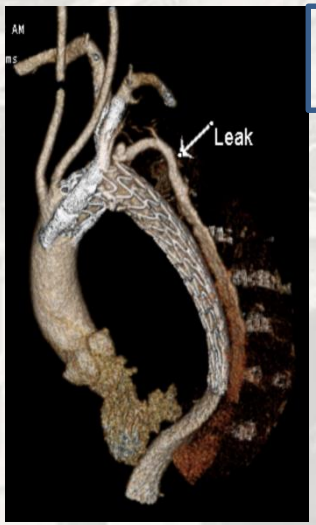

Tear in fabric of SG and partial thrombosis of FL at day 5 post TEVAR

At day 55 the FL thrombosis has improved, but is still incomplete and fed from the fabric tear

Strategy:
Secondary induction of complete FL thrombosis

# *3D CT guided reintervention with FLIRT concept in type B dissection*

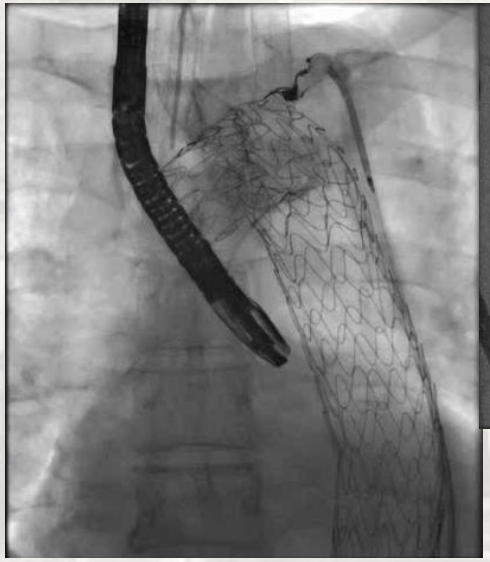


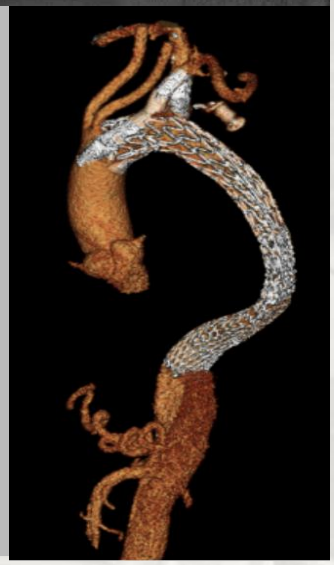



1st attempt

Coils, occluder and iliac Stentgraft to isolate FL

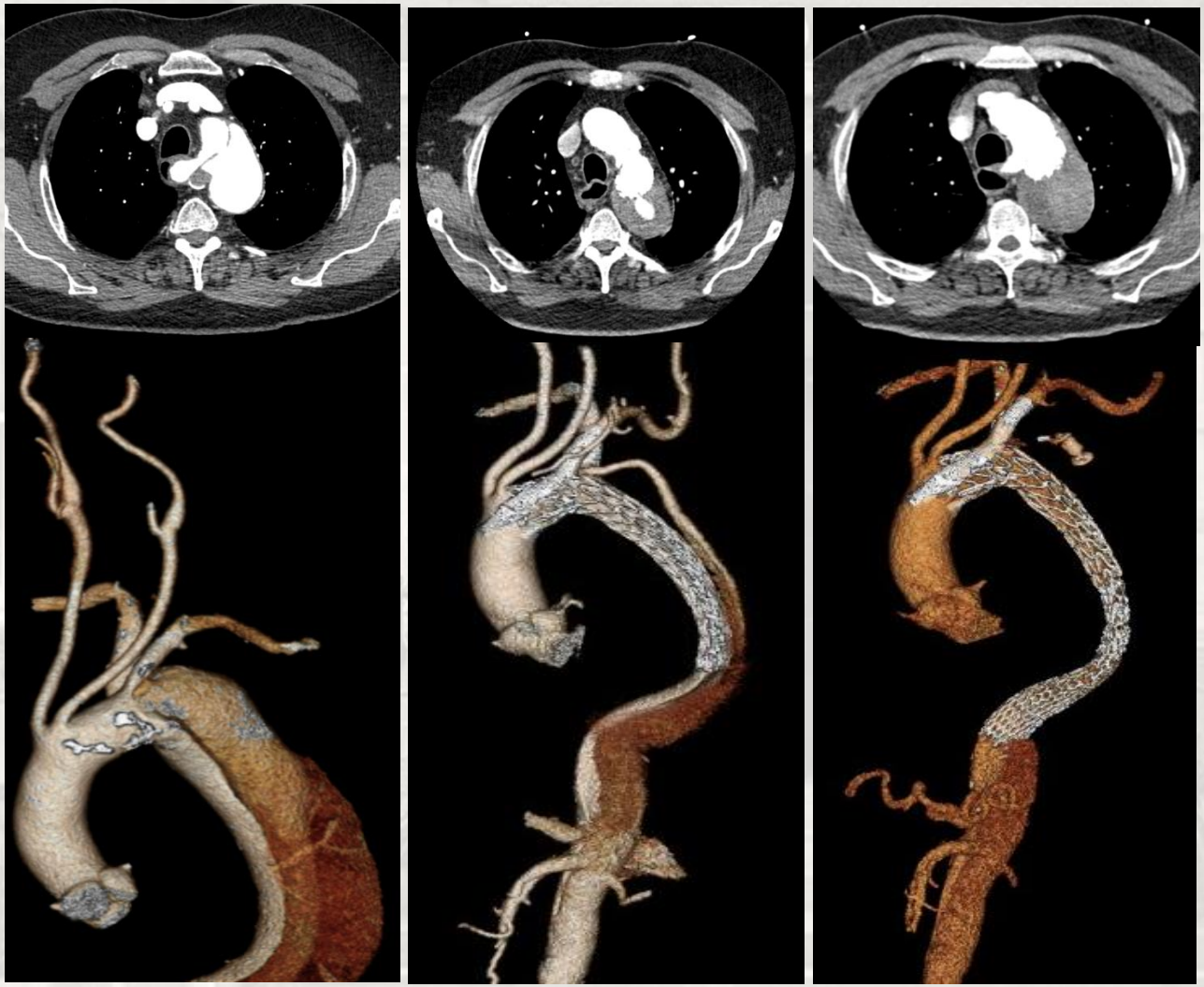
2nd attempt





