HOW TO IMPLEMENT A SUCCESSFUL PROGRAMME FOR EVAR OF RUPTURED ANEURYSMS

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On behalf of Vascular Specialists UHZ
Disclosure

Speaker name: Zoran Rancic

I have the following potential conflicts of interest to report:

✓ Consulting
  Medtronic Academia
April 1994
FIRST ENDO
REPAIR
(EVAR)
FOR RAAA
IN WORLD

Inoperable Patient
Hostile Abd
EF 16%
BP 60 mmHg
Severe Pain

Courtesy of Frank J. Veith
Editor's Choice — Endovascular Aneurysm Repair Versus Open Repair for Patients with a Ruptured Abdominal Aortic Aneurysm: A Systematic Review and Meta-analysis of Short-term Survival

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WHAT THIS PAPER ADDS
There is a clinical equipoise about the best treatment for a patient with a ruptured abdominal aortic aneurysm: endovascular (EVAR) or open repair (OR). The results of the present systematic review indicate that endovascular aneurysm repair is not inferior to open repair with regard to short-term survival. This supports the use of EVAR in suitable patients and OR as a reasonable alternative. Possible future directions are centralisation of care in high-volume hospitals, ‘EVAR-first’/hybrid repair, or an ‘EVAR-only’ approach.

Background: There is clinical equipoise between open (OR) and endovascular aneurysm repair (EVAR) for the best treatment of ruptured abdominal aortic aneurysm (RAAA).

Objective: The aim of the study was to perform a systematic review and meta-analysis to estimate the short-term (combined 30 day or in-hospital) survival after EVAR and OR for patients with RAAA. Data sources included Medline, Embase, and the World Health Organization International Clinical Trials Registry until 13 January 2014. All randomised controlled trials (RCTs), observational cohort studies, and administrative registries comparing OR and EVAR of at least 50 patients were included. Articles were full-length and in English.

Methods: Standard PRISMA guidelines were followed. The methodological quality of RCTs was assessed with the Cochrane Collaboration’s tool for assessing risk of bias. The quality of observational studies was assessed with a modified Cochrane Collaboration’s tool for assessing risk of bias, the Newcastle–Ottawa Scale, and the Methodological Index for Non-Randomized Studies. The results of the RCTs, of the observational studies, and of the administrative registries were pooled separately and analysed with the use of a random effects model.

Results: From a total of 3,769 articles, three RCTs, 21 observational studies, and eight administrative registries met the inclusion criteria. In the RCTs, the risk of bias was lowest and the pooled odds ratio for death after EVAR versus OR was 0.90 (95% CI 0.65–1.24). The majority of the observational studies had a high risk of bias and the pooled odds ratio for death was 0.44 (95% CI 0.37–0.53). The majority of the administrative registries had a high risk of bias and the pooled odds ratio for death was 0.54 (95% CI 0.47–0.62).

Conclusion: Endovascular aneurysm repair is not inferior to open repair in patients with a ruptured abdominal aortic aneurysm. This supports the use of EVAR in suitable patients and OR as a reasonable alternative.

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Keywords: Open repair, Endovascular aneurysm repair

MeSH keywords: Abdominal Aortic Aneurysm, Aortic Rupture, Vascular Surgical Procedures
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WHAT THIS PAPER ADDS

There is clinical equipoise about the best treatment for a patient with a ruptured abdominal aortic aneurysm (RAA). The options include endovascular (EVAR) or open repair (OR). The results of the current available evidence do not support the statement that EVAR is inferior to OR. EVAR in suitable patients and OR as a reasonable alternative in high-volume hospitals, “EVAR-first”/hybrid repair, or an “EVAR-first” strategy could be a reasonable approach.

Background: There is clinical equipoise about the best treatment for a patient with a ruptured abdominal aortic aneurysm (RAA). The options include endovascular (EVAR) or open repair (OR). The results of the current available evidence do not support the statement that EVAR is inferior to OR. EVAR in suitable patients and OR as a reasonable alternative in high-volume hospitals, “EVAR-first”/hybrid repair, or an “EVAR-first” strategy could be a reasonable approach.

Objective: The aim of the study was to perform a systematic review and meta-analysis to evaluate the differences in survival (combined 30-day or in-hospital) after EVAR and OR. The search was performed in Medline, Embase, and the World Health Organization International Clinical Trials Registry Platform. All randomised controlled trials (RCTs), observational cohort studies, and case series of EVAR and OR of at least 50 patients were included. Articles were excluded if they did not report outcomes of EVAR and OR.

