Remediation of Type IA & IB Endoleaks
The Toolkit You Will Need

Warren Gasper MD
Assistant Professor of Surgery
UCSF Vascular Surgery

Type I Endoleak
Improper seal between the stent graft and the target vessel wall

- Type IA – proximal endograft-aorta seal
- Type IB – distal endograft-iliac artery seal

Continued arterial flow and pressure into a closed aneurysm sack with limited outflow

Systematic review of 8 case series reporting 190 late aneurysm ruptures after EVAR
0.9% incidence of late rupture after EVAR

"Type I endoleak was the leading cause and was identified as the responsible factor for rupture in half of the late ruptures (52%, 95% CI 45 to 59)"

Every type I endoleak needs a plan for how to treat it
The Type IA Toolkit

- More Ballooning
- Graft edge below the renal arteries?
  - Extend cephalad with a cuff
- Graft edge up to the renal arteries?
  - Balloon mounted Palmaz stent
  - Endoanchors
  - Coil / embolize the endoleak
- Still have a type IA endoleak?
  - Renal snorkel
  - Convert to fenestrated/branched
  - Convert to open

The Type IB Toolkit

- More Ballooning
- Graft above the iliac bifurcation?
  - Limb extension
- Graft limb at the bifurcation?
  - Balloon mounted Palmaz stent
  - Endoanchors
  - Coil / embolize the endoleak
- Still have a type IB endoleak?
  - Limb extension to external iliac ± hypogastric artery coiling
  - Convert to open
What happens to partially treated type I endoleaks?

Table II. Postoperative and 1-year outcomes

<table>
<thead>
<tr>
<th>Overall (N = 2482)</th>
<th>Type I (n = 80)</th>
<th>None (n = 2322)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postoperative outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>17 (1)</td>
<td>6 (5)</td>
<td>13 (1)</td>
</tr>
<tr>
<td>Mortal cardiac infection</td>
<td>47 (2)</td>
<td>2 (2)</td>
<td>45 (2)</td>
</tr>
<tr>
<td>Cardiac dysrhythmia</td>
<td>35 (2)</td>
<td>7 (9)</td>
<td>28 (2)</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>45 (2)</td>
<td>6 (8)</td>
<td>39 (2)</td>
</tr>
<tr>
<td>Change in renal function</td>
<td>90 (6)</td>
<td>3 (4)</td>
<td>87 (6)</td>
</tr>
<tr>
<td>Leg ischemia/infarct</td>
<td>31 (2)</td>
<td>2 (3)</td>
<td>29 (2)</td>
</tr>
<tr>
<td>Wound dehiscence</td>
<td>18 (1)</td>
<td>1 (1)</td>
<td>17 (1)</td>
</tr>
<tr>
<td>Return to operating room</td>
<td>30 (2)</td>
<td>1 (1)</td>
<td>29 (2)</td>
</tr>
<tr>
<td>One-year follow-up outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-Year mortality</td>
<td>187 (6)</td>
<td>7 (9)</td>
<td>180 (6)</td>
</tr>
<tr>
<td>Conversion to open repair</td>
<td>4 (1)</td>
<td>0 (0)</td>
<td>4 (1)</td>
</tr>
<tr>
<td>Current TIE</td>
<td>23 (2)</td>
<td>3 (4)</td>
<td>20 (2)</td>
</tr>
<tr>
<td>New interventions</td>
<td>76 (3)</td>
<td>7 (9)</td>
<td>69 (3)</td>
</tr>
<tr>
<td>Intervention for endoleak</td>
<td>43 (2)</td>
<td>0 (0)</td>
<td>43 (2)</td>
</tr>
</tbody>
</table>

TIE: Type I endoleak

1 month postop

How well do Palmaz stents work?

- Palmaz XL stent hand-crimped onto a large balloon and delivered across the proximal graft edge
- 3 centers reviewed their use of Palmaz stents during EVAR (n=2789)
  - 207 patients (7%) had Palmaz stents
  - 184/207 (89%) were successful
- The rate of recurrent type I endoleak, at the 2/3 centers that reported it, was 0.

What about endoanchors?
How well do endoanchors work?

