



**AORTIC
LIVE**

2017

October 23–24, 2017
Hamburg, Germany

4th Aortic Live Symposium

OPEN AND ENDOVASCULAR TECHNIQUES IN THE CARDIOTHORACIC SURGEON'S HANDS

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- Director Cardiac Surgery
- Austin Hospital

Disclosure

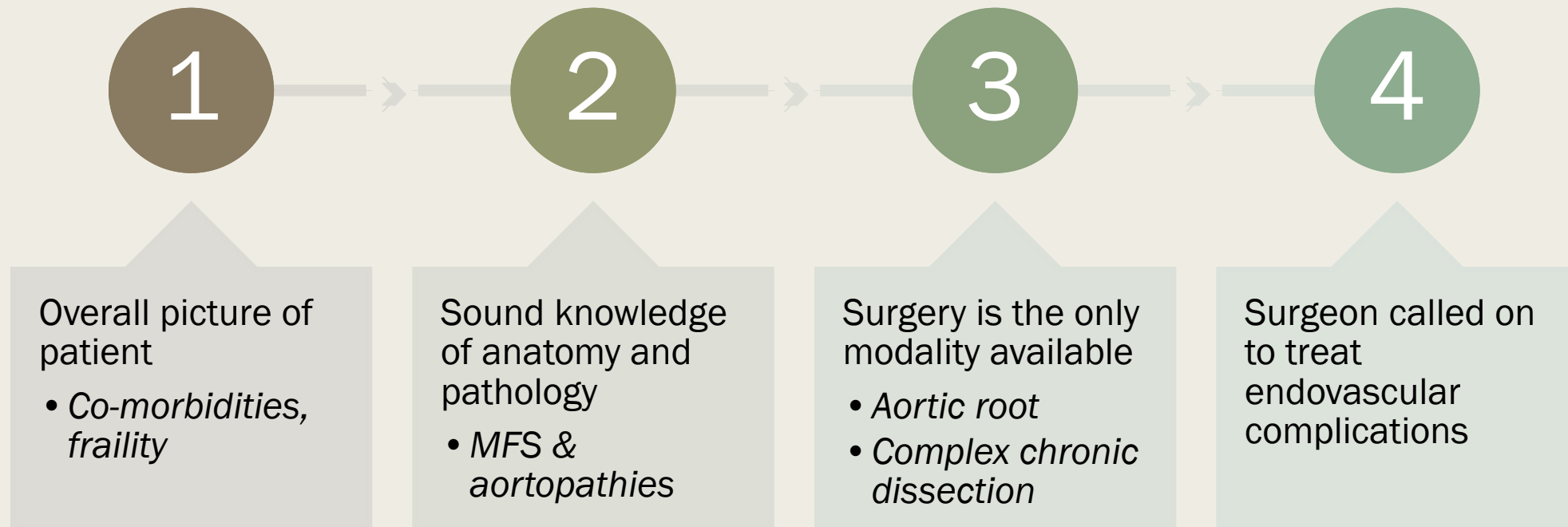
I do not have any potential
conflict of interest

Who controls the Aorta?



- Cardiologist
- Radiologist
- Vascular Surgeon

Why should the surgeon remain a major player?



What should a surgeon do to remain in the game?

Maintain

Maintain excellent open surgical outcomes

- despite increasing complexity and patient risk profile

Plan

Plan surgery to avoid future re-intervention

- or simplify such interventions should they occur

Have

Have a good foundation in endovascular intervention

- In good position to evaluate best intervention modality for any patient

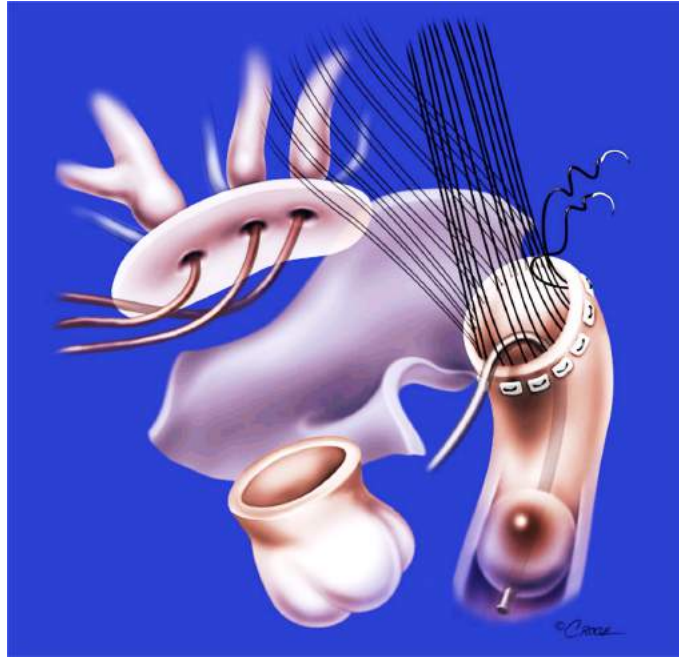


MAINTAIN EXCELLENT OPEN SURGICAL OUTCOMES

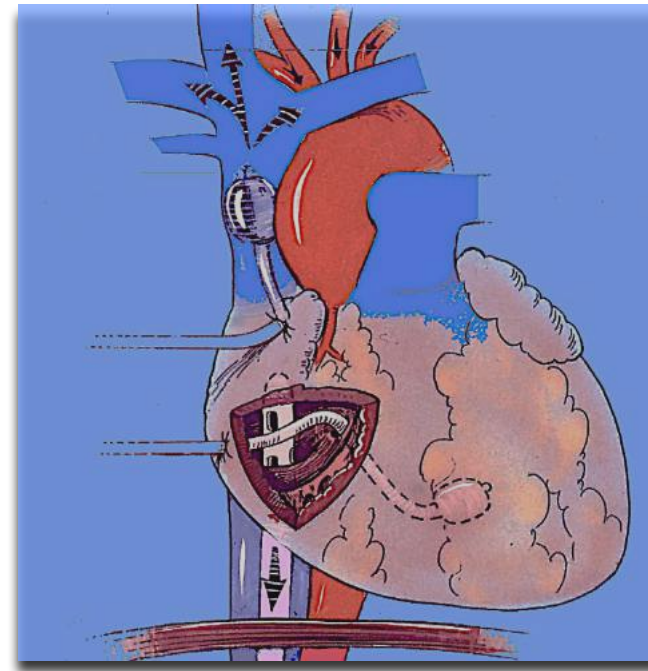


Aortic Arch Repair

Current techniques for Total Arch Repair



Antegrade



Retrograde

DHCA & Cerebral Perfusion

A meta-analysis of deep hypothermic circulatory arrest alone versus with adjunctive selective antegrade cerebral perfusion

Ann Cardiothorac Surg 2013;2(2):148-158

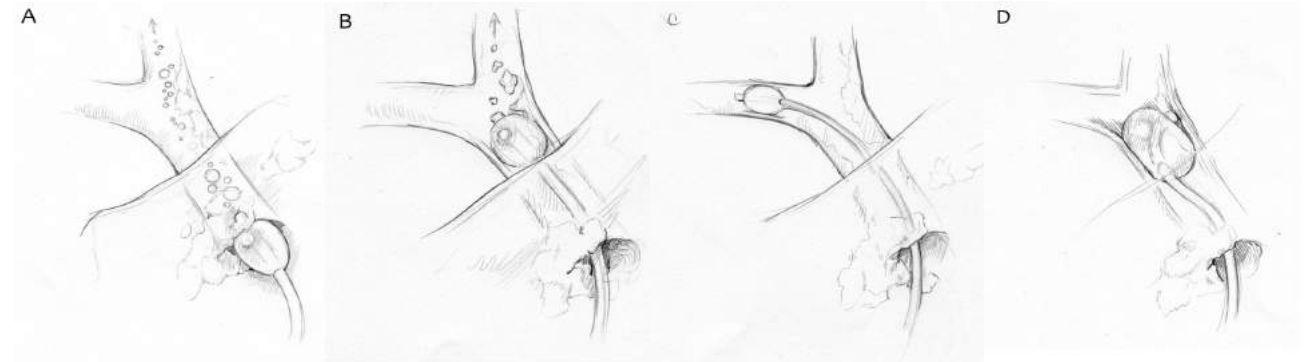
David H. Tian¹, Benjamin Wan¹, Paul G. Bannon^{1,2}, Martin Misfeld³, Scott A. LeMaire^{4,5}, Teruhisa Kazui⁶, Nicholas T. Kouchoukos⁷, John A. Elefteriades⁸, Joseph E. Bavaria⁹, Joseph S. Coselli^{4,5}, Randall B. Griepp¹⁰, Friedrich W. Mohr³, Aung Oo¹¹, Lars G. Svensson¹², G. Chad Hughes¹³, Malcolm J. Underwood¹⁴, Edward P. Chen¹⁵, Thoralf M. Sundt¹⁶, Tristan D. Yan^{1,2}

Mortality outcomes were reported in all but one study (20).

Overall, mortality was significantly lower when SACP was employed as a neuroprotection adjunct (DHCA *vs.* DHCA + SACP: 15.2% *vs.* 8.5%; OR, 1.87; 95% CI, 1.18-Permanent and temporary neurological deficits were reported in all studies. No significant difference was observed between DHCA and DHCA + SACP groups with respect to either PND [8.0% *vs.* 6.8%] OR, 1.21; 95% confidence interval (CI), 0.72-2.04; P=0.46; I²=0%; *Figure 4*] or TND (13.9% *vs.* 11.1%; OR, 1.08; 95% CI, 0.61-1.91;

Why is HCA+ACP not perfect ?

- Cannulation complications
- Cluttering of surgical field
- Periods of CA still required



Illogical Surgical Sequence

■ Myocardial Ischemia time (resection + 5 anastomoses)

- *Distal anastomosis*
- *Arch Branch Reconstruction*
- *Proximal repair*

■ Distal Organ & SC Ischemia time (resection + 4 anastomoses)

- *Distal anastomosis*
- *+/-Arch Branch Reconstruction*

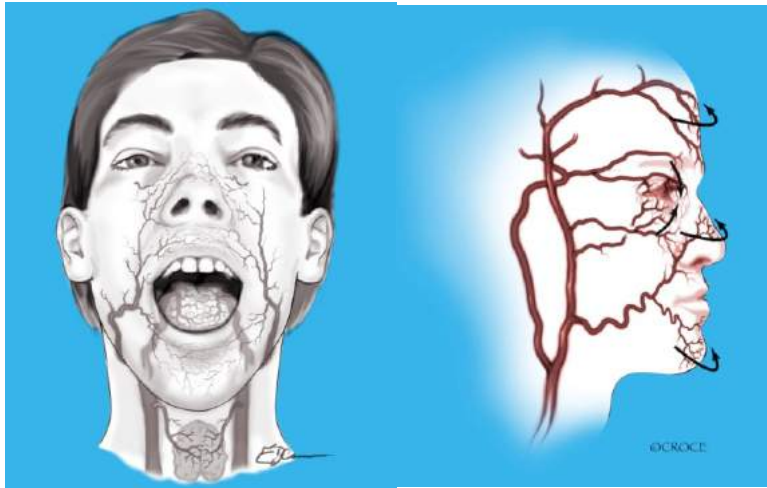


**BRANCH FIRST
TOTAL ARCH
REPAIR**



Essential Premise of “Branch First”