Methods: Standard PRISMA guidelines were followed. The network meta-analysis was performed using Cochrane Collaboration’s tool for assessing risk of bias. The 95% CIs were calculated using the modified Cochrane Collaboration’s tool for assessing risk of bias. The network meta-analysis was performed using the Network Meta-Analysis tool. The results of the network meta-analysis were presented in a forest plot, and the administrative registries were pooled separately and analysed using Stata 13.0.

Results: From a total of 3,769 articles, three RCTs, 21 observational cohort studies, and 33 case series met the inclusion criteria. In the RCTs, the risk of bias was low or unclear. In the observational cohort studies, the pooled odds ratio for death was 0.49 (95% CI 0.37–0.63). The majority of the studies showed a lower risk of bias and the pooled odds ratio for death was 0.54 (95% CI 0.42–0.69). The overall effect of EVAR was 0.56 (95% CI 0.38–0.81). This supports the use of EVAR in suitable patients and OR as a reasonable alternative in high-volume hospitals, “EVAR-first”/hybrid repair, or an “EVAR-first” strategy could be a reasonable approach.

Conclusion: Endovascular aneurysm repair is not inferior to open repair for patients with a ruptured abdominal aortic aneurysm. This supports the use of EVAR in suitable patients and OR as a reasonable alternative in high-volume hospitals, “EVAR-first”/hybrid repair, or an “EVAR-first” strategy could be a reasonable approach.

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WHAT THIS PAPER ADDS
There is clinical equipoise about the best treatment for a patient with a ruptured abdominal aortic aneurysm (RAA); endovascular (EVAR) or open repair (OR). The results of this systematic review and meta-analysis suggest that EVAR in suitable patients is not inferior to open repair with regard to 30-day mortality. EVAR is associated with less bowel ischemia, and EVAR in suitable patients and OR as a reasonable alternative in high-volume hospitals, ‘EVAR-first’/hybrid repair, or an ‘EVAR-first’/hybrid repair with a low threshold for conversion to open repair.”

Background: There is clinical equipoise about the best treatment for a patient with a ruptured abdominal aortic aneurysm (RAA); endovascular (EVAR) or open repair (OR). The aim of the study was to perform a systematic review and meta-analysis of randomized controlled trials (RCTs) and observational studies. A systematic review and meta-analysis of randomized controlled trials (RCTs), observational cohort studies, and case-control studies of EVAR and OR of at least 50 patients were included. Articles were included if they were written in English or if the conclusion was translated to English. Methods: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed. The risk of bias assessment was performed using the Cochrane Collaboration’s tool for assessing risk of bias. The ‘double-blind’ design was used to assess the risk of bias. The methodological index for Non-Randomized Studies (MINORS) was used to assess the risk of bias. The results of the individual studies were pooled separately and an overall pooled estimate was calculated. Results: From a total of 3,769 articles, three RCTs, 21 observational studies, and one case-control study met the inclusion criteria. In the RCTs, the risk of bias was low for both OR and EVAR. The pooled odds ratio for death was 0.90 (95% CI 0.65—1.24). The majority of the studies were high quality, and the pooled odds ratio for death was 0.44 (95% CI 0.37—0.53). The risk of bias and the pooled odds ratio for death was 0.54 (95% CI 0.29—1.01). Conclusion: Endovascular aneurysm repair is not inferior to open repair for patients with a ruptured abdominal aortic aneurysm. This supports the use of EVAR in suitable patients and OR as a reasonable alternative in high-volume hospitals, ‘EVAR-first’/hybrid repair, or an ‘EVAR-first’/hybrid repair with a low threshold for conversion to open repair.

