Ruptured AAA
Open and Endo are Complementary and Required

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Disclosures

• Consultant
  – Arsenal, Cook, Endologix, Gore, Medtronic, Cook

• Research Grant /research support
  – Cook, Gore, Maquet, Medtronic, Siemens

• Advisory Board
  – Endologix, Gore, Medtronic, Siemens

• Paid speaker
  – Cook, Endologix, Gore, Maquet, Medtronic, Siemens

• Major stokeholder
  – none

No conflict of interest
First EVAR in rAAA in the World

at Montefiori Hospital, NYC in April 1994 by F. Veith & T. Ohki
Since then, for treatment of Ruptured AAA...
Open Repair and EVAR became complementary
Evidence to prove this hypothesis?

1 Meta – Analysis
1 Cochrane review
5 RCT’s
> 100 case control studies
Cohort Study

- Collected data from 1049 in 49 centers
- 1037 EVAR and 763 Open repair
- Overall mortality was 21.2%

EVAR is better with lower procedural mortality in favourable anatomy

<table>
<thead>
<tr>
<th></th>
<th>EVAR</th>
<th>OR</th>
<th>P</th>
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<tbody>
<tr>
<td>30 day mortality</td>
<td>19.7%</td>
<td>36.3%</td>
<td>&lt;0.0001</td>
</tr>
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</table>
5 RCT’s: EVAR vs. Open Repair

Nottingham - 2006
ACE - 2011
AJAX - 2013
ECAR - 2015
IMPROVE - 2017

Hinchliffe R, et al.
AJVS 2006
Becquemin JP et al.,
AJVS 2011
Reimerink J,
Ann Surg 2013
Desgranges =
EJVES 2015

➢ 4 out of 5 RCT showed no survival benefit of EVAR over OR
### IMPROVE Trial @ 3 yrs

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>EVAR</th>
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<tbody>
<tr>
<td>30 day mortality</td>
<td>36.4%</td>
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<tr>
<td>3 yrs.mortality</td>
<td>42%</td>
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<tr>
<td>Reinterventions @3 yrs</td>
<td>38%</td>
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<tr>
<td>QALY’s</td>
<td>1.14</td>
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<tr>
<td>Cost</td>
<td>16.878</td>
</tr>
<tr>
<td></td>
<td>Open Repair</td>
</tr>
<tr>
<td>30 day mortality</td>
<td>40.6%</td>
</tr>
<tr>
<td>3 yrs.mortality</td>
<td>54%</td>
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<tr>
<td>Reinterventions @3 yrs</td>
<td>36%</td>
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<tr>
<td>QALY’s</td>
<td>0.97</td>
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<td>Cost</td>
<td>19483</td>
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<tr>
<td>0.62</td>
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<tr>
<td>0.008</td>
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<tr>
<td>0.88</td>
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<tr>
<td>0.048</td>
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<td>0.120</td>
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- No 30 day but 3 yrs. survival benefit after EVAR
- Women may benefit more than men from EVAR
Meta-Analysis

- 3 RCT (AJAX, ECAR, IMPROVE): 836 patients
- Study endpoint was 90 day survival

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<td>90 day mortality</td>
<td>34.3%</td>
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Survival is similar for all patients
30 day mortality

Major complications

Moderate-quality evidence suggesting no difference in early mortality and long-term data are lacking
### Correlation of Hospital Size and Tx of rAAA

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<tr>
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Courtesy of Matt Thompson
# Correlation of Hospital Size and Tx of rAAA

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Courtesy of Matt Thompson
Surgeon Volume and Outcome

- 5972 OR and 8121 EVAR analyzed
- Institutional volume: low < 7, medium 7-30 and high >30
- In OR, institutional volume correlated with mortality
- Surgeon volume, (defined low < 2, medium 3-9, high >9)

- Mortality
  - 8.7% low volume surgeon
  - 4.8% medium volume surgeon
  - 3.3% high volume surgeon
Mortality from ruptured abdominal aortic aneurysm: clinical lessons from a comparison of outcomes in England and the USA

Alan Karthi kesalingam, Peter J Holt, Alberto Vidal-Diez, Bans A Ozlemir, Jan D Palominski, Robert J Hinchliffe, Matthew M Thompson

Summary
Background The outcome of patients with ruptured abdominal aortic aneurysm (rAAA) varies by country. Study of practice differences might allow the formulation of pathways to improve care.

Methods We compared data from the Hospital Episode Statistics for England and the Nationwide Inpatient Sample for the USA for patients admitted to hospital with rAAA from 2005 to 2010. Primary outcomes were in-hospital mortality, mortality after intervention, and decision to follow non-corrective treatment. In-hospital mortality and the rate of non-corrective treatment were analysed by binary logistic regression for each healthcare system, after adjustment for age, sex, year, and Charlson comorbidity index.

