New brain lesions after carotid stenting versus carotid endarterectomy: a systematic review of the literature

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CRD summary
The review assessed the incidence of new brain lesions identified using diffusion-weighted imaging following either carotid angioplasty and stenting (CAS) or carotid endarterectomy and found CAS to be associated with significantly more new lesions after surgery. The authors' conclusions reflected the evidence presented, but potential biases in the review methodology made the reliability of the conclusions uncertain.

Authors' objectives
To identify the incidence of new brain lesions identified using diffusion-weighted imaging following either carotid angioplasty and stenting (CAS) or carotid endarterectomy (CEA).

Searching
The reviewers searched PubMed for peer-reviewed studies published between 1990 and June 2007; reference lists of included articles were searched for further relevant studies. Keywords used in the search were reported. Only studies published in English were considered for inclusion.

Study selection
Studies of patients treated with either CEA or CAS who had diffusion-weighted imaging performed one or two days before operation and up to 72 hours after operation were eligible for inclusion. Included studies had to follow up imaging of patients systematically and not just in cases of complications. The primary outcome was new ischaemic lesions identified by diffusion-weighted imaging. Studies were excluded if only angioplasty without stent replacement was performed. Editorials, letters, case reports and reviews were excluded.

For studies that included CEA, general anaesthetic was used more often than local anaesthetic. Some studies of CEA used selective shunting while others used shunting in all patients. For studies that included CAS (where reported) different studies used either closed cell or open cell stents or both (where reported). Patient age ranged from 31 to 92 years; most were in their sixties or seventies.

Assessment of study quality
The authors did not state that they assessed study validity.

Data extraction
Two reviewers independently extracted a range of data to calculate effect sizes.

Methods of synthesis
Where studies allowed direct comparison between CAS and CEA groups, Peto odds ratios (ORs) with 95% confidence intervals (CIs) were calculated that compared incidences in new diffusion-weighted imaging lesions and incidences of new strokes or death within 30 days of the procedure. Where only indirect comparison was possible, two-tailed $\chi^2$ tests (threshold $p<0.05$) with Yates' correction were used to determine whether there were statistically significant differences between groups. The influence of a number of procedural variables (such as stent design on outcomes) was also assessed.

Results of the review
It appeared that 33 studies (n=2,117 procedures, range 10 to 206 procedures) with 754 procedures for CEA and 1,363 procedures for CAS were included.

Direct Comparisons: Six studies (n= 620 procedures) directly compared CAS with CEA. Based on these studies, incidence of any new diffusion-weighted imaging lesion was estimated to be statistically significantly higher after CAS
than CEA (OR 6.1, 95% CI 4.19 to 8.87). Five studies (n=573 procedures) were pooled in a meta-analysis that compared the risk of any new stroke or death within 30 days. This indicated that the odds of neurological complications were higher after CAS compared with CEA, but the difference was not statistically significant. There was no evidence of significant heterogeneity for these analyses.

**Indirect Comparisons:** Incidence of new diffusion-weighted imaging lesions was statistically significantly higher after CAS (37%) than CEA (10%). The percentage of patients with symptomatic stenosis was similar in both groups (59% for CAS and 61% for CEA). Combined stroke and death rate within 30 days was 2.12% in patients with CEA and 3.45% in patients with CAS. Incidence of any new diffusion-weighted imaging lesion was higher after CAS (37%) than CEA (10%). Where reported, incidence of new ischemic lesions was higher following CAS than CEA. Where reported, the incidence of new diffusion-weighted imaging lesions was higher after CAS both in initially symptomatic and asymptomatic patients. Three procedural variables were associated with statistically significant differences in incidence of new ipsilateral diffusion-weighted imaging lesions between subgroups: for CAS (where reported) whether the stent design was closed or open (lower in closed stent subgroup); whether distal filter protection was used (lower when it was used); and for CEA whether selective or obligate shunting was used (lower when selective shunting was used). (Not all procedural variables were included in the analysis.)

**Authors' conclusions**

New diffusion-weighted imaging lesions occurred more frequently after CAS than after CEA. Technical advances mainly in the field of endovascular therapy may potentially reduce the incidence of these adverse ischemic events.

**CRD commentary**

This review addressed a clear review question using appropriate study selection criteria. The search was somewhat limited as only one major database was searched and included studies were restricted to peer-reviewed publications in English, so there were risks of publication and language biases. Study validity was not assessed and so it was not possible to adequately comment on the reliability of the results presented. Many primary study details were reported, but study design details were not. The lack of reporting of study designs made it impossible to comment on the appropriateness of the synthesis (combining different study designs may increase the risk of bias).

The authors' conclusions reflected the evidence presented, but given the potential for language and publication bias, lack of a validity assessment and the unknown study designs of included studies, the reliability of the conclusions is uncertain.

**Implications of the review for practice and research**

**Practice:** The authors stated that use of a cerebral protection device and a closed-cell stent in CAS as well as selective shunting during CEA significantly reduced the occurrence of new ipsilateral diffusion-weighted imaging lesions after carotid interventions; uncritical widespread use of CAS did not seem justified and continuous efforts were needed to optimise this technique.

**Research:** The authors stated that future studies should use diffusion-weighted imaging to compare CAS and CEA procedures, even in small patient groups, to optimise the technique and patient selection.

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**Bibliographic details**


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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.