ENDOVASCULAR MANAGEMENT OF AORTIC DISEASE

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VASCULAR SURGEON

OUTLINE

• Evolution of aortic endovascular technology
• Changes in management of Type B dissection
• Hybrid aortic repair
• The future: ascending aortic and arch stenting

TIMELINE

• 1987 – Volodos – first stent graft repair of aortic pathology (USSR)
• 1991 – Parodi and Palmaz for AAA
  – O’Laughlin for coarctation
• 1994 – Scott and Chuter – transitioned to bifurcated EVAR graft
  – Dake introduced stent for descending thoracic aortic aneurysm
• 1998 – Shimono and Dake – stent graft for acute aortic dissection
• 1999 – First commercially available EVAR stent
• 2005 – First commercially available TEVAR stent

GLOBAL TREND
BENEFITS OF ENDOVASCULAR REPAIR

- Reduced morbidity and mortality
- Reduced procedure time
- Reduced length of hospital stay
- Avoidance of ICU post op
- Potential for local or regional anaesthetic
- Percutaneous access

TREATMENT OF TYPE B DISSECTION

CURRENT MANAGEMENT

Type A
- Open surgery to repair ascending aorta/arch

Type B
- Complicated (30%) → TEVAR
- Uncomplicated (70%) → Medical therapy.....

BUT....

- Persistent flow into the false lumen + weakening of the outer wall frequently results in extension of the dissection and/or aneurysmal dilatation
- DeBakey demonstrated this as early as 1982 where 40% of patients developed aneurysmal degeneration
- Replicated in multiple contemporary studies demonstrating 30% cumulative mortality at 5 years + intervention-free survival at 6 years of only 41%

LITERATURE
WHO TO TREAT

- Risk stratification studies have found a number of factors which correlate to aortic growth including:
  - Primary entry tear diameter >10mm
  - Primary entry tear location
  - Total aortic diameter >4cm
  - False lumen diameter >22mm
  - Partial false lumen thrombosis
  - Fusiform index >0.64
SURGERY AND ENDOVASCULAR COLLABORATION

HYBRID REPAIR
HYBRID REPAIR

• Allows ample landing zone for stenting of distal dissection
• Mitigates risk of retrograde aortic dissection
• Currently completion stent grafting performed in patients with:
  - Ongoing or recurrent branch ischaemia with mal-perfusion
  - Radiological true lumen collapse
  - Rapid dilatation of false lumen
  - Concave true lumen

• 70 year old female
• Progressive dilatation of thoracic aortic aneurysm
• Dilated ascending aorta
• AR
• Previous coronary stents
• Underwent arch replacement with reimplant IA and left CCA, CABG and AVR
• Left carotid-subclavian bypass
WHY SHOULD WE EXPLORE?

- Total arch repair (n=2880)
  - Operative mortality 5.3%
  - Stroke 5.2%
- Hybrid repair (n=195)
  - Stroke 7%
  - Spinal cord ischaemia 0.5%
- Hybrid repair vs total arch reconstruction (n=27 vs 45)
  - Stroke 4% vs 9%
  - Periop mortality 11% vs 16%
  - >75 years 36% mortality vs 5% for <75 years

Settepani et al, J Vasc Surg 2016;63:537-545
Milewski et al, J Thorac Cardiovasc Surg 2010;140:590-7

CHALLENGES OF ASCENDING AORTA

- Location of the coronary arteries and aortic valve
- Shear stress and haemodynamics of the left ventricular outflow tract forces
- Curvature of the ascending aorta
- Position and proximity of the arch vessels
- Ascending-descending aortic size discrepancy

ZONES OF THE AORTIC ARCH

- From 1995-2017, 13 different stent grafts used in 118 patients
- Device:
  - 71.2% thoracic stents
  - 11% abdominal cuffs
  - 10.2% custom made

Indication
- Type A dissection 50%
- Pseudoaneurysm 29.7%
- Aortic aneurysm 5.1%
- PAU 4.2%
- Aortic rupture 2.5%
- Access
  - Femoral 63.7%
  - Transapical 14.4%
  - Cervical 12.7%
  - Axillary 6.8%
- Endoleak 18.6% (9.3% reintervention)
- All cause mortality 15.2%
- Conversion to open 3.4%
- Stroke 3.4%

Conclusions: Despite the absence of a dedicated aortic stent graft for the ascending aorta, patients with a range of ascending aortic diseases are being successfully treated by endovascular technologies. For optimal outcomes, patient selection is critical to align aortic anatomy with the limited device sizing options, and it should be reserved for patients at high surgical risk. (J Vasc Surg 2018;67:332-42)
## ANATOMICAL CRITERIA

### Landing zones
- length >15mm
diameter >16mm and <42mm
- <10% difference between proximal and distal landing zone
- absence of calcification or thrombotic material
- intimal tear >10mm above the sinotubular junction
- intimal tear >5mm proximal to IA
- no aortic regurgitation
- diameter common/external iliac >7mm
- absence of extreme tortuosity

### In aortic dissection
- intimal tear >10mm above the sinotubular junction
- intimal tear >5mm proximal to IA
- no aortic regurgitation

### Access vessels
- diameter common/external iliac >7mm
- absence of extreme tortuosity

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## HOW DO WE ACHIEVE ARCH BRANCH PRESERVATION?

### TAG THORACIC BRANCH ENDOGRAFT

![Diagram of TAG THORACIC BRANCH ENDOGRAFT]

### PRELIMINARY RESULTS FEASIBILITY STUDY

- N=22, mean age 74.1
  - Fusiform (10)
  - Saccular (12)
  - Zone 2
- Left SCA patency 100%
- Type I endoleaks
  - Intraop 18%
  - 1 month 0%
- Survival: 94.7% @ 6 months

### BRANCHED ARCH ENDOGRAFT - COOK

![Diagram of BRANCHED ARCH ENDOGRAFT]

### How do we achieve arch branch preservation?

<table>
<thead>
<tr>
<th>Group</th>
<th>Procedure</th>
<th>Length [mm]</th>
<th>Intraop time [min]</th>
<th>Overall volume of contrast [mL]</th>
<th>Early postoperative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>Endoleaks</td>
<td>40 (30-50)</td>
<td>4 (3-4.9)</td>
<td>6 (3.8-9)</td>
<td>1 (0-2)</td>
</tr>
<tr>
<td>Group 2</td>
<td>Endoleaks</td>
<td>30 (20-40)</td>
<td>3 (2-4)</td>
<td>5 (3-8)</td>
<td>0</td>
</tr>
</tbody>
</table>

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LOCAL EXPERIENCE

- 74 year old male
- HT, COPD, colon resection
- Presented with chest pain & fever
- Positive staph aureus blood culture

SUMMARY

- Endovascular treatment of the thoracic aorta has evolved significantly
- More aggressive management of "uncomplicated" Type B dissection is appropriate for high risk features
- Collaboration between cardiothoracic and vascular surgery is needed to ensure that initial open repair of Type A dissection provides optimal landing zone for future endovascular stent grafts
- With advances in stent design and future large clinical trials endovascular repair of the arch and ascending aorta will play a significant role in the treatment of high risk patients