Inching toward an endovascular solution for proximal dissection – Will an Endo-Bentall see the light of day?

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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 immediately sent to the Tower of London.

...pericardium extended with coagulated blood and a transverse fissure on the inner side of the ascending aorta 3.75 cm...
All Type B Dissection

- Complicated
- Chronic
- Uncomplicated
Pioneering work led to custom-made Chuter endograft
Ready for broader applications? TEVAR and the near future

Expanding Indications

- Total-arch solutions
- Ascending aorta
- Dissection-specific devices
- Type A dissections
- More long-term data

Low profile branch technology

Technology on the horizon, but not successful and not approved
Selection

Previous sternotomy for type A
Not suitable for re-do surgery

Pharyngolaryngectomy
Neck dissection, radiotherapy, etc
Tracheostomy
Emerging Management of the ascending aorta
• Patients turned down for surgery for frailty or old age at MDT

• Special cases
  – Previous TEVAR
  – Previous type A dissection treated surgically
  – Previous TEVAR with large type 1A endoleak

Future case
Hybrid theatre: new options of complex endovascular approaches
Acute Type A Dissection: proximal TEVAR?

Implantation under rapid RV pacing
Delivery of 36 mm x 6.4 cm TX2 Graft
Series of 12 patients unfit for open surgery

### Characteristics

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

#### Table: Patient Characteristics

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age &amp; Sex</th>
<th>Diagnosis</th>
<th>EuroScore II</th>
<th>SG</th>
<th>Procedure duration (min)</th>
<th>Follow-up (months)</th>
<th>Complications</th>
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<tbody>
<tr>
<td>1</td>
<td>74M</td>
<td>cTAAD</td>
<td>6.9</td>
<td>Cook</td>
<td>90</td>
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<td>8.1</td>
<td>Bolton NBS</td>
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<td>149</td>
<td>15, †</td>
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<td>90M</td>
<td>cTAAD</td>
<td>19.3</td>
<td>Cook</td>
<td>70</td>
<td>0, †</td>
<td>Ventricular rupture, tamponade</td>
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<td>aTAAD</td>
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<td>61</td>
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<td>7</td>
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<td>87F</td>
<td>aTAAD post TAVR</td>
<td>7</td>
<td>Optimed</td>
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<tr>
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<td>Cook</td>
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<tr>
<td>12</td>
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<td>8.9</td>
<td>Gore + Viabahn in innominate artery</td>
<td>60</td>
<td>0</td>
<td>none</td>
</tr>
</tbody>
</table>
Nice initial result after TEVAR in ascending aorta

From top to bottom: 2-dimensional transversal and coronal display of ascending (type A) aortic dissection before (left) and after stentgrafting (right) showing reconstruction and remodelling of the aorta. The lower panel demonstrates the successful intervention as a 3-dimensional reconstruction.
Evolution after successful proximal stent-grafting

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).

Pre-TEVAR  At discharge  16 months F/U

Yuan X et al. Cath Cardiovasc Int 2018
(A) Final angiography showing no aortic regurgitation or endoleak with patency of the coronary arteries and bridging stents perfusing the supra-aortic trunks. Results were confirmed on the postoperative 3-dimensional reconstruction (B) and maintained on the 7-month follow-up scan (C).

Hertault et al JEV 2018
Can this be replaced by an Endovascular Procedure?

Bentall Procedure
Open Heart Surgery
Final Challenge:
Is There a Potential for an Endovascular Bentall Procedure?

Covered stents (Jostent) for Coroneries
Anatomic Feasibility of an Endovascular Valve-Carrying Conduit for the Treatment of Type A Aortic Dissection

167 patients  
3 landing zones  
113 patients (68%)

- With high quality CT scans were screened for anatomic feasibility
- ① distal sealing zone  
- ② proximal sealing zone  
- ③ transcatheter valve
- Are potential candidates, but most would require tapered stent-grafts

Kreibich M et al., JTCVS 2018
The future is approaching...but not close yet!

Slide by Ted Diethrich 2006
Is an Endo-Bentall a Feasible Option soon?

Answer:
Almost Certainly, but not today & not tomorrow!
Conclusion and Outlook

- Endovascular management of proximal (type A, DeBakey II) dissection is feasible in selected cases, but requires improved technology (better conformability, fenestrated/branched grafts and individualized solutions).

- The use of coils and closure devices to manage the false lumen is a new efficient (minimalistic FLIRT) strategy likely to avoid some problems of stenting and open surgery in selected cases.

- The ultimate goal of a total endovascular solution for ascending aortic pathologies (endo-Bentall) is still way ahead of us.
Brompton Aortic Centre 2018

Prof J Pepper
/cardiac surgeon

Ulrich Rosendahl
/cardiac surgeon

Jullien Gaer
/cardiac surgeon

Prof C Nienaber
/cardiologist

Maz Mireskandari
/vascular surgeon

Nick Cheshire
/cardiac surgeon

Mike Rubens
/Imaging
The inner branch concept
The end product
TEVAR In Acute Type A Dissection in 2006

Implantation under rapid RV pacing
Endovascular approach to proximal (ascending) aortic dissection

The concept of remodeling works!

Type A aortic dissection in 2012
77 yrs old lady
Euroscore 21
Refused open surgery for type A dissection
Endovascular Repair of Ascending Aortic Dissection

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

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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 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)

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Emerging Therapy for the ascending Aorta

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.
Same Problem – this time another strategy?

CASE M.P

Inoperable
Euroscore II 21%
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 under review 2017
Interventional false lumen management in proximal aortic dissection

Successful exclusion of false lumen in type A dissection;

No contrast communication to the false lumen;

Patient discharged on 3 days post intervention.

Remodelling at 6 months

Yuan X et al JEVT 2017
(A) The ascending arch endograft was deployed as planned. During advancement of the branched endograft delivery system, (B, C) the ascending endograft was pushed toward the valve. (D) Aortography showed patent coronary arteries but severe aortic regurgitation. (E) Transesophageal echocardiography showed the left main trunk cusp pinned to the aortic wall by the endograft (white arrow). Black arrow shows a free cusp. (F, G) The aortic annulus was evaluated on the preoperative images to select the appropriate valve size. (H) Views perpendicular to the annulus plane were automatically defined by the software and sent to the C-arm to assist accurate valve deployment. (I) The balloon-expandable Sapien S3 prosthesis was positioned through the aortic valve. (J) Deployment was performed under rapid pacing. (K) The sheath and wire were then retrieved.