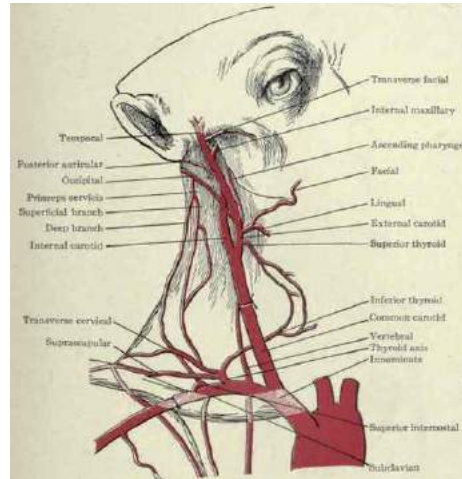
Rich Collateral Circulation



Across the Midline

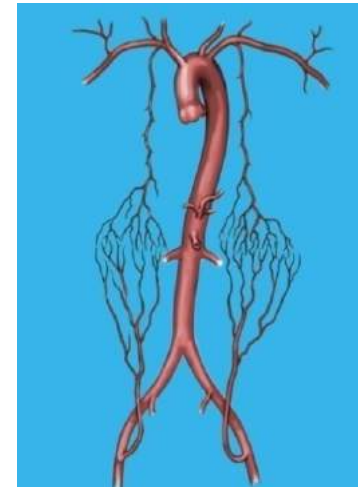
IA \Rightarrow LCCA/LSCA

- Tongue
- Thyroid
- Face



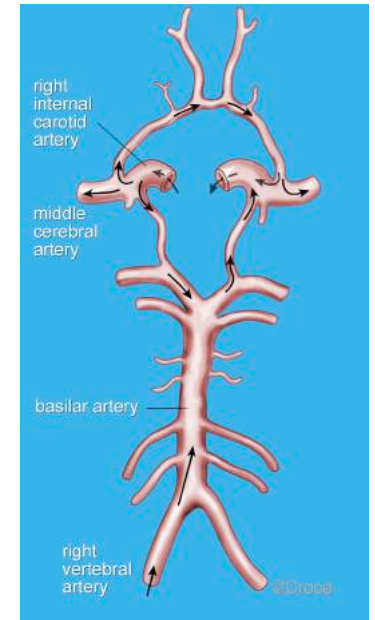
Around neck/ shoulder

CCA \Rightarrow SCA



Upper / Lower Body

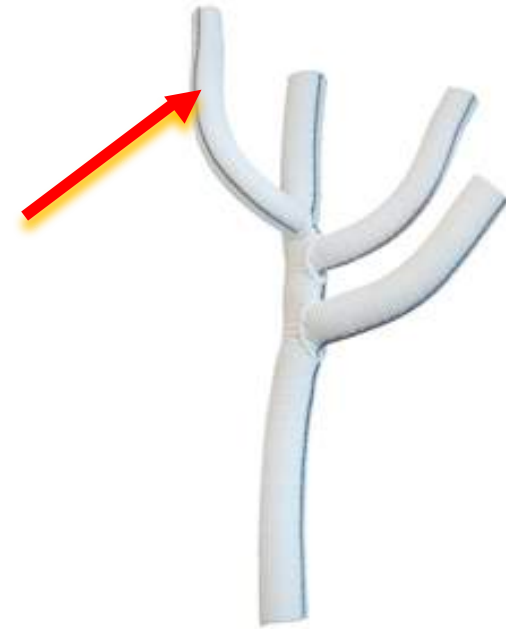
- IMA \Rightarrow IEA
- Body wall muscle
- spine



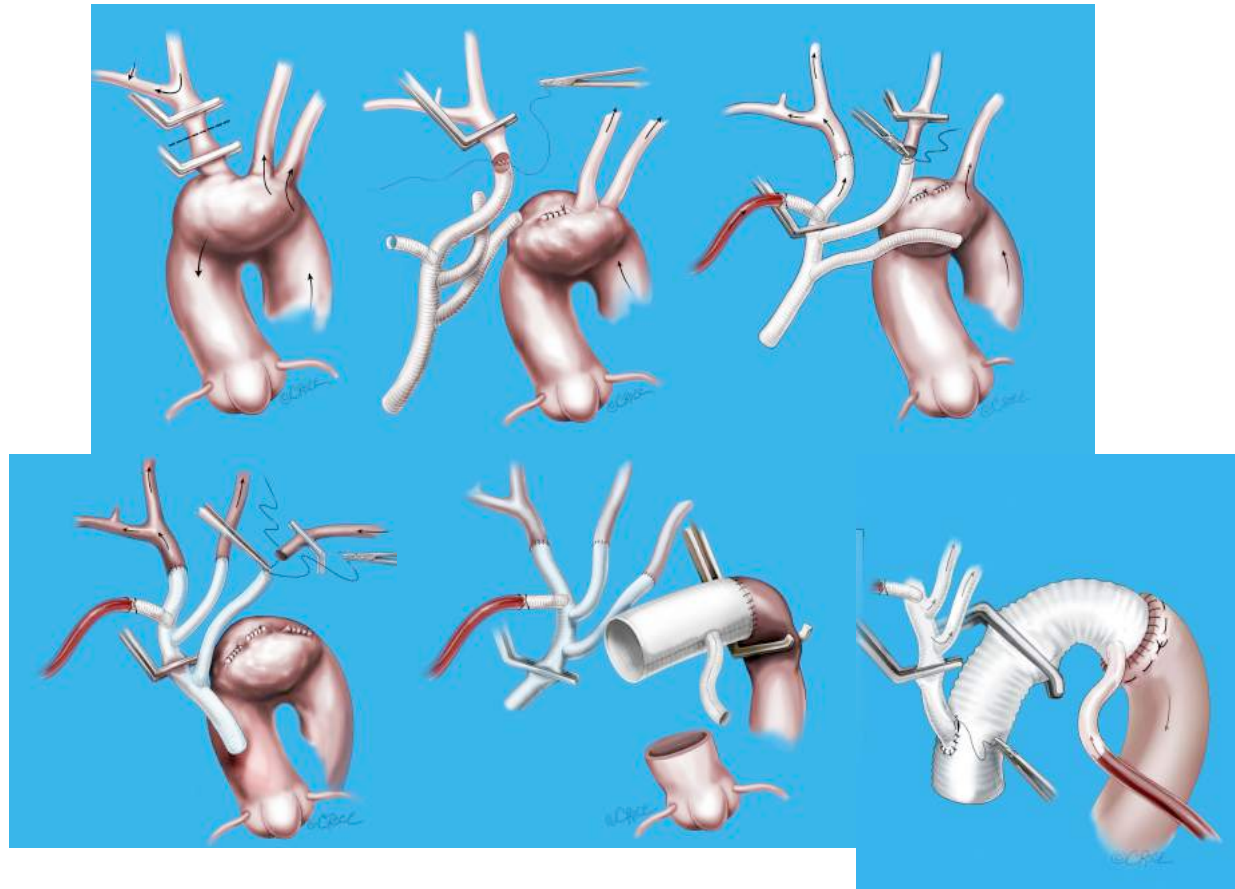
COW

“Branch First” means Reconstruct Branches **Before** Arch or **Anything else**

- TAPP graft
- Clamp & Reconstruct **1 branch** at a time
- Individual **Short clamp** time: 5-10 min
- Re-perfuse with side port
- Recovery time between clamps
- Sequence : IA to LSCA
- No cardiac, cerebral, SC or distal organ ischemia



Branch First Total arch replacement: Sequence



Total Arch Replacement Outcomes



- ***NO mortality in electives or ATAAD w/out malperfusion/rupture*



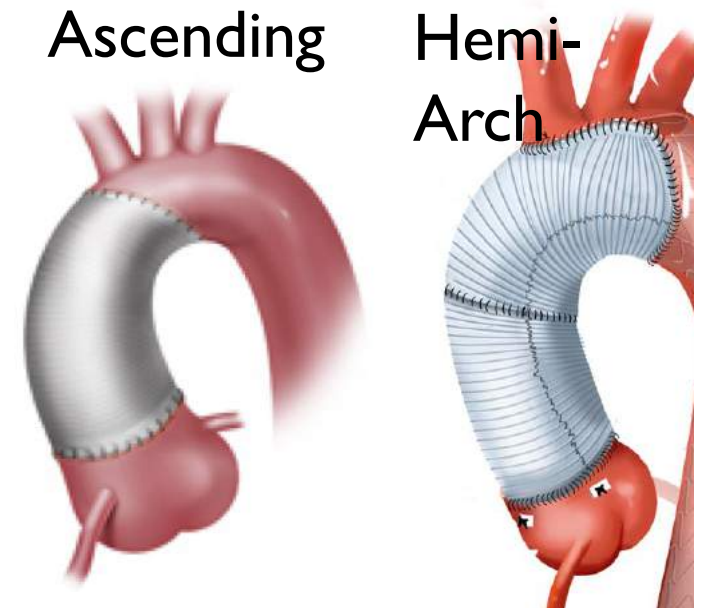
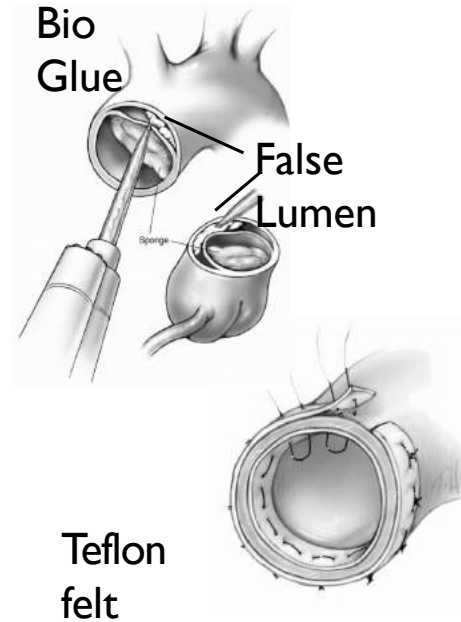
PLAN SURGERY TO AVOID FUTURE RE-INTERVENTION



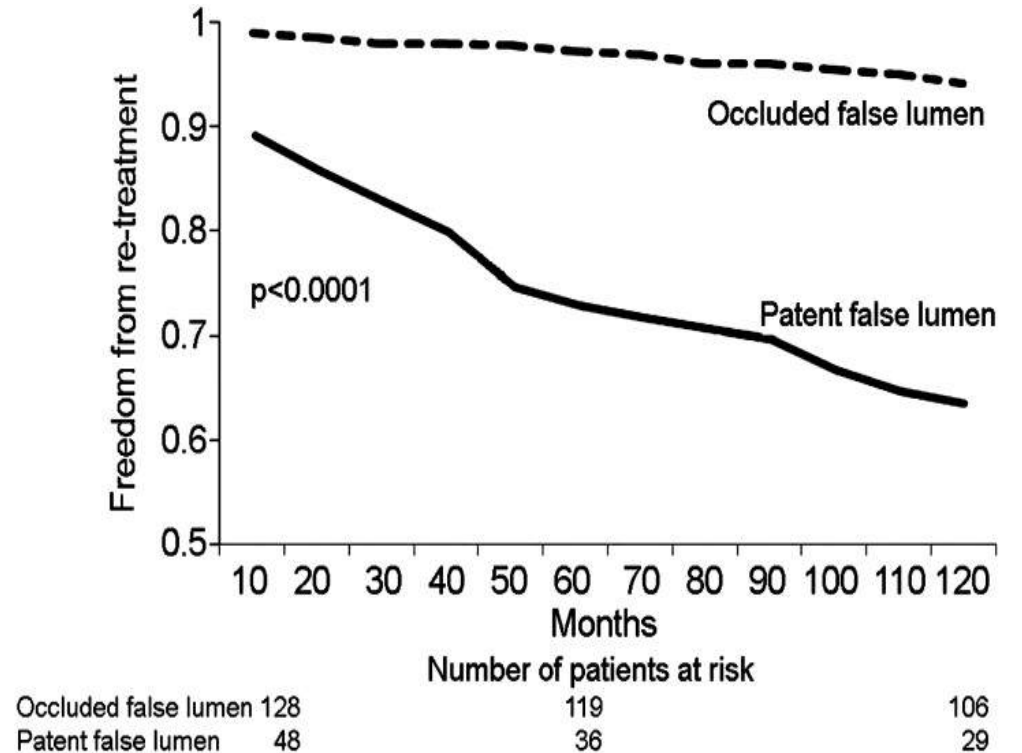
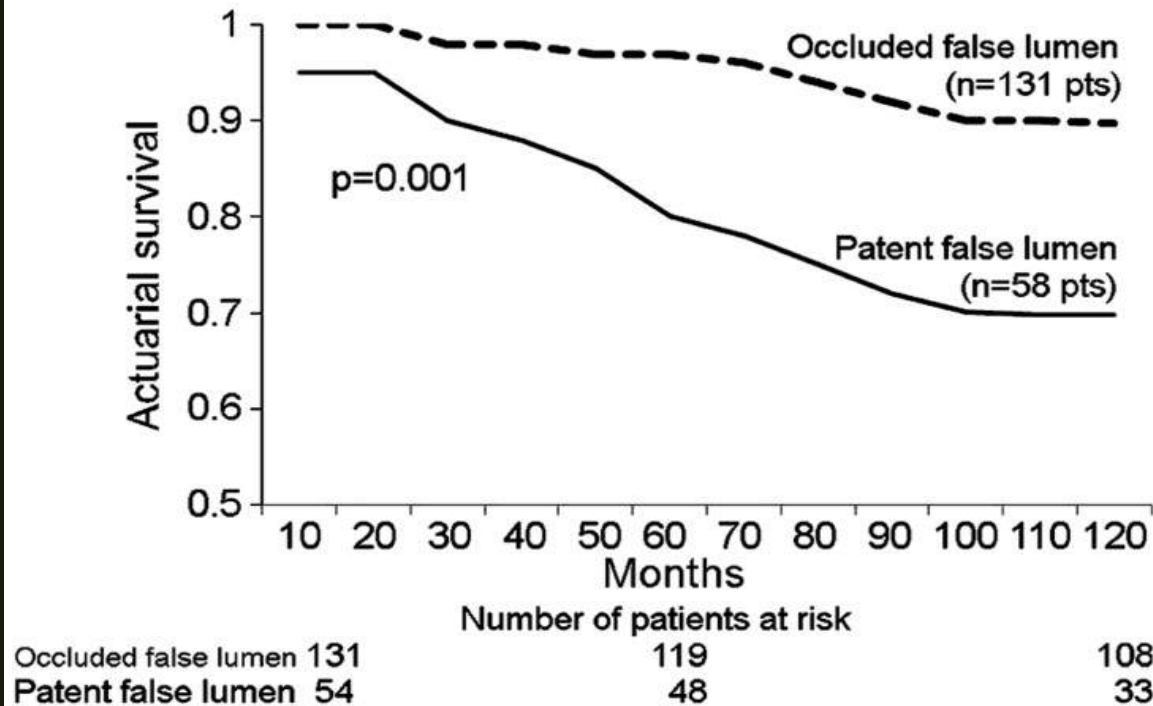
Acute Type A Dissection

