Secondary interventions following endovascular repair of infrarenal AAA: implications of a normal initial post repair CT angiogram

Poster No.: C-2484  
Congress: ECR 2015  
Type: Scientific Exhibit  
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Keywords: Vascular, Arteries / Aorta, Interventional vascular, CT-Angiography, CT, Stents  
DOI: 10.1594/ecr2015/C-2484

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Aims and objectives

• Endovascular aneurysm repair (EVAR) is a minimally invasive alternative to open repair for patients with large abdominal aortic aneurysms (AAA). It is associated with lower 30-day mortality and morbidity, shorter hospital inpatient stay and improved time to recovery of activity when compared with open repair but is associated with novel complications and higher rates of secondary intervention[1,2].

• 16-33% of patients require a secondary intervention after EVAR[2-6] and while rates have fallen over time they remain significant.

• This necessitates prolonged surveillance which is associated with increased cost[7], patient inconvenience and the risks of repeated exposure to ionizing radiation and iodinated contrast[8,9].

• In order to reduce the burden of follow up post EVAR, attempts have been made to identify patients at low risk of secondary intervention based on pre-operative aneurysm morphology. Aneurysm size, neck features (diameter, angulation, length, shape and degree of thrombus), size and number of branch vessels and iliac artery anatomy have been shown to correlate with rates of future complication[10-12], but it has been impossible to identify any particular single- or group of-preoperative aneurysm morphological characteristics that reduce the rate of secondary intervention sufficiently to obviate the need for ongoing surveillance post EVAR.

• We hypothesised that a normal first post-EVAR CTA would be predictive of reduced rates of secondary intervention, and whether this would obviate the need for ongoing surveillance.
Methods and materials

• We retrospectively reviewed the electronic records of all patients undergoing EVAR for infrarenal AAA in our institution (a large tertiary referral centre) between 01.05.2007 to 31.02.2013 inclusive. No patients were excluded.

• Databases interrogated were the radiology Picture Archive and Communication System (Agfa PACS), the radiology information system (CRIS - Healthcare Software Solutions Ltd), an in-house bespoke electronic pathology results server and an in-house bespoke electronic patient record system (Patient Pathway Manager [PPM]). PPM contains outpatient clinic letters, operative notes, attendance details and inpatient episode discharge summaries. Original paper notes were not accessed.

• Data collected were basic demographics (age at EVAR, gender), date of EVAR, indication for EVAR (elective or emergency), device type, results of follow up imaging, date and nature of any secondary intervention (surgical or endovascular) and if the patient died, the date of death. Cause of death was not recorded.

• Data was captured for events occurring from the date of EVAR up until (and including) 31.02.2014. End of follow up was defined as the date of the last recorded interaction of the patient with the hospital or the date of death, whichever was the earliest. This allowed for a theoretical minimum follow-up (for surviving patients) of 12 months and maximum of 82 months.

• Scan reports describing "normal" or "unremarkable" post EVAR appearances were classified as normal. A scan report describing endoleak (all types), graft migration, component disintegrity, strut fracture, inadvertent vessel occlusion or limb- or runoff-iliac-vessel kink or stenosis was classified as abnormal.

• Survival and freedom from secondary intervention analyses were performed using Kaplan Meier lifetable analysis, censored for date of last interaction with the hospital or a compound of date of death or date of last interaction with the hospital respectively.

• Analysis was by pre-determined subgroups of the full dataset (elective or emergency indication, device type and normal or abnormal first scan).
Results

Demographics

• 256 patients (222 males) were included.

• The median age at intervention was 76 years.

• Median follow up (of surviving patients) was 39 months (range 11 - 74 months).

• 203 patients were treated electively.

• Types of stent graft used were Medtronic Talent (106), Medtronic Endurant (112), Gore Excluder (12), Cook Zenith Flex (13), VascuTek Anacoda (8), VascuTek Anaconda fenestrated (2) and Lombard Medical Aorfix (1). Additionally, 2 patients received a device designed for the thoracic aorta (Medtronic Valiant) as a tube graft in an AAA.

Mortality

• 30-day mortality in the elective patient group was 2.4% (5 deaths) and in the emergency patient group was 21.2% (11 deaths).

• All cause mortality was 12.8%, 19.7% and 32.0% at 1, 2 and 5 years (elective group) and 32.7%, 34.6% and 44.2% (emergency group) respectively (figure 1).

• Seven patients died before any post procedural imaging could be undertaken. These were all from the emergency group.

Rates of secondary intervention

• The overall rate of secondary intervention was 18.8% (48 of 256 patients). Median interval from EVAR to first secondary intervention was 233 days (range 2 to 2144 days).
• Secondary intervention rate was higher in the emergency patient cohort than the elective one, 31.0% (13/42) compared to 17.6% (35/198)

**Normal vs abnormal first follow-up CTA in elective patients**

• The 203 elective patients were subdivided into two groups: normal first postoperative CTA and abnormal first postoperative CTA. Rates of secondary interventions were analysed (table 1, figure 2).

• Secondary intervention rate in all elective patients was 17.6% at median followup of 43 months.

• In the cohort of patient with a normal first CTA this was substantially less at 7.6%.

**Elective patient with a normal first CTA: Talent vs Endurant stentgrafts**

• 55 Endurant and 55 Talent stentgraft patients in this cohort.

• In the subset of patients with a normal first CTA who received a Talent stent graft seven patients required a secondary intervention - a rate of

12.7% at 43 months median followup.

• Interestingly the subset of patients with a normal first CTA who received an Endurant stentgraft had no secondary interventions at 43 months median followup (table 2, figure 3).
Fig. 1: All cause mortality Kaplan Meier curve

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<table>
<thead>
<tr>
<th>Type</th>
<th>Total</th>
<th>No. of patients requiring secondary intervention</th>
<th>Percentage</th>
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<tr>
<td>Abnormal CTA</td>
<td>66</td>
<td>25</td>
<td>37.90%</td>
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<tr>
<td>Normal CTA</td>
<td>132</td>
<td>10</td>
<td>7.60%</td>
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<tr>
<td>Overall</td>
<td>198</td>
<td>35</td>
<td>17.60%</td>
</tr>
</tbody>
</table>

Table 1: Normal vs Abnormal first followup CTA in elective patients

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Fig. 2: Kaplan-Meier chart representing rates of secondary intervention in elective patients with a normal or abnormal first CTA.

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<table>
<thead>
<tr>
<th>Type</th>
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<th>No. of patients requiring secondary intervention</th>
<th>Percent (%)</th>
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</thead>
<tbody>
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<td>Stentgraft type</td>
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<tr>
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<td>0</td>
<td>0</td>
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<tr>
<td>Talent</td>
<td>55</td>
<td>7</td>
<td>12.7</td>
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<tr>
<td>Overall</td>
<td>110</td>
<td>7</td>
<td>6.40</td>
</tr>
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</table>

Table 2: Elective patients with a normal first CTA: Talent vs Endurant stent grafts

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Fig. 3: Kaplan Meier chart of elective patients with a normal first CTA: Talent vs Endurant stentgrafts

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Conclusion

• In elective EVAR patients with a normal first follow-up scan the overall rate of secondary intervention was 7.6% at 43 months median follow-up, compared to 17.6% in all elective patients and 16-33% in published literature [2-6].

• The finding that no secondary interventions were undertaken in 55 patients undergoing elective EVAR with Endurant stentgrafts and a normal first CTA is interesting but requires further confirmation.

• We intend to analyse the effect of further baseline parameters such as neck anatomy and compliance with IFU, device type and elective vs acute EVAR.


