Emerging Roles for Distal Aortic Interventions in Type A Dissection Surgery

Type A Dissection Workshop
2014 CCC Vancouver
Oct 26th, 2014

Jehangir Appoo
Libin Cardiovascular Institute
University of Calgary
Current “standard of care” for acute Type A Dissection

Very good operation
Saves many lives in distressful times

but, is it enough in all cases?
does it treat the full disease process?
does it make our patients “whole”?
Case Example: 46y.o male flown in from OSH – May 2014

Hemodynamic shock

Abdomen distended, tender
Case Example: 46y.o male flown in from OSH – May 2014

Evidence of renal infarct/malperfusion
Both legs pulseless, cold, mottled and paralyzed
Our 46y.o patient

Is standard “hemiarch” surgery the right operation?

Will visceral, renal, & peripheral perfusion be restored?

Will he have use of his legs?

Will he survive?
Problem:

- Long term survival is compromised
- Distal aortic problems may be higher than we appreciate
Problem:

Long term survival is compromised

Immediate op mortality is high:

- IRAD (2005) 25%
- GERAADA (2014) 17%
- US Registry Data (Oct. 2014) 21%

Distal aortic problems may be higher than we appreciate
Problem:

Long term survival is compromised
Distal aortic problems may be higher than we appreciate

Immediate op mortality is high:

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GERAADA (2014) 17%
US Registry Data (2014) 25%

Question:

Can extended distal aortic repair decrease long term mortality?
Can increase complexity be accomplished without increased periop morbidity?
Problem:

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- Distal aortic problems may be higher than we appreciate

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- GERAADA (2014) 17%
- US Registry Data (Oct. 2014) 21%

Question:

- Can extended distal aortic repair decrease long term mortality?
- Can increase complexity be accomplished without increased periop morbidity?

Goal:

- Decrease both long term and short term mortality
Global evolving technical approaches to extended distal repair

Classification according to extent of aorta resected:

I. Zone 2/3 Arch + Stent graft

I. Arch Debranching + Zone 0 Stent Graft

I. Conventional Hemiarch + Stent Graft under Circ Arrest (FET)
Primary entry tear located in distal arch or descending thoracic aorta up to 20-30%

Replacing ascending aorta does not satisfy surgical principle of resecting primary entry tear
Uchida 2013 (Personal Communication)

Zone 2 Arch

118 pts

6% op mortality
Indications for frozen elephant trunk in type A aortic dissection

- Younger Patients (Age < 70 Years) N=40
- Age ≥70 yrs
  - Primary Entry: Located on the distal arch N=36
  - True Lumen: Occluded or severely collapsed N=27
  - Arch Dilatation > 40 mm N=15

To Consider Frozen elephant trunk Technique as a Distal Repair
E-Vita
Global evolving technical approaches to extended distal repair

Classification according to extent of aorta resected:

I. Zone 2/3 Arch + Stent graft

I. Arch Debranching + Zone 0 Stent Graft

I. Conventional Hemiarch + Stent Graft under Circ Arrest (FET)
Arch Debranching and Zone 0 TEVAR for acute Type A Dissection
Transforming “difficult distal” operation to a more “proximal” operation

Siena technique
Staged approach
Arch Debranching and Zone 0 TEVAR for acute Type A Dissection

  Siena technique
  Staged approach

  Single stage total arch repair
  Without circ arrest
Arch Debranching and Zone 0 TEVAR for acute Type A Dissection

Siena technique
Staged approach

Ann Cardiothoracic Surg 2013
Single stage total arch repair without circ arrest

Chang et al. JTCVS 2013
Single stage total arch repair without circ arrest
21 patients with TypeA
Global evolving technical approaches to extended distal repair

Classification according to extent of aorta resected:

I. Zone 2/3 Arch + Stent graft
I. Arch Debranching + Zone 0 Stent Graft
I. Conventional Hemiarch + Stent Graft under Circ Arrest (FET)
Antegrade Thoracic Stent Grafting During Repair of Acute DeBakey I Dissection Prevents Development of Thoracoabdominal Aortic Aneurysms

Alberto Pochettino, MD, William T. Brinkman, MD, Patrick Moeller, BS, Wilson Y. Szeto, MD, William Moser, CRNP, Katherine Cornelius, BSN, Frank W. Bowen, MD, Y. Joseph Woo, MD, and Joseph E. Bavaria, MD

