
Endovascular stenting versus open surgery for thoracic aortic disease: systematic review and meta-analysis of perioperative results

Walsh S R, Tang T Y, Sadat U, Naik J, Gaunt M E, Boyle J R, Hayes P D, Varty K

CRD summary

The authors concluded that endovascular thoracic repair reduces perioperative mortality and major neurological injury in stable patients with descending thoracic aortic aneurysms compared to open surgery. The benefit in other aortic conditions was less clear. Despite some minor limitations in reporting the authors' conclusions are likely to be reliable.

Authors' objectives

To compare the effects of endovascular stenting with open surgery for thoracic aortic disease (TAD).

Searching

PubMed and EMBASE were searched without restriction from January 1991 to March 2007; search terms were reported. Conference proceedings from major cardiothoracic, vascular and endovascular meetings were searched from 2000 to 2006. Reference lists of relevant studies were checked.

Study selection

Studies that compared endovascular treatment of thoracic aortic pathology with open surgery were eligible for inclusion in the review. Primary outcomes included 30-day mortality, re-intervention rates (further invasive procedures required to manage complications) and major neurological injury (spinal cord injury or cerebrovascular injury). A number of secondary outcomes were reported (details in paper). The majority of the included studies were retrospective case series; one study was (partial) prospective with some historical case controls. Most studies included emergency procedures. Target conditions included descending TAA, blunt thoracic transaction, acute and chronic traumatic injury of descending thoracic aorta, (acute traumatic/blunt) thoracic aortic rupture, aneurysms, trauma and dissection.

The authors do not state how papers were selected for the review, nor how many reviewers performed the selection.

Assessment of study quality

The quality of the included studies was assessed using the Down and Black score, which evaluated papers on against 27 criteria on reporting, external validity, bias, confounding and power. Each study received a score (maximum possible score 31). The authors did not say how many reviewers performed the validity assessment.

Data extraction

Data were extracted directly into a spreadsheet. Mortality, major injury and major re-intervention rates were recorded. Odds ratios and effect sizes (ES) with their corresponding 95% confidence intervals (CI) were calculated for primary and secondary outcomes (respectively). The authors do not state how data were extracted nor how many reviewers performed the data extraction.

Methods of synthesis

Studies were pooled in a meta-analysis using a random-effects model. Summary estimates for the primary outcomes were reported as OR with 95% CI, and ES estimates were calculated for secondary outcomes. Statistical heterogeneity was assessed using the Cochran Q test. Publication bias was assessed by visual inspection of funnel plots and by the Egger test. Subgroup analysis was performed (aortic pathology).

Results of the review

Seventeen case control studies were included in the review (n=1,109; 538 endovascular and 571 open surgery). Overall, the quality of the included studies was judged to be moderate: quality scores ranged from 9 to 20.

Perioperative mortality: there were 30 deaths (5.57 per cent) in the stenting group and 94 deaths (16.5 per cent) in the open arm group. Endovascular stenting was associated with a reduction in perioperative mortality (OR 0.36, 95% CI:

0.228, 0.578).

Major neurological injury (13 studies, n=958): major complications occurred in 26 (5.4 per cent) of stent patients and 67 (14 per cent) of open patients. A significant reduction in major neurological injury was found in the endovascular stenting group compared with the open arm group (OR 0.39, 95% CI: 0.25, 0.62); no evidence of statistical heterogeneity was found. When the subgroups (perioperative stroke and paraplegia) were analysed, stenting was associated with a statistically significant reduction in risk of paraplegia (OR 0.33, 95% CI: 0.18, 0.63) but not perioperative stroke.

Major reintervention (nine studies, n=769): major re-interventions were required in 29 (7 per cent) of stent patients and 30 (8.4 per cent) of open patients. No statistically significant between-group difference was found; there was no evidence of statistical heterogeneity.

Length of hospital and ITU stay (seven studies, n=468): a reduction in length of ITU stay (ES -1.26 days, 95% CI: -1.77, -0.76) and hospital stay (ES -1.00 days, 95% CI: -1.58, -0.45) was found in the stenting arm. Evidence of significant heterogeneity was found for both outcomes.

Emergency versus elective surgery (three studies, n=187): a reduction in perioperative mortality was found in the endovascular stenting group compared with the open arm group (OR 0.23, 95% CI: 0.09, 0.59). No statistically significant between-group differences were found for major neurological injury or major reintervention.

Subgroups by pathology

Stenting versus open surgery (thoracic aortic aneurysms) (three studies, n=358): mortality (OR 0.25, 95% CI: 0.09, 0.66) and major neurological injury (OR 0.28, 95% CI: 0.13, 0.61) were significantly lower in the endovascular group. No statistically significant between-group differences were found for major reinterventions. Unstable patients were excluded from analysis.

Stenting versus open surgery (descending thoracic trauma) (seven studies, n=274): endovascular repair was associated with a borderline statistically significant reduction in neurological injury compared with open repair (OR 0.17, 95% CI: 0.03, 1.03). No statistically significant difference was found for mortality or major re-interventions.

Stenting versus open surgery (thoracic aortic rupture) (two studies, n=83): no statistically significant difference was found for mortality, major neurological injury or major re-interventions when endovascular repair was compared with open repair in patients with acute thoracic aortic rupture.

Stenting versus open surgery (thoracic aortic dissection): one study was found, results not reported.

No evidence of statistical heterogeneity was found and there was no evidence of publication bias.

Authors' conclusions

Results suggest that endovascular thoracic aortic repair reduces perioperative mortality and major neurological injury in stable patients with descending thoracic aortic aneurysms compared to open surgery. The benefit in other aortic conditions is less clear.

CRD commentary

The review question was supported by clear inclusion criteria. Several sources were searched without restriction and the authors attempted to locate unpublished material, minimising the likelihood of language and publication bias. It is unclear whether steps were taken to minimise the likelihood of reviewer error and bias in selecting papers for inclusion in the review, data extraction and assessment of study quality. Total scores for the quality assessment were reported. Standard meta-analytic methods were used. Statistical heterogeneity was assessed and subgroup analysis performed. Despite some minor limitations in reporting the authors' conclusions are likely to be reliable.

Implications of the review for practice and research

Practice: the authors did not state any implications for practice.

Research: the authors stated that future studies should avoid comparisons with historical open controls and use consecutive contemporaneous control patients. At a minimum, future reports should also provide 30-day mortality rates, cerebrovascular accident, paraplegia and major reintervention rates. The authors highlighted a lack of comprehensive cost-effectiveness analysis comparing endovascular stenting and open surgery.

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