Short term and intermediate term comparison of endarterectomy versus stenting for carotid artery stenosis: systematic review and meta-analysis of randomised controlled clinical trials


CRD summary
The authors concluded that carotid endarterectomy was associated with better periprocedural outcomes than carotid artery stenting, but differences were not significant in the longer term. The unclear quality of included trials leads to uncertainty about the reliability of the authors' conclusions.

Authors' objectives
To evaluate the short term safety and immediate term efficacy of carotid endarterectomy compared with carotid artery stenting.

Searching
BIOSIS Previews, EMBASE, MEDLINE, Cochrane Central Register of Controlled Trials (CENTRAL), International Pharmaceutical Abstracts database, Web of Science and Google scholar were searched from January 1990 to July 2009. Search terms were reported. In addition, abstract lists and conference proceedings were searched from: the American College of Cardiology and the European Society of Cardiology (2006 to 2009); the Transcatheter Cardiovascular Therapeutics and the American Heart Association (2006 to 2008). Published review articles, editorials, Internet-based sources of information, and reference lists of selected articles were also scanned to locate further studies. There were no language restrictions.

Study selection
Randomised controlled trials (RCTs) that compared endarterectomy with stenting in patients with symptomatic or asymptomatic coronary artery stenosis, and reporting death and/or stroke, were eligible for inclusion in the review. Trials had to report at least 30 days of follow-up. In the included trials, there was variation in the definition of periprocedural stroke.

The primary outcomes reported were composite measures of death or stroke. Secondary outcomes were individual end points of death, stroke, myocardial infarction, facial neuropathy, and composite measures of mortality or disabling stroke.

The majority of included patients were symptomatic, and the mean age range was between 66 to 73 years.

Two reviewers independently selected trials for inclusion in the review. Disagreements were resolved by discussion.

Assessment of study quality
Trial quality was assessed on randomisation, allocation concealment, intention to treat analysis, blinding, premature stopping of patient enrolment, and drop-outs.

The validity assessment was carried out by three reviewers.

Data extraction
Intention-to-treat data were extracted on event rates for death, strokes, myocardial infarction and facial neuropathy, from which odds ratios (OR) or hazard ratios (HR) and 95% confidence intervals (CI) were calculated. Continuity correction was used where a nil event occurred in one of the study groups. Authors were contacted for further data, where necessary.

Data were extracted by three reviewers.
Methods of synthesis
Odds ratios, hazard ratios and 95% confidence intervals were pooled using a random-effects meta-analysis with inverse variance weighting. Sensitivity analysis was conducted using alternative analytical models (Hartung-Knapp variance estimates; an "exact" likelihood approach; and the Peto method). Hazard ratios were also pooled using a cumulative random-effects meta-analysis by sequentially integrating newly published trials. Statistical heterogeneity was assessed using the $I^2$ statistic. Further sensitivity analysis was carried out to explore the effect of removing each trial in turn. Publication bias was assessed visually using funnel plots, and by Egger's test.

Results of the review
Eleven RCTs (n=4,796 patients) were included in the review. Sample sizes ranged from 20 to 1,170. The duration of follow-up ranged from 30 days to 65 months. The quality of trials was not reported.

Periprocedural outcomes: Compared to carotid artery stenting, carotid endarterectomy resulted in a reduction in stroke (OR 0.65, 95% CI 0.43 to 1.00; $I^2=48.4%$; nine trials) and the composite outcome of stroke/death (OR 0.67, 95% CI 0.47 to 0.95; $I^2=37.4%$; 10 trials). However, both myocardial infarction (OR 2.69, 95% CI 1.06 to 6.79; $I^2=0%$; four trials) and cranial facial neuropathy (OR 10.25, 95% CI 4.02 to 26.13; $I^2=0%$; six trials) were significantly increased following endarterectomy. There was no significant difference between the two techniques in terms of mortality (eight trials) or the composite end point of disabling stroke/death (eight trials). The superiority of endarterectomy in terms of stroke/death was greater in trials that were stopped prematurely (OR 0.56, 95% CI 0.30 to 1.0; five trials), but the difference between the interventions diminished over time. Sensitivity analyses did not materially alter the main findings. There was no evidence of publication bias.

Intermediate term outcomes: There were no statistically significant differences between the interventions in any of the analyses.

Authors’ conclusions
Carotid endarterectomy was associated with better periprocedural outcomes than carotid artery stenting. There were no significant differences between the interventions in the intermediate to long term.

CRD commentary
The review addressed a clear question and this was supported by potentially reproducible inclusion criteria. The search strategy contained several relevant sources, including those relating to unpublished material. Publication bias was assessed. The review process was carried out with sufficient attempts to minimise errors and biases, and appropriate quality assessment criteria were applied to the included study designs. However, the absence of reported quality results represents a substantial limitation when interpreting the reliability of the review findings. Study characteristics were provided; the sample sizes of some trials were small. The chosen methods of synthesis appeared to be appropriate in the presence of some statistical heterogeneity. The unclear quality of included trials leads to uncertainty about the reliability of the authors’ conclusions.

Implications of the review for practice and research
Practice: The authors stated that patients requiring carotid revascularisation should be offered carotid endarterectomy as a first choice. Carotid stenting should be offered to patients at high surgical risk.

Research: The authors stated that trials of contemporary carotid artery stenting compared with carotid endarterectomy are needed to understand the performance of each intervention in patients with or without symptoms. Trials should include the use of composite end points that also include safety end points.

Funding
Postdoctoral fellowship grant for one author from the Swiss National Research Foundation and the Schweizerische Stiftung fur Medizinisch-Biologische Stipenden.

Bibliographic details
Meier P, Knapp G, Tamhane U, Chaturvedi S, Gurm HS. Short term and intermediate term comparison of
endarterectomy versus stenting for carotid artery stenosis: systematic review and meta-analysis of randomised controlled clinical trials. BMJ 2010; 340:c467

PubMedID
20154049

DOI
10.1136/bmj.c467

Original Paper URL
http://www.bmj.com/cgi/content/abstract/340/feb12_1/c467

Indexing Status
Subject indexing assigned by NLM

MeSH
Carotid Stenosis /surgery; Endarterectomy, Carotid /methods; Humans; Myocardial Infarction /etiology; Odds Ratio; Randomized Controlled Trials as Topic; Risk Factors; Stents; Stroke /etiology; Treatment Outcome

AccessionNumber
12010001015

Date bibliographic record published
17/02/2010

Date abstract record published
03/03/2010

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.