New Findings Regarding Re-Interventions for Failed TEVARs

Background: Challenges of analyzing TEVAR Outcomes in regard to re-interventions

- Heterogenous patient populations
- Expanding indications for diverse thoracic aortic pathologies: Degenerative DTA Vs RAU Vs TBAD Vs BTAI
- Elective Vs Emergency indications for both Acute Vs Chronic pathologies
- Changes in device iterations / technology over time
  - Lower profile → less peripheral vascular complications
  - Improved conformability → less Type I endoleaks

Pathology-specific secondary aortic interventions after thoracic endovascular aortic repair

- Acute - 15%
- Post-aportal - 10%
- TBAD - 5%
- BTAI - 5%
- DTAI - 5%
- RAU - 5%
- Other - 5%
- Transaortic transections - 5%
- Infrarenal aortic repairs - 5%
- Ascending aortic repairs - 5%

Aortic pathology/TEVAR indication influences re-interventions rates

SAI did not negatively affect long-term survival, aortic pathology did!

The SUMMIT registry includes aggregated data of 521 TEVAR patients from five prospective, multicenter trials evaluating thoracic endografts of the Zenith platform

- Acute and Chronic TBADs are associated with a higher risk for re-intervention compared to BTAI, DTAI, and RAU
- Case complexity predictive of re-interventions
  - Intraop contrast
  - Blood transfusion
Long-term results of endovascular repair for descending thoracic aortic aneurysms
David N. Ranney, MD, Morgan L. Cox, MD, Babatunde A. Yerokun, MD, Ehsan Benrashid, MD, Richard L. McCann, MD, G. Chad Hughes, MD
Journal of Vascular Surgery DOI: 10.1016/j.jvs.2017.06.094

- Single center series (192 patients) of TEVAR for DTAA (non-syndromic) with adherence to the IFU
- Mean follow-up of 69 ± 44 months
- Endovascular re-intervention in 14 patients (7.3%) for Types I, II, and III endoleak — all resolved.
- No open re-interventions required
- Late TEVAR durability (12 years) established for DTAA
- Outcomes not device related

Initial and midterm results of the Bolton Relay Thoracic Aortic Endovascular Pivotal Trial
Mark A. Farber, MD, W. Anthony Lee, MD, Wilson Y. Szeto, MD, Jean M. Panneton, MD, Christopher J. Kwolek, MD

- 5 year outcomes for DTAA
- Secondary procedures were performed in 10 patients (7.5%), with seven procedures to correct Ia endoleak and one surgical conversion

Results of the VALOR II trial of the Medtronic Valiant Thoracic Stent Graft
Mark F. Conrad, MD, MMSc, James Tuchek, MD, Robert Freezor, MD, Joseph Bavaria, MD, Rodney White, MD, Ronald Fairman, MD

- 5 year outcomes for DTAA
- Re-intervention rate 7% (11 patients) with 9 procedures for type I endoleak, 3 for aneurysm expansion, and 1 for rupture.
- Average time to re-intervention was 100 days; all but one were performed after at least one year follow-up.

Composite-Freedom (Secondary Procedures, Surgical Conversions, and Ruptures) VALOR I vs VALOR II

- Conclusions
  - Evolving commercial devices have the potential for reduced re-intervention rates for DTAA pathology:
    - Most dramatic improvements have occurred in first year
    - Endoleak (Type II) remains primary reason for re-intervention following TEVAR
    - Lower profile devices and improved conformability may explain reduced re-intervention rates following TEVAR for DTAA.
  - Current device technology continues to yield higher re-intervention rates for acute and non-acute TAA, BMI, and PAA, indicating the need for further evolution in pathology driven commercial technology.
**Reintervention Rate by Type of Index Procedure**

<table>
<thead>
<tr>
<th>Index pathologic indication for TEVAR</th>
<th>Reintervention rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All cases (n=680)</td>
<td>108 (16%)</td>
</tr>
<tr>
<td>Descending thoracic aneurysm</td>
<td>46 (6.8%)</td>
</tr>
<tr>
<td>Type A dissection</td>
<td>15 (2.5%)</td>
</tr>
<tr>
<td>Acute type B dissection</td>
<td>11 (1.6%)</td>
</tr>
<tr>
<td>Chronic type B dissection</td>
<td>4 (0.6%)</td>
</tr>
<tr>
<td>Aortic hybrid</td>
<td>2 (0.3%)</td>
</tr>
<tr>
<td>Traumatic transection</td>
<td>3 (0.5%)</td>
</tr>
<tr>
<td>Infection (mycotic, A-B-II format)</td>
<td>10 (1.5%)</td>
</tr>
<tr>
<td>PAU</td>
<td>2 (0.3%)</td>
</tr>
<tr>
<td>Other</td>
<td>18 (2.7%)</td>
</tr>
</tbody>
</table>

**Outcome By Open Vs Endo Reintervention**

<table>
<thead>
<tr>
<th>Complication</th>
<th>Total (n = 680)</th>
<th>Open (n = 38)</th>
<th>Endovascular (n = 60)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mal-dys 2</td>
<td>7 (10.7%)</td>
<td>3 (15.8%)</td>
<td>4 (6.7%)</td>
<td>.35</td>
</tr>
<tr>
<td>Re-operation</td>
<td>2 (3.5%)</td>
<td>0 (0%)</td>
<td>2 (3.3%)</td>
<td>1</td>
</tr>
<tr>
<td>Pulmonar</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>.63</td>
</tr>
<tr>
<td>Duodenal/pancreas</td>
<td>2 (3.3%)</td>
<td>0 (0%)</td>
<td>2 (3.3%)</td>
<td>1</td>
</tr>
<tr>
<td>Stroke</td>
<td>1 (1.5%)</td>
<td>0 (0%)</td>
<td>1 (1.7%)</td>
<td>.1</td>
</tr>
<tr>
<td>Renal failure</td>
<td>7 (10.7%)</td>
<td>3 (15.8%)</td>
<td>4 (6.7%)</td>
<td>.35</td>
</tr>
<tr>
<td>Renal failure requiring diuresis</td>
<td>4 (5.9%)</td>
<td>3 (15.8%)</td>
<td>1 (1.7%)</td>
<td>.05</td>
</tr>
</tbody>
</table>

**Reasons for Re-intervention (80/680)**

- Endoleak: 65 (16%)
- Type I: 24
- Type II: 5
- Type III: 9
- Multiple or unclear origin: 7
- Penumbral events: 11 (16%)
- Aortic type A dissection: 9
- Aneurysmal degeneration: 2
- Retrograde type A dissection: 2
- Dural aortic events (diastolic expansion): 15 (18%)
- Infection: 3 (4%)
- Other: carotid occlusion, stent collapse: 2 (3%)
Conclusions

- Re-intervention after TEVAR is not uncommon (11% in our series)
- Does not negatively impact on long-term survival.

- Although most secondary interventions will be endovascular, a variety of open techniques will be indicated for definitive repair:
  - Stent graft incorporation
  - Stent graft explant