Keywords: Open repair, Endovascular aneurysm repair
MeSH keywords: Abdominal Aortic Aneurysm, Aortic Rupture, Endovascular Aneurysm Repair, Mortality

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![Graph showing odds ratio and events for EVAR and OR studies.](image-url)
Clinical experience UHZ

• 1997-2014

• 330 repairs for acute AAA presentation

• 42% OR and 58% ER
UHZ rAAA experience 1997-2014

30-day mortality

- rOR: 33%
- rEVAR: 17%
- RRR: 58%
Define Standard operating procedure!
Hemodynamic
Hypotensive hemostasis

- **permissive hypovolemia**
  - No or little infusions

- **controlled hypotension**
  - MAP > 50 mmHg
  - SBP > 70 mmHg

- **Diagram**
  - Stable: 50%
  - Shock < 50 mmHg: 17%
  - Shock < 70 mmHg: 33%
Management of blood pressure

- Normal or high
  - Pharmacological lowering
    - Target BP < 90 mmHg

- Low
  - Stable
    - Fluid restriction
      - Target BP ≥ 70 mmHg
  - Unstable
    - Catecholamines fluids
      - Target BP ≥ 70 mmHg
ENDOCLAMPING in case of hemodynamic crash
HOW TO IMPLEMENT Hemodynamic FOR SUCCESSFUL PROGRAMME?
It is a package

In-hospital

Pre-hospital
YOU DETERMINE THE OUTCOME
All the Staff INVOLVED IN TREATMENT AND REFFERAL OF PTS WITH RAAA has to know!
Hemodynamics

IMAGING

TEAM

ACS

Procedures
Preoperative CTA
- confirms diagnosis
- planing
Preoperative CTA
- confirm diagnosis

4 \( \div \) 350 (1%)
CTA: to define the anatomy and suitability for rEVAR

Proximal neck

Exclusion criteria for REVAR

Distal access
Good anatomy and suitable rEVAR
Anatomical Limitations for „simple“ rEVAR
Chimney and Periscope Graft
Sizing issue

Aortic endograft sizing in trauma patients with hemodynamic instability

Frederik H.W. Jonker, MD,* Henne J. M. Verhagen, MD, PhD,* Hamid Mozhibian, MD,* Kimberly A. Davis, MD,* Frans L. Moll, MD, PhD,* and Bart E. Muhu, MD, PhD,* New Haven, Conn; and Rotterdam and Utrecht, The Netherlands

Objective: To investigate changes in aortic diameter in hemodynamically unstable trauma patients and the implications for sizing of thoracic endovascular aortic repair (TAAA) methods.

Methods: We retrospectively evaluated all trauma patients with a pulse pressure <95 mm Hg and a pulse ≥100 bpm and abdomen at admission and as another women and 2009. The CT examinations were reviewed in a blinded manner with an inter-observer correlation of 0.5. Differences in the control groups were compared using the paired t-test. Results: Forty-three patients were identified, including: 26 < 15, mean pulse and blood pressure when aortic diameter was significantly larger than the control, hemodynamically unstable, at all evaluated levels. A diameter was most consistent at the level of the mid descending thoracic aorta (12.6%, P = 0.004).

Conclusions: The aortic diameter decreases dramatically in aortic diameter could theoretically lead to intact hemodynamically unstable TAAA patients requiring aortic diameters in individual hemodynamically unstable (2010;52:39-44.).

Fig 2. Mean increase in aortic diameter in patients with a pulse ≥130/min. The mean increase in aortic diameter was most consistent at the level of the mid descending thoracic aorta (P = 0.003), and at the level of the infrarenal aorta (P = 0.004), the mean increase in aortic diameter failed to reach statistical significance at the remaining levels.
Logistics @ UHZ

Manpower
- 24h/day
  - Anaesthetists,
  - radiologists,
  - ICU doctors,
  - nurses
- On call (30’)
  - Interventional radiologists (n=3)
  - surgeons (n=3)
Standard devices

- Infrarenal fixation devices
  - Excluder

- Transrenal fixation devices
  - Endurant/Zenith/Evita

- Hybrid devices
  - Excluder/Endurant/Zenith/Evita
Chimney technique is standardized!
ACS is frequent!

