Carotid angioplasty with or without stenting versus carotid endarterectomy for carotid artery stenosis: a meta-analysis

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CRD summary
This review concluded that, except a lower risk of cranial nerve injury, there is no significant difference between carotid angioplasty and carotid endarterectomy for treating carotid artery stenosis. The findings should be treated with some caution given the concerns about potential reviewer error/bias and publication bias.

Authors' objectives
To compare the efficacy of carotid angioplasty with or without stent placement and carotid endarterectomy in patients with internal carotid artery stenosis.

Searching
MEDLINE and the Cochrane Library were searched from 1990 to June 2007. Search terms were reported. The reference lists of relevant articles were checked to identify additional studies.

Study selection
Randomised controlled trials (RCTs) that compared carotid angioplasty, with or without stent placement, to carotid endarterectomy in patients with cervical internal carotid artery stenosis were eligible for inclusion. Outcomes of interest included death, stroke, myocardial infarction, cranial nerve injury, major bleeding and target-vessel revascularisation.

In the included studies, patients had both symptomatic and asymptomatic internal carotid artery stenosis, but the majority of patients (89%) had symptomatic internal carotid artery stenosis. A variety of different stents were used in the carotid angioplasty group. The Wallstent was the most commonly used stent.

Outcomes reported were death, stroke (classified as ipsilateral, disabling or any), myocardial infarction, cranial nerve damage and various combinations of these outcomes, at 30 days, six months and one year post procedure.

One reviewer assessed studies for inclusion.

Assessment of study quality
Validity assessment was performed by one reviewer. The criteria used to assess the quality of each study were not reported.

Data extraction
Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated for each study and outcome.

Data extraction was performed by one reviewer.

Methods of synthesis
Pooled ORs and 95% CIs were calculated and reported using both random-effects model (DerSimonian and Laird) and fixed-effect model (Peto) meta-analysis. Heterogeneity was assessed using the Cochran Q and $I^2$ tests. Publication bias was assessed by visual inspection of funnel plots. The authors stated that this was also tested for asymmetry, but did not report what test was used.

Results of the review
Nine RCTs (n=3,138) were included in the review. The quality of the trials was not reported. Five of the trials were stopped prematurely. The reasons for stoppage were worse outcomes in carotid angioplasty patients (three trials), opposition to being randomised into the carotid angioplasty group (one trial) and funding problems (one trial).
Using random-effects meta-analysis, carotid angioplasty was associated with a statistically significant decrease in cranial nerve injury compared with carotid endarterectomy at 30 days post procedure (OR 0.12, 95% CI: 0.05, 0.29, p<0.001, seven trials). There were no statistically significant differences between carotid angioplasty and carotid endarterectomy for death (OR 0.75, 95% CI: 0.38, 1.48, p=0.40, eight trials) or myocardial infarction (OR 0.69, 95% CI: 0.23, 2.10, p=0.51, six trials) at 30 days post procedure. Various combinations of these outcomes were also reported and no statistically significant differences were found. Using fixed-effect meta-analysis, similar results for all above outcomes were obtained with the exception of stroke (OR 1.49, 95% CI: 1.07, 2.07, p=0.02) and death or any stroke combined (OR 1.37, 95% CI: 1.04, 1.81, p=0.03). Heterogeneity was statistically significant for the later outcome (p=0.04).

Using random-effects meta-analysis, there was no significant difference between carotid angioplasty and carotid endarterectomy for death or stroke combined at 6 months (OR 1.50, 95% CI: 0.69, 3.23, p=0.30, two trials) or at 12 months post procedure (OR 1.25, 95% CI: 0.59, 2.63, p=0.56, three trials). These results remained similar with fixed-effect meta-analysis.

Tests for publication bias were reported as non-significant (p>0.1) for all outcomes except for death or stroke combined at six month post procedure (p<0.01).

**Authors' conclusions**
Except for a lower risk of cranial nerve injury, carotid angioplasty is neither safer nor associated with a better short-term outcome as compared to carotid endarterectomy in treating carotid artery stenosis.

**CRD commentary**
The review had clear inclusion criteria for participants, interventions, study design and outcomes. Relevant databases were searched and reference lists were reviewed to locate additional information. It is unclear if language restrictions were applied, so language bias cannot be ruled out. In addition, the authors stated that only published data were included, which raises the potential for publication bias; this was tested for and only found to be present in one of the meta-analyses. Study selection, data extraction and validity assessment were conducted by a single reviewer, leaving it potentially open to error and/or bias. The authors stated that study validity was assessed but the results of this were not reported. Consequently, the reliability of the included studies, and the synthesis derived from them, is uncertain. Also, as five of the nine trials were terminated early, this information is likely to have been important. The meta-analysis of trials is likely to be appropriate. Heterogeneity was found to be present for some outcomes; the reasons for this could have been explored. The authors' conclusions appear to be supported by the data presented, but potential for reviewer error/bias and publication bias, mean that these conclusions should be treated with some caution.

**Implications of the review for practice and research**
The authors did not state any implications for practice or further research.

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