Division of Cardiovascular Surgery, Department of Surgery, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania
# Early Outcomes of FET 2005-2012

<table>
<thead>
<tr>
<th></th>
<th>Stented (N)</th>
<th>Standard Repair (N)</th>
<th>Malperfusion Resolved Stented vs. Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penn</td>
<td>62</td>
<td>180</td>
<td>NA</td>
</tr>
<tr>
<td>Texas</td>
<td>25</td>
<td>87</td>
<td>84% vs. 54% (p &lt; 0.05)</td>
</tr>
</tbody>
</table>

Vallabhajosyula
Preventza

J Thorac Cardiovasc Surg 2014
J Thorac Cardiovasc Surg 2014
Does standard surgical repair of Debakey Type 1 Dissection alter true lumen geometry downstream?

Conventional hemiarch $\rightarrow$ true lumen/total aortic ratio distally:
- Increased: 44%
- Decreased: 56%

Harmse, Appoo, Herget, Merchant, Wong & Ferris. 2014 In submission
Our 46y.o patient

Is standard “hemiarch” surgery the right operation?

Will visceral, renal, & peripheral perfusion be restored?

Will he have use of his legs?

Will he survive?

50/50 chance that complicated malperfusion resolves with standard repair
Depending on whether you are at CCF, Mayo, Calgary, Penn, Germany, Japan or China & which surgeon is on call, variety of novel operations being carried on for Type A dissection. Not standardized….yet
2014 ESC Guidelines on the diagnosis and treatment of aortic diseases

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

The Task Force for the Diagnosis and Treatment of Aortic Diseases of the European Society of Cardiology (ESC)
### Recommendations for treatment of aortic dissection

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>In all patients with AD, medical therapy including pain relief and blood pressure control is recommended.</td>
<td>I</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>In patients with Type A AD, urgent surgery is recommended.</td>
<td>I</td>
<td>B</td>
<td>1,2</td>
</tr>
<tr>
<td>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.</td>
<td>IIa</td>
<td>B</td>
<td>2,118, 202–204, 227</td>
</tr>
</tbody>
</table>

Validation!
Example of Arch Debranching for acute Type A Aortic Dissection
59 y.o. Male  
acute Type A Dissection  
pre-existing 5.5cm descending thoracic aortic aneurysm
59 y.o. Male  acute Type A Dissection 2014  
pre-existing 5.5cm descending thoracic aortic aneurysm

Type II Hybrid Arch Repair
Debranch then re-assess – may or may not need stent graft

Post CPB for Asc Ao replacement & Debranching acute Type A – before TEVAR

Obliteration of false lumen in arch & prox descending aorta
Example of Frozen Elephant Trunk for acute Type A Aortic Dissection
Our 46y.o male flown in from OSH – May 2014
Type A dissection with shock, visceral, renal & LE malperfusion
Post CPB on table Angio after FET, HemiArch, Asc Ao Replacement, Ao valve repair

Thoracic Ao TL expansion seen on angio & TEE

Good perfusion of celiac, SMA & nephrograms visible
Our next stage of evolution:

Type II Hybrid Zone 2 Arch
World wide tour of novel techniques used by select cardiac surgeons – not institution wide yet

Early results 2012-2014

Currently on a steep learning curve

Latest guidelines supportive for malperfusion indication
Consideration for extended distal repair:

- Primary Intimal Tear in distal arch
- Distal malperfusion syndrome
- Enlarged false lumen/true lumen ratio
- Dilated arch
- Young patients
In the future:

What % of pts would be eligible for isolated endovascular repair of acute type A dissection?

Which patients benefit from conventional surgery vs. hybrid surgery vs. endovascular?