Conventional Wisdom of Surgery for ATAAD

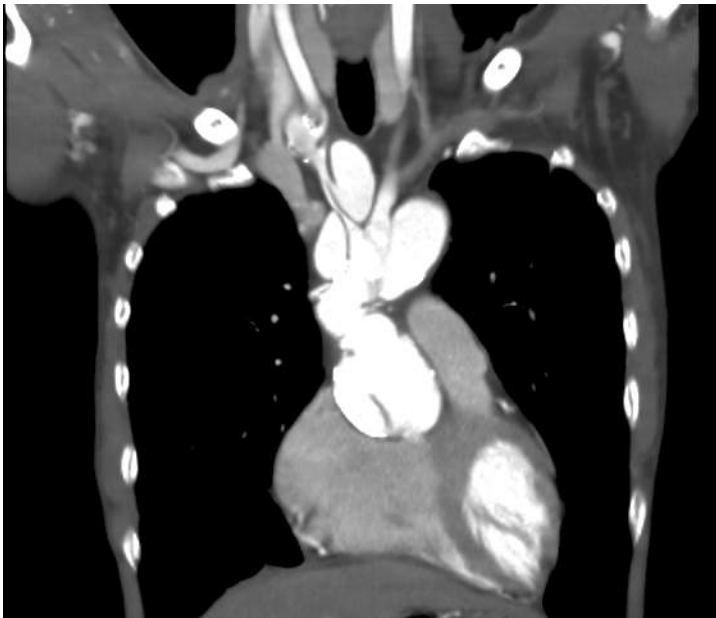
- *Resect primary tear*
- *Re-suspend the AV / replace root*
- *Correct coronary ischemia*
- *Re-Establish true lumen flow*
- *“get the hell out...live to fight another day”*
- ***Mortality 20% - NOT EXACTLY a brilliant early result***



Consequences of untreated distal aorta



Surgery for Aftermath of Conventional Repair



- Redo sternotomy root and total arch

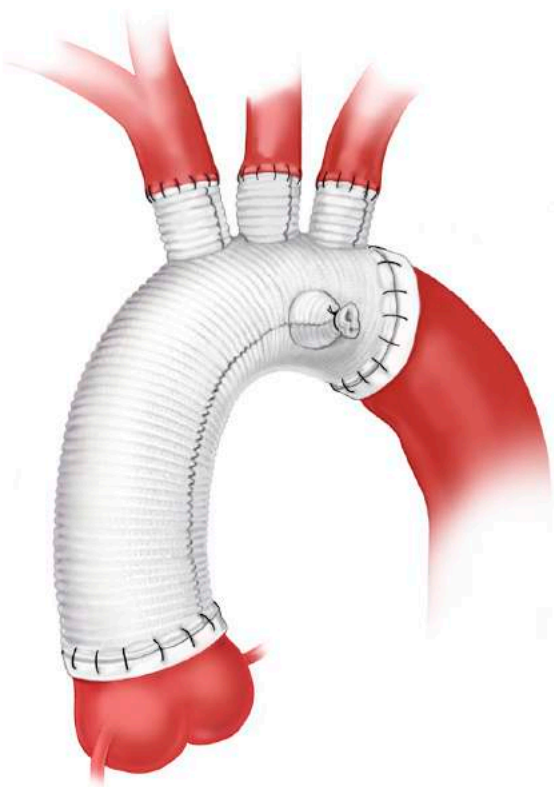
- Thoraco-abdominal
 - Long segment replacement
 - Patent Intercostals



BUT

Stroke, paraplegia
bleeding, MOF,
DEATH

Total Arch Replacement



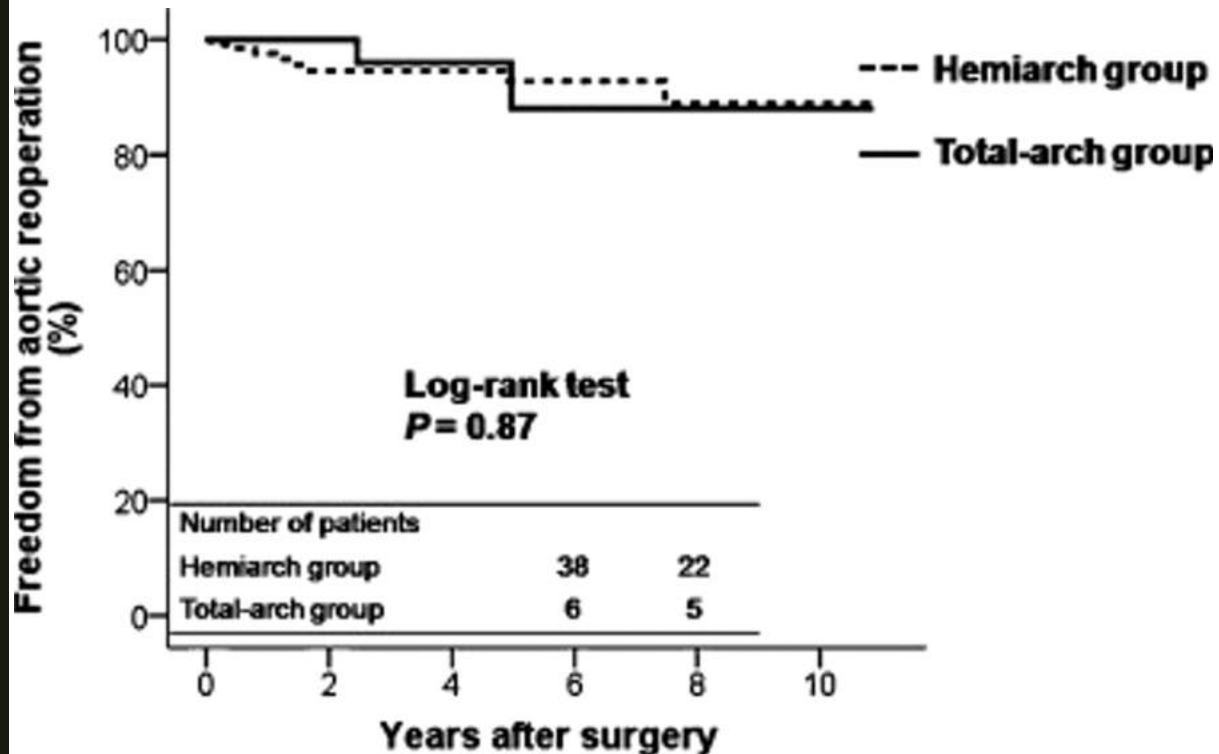
- Operative mortality: 4-6%

Esposito, G, et al (2012). *Eur J Cardiothorac Surg* 42: 242-248.

Glauber, M, et al (2011). *Eur J Cardiothorac Surg* 40: 418-423.

Matalanis, G, et al (2015). *JTCVS* 149: S76-S82

Total Arch Vs Hemiarch replacement



- *Distal aorta*
 - No difference!!
 - Old re-entries become the new entries
- *Advantage*
 - Avoid re-do sternotomy
 - With correct root management
 - All cerebral blood flow arises from Dacron,
 - Easier* endovascular later



HAVE A GOOD FOUNDATION IN
ENDOVASCULAR INTERVENTION





Check List

- Contrast, Pump rates, moving II and table
- Access sites
 - *Femoral, radial, brachial, axillary, carotid, Ascending, LV apex*
- Pre-closure devices
- Wires : sizes, “slipperiness”, stiffness, length
- Catheters: angle tips, pre-shaped
- Guides and sheaths
- Angioplasty balloons
- Stents
- Lead Apron

What I discovered

Technical hurdle of “wire skills” for a
Cardiac Surgeon

1 week

Inventory skills

6 months

Total planning of procedure and all
potential complications

ongoing

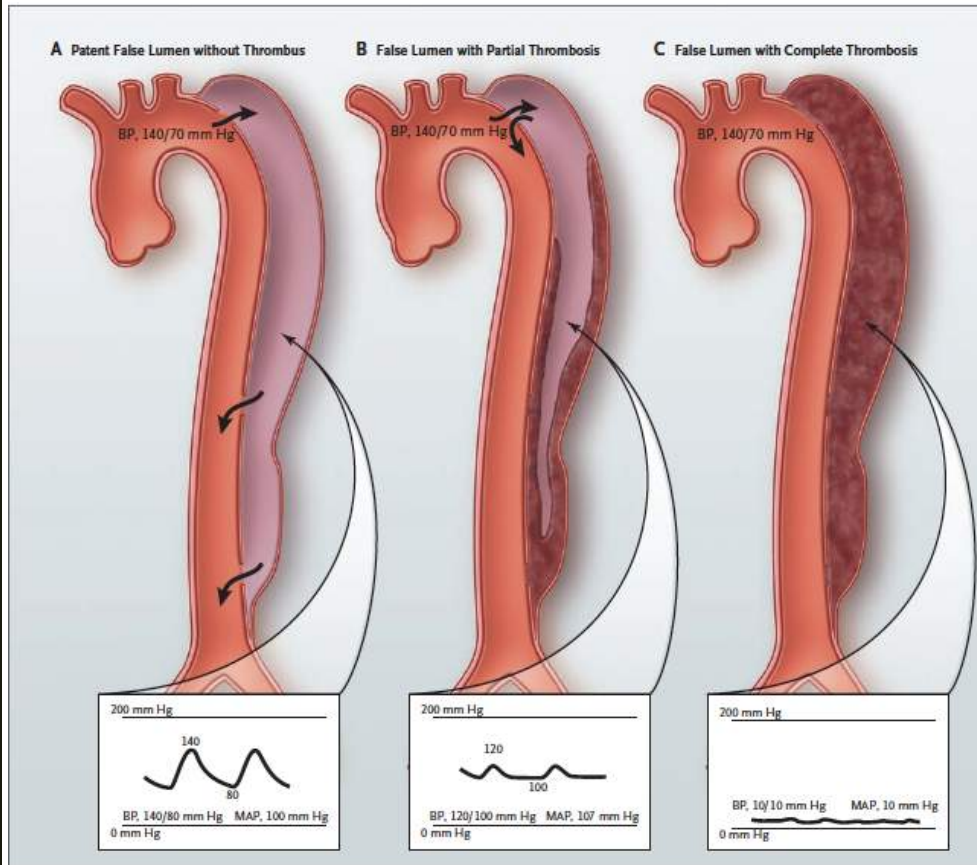


APPLICATION OF ENDOVASCULAR INTERVENTION KNOWLEDGE



Total Aortic Repair for Acute Type A dissection

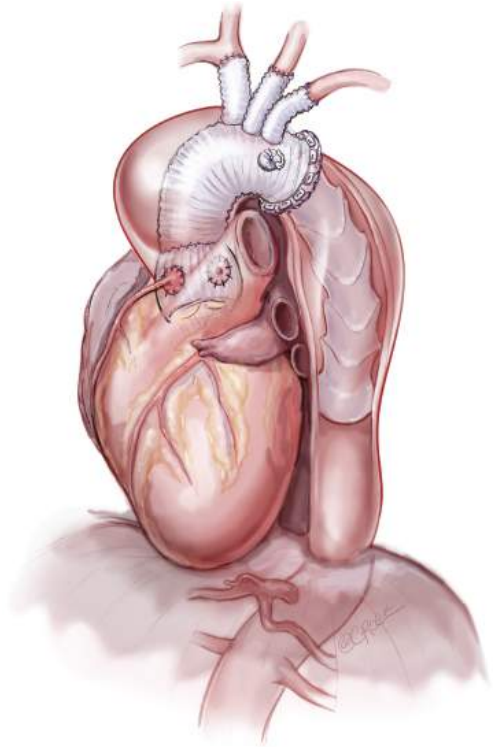
Why does the FL persist and grow?



