TEVAR Treatment of Patch Aneurysms and Other Complications of Prior Open Repairs: Advantages, Limitations, Precautions

Dittmar Böckler, Drosos Kotelis
Department of Vascular and Endovascular Surgery
University of Heidelberg, Germany

Disclosures

- Consultant
  - Endologix, Endomax, Gore, Medtronic
- Research Grant / research support
  - Gore, Maquet, Medtronic, Siemens
- Advisory Board
  - Endologix, Gore, Maquet, Medtronic, Siemens
- Paid speaker
  - Endologix, Gore, Maquet, Medtronic, Siemens
- Major stakeholder
  - None

Surgical repair as a Standard of Care for Coarctatio aortae (CoA)

Surgically repair is a standard of care for Coarctatio aortae (CoA)

Trend towards stenting

- Stent and Surgery equal regarding hemodynamically results
- Stents fewer acute complications (2.1% vs 8.1%, p<0.0001)
- Shorter hospital stay (2.4 days vs. 6.4 days, p<0.0001)

Pseudoaneurysm after CoA - Repair

- Incidence: 11-24%
- Risk factors: dacron plasty, advanced age at OR


Endovascular Treatment Option (TEVAR)

- LSA Transposition & 3 stentgrafts in reversed trombone technique
Challenging Morphology for TEVAR

- Small access vessels
- Gothic tortuous arch
- Proximity to supracoarctation pathology
- Caliber mismatch
- Relatively young patients

Ref.: Kotelis D, Böckler D et al. ICVTS 2015; Oct 26

Patients and indications
March 1997 – November 2015  n=457

<table>
<thead>
<tr>
<th>Total</th>
<th>Elective</th>
<th>Urgent/Emergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic aortic aneurysm (TAA)</td>
<td>85</td>
<td>63 (74.1)</td>
</tr>
<tr>
<td>Ruptured TAA</td>
<td>31</td>
<td>-</td>
</tr>
<tr>
<td>Thoracoabdominal aneurysm</td>
<td>78</td>
<td>52 (66.6)</td>
</tr>
<tr>
<td>Penetrating aortic ulcer (PAU)</td>
<td>67</td>
<td>34 (50.7)</td>
</tr>
<tr>
<td>Traumatic aortic rupture</td>
<td>27</td>
<td>-</td>
</tr>
<tr>
<td>Chronic Type B dissection</td>
<td>54</td>
<td>39 (72.2)</td>
</tr>
<tr>
<td>Acute Type B dissection</td>
<td>54</td>
<td>20 (37.1)</td>
</tr>
<tr>
<td>Intramural haematoma (IMH)</td>
<td>27</td>
<td>15 (55.6)</td>
</tr>
<tr>
<td>Type A dissection</td>
<td>6</td>
<td>1 (16.7)</td>
</tr>
<tr>
<td>Aortobronchial fistula</td>
<td>9</td>
<td>-</td>
</tr>
</tbody>
</table>

Heidelberg Experience (n=11, fu 5 yrs.)

To analyse early and long-term results of TEVAR in patients with pseudoaneurysms after surgical CoA repair

Objective

➢ Retrospective single center study (1999-2015)
➢ 11 patients out of 418 TEVAR procedures
➢ 8 male, median age 53 yrs.
➢ 9 Dacron patch aortoplasty, 2 subclavian flap
➢ 7 asymptomatic, 4 emergencies
➢ Mean pseudoaneurysm diameter 56 mm
➢ Median No. of devices n=1 (range 1-5)
➢ Median FU 60 mths., no pat. lost to FU

Methods

Ref.: Kotelis D, Böckler D et al. ICVTS 2015; Oct 26

Patient Characteristics

Table 1: Patients characteristics (n=11)

