COMPLICATIONS OF TEVAR

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IMAD CONGRESS
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• Stentgrafting is a recognized treatment for TAA & TAD and has been proposed as first choice for HRP thanks to a lower morbidity and mortality rate

• Complications still persist and are related to patients comorbidity or device placement

• Specific complications are also related to complex cases needing hybrid surgery

• Their managements need an expert and multidisciplinary team
I. COMPLICATIONS FROM CONVENTIONAL TEVAR

II. COMPLICATIONS REFERED TO COMPLEX ANEURYSM NEEDING AORTIC DEBRANCHING

- Latest publications: TRAVIATA registry (Valiant SG)
# Endografts in the Descending Aorta Safety Data (French Report)

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>Nb studies</th>
<th>Nb patients</th>
<th>Global average value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day mortality</td>
<td>31</td>
<td>1756</td>
<td>6%</td>
<td>0-15</td>
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<tr>
<td>Global mortality</td>
<td>17</td>
<td>889</td>
<td>11.7% at 18.4 months</td>
<td></td>
</tr>
<tr>
<td>Arterial access harm</td>
<td>14</td>
<td>803</td>
<td>5.8%</td>
<td>1.4-14</td>
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<tr>
<td>Endograft fracture</td>
<td>3</td>
<td>208</td>
<td>5.3%</td>
<td></td>
</tr>
<tr>
<td>Endograft migration</td>
<td>8</td>
<td>525</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Paraplegia</td>
<td>24</td>
<td>1480</td>
<td>2.1% / 2.5% *</td>
<td>0-6.5</td>
</tr>
<tr>
<td>Stroke</td>
<td>18</td>
<td>836</td>
<td>4.5% / 3.1% *</td>
<td>1.4-20</td>
</tr>
<tr>
<td>Renal failure</td>
<td>11</td>
<td>501</td>
<td>5.2%</td>
<td>2-11.7</td>
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<tr>
<td>Respiratory comp.</td>
<td>7</td>
<td>448</td>
<td>9.8%</td>
<td></td>
</tr>
<tr>
<td>Scar complication</td>
<td>6</td>
<td>220</td>
<td>8.2%</td>
<td></td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
<td>2</td>
<td>121</td>
<td>1.7%</td>
<td></td>
</tr>
<tr>
<td>Iatrogenic dissection</td>
<td>3</td>
<td>180</td>
<td>3.3%</td>
<td></td>
</tr>
</tbody>
</table>

* = Eurostar thoracic registry
**ACCESS PROBLEMS**

**Calcifications are worse than small size**

**Preventions:**
- Best side selection
- Proper sizing of access
- Device size reduction

**Management of iliac diameter reduction:**
- Balloons & stent
- Covered stents: Paving & cracking (M. Malina)

**Management of tortuositites:**
- Stiff guide wires & buddy wire technique
- Combined brachio-femoral wire
- Groin cutdown with Iliac artery isolation and traction
- Iliac conduit – Sub peritoneal approach

*Rarely* = abdominal aortic access antegrade axillary access (TAG)

**Management of rupture:**
- Keep the wire +++
- Reballooning for hemostasis
- Covered stent
- Surgery + iliac conduit
ILIAC RUPTURE
**Risk factors identified**
- Arch involvement
- Female gender \( P=0.039 \)
- Procedure duration > 2h40m \( p=0.013 \)

**Prevention:**
- Consider arch anatomy & thrombus deposition
  - recuse shaggy aortas
  - Careful manipulations in arch
- Consider device nose cone aspect
- Consider LCC & IA relocation if necessary (prefer total transposition)
- Arch filter protection (in process)

**Management:**
- Stroke centers, ICU
- Brain CT scan (infarction, contrast fixation)
- Intra cerebral clot removal
- Stents…..!
- Interventional Neuroradiologists

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**Embrella Embolic Deflector Device**
Paraplegia

Many unresolved issues

R. Factors identified:
- TAA are more risky than TAD (Residual flow in intercostal arteries)
  - Previous AAA surgery $p=0.037$
  - LSA coverage $p=0.027$
  - Length coverage $p=0.045$