Findings The study included 11799 patients with rAAA in England and 23838 patients with rAAA in the USA. In-hospital mortality was lower in the USA than in England (53-95% [95% CI 51-26-54-85] vs 65-90%; p<0.0001). Intervention (open or endovascular repair) was offered to a greater proportion of cases in the USA than in England (19-174 [80-43%] vs 6897 [58-45%; p<0.0001]) and endovascular repair was more common in the USA than in England (4003 [20-88%] vs 589 [8-54%]; p<0.0001). Postintervention mortality was similar in both countries (41-77% for England and 41-65% for USA). These observations persisted in age-matched and sex-matched comparisons. In both countries, reduced mortality was associated with increased use of endovascular repair; increased hospital caseload (volume) for rAAA, high hospital bed capacity, hospitals with teaching status, and admission on a weekday.

Interpretation In-hospital survival from rAAA, intervention rates, and uptake of endovascular repair are lower in England than in the USA. In England and the USA, the lowest mortality for rAAA was seen in teaching hospitals with larger bed capacities and doing a greater proportion of cases with endovascular repair. These common factors suggest strategies for improving outcomes for patients with rAAA.

Figure 1: In-hospital mortality for ruptured abdominal aortic aneurysm after stratified matching for sex and 5-year age grouping

In Hospital Mortality for rAAA varies by country
Endovascular technology, hospital volume, and mortality with abdominal aortic aneurysm surgery


Objective: To determine whether the introduction of endovascular technology changed the relationship of hospital volume to mortality with abdominal aortic aneurysm repair.

Methods: Data from all hospitals in the United States that performed abdominal aortic aneurysm surgery on Medicare patients from 2001 to 2003 were obtained from the national Medicare database. The primary outcome variable was death $\leq$ 30 days of operation or before hospital discharge. We determined the effect of total hospital volume on operative mortality for all types of repair and for endovascular and open repair separately. All analyses were adjusted for patient risk using logistic regression.

Results: The proportion of abdominal aortic aneurysms repaired with an endovascular approach increased from 27% to 39% during the 3-year study period. Hospital volume was significantly related to operative mortality in all comparisons. Mortality rates were 80% higher at hospitals in the lowest vs the highest quartile of total volume (odds ratio [OR], 1.81; 95% confidence interval [CI], 1.62-2.04) when considering all types of repair together. A similar relationship between total hospital volume and mortality was found when separately examining open repair (OR, 1.52; 95% CI, 1.33-1.73) and endovascular repair (OR, 1.68; 95% CI, 1.32-2.22). Higher-volume hospitals were more likely to use the endovascular approach. The highest-volume hospitals used the endovascular approach 44% of the time compared with only 18% at the lowest-volume hospitals. This greater use of the endovascular procedure at high-volume hospitals accounted for 37% of the difference in mortality between high- and low-volume hospitals.

Conclusion: As the endovascular repair becomes more widespread, the relationship between hospital volume and operative mortality still remains. High-volume hospitals are more likely to use the endovascular approach, and this explains a significant portion of the observed impact of hospital volume on mortality. (J Vasc Surg 2008;47:1150-4.)
Centralization > Specialization > Outcome

- Analysis of surgical speciality and 30d mortality rAAA

- General surgeons: 50%

- Vascular surgeons: 33.7%

Morbidity and return to theatre similar difference
**Conclusions:** The early results show that emergent endovascular treatment of hemodynamically stable and unstable patients is associated with a limited mortality of 18% once a standardized protocol is established. There is an increased recognition of emerging complications with an endovascular approach, and a synchrony of disciplines must be developed to initiate a successful program for endovascular treatment of r-AAA. (J Vasc Surg 2006;44:1-8.)
Infrastructure is also required
Education & Training of rAAA Management is key

Theory alone won’t learn you how to swim

Anders Wanhainen, Fabio Verzini, Isabelle Van Herzeel, Eric Allaer, Matthew Bown, Tina Cohnert, Florian Dick, Joost van Herwaarden, Christos Kar Kos, Mark Koelmay, Til Köbel, Ian Lofertus, Kevin Mann, Germano Mellissano, Janet Powell, Zoltán Széberin

ESVS Guidelines Committee, Gert J. de Borst, Nabil Chakfe, Sebastian Debus, Rob Hinchliffe, Stavros Kakos, Igor Koncar, Philippe Kohl, Jes S. Lindholm, Melina de Vega, Frank Vermassen


<table>
<thead>
<tr>
<th>Recommendation 3</th>
<th>Class</th>
<th>Level</th>
<th>References</th>
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<td>Abdominal aortic aneurysm repair should only be considered in centres with a minimum yearly caseload of 30 repairs.</td>
<td>IIA</td>
<td>C</td>
<td>[64,278,328,788]</td>
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Summary & Conclusions

➢ 5 RCT Trials, 1 Metanalysis, 1 Cochrane Review
➢ Lots of high level evidence, but with moderate quality (Cochrane)
➢ 4 out of 5 RCT showed no survival benefit of EVAR over OR
➢ Evidence is therefore not for NOR against EVAR in rAAA
➢ EVAR for morphological suitable patients and better in women
➢ OR is also needed as an treatment option
➢ Infrastructure and volume does matter
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