# *…or false lumen coils & occluder to facilitate thrombosis and aortic remodeling*

Pre-TEVAR | 55 d post-TEVAR | 3 d post-repair



*Complex, but uncomplicated case with secondary reperfusion of false lumen from proximal inflow caused by rupture of graft fabric.*
*Retrograde coiling and an occluder turn procedural failure into a great success with additional procedures!*

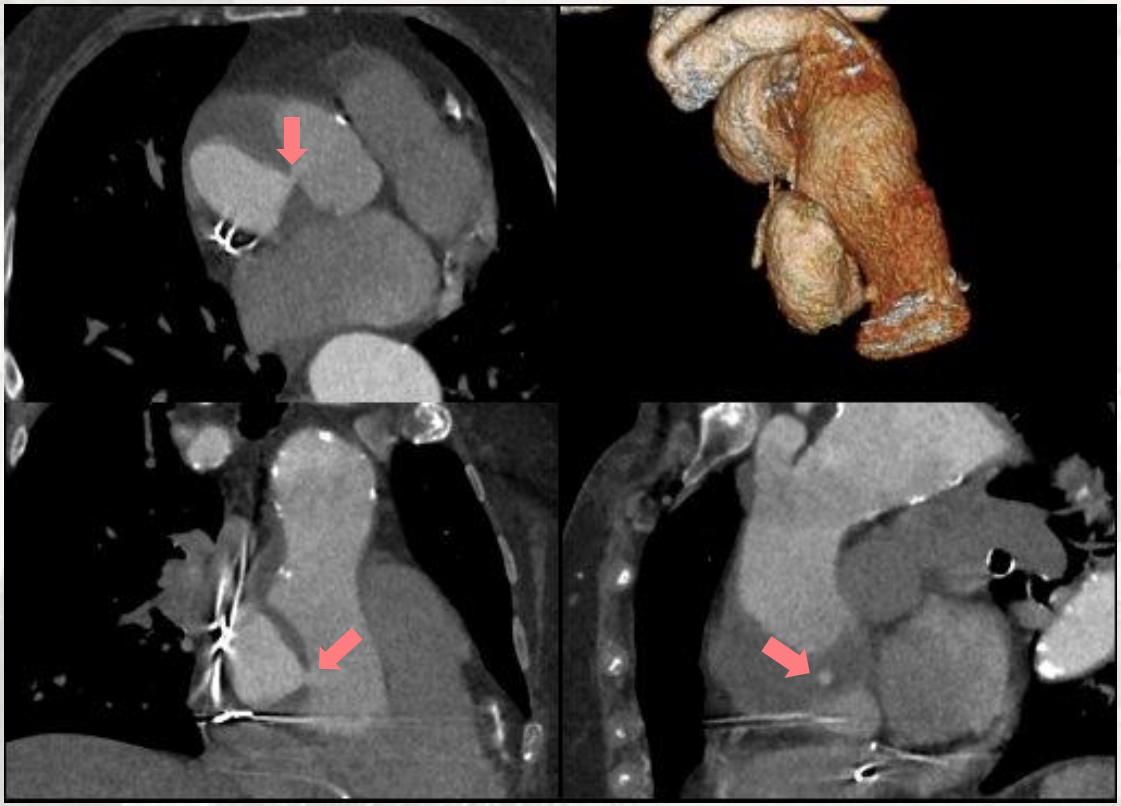
# *FLIRT with the impossible…FL management in this type A dissection?*

75 y/o female

- Admitted from a routine surveillance CT of thoracic aortic aneurysm showed a new dissection in aortic root