Identification of risk of paraplegia:
- Sources of Spinal chord blood supply to be identified on imaging
  (Adamkievicz artery, also collateral from Cephalad & caudal)

Prevention:
- Avoid perioperative hypotension
- Perform LSA revascularization (mandatory if no posterior communicating arteries)
- Avoid excessive coverage of aorta
- Avoid concomitant repair AAA + TAA

Motor evoked potentials? (M. Jacob)
- Selective spinal drainage
  (if previous AAA repair, LSA exclusion, renal failure, ASA 4)
  - Avoid HRP identified (inform patients)

Management:
- Medullar MR diagnosis
- Increase HBP (180 systolic, mean >95)
- Spinal drainage (pressure <10cm water)
  - Max Spinal Fluid withdrawn 20ml/h
  - Maintain > 3 days
- Steroides?
## ENDOGRAFTS IN THE DESCENDING AORTA

### EFFICACY DATA

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<thead>
<tr>
<th>Endpoint</th>
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<th>Nb patients</th>
<th>Global average value</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technical success</td>
<td>31</td>
<td>647</td>
<td>94.6%</td>
<td>77-100</td>
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<tr>
<td>Blood loss</td>
<td>6</td>
<td>372</td>
<td>358.5ml</td>
<td>0-3000</td>
</tr>
<tr>
<td>Surgical conversion</td>
<td>26</td>
<td>1620</td>
<td>1.4%</td>
<td>0-7.4</td>
</tr>
<tr>
<td>Length intervention</td>
<td>7</td>
<td>375</td>
<td>118mn</td>
<td>56-197</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>17</td>
<td>542</td>
<td>6.6j</td>
<td>2.8-10</td>
</tr>
<tr>
<td>ICU stay</td>
<td>8</td>
<td>384</td>
<td>2.9j</td>
<td>1.5-4.3</td>
</tr>
<tr>
<td>Early endoleaks</td>
<td>18</td>
<td>796</td>
<td>10.5% / 6.5%*</td>
<td>0-45</td>
</tr>
<tr>
<td>Late endoleaks</td>
<td>18</td>
<td>907</td>
<td>7.5% at 17.9 months</td>
<td></td>
</tr>
<tr>
<td>Endoleaks on TAAs</td>
<td>9</td>
<td>419</td>
<td>10.3%</td>
<td>4-30</td>
</tr>
<tr>
<td>FL perfusion on TADs</td>
<td>9</td>
<td>261</td>
<td>11.1%</td>
<td>7-47</td>
</tr>
<tr>
<td>Sac increase</td>
<td>5</td>
<td>247</td>
<td>3.6%</td>
<td>4-11</td>
</tr>
<tr>
<td>Sac decrease</td>
<td>3</td>
<td>117</td>
<td>58%</td>
<td>17-73</td>
</tr>
<tr>
<td>Stable sac</td>
<td>3</td>
<td>117</td>
<td>29%</td>
<td>14-69</td>
</tr>
</tbody>
</table>

* = TRAVIATA
Secondary endoleaks up to 30% reported! (IC or bronchial origins?)

- **Type 2**: Abstention except sac enlargement or LSA reflux (Coiling)
- **Type 3**: Seal defection of modular components. Bloodstress, migrations, tortuositities -> long overlapping -> SG extension
- **Type 1**: From the attachment sites ≈ 8-10%
  - -> additional SG +/- debranching
  - Avoid placement in curvatures
  - Use arch dedicated devices

Persistence of blood flow outside the SG lumen
Prevention is surveillance: CT, MRI
Others rare complications

- **Strut perforation**: pseudo-aneurysms and aortic fistulas (esophagus, bronchus)
- **End organ ischemia** due to vascular compromise by coverage CA, LSA, Adamkiewicz
- **Retrograde type A dissection & stent collapse**
  
