How to Identify Healthy Aorta to Land the Ends of Aortic Grafts with Complex AAA: Is it Always Necessary To Do So?

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November 18, 2015
VEITH 2015
New York, NY

Disclosures
• Bolton Medical – Consultant
• Cook Medical - Consultant

What is Healthy Aorta?
• Is any aorta in a patient with an aneurysm healthy?
• Probably not
• Given this, is the real question...

What is Healthy Enough?

Healthy Enough
= PROVIDES A LONG-TERM DURABLE REPAIR
How do we determine that?

Assess Through Information We Can Measure
• Predominantly CT-based
  – Diameter
  – Length
  – Associated Pathology
• Finite Parameters

What we cannot determine!
Histologic Architecture – "Pre-Disease" State
Apply CT-based Measurements to IFU’s…

- Expanding IFU’s
  - >7 mm neck length
  - 18-32 mm diameter
  - Neck angle <45-60 degrees
  - Iliacs >6 mm and < 20

... and apply Judgement

WHAT IS THE KEY TO DETERMINING DURABILITY?

Was our JUDGEMENT correct?

AAA with Healthy Necks Dilate

OR (N=46)  EVAR (N=103)
- Mean FU = 36 mos  - Mean FU = 39 mos

~20% incidence of neck dilation after Open and EVAR
10-30% require reintervention

increase greater than 2 mm  increase greater than 2 mm
- 11% of these required re-intervention  - 31% of these required re-intervention

Hostile Necks Continue to Dilate

- N = 31 patients
- Median neck diameter = 28 (24-30) mm
- All patients had 1 Palmaz stent placement
- 6 Aortic Cuffs
- 100% resolution of Type I endoleak
- Median follow-up = 53 (14-90) months

Normal Aortas Dilate with Time

Female
Male

Age (years)

Aortic Diameter (cm)
Slow progressive dilation

March, 2003  
December, 2007

Not just in the neck!

30% 34% 83%

Suprarenal  Infrarenal

15mm below lowest renal artery

>10% Increase

F/B EVAR: 2.8% Type 1 Endoleak

Higher Rates:
- Most type 1 leaks occurred late
- Most occurred from patients early in our experience
- Landing zone
  - Shorter
  - Involved fewer visceral vessels
- Lead to more aggressive aortic coverage

CAN WE PREDICT LONG-TERM FAILURE?

Late Failure Analysis

3 IDE Studies  
N = 1097

Application of Study Inclusion Criteria  
N = 213

OSR Information Available

Staged Procedures (52)  
Distant Aneurysms (44)  
Technical failure (9)  
Early Failure (1)

Yes  
N = 107

No  
N = 106

Yes  
N = 104 (9.5%)

No  
N = 3
Demographic Factors Associated with Late Failure of Open Repair

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>LF (%)</th>
<th>Primary EVAR (%)</th>
<th>P-Value</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>104 (9%)</td>
<td>993 (91%)</td>
<td>&lt;0.001</td>
<td>0.6 (0.5-0.7)</td>
</tr>
<tr>
<td>Age at First Repair (mean, SD)</td>
<td>61.4 (10.0)</td>
<td>74.1 (9.6)</td>
<td>&lt;0.001</td>
<td>0.6 (0.5-0.7)</td>
</tr>
<tr>
<td>Dissection</td>
<td>12 (12%)</td>
<td>35 (4%)</td>
<td>&lt;0.01</td>
<td>1.6 (0.6-3.9)</td>
</tr>
<tr>
<td>Family History</td>
<td>21 (20%)</td>
<td>67 (7%)</td>
<td>&lt;0.001</td>
<td>2.8 (1.5-5.1)</td>
</tr>
<tr>
<td>CRI</td>
<td>24 (23%)</td>
<td>93 (9%)</td>
<td>&lt;0.001</td>
<td>2.4 (1.4-4.3)</td>
</tr>
<tr>
<td>CAD</td>
<td>69 (66%)</td>
<td>539 (54%)</td>
<td>&lt;0.01</td>
<td>1.7 (1.0-2.8)</td>
</tr>
<tr>
<td>PAD</td>
<td>28 (27%)</td>
<td>147 (15%)</td>
<td>&lt;0.001</td>
<td>2.3 (1.4-3.9)</td>
</tr>
<tr>
<td>Male Gender</td>
<td>86 (83%)</td>
<td>755 (76%)</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>89 (86%)</td>
<td>824 (85%)</td>
<td>0.6</td>
<td></td>
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<tr>
<td>Hypertension</td>
<td>85 (82%)</td>
<td>775 (78%)</td>
<td>0.4</td>
<td></td>
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<tr>
<td>Emergent Initial Rep</td>
<td>9 (9%)</td>
<td>79 (8%)</td>
<td>0.8</td>
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</tbody>
</table>

Younger Patients
- Family History
- Dissection
- Atherosclerosis

Age

- Younger patients more vulnerable to LF
  - Life expectancy greater than durability of repair

- Older patients have LF occur earlier
  - More limited repairs sparing borderline aortic segments to decrease operative risk

Approaches in our Practice

- Patients at risk for LATE FAILURE
  - Younger patients
  - Family history of aneurysms

Due to the LF risk, an aortic repair should be optimized in the perspective of any further intervention

May be particularly pertinent after endografting (EVAR, TEVAR, FEVAR)

Shorter Time to Late Failure after Open Repair

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>%</th>
<th>Time to LF (mean, SD)</th>
<th>Univariable (P-Value)</th>
<th>Multivariable (P-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at OSR (Per 5 year increases)</td>
<td>100%</td>
<td>-</td>
<td>0.02</td>
<td>0.01</td>
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<tr>
<td>Etiology of Aortic Disease</td>
<td></td>
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</tr>
<tr>
<td>Dissection</td>
<td></td>
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<td></td>
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<tr>
<td>Other</td>
<td></td>
<td></td>
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<tr>
<td>Extension at initial OSR</td>
<td></td>
<td></td>
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<tr>
<td>Other aneurysms</td>
<td></td>
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<tr>
<td>Hyperlipidemia</td>
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</table>

Older Patients
- Extensive Aneurysms
- Other Aneurysms

DOES LONG-TERM (> 5 YRS) MATTER?

YES!!!!!
Aging Population

Couple Data With: Improved Survival over Time after AAA Repair

In Particular in the Older Population

THE RISK FOR FAILURE IS RISING
AND CURRENT THERAPY SHOULD BE DESIGNED TO PREPARE FOR THAT

NEEDS FOR THE FUTURE
Don’t Underestimate Disease Progression
Don’t Underestimate Patient Survival
Develop a Better Understanding of Aneurysm Pathobiology

DEVELOP ADJUNCTS TO ASSIST OUR CURRENT JUDGMENT
Molecular Imaging

- Refine risk prediction and stratification by incorporating biologic information into imaging

Osborn EA, JACC: Cardiovasc Imag 2009; 2: 97-113

Use of Biomarkers

- Use in conjunction with pre-operative and post-operative imaging
- Relies on better understanding of pathogenesis

Genomic Analysis

- Better estimate “At Risk” patients

Concomitant Pharmacologic Treatment

- Stabilize “At Risk” Segments of the aorta

Better Assess
Patient Survival Probability

Choose Repair Method And Extent that Best Balances Durability and Survival

Better Assess Aortic Failure Probability

BETTER JUDGEMENT

February 12 – 13, 2016
The Biltmore Hotel Coral Gables, Florida

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