Endoleaks after F-BEVAR

How to Assess & Treat?

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FACULTY DISCLOSURE

Gustavo S. Oderich MD

- Consulting, DSMB, CEC*
  
  *Cook Medical Inc., WL Gore, Lombardi

- Honoraria
  
  *WL Gore, Endologix

- Research grants*
  
  *Cook Medical Inc., WL Gore, Atrium Maquet

* All consulting fees and grants paid to Mayo Clinic
DISEASE PROGRESSION

Post-procedure

60 months

Above endograft

33.99 mm

39.60 mm

43.07 mm

At right renal artery origin

33.69 mm

39.29 mm

40.17 mm

Post-procedure

24 months

60 months
EVOLVING SELECTION OF LANDING ZONES
MORE VESSELS, LESS LEAKS

F-BEVAR FAILURE MODES

Days
- Kinks, compression
  - Edge kinks
  - Dilator injury
- Endoleaks

Months
- In-stent stenosis
  - Bare-metal
- Endoleaks
- Infection

Distal edge stenosis
- Covered
- Self-expandable

Years
- Compression, separation
- Migration
- Remodeling
- Endoleaks
- Infection

Days M Months Y
ENDOLEAK CLASSIFICATION

Ia: Proximal attachment
Ib: Distal attachment
Ic: Sidebranch attachment
II: Retrograde (Lumbars, IMA, ...)
IIIa: Attachment aortic-aortic or aortic-bifurcated component
IIIb: Attachment bifurcated-iliac limb or iliac limb-iliac limb component
IIIc: Attachment aortic side branch or side branch-side branch component
IIId: Graft tear, perforation, or fracture
IV: Graft porosity
V: Endotension
Prospective Non Randomized Trial to Evaluate F-BEVAR of Pararenal and TAAAs using Supra-Celiac Sealing Zones

Gustavo S. Oderich MD, Mauricio Ribeiro MD PhD, Jan Hofer RN, Jean Wigham RN, Leonardo Reis de Souza MD, Julia Chini, Stephen Cha MS, Thanila A. Macedo MD and Peter Gloviczki MD.

Division of Vascular and Endovascular Surgery and Departments of Radiology, Epidemiology and Biostatistics
TRIAL DESIGN

• Prospective, non-randomized study
• Cook manufactured F-BEVAR for pararenal and TAAAs
• Imaging follow up:
  – CBCT intra-operative
  – CTA Dismissal, 1 month, 6 month and yearly
  – Duplex US preop, 1 month, 6 month and yearly
  – Clinical examination and labs
• Independent imaging review (Vascular CTA lab)
• Independent DSMB adjudication of clinical events
ENDOLEAKS AFTER F-BEVAR

127 patients
46% had any endoleak

From the Society for Vascular Surgery

Prospective, nonrandomized study to evaluate endovascular repair of pararenal and thoracoabdominal aortic aneurysms using fenestrated-branched endografts based on suprarenal sealing zones

Custavo S. Oderich, MD, Mauricio Ribeiro MD, PhD, Jan Hofer, RN, Jean Wigham, RN, Stephen Cha, MS, Julia Chini, Thania A. Macedo, MD, and Peter Gloviczki, MD, Rochester, Minn; and Ribeirão Preto, Brazil

## F-BEVAR REINTERVENTIONS

<table>
<thead>
<tr>
<th>Reintervention</th>
<th>Total</th>
<th>&lt;30 days</th>
<th>&gt;30 days</th>
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<tbody>
<tr>
<td>Aortic</td>
<td>14 (11%)</td>
<td>5 (4%)</td>
<td>9 (7%)</td>
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<tr>
<td>Branch stenosis</td>
<td>4 (3%)</td>
<td>0</td>
<td>4 (3%)</td>
</tr>
<tr>
<td>Iliac limb stenosis</td>
<td>2 (2%)</td>
<td>2 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>Endoleak</td>
<td>7 (6%)</td>
<td>2 (2%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Type IA</td>
<td>2 (2%)</td>
<td>1 (1%)</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Type IC</td>
<td>1 (1%)</td>
<td>0</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Type III</td>
<td>6 (5%)</td>
<td>2 (2%)</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>Non-aortic</td>
<td>8 (6%)</td>
<td>6 (5%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Access related</td>
<td>4 (3%)</td>
<td>2 (2%)</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Laparotomy</td>
<td>4 (3%)</td>
<td>4 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>23 (18%)</td>
<td>11 (9%)</td>
<td>12 (9%)</td>
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</table>
TREATMENT CONSIDERATIONS

- Endoleak mechanism or type?
  - Antegrade or attachment related?
  - Retrograde?
  - Associated device integrity or structural issues

- Sac enlargement?

- Endovascular solution?
  - Is there a new achievable sealing zone?
  - What are complicating factors imposed by prior FEVAR?

