REVIEW

Comparison of Cognitive Function after Carotid Artery Stenting versus Carotid Endarterectomy

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WHAT THIS PAPER ADDS

This article has reviewed the literature for studies evaluating the changes in cognitive function after carotid artery stenting (CAS) versus carotid endarterectomy (CEA). The majority of the 13 studies that were identified did not demonstrate a significant difference between the two procedures with regard to an effect on cognitive function. However, the lack of standardization of specific cognitive tests and timing of assessment of cognitive function after CAS and CEA do not allow for definite conclusions to be drawn. Future studies should address the limitations of the previous studies and systematically evaluate the effect of CAS and CEA on cognitive function.

The effect of carotid artery stenting (CAS) and carotid endarterectomy (CEA) on cognitive function is unclear. Both cognitive improvement and decline have been reported after CAS and CEA. We aimed to compare the changes in postprocedural cognitive function after CAS versus CEA. A systematic qualitative review of the literature was conducted according to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analysis statement for studies evaluating the changes in cognitive function after CAS compared with CEA. Thirteen studies (403 CEAs; 368 CAS procedures) comparing the changes in cognitive function after CEA versus CAS were identified. Most studies did not show significant differences in overall cognitive function or only showed a difference in a single cognitive test between the two procedures. A definitive conclusion regarding the effect of CAS versus CEA on cognitive function was not possible owing to heterogeneity in definition, method, timing of assessment, and type of cognitive tests. For the same reasons, performing a meta-analysis was not feasible. The lack of standardization of specific cognitive tests and timing of assessment of cognitive function after CAS and CEA do not allow for definite conclusions to be drawn. Larger, adequately-powered and appropriately designed studies are required to accurately evaluate the effect of CAS versus CEA on postprocedural cognitive function.

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INTRODUCTION

It has previously been reported that carotid endarterectomy (CEA) and carotid artery stenting (CAS) are effective procedures for the prevention of stroke in patients with carotid artery stenosis.[1,2] The effect of CAS and CEA on cognitive function, however, is controversial. The term "cognitive function" includes a variety of functions, such as verbal and non-verbal memory, attention, executive function, mood, language, and motor skills. A cross-sectional, cohort study on 4,006 patients without a history of a cerebrovascular event reported that a $\geq$75% internal carotid artery stenosis is associated with an almost sevenfold increased risk of cognitive impairment and an almost threefold increased risk of cognitive decline.[3] These results suggest that even asymptomatic carotid artery stenosis is strongly associated with cognitive impairment and decline.[3] Some studies have demonstrated cognitive improvement after both CEA[4] and CAS,[5,6] whereas others have shown no change[7,8] or even cognitive decline.[9,10]

A systematic review on the effects of CAS and CEA on cognitive function, a few years ago, concluded that neither procedure clearly affected cognition.[11] This systematic review included 25 articles evaluating cognitive function after CEA, four after CAS, and only three studies comparing the effects of CAS versus CEA on cognitive performance (113 CEAs vs. 94 angioplasty/CAS procedures).[11] The

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PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	PICOS Appendix
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Not registered
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	6 and PICOS Appendix
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5-6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Figure 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	5-6 PICOS Appendix
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Cochrane check list (Table 3)
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	No quantitative synthesis undertaken
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	No quantitative synthesis undertaken
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Cochrane check list (Table 3)
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	Not applicable
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	7 and Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 1
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Table 1, Cochrane check list (Table 3)
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Table 1
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	No quantitative synthesis undertaken
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Cochrane check list (Table 3)
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	Not applicable

Figure 1. Checklist with the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) Statement.[16] For more information, visit www.prisma-statement.org.