One hundred percent of ruptured abdominal aortic aneurysms can be treated endovascularly if adjunctive techniques are used.

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Disclosures

I have the following potential conflicts of interest to report:

<table>
<thead>
<tr>
<th>Educational Program</th>
<th>W.L Gore &amp; Associates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant</td>
<td>Covidien</td>
</tr>
<tr>
<td>Stockholder</td>
<td>LeMaitre</td>
</tr>
</tbody>
</table>
Two-center study (Zurich/Örebro)
473 pts with RAAA

Objective: To present the combined 14-year experience of 2 university centers performing endovascular aneurysm repair (EVAR) and on 100% of noninfected ruptured abdominal aortic aneurysms (RAAA) over the last 32 months (April 2009-Dec 2011)

### TABLE 1. Patient Characteristics and 30-day Mortality of Operative and Total Cohorts

<table>
<thead>
<tr>
<th></th>
<th>EVAR-ONLY</th>
<th>EVAR OPEN</th>
<th>EVAR/OPEN</th>
<th>Combined OPEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at operation</td>
<td>Mean (SD)</td>
<td>75.9 (7.8)</td>
<td>74.1 (9.1)</td>
<td>72.1 (8.5)</td>
</tr>
<tr>
<td>Sex</td>
<td>Women</td>
<td>24%</td>
<td>15%</td>
<td>13%</td>
</tr>
<tr>
<td>Type of rupture</td>
<td>Contained</td>
<td>67%</td>
<td>64%</td>
<td>71%</td>
</tr>
<tr>
<td></td>
<td>Free</td>
<td>27%</td>
<td>32%</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>Fistula</td>
<td>6%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>6 missing info</td>
<td>6 missing info</td>
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</tr>
<tr>
<td>Hemodynamics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BP systolic &lt; 80 mmHg</td>
<td>47%</td>
<td>41%</td>
<td>34%</td>
</tr>
<tr>
<td>Anesthesia</td>
<td>LA</td>
<td>63%</td>
<td>58%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>LA/GA</td>
<td>20%</td>
<td>24%</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>GA</td>
<td>13%</td>
<td>16%</td>
<td>81%</td>
</tr>
<tr>
<td></td>
<td>Other (eg, Ketalar)</td>
<td>4%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
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</tr>
<tr>
<td>AD</td>
<td>No</td>
<td>71%</td>
<td>78%</td>
<td>76%</td>
</tr>
<tr>
<td></td>
<td>Laparotomy</td>
<td>20%</td>
<td>15%</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>9%</td>
<td>7%</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td>Missing</td>
<td>6 missing info</td>
<td>6 missing info</td>
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<tr>
<td>Clinic (% of patients)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zurich</td>
<td></td>
<td>40</td>
<td>60</td>
<td>63</td>
</tr>
<tr>
<td>Örebro</td>
<td></td>
<td>50</td>
<td>40</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Operative cohort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-day mortality</td>
<td>24%</td>
<td>27%</td>
<td>26%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Total cohort</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-day mortality</td>
<td>24%, P = 0.106*</td>
<td>37.4%, P = 0.051†</td>
<td>37.4%, P = 0.051†</td>
<td>37.4%, P = 0.051†</td>
</tr>
<tr>
<td></td>
<td>n = 72</td>
<td>n = 198</td>
<td>n = 198</td>
<td>n = 361</td>
</tr>
</tbody>
</table>
EVAR/ONLY v. EVAR/OPEN

- Rejection rate decreased from 10 to 4%
- Age increased from 73 to 76 yrs
- Women increased from 14 to 24%
- Hemodynamic instable increased from 38 to 47%
Access

• Percutaneous access
• Local anaesthesia if possible
• Fascia suture technique for closure
  – No pre-suturering
  – Fast
  – Versatile
  – Reliable

Larzon T et al. A Randomized Controlled Trial of the Fascia Suture Technique Compared with a Suture-mediated Closure Device for Femoral Arterial Closure after Endovascular Aortic Repair. Eur J Vasc Endovasc Surg. 2014 Dec 27
Occlusion Balloon

