Complications during EVAR: Strategies to prevent them?

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Disclosure

Speaker name: Daniela Branzan, MD

I have the following potential conflicts of interest to report:

- Grants and Speaking Fees from:
  - Artivion
  - Bentley Innomed GmbH
  - Cook Medical
  - Cydar Medical
  - Endologix
Complications during EVAR

Immediate

• related to insertion of the delivery system
  – arterial occlusion
  – arterial rupture/dissection with bleeding

• related to endograft deployment
  – unintentionally covered of visceral vessels and the hypogastric artery
  – atheroembolism
  – lower limb ischemia (graft limb kinks, graft limb occlusion)
  – endoleaks

• systemic perioperative complications
  – ischemic complications (intestine, pelvic organs, spinal cord, or kidneys)
  – renal insufficiency (eg, allergic reaction, contrast-induced nephropathy)
# Delayed

## Table 6.2. Long-term graft related complications after endovascular aneurysm repair.

<table>
<thead>
<tr>
<th>Complications</th>
<th>Definition</th>
<th>Estimated frequency during 5 year follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I endoleak</td>
<td>Peri-graft flow occurring from attachment sites</td>
<td>5%</td>
</tr>
<tr>
<td>A</td>
<td>proximal end of stent graft</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>distal end of stent graft</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>iliac occluder</td>
<td></td>
</tr>
<tr>
<td>Type II endoleak</td>
<td>Perigraft flow occurring from collateral branches to the aneurysm; inferior mesenteric artery (IIA) and lumbar arteries (IIB)</td>
<td>20–40%, 10% persistent at 2 years</td>
</tr>
<tr>
<td></td>
<td>Categorised as early or late/delayed (before or after 12 months) and as transient or persistent (resolved or not resolved ≤6 months)</td>
<td></td>
</tr>
<tr>
<td>Type III endoleak</td>
<td>Peri-graft flow occurring from stent graft defect or junction sites</td>
<td>1–3%</td>
</tr>
<tr>
<td>A</td>
<td>leak from junctions or modular disconnection</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>fabric holes</td>
<td></td>
</tr>
<tr>
<td>Type IV endoleak</td>
<td>Peri-graft flow occurring from stent graft fabric porosity &lt;30 days after placement</td>
<td>1%</td>
</tr>
<tr>
<td>Endotension</td>
<td>AAA sac enlargement without visualised endoleak</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Migration</td>
<td>Movement of the stent graft in relation to proximal or distal landing zone</td>
<td>1%</td>
</tr>
<tr>
<td>Limb kinking and occlusion</td>
<td>Graft thrombosis or stenosis</td>
<td>4–8%</td>
</tr>
<tr>
<td>Infection</td>
<td>Stent graft infection</td>
<td>0.5–1%</td>
</tr>
<tr>
<td>Rupture</td>
<td>Aortic rupture</td>
<td>1–5%</td>
</tr>
</tbody>
</table>

AAA = abdominal aortic aneurysm.

References: [495, 496, 47, 497, 498, 1, 499, 500].
Access site complications

Occlusion / stenosis of the AFC after Proglide:
• Surgical treatment
• Endovascular treatment:
  – Access difficult (cross-over not possible)
    – Transbrachial
    – Transfemoral retrograde
    – Sonographic access 4 F sheath
    – PTA retrograde

Bleeding/Closure with Proglide not successful:
• Surgical treatment
• Endovascular treatment:
  – Viabahn implantation
  – Access difficult (possibly retrograde via AFS)
  – AFC not infrequently too large in AAA patients
Avoid access site complications at Puncture Site

Suitable CFA anatomy:
- CFA bifurcation > 2 cm below the inguinal ligament;
- no Ca++ in the anterior arterial wall;
- Ca++ affecting <50% of the posterior wall.

Puncture of the CFA under ultrasound guidance:
- proximal to the CFA bifurcation;
- in the anterior wall of CFA;
- a transverse or a longitudinal view.
Iliac perforation - 'crack-and-pave' technique

Small EIA

7/40mm-Balloon

8/40mm-Balloon
Iliac perforation - 'crack-and-pave' technique

2 x Fluency 12/60mm

After PTA 10mm-Ballon
Iliac perforation – How to avoid

- Plan the procedure carefully
  - Small-profile devices
  - Lithotripsy
  - Pave-and-crack
  - Iliac conduit
Limb Kinking and Occlusion

Incidence:
- 5.6 % (5454 EVAR patients 1995-2014)
- Incidence decreasing over the years

Acute (-30 d after EVAR): 50%

Amputation: 0.031 %

Risk factors:
- Narrow aortic bifurcation < 16mm
- Angulation iliac arteries ≥ 60°
- Circumferential calcification ≥ 50%
- Oversizing ≥ 15%

Hammond et al. J vasc Surg 2018
Briggs et al. J Vasc Surg 2018
Moulakakis et al. Ann Vasc Surg 2018
Risk of narrow aortic bifurcation
Limb Occlusion due to narrow aortic bifurcation

Options:

- **Endo:**
  - Lysis
  - Thrombectomy
  - Stent graft
- **Surgical**
  - Fogarty
Limb Occlusion due to narrow aortic bifurcation
Limb Occlusion due to narrow aortic bifurcation

2 x LifeStream 12/37mm
Infrarenal angulation as possible cause of limb occlusion
Infrarenal angulation as possible cause of limb occlusion

2 x 10/40mm Ballon-expandable Stents + 12mm-PTA
Elongated EIA as possible cause of limb occlusion

<table>
<thead>
<tr>
<th>Rates at 1-year</th>
<th>Ovation IDE</th>
<th>Cook Zenith Flex IDE</th>
<th>Endologix PowerLink IDE</th>
<th>Gore Excluder Combined IDE</th>
<th>Lombard Aorfix IDE</th>
<th>Medtronic Endurant IDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limb Occlusions</td>
<td>1.2%</td>
<td>3.0%</td>
<td>3.1%</td>
<td>0.4%</td>
<td>3.7%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>
Elongated EIA as possible cause of limb occlusion

GORE Excluder

Concertina phenomenon

After removal of the guidewire
Unintentionally occlusion of visceral vessels
Unintentionally occlusion of visceral vessels

6-7Fr-90cm Sheath
Left brachial

6/20 low-profile Balloon
cover Stent
Unintentionally occlusion of visceral vessels
Typ Ia-Endoleak

Neck Ca2+ $\rightarrow$ Typ-Ia EL
Typ Ia-Endoleak

Neck Ca2+ → Typ-Ia EL

Two Days later
Treatment of Typ Ia-Endoleak

Typ-I in an angulated aorta

Palmaz-Stent

Result
HeliFX EndoAnchor
For Treatment of Typ-I Endoleaks
Typ II-Endoleak

Prevention durch Pre-EVAR Coiling
Stentgraft Infection
Conclusions

- Complications associated with endovascular abdominal aortic repair are commonly related to some technical aspect of endograft placement.

- Immediate graft-related complications are managed when they are identified.

- However, the endograft remains a dynamic entity, and late endograft-related complications can occur.

- Compared with open surgical repair, the overall incidence of severe perioperative systemic complications is generally lower.
Thank you!

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