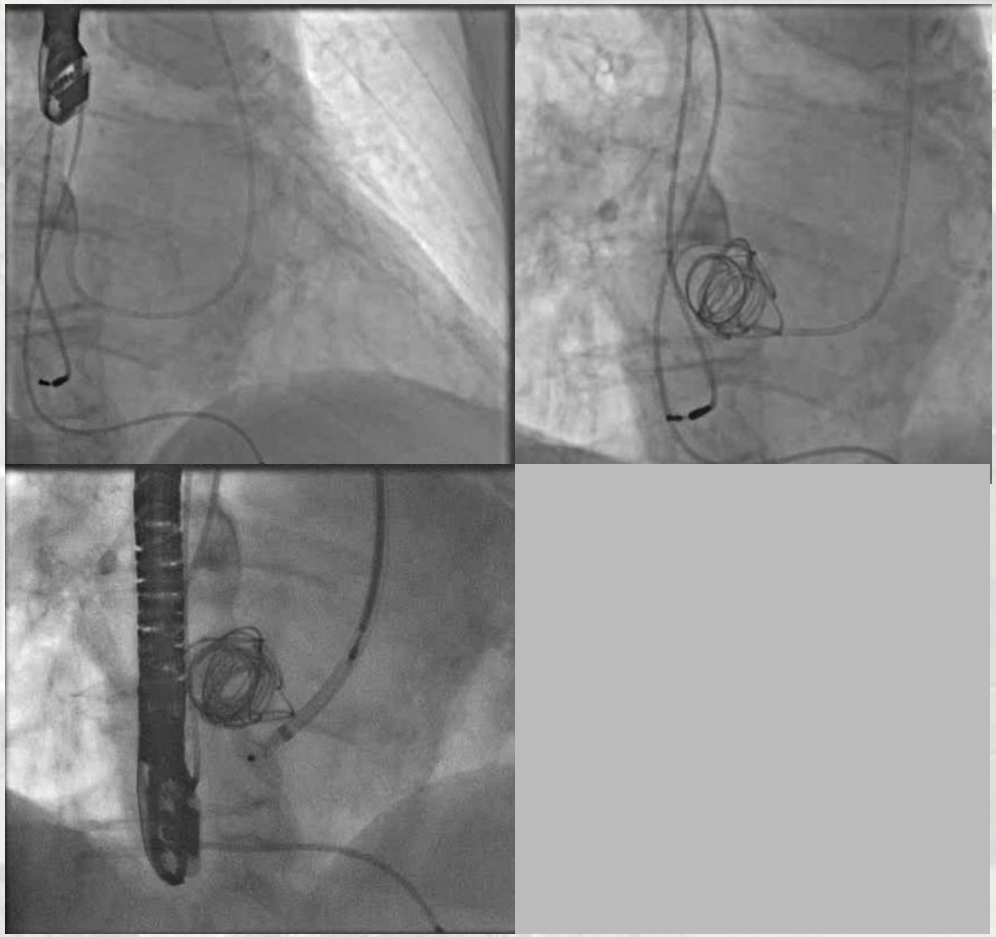
- Hypertension
- Apronectomy in Feb 1999
- Coronary angiogram : LAD 70% stenosis in 2001
- Infra-renal AAA repair in 2006
- Permanent pacemaker implantation in Mar 2007
- Osteoarthritis with total knee replacements
- Lower gastrointestinal haemorrhage with bowel resection in 2015, end-to-end anastomosis
- Aorto-femoral bypass

# *Individual approach – false lumen management in type A dissection*



Type A dissection confined to just above the aortic root to mid ascending aorta.
Measured 26 x 42 mm
Entry tear diameter 5mm

# *Individual approach – false lumen management in type A dissection*



Angiogram confirms the false lumen and entry tear.

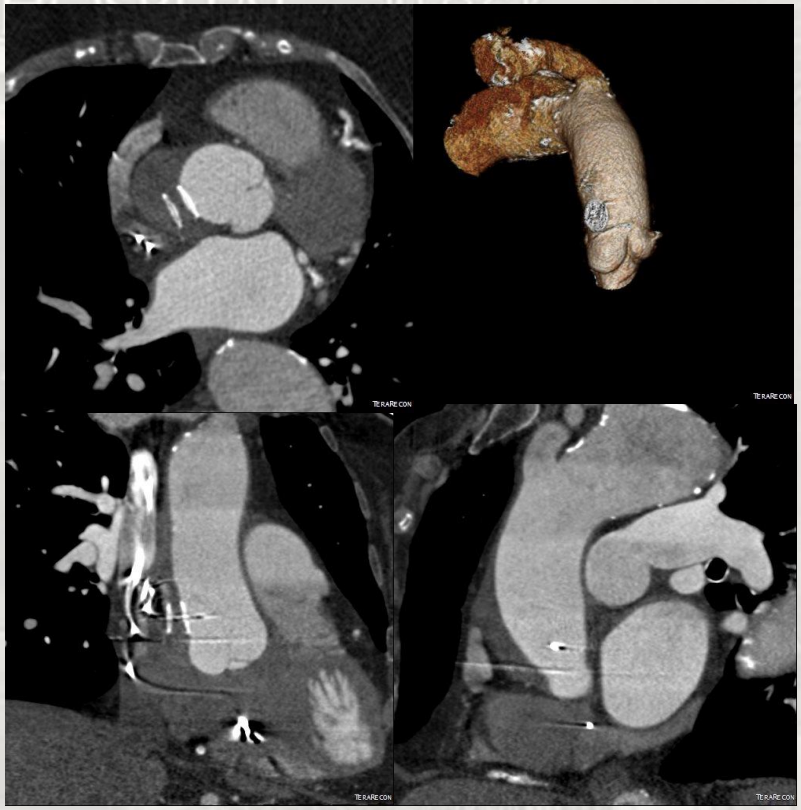
- 15 x 5 mm coils deployed via MP followed by a 10mm Amplatzer PFO closure device placed across the entry tear.
- Final angiogram shows tear sealed and coronary ostium unblocked.