**List of patients:**
- 319 patients in 43 centers (ANCHOR Registry)
- 242 patients with adjunct use during EVAR
- 77 patients undergoing a secondary intervention

**1 month postop**

**Type IA & IB Endoleak Remediation | UCSF Vascular Symposium 2016**

**Table IV.** Details of the index procedure and the initial hospitalization

<table>
<thead>
<tr>
<th>Measure</th>
<th>Primary arm indication</th>
<th>Revision arm indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>178</td>
<td>60</td>
</tr>
<tr>
<td>Age</td>
<td>62 ± 20</td>
<td>62 ± 23</td>
</tr>
<tr>
<td>Gender</td>
<td>58 ± 16</td>
<td>56 ± 18</td>
</tr>
<tr>
<td>Mean age (in months)</td>
<td>52 ± 7.5</td>
<td>50 ± 11</td>
</tr>
<tr>
<td>Technical access</td>
<td>20 ± 13</td>
<td>30 ± 14</td>
</tr>
<tr>
<td>Procedural success</td>
<td>172 (96.0%)</td>
<td>20 (80%)</td>
</tr>
<tr>
<td>Intercase time, min</td>
<td>87 (27)</td>
<td>86 (27)</td>
</tr>
</tbody>
</table>

**Table VII.** Imaging results (case laboratory reported, 202 follow-up imaging studies)

<table>
<thead>
<tr>
<th>Indication for Endoleak</th>
<th>Follow-up, mean ± SD (months)</th>
<th>Type IA endoleak, n (%)</th>
<th>Type IA endoleak migration, n (%)</th>
<th>Sec regression, n (%)</th>
<th>Sec migration, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Persistent</td>
<td>71 ± 2.5</td>
<td>9/19 (47)</td>
<td>0/12 (0)</td>
<td>13/39 (43)</td>
<td>7/12 (0)</td>
</tr>
<tr>
<td>Non Persistent</td>
<td>7.3 ± 5.7</td>
<td>9/19 (47)</td>
<td>0/12 (0)</td>
<td>13/39 (43)</td>
<td>7/12 (0)</td>
</tr>
<tr>
<td>Type IA endoleak</td>
<td>6.7 ± 5.6</td>
<td>9/19 (47)</td>
<td>0/12 (0)</td>
<td>13/39 (43)</td>
<td>7/12 (0)</td>
</tr>
<tr>
<td>Migration and endoleak</td>
<td>6.3 ± 4.3</td>
<td>9/19 (47)</td>
<td>0/12 (0)</td>
<td>13/39 (43)</td>
<td>7/12 (0)</td>
</tr>
<tr>
<td>All</td>
<td>7.1 ± 5.6</td>
<td>18/38 (47)</td>
<td>0/12 (0)</td>
<td>13/39 (43)</td>
<td>7/12 (0)</td>
</tr>
</tbody>
</table>

Secondary treatment:
- Persistent type IA endoleak
- 7 Endoanchors placed along the left side of the graft
- No type IA endoleak on completion angiography
Avoiding type I endoleaks

Preoperatively
- How “hostile” is the neck?
- How large are the iliacs?
- Does the aneurysm have juxtarenal / pararenal / suprarenal morphology?

Postoperative Surveillance
- Is the neck dilating?
- Are the iliac arteries dilating?

“Hostile” or “non-IFU” Neck
- Neck length <10 mm
- Neck angle >60 degrees
- >50% circumferential proximal neck thrombus (>2 mm thick)
- >50% calcified proximal neck
- Reverse taper
- Diameter >31 mm

Summary – the type IA toolkit

Type I endoleaks are associated with late rupture and must be addressed
- Type IA
  - Balloon and extend as close to the renal arteries as possible with a cuff
  - Consider a Palmaz stent or endoanchors to improve the seal
  - Coil or embolize the channel
  - Obtain a suprarenal seal with a snorkel, fenestrated or branched repair
  - Open surgery
    - Cinch the neck around the graft
    - Conversion to an open repair

Summary – what’s in my toolkit

- Type IB
  - Balloon and extend as close to the iliac bifurcation as possible with a limb
  - Consider a Palmaz stent or endoanchors to improve the seal
  - Coil or embolize the channel
  - Extend the limb to the external iliac ± coiling of the hypogastric artery
  - Convert to open

Good case planning will help anticipate and avoid these endoleaks

Conclusions

- Type I endoleaks are associated with late rupture and must be addressed
- Many type I endoleaks can be successfully treated with adjunct endovascular procedures
- Strict surveillance is necessary as the endoleaks can recur
- The increasing variety of treatment options may reduce the need to force a graft into a “non-IFU” anatomy where the risk of failure is high