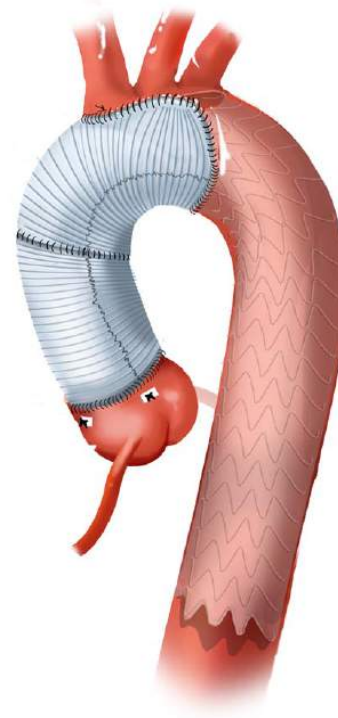
- **False Lumen Diastolic Hypertension**
 - Large entry tears
 - Poor diastolic emptying of FL
- **↓ Wall thickness of FL + LaPlace**
- **Branch dependence on FL supply**

SOLUTION 1 – REDUCE ENTRY TEARS

Descending Endografting



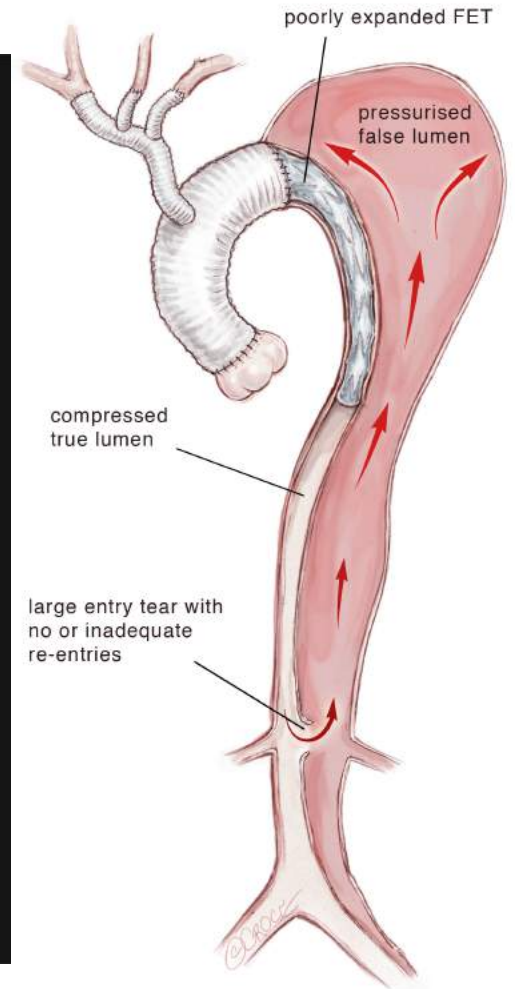
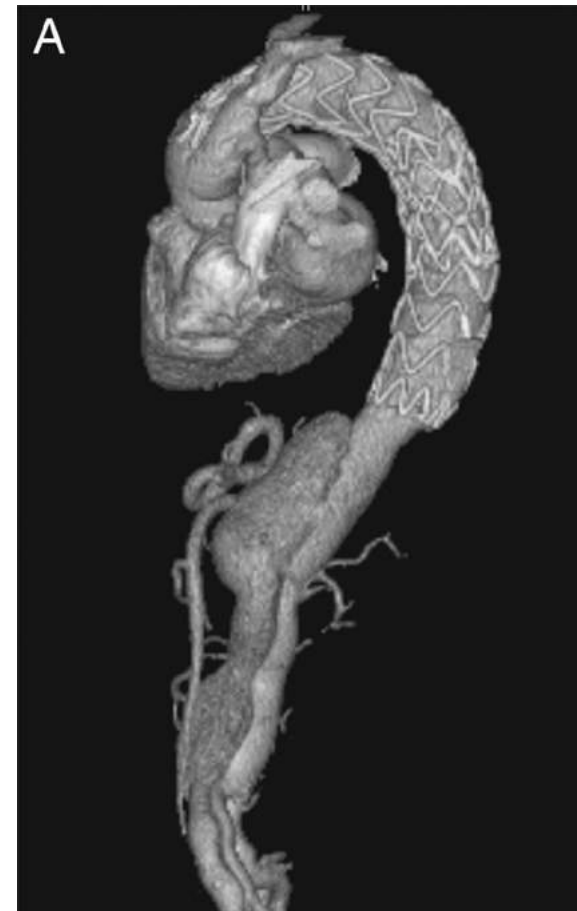
Sun L, et al. Circulation. 2011.
Uchida N, et al. J Thorac Cardiovasc Surg. 2006.

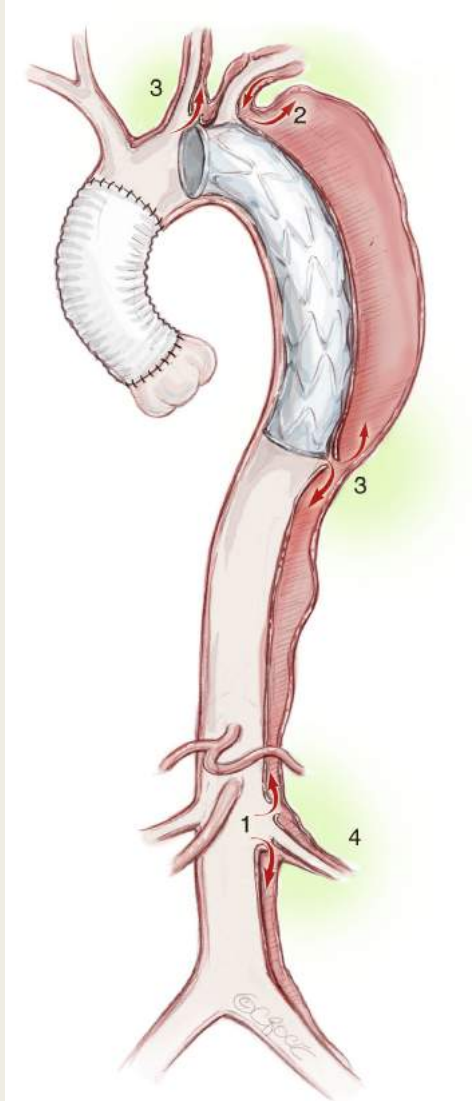


Pochettino, Szeto, and Bavaria; AnnThor Surg 2009.
Esposito, G, et al. Eur J Cardiothorac Surg. 2012

Efficacy of descending ELG

- 70-80% FL thrombosis “peri-stent”
BUT
- 70-80% patent distal to stent
- Paraplegia
- Stent compression
 - *Haemolysis, Coarctation*





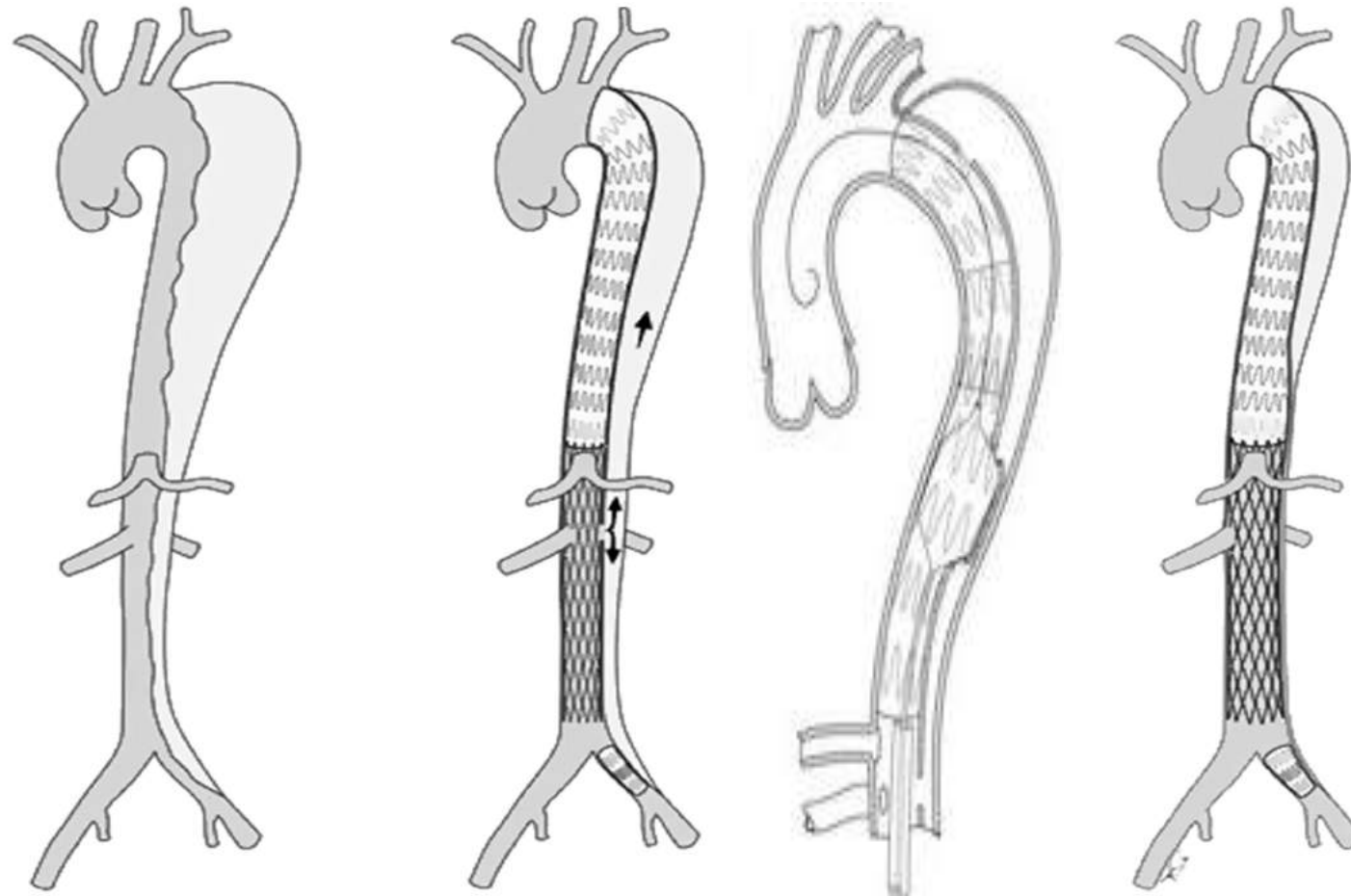
Why do standard Stent Grafts fail?