- Open surgical solution?
  - Can the patient handle explantation?
  - Clamp site? Side branch reconstruction?
TYPE IA ENDOLEAKS…
TYPE IA ENDOLEAK

Proximal TEVAR attachment

Need for brachial access
TYPE IA ENDOLEAK
Proximal TEVAR attachment

Arch extension with C-TAG and anchors
TYPE IA ENDOLEAK

Progression of aortic disease

Reverse Frozen elephant trunk technique
TYPE IA ENDOLEAK

Device infolding
TYPE IC
ENDOLEAKS…
TYPE IC ENDOLEAK
SMA and L renal branch stents

SMA branch

L renal branch

Contrast outside SMA distal attachment site

Left renal stent barely into renal artery
SMA angiography confirmed filling of the excluded sac

Parallel “sandwich stents” into SMA and replaced RHA

LRA angiography confirms filling of the excluded sac
LRA sacrifice with Amplatz plug

SMA and Replaced RHA parallel stents
TYPE III ENDOLEAKS...
Interval repair with extension of fenestrated and branched endograft

Large type III endoleak between the outer most stent from prior repair and inner stent from extension fenestrated/branched repair
Spontaneous resolution on first follow up CTA...

Interval spontaneous resolution of Type III endoleak
TYPE IIIc ENDOLEAK

Bifurcated component separation

2011

9-cm

2013

11-cm
TYPE IIIc ENDOLEAK
SMA fenestrated-branch stent disconnection
TYPE III/II ENDOLEAK

Celiac fenestration and IMA

Large endoleak without definitive connection to the SMA or Celiac attachments.

Guide-wire celiac fenestration inside aneurysm sac confirmed type III endoleak.
TYPE IIIId ENDOLEAK

Fabric tear (probably from posterior diameter-reducing ties)
TYPE II ENDOLEAKS...
TYPE II ENDOLEAKS

- Patent IMA or Hypogastric collaterals
  - Trans-arterial

- Occluded IMA or Hypogastric collaterals
  - Trans-lumbar
TYPE II ENDOLEAKS

Needle assist

Bulls Eye View

Progression View
TYPE II ENDOLEAKS
Recalcitrant endoleak after multiple prior interventions
## TYPE II ENDOLEAKS

Recalcitrant endoleak after multiple prior interventions

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<tr>
<th>Date</th>
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<th>Finding</th>
<th>Intervention</th>
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<tbody>
<tr>
<td>Preop</td>
<td>62</td>
<td>-</td>
<td>FEVAR</td>
</tr>
<tr>
<td>Dismissal</td>
<td>62</td>
<td>Type II</td>
<td>-</td>
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<tr>
<td>1 month</td>
<td>66</td>
<td>Type II</td>
<td>-</td>
</tr>
<tr>
<td>12 month</td>
<td>72</td>
<td>Type II</td>
<td>Coiling/Onyx</td>
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<tr>
<td>18 month</td>
<td>79</td>
<td>Type II</td>
<td>Onyx</td>
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<tr>
<td>24 month</td>
<td>82</td>
<td>Type II?</td>
<td>Onyx</td>
</tr>
<tr>
<td>30 month</td>
<td>82</td>
<td>Type II?</td>
<td>-</td>
</tr>
<tr>
<td>48 month</td>
<td>95</td>
<td>Type II?</td>
<td>Stent realignment</td>
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<tr>
<td>60 month</td>
<td>100</td>
<td>Type II?</td>
<td>?</td>
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HIGH-DEFINITION CONE BEAM CT

* GE Discovery 740 (7 sec Spin)
CONCLUSION

• Most common endoleaks are type II and type III from fenestration attachments, which can be treated by embolization and stent reinforcement.

• Rates of type Ia endoleak are low when repairs are planned with supra-celiac sealing zones, but likely are more frequent with less extensive repairs.

• Options are limited once there is failure of proximal neck after FEVAR (e.g. explant, branch, CHIMPS), so it is better to prevent this complication!
### Visceral Branch Devices

#### Patient-Specific
- Cook Zenith®
- Fenestrated Anaconda™
- JOTEC™
- Endolgix Ventana®

#### Off-the-Shelf
- Cook p-Branch®
- Cook t-Branch®
- Gore TAMBE®

<table>
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<tr>
<th>FDA Approved</th>
<th>CE Mark</th>
<th>CE Mark</th>
<th>CE Mark</th>
<th>PIVOTAL TRIAL Terminated</th>
<th>PIVOTAL TRIAL</th>
<th>TRIAL DESIGN</th>
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<tbody>
<tr>
<td>Juxtarenal</td>
<td>Pararenal TAAA</td>
<td>Pararenal</td>
<td>TAAA</td>
<td>Juxtarenal</td>
<td>Pararenal</td>
<td>TAAA</td>
<td>Pararenal TAAA</td>
</tr>
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