# *Individual approach – false lumen management in type A dissection*

CT scan 3 days after procedure

No contrast communication to the false lumen

CT scan 6 months after procedure



Device sealing in site precisely with excellent remodelling

Yuan X et al. JEVT 2017

# Demographic information, pathology and procedures

| | Age (at FLIRT) | Sex | Type of pathology | Euroscore II | Previous surgery/intervention | Charlson Comorbidity Index: points | Charlson Comorbidity Index: Estimated 10-year survival | Duration from onset to FLIRT |
|---|---|---|---|---|---|---|---|---|
| **Occluder (Tear)** | | | | | | | | |
| Case 1 | 75 | F | Ascending dissection | 19% | Apronectomy, pulmonary embolization, infrarenal AAA repair, PPM, bilateral total knee replacement, lower GI haemorrhage, aorto-femoral bypass | 6 | 2% | 3 months |
| Case 2 | 85 | F | Ascending dissection | 6% | AF, bilateral hip replacement, left knee replacement | 5 | 21% | 1 months |
| Case 3 | 86 | F | Ascending dissection | 16% | NA | 7 | 0 | 4 months |
| Case 4 | 81 | M | Ascending false(suture) aneurysm; | 31% | Multiple surgeries, ascending resection, AVR mechanical valve; multiple PCIs | 10 | 0 | 2 months |
| Case 5 | 78 | M | Ascending dissection | 10% | MVR+CABG | 4 | 53% | 6 months |
| Case 6 | 47 | M | TBAD | 8% | TEVAR, AVR | 2 | 90% | 9 months |
| **Occluder (FL)** | | | | | | | | |
| Case 7* | 66 | M | TBAD | 12% | TEVAR | 4 | 53% | 2 months |
| Case 8 | 64 | M | TBAD | 7% | TEVAR | 5 | 21% | 4 months |
| **Onyx** | | | | | | | | |
| Case 9 | 75 | M | TBAD | 10% | Stent-graft + chimney | 4 | 53% | 3 months |
| Case 10 | 66 | M | Arch dissection | 9% | Stent-graft + chimney | 3 | 77% | 2 months |

*Staged procedure. AAA, abdominal aortic aneurysm; AF, atrial fibrillation; AVR, aortic valve replacement; CABG, coronary artery bypass grafting; GI, gastrointestinal; MVR, mitral valve replacement; PCI, percutaneous coronary intervention; PPM, permanent pacemaker; TAAD, type A aortic dissection; TBAD, type B aortic dissection; TEVAR, thoracic endovascular aortic repair

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# *Procedural details (FLIRT concept) and success rate*

| | Intervention | Occluder size (mm) | | Number of coils used | Access for FLIRT | Access size(Fr) | Complications | MACCE | F/U duration (months) |
|---|---|---|---|---|---|---|---|---|---|
| | | Waist | Disc(R/L) | | | | | | |
| **Occluder(Tear)** | | | | | | | | | |
| Case 1 | PFO occluder + coils | 3 | 18/18 | 5 | Left brachial artery | 8 | No | No | 13 |
| Case 2 | ASD occluder + coils | 14 | 24/28 | 8 | Left brachial artery | 7 | No | No | 10 |
| Case 3 | PFO occluder | 3 | 25/18 | 0 | Right femoral artery | 8 | No | No | 43 |
| Case 4 | ASD occluder | 26 | 36/40 | 0 | Left brachial artery | 10 | Local hematoma | No | 9 |
| Case 5 | ASD occluder + coils | 6 | 14/18 | 8 | Right femoral artery | 8 | No | No | 9 |
| Case 6 | PFO occluder | 3 | 30/30 | 0 | Right femoral artery | 8 | No | No | 79 |
| **Occluder(FL)** | | | | | | | | | |
| Case 7 stage 1 | Amplatzer plug II + coils | 16 | 16/16 | 8 | Right femoral artery | 8 | No | No | - |
| Case 7 stage 2 | coils | NA | NA | 5 | Left brachial artery | 6 | No | No | 10 |
| Case 8 | Amplatzer duct II + coils | 6 | 12 | 8 | Left femoral artery | 9 | No | No | 14 |
| **Onyx** | | | | | | | | | |
| Case 9 | 10ml Onyx + coils | NA | NA | 6 | Right femoral artery | 8 | No | No | 49 |
| Case 10 | 10ml Onyx + coils | NA | NA | 8 | Right femoral artery + brachial artery | 8 | No | No | 57 |

ASD, atrial septal defect; MACCE, major adverse cardiovascular and cerebrovascular events; PFO, patent foramen ovale.