Strategies

  Surgical asc ao replacement followed by branch grafts?
<table>
<thead>
<tr>
<th></th>
<th>Stented</th>
<th>Standard Repair</th>
<th>P value</th>
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<tbody>
<tr>
<td>N (Penn)</td>
<td>62</td>
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<tr>
<td>(Texas)</td>
<td>25</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>Mortality</td>
<td>10%</td>
<td>14%</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>12%</td>
<td>13.8%</td>
<td>NS</td>
</tr>
<tr>
<td>CVA</td>
<td>5%</td>
<td>8%</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>12%</td>
<td>10.3%</td>
<td>NS</td>
</tr>
<tr>
<td>Transient SCI</td>
<td>6%</td>
<td>2%</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>8%</td>
<td>2.4%</td>
<td>NS</td>
</tr>
<tr>
<td>Circ arrest times</td>
<td>55±18 mins</td>
<td>37±18 mins</td>
<td>P = .001</td>
</tr>
<tr>
<td></td>
<td>35mins</td>
<td>34mins</td>
<td>NS</td>
</tr>
<tr>
<td>False Lumen Obliteration</td>
<td>82%</td>
<td>39%</td>
<td>P &lt; .001</td>
</tr>
<tr>
<td></td>
<td>~50%</td>
<td>~50%</td>
<td>NS</td>
</tr>
<tr>
<td>Malperfusion Resolved</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>84.2%</td>
<td>54.2%</td>
<td>P &lt; .037</td>
</tr>
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</table>
### Pochettino/UPENN Early outcomes

#### 2005 – 2012

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<td>CVA</td>
<td>5%</td>
<td>8%</td>
<td>NS</td>
</tr>
<tr>
<td>Paraplegia</td>
<td>0%</td>
<td>1%</td>
<td>NS</td>
</tr>
<tr>
<td>Circ arrest times</td>
<td>55±18 mins</td>
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Mean f/u 2.7 yrs

Vallabhajosyula JTCVS 2014
Extended aortic repairs

• Improved false lumen obliteration
  – Reduced potential malperfusion
  – Reduced late dilatation

• Reduced late re-interventions

• Reduced late mortality

• Improve our late outcomes with minimal morbidity

= No brainer
Operative Mortality

Malperfusion: 30%
No malperfusion: 6%
Total Aortic Arch Grafting for Acute Type A Dissection: Analysis of Residual False Lumen

Yoshiharu Takahara, MD, Yoshio Sudo, MD, Kenzi Mogi, MD, Mituyuki Nakayama, MD, and Manabu Sakurai, MD
Division of Cardiovascular Surgery, Funabashi Municipal Medical Center, Funabashi, Japan

Background. In surgery unresected dissection as causes of the progression of aortic dissection are grafting possible through all patients with type A aortic dissection, where ever an arch.

Methods. A total of 37 type A dissection underwent grafting between August 1 and 2006. We evaluated using the computer operation.

Results. The hospital mortality for the FET group was 6.3% and 11.1% for the FET group. Emergency total arch replacement with a modified elephant trunk technique was performed in all patients.

Operative Strategy for Acute Type A Aortic Dissection: Ascending Aortic or Hemiarch Versus Total Arch Replacement With Frozen Elephant Trunk

Naomichi Uchida, MD, Hidenori Shishimura, MD, Akira Katayama, MD, Norimitsu Shimada, MD, Miwa Sutoh, MD, and Hiroshi Ishihara, MD
Division of Cardiovascular Surgery, Hiroshima-city Asa General Hospital, and Kajikawa Private Hospital, Hiroshima, Japan

Background. We assessed the outcome of operative replacement with a modified technique for acute type A aortic dissection. Our aggressive approach is justified by the following factors: (1) the need for aortic arch replacement with individual aortic arch dissection. The modified elephant trunk provided secure anastomosis and early true lumen formation.

Methods. Between 2000 and 2006, all patients underwent emergency total arch replacement. The modified technique was applied in the following patients: the transverse arch or the proximal descending aorta, massive arch dissection, Marfan syndrome, and atheromatous arch. The technique used a modified elephant trunk for secure anastomosis and early true lumen formation.

Results. Three patients in the FET group died, and 2 patients in the AHR group died. In long-term follow-up (mean, 67 months), the survival rate after 5 years was 95.3% for the FET group and 69.0% for the AHR group.

(p = 0.03). The event rate for the thoracic aorta after 5 years showed a significant difference between the FET and AHR groups (95.7% versus 73.0%, p = 0.01). A false lumen at the proximal descending aorta was patent in 16 patients (29%) in the AHR group, but it was thrombosed in all in the FET group.

Conclusions. In patients with acute type A aortic dissection, it is possible to perform extensive primary repair using the FET technique with relative safety. FET may reduce the necessity for further operations to manage a residual false lumen.