1. Can't cover entries at arch or visceral branch origins
2. Retrograde Perfusion of FL from a covered branch
3. Intimal tears from proximal/distal end of stent
4. Branches dependent on FL perfusion
5. Standard Type I – V endoleaks

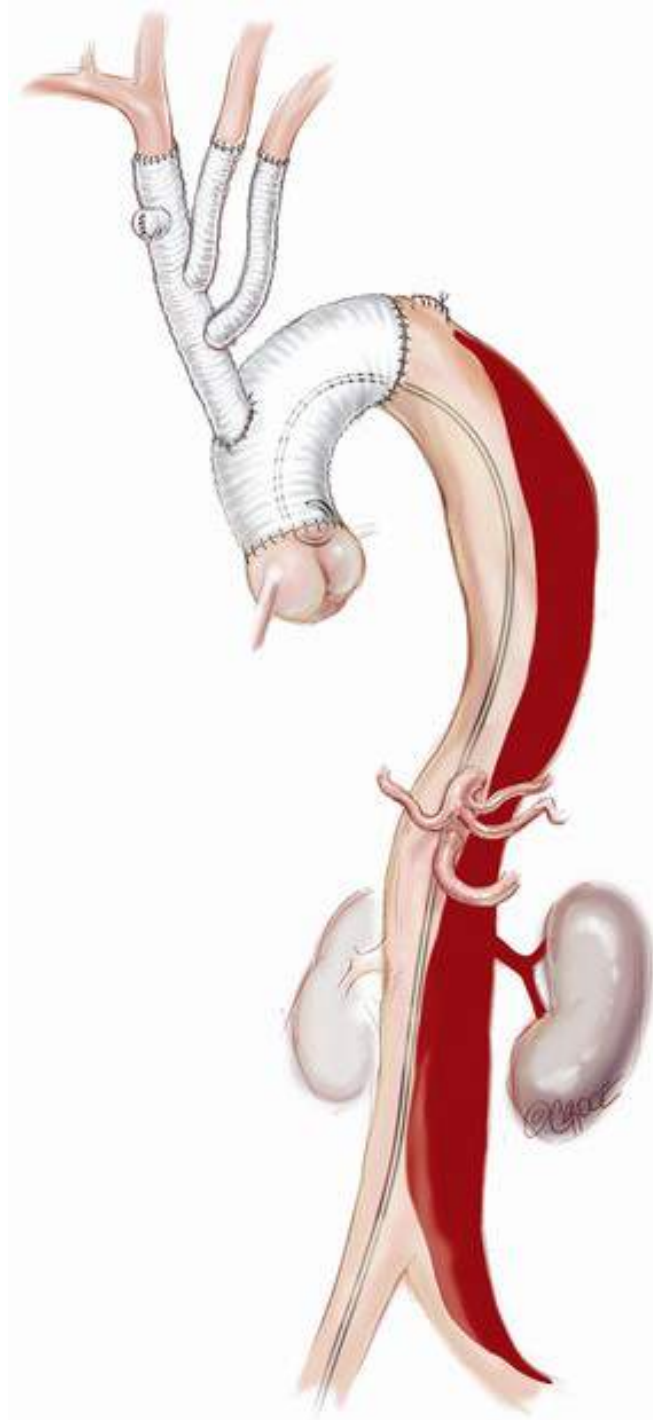
SOLUTION 2 - IMPROVE FL DRAINAGE

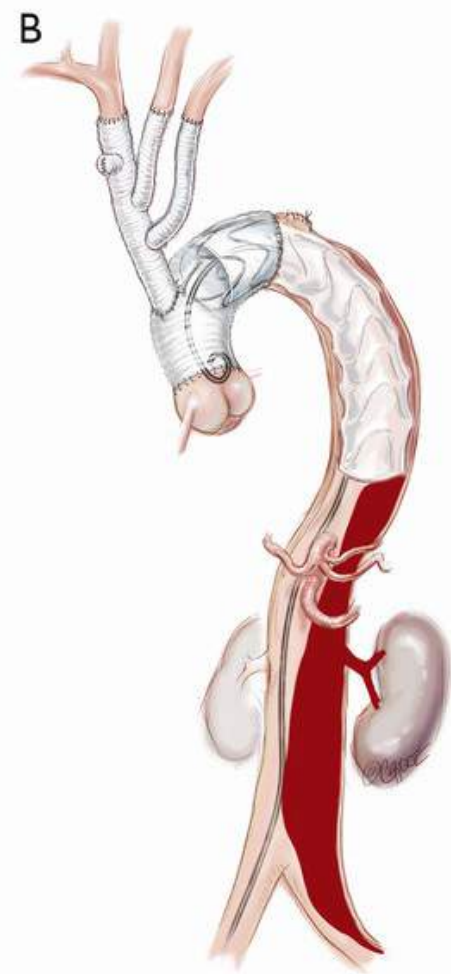
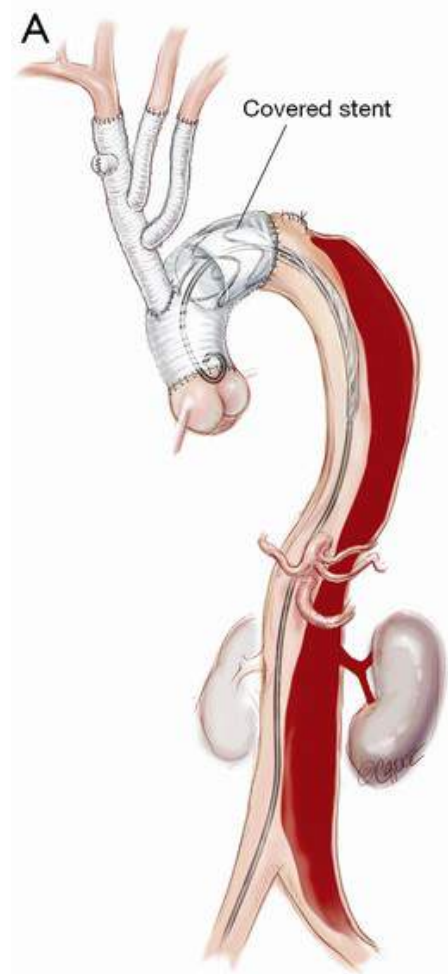
Stent-Assisted Balloon-Induced Intimal Disruption and Relamination in Aortic Dissection Repair: The STABILISE concept

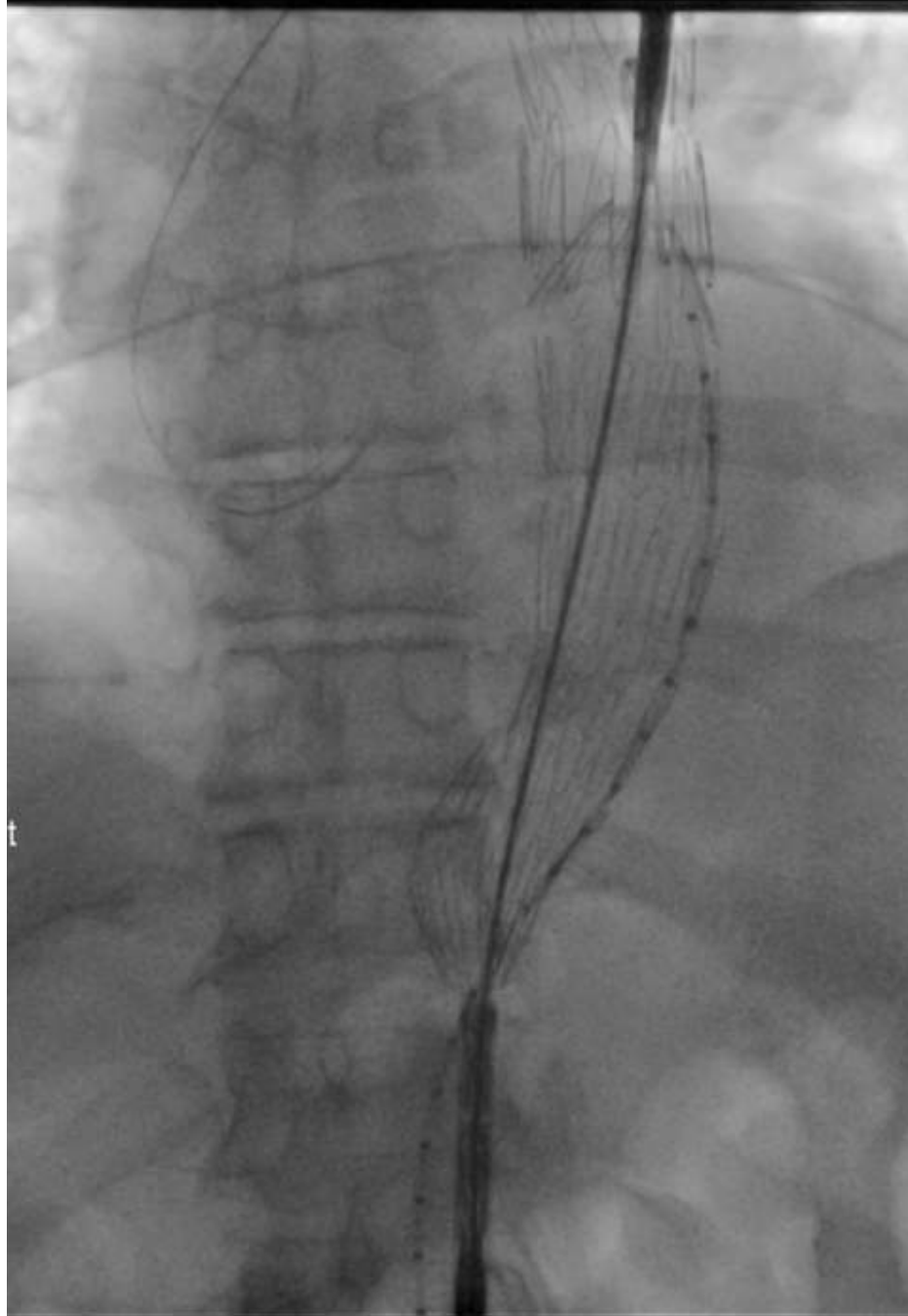
Sophie C. Hofferberth, MBBS, BSc,^a Ian K. Nixon, MBBS, FRACS,^a Raymond C. Boston, PhD,^b
Craig S. McLachlan, PhD, MPH,^c and Peter J. Mossop, MBBS, FRACR^{d,e}



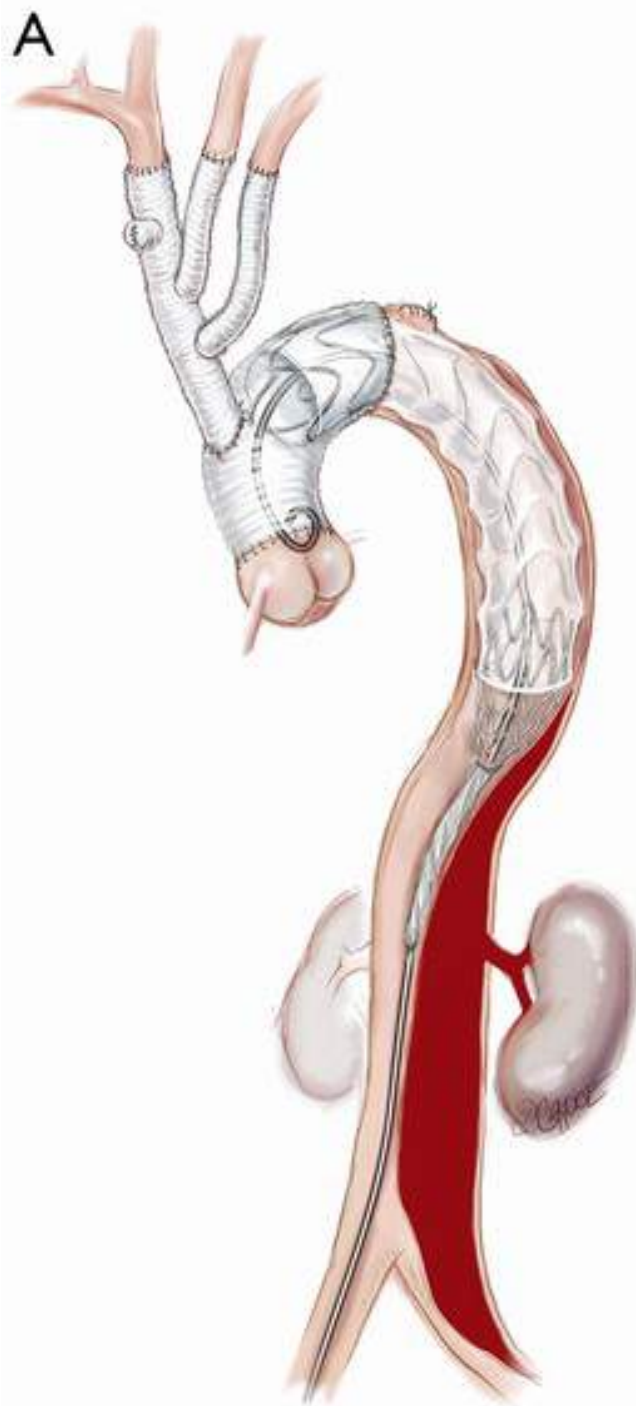
- Total fenestration
- Structural support
- Healing of media



