REVIEW

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 CME ☆

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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 obersvational 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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INTRODUCTION

The death rate in all patients with a ruptured abdominal aortic aneurysm (RAAA) is around 80%.[1] One-third of all patients with RAAA do not reach the hospital alive, and one-third do not have an intervention. Of the patients having an intervention, only half survive intervention and admission. The traditional intervention is open surgical repair (OR) with exclusion of the aneurysm with a synthetic tube or bifurcated graft. Endovascular aneurysm repair (EVAR) was developed in the 1990s. The experience with elective EVAR has led to its increasing use in the emergency setting. Between 46% and 64% of patients with RAAA have suitable aortic anatomy for EVAR.[2,3]

☆ Appendix 1: protocol, quality assessment RCTs, quality assessment observational studies and administrative registries, search PubMed, search Embase, Figs. 7—10.

CME To access continuing medical education questions on this paper, please go to www.vascularedu cation.com and click on 'CME'

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Observational studies have reported improved short-term survival after EVAR compared with OR. Observational studies however have methodological limitations, leading to biased estimates of outcome. Randomised controlled trials are regarded as providing the best evidence for the relative efficacy of interventions. An early trial from the UK did not show any benefit of EVAR in patients with RAAA.[4] Recently, the results of two larger RCTs have been published.[2,3] These new studies might help to better determine whether EVAR improves short-term survival when compared with open repair, which in turn might help caregivers to decide on the best treatment strategy.

OBJECTIVE

The aim of this study was to perform a systematic review and meta-analysis to obtain the best estimates of the short-term (combined 30-day or in-hospital) survival after endovascular repair compared with open repair for patients with a RAAA in randomised controlled trials and observational studies.

METHODS

The present review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[5] The objectives, the methodology, and the inclusion criteria were prespecified in a protocol (Appendix 1).

Search strategy

A systematic search in Medline through Pubmed and in Embase through Ovid was conducted with the assistance of a clinical librarian. The search strategy was built around the participants, intervention, comparison, outcomes, and study design (PICOS) framework (Appendix 1). Additionally, the World Health Organization International Clinical Trials Registry Platform (WHOICTRP) was searched for relevant RCTs.

The last search was done on the 13 January 2014. Two authors (SvB, AC) independently screened the titles and abstracts of the identified articles for relevance. Subsequently, the relevant full length articles were assessed by two authors (SvB, AC) to check if they met the inclusion criteria. Disagreements were resolved by discussion with two other authors (MK, RB). The reference list of the included articles was checked for other eligible articles and a cited reference search in the Web of Science was done.

Eligibility criteria

All RCTs comparing OR and EVAR, and all observational studies comparing OR and EVAR that included at least 50 patients were included. Observational studies that included patients based on the International Classification of Diseases (ICD) or other forms of coding were analysed separately, and are referred to as administrative registries. Studies were included if they were full length and in English. Studies reporting more than once on the same patient population were included only once, based on relevance and size. Studies were excluded if they did not allow extraction of two-by-two contingency tables for the endpoint 30-day or in-hospital death rate.

Assessment of study quality

The methodological quality of the included articles was independently assessed by two authors (SvB, AC). For the RCTs, The Cochrane Collaboration's tool for assessing risk of bias was used (Appendix 1). For the observational studies and administrative registries, a tool based on the Cochrane Collaboration's tool for assessing risk of bias, the Newcastle—Ottawa Scale, and the Methodological Index for Non-Randomized Studies (MINORS) was used (Appendix). Again, disagreements were resolved by discussion with two other authors. The risk of bias within studies was reported as an online supplement (Appendix 1, Figs. 7—9).

Data collection

Data were extracted independently by two authors (SvB, AC) with use of a standardised form in Microsoft Office Access 2003 (Microsoft Corporation, Redmond, WA, USA). The following data were collected: study design (RCT, observational study or administrative registry), study period, study size, country, and rejection rate. For the included RCTs, the number of events and the total number of patients per type of intervention were extracted based on intention-to-treat analysis. For the included observational studies, the number of events and the total number of patients per type of intervention were extracted based on as-treated analysis. Authors were contacted to obtain missing data if necessary. When the authors were unable to provide missing data, the study was excluded from the analysis.

Statistical analysis

The primary endpoint was the combined 30-day and in-hospital death rate. If not reported, the 30-day or in-hospital death rate was used instead. For the observational studies, a secondary endpoint was the odds ratio of EVAR on death rate after adjustment for age, sex, and hemodynamic stability. The statistical analysis was performed using Review Manager 5.2 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration) and Stata/SE 11.0 (StataCorp, College Station, TX, USA). Three meta-analyses were done. The first meta-analysis included all RCTs, the second all observational studies, and the third all administrative registries. Pooled effects of EVAR and OR were presented as odds ratios with 95% CI. Because heterogeneity was expected, the meta-analyses were done a priori with the use of a random effects model. A prespecified sensitivity analysis of observational studies was done by pooling the odds ratios of EVAR versus OR adjusted for at least, age,[6] sex,[7] and hemodynamic stability.[8] Heterogeneity between studies was determined with the I^2 statistic. An I^2 between 30% and 50% was considered moderate heterogeneity and between 60% and 90% as substantial heterogeneity. Funnel plots were created and