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# *Impact of FLIRT on anatomic details, remodelling and false lumen thrombosis in proximal (type A) and distal (type B) aortic dissection*

| Type of dissection | Dimension | Max diameter of aorta (mm) | | | Area of true lumen at the level of max diameter aorta($cm^2$) | | | False lumen thrombosis |
|---|---|---|---|---|---|---|---|---|
| | | Pre-procedure | At discharge* | 6 months follow-up* | Pre-procedure | At discharge | 6 months follow-up | |
| Type A | Case 1 | 75 | 51 | 49 | 11.8 | 13.4 | 14.5 | Complete |
| | Case 2 | 66 | 44 | 40 | 3.4 | 10.7 | 12.7 | Complete |
| | Case 3 | 55 | 55 | 50 | 4.1 | 6.0 | 9.4 | Complete |
| | Case 4 | 60 | 62 | 57 | 3.3 | 7.1 | 8.3 | Complete |
| | Case 5 | 63 | 68 | 55 | 6.5 | 6.7 | 12.1 | Complete |
| Type B | At the level of left subclavian artery | | | | | | | |
| | Case 6 | 36 | 33 | 43 | 4.3 | 3.1 | 4.6 | Complete |
| | Case 7 | 35 | 32 | 32 | 10.4 | 8.2 | 8.2 | Partial |
| | Case 8 | 29 | 27 | 34 | 6.6 | 4.2 | 9.1 | Complete |
| | Case 9 | 44 | 44 | 40 | 8.5 | 8.4 | 11.4 | Complete |
| | Case 10 | 53 | 53 | 40 | 9.9 | 9.9 | 12.0 | Complete |
| | At the level of pulmonary artery bifurcation | | | | | | | |
| | Case 6 | 66 | 63 | 65 | 8.9 | 8.5 | 12.5 | Complete |
| | Case 7 | 50 | 75 | 58 | 5.1 | 7.5 | 9.3 | Partial |
| | Case 8 | 64 | 71 | 69 | 5.5 | 6.1 | 9.3 | Complete |
| | Case 9 | 45 | 45 | 40 | 9.7 | 9.7 | 10.1 | Complete |
| | Case 10 | 52 | 51 | 38 | 8.8 | 8.7 | 10.1 | Complete |
| | At the level of diaphragm | | | | | | | |
| | Case 6 | 51 | 45 | 29 | 3.2 | 3.3 | 4.5 | Complete |
| | Case 7 | 30 | 28 | 37 | 6.2 | 6.8 | 8.0 | Partial |
| | Case 8 | 42 | 39 | 42 | 3.3 | 3.8 | 3.9 | Complete |
| | Case 9 | 43 | 43 | 39 | 9.3 | 9.2 | 9.8 | Complete |
| | Case 10 | 50 | 50 | 38 | 9.3 | 9.2 | 10.9 | Complete |

*The same level as pre-procedure.

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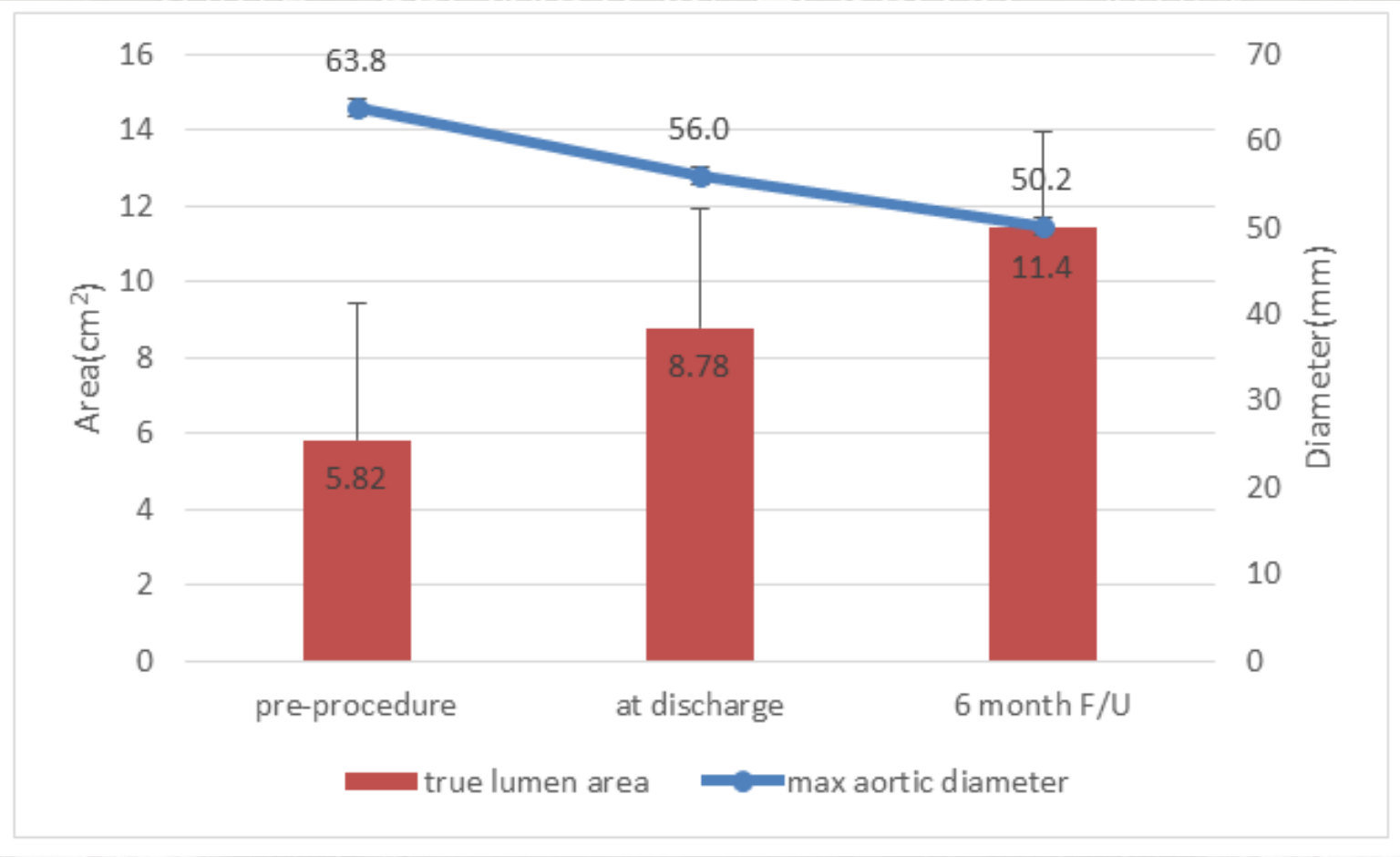
*Proximal dissection cases treated with FLIRT (occluders and coils), demonstrated the increasing true lumen area and shrinking maximum diameter of the aorta over time.*

