Changes in stent graft apposition and neck morphology post EVAR, CHEVAR, and FEVAR. Are there any differences?

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Disclosures:

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Research grants: Cardionovum, BARD, Endologix, BTG
Background

• Current (CT, duplex, X-ray) post-EVAR FU is focused on complications (endoleaks, AAA growth)

• Slight changes in apposition, aortic neck morphology, and endograft dimensions are missed

• **FU imaging should prevent/predict complications and not only show complications**
A new method for precise determination of endograft position and apposition in the aortic neck after endovascular aortic aneurysm repair

THE JOURNAL OF CARDIOVASCULAR SURGERY

Kim VAN NOORT 1, 2 *, Richte C. L. SCHUURMANN 1, 2, Cornelis H. SLUMP 3, Jan A. VOS 4, Jean-Paul P. M. DE VRIES 4

Figure 1.—Determination of aortic neck surface (ANS, green surface) and endograft apposition surface (EAS, yellow). A) Pre-EVAR ANS (green surface) is the surface between lower margins of the renal arteries (blue dots) and the distal end of the neck (red line). B) Post-EVAR ANS (green surface) is the surface between the lower margins of the renal arteries (blue dots) and the distal apposition boundary (DAB) (red line). C) Post-EVAR EAS in the aortic neck (yellow surface) between the proximal end of the endograft fabric (yellow line) and DAB (red line).
Software

- Dedicated, validated proprietary software
- 3D coordinates from 3Mensio workstation
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ANS

EAS
### Changes in apposition during follow-up

<table>
<thead>
<tr>
<th>Pre-EVAR: 1 months</th>
<th>Follow-up: 3 months</th>
<th>Follow-up: 15 months</th>
<th>Follow-up: 27 months</th>
<th>Follow-up: 51 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Neck:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>15 mm</td>
<td>17 mm</td>
<td>27 mm</td>
<td>21 mm</td>
</tr>
<tr>
<td>Diameter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>23 mm</td>
<td>23 mm</td>
<td>23 mm</td>
<td>24 mm</td>
</tr>
<tr>
<td>-5</td>
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<td>24 mm</td>
<td>24 mm</td>
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<td>-10</td>
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</tr>
<tr>
<td>-15</td>
<td>25 mm</td>
<td>26 mm</td>
<td>26 mm</td>
<td>29 mm</td>
</tr>
<tr>
<td>Surface</td>
<td>1051 mm²</td>
<td>1676 mm²</td>
<td>2587 mm²</td>
<td>2050 mm²</td>
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<tr>
<td><strong>Thrombus:</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circumference</td>
<td>0 °</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thickness</td>
<td>0 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Calcification:</strong></td>
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<td></td>
<td></td>
</tr>
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<td>Circumference</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Thickness</td>
<td>0 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Device main body:</strong></td>
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</tr>
<tr>
<td>Diameter</td>
<td>28 mm</td>
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</tr>
<tr>
<td>Oversized</td>
<td>22%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Apposition:</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Length</td>
<td>12 mm</td>
<td>12 mm</td>
<td>4 mm</td>
<td>0 mm</td>
</tr>
<tr>
<td>Surface</td>
<td>1164 mm² (69%)</td>
<td>1528 mm² (59%)</td>
<td>509 mm² (25%)</td>
<td>0 mm² (3%)</td>
</tr>
<tr>
<td><strong>Top of fabric:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFD</td>
<td>4 mm</td>
<td></td>
<td>14 mm</td>
<td>18 mm</td>
</tr>
<tr>
<td>CFD</td>
<td>5 mm</td>
<td></td>
<td>14 mm</td>
<td>20 mm</td>
</tr>
<tr>
<td>Diameter</td>
<td>23 mm (82%)</td>
<td>25 mm (89%)</td>
<td>27 mm (96%)</td>
<td>29 mm (100%)</td>
</tr>
<tr>
<td>Tilt</td>
<td>g°</td>
<td></td>
<td>g°</td>
<td>4°</td>
</tr>
<tr>
<td><strong>Aneurysm:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>71 mm (96%)</td>
<td>75 mm (105%)</td>
<td>77 mm (107%)</td>
<td>83 mm (116%)</td>
</tr>
</tbody>
</table>
Study design

• Four groups of elective EVAR patients
  o Type IA endoleak n = 36
  o Migration (>10 mm) n = 9
  o Type II endoleak n = 16
  o Controls n = 37

• Software analyse
  • endograft dimensions/ aortic neck measurements
    o First post-EVAR CTA (1 month)
    AND
    o CTA scan before complication (type IA & migration); or
    o Late (>1 year) CTA scan (type II & controls)
Study design
Study design
1 month CT (no differences)
Apposition length (CT scan *before* complication)
Apposition % neck (CT scan before complication)
Endograft expansion (CT scan *before* complication)
AAA sac expansion (CT scan *before* complication)
Changes in stent geometry post ch-EVAS

ANS

Non-apposition
Changes in stent geometry post ch-EVAS

Pre-ANS

1 month

1 year
Changes in stent geometry post ch-EVAS
Changes in chimney graft geometry post ch-EVAS
Study design

• 20 ch-EVAS patients with 1 year CTA FU
  o Type IA endoleak  n=5
  o Type IB endoleak  n=1
Non apposition surface (n=20)

• 1 Month CTA: 20.1% of the aortic neck surface

• 1 Year CTA: 30.6% of the aortic neck surface

• Neck diameter didn’t change $\rightarrow$ migration
Non apposition surface (n=20)

Pre-EVAS

1 month

1 year
Nellix stentframes vs chimney grafts migration
Conclusions

• Detailed determination of position, and apposition of endograft / chimney grafts in the aortic neck on regular postoperative CTA scans is feasible with new software.

• Early detection of morphological neck changes may prevent disastrous complications, and can make reinterventions less invasive.
• Today, the majority of the early morphological changes will be missed with standard CT (reports)
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