Endovascular Ascending Repair: Is This the Next Frontier?

The 11th Houston Aortic Symposium
Session II: Ascending Aorta/Aortic Dissection (Proximal)
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Within the past 12 months, the presenter or their spouse/partner have had a financial interest/arrangement or affiliation with the organization listed below.

- **Research/Research Grants, Clinical Trial Support**
  - W. L. Gore
  - Cook Medical
  - Bard
  - Novate

- **Consulting Fees/Honoraria**
  - W. L. Gore
  - Cook Medical

- **Equity Interests/Stock Options**
  - Endoluminal Sciences
  - Graftwork
  - Intact

- **Officer, Director, Board Member or other Fiduciary Role**
  - VIVA Physicians Group

- **Speaker’s Bureau**
  - None
Many ways to consider a response
Many ways to consider a response
…but I only have 8 minutes
Chaos

Zone Of Complexity

Control

Agreement

Certainty
Successful treatment of a Stanford type A dissection by percutaneous placement of a covered stent graft in the ascending aorta

Kai Ihnken, MD, Daniel Sze, MD, PhD, Michael D. Deke, MD, Dominik Fleischmann, MD, Pieter Van Der Starre, MD, PhD, and Robert Robbins, MD, Stanford, Calif


The criterion standard treatment for acute Stanford type A aortic dissection is emergency surgical intervention. Stent-graft placement has emerged as an alternative treatment for various descending aortic pathologic conditions, including complicated type B dissections, aortic rupture, giant penetrating ulcers, aneurysms, and stent-graft coverage of the primary intimal tear.1,2 A combined surgical and endovascular approach for acute ascending aortic dissection has been reported.3 We report on percutaneous stent-graft placement in the ascending aorta as a primary and sole treatment for acute Stanford type A dissection.

Clinical Summary

An 89-year-old woman was admitted for acute onset of severe chest and back pain. A spiral computed tomographic (CT) angiogram demonstrated severe atherosclerotic degeneration, extensive intimal ulceration from the aortic root to the level of the celiac axis, and a primary intimal tear in the distal ascending aorta. Extensive blood in the mediastinum and pericardium suggested a contained rupture (Figure 1).
ASCENDING AORTIC ENDOGRAFTS

Initial Examples (n=41)

- Type A IMH/Dissection: 10 (3 <14days)
- Trauma: 4
- Fistula to PA (iatrogenic): 1
- Mycotic Aneurysm: 10; fungal: 4 (transplant: single lung - 1, heart/lung - 2, and double lung - 1)
- Anastomotic Pseudoaneurysm: 16 (heart transplant: 3 )
CHALLENGES POSED BY THE ASCENDING AORTA

Anatomy

- Stent parking place (shorter)
- Curved geometry
- Non-cylindrical shapes
- Large diameter
- Neck mismatch frequent (taper, reverse taper)
- Branches (coronaries, innominate, bypass grafts)
CHALLENGES POSED BY THE ASCENDING AORTA

Physiology

- Increased flow
- Enhanced compliance--dynamic aortic deformation
- Proximal aortic movement
- Cardiac dynamics
- Respiratory motion
86-year-old woman with acute type A dissection
Acute Type A Dissection

CTA post stent-graft
Follow-up at 6 weeks
Now, @ 90-years-old, woman who underwent stent-graft placement in ascending aorta three years ago to manage type A dissection.
Axial scans @ 3 years

Peri-graft opacification at root
3-year CT follow-up
CT @ 3 years s/p endograft
Proximal “bird beak”
The left coronary’s friend
Proximal “bird beak”

Incomplete Endograft Apposition to the Aortic Arch: Bird-Beak Configuration Increases Risk of Endoleak Formation after Thoracic Endovascular Aortic Repair

Purpose: To determine the clinical importance of the bird-beak configuration after thoracic endovascular aortic repair (TEVAR).

Materials and Methods: The institutional review board approved this retrospective study and waived the requirement to obtain informed consent from patients. Sixty-four patients (40 men, 24 women; mean age, 64 years) who underwent TEVAR...
Distal “bird beak”
67-year-old woman, who is a devoted Jehovah’s Witness, with a history of hypertension presents to outside facility with acute onset of chest pain. CT scan diagnostic for focal type A aortic dissection with extensive IMH.

Upon transfer to Stanford, she has an episode of confusion, expressive aphasia and right facial droop when blood pressure pharmacologically lowered to SBP <110mmHg. Neurologic exam improves to baseline with SBP >120. CT/CTA/CTP shows short segment severe stenosis in a superior division left M2 branch associated with perfusion delay, but no stroke core. Neuro IR study and catheter-directed tPA, but no PTA or stent.
48 hours post-procedure, Hgb 4.5. Upper GI endoscopy performed 2 days later. Exam significant for duodenal ulcer with active bleeding – 5 clips placed. Patient becomes progressively somnolent and hypotensive – expires 18 hours later.
89-year-old man in relatively good health; lives independently, s/p bio-prosthetic aortic valve in 2012. At that time, surgeon described small focal dissection at cannula site that was "tacked down" during operation. Now with follow-up CT 4 years later.
Small lung nodule noted and follow-up CT scan performed 10 months later. He is asymptomatic.
CT follow-up 8 months later.
He remains asymptomatic.
Referred for possible endovascular management. Repeat CT scan 8 weeks later prior to consultation
CT scan 1 month after stent-graft placement
2 months later
### Aortic Major Diameters Comparison