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Treatment</th>
<th>n=</th>
<th>ACS (%)</th>
<th>30-day mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ACS -</td>
</tr>
<tr>
<td>Starnes</td>
<td>2009</td>
<td>OR EVAR</td>
<td>24</td>
<td>25</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>27</td>
<td>7</td>
<td>16%</td>
</tr>
<tr>
<td>Mayer</td>
<td>2009</td>
<td>EVAR</td>
<td>102</td>
<td>22</td>
<td>9%</td>
</tr>
<tr>
<td>Mehta</td>
<td>2005</td>
<td>EVAR</td>
<td>30</td>
<td>20</td>
<td>13%</td>
</tr>
<tr>
<td>Papavassilious</td>
<td>2003</td>
<td>OR</td>
<td>22</td>
<td>27</td>
<td>25%</td>
</tr>
<tr>
<td>Foy</td>
<td>2003</td>
<td>OR</td>
<td>21</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Rasmussen</td>
<td>2002</td>
<td>OR</td>
<td>135</td>
<td>33</td>
<td>9%</td>
</tr>
<tr>
<td>Oehlschlager</td>
<td>1997</td>
<td>OR</td>
<td>38</td>
<td>21</td>
<td>50%</td>
</tr>
<tr>
<td>Fietsam</td>
<td>1989</td>
<td>OR</td>
<td>100</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
ACS is a serial killer!
Abdominal Compartment Syndrome
UHZ algorithm for ACS is defined.
HOW TO IMPLEMENT ACS FOR SUCCESSFUL TREATMENT?
1. BE AWARE!
1. BE AWARE!
2. MEASURE AN URINARY BLADDER PRESSURE!
3. IN CASE OF DECOMPRESSION BLEEDING: PATCH ON RUPTURE SITE
Team Work

Surgeon
Preop
- Vascular surgeon
- Radiologist
- Anaesthesiologist

Intraop
- Vascular surgeon
- Interventional radiologist
- Anaesthesiologist
- Scrub nurse

Postop
- Vascular surgeon
- Radiologist
- ICU staff
## Communication example

<table>
<thead>
<tr>
<th>Role</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Referral hospital</td>
<td>• No infusions/systolic BP 70-90 mm Hg</td>
</tr>
<tr>
<td>Anaesthetist</td>
<td>• rAAA is coming</td>
</tr>
<tr>
<td>ICU</td>
<td>• IC bed available</td>
</tr>
<tr>
<td>Radiologist</td>
<td>• TA EVAR CT protocol/EVAR TEAM</td>
</tr>
<tr>
<td>Trauma Surgeon</td>
<td>• Emergency Room/Theatre</td>
</tr>
<tr>
<td>Vascular Surgery Resident</td>
<td>• Must be free and ready</td>
</tr>
</tbody>
</table>
Significant decrease of rAAA @ UHZ
REVAR TEAM UHZ 1998-2014

Radiologists
- Thomas Pfammatter
- Ulrich Blum
- Paul Hilfiker
- Ursula Wolfensberger
- Roger Pfiffner
- Lukas Hechelhammer
- Susanne Abderhalden
- Michael Glenck
- Gilbert Puippe

Surgeons
- Mario Lachat
- Jürg Schmidli
- Andreas Künzli
- Michael SzenteVarga
- Dieter Mayer
- Jean-Marc Gauer
- Markus Wilhelm
- Alberto Weber
- Simone Hofer
- Zoran Rancic
- Felice Pecoraro
- Daniel Becker
- Philippe Ghibu

INTERVENTIONAL VASCULAR SPECIALISTS (N=22)
rAAA experience UHZ 1997-2014

- 22 vascular specialists
  - 13 vascular surgeons & 9 interventional radiologists
- 330 cases in 17 years
  - 145 OR & 185 ER
- Overall 25 cases per VS/IR pair
  - <2 cases per year/VS/IR pair
- Experience of «grand-fathers» (>1 year of experience)
  - <3 cases/year per VS/IR pair
HOW TO IMPLEMENT TEAM FOR SUCCESSFUL TREATMENT?
Training of technical skills: Generic or Patient-specific Rehearsal
Training of human factor skills: ORCAMP

Mixed Reality
Conclusion

1. EVAR is better, based on literature
Conclusion

1. EVAR is better, based on literature
2. Identify the patient population and critical key points
Conclusion

1. EVAR is better, based on literature
2. Identify the patient population and critical key points
3. Elaborate protocols and necessary logistics and get protocols accepted by partners
Conclusion

1. EVAR is better, based on literature
2. Identify the patient population and critical key points
3. Elaborate protocols and necessary logistics and get protocols accepted by partners
4. Teach medical partners (IR in Zurich) all medical care supporters (first aid-medical students)
Conclusion

1. EVAR is better, based on literature
2. Identify the patient population and critical key points
3. Elaborate protocols and necessary logistics and get protocols accepted by partners
4. Teach medical partners (IR in Zurich) all medical care supporters (first aid-medical students)
5. Consider time horizon of about 2-5 years
HOW TO IMPLEMENT A SUCCESSFUL PROGRAMME FOR EVAR OF RUPTURED ANEURYSMS

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