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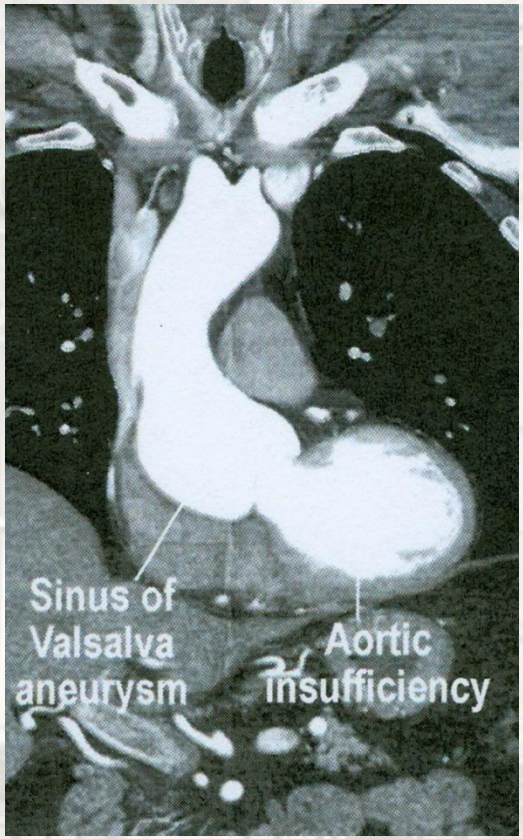
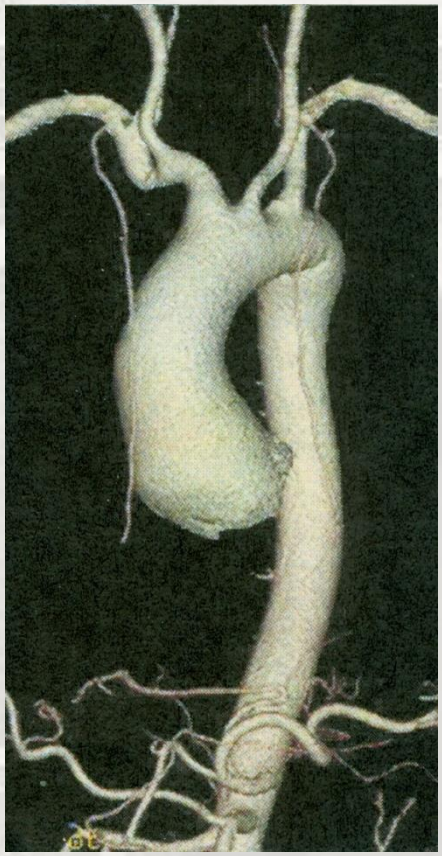
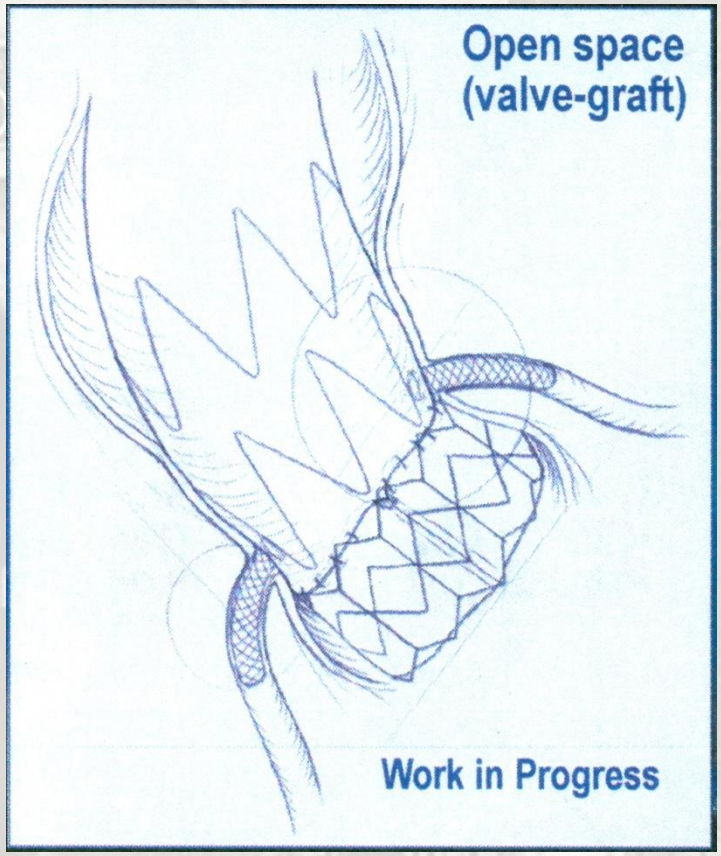
# *Final Challenge:*
# *Is There a Potential for an Endovascular Bentall Procedure?*



