Endovascular stenting or carotid endarterectomy for treatment of carotid stenosis: a meta-analysis

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CRD summary
This review found that in patients with symptomatic or asymptomatic carotid artery stenosis, carotid endarterectomy reduced the risk of stroke, increased the risk of myocardial infarction, and had no effect on mortality, within 30 days, compared with stenting. The limitations in the review methods and reporting, particularly for the synthesis, mean that the reliability of the results is uncertain.

Authors' objectives
To evaluate the relative efficacy and safety of carotid artery stenting compared with open carotid surgery for symptomatic or asymptomatic carotid artery stenosis.

Searching
PubMed (to July 2010) was searched for studies published in English in the previous 10 years. Brief search terms were given. Bibliographies of identified studies, and of recent meta-analyses, were searched.

Study selection
Randomised controlled trials (RCTs) of carotid artery stenting compared with open carotid surgery in patients with carotid artery stenosis, with or without symptoms, were eligible for inclusion. The outcomes of interest were stroke, myocardial infarction and deaths, within 30 days.

In included trials, the mean age of patients ranged from 66.4 years to 72.6 years; the degree of stenosis ranged from more than 50% to more than 80%. In most trials (80%), 90% of patients or all patients were symptomatic; in one trial over 70% were asymptomatic. The use of anti-platelet therapy and the surgical technique for (open) carotid endarterectomy were reported where specified. Cerebral protection devices were not used in half the trials and used for 27% of patients in one trial.

The author did not state how many people selected the trials.

Assessment of study quality
Quality was assessed using the Cochrane risk of bias tool, for the following items: sequence generation, allocation concealment, blinding of the observer for all three outcomes, and incomplete outcome data and dropouts described. Other possible sources of bias, including financial interests, were recorded.

The author did not state how many people assessed quality.

Data extraction
Data were extracted to calculate risk ratios and 95% confidence intervals. It seems that per-protocol and intention-to-treat results were extracted. The definitions of the diagnosis of stroke or myocardial infarction were as reported for each trial.

The author did not state how many people extracted or checked these data.

Methods of synthesis
The trial data were combined in a meta-analysis; few details were reported, but it appears that a random-effects model was used in at least one analysis. Statistical heterogeneity was measured using $I^2$. For stroke, a subgroup analysis was performed on trials with a high use (72% or more) of cerebral protection devices. The number needed to treat or the number needed to harm were calculated. It seems that the author used the fail-safe N to assess publication bias.

Results of the review
Ten trials, with about 7,000 patients, were included, but the three smallest trials did not contribute to the analyses. The trials ranged in size from 23 (104 for the fourth trial) to 2,502 patients. Five of the 10 trials were rated as free of bias; two were at risk from one source of bias, and three were at risk from more than one source. The fail-safe N was 17 for stroke and seven for myocardial infarction. Follow-up ranged from 30 days to 66 months.

Nine trials reported strokes within 30 days, but there was moderate statistical heterogeneity ($I^2=49.8\%$). Four trials reported a high use of cerebral protection devices and meta-analysis of these found that open carotid surgery reduced the rate of stroke at 30 days (RR 0.50, 95% CI 0.38 to 0.67), with no evidence of statistical heterogeneity ($I^2=0$). The number needed to treat was 37 (95% CI 29 to 55).

Six trials reported myocardial infarctions within 30 days. Open carotid endarterectomy increased the risk of myocardial infarction at 30 days, compared with stenting (RR 2.16, 95% CI 1.32 to 3.54), with no evidence of statistical heterogeneity ($I^2=0$). The number needed to harm was 96 (95% CI 341 to 44).

Seven trials reported deaths within 30 days. There was no difference in the risk of death between the two treatment groups (RR 0.72, 95% CI 0.42 to 1.24; using a random-effects model). There was no evidence of statistical heterogeneity ($I^2=2\%$).

Authors’ conclusions
Compared with stenting, at 30 days, carotid endarterectomy reduced the risk of stroke, increased the risk of myocardial infarction, and had no effect on the risk of death.

CRD commentary
The review addressed a clear question. The intervention, participant, design and outcome criteria were clear, but a criterion was added for the analysis of stroke, after the identification of the eligible trials. The search was limited in scope and restricted to published studies reported in English; relevant trials might have been omitted. It was not clear whether study selection, data extraction and quality assessment were performed by more than one person, leaving the possibility of error and bias. The assessment of the risk of bias in the trials was appropriate.

Combining the results in meta-analysis was appropriate, but it was not clear whether random-effects or fixed-effect models were used for some analyses. The meta-analysis appears to have been conducted on a mixture of per-protocol and intention-to-treat results. The reasons for the omission of data from potentially relevant trials were not reported and the results for stroke appear to have been from a post-hoc analysis.

The limitations of the review methods and reporting, particularly for the synthesis, mean that the reliability of the results is uncertain.

Implications of the review for practice and research
Practice: The author stated that carotid artery endarterectomy could offer the best overall outcome and was the only superior treatment to medical therapy alone, for symptomatic patients.

Research: The author stated that studies that directly compared stenting with medical therapy alone, for asymptomatic and symptomatic patients, were required.

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