CRD summary
This review concluded that several treatment strategies were reported for in-stent restenosis after carotid artery stent placement, with acceptable short-term results. However, the quality of available data was limited by the variability of results and study designs. In view of the limited quality of evidence identified, the authors’ cautious conclusions appear to be appropriate.

Authors' objectives
To assess the therapeutic options for in-stent restenosis after carotid artery stent placement.

Searching
PubMed and EMBASE were searched up to January 2009. Search terms were reported. Reference lists of relevant publications were screened. Only studies published in English were included.

Study selection
Studies that evaluated a specified treatment of in-stent restenosis after carotid artery stent placement and reported outcomes were eligible for inclusion. Studies that focused on thrombosis rather than stenosis were excluded. The review outcomes were the incidences of recurrent restenosis and peri-procedural complications.

The most commonly used interventions in included studies were repeat percutaneous transluminal angioplasty, repeat carotid artery stent placement, and carotid endarterectomy with stent removal. In all included studies, the identification of in-stent restenosis by duplex ultrasound scanning was further verified by carotid angiography. Where reported, 29% of included patients underwent the primary carotid artery stent procedure for restenosis after previous ipsilateral carotid endarterectomy. The time between carotid artery stent placement and the diagnosis of in-stent restenosis ranged from two to 47 months. The included patients had a mean age of 60 years, 57% were male and 26% had symptomatic in-stent restenosis.

Two reviewers independently assessed studies for inclusion.

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

Data extraction
Data were extracted on number of patients who experienced recurrent restenosis.

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
The percentage of patients with recurrent restenosis was calculated. The pooled relative risks (RRs) with 95% confidence intervals (CIs) were also estimated. The method used to calculate relative risks was not reported.

Results of the review
Twenty studies were included in the review (n=96 patients with 100 affected carotid arteries). Eleven studies were case reports and nine studies were observational cohort studies. The mean duration of follow-up was 15 months (ranging from one to 42 months).

Twelve out of 84 patients (14%) experienced the recurrent restenosis after intervention for in-stent restenosis: eight after repeated percutaneous transluminal angioplasty and four after repeated carotid artery stent. All the 12 patients received tertiary treatment. Two patients developed a third recurrence and eventually disabling stroke. There was no...
significant difference in the rate of recurrent stenosis (RR 1.15, 95% CI 0.38 to 3.5) between repeat percutaneous transluminal angioplasty and repeat carotid artery stent replacement.

No peri-procedural complications were reported in any of the studies.

**Authors' conclusions**
Several treatment strategies for in-stent restenosis after carotid artery stent placement have been reported with acceptable short-term results, but the quality of available data was limited by the variability of results and study designs.

**CRD commentary**
The inclusion criteria of the review were clear. Only two relevant databases were searched, so relevant studies may have been missed. The decision to restrict the review to published studies in English may have increased the risk of both publication and language biases. Steps were made to minimise reviewer errors and biases in the study selection process, but it was unclear whether data extraction was also performed in duplicate.

No formal quality assessment of included studies was performed. All included studies were observational studies, a type of study design with low methodological rigour. The authors stated that a narrative synthesis was employed, but it appeared that a pooled analysis of relevant outcomes was performed. Deriving pooled outcomes from included studies with a high level of clinical heterogeneity may have not been appropriate.

In view of the limited quality of evidence identified, the authors' cautious conclusions appear to be appropriate.

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

**Practice:** The authors stated that in light of the limited quality of the available data, no recommendation can be made for any specific therapy for in-stent restenosis after carotid artery stent placement.

**Research:** The authors stated that further studies with better study design and more consistency of reporting standards were required to investigate the effectiveness of different therapies for in-stent restenosis after carotid artery stent placement. Further studies were required to investigate the rate of in-stent restenosis in patients undergoing the original carotid artery stent placement procedure for recurrent stenosis after a previous ipsilateral carotid endarterectomy.
Oclusion, Vascular /epidemiology /surgery; Humans; Incidence; Reoperation /utilization; Stents; Treatment Outcome

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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.