Endovascular repair of ruptured abdominal aortic aneurysms: a systematic review and meta-analysis

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CRD summary
The review concluded that mortality in patients who underwent endovascular aneurysm repair of ruptured aneurysms was lower than that in historical reports of unselected patients who underwent open repair, but that further research is needed. Given the questionable methods used to analyse and compare the low quality underlying evidence base, the authors’ conclusions should be interpreted with caution.

Authors’ objectives
To compare mortality rates of patients undergoing endovascular aneurysm repair of ruptured aneurysms with those undergoing open repair.

Searching
MEDLINE, EMBASE, the Cochrane Database of Systematic Reviews, DARE, the Cochrane Central Register of Controlled Trials (CENTRAL), Best Evidence, and two clinical trial registries were searched from 1994 to 2006 for studies in any language; search terms were reported. Reference lists of reviews, conference proceedings, and one reviewer's files were also searched.

Study selection
Studies that reported mortality in groups or subgroups of 10 or more patients with ruptured infra-renal abdominal aortic aneurysms, in whom endovascular repair had been attempted, were eligible for inclusion. Studies not defining ruptured aneurysm based on computerised tomography or ultrasound, and studies of aneurysm rupture after placement of an endovascular graft were excluded. For duplicate publications, reports with the largest number of patients were included.

The primary outcome of interest was in-hospital mortality.

The mean age of included patients was 74 years; the mean time from emergency room to operating room was 72 minutes. Most included studies used historical or concurrent cohorts undergoing open repair as control groups, although many studies did not have control groups. Most of the grafts used were bifurcated.

Two reviewers assessed studies for inclusion.

Assessment of study quality
Study quality was evaluated according to the following criteria: description of controls, direction of inquiry (prospective or retrospective), blinding of outcome assessors, pre-specification of outcomes, the use of an algorithm for assessing eligibility for endovascular aneurysm repair of ruptured aneurysms, and the disclosure of the source of funding.

The authors did not state how many reviewers assessed study quality.

Data extraction
Mortality and morbidity rates were extracted for the groups undergoing endovascular aneurysm repair of ruptured aneurysms. Authors were contacted for missing data when necessary.

Two reviewers independently extracted data.

Methods of synthesis
Rates were pooled for only the endovascular aneurysm repair groups using a random-effects model (inverse variance function of RevMan). For the open repair groups, mortality data was obtained from a meta-analysis published in 2002.
and a population-based study published in 2005. Heterogeneity was assessed using the $I^2$ statistic. Subgroup analyses were also performed.

**Results of the review**

Eighteen studies were included in the review (n=436 patients undergoing endovascular aneurysm repair of ruptured aneurysms). These included eight case series, five cross-sectional studies, four retrospective cohort studies, and one controlled trial. Methodological quality overall was low: nine studies were prospective, no studies blinded outcome assessors, outcomes were pre-specified in half the studies, and two studies reported on funding sources (although 10 studies reported no conflict of interest).

In-hospital mortality of patients who underwent endovascular aneurysm repair of ruptured aneurysms ranged from 0 to 45%, with pooled mortality being 21% (95% CI 13 to 29; $I^2$=90%; 18 studies). Subgroup analyses were reported (the authors suggested that surgical volume explained the heterogeneity).

A pooled estimate suggested 53% (95% CI 45 to 61; $I^2$=54%; 10 studies) of patients were ineligible for endovascular aneurysm repair.

Details of adverse events were also reported.

**Authors' conclusions**

Mortality in patients who underwent endovascular aneurysm repair of ruptured aneurysms was lower than that in historical reports of unselected patients who underwent open repair, but further research is needed.

**CRD commentary**

The review addressed a clear question and was supported by appropriate inclusion criteria. Attempts to identify all relevant studies in any language were undertaken by searching relevant databases and checking references. Searches were also made for unpublished studies. Suitable methods were employed to reduce the risks of reviewer error and bias for the processes of study selection and data extraction, although the authors did not report on whether such methods were used to assess study quality.

Study quality was adequately assessed (and was used in interpreting the results of the review), with the overall quality of studies being low. Sufficient study details were provided. The authors' rationale for not using control group data appeared reasonable (the groups appeared too different for meaningful comparison). However, the method used to pool data from only a single treatment group appeared questionable, as the meta-analysis software used was designed to calculate a pooled treatment effect by comparing two different treatment groups. The authors compared their results of endovascular aneurysm repair with historical reports of open repair data for which they did not apply the same systematic methods (e.g. study selection, quality assessment, pooling of data).

Although several aspects of the review were well-conducted, the questionable analysis methods used, and the pooling of heterogeneous, poor quality studies indicate that the authors’ conclusions should be interpreted with caution.

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

**Practice:** The authors implied that endovascular aneurysm repair of ruptured aneurysms should be considered in centres where adequate expertise and resources are available without incurring delay.

**Research:** The authors stated that a large randomised trial comparing endovascular aneurysm repair with open repair is needed, but that, in the interim, centres using endovascular aneurysm repair of ruptured aneurysms should contribute data to a central registry. The authors also made several suggestions for improving reporting in non-randomised studies.

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