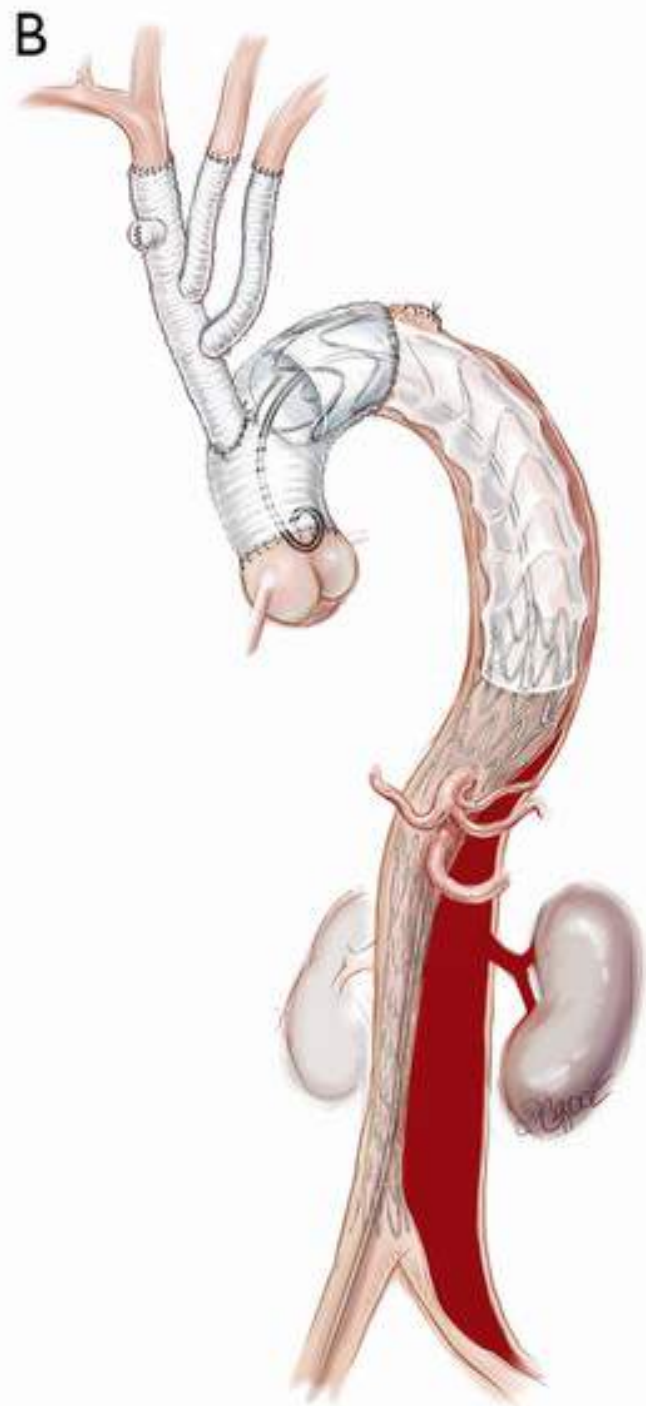


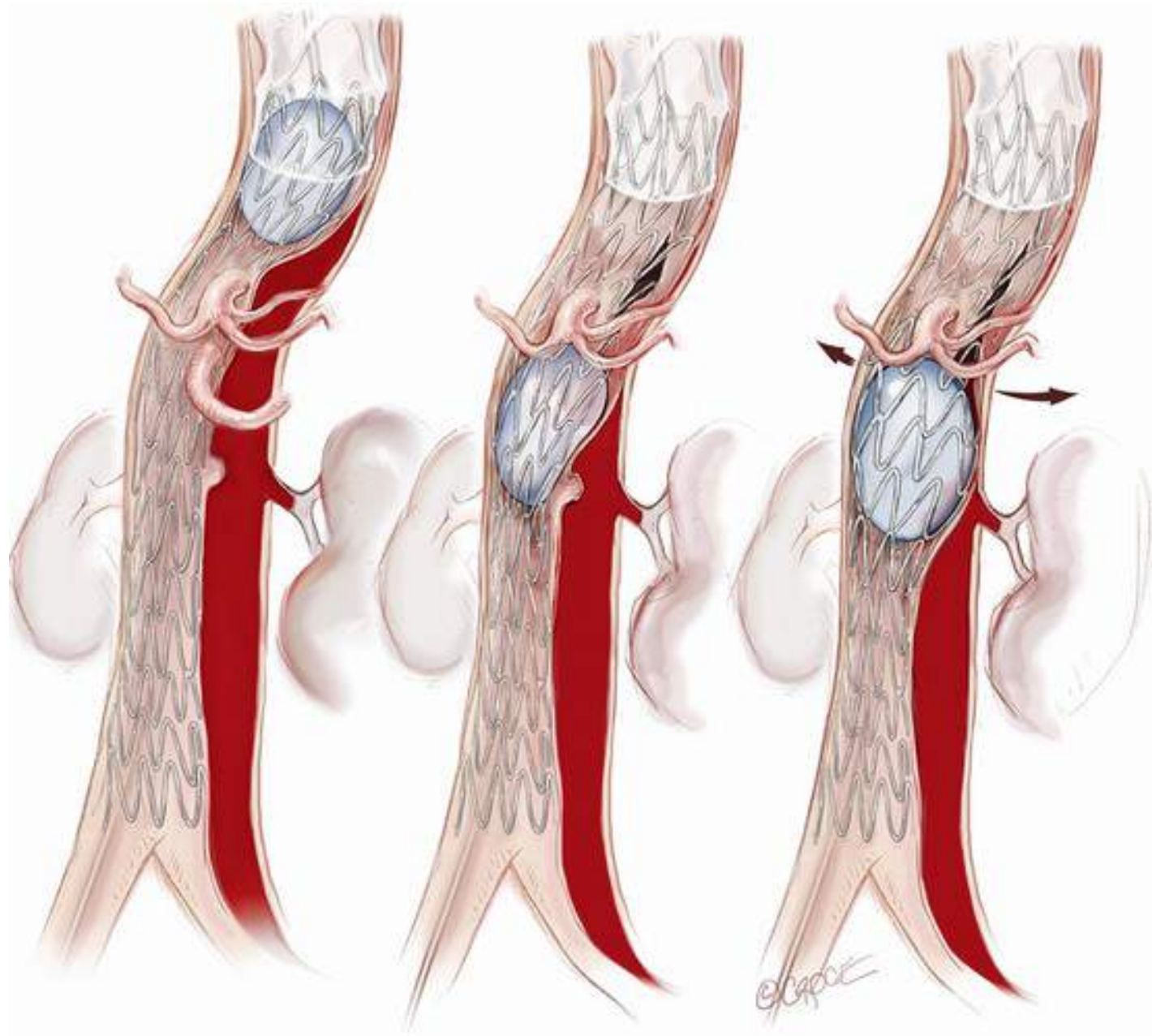


A



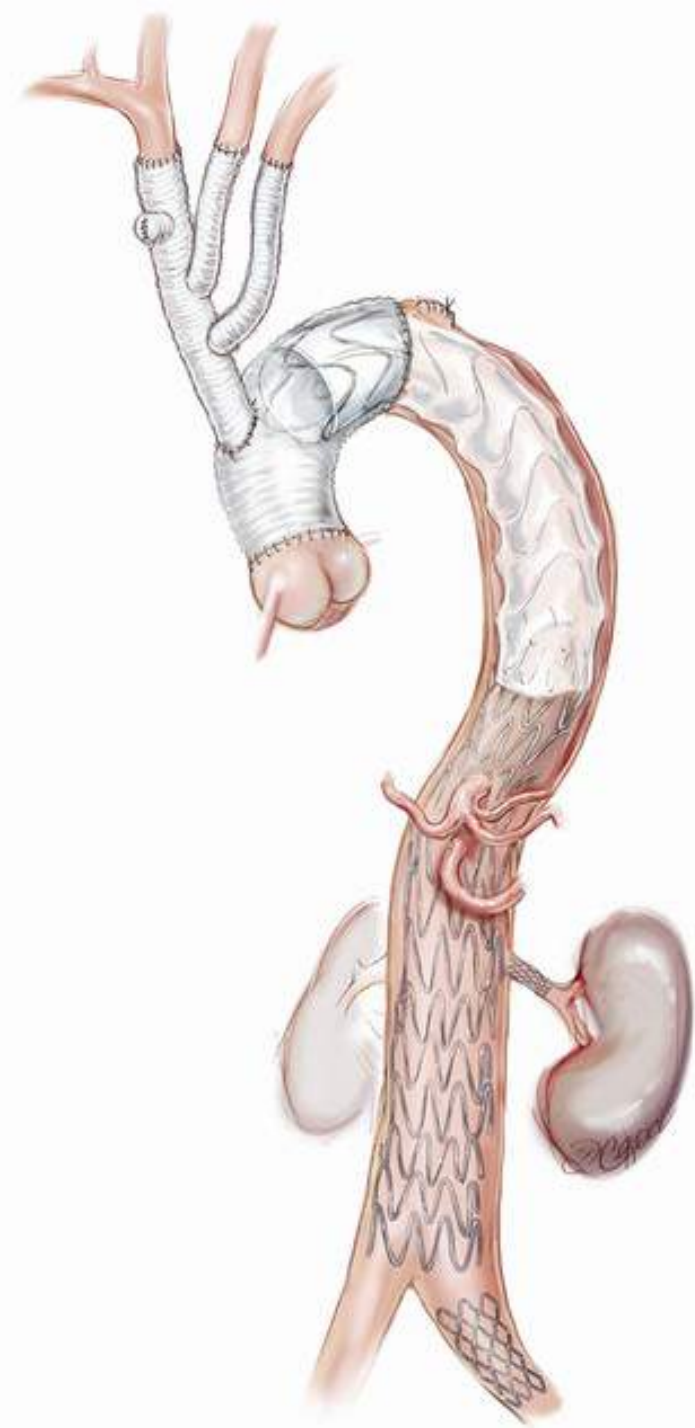
B





WL: 2047 WW: 4095

03357453
21



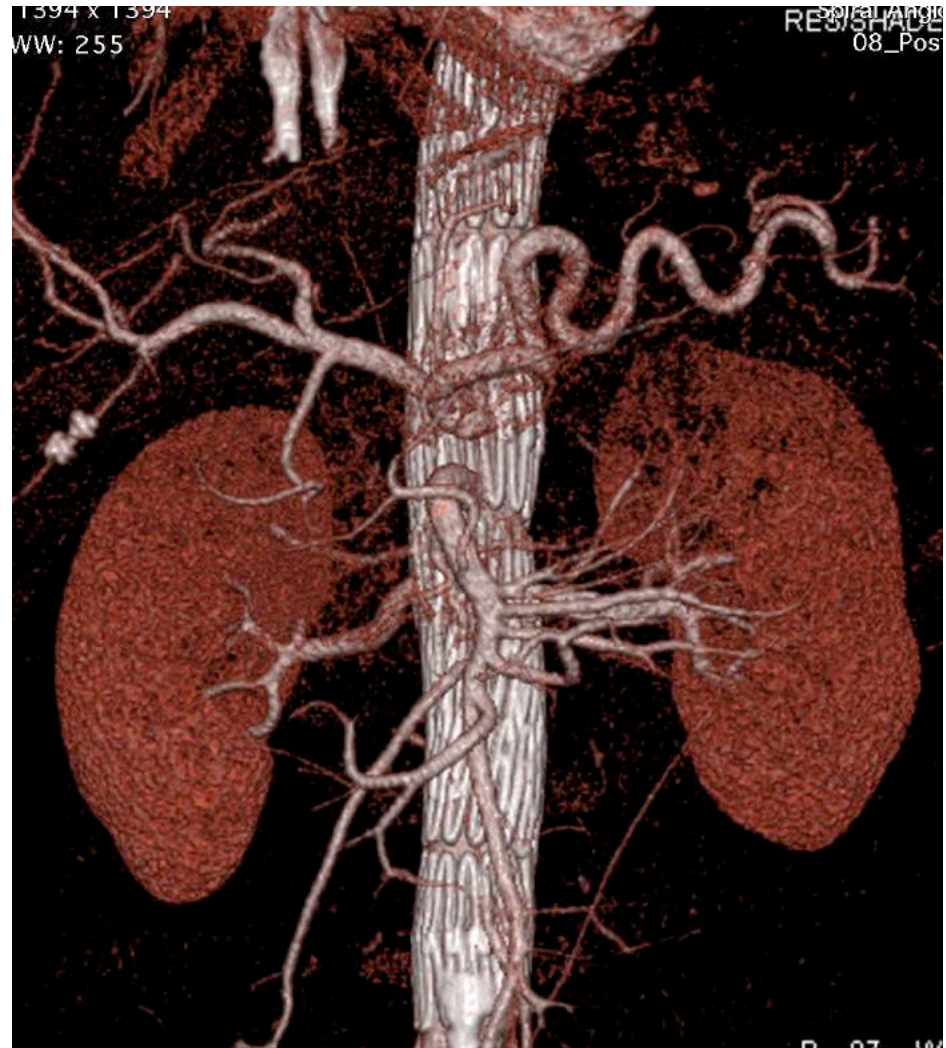


TOTAL AORTIC REPAIR – Early Experience

- 15 patients : Oct 12- Dec 16
- Female: 4
- Age: 19-74
- 80% Acute, 20% Chronic (up to 3 yrs)
- Indication
 - *persistent gut or leg ischaemia: 9*
 - *Rapid enlargement FL : 1*
 - *TL collapse on CT : 5*

Early Outcome

- Operative mortality: nil
- Procedural success: 100%
- Complications
 - ◆ *1 CVA after stent –minor residual*
 - ◆ *No Paraplegia, Access related complications*
- No FL patency in whole TAA
 - *X2 cases v. localised - Rx short covered stent cuffs*

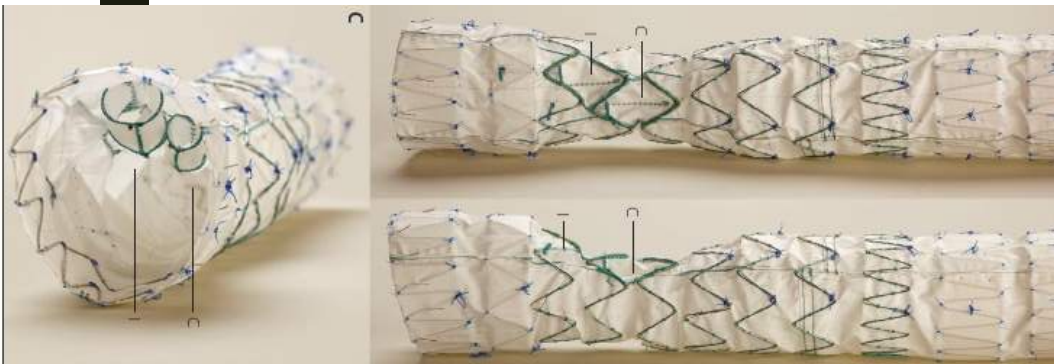


4 yrs post-op

