Hybrid Type II Debranching Arch for Acute Debakey Type 1 Dissection
-The Calgary Approach and Evolution

Jehangir J. Appoo
Lbin Cardiovascular Institute,
University of Calgary

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Worldwide multiple novel options for Aortic Dissection

Today:

Will discuss the Type II Hybrid Arch Approach

- Surgical ascending aortic replacement
- Debranching of arch vessels
- Zone 0 TEVAR

Share 4 indications where it can be useful

Discuss what we’ve learned from our experience and evolution of our technique
Principles Type II Hybrid Arch

1. Asc Ao replaced

1. Robust dacron proximal landing zone created

1. Arch vessels are transposed more proximally

1. TEVAR deployment antegrade or retrograde but traditional off pump approach

Bavaria JTCVS 2013
Where did this story begin for us?

Early 2009 moved towards a single stage repair for selected patients with diffuse aortomegaly.
Rational in 2009:

- Avoid prolonged deep hypothermic circ arrest associated with elephant trunk procedure
- Avoid interval mortality between first and second stage procedures
- Antegrade access in patients with ileo-femoral disease
- Decrease periop mortality compared with 2 stage elephant trunk procedure: 7.2% - 36% in high volume centres (Grieppe Eur. J CT Surg 2008)
Surgical Principles of our Type II Hybrid Arch Technique

On CPB

Axillary Cannulation

28-30 degrees Celsius

Cross Clamp
28 mm Tube Graft
Left Common Carotid and Left Subclavian Branches
Brachiocephalic Trunk Branch
Endovascular System Delivery Branch
28 mm Tube Graft
Surgical Principles of Calgary Type II Hybrid Arch Technique

Arch debranching after asc ao replacement

Left subclavian vs. axillary

Single stage antegrade delivery of endovascular prosthesis under fluouroscopy
Based on our experience with diffuse thoracic aortomegaly, Type II Hybrid Arch operation extended to select acute Debakey Type 1 Dissections
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

Ann Thorac Surg 2012
Ann Cardiothorac Surg 2013
Single stage total arch repair
Without circ arrest
Arch Debranching and Zone 0 TEVAR for acute Type A Dissection

Siena technique
Staged approach

Ann Thorac Surg 2012
Ann Cardiothorac 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 Type A
Early experience 20 patients, 2007-2012, Calgary and Penn

Mean age 67

Combination Acute & Chronic Cases

Mean Euroscore II 29.5 ± 19.4

5% hospital mortality
5% permanent stroke
20% transient paraplegia
Indication #1 – distal malperfusion
54 y.o male acute Type A transferred from OSH

Arch Tear
Left carotid dissection
Effaced TL in thoraco-abdominal segment

Clinically, unwell
On going abdominal pain
Oliguric
Weak femoral pulses
Clinical and Radiological suspicion of visceral malperfusion in young male

Is standard “hemiarch” surgery the right operation?

Will visceral malperfusion resolve?

Is Type II Hybrid Arch an optimal option?
- Ascending aorta replaced
- Arch debranched
- After coming off CPB, on table angiogram done to re-assess distal malperfusion
Single 37mm x 20cm endograft inserted from mid ascending aorta to descending aorta

Obliteration of false lumen in arch & prox descending aorta
Indication #2 – Primary Intimal Tear in Distal Arch

Estimate 15-20% type A dissections, primary intimal tear is in distal arc or prox descending aorta

Surgical principle is to resect primary intimal tear
68y.o male with Type A dissection and Distal Arch Tear

Tear btw L carotid and ScvA

4.5cm arch

Innom a. dissected

Asc Ao TL compressed
68y.o male with Type A dissection and Distal Arch Tear

Type II Hybrid Arch Repair

Ascending Aortic Replacement and Total arch reconstruction without circ arrest
Indication #3 – Distal Aneurysm
59 y.o. Male  
Acute Debakey Type I Dissection  
pre-existing 5cm descending thoracic aortic aneurysm
59 y.o. Male

acute Debakey Type I Dissection

pre-existing 5cm descending thoracic aortic aneurysm

Type II Hybrid Arch Repair
Indication #4: Young patient
39y.o acute Type A
BMI 60

Pulseless/Ischemic leg

Debranched but no stent graft

2 year f/u: slow growth of desc Ao
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)

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**Recommendations for treatment of aortic dissection**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
<th>Ref.</th>
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</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>
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<tr>
<td>In patients with Type A AD, urgent surgery is recommended.</td>
<td>I</td>
<td>B</td>
<td>1,2</td>
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<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>
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Validation for extended arch approach
Type II Hybrid Arch can be very useful technique in acute situation for dealing with complicated Debakey Type I Dissections. But, are there concerns we’ve appreciated during our evolution? What have we learned?
Durability/Stability of graft in Zone 0 is my biggest question about the Type II Hybrid Arch.

Is the Ascending Aorta too angulated for today’s stent graft technology?

Are we running too far ahead of the curve?
Nice straight proximal landing zone after Type II Hybrid in acute Debakey Type I dissection

Durability may be related to achieving ideal proximal landing zone anatomy
“Bird Beak” can be common

2 complications at prox landing zone requiring re-intervention
Stent graft migration
n = 1

Treated with additional proximal device
Graft Buckling

n=1

1 year follow up
Graft buckling
n=1

2 year follow up
Rescued with Palmaz Stent
Our ongoing evolution

Orthotopic Zone 0 endovascular stent landing is feasible but proximal landing zone needs ongoing observation.

While we wait for technology to improve, we have transitioned towards a “Zone 2” Approach.

Transect the arch between the left carotid and left subclavian.
Classic Type II Hybrid Arch  

Zone 2 Arch – next generation of Type II Hybrid Arch

Zone 2 Arch
HCA 12 to 15 mins
SACP 22 to 25 mins
Our Evolution of Type II Hybrid Arch

2009

Total arch, Elephant Trunk – 2 stage procedure for aortomegaly

2014

Hybrid Type II single stage repair for diffuse aortomegaly

2009-2013

No circ arrest

Improved debranching techniques

Refinement of neurocirc strategy

Hybrid Type II for acute dissection

2009-2013

2005-2008

Young surgeon starting out

2009

Improved debranching techniques

2014

Zone 2 Type II Hybrid Arch
Conclusions/Lessons learned from our evolution for extended distal repair in acute dissection:

1. Extended arch reconstruction for acute Debakey Type I Dissections is helpful for some patients
   1. Malperfusion is a compelling indication for extended arch
Conclusions/Lessons learned from our evolution for extended distal repair in acute dissection:

2 Hybrid Type II Arch is an effective option to address ascending aorta, total arch and descending aorta simultaneously in a diffuse disease process.
Conclusions/Lessons learned from our evolution for extended distal repair in acute dissection:

3 Angles of Asc aorta and U shaped curvature of aorta from STJ to descending aorta poses some unanswered challenges for current technology.
Conclusions/Lessons learned from our evolution for extended distal repair in acute dissection:

4 While we wait for technology to innovate, we have transitioned to Zone 2 Arch solution to provide a robust and less challenging proximal Landing Zone.

My current approach to Type A Dissection in 2015:
Zone 2 Arch ± single stage TEVAR
Thank You

Surgical colleagues
IR colleagues
OR Team

Th Ao Research Team
  DI
  Biomed Engineering
  Pathology
  CV Anaesthesia
  Coordinators

jehangir.appoo@albertahealthservices.ca