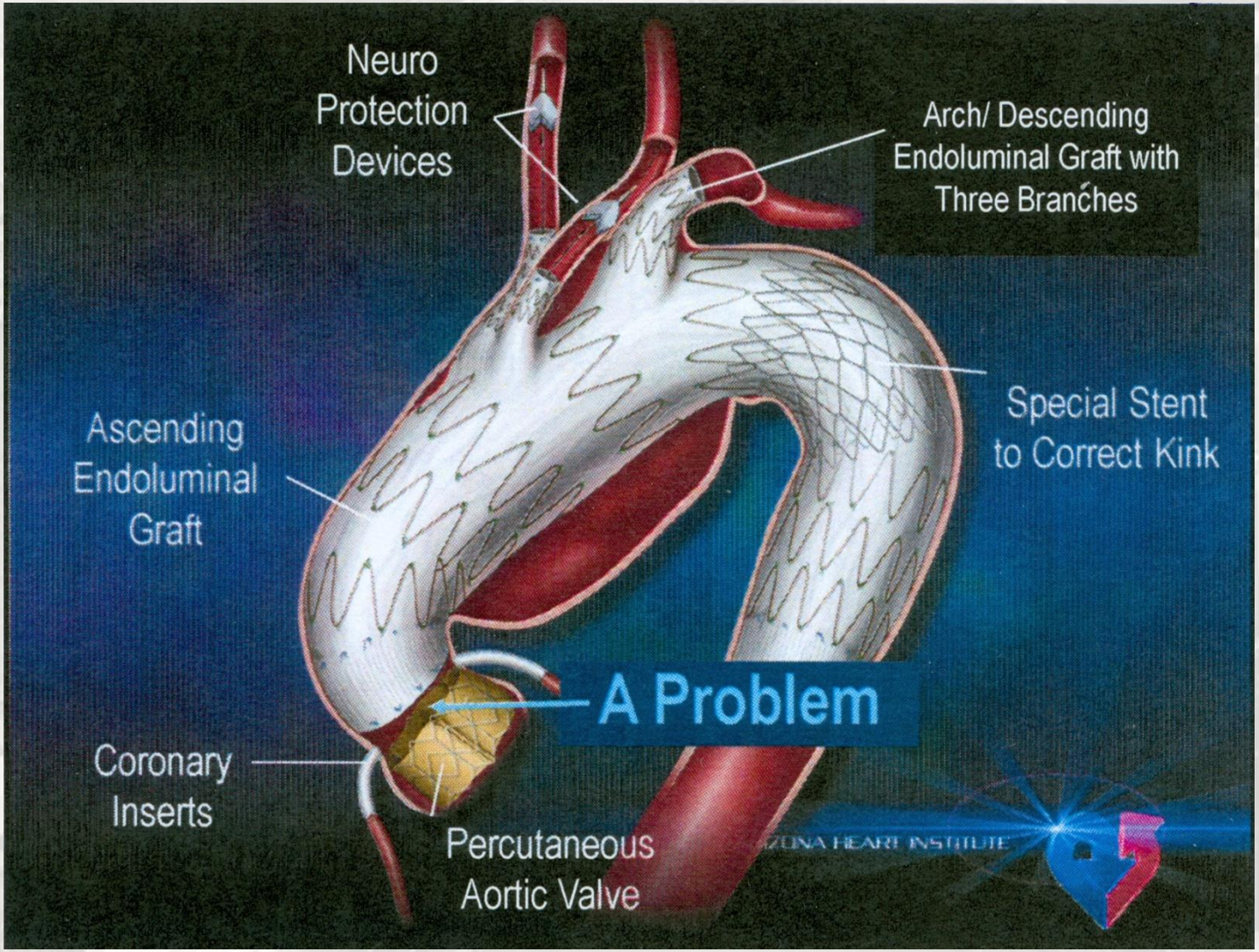






Sketch from Engineering Lab in 2006

Covered stents (Jostent) for Coroneries

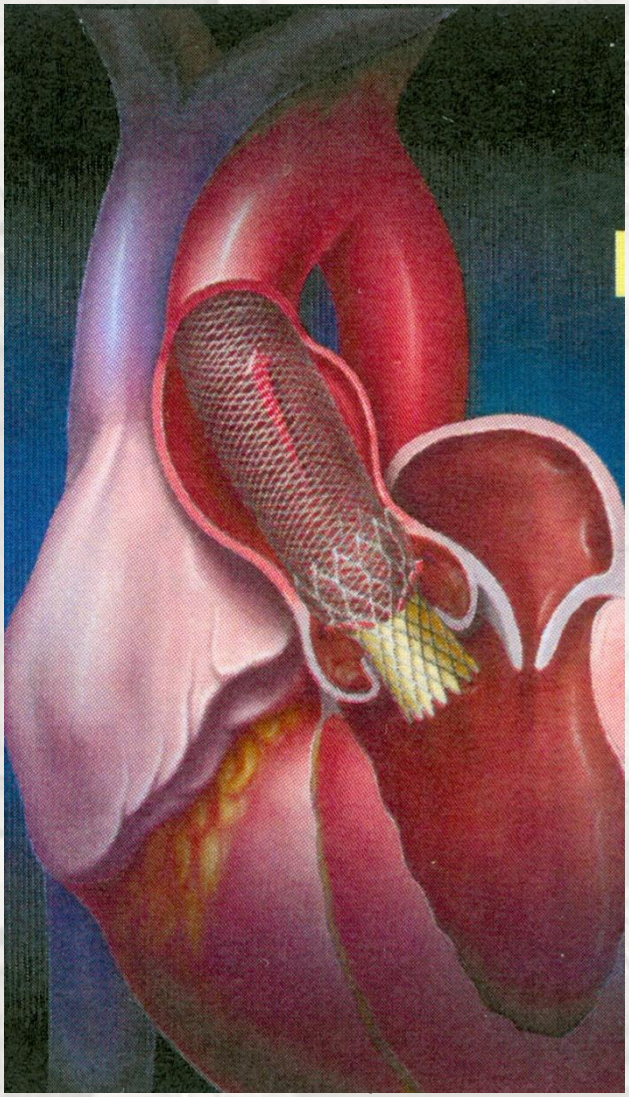
# *The future is approaching…but not close yet!*



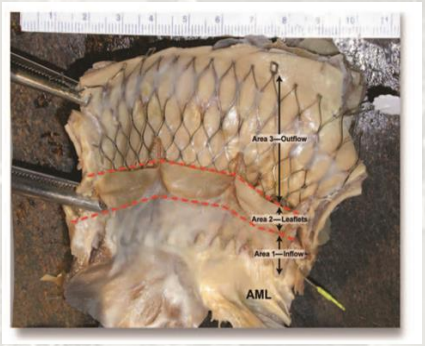

**Wishful thinking by Ted Diethrich † in 2006**

# *New Future ?*

2006



*Is an Endo - Bentall a Feasible Option soon?*




*Answer:*

*Almost Certainly, but not today & not tomorrow*!