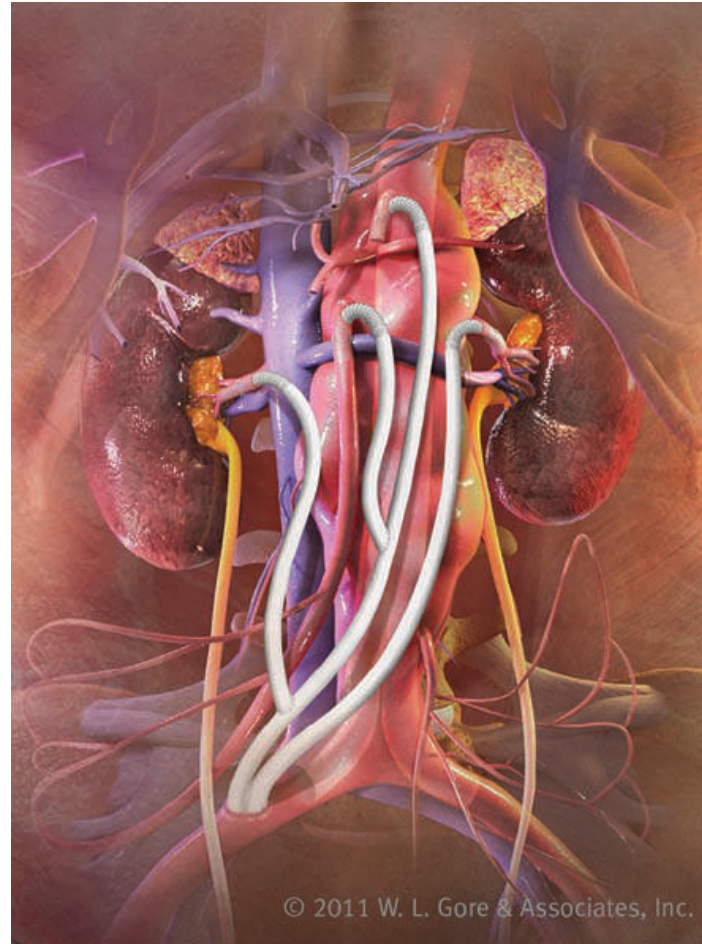
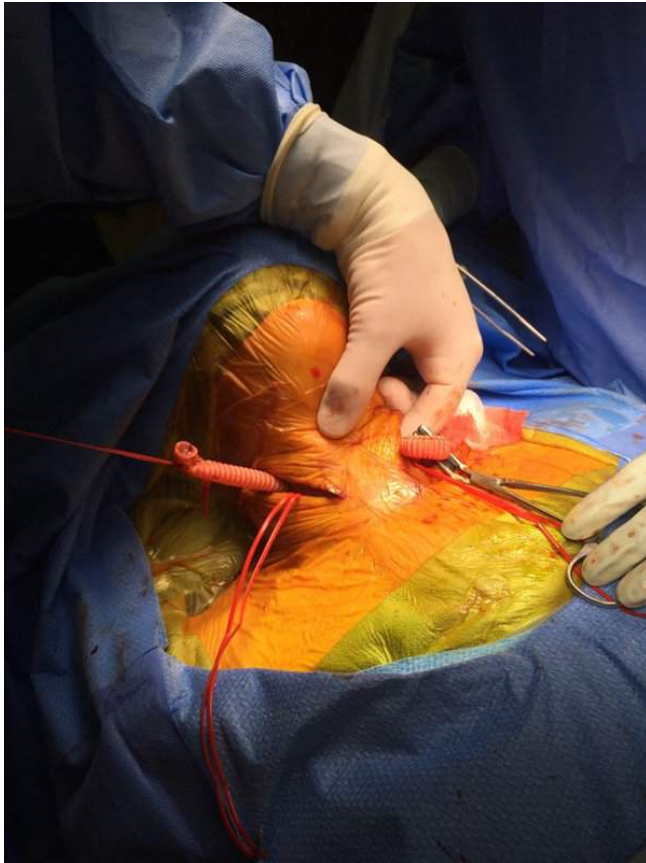
Concluding Remarks

- The era of endovascular surgery is here and rapidly expanding
- Open aortic surgery reducing overall numbers, but
 - *Increasing complexity – redo, multi-segment, valve sparing*
 - *Greater public expectations*
 - *Train fewer open surgeons, but train them well*
- Vital that Cardiac surgeon remain a main player
 - *Best position to be the patient advocate*
- Obligatory endovascular experience during training
- Functional Aortic MDT to maximise expertise in all areas

Total Endovascular Solutions



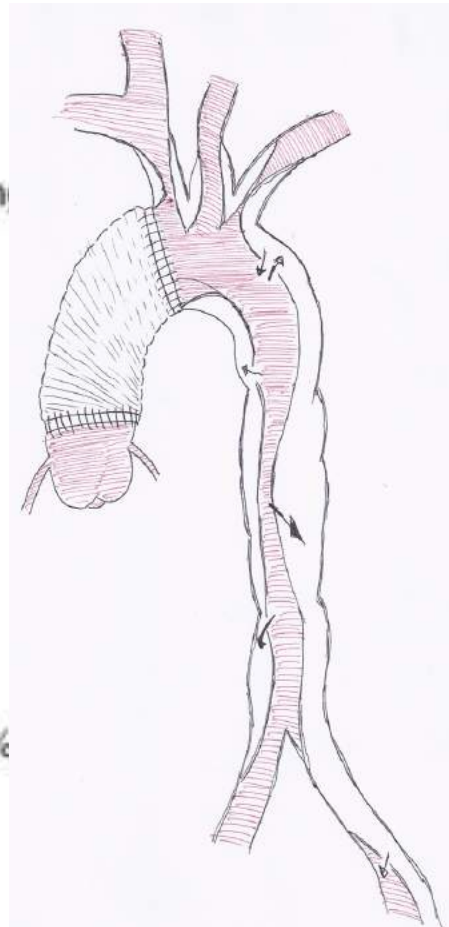
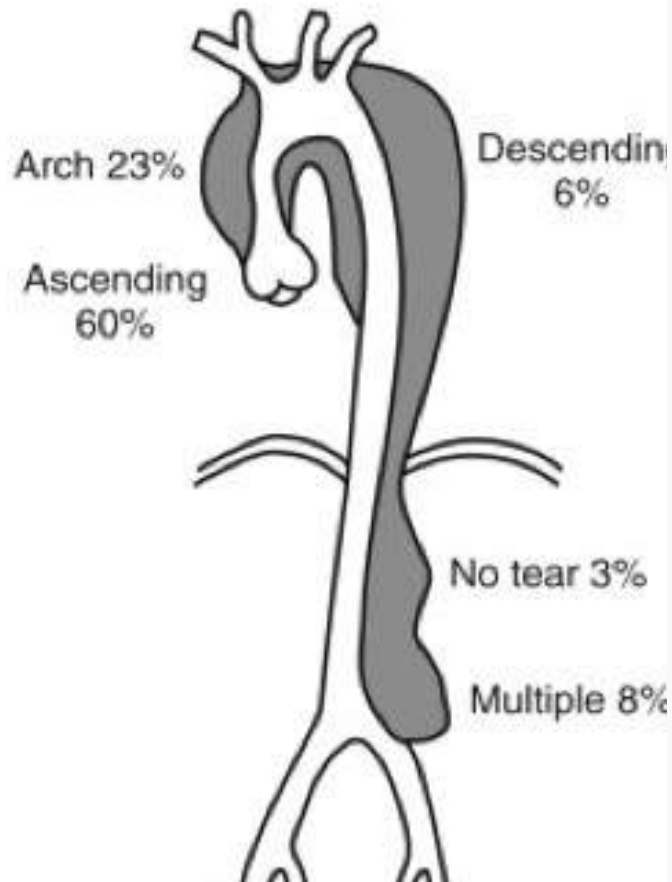
Extra-anatomic De-branching + Stent



ARE WE TOTALLY POWERLESS IN PREVENTING THE NATURAL HISTORY?