• Very good results but not likely reproducible worldwide led to introduction of
  — “Frozen Elephant Trunk”
E-Vita Results

106 patients ~ half acute/half chronic
SACP 74mins + 8mins HCA
12% operative mortality
False lumen thrombosis 92% (acute) & 66% (chronic)
An Alternative Approach to Diffuse Thoracic Aortomegaly: On-Pump Hybrid Total Arch Repair Without Circulatory Arrest

William D. T. Kent, MD, MSc, Jason K. Wong, MD, Eric J. Herget, Joseph E. Bavaria, MD, and Jehangir J. Appoo, MDCM

Diffuse thoracic aortomegaly has conventionally been managed with a two-stage elephant trunk procedure, requiring prolonged circulatory arrest, with an inherent risk of major morbidity and mortality. Recently, to improve outcomes, several hybrid arch procedures have been proposed using off-pump techniques. We have adopted an alternative, single-stage hybrid strategy using cardiopulmonary bypass without circulatory arrest to replace the ascending aorta and perform arch debranching and antegrade endovascular stent graft deployment.

Unlike off-pump procedures, pathology of the aortic valve, root, and ascending aorta is addressed while avoiding the complications of stent graft placement in the native ascending aorta.

(Ann Thorac Surg 2011;xxx:xxx) © 2011 by The Society of Thoracic Surgeons
Completed Arch Debranching
Acute Type A Case
Completed Hybrid Procedure
Potential Advantages of our Hybrid Total Arch for Acute Type A

**Early**

- Avoidance of circulatory arrest
  - Hypothermia
  - Stroke?
- Decreased bleeding
  - From distal anastomosis
  - Mild Hypothermia
- Avoid/Treat Malperfusion

**Late**

- No residual flap in aortic arch
- Obliteration of false lumen
- Good potential landing zone if needed
- Disease specific approach
Surgical Correction of Ascending Type A Thoracic Aortic Dissection: Simultaneous Endoluminal Exclusion of the Arch and Distal Aorta

Edward B. Diethrich, MD; Marwan Ghazoul, MD; Grayson H. Wheatley III, MD; Jeffrey Alpern, DO; Julio Rodriguez-Lopez, MD; Venkatesh Ramaiah, MD; and James Williams, BA
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

Department of Cardiovascular Disease, Città di Lecce Hospital, GVM Research and Care, Strada Provinciale per Arnesano, Lecce, Department of Surgery and Bioengineering, Unit of Cardiac Surgery, University of Siena, Siena, Italy

Background. We assess midterm results of a hybrid approach to DeBakey type I aortic dissection using a new multibranched Dacron graft to create, by relocation of the inflow openings to the arch vessels toward the aortic root, a new aortic arch for an easier and safer second-staged endovascular stent grafting of the distal thoracic aorta.

Methods. From March 2006 to July 2008 24 patients with DeBakey type I aortic dissection underwent ascending aorta and aortic arch replacement with debranching of epiaortic vessels using a new prosthesis to create an optimal landing zone for possible subsequent endovascular stent grafting of the distal thoracic aorta. Fifteen patients, who postoperatively presented a residual patent distal false lumen, underwent a successful second-stage endovascular stent-graft implantation.

Results. One patient died after the surgical stage while there was no death after the endovascular stage with hospital mortality of 4.2%. Follow-up confirmed complete thrombosis of the residual distal false lumen in 95.6% and partial thrombosis in 4.4% of patients with no evidence of endoleaks in the cases that required the endovascular procedure. Overall actuarial survival at 28 months is 92.1% ± 7.9% with 100% freedom from reoperation.

Conclusions. Hybrid treatment of DeBakey type I aortic dissection with aortic arch debranching, using a new multibranched prosthesis (Lupiae Graft; Vascutek Terumo Inc, Scotland, United Kingdom) is confirmed to facilitate the subsequent endovascular completion. Midterm results in terms of survival and distal false lumen thrombosis are satisfactory. Further study of this operation is warranted to confirm the effectiveness and the durability of this approach.

