Aneurysm Sac Failure to Regress After EVAR is Associated with Lower Long-Term Survival

Virendra I. Patel, MD MPH
Associate Professor of Surgery
Vascular Surgery and Endovascular Interventions
I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s)

I do not have any potential conflict of interest
Background

- EVAR now the dominant treatment modality
  - Early survival advantage
  - Wanes and then reverses over time

- May be due to:
  - Patient selection
  - Late complications
  - Re-interventions

Raithel. Device Evaluations 2011
Aneurysm Sac Behavior

- Endoleaks are most common reason for re-intervention
  - Most commonly Type II

- Expanding sacs mandate re-intervention

- Sac expansion linked to poor outcomes *(Deery et al. JVS 2017)*

- What about sacs that don’t regress, but don’t expand?
Study Design and Cohort

• Infrarenal EVAR in the VQI from 2003-2017

• Patients with measured diameter:
  ▫ Preoperatively
  ▫ One year postoperatively (± 6 months)

• Excluded:
  ▫ Patients without follow-up imaging
  ▫ Conversion to open
  ▫ Prior aortic surgery
Study Population

30,074 EVAR

9,559 (32%) without follow-up

20,515 Patients

5,698 (27%) no imaging

14,817 in final sample
Analysis

• Sac behavior:
  ▫ Regress
  ▫ Stable
  ▫ Expand

• Outcomes:
  ▫ Long-term survival
  ▫ New endoleaks

• Secondary Analysis:
  ▫ Propensity Matched
  ▫ 1:1 between sac regression and failure to regress

Failure To Regress
Analysis

• Sac behavior:
  ▫ 40% regressed
  ▫ 35% remained stable
  ▫ 25% expanded

• Results similar when limited only to centers with good (>50%) or excellent (>75%) follow-up rates
### Predictors of Sac Expansion

<table>
<thead>
<tr>
<th>Predictor</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (by decade)</td>
<td>1.07</td>
<td>[1.01 – 1.13]</td>
<td>.02</td>
</tr>
<tr>
<td>New endoleak</td>
<td>1.23</td>
<td>[1.10 – 1.37]</td>
<td>.001</td>
</tr>
<tr>
<td>Diameter &lt; 5cm</td>
<td>1.37</td>
<td>[1.21 – 1.55]</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Anemia (Hb &lt; 10)</td>
<td>1.47</td>
<td>[1.20 – 1.80]</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Rupture</td>
<td>1.33</td>
<td>[1.07 – 1.65]</td>
<td>.01</td>
</tr>
<tr>
<td>CKD</td>
<td>1.15</td>
<td>[1.05 – 1.25]</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>Former smoking</td>
<td>0.86</td>
<td>[0.76 – 0.96]</td>
<td>&lt; .01</td>
</tr>
<tr>
<td>CeVD</td>
<td>0.82</td>
<td>[0.67 – 0.99]</td>
<td>.04</td>
</tr>
<tr>
<td>Statin at discharge</td>
<td>0.83</td>
<td>[0.75 – 0.91]</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>
Long-Term Mortality

Stable sac size:
HR 1.20 [1.03 – 1.39]
P = .02

Sac expansion
HR 1.63 [1.28 – 2.07]
P < .001
Adjusted Hazard Ratios for Mortality, by Sac Change

Long-Term Mortality

ColumbiaDoctors
Aortic Center

NewYork-Presbyterian
Sensitivity Analyses

- Patients lost to follow
  - Lower survival similar to patients with sac regression

- Results robust if only centers with good or excellent follow-up rates considered

- Differential Re-Classification
  - Re-classify patients lost to follow-up as stable, regression, or expand
  - Results hold unless over 55% of patients lost to follow-up were reclassified as sac regression
Propensity-Matched Cohort

Sac Regression

Failure to Regress

\( P = .02, \text{ all SE } < 0.1 \)
What is wrong with a stable sac?

- Ongoing wall stress linked to elevated cardiovascular risk
- Unrecognized endoleaks
- May be a marker of fragility
  - Patient cannot mount the requisite response
  - Abnormal response to injury?
- May represent patients with marginal or unsuitable anatomy
Limitations

- Retrospective
- Limited by loss to follow-up
- No standard imaging modality or independent review
- Endoleaks and re-interventions self-reported
- Graft type blinded
- No anatomic detail other than diameter
Conclusion

- AAA sac behavior is associated with new endoleaks and long-term mortality

- Not only expansion, but any failure of the sac to regress, is associated with lower long-term survival
  - Independent of re-interventions or endoleaks
  - May be modified by statin therapy

- Further study is needed
  - On role of re-intervention for stable sac
Aneurysm Sac Failure to Regress After EVAR is Associated with Lower Long-Term Survival

Virendra I. Patel, MD MPH
Associate Professor of Surgery
Vascular Surgery and Endovascular Interventions