Impact of carotid endarterectomy upon cognitive functioning: a systematic review of the literature


Authors' objectives
To assess the extent to which carotid endarterectomy influences cognitive functioning.

Searching
Published studies were sought from computerised searches of MEDLINE (1966 to 1997) and PsycLIT (1974 to 1997). References in relevant papers were examined.

Study selection
Study designs of evaluations included in the review
Included studies were of the following designs: repeated measures with first assessment prior to surgery and a separate control group or patients examined across time acting as their own controls. The mean follow-up time for 26 studies using repeated measures was 22 weeks. Two studies that relied solely on post-operative assessments and comparisons with control groups were reported as excluded though details were given in tables. Inclusion criteria were not defined for study design.

Specific interventions included in the review
Carotid endarterectomy (CEA) was studied.

Participants included in the review
Patients with the following medical conditions who were undergoing CEA were included: carotid artery disease (CAD: uni and bilateral); large vessel disease; transient ischaemic attacks (TIA: uni and bilateral); symptoms of cerebral ischaemia or emboli; stroke; and low flow endangered brain. Control groups (where they existed) included unoperated patients with the following conditions: large or small vessel disease; other surgery (including non-neurological, peripheral vascular surgery, cholecystectomy, CAE for haemodynamically insignificant lesions, femeropopliteal bypass, and atherosclerosis); normal population; CAD with medical management; chronic schizophrenia; carotid abnormality; and surgically untreatable TIA.

Outcomes assessed in the review
Cognitive functioning was assessed. The number and type of neuropsychological tests in individual studies ranged from 5 to 34. A range of different cognitive functions was assessed including intelligence tests, verbal skills, concentration, perceptual (not verbal) IQ, attention, concentration, memory, verbal fluency, short-term memory, spatial operation, motor performance, and mnemic functions. The outcome of surgery was also evaluated.

How were decisions on the relevance of primary studies made?
The authors do not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
No formal assessment of validity was undertaken, although some aspects of validity were discussed. These included study details and appropriateness of the control group.

Data extraction
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction. Tables reported in the review included the following information: author; year of publication; sample size; testing interval; number of tests; patient and control group details; additional matching; and exclusion criteria. In studies...
with multiple assessments, results were taken from the final assessment. The influence of years of education on results of surgery was also examined. Results appear to have been classified as 'improvement' or 'no improvement'.

Methods of synthesis

How were the studies combined?
The proportion of studies reporting improvement was calculated.

How were differences between studies investigated?
Differences were discussed in the text but no formal assessment of heterogeneity was undertaken.

Results of the review

Twenty-six studies were included (985 patients).

Outcome: Results were inconsistent with 16/28 (57%) of studies reported that CEA was associated with improvement in cognitive test performance, 12/28 studies found no benefit from CEA, and 1 study reported deterioration with CEA. The authors report that results were rarely clear cut with some studies reporting no benefit while limited improvement in cognition was apparent.

Assessment interval: studies which reported an improvement tended to have a longer follow-up (median 16 weeks) than studies reporting no change or a decline (median 8 weeks).

Number of participants: Sample size ranged from 6 to 145 patients and showed no association with outcome (improvement mean = 33.5 patients vs no improvement mean = 42 subjects; P = 0.13).

Patient characteristics: no influence of years of education on outcome was seen (improvement mean = 9.2 years vs no improvement mean = 9.9 years; P = 0.26).

Many of the studies failed to measure mood states but those that did reported an improvement postoperatively both in anxiety (3 studies) and depression (2 studies).

Disease severity: conflicting results with some studies reporting greater cognitive improvement after surgery in TIA than stroke patients (3 studies) and with more severe stenosis (3 studies) and other reporting no impact of disease severity on outcome.

The amount of study detail reported varied considerably with many studies failing to report fully on demographic, mood and medical characteristics of their sample. Samples differed on demographic factors (such as age, years of education, gender distribution), type of patient and control group, matching criteria, severity and side of ipsilateral and contralateral stenosis, range of cognitive tests employed, timing of assessment and methods used to analyse cognitive change. The diverse methods of analysis adopted contributed to the difficulty of comparing studies.

Authors' conclusions

Given the conflicting findings, and the methodological issues, it is not possible to draw a clear conclusion regarding the impact of carotid endarterectomy upon cognition. Future research which pays attention to these methodological factors is needed in order to adequately resolve the current debate.

CRD commentary

The aims were stated and inclusion criteria defined in terms of intervention and outcome. Two relevant databases were searched but no details were given of keywords used, language restrictions applied or methods used to select primary studies. No attempt was made to locate unpublished studies and this, as the authors rightly state, raises the possibility of publication bias. Although no formal assessment of validity was undertaken, relevant aspects of validity were discussed. Most of the relevant details of the primary studies were presented in tabular format though outcome measures used to individual studies were not specified and methods used to extract data were not described. Two studies were reported as
excluded in the text yet were included in tables. It is not clear whether study outcomes were classified as improved based on point estimates or levels of statistical significance. Given the differences between studies, a narrative review was appropriate. In reporting results, attention was not drawn to results from better quality studies.

The evidence presented supported the authors’ conclusions.

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

Practice: The authors report that it is not possible to draw a clear conclusion regarding the impact of carotid endarterectomy upon cognition.

Research: The authors report that future research which pays attention to these methodological factors is needed to adequately resolve the current debate.

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