Renal decline after aneurysm repair

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Disclosures

Salary: National Institute for Health Research (NIHR)

CONSULTANCIES

General Electric: consultancy, trial steering committee
Novartis: consultancy, trial planning
Amgen: investigator in clinical trial (paid)

TRAVEL, BURSARIES, AWARDS, PRIVATE GRANTS

Maquet
British Society for Endovascular Therapy
Vascutek Terumo (educational grant)
Contents

1) Acute Renal Injury (or AKI)

2) Long-term Renal Injury
EVAR & Acute Kidney Injury

**Incidence**

<table>
<thead>
<tr>
<th>Incidence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence</td>
<td>19%</td>
</tr>
<tr>
<td>Mostly transient</td>
<td>87% ➔ baseline</td>
</tr>
<tr>
<td>Primary risk factor</td>
<td>low eGFR</td>
</tr>
</tbody>
</table>

**Implications**

<table>
<thead>
<tr>
<th></th>
<th>HR:</th>
<th>(95% CI:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term mortality</td>
<td>4.8</td>
<td>2.3-5.6</td>
<td></td>
</tr>
<tr>
<td>Long term mortality</td>
<td>2.4</td>
<td>1.4-3.1</td>
<td></td>
</tr>
<tr>
<td>Long term CV events</td>
<td>3.8</td>
<td>2.8-5.1</td>
<td></td>
</tr>
</tbody>
</table>

Saratzis et al. EJVES 2016;51
Saratzis et al. CJASN 2015; 10
Saratzis et al. EJVES 2015;49
Saratzis et al. CJASN 2015;10
Saratzis et al. AJN 2016;15
Saratzis et al. Kidney International 2017

**Renal artery related complications:**
Coverage of accessory renal arteries
Occlusion of orifice
Dissection or stenosis

**Contrast**

**Endo-graft:**
inflammatory response to implantation of a foreign body

**Aneurysm sac:**
inflammatory infiltrate

**Lower limbs excluded from circulation** (45-120 minutes): Ischaemia-reperfusion injury
Impact of AKI on survival

2 x more likely to die @ 8 years

950 EVARs & 412 OARs → 8.5 years

Saratzis et al. AJN 2015
Causes of renal injury

... in the **LONG** term

**Renal artery disease** (atheromatosis)
Cardiovascular co-morbidities & **IHD**
**Cardio-renal** syndrome
Uncontrolled **hypertension**
Repeat exposure to **contrast**

Evidence gap

Do patients undergoing **EVAR** have a more significant drop in **LONG** term renal function compared to non-AAA patients?

Does that actually impact on **outcome**?
What happens to eGFR long term?

Elective EVARs against carotid patients $\rightarrow 121$ cases

Saratzis A et al. CJASN 2015; 10

22 % drop
Methods

• Group 1: 1,329 patients from Framingham HS with abdominal CTs and 10 year FU with eGFR

• Group 2: 1,014 EVARs & 315 OARs (2002 → 2010)

• Nested case-matching (eGFR & age)

• Follow up for 10 years
Study design

Framingham controls

Nested case – matching for GFR & age

EVAR (elective)

Open aneurysm repair (elective)
## Baseline characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>EVAR</th>
<th>OAR</th>
<th>Framingham</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, years</strong></td>
<td>73±7</td>
<td>74±7</td>
<td>75±2</td>
<td>0.473</td>
</tr>
<tr>
<td><strong>Male sex</strong></td>
<td>97%</td>
<td>92%</td>
<td>97%</td>
<td>0.102</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td>22%</td>
<td>17%</td>
<td>11%</td>
<td>0.058</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td>81%</td>
<td>75%</td>
<td>70%</td>
<td>0.071</td>
</tr>
<tr>
<td><strong>COPD</strong></td>
<td>15%</td>
<td>12%</td>
<td>8%</td>
<td>0.493</td>
</tr>
<tr>
<td><strong>MI</strong></td>
<td>7%</td>
<td>12%</td>
<td>6%</td>
<td>0.377</td>
</tr>
<tr>
<td><strong>Diabetes</strong></td>
<td>3%</td>
<td>6%</td>
<td>14%</td>
<td>0.080</td>
</tr>
<tr>
<td><strong>ACE-inhibitor therapy</strong></td>
<td>37%</td>
<td>38%</td>
<td>33%</td>
<td>0.890</td>
</tr>
<tr>
<td><strong>Antiplatelet therapy</strong></td>
<td>92%</td>
<td>100%</td>
<td>90%</td>
<td>0.072</td>
</tr>
<tr>
<td><strong>Statin therapy</strong></td>
<td>82%</td>
<td>80%</td>
<td>65%</td>
<td>0.086</td>
</tr>
<tr>
<td><strong>Baseline eGFR, ml/kg/1.73 m²</strong></td>
<td>68±16</td>
<td>71±12</td>
<td>74±9</td>
<td>0.956</td>
</tr>
</tbody>
</table>

No significant differences in the prevalence of smoking, diabetes, hypertension


Cardiovascular & FU profiles...

<table>
<thead>
<tr>
<th>Variable</th>
<th>EVAR</th>
<th>OAR</th>
<th>Framingham</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Framingham risk score</td>
<td>18%</td>
<td>12%</td>
<td>17%</td>
<td>0.732</td>
</tr>
<tr>
<td>Renal artery stenosis</td>
<td>7%</td>
<td>5%</td>
<td>7%</td>
<td>0.123</td>
</tr>
<tr>
<td>CT with contrast during FU</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>0.091</td>
</tr>
<tr>
<td>Micro-embolic in renal parenchyma</td>
<td>1%</td>
<td>1%</td>
<td>0</td>
<td>0.083</td>
</tr>
</tbody>
</table>

..no significant differences
Mean annual decline in eGFR:

- $0.7 \pm 0.3 \text{ ml/min/1.73m}^2$ for non-AAA
- $1.4 \pm 0.6$ for EVAR
- $1.1 \pm 0.7$ for OAR ($p<0.001$)
Multivariate analyses

EVAR associated with eGFR drop $>$ 30% at 10 years

(OR: 2.4, 95% CI: 1.3-4.1, $p=0.03$)
Adjusted for age, sex, statin, BP, CT follow-up

EVAR associated with higher CKD stage at 10 years

(OR: 3.4, 95% CI: 1.1-4.8, $p<0.001$)
Adjusted for age, sex, statin, BP, CT follow-up
Impact of long term renal injury

Log rank test, p=0.01
Conclusions

• Patients undergoing EVAR develop a steep decline in long-term renal function

• Need to improve surveillance protocols to address this:
  Better BP control
  Offer ACEi/ARBs
  Regular GFR measurements
  Control of CV parameters
  antiPLTs

• Future research → identify pts @ highest risk
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