- Single-balloon*
- Double balloon**

** Larzon T et al J Endovasc Ther 2005;12;548-55
Chimney graft

Stable RAAA

• Insert chimneys from proximal access (left axillary or brachial arteries)
• Deploy aortic stentgraft (SG)
• Deploy chimneys

Chimney graft

Unstable RAAA

- Aortic balloon occlusion (ABO)
- Insert chimneys from proximal access parallel to balloon
- Deploy aortic SG
- Deploy chimneys
- Consider to sacrifize one renal in cases of time-consuming cannulation

Onyx embolization

Adjunct tool
• Used for prophylactic treatment of type II endoleak from the hypogastric artery in aorto-iliac aneurysms
• “Plugging and sealing” technique

Onyx embolization

Technical issues

• Before extension leave a catheter free in the common iliac artery

Onyx embolization

Technical issues

• Before extension leave a catheter free in the common iliac artery
• After deployment of the extension SG make an angiography

Onyx embolization

Technical issues

• Before extension leave a catheter free in the common iliac artery
• After deployment of the extension SG make an angiography
• Inject Onyx. Catheter tip must not be placed in the hypogastric artery

Onyx embolization

Technical issues

• Before extension leave a catheter free in the common iliac artery
• After deployment of the extension SG make an angiography
• Inject Onyx. Catheter tip must not be placed in the hypogastric artery
• Complete filling of the main trunk

Onyx embolization

Adjunct tool

- Used to seal type I endoleak
- In cases with tortuous necks with bad wall apposition instead of using bare stents
- After chimneys with leakage through gutters
Onyx embolization

Adjunct tool

- Used to seal type I endoleak
- In cases with tortuous necks with bad wall apposition instead of using bare stents
- After chimneys with leakage through gutters
Onyx embolization

Technical issues

• Leave two catheters in the sac
Onyx embolization

Technical issues

• Leave two catheters in the sac
Onyx embolization

Technical issues

- Leave two catheters in the sac
- Inject Onyx (one catheter can be used for angiography)
Onyx embolization

Technical issues

- Leave two catheters in the sac
- Inject Onyx (one catheter can be used for angiography)
- Proximal access is an alternative
Onyx embolization

Technical issues

• Leave two catheters in the sac
• Inject Onyx (one catheter can be used for angiography)
• Proximal access is an alternative
• Risk for remote embolization why slow injection is recommended
Onyx embolization

Technical issues

• Leave two catheters in the sac
• Inject Onyx (one catheter can be used for angiography)
• Proximal access is an alternative
• Risk for remote embolization why slow injection is recommended
• Occlusion balloon to control flow
Abdominal compartment syndrome

Technical issues

- Laparatomy with VAC dressing
Abdominal compartment syndrome

Technical issues

• Laparotomy with VAC dressing
• t-PA assisted catheter decompressing technique

Abdominal compartment syndrome

Technical issues

• Laparotomy with VAC dressing
• t-PA assisted catheter decompressing technique
• CT-guided under local anesthesia
• Can decrease intraabdominal pressure but is limited in amount of blood and speed in drainage

Single center experience - RAAA

Örebro University Hospital

- Number of patients
- Unfit for any intervention
- Operative mortality
- Cohort mortality
- Hemodynamic shock

2009 – 2013 (100% EVAR)

- 70
- 6 (9%)
- 17/64 (27%)
- 23/70 (33%)
- 34/64 (53%)

Single center experience - RAAA

Örebro University Hospital
- Local anesthesia only
- Mortality: GA only > LA only
- ABO treatment
- Mortality: ABO > no ABO
- Mortality: chimney v. no chimney
- ACS with intervention
- Mortality: ASC > no ACS
- ≥1 adjunctive technique

2009 – 2013 (100% EVAR)
- 40/64 (53%)
- p=0.009
- 17/64 (27%)
- p=0.004
- p=0.693
- 17/64 (27%)
- p=0.004
- 32/64 (50%)

Conclusion

• Our data support that OR of RAAA can be replaced by EVAR with appropriate management of existing adjunctive techniques

• Important to adapt techniques that can be used in both elective as emergency situations
The Vascular team in Örebro

Thank you!
One hundred percent of ruptured abdominal aortic aneurysms can be treated endovascularly if adjunctive techniques are used.

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