Meta-analysis and systematic review of the relationship between volume and outcome in abdominal aortic aneurysm surgery

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CRD summary
This review determined the relationship between hospital volume and outcome of surgery for non-ruptured and ruptured abdominal aortic aneurysm (AAA). The authors’ conclusion, that higher annual volume is associated with lower mortality in ruptured and elective AAA repair, appears to follow from the results reported but its robustness is limited by the lack of details on study quality and methodology.

Authors' objectives
To determine the relationship between hospital volume and outcome of surgery for non-ruptured and ruptured abdominal aortic aneurysm (AAA).

Searching
PubMed, EMBASE (1974 to 2006) and the Cochrane Library were searched for relevant articles; the search terms were reported. In addition, UK Hospital Episode Statistics (HES) were obtained for the year 2000.

Study selection
Study designs of evaluations included in the review
The authors did not state what study designs were included in the review.

Specific interventions included in the review
Studies investigating the hospital volume-outcome relationship for elective AAA (emergency admissions without rupture were also considered) and ruptured AAA (ruptures reported separately and elective and ruptured cases reported as a single group were considered) were eligible for inclusion. Studies investigating thoracic and thoracoabdominal aneurysm repairs were excluded, as were those investigating the relationship between surgeon and operation volume.

Participants included in the review
Studies of individuals with AAA were included.

Outcomes assessed in the review
The primary outcome was the mortality rate.

How were decisions on the relevance of primary studies made?
The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors stated that the validity of the included studies was assessed, but did not state how many reviewers performed the assessment. The only criterion reported was the absence or presence of case-mix adjustment.

Data extraction
One reviewer extracted the data. Where available, case-mix adjusted data were extracted. Odds ratios (OR) for mortality were extracted for each study. The HES data were grouped into low- and high-volume hospitals.

Methods of synthesis
How were the studies combined?
Studies that presented sufficient data were combined in fixed-effect meta-analysis, grouped by elective aneurysm repair and ruptured aneurysm repair. Summary data were presented as ORs with their corresponding 95% confidence intervals (CIs).

How were differences between studies investigated?
Studies of ruptured aneurysm studies were further grouped by type or article (ruptures reported separately and elective and ruptured cases reported as a single group).

Results of the review
Thirty-three studies of elective AAA repair (32 primary studies plus HES data, total n=421,299) and 19 studies of ruptured AAA repair (n=45,796) were included in the review.

Thirty-three studies were included in the meta-analyses: 22 studies of elective AAA repair (n=352,888) and 11 studies of ruptured AAA repair (n=29,100).

Elective aneurysm repair.
The mean mortality rate was 9.5% (based on 33 studies, n=421,299). When hospital volume was considered, the OR for mortality was 0.66 (95% CI: 0.65, 0.67) in favour of high-volume hospitals, at a weighted mean threshold between high- and low-volume hospitals of 43 AAAs per year (based on 22 studies). Overall, the 11 studies not included in the meta-analysis showed improved results at higher volume hospitals.

Ruptured aneurysm repair.
The mean mortality rate was 37.1% (based on 19 studies, n=45,796). When hospital volume was considered, the OR for mortality was 0.78 (95% CI: 0.73, 0.82) in favour of high-volume hospitals, at a weighted mean threshold between high- and low-volume hospitals of 15 AAAs per year (based on 11 studies). The results did not significantly change when only studies reporting ruptures only were assessed (data not presented). Of the 7 studies not included in the meta-analysis, four showed improved results at higher volume hospitals and three showed no association between volume and outcome.

Authors' conclusions
Higher annual volume was associated with lower mortality in both ruptured and elective AAA repair, indicating that AAA surgery should be carried out only at higher volume hospitals.

CRD commentary
The review question was clearly stated. Three electronic databases were searched for published data; the authors did not state whether their search was restricted by language. The authors did not state the methods used to select articles, extract the data or assess study validity, thus the likelihood of reviewer error or bias being introduced at these stages cannot be assessed. The authors appear to have included data from more than one category (reporting different case-mixes) within a single study. The authors' conclusions appear to follow from the results reported, but the robustness of the conclusions is limited by the lack of details on study quality and methodology.

Implications of the review for practice and research
Practice: The authors stated that elective and ruptured AAA repair should be performed at high-volume centres.

Research: The authors suggested that volume and performance criteria should be established for AAA surgery.

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