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (years)</th>
<th>Type of surgery</th>
<th>Procedures of TEVAR</th>
<th>Site of pseudoaneurysm</th>
<th>Age of TEVAR in years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64</td>
<td>Type A dissection</td>
<td>3</td>
<td>Thoracic</td>
<td>74</td>
</tr>
<tr>
<td>2</td>
<td>65</td>
<td>Type B dissection</td>
<td>1</td>
<td>Thoracic</td>
<td>65</td>
</tr>
<tr>
<td>3</td>
<td>66</td>
<td>Type B dissection</td>
<td>1</td>
<td>Thoracic</td>
<td>66</td>
</tr>
<tr>
<td>4</td>
<td>67</td>
<td>Type A dissection</td>
<td>3</td>
<td>Thoracic</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>68</td>
<td>Type B dissection</td>
<td>1</td>
<td>Thoracic</td>
<td>68</td>
</tr>
<tr>
<td>6</td>
<td>69</td>
<td>Type A dissection</td>
<td>3</td>
<td>Thoracic</td>
<td>69</td>
</tr>
<tr>
<td>7</td>
<td>70</td>
<td>Type B dissection</td>
<td>1</td>
<td>Thoracic</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>71</td>
<td>Type A dissection</td>
<td>3</td>
<td>Thoracic</td>
<td>71</td>
</tr>
<tr>
<td>9</td>
<td>72</td>
<td>Type B dissection</td>
<td>1</td>
<td>Thoracic</td>
<td>72</td>
</tr>
<tr>
<td>10</td>
<td>73</td>
<td>Type A dissection</td>
<td>3</td>
<td>Thoracic</td>
<td>73</td>
</tr>
<tr>
<td>11</td>
<td>74</td>
<td>Type B dissection</td>
<td>1</td>
<td>Thoracic</td>
<td>74</td>
</tr>
</tbody>
</table>

Type A dissection: Pseudoaneurysm in descending aorta.
Type B dissection: Pseudoaneurysm in infrarenal aorta.
CoA: Coarctation of the aorta.
TEVAR: Thoracic endovascular aortic repair.
Early Results

- In-hospital mortality: 0/11
- Cardiac, pulmonary, renal events: 0/11
- Endoleak Type Ib: 1/11
- Stroke: 2/11
- right sided on day 1 and 3
- fully recovered

Ref. : Kotelis D, Böckler D et al. ICVTS 2015; Oct 26

Long-term Results @ 5 yrs.

- Mortality (due do ALS): 1 / 11
- Sac shrinkage: 9/10
- Type II endoleaks: 2/10
- Reinterventions: 3 /10
- Distal extenison (EL Type Ib)
- Sec. chimney (partial coverage of CCA)
- Carotid-subclavian Bypass (arm claudicatio)

Ref. : Kotelis D, Böckler D et al. ICVTS 2015; Oct 26

Observations

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Endarterectomy</th>
<th>Contained Patch Rupture and ABF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type II endoleak</td>
<td>-</td>
<td>73 yrs. female, aortic coarctation surgery 1975, episode of bloody cough</td>
</tr>
<tr>
<td>Sac shrinkage</td>
<td>9/10</td>
<td></td>
</tr>
<tr>
<td>Cardiac, pulmonary, renal events</td>
<td>0/11</td>
<td></td>
</tr>
<tr>
<td>In-hospital mortality</td>
<td>0/11</td>
<td></td>
</tr>
<tr>
<td>Type Ib endoleaks</td>
<td>1/11</td>
<td></td>
</tr>
<tr>
<td>Stroke</td>
<td>2/11</td>
<td></td>
</tr>
<tr>
<td>right sided on day 1 and 3</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>fully recovered</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Ref. : Kotelis D, Böckler D et al. ICVTS 2015; Oct 26

PLZ 2 - Need for LSA Management

Ref. : Kotelis D, Böckler D et al. ICVTS 2015; Oct 26

Abstract

Role of endovascular repair in the management of late pseudo-aneurysms following open surgery for aortic coarctation

Luca Botta, Vincenzo Russo, Vincenzo Russo, Luigi Lovato, Roberto Di Bartolomeo, Guido Oppido, Marzia Rosati, Rossella Fattori, Francesco Massi

Aims

The aim of this study was to report the results of endovascular treatment of pseudo-aneurysms following open surgery for aortic coarctation.

Methods

The study included 11 patients treated with endovascular procedures. The procedures included stent-graft placement, open repair, and carotid-subclavian bypass.

Results

The endovascular procedures were successful in all cases. No complications were reported. The median follow-up was 44.5 months.

Conclusions

Endovascular repair of pseudo-aneurysms following open surgery for aortic coarctation is feasible and safe. However, more patients and longer follow-up are necessary to assess the efficacy of this promising less-invasive alternative to open re-do surgery.
TEVAR for complications

Transapical TAVI  Post TAVI - Rupture  TEVAR

Summary

- Life expectancy of post-CoA patients is 90% @ 25 yrs.
- Associated risk for aneurysm formation is up to 50%
- Early treatment is crucial due to unknown rupture rate
- Implantation is challenging due to anatomic specifics
- Need of LSA-Management (most cases PLZ 2)
- Relevant revision rate and stroke risk
- Unpredicted need of multiple “conformable” devices

Conclusions

- TEVAR of post-CoA pseudoaneurysm is feasible in elective and emergency cases
- First line treatment rather than redo open surgery
- Durable longterm results
- On-site cardiothoracic surgery backup is essential