A systematic review and meta-analysis of endovascular repair (EVAR) for ruptured abdominal aortic aneurysm

CRD summary
The authors concluded that mortality from endovascular abdominal aortic aneurysm repair for ruptured abdominal aortic aneurysm appeared lower than in open repair of AAA. Shortcomings in the review methodology, potential for missed studies and a lack of information about study design and methodological quality suggested that the findings of this review may not be reliable.

Authors' objectives
To determine the mortality rate from endovascular abdominal aortic aneurysm repair (EVAR) due to ruptured abdominal aortic aneurysm (AAA).

Searching
MEDLINE and EMBASE were searched up to 2007 for articles published in English. Search terms were reported. References of identified articles and several relevant book chapters were handsearched.

Study selection
Studies were eligible for inclusion if they reported data on mortality rates following emergency EVAR for ruptured AAA, irrespective of operative techniques or stent design. Studies of acute but not ruptured AAA were excluded. Studies of only one patient group, studies with less than five patients, case reports, review articles and letters were excluded.

Included studies were of EVAR for ruptured AAA on patients with a mean preoperative AAA size of 7.28 cm. Most patients were male. Average age was 74.1 years. For the purpose of the review, mortality was defined as in-hospital or 30-day mortality. Other outcomes reported in the review were: morbidity; length of hospital stay; length of intensive care unit stay; blood loss; and intra-operative time. All of the included studies were conducted in Europe or USA.

The study selection appears to have been carried out by one reviewer.

Assessment of study quality
The authors did not state that they assessed study validity.

Data extraction
For morbidity and mortality, the number of events was extracted or calculated from percentages and used to calculate a point estimate with corresponding 95% confidence intervals (CI). All morbidity was grouped together. Length of hospital stay and average blood loss were extracted. For the purposes of analysis, the differences between different measures of central location were ignored. The mid-date of each study and study location were extracted as a potential covariates. The data appeared to have been extracted by one reviewer.

Methods of synthesis
For mortality and morbidity, data was combined using a random-effects log odds outcome scale. Statistical heterogeneity was assessed using $X^2$ and $I^2$ statistics. A meta-regression model was used to explore heterogeneity with study location and mid-date as covariates. Continuous outcomes were combined using unweighted averages. Publication bias was assessed using funnel plots and Egger's test.

Results of the review
Thirty-one studies were included for the review (n=982). The designs of included studies were not reported.

Ruptured AAA following treatment with EVAR was associated with a 24% mortality rate (95% CI 20% to 28%); 31
studies). The pooled morbidity rate for ruptured AAA following EVAR was 44% (95% CI 33% to 55%; 21 studies). There was evidence of statistically significant heterogeneity for both outcomes (p<0.001, $I^2$=49% and 75%). There was evidence of publication bias for mortality and significant funnel plot asymmetry for morbidity. The unweighted average procedure time was 155.1 min (20 studies). The unweighted average intensive care unit stay was 113 hours (six studies). The unweighted average blood loss was 523mL (14 studies).

Mortality, morbidity, blood loss and length of hospital stay and intensive care unit stay did not significantly vary over time. Intra-operative time was significantly lower for more recent studies (20 studies, p=0.024). Morbidity and mortality did not significantly alter according to whether the study was conducted in the USA or Europe.

**Authors’ conclusions**

This review showed mortality rates of 24% from EVAR for ruptured AAA, which was lower than reported for open repair of AAA. The presence of publication bias meant that mortality rates may have been higher.

**CRD commentary**

The review addressed a clear question. Inclusion criteria were well-defined for intervention, outcomes and participants, but broad for study design. Only two databases were searched, so relevant data may have been missed. Language restrictions were imposed, which introduced a risk of language bias. There was no search to identify unpublished material. Publication bias was assessed and evidence of significant publication bias was found. Appropriate steps did not appear to have been taken in the study selection and data extraction processes to minimise reviewer error and bias. The methodological quality of included studies was not assessed. There was insufficient information provided about the included studies to determine the quality of the included studies. No information was provided on the study design and studies appear to have been combined regardless of design. Appropriate methods were used to combine the studies, statistical heterogeneity was assessed and potential sources of heterogeneity were investigated. However, for some outcomes the authors appeared to pool results simply by calculating an average across studies. Shortcomings in the review methodology, potential for missed studies and the lack of information about study design and methodological quality suggested that the findings of this review may not be reliable.

**Implications of the review for practice and research**

**Practice:** The authors did not state any recommendations for practice.

**Research:** The authors stated that a randomised controlled trial of EVAR for ruptured AAA should be conducted; ethical problems may be encountered in terms of gaining informed consent.

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