Patterns Of Rupture Of AAAs after EVAR:
How Does It Differ From Rupture Patterns In Untreated AAAs

Markus K. Furrer
Thoracic and Vascular Unit
Department of Surgery, KSGR
Chur, Switzerland

The Problem
Stentgraft Migration with AAA Rupture 43 Months after EVAR

No Financial Disclosures

The Problem
Rupture after EVAR
EVAR Trial I & II: 848 p (27 ruptures) 0.7% per 100 person-years
2000-2010: 1736 p (20 ruptures) 0.4% per 100 person-years

Own patients (KSGR)
6/2008 – 01/2015: 118 EVAR
Mean Follow-up: 26 M.
2 Ruptures
2 Symptomatic Aneurysms

Own patients (KSGR)
Rupture 0.8% per 100 person-years
Rupture & Symptomatic 1.6% per 100 person-years
**Pattern of Ruptured Untreated AAA**

- **M.E. 86 years**

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptomatic</td>
<td>Rupture</td>
<td>Rupture</td>
<td>Symptomatic</td>
</tr>
<tr>
<td>Time after EVAR</td>
<td>8 Months</td>
<td>32 Months</td>
<td>43 Months</td>
</tr>
<tr>
<td>Surveillance Imaging</td>
<td>1.CT</td>
<td>1.CT 2.Dx 3.Dx</td>
<td>1.CT 2 CT 3.Dx 4.Dx</td>
</tr>
<tr>
<td>Sten. Shrinkung</td>
<td>-</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Mechanism</td>
<td>Type III EL overlapping?</td>
<td>Type III EL (graft migration)</td>
<td>Type IV EL (graft migration)</td>
</tr>
<tr>
<td>Procedure</td>
<td>EVAR</td>
<td>EVAR</td>
<td>OR</td>
</tr>
<tr>
<td>Survivor</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Different Patterns**

<table>
<thead>
<tr>
<th>Rupture Patterns of AAA</th>
<th>Former EVAR</th>
<th>Untreated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients History</td>
<td>AAA is known</td>
<td>Unknown Disease</td>
</tr>
<tr>
<td>Time to Diagnosis</td>
<td>Shorter (?)</td>
<td>Misleading DD</td>
</tr>
<tr>
<td>Prediction</td>
<td>Might be predicted</td>
<td>AAA known but Treatment refused</td>
</tr>
<tr>
<td>Patho-Physiology</td>
<td>No differences in Type I and III Endoleaks</td>
<td>Worse than in Type II Endoleaks (?)</td>
</tr>
<tr>
<td>Treatment</td>
<td>Endovascular repair using former Stentgraft</td>
<td>De Novo Repair</td>
</tr>
<tr>
<td>Mortality</td>
<td>32%-87%</td>
<td>11-89%</td>
</tr>
<tr>
<td>- of admitted Patients</td>
<td>?</td>
<td>60-75%</td>
</tr>
</tbody>
</table>

**Systemic Review and Meta-Analysis**

- **Incidence:** 0.9% (**8 Series: 16 937 EVAR with 152 Ruptures**)
- **Mean Time to Rupture:** 37 months
- **Not compliant with Surveillance:** 37%
- **Perioperative Mortality:** 32%

**Notes:**
- J Endovasc Ther. 2015 Oct;22(5):734-44.
- Late Rupture of Abdominal Aortic Aneurysm After Previous Endovascular Repair: A Systematic Review and Meta-analysis.
The Problem

Late Rupture of Abdominal Aortic Aneurysm After Previous Endovascular Repair: A Systematic Review and Meta-analysis.


Rupture Patterns of AAA Former EVAR Untreated

- Patients History
  - AAA is known
  - Unknown Disease
- Time to Diagnosis
  - Shorter (?)
- Prediction
  - Might be predicted
  - AAA known but Treatment refused
- Patho-Physiology
  - No differences in Type I and III Endoleaks
  - Type II Endoleaks
- Treatment
  - Endovascular Repair
  - De Novo Repair
- Mortality
  - of admitted Patients: 32%- 67%
  - over-all: 11-89%

Different Patterns

Type III Endoleak

B.E., 1928
8 cm Aneurysm

No Endoleak after Implantation

Mortality after EVAR

Rupture after EVAR

- EVAR Trial I & II: 848 p (27 ruptures)
  - MORTALITY: 67%
  - 2000-2010: 1736 p (20 ruptures)
  - MORTALITY: 55% (OP 43%)
### Prevention of Rupture after EVAR

#### 4 Patients with Ruptured or Symptomatic AAA

<table>
<thead>
<tr>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient at Risk?</strong></td>
<td>EL type III</td>
<td>right iliac sealing &lt; 2cm</td>
<td>off-label-use</td>
</tr>
<tr>
<td><strong>Time after EVAR</strong></td>
<td>8 months</td>
<td>32 months</td>
<td>43 months</td>
</tr>
<tr>
<td><strong>Surveillance Imaging</strong></td>
<td>1.CT</td>
<td>1.CT 2.De 3.De</td>
<td>1.CT 2.CT 3.De 4.De</td>
</tr>
<tr>
<td><strong>SAC Shrinking</strong></td>
<td>no</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td><strong>Mechanism</strong></td>
<td>Type III EL (overlapping?)</td>
<td>Type III EL (graft migration)</td>
<td>Type IA EL graft migration</td>
</tr>
</tbody>
</table>

### Prevention of Rupture after EVAR

#### New adapted Risk adjusted Surveillance Program KSGR

<table>
<thead>
<tr>
<th>postop</th>
<th>3 months</th>
<th>1 year</th>
<th>2 years</th>
<th>3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient at Risk</strong></td>
<td>CT</td>
<td>CT scan</td>
<td>CT scan</td>
<td>CT scan</td>
</tr>
<tr>
<td><strong>Low Risk Patient</strong></td>
<td>CT — no EL</td>
<td>Duplex x-ray</td>
<td>Duplex x-ray</td>
<td>Duplex x-ray</td>
</tr>
</tbody>
</table>

### Conclusions

- Ruptures after EVAR in 75% due to Endoleak Type I and III
- Mortality as high as in untreated AAA
- Surveillance after EVAR based on Risk Profile:
  - Low: Duplex Ultrasound and X-ray is an Option
  - High: CT (+ delayed phase)
- Corrections of short Sealing Zones and Overlaps!

### Prevention of Rupture after EVAR

#### Patients at risk

- short aortic sealing zone < 1,5 cm
- short iliac sealing zone < 2cm
- thrombotic neck
- tortuosity/ kinking
- off-label-use
- endoleak II
- sac growth