Siena Technique
Staged Operation

Circulatory Arrest Used for Distal Aortic Anastomosis
Hybrid Total Arch for Acute Dissection

- Evolving experience
- No right answer/dogma
- Multiple options
- Pros & Cons
Hybrid Total Arch for Acute Dissection

- Who should we be doing this “disease specific” operation for?
  - Intimal tear in aortic arch
  - Retrograde dissections
  - Arch re-entry tears
  - CT disorder?
  - Arch aneurysm
  - Younger age
Results of “Type II” Hybrid Arch Repair with Zone 0 Stent Graft Deployment

Jehangir Appoo, William Kent, Eric Herget, Jason Wong, Alberto Pochettino and Joseph Bavaria

Division of Cardiac Surgery, Libin Cardiovascular Institute of Alberta & Division of Diagnostic Imaging, University of Calgary
&
Hospital of the Univ. of Pennsylvania, Dept. of Cardiac Surgery, University of Pennsylvania
Evolution of Management Options for Diffuse Pathology of the Ascending, Arch and Descending Thoracic Aorta

I. Conventional open two-stage procedure
   I. Treatment mortality including first stage, second stage and interval mortality as high as 36% in contemporary series
      Etz, Griep et al. EJCTS 2008;34;605-615

II. Frozen stented elephant trunk concept (E-vita Registry)
   I. 15% operative mortality and 8% SCI
III. Type I Hybrid – Arch Debranching Procedure

I. 122 of 195 cases were Zone 0 TEVAR:
   – 10.5% incidence of proximal Type I endoleak, retrograde Type A dissection and graft migration
     Antoniou et al., Eur J Vasc Endovasc Surg 2010;39:683-690

IV. Type II Hybrid Arch Procedure

I. Novel approach which may have advantages for managing both acute and chronic diffuse thoracic aortic pathology
Milewski, Bavaria et al., JTCVS 2010;140:590-7
The “Type II” Hybrid Option

Advantages:

1. Single stage

2. “Bavaria graft” replaces diseased ascending aorta, provides robust fixation for stent graft and minimizes risk of endoleak and retrograde dissection
The “Type II” Hybrid Option

Advantages:

3. Avoidance of prolonged circulatory arrest

4. CPB is advantageous:
   • Cerebral protection
   • Perfusion during arch debranching
   • Resection of ascending aorta
Native Ao Arch

Branches to Left Carotid and Left Subclavian Arteries

Branch to Innominate Artery Under Innominate Vein

Native Ao Arch

Proximal Stent Graft Landing Zone in Replaced Ascending Aorta
### Procedure

- Replacement of Ascending +/- aortic valve and root repair
- Arch debranching
- Antegrade endovascular stent graft deployment

### Operative Details

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Intraoperative Temperature</td>
<td>25 - 30°C</td>
</tr>
<tr>
<td>Mean CPB time</td>
<td>259 min</td>
</tr>
<tr>
<td>Mean Cross-Clamp Time</td>
<td>100 min</td>
</tr>
<tr>
<td>*Circulatory Arrest (Simple open distal)</td>
<td>9/18 patients</td>
</tr>
<tr>
<td>Stent’s Deployed Antegrade (mean #)</td>
<td>1.9</td>
</tr>
<tr>
<td>Aortic valve repair +/- root work</td>
<td>4/18 patients</td>
</tr>
</tbody>
</table>
## Results: Perioperative

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Successful technical deployment</td>
<td>18 (100)</td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>1 (5.5)</td>
</tr>
<tr>
<td>Transient paraplegia</td>
<td>3 (16.7)</td>
</tr>
<tr>
<td>Renal Failure (Dialysis)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Reoperation for bleeding</td>
<td>4 (22.2)</td>
</tr>
<tr>
<td>Stroke</td>
<td>1 (5.5)</td>
</tr>
</tbody>
</table>
## Results: Late
Mean Follow-up: 24 months

<table>
<thead>
<tr>
<th></th>
<th>Pt. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late mortality</td>
<td>2 (11.1)</td>
</tr>
<tr>
<td>Stent fracture</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Stent migration</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Retrograde Type A Dissection</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Aneurysm growth</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Endoleak</td>
<td>2 (11.1)</td>
</tr>
</tbody>
</table>
Type II Hybrid Procedure:

Two year follow-up:
- Technically achievable repair
- Less invasive and potentially improved perioperative outcomes
- No incidence of rupture, aneurysm progression, or retrograde type A dissection at 2 year follow up. No delayed type 1 endoleak
- Attractive option for patients with diffuse thoracic aortic pathology
- Long-term results yet to be determined
**Etz, Grieppe et al. – Eur J. CT Surg 2008**