**Krieger, Arthur A**

**Report Generated at:** 2/12/2018 8:21:21 AM

#### Graph

- **X-axis:** Dates (01/05/2018-CT, 10/19/2017-CT, 10/09/2017-CT, 08/21/2017-CT, 06/15/2017-CT, 05/24/2017-CT, 07/28/2016-CT)
- **Y-axis:** Major Diameter (in mm)

#### Table

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#### Notes
- **STJ To MAA:** 25% 50% 75%
- **MAA To Parc:** 25% 50% 75%
- **Parc To Darc:** 25% 50% 75%
- **Darc To Pdes:** 25% 50% 75%
- **Pdes To Ddes:** 25% 50% 75%
- **Ddes To Celiac:** 25% 50% 75%
- **Celiac To Renal:** 25% 50% 75%
- **Renal To Bif:** 25% 50% 75%
ASCENDING AORTIC ENDOGRAFTS

Consideration of Ideal Device Attributes

• **Graft prosthesis**
  – Extremely conformable (especially proximally)
  – Variety of lengths, diameters, tapers, reverse tapers, etc.
  – Potential for pre-curved or pre-shaped devices
  – Migration resistant
  – Capacity for branch fenestrations (proximal, distal, both) and/or branch opportunities (distally for arch branches)

• **Delivery system**
  – Short, well-transitioned tip
  – Very flexible shaft with centering capability pre-deployment
  – Short and long catheter lengths (trans-apical, arch or femoral introduction)
  – Final release after partial graft expansion
  – Graft re-constraining/re-positioning capability
My idiosyncratic view of what is missing from current devices and underappreciated as an important consideration to better address both the potent physiological and anatomical challenges we face in the ascending aorta...
My idiosyncratic view of what is missing from current devices and underappreciated as an important consideration to better address both the potent physiological and anatomical challenges we face in the ascending aorta...

Enhanced Conformability
Enhanced Conformability

(think, truck bed liner)
Enhanced Conformability

(think, truck bed liner)

and...
Enhanced Conformability

(think, truck bed liner)
and...

true orthogonal deployment at the STJ
Ascending Device

Type A Dissection
Low profile 16-20 Fr
Controlled deployment
Cover entry tear
Promote false lumen thrombosis
Promote aortic remodeling

Picture courtesy of Matt Thompson - London
Curing Aortic Dissection: Where to Next?
Gore Type A Dissection Early Feasibility Study

- The Gore 14-02 Type A EFS is the first industry sponsored FDA approved trial for endovascular repair in the ascending aorta.
- Focused goal of this EFS is to assess the feasibility of endovascular repair of Type A dissections.
  - Early clinical learnings will inform the evolution of the clinical treatment and design of devices for ascending dissections.
Gore Type A EFS Overview

- **Study Population:** DeBakey Type I/II Dissection
  - Approved for up to 10 patients
  - 3 sites enrolling
- **Primary treatment using the TBE Aortic Extenders to stabilize the length of the dissected ascending aorta**

<table>
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<tr>
<th>Site</th>
<th>Principal Investigator</th>
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<tbody>
<tr>
<td>Houston Methodist Hospital</td>
<td>Jean Bismuth, MD</td>
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<tr>
<td>Memorial Hermann Heart &amp; Vascular Institute</td>
<td>Anthony Estrera, MD</td>
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<tr>
<td>St. Luke’s Health Baylor</td>
<td>Joseph Coselli, MD</td>
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</tbody>
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National Principal Investigator:
Michael Reardon, MD
Houston Methodist
Evaluation of the GORE® TAG® Thoracic Branch Endoprosthesis in the Treatment of DeBakey Type I/II Aortic Dissection

- The complete GORE® TAG® TBE system is available for further distal repair of the Type A dissection as needed

Gore Investigational Device
Complete endovascular treatment of acute proximal ascending aortic dissection and combined aortic valve pathology

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Department of Cardiothoracic Surgery, University Heart Center Dresden, Dresden, Germany
Received: November 5, 2014; Received in revised form: December 24, 2014; Accepted: January 1, 2015; Published Online: January 07, 2015

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First-in-man Experience with a Novel Approach for Complete Endovascular Treatment of Acute Aortic Dissection Type A and Combined Aortic Valve Pathology

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Complete endovascular treatment of acute proximal ascending aortic dissection and combined aortic valve pathology

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Conclusion

• Our appreciation of the variety and complexity posed by thoracic aortic pathologies has outpaced our technical sophistication and ability to develop endovascular solutions.

• This is especially true in the ascending aorta and aortic arch where unique anatomical and physiological factors present special challenges.

• Now, we are poised to tackle the next frontier with purpose built endovascular grafts designed to address these challenges.
Thank you