Which ugly AAA necks can be treated by standard EVAR devices plus EndoAnchors and which cannot:

What are the failure modes of EndoAnchors and how to avoid them

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Heli-FX EndoAnchor System
• Provide fixation and seal in aortic necks
• Prevent/resolve migration or endoleaks

- aortic circumference
- fixation
- leak
- most of EndoAnchors
- into aortic wall


Objectives
1) Quantify EndoAnchor penetration into the aortic wall in patients underdoind EVAR
2) Assess predictors of successful penetration and association to postprocedural type Ia endoleak

Methods – ANCHOR database
• Inclusion criteria
  - Treat type Ia endoleak
  - First postprocedure contrast-enhanced CT scan
• Exclusion criteria
  - CT artifacts due to metal or glue
  - CT slice thickness >3 mm
  - Implantation of adjuvant aortic extension cuffs
• Patients from two cohorts (primary and revision)
  - Successful: no type Ia endoleak after EndoAnchors
  - Unsuccessful: persisting type Ia endoleak after EndoAnchors

Disclosures
Co-founder of Endovascular Diagnostics
Consultant for Medtronic, Bentley Innomed
Advisory board member: Medtronic
Research grants: Cardionovum, Stichting Lijf & Leven

EndoAnchor analysis
• Penetration and circumferential location
  - Penetration ≥2 mm or gap between endograft and aortic wall
  - Good penetration ≥2 mm
  - Borderline penetration <2 mm
EndoAnchor analysis

- Penetration and circumferential location

![Good penetration ≥2 mm](image)

- Borderline penetration
  - <2 mm or gap between endograft and aortic wall

EndoAnchor penetration

- 580 EndoAnchors

<table>
<thead>
<tr>
<th>Variable</th>
<th>Type Ia endoleak</th>
<th>No-endoleak</th>
<th>Trend</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EndoAnchors, N</td>
<td>247 (42.8%)</td>
<td>333 (57.2%)</td>
<td></td>
<td>.009</td>
</tr>
<tr>
<td>EndoAnchor penetration</td>
<td>36 (14.7%)</td>
<td>32 (9.6%)</td>
<td></td>
<td>.002</td>
</tr>
<tr>
<td>Distance from LRA, mm</td>
<td>9 (6-13)</td>
<td>1 (4-13)</td>
<td>.006</td>
<td></td>
</tr>
<tr>
<td>Pelvic diameter, mm²</td>
<td>5.9 (4.6-8.1)</td>
<td>7.3 (4.6-8.7)</td>
<td>.118</td>
<td></td>
</tr>
<tr>
<td>LBA, lowest renal artery</td>
<td>156 (263)</td>
<td>188 (283)</td>
<td>273</td>
<td></td>
</tr>
</tbody>
</table>

*Data is represented as number (%) and median (IQR).

*Seven EndoAnchors were deployed above the fabric; 4 in the persistent type Ia endoleak group and 3 in the no-endoleak group.

Results (anatomical criteria)

<table>
<thead>
<tr>
<th>Aortic diameter, mm below lowest renal artery</th>
<th>Endograft, mm</th>
<th>EndoAnchor penetration</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.1 (28.3-31.5)</td>
<td>26.1 (24.4-27.5)</td>
<td>26.7 (23.6-29.6)</td>
</tr>
<tr>
<td>Precipitous neck length, mm</td>
<td>9.6 (7.0-10.3)</td>
<td>15.1 (8.7-21.4)</td>
</tr>
<tr>
<td>Borderline neck length, mm</td>
<td>17.1 (13.6-20.9)</td>
<td>28.1 (17.8-30.0)</td>
</tr>
<tr>
<td>Maximum aortic diameter, mm</td>
<td>50.3 (47.8-53.0)</td>
<td>50.6 (47.8-53.0)</td>
</tr>
<tr>
<td>Neck thrombus average thickness, mm</td>
<td>0.8 (0.7-1.0)</td>
<td>0.7 (0.7-1.0)</td>
</tr>
<tr>
<td>Neck calcification average thickness, mm</td>
<td>0.8 (0.8-1.0)</td>
<td>0.8 (0.8-1.0)</td>
</tr>
<tr>
<td>Neck calcium hardness, mm</td>
<td>0.4 (0.4-0.4)</td>
<td>0.4 (0.4-0.4)</td>
</tr>
</tbody>
</table>

*Omnibus are similar for the group mean due to missing values. Data is represented as median (IQR).

Predictors successful EndoAnchor penetration

- Independent protective factors
  - Oversizing, %
  - Endurant stent

- Independent risk factors
  - Aortic diameter at lowest renal artery, 5 mm, 10 mm
  - Neck thrombus and calcium circumference and thickness

<table>
<thead>
<tr>
<th>Multivariate Logistic Regression</th>
<th>OR</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endurant stent</td>
<td>3.724</td>
<td>.001</td>
</tr>
<tr>
<td>Aortic diameter 10-mm below lowest renal artery, mm</td>
<td>0.894</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Neck calcium average thickness, mm</td>
<td>0.562</td>
<td>.004</td>
</tr>
</tbody>
</table>

Predictors of type Ia endoleak

- Independent protective factors
  - Proximal neck length
  - Good penetrating EndoAnchors

- Independent risk factors
  - Aortic diameter 5 mm below lowest renal artery
  - Borderline EndoAnchors
  - Non-penetrating EndoAnchors

<table>
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<tr>
<th>Multivariate Logistic Regression</th>
<th>OR</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No penetration</td>
<td>1.714</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Successful deployment

Endograft: Gore Excluder
Misdeployment and incorrect indication

Undersized endograft

Misdeployment (calcium and thrombus)

Endograft: Endurant 7 EndoAnchors

Conclusions

- Good EndoAnchor penetration less likely when
  - Larger aortic neck diameter (>30 mm)
  - EndoAnchor is not perpendicular vs stentgraft
  - Beyond recommended use
  - >2 mm thrombus or calcium
  - Not in infrarenal neck
  - Gap >2 mm

- Bordeling or no EndoAnchor penetration
  - Predictive of postprocedural type Ia endoleak
Conclusions

- Essentials for successful EndoAnchor deployment
  - Within recommended use
  - Pre-operative planning
  - C-arm position during implantation
  - EndoAnchors only in proximal 5 – 10 mm of endograft