<table>
<thead>
<tr>
<th>Surgeon</th>
<th>Year</th>
<th>ET1 Mortality</th>
<th>ET2 Mortality</th>
<th>Interval Mortality</th>
<th>Rx Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Svensson</td>
<td>2004</td>
<td>2%</td>
<td>8.5%</td>
<td>14%</td>
<td>18%</td>
</tr>
<tr>
<td>Safi</td>
<td>2007</td>
<td>6.3%</td>
<td>9.6%</td>
<td>10%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Lemaire/Coselli</td>
<td>2006</td>
<td>12%</td>
<td>4%</td>
<td>25%</td>
<td>36%</td>
</tr>
<tr>
<td>Kouchoukos</td>
<td>2007</td>
<td>7.2%</td>
<td>--</td>
<td>--</td>
<td>7.2%</td>
</tr>
<tr>
<td>Grieppe</td>
<td>2008</td>
<td>6%</td>
<td>7%</td>
<td>12%</td>
<td>24.5%</td>
</tr>
</tbody>
</table>

**ET1 Mortality – 6-7% in high volume leading centres.**

**Interval mortality may be decreased with endo stage II but is still real**
Thus, best case scenario for open total arch in real world is likely a treatment mortality of at least 15%, possibly higher.

Significant mortality in an asymptomatic lesion in an elderly patient.

Morbidity of bleeding, stroke, prolonged ICU.

Role for decreasing “dimensions” of this operation.
Large data bases show us that mortality for all cardiac surgery increases with age.

AVR: 60 y.o → 80 y.o 3x increase in op risk

Total arch/Elephant Trunk 60 y.o → 80 y.o ?
Defn of Hybrid Arch:
Combination of sternotomy & endovascular surgery

Idea behind Hybrid Arch:
Decrease the scope of invasive surgery to improve upon morbidity and mortality
Many techniques
- On pump – off pump
- Circ arrest, no circ arrest
- Single stage vs. two stage
- Location of stent placement
- Antegrade vs. retrograde stent placement
- Cardiac surgery vs. vascular surgery vs. IR
Bavaria classification for Hybrid Arch
General Principles of our Type II Hybrid Arch Strategy

Sternotomy

On CPB with Mild-Mod Hypothermia

Replacement of Ascending aorta

Short Circ arrest or avoid circ arrest

Arch Debranching

Antegrade Deployment

Single Stage Repair

Diffuse Aortomegaly → Acute Type A Dissection
Advantages of Hybrid Strategy for diffuse aortic disease

Avoidance of prolonged circ arrest

Avoid effects of deep hypothermia

Avoid dissection around recurrently laryngeal

Challenging distal operation converted to proximal repair

Single stage repair
Total arch replacement: A 2% to 6% risk of death and a 2% to 7% risk of stroke have been reported for these extensive and high-risk procedures. Emergency operation mortality and stroke rates are higher (15% and 14%, respectively) (778). Careful brain and myocardial protection, correction of coagulopathies, and improved operative techniques, including the use of elephant trunk procedure, have led to improved outcomes (680,779).
Elements of a good talk

1. Audience-centric
   1. Material developed from a place of empathy towards audience
      1. I.e.: how difficult dissections are/ how worrisome/challenging middle of the night cases therefore we are hard wired not to do more surgery than necessary, but is this the optimal thing – from a physiologic and anatomic aspect

2. Role as mentor
   1. Giving audience a tool/gift that will help them in some way.
   2. If audience rejects your idea, the idea dies – thus speaker needs the audience more than audience needs the speaker
   3. Humility rather than arrogance
   4. I.e.: tool:
      1. consider the importance of the effaced true lumen to your patients. Which of their organs are perfused by this narrow channel? What is at risk?
      2. One simple way to help is to monitor perfusion during CPB and have low threshold to add an additional arterial cannula.
      3. Consider adding endovascular surgery to your armamentarium/to your group’s armamentarium – ask a colleague for help
1. Wrap content in a story
   1. “Story” of pt. Humber?
   2. Story of making your patient whole
2. Think about the point you are trying to make
   1. We are in a new paradigm in understanding and treatment of the disease.
   2. Midst of exciting revolution where we are trying newer operations newer techniques to improve patient outcomes
3. Capture resistence
4. Have a call to action