IVUS for aorto-iliac disease: Is contrast media application and high energy radiation redundant?

Jörg Teßarek MD
Vascular Surgery
Bonifatius Hospital Lingen
Disclosure

Speaker name:

.............Jörg Teßarek...........................................................

I have the following potential conflicts of interest to report:

☐ Consulting

☐ Employment in industry

☐ Stockholder of a healthcare company

☐ Owner of a healthcare company

☒ Other(s): honoraria for presentations

☐ I do not have any potential conflict of interest
The interdependancy of renal function, iodinated contrast and overall outcome after aneurysm repair

Acute kidney injury definition: drop in eGFR by 25% within 24h after the intervention

_Incidence in a prospective study (UK): 19-29% of patients with EVAR/ f/bEVAR_

Higher then in patients presenting with acute sepsis or cardiovascular event

Patient radiation dose (associated with higher amounts of iodinated contrast)


Table 1. Patient and procedure characteristics for branched/fenestrated, thoracic and infra-renal endovascular aortic repairs.

<table>
<thead>
<tr>
<th></th>
<th>BEVAR/FEVAR (n = 53)</th>
<th>TEVAR (n = 232)</th>
<th>IEVAR (n = 630)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>76 (58–85)</td>
<td>71 (15–89)</td>
<td>76 (37–93)</td>
</tr>
<tr>
<td><strong>Female (%)</strong></td>
<td>13 (25%)</td>
<td>72 (31%)</td>
<td>67 (11%)</td>
</tr>
<tr>
<td><strong>Screening time (mins)</strong></td>
<td>58 (6.7–212)</td>
<td>10 (1.5–130)</td>
<td>18 (2.4–161)</td>
</tr>
<tr>
<td><strong>Peak skin dose (Gy)</strong></td>
<td>1.3 (0.7–8.7)</td>
<td>0.8 (0.46–1.44)</td>
<td>0.71 (0.44–13.7)</td>
</tr>
<tr>
<td><strong>Whole body dose (Sv)</strong></td>
<td>0.096 (0.0052–0.64)</td>
<td>0.058 (0.034–0.11)</td>
<td>0.053 (0.033–1.00)</td>
</tr>
<tr>
<td><strong>Skin dose &gt;2 Gy</strong></td>
<td>17 (31%)</td>
<td>26 (11%)</td>
<td>69 (11%)</td>
</tr>
</tbody>
</table>

The DAP was higher (p = 0.004) in the BEVAR/FEVAR group compared with IEVAR and TEVAR: 32,060 cGy cm² [17,207–213,322] vs 17,300 cGy cm² [10,940–334,340] vs 19,440 cGy cm² [11,284–35,101], respectively (Fig. 3).
100-240-fold elevation of Air Kerma (mGy) if angio is performed (10-13 frames comparison)

Patient AND Staff members risk!

<table>
<thead>
<tr>
<th></th>
<th>Fluoroscopy</th>
<th>Angiography</th>
<th>RAO angio</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of images</td>
<td>10</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Air Kerma (mGy)</td>
<td>0.11</td>
<td>10.58</td>
<td>24.39</td>
</tr>
</tbody>
</table>

all data collected from a standard SID 105cm, C-arm position

RAO 2°, caudal 2° and RAO 49°
## ROI for procedural success

<table>
<thead>
<tr>
<th></th>
<th>Angio</th>
<th>IVUS</th>
<th>Image fusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target vessels</td>
<td>+</td>
<td>+</td>
<td>+/-??</td>
</tr>
<tr>
<td>Patency</td>
<td>+</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>IA/IB EL</td>
<td>+</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>(indirect)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II EL</td>
<td>+</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Crimping</td>
<td>--</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>Infolding</td>
<td>--</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>Stenosis</td>
<td>--+</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>Thrombus</td>
<td>--</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>No CT/MR</td>
<td>??</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>REBOA</td>
<td>??</td>
<td>+</td>
<td>--</td>
</tr>
<tr>
<td>Artefacts</td>
<td>++ (CO2)</td>
<td>--</td>
<td>??</td>
</tr>
</tbody>
</table>
Completion IVUS

→ and no longer completion angiography
Significant Reduction of Dose Area Product mGy x cm² (BMI adjusted) without loss of procedural safety

DRL (Diagnose Related Levels): 230.000 mGy/cm²

Reduction for TEVAR: 83%

Pre Clarity: 201078 (34) p = 0.0038
Post Clarity: 109383 (44) 45.6%
IVUS/ angio: 48876 (23) 55.36%
IVUS: 22232 (14) 44.52%
Comparison of IVUS vs. Angio guidance

Compared to standard EVAR there is a reduction of:
- ~96.3% DRL (230.000)
- ~96% for pre clarity
- ~92% for clarity
- ~83.5% of mixed procedures with 2 angioruns
- ~60% for early IVUS cases
100% Procedural safety for standard EVAR, ISB...

• No difference in procedure time
• Target vessel definition reliable and safe
• 1 RA / 62 during EVAR required cannulation
• No target vessel loss
• No relevant loss of neck length (max. 4mm/ 44mm neck)
  – 1 type I EL 4 mo after implantation (FU -3 yrs)
  – Visible migration in native x-ray
  – No relevant type II EL

  – FU: 30 day CT; 3/6/12... mo with DUS and x-ray
What is about PAD
IVUS guided procedures for aorto-iliac occlusion

Preliminary results after 11 procedures completely based on IVUS

Reduction of CM to zero
Reduction of DAP about 83%
Concluding:

- IVUS is a well evaluated 3D imaging technique using a single projection axis/ c-arm position and optimal passive protection.
- Reduction of contrast media to "zero" (no more "renal side").
- Reduction of DAP (>95%) and Air Kerma (250 fold).
- Fits to any workflow in the OR (hybrid/ mobile C-arm).
- Allows exact device placement and control.
- Strong rational for IVUS guided procedures for AAA and aortoiliac PAD.
- For aorto-iliac stenosis (occlusion).
- For standard EVAR as an index procedure:
  - Contrast application (iodinated and CO2).
  - High energy radiation are redundant.
Thank you for your attention

joerg.tessarek@hospital-lingen.de
Bonifatius Hospital Lingen