  1.33% for European registry TEVAR complications but 42% mortality
Mortality rate is lower than after surgery
Paraplegia rate is lower than after surgery
Subclavian artery preservation or bypass reduces paraplegia (Eurostar Registry Data)
Access remains a key issue
3 cm neck length is optimal and justify aortic debranching if necessary in order to reduce type I endoleak
II. COMPLICATIONS REFERED TO COMPLEX ANEURYSM NEEDING AORTIC DEBRANCHING

- Distal extension to visceral arteries
- Proximal extension to supra aortic vessels
- Combined proximal and distal extension
Retrograde debranching is a huge operation*: 

- 30 day non ruptured mortality ~ 15-20%
- Paraplegia: 9.6% (Temporary deficit: 5.7%)
- Stroke: 3.8%
- Hepatic failure
- Colonic infarction
- Other complications: IM, Respiratory or renal failure

* From "Hybrid approach to thoraco-abdominal aneurysms types I-III & V"- Nick Cheshire - MEET 2007
Personal series of 54 patients:

- 4 fatal complications: 7.5%
  - 2 from iatrogenic mechanical complications (immediate)
  - 1 from multi organ failure on day 3
  - 1 from gastric hemorrhage on day 13

- 11 other complications
  (some concomitants)
ETIOLOGY OF COMPLICATIONS

- Arch specific vs. non specific
- Specific mechanisms
  - 1st step (surgical)
    - Aortic cross clamping & suture
    - Bypass grafting related
  - 2nd step (endovascular)
    - Catheterization & stentgraft deployment
• After stentgrafting (6 cases; 11.3%)

  - Access complications
    - 1 fatal iliac rupture
  - Neurological events
    - 1 temporary spinal chord ischemia
  - Renal failure (2 cases)
  - Fatal multi organ failure (1 case)
  - Fatal digestive hemorrhage (1 case)
  - Endoleaks (4.6%)
    - 2 proximal type 1 requiring extension
ARCH-SPECIFIC COMPLICATIONS

After transposition

- 1 ascending aorta dissection on clamping site
  (uncomplicated – 1.8%)
- 1 minor stroke*

After stentgrafting

- 2 left ventricle perforation, 1 fatal
- 3 left upper limb ischemia requiring treatment (bypass and overstenting)
- 4 neurological events (3 new)
  - 2 delayed TIAs (Total arch)
    - 1 due to 1 branch occlusion
    - 1 ocular due to thrombus at the origin of the Ao-IA bypass
- 2 acute major strokes (Hemi-arch)
  (1 worsening minor stroke*)
- 1 type II specific endoleaks from LSA (successful coil embolisation)

• Neuro-events: 7.3%
• Strokes: 3.7%

Total arch transposition appears safer
AORTIC DISSECTION ON CLAMPING SITE

COMBINED TYPE A DISSECTION
72 yo male patient with a residual arch dissecting aneurysm 2 years after acute type A TAD surgery (asc. Ao. replacement + valve resuspension).

- Underwent a redo CPB for aortic valve replacement & concomitant total arch transposition.
- Delayed stentgrafting on the aortic arch
- On day 5, TIA due to thrombosis of the LCC bypass, treated by carotid-carotid bypass.
CASE OF LEFT VENTRICLE PERFORATION

- Successful exclusion of the aneurysm
- Unexplained hypotension

Before exclusion

After exclusion

- Echography assessment: Posterior pericardial tamponade
- Failed surgical on-pump repair
  - Death
• Access management is a key point
• Comfortable PLZ and clear markers are mandatory
• Careful catheter maneuvers through the arch & GW control prevent stroke
• Avoid the trombone technique in the middle aortic arch (endoleaks, kinking…)
• Prefer tapered devices for dissections
• Arch dedicated devices
CONCLUSION

- TEVAR complications rate support stent graft preference for thoracic aneurysm and dissection
- Extended diseases to supra aortic vessel and visceral arteries are associated to specific complications to brain or visceral organs.
- Dedicated devices are needed for arch placement and branch technology for abdominal extension
Save the date
MEET 2011
Crowne Plaza St Peter’s Hotel
Rome, Italy
October 27-29