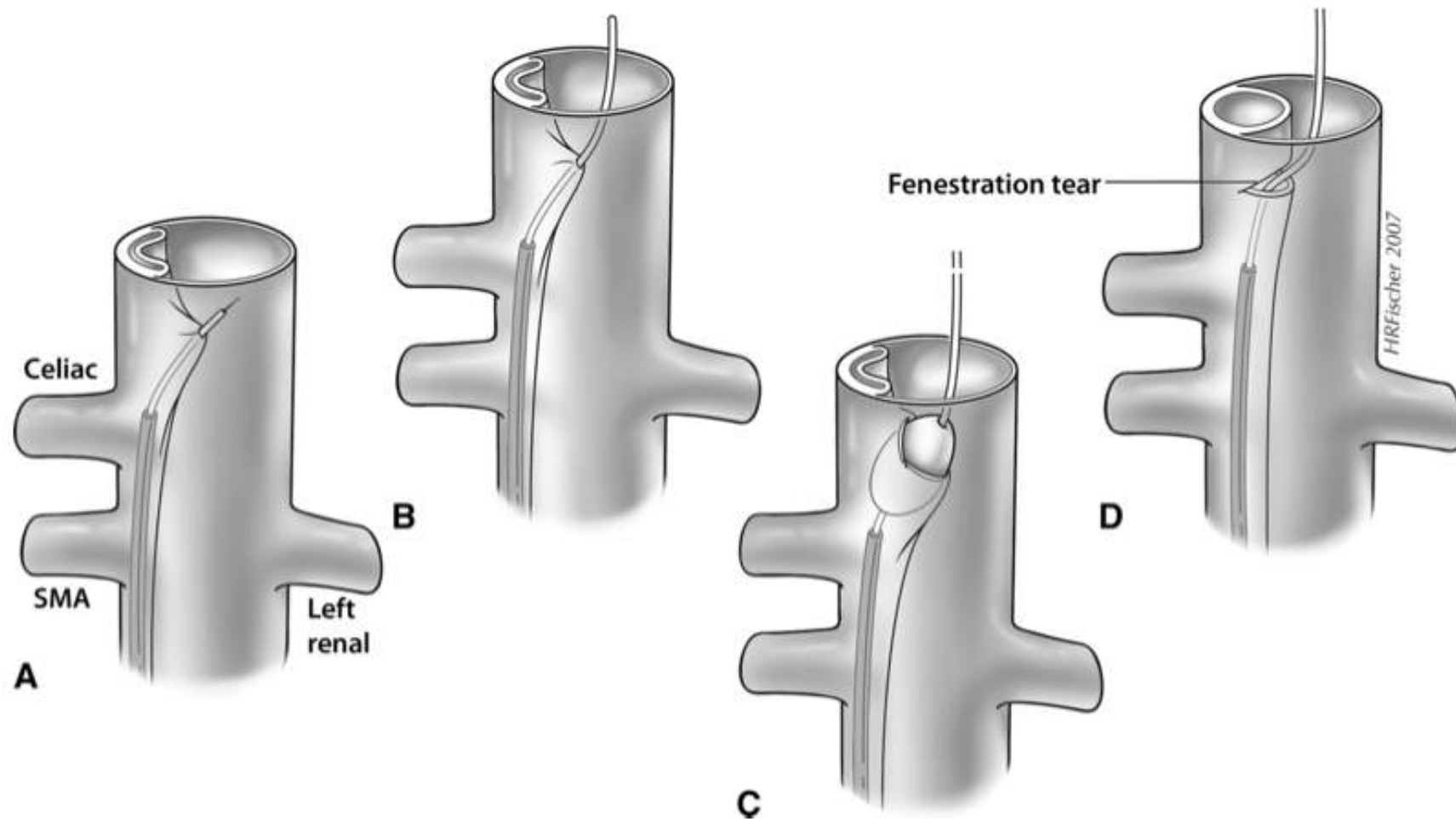
Towards a Rational Solution


Entry Tear in Type A Aortic Dissection is not always in the ascending Aorta



- 40% primary tears not in Ascending
- Old Re-entry tears are the new entries
- Clamp and anastomotic site entries

Fenestration



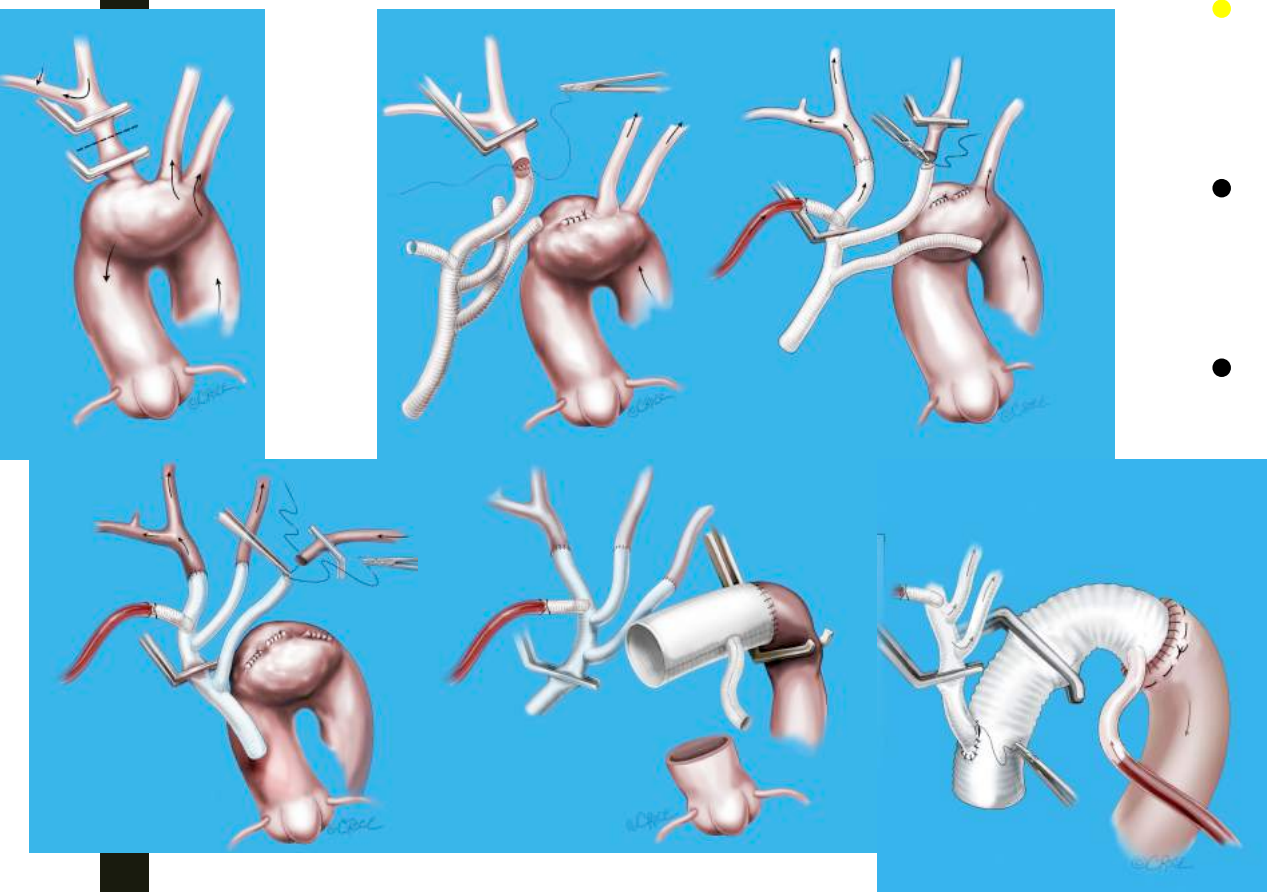


COMPLETE AORTIC REPAIR FOR ATAAD

A New Paradigm



First stage: Branch First Total arch replacement

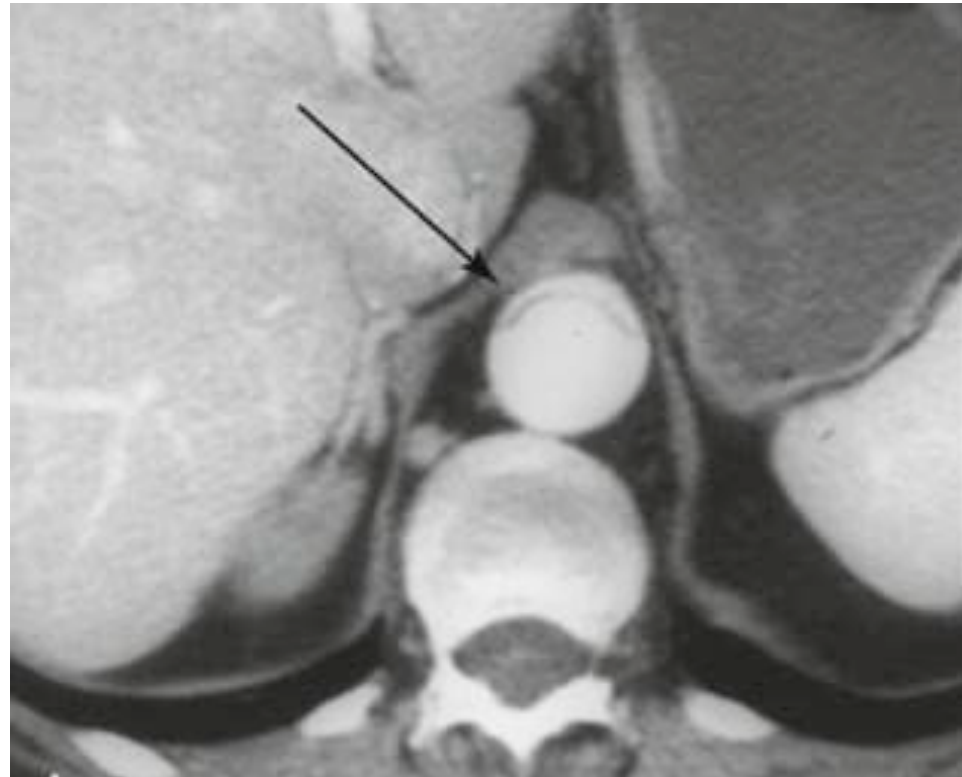


- All arch branches from Dacron
- Long landing zone w/out FET
- FET
 - Large tear in upper DTA
 - Retrograde Type A
 - Fragile distal anastomosis

Second stage: “Dissection” Stent Grafting

INDICATIONS

- Ongoing distal mal-perfusion
- Enlarging FL
- TL collapse
- ?! Concave TL



Second stage: Covered & fenestrated Stents

TIMING

■ 3-14 days post-op

- *same admission or early re-admission*

■ Immediate, intra-op

- *if persistent distal malperfusion*
- *? more cases if hybrid lab available*

■ Pre-op

- *Liver/Bowel ischemia with metabolic derangement*

Precautions

- Contraindicated if periaortic hematoma or leak
- Don't inflate balloon beyond outer diameter of Aorta
- Avoid stent overlap in visceral aorta
- Low threshold for covered stents to re-align visceral branch to TL
- ? Role in Genetic Aortopathies

What happens when principals are ignored



Conclusion - Decision time for ATAAD Mx

Conservative

- Non-aortic specialist
- Early mortality 25%
- Lose some to aortic rupture
- Refer rest to aortic centre for complicated Sx/stenting

Total aortic Repair

- Referral to Aortic Centre
- Low early mortality
- Potential for cure

Benefits of Total Aortic Repair

- Complete ascending and arch repair (+ root if required)
 - *Avoid difficult re-sternotomy for late aneurysm of root/arch*
 - *Arch branch flow secured to Dacron rather than dissected aorta*
 - *No proximal sources to feed FL*
 - *Stable long landing zone for subsequent Stent graft*

Benefits of Total Aortic Repair

- *Prevent branch ischemia (early or delayed/insidious)*
- *Ensure TL expansion & perfusion*
- *Re-align visceral/iliac branch to TL*

Benefits of Total Aortic Repair

- Prevent late Thoraco-abdominal aneurysm development
 - *No FL pressure / shear differential in diastole*
 - *Encourage complete healing of the layers, by re-apposition*
 - *Stent graft structural support to aortic wall*