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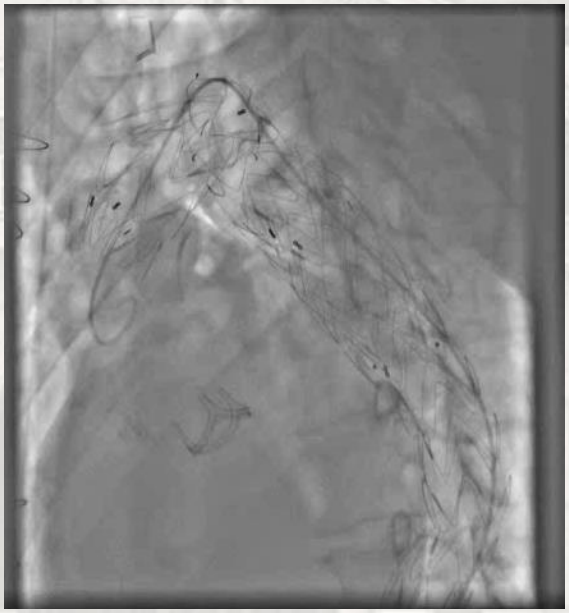
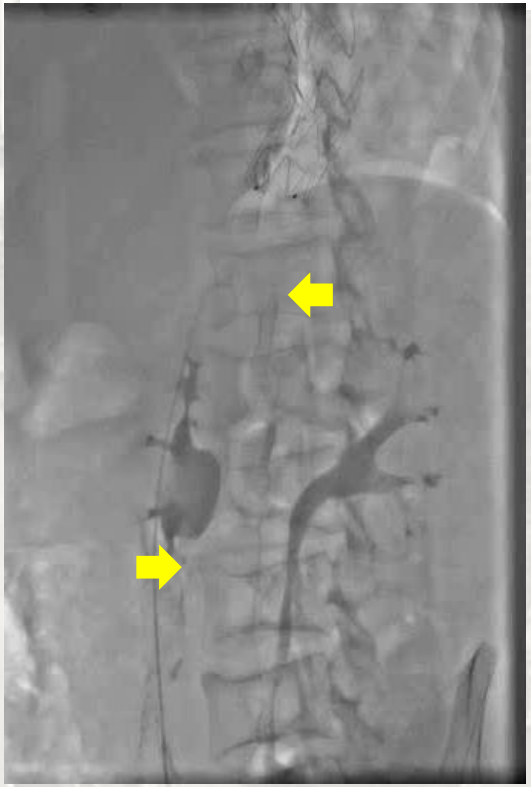
*Highly complex case selected for elective FLIRT at distal reentries*

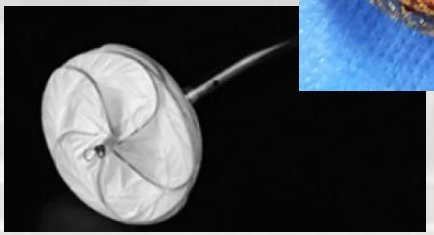

Surgery 1995/2017



2 TEVAR in ET 2/18



Candidate
for FLIRT ?

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# *Brompton Aortic Centre 2018*

# ***PETTICOAT*** *for improved realignment ?*