Postoperative cognitive dysfunction after noncardiac surgery: a systematic review
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CRD summary
This review found some evidence of post-operative cognitive dysfunction in the early weeks after major noncardiac surgery, especially in older people. There was insufficient evidence about risks persisting beyond 6 months. Limitations of the review methodology, the variations in definitions of cognitive decline, and the lack of a quality assessment mean that the results may not be reliable.

Authors' objectives
To systematically review the evidence of whether noncardiac surgery is related to post-operative cognitive dysfunction.

Searching
MEDLINE, EMBASE, PsycINFO and the Cochrane Library (the Cochrane Database of Systematic Reviews, DARE and the Cochrane CENTRAL Register) were searched up to December 2005. The search strategy used was described in the review. The bibliographies of relevant papers were screened and journals were searched by hand. The search was limited to articles published in English.

Study selection
Studies involving patients who had undergone noncardiac surgery were eligible for inclusion. Studies involving patients who had undergone cardiac or brain surgery, carotid artery surgery, angioplasty, transplantation surgery or thyroid surgery were not eligible. The included studies involved participants who underwent many types of noncardiac surgery, from minor to major vascular and thoracic surgery. Where reported, the age of the patients ranged from 18 to 94 years (where reported, mean/median range: 27.8 to 84) and the proportion of males from 0 to 100%.

Studies in which at least one post-operative neuropsychological assessment, made after 7 days post-operatively, were eligible for inclusion. Studies involving subjective reports of cognitive dysfunction or observational assessment of cognition were not eligible. In the included studies, the neuropsychological assessment was made using a variety of methods, including a single test, a composite measure, or up to individual 28 tests. These covered one or more of the following domains: verbal and language skills; memory and learning; attention, concentration and perception; visual and spatial skills; visuomotor and manual skills; numerical; executive functions. Memory and learning was assessed in all studies. Decline in performance was measured in various ways. In the included studies, the comparison group was either a control group (non-surgery, or regional versus general anaesthesia), analysis over time, or comparison with normative data.

Randomised controlled trials and observational studies with more than 10 participants were eligible for inclusion. The included studies were a mixture of cohort studies and randomised trials.

The authors did not state how the papers were selected for the review, or how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity. They calculated that the majority of the included studies were underpowered to detect an association between surgery and post-operative cognitive dysfunction.

Data extraction
The authors did not state how the data were extracted for the review, or how many reviewers performed the data extraction.

Methods of synthesis
The studies were combined using a narrative, and described according to time since surgery (7 to 21 days, 22 to 132 days, over 6 months) or technique comparison (normotensive versus hypotensive, intravenous versus inhalation, methods to reduce hypoxaemia, normocapnia versus hypocapnia, intravenous vitamin administration). Other
comparisons, such as those between major and minor surgery groups and those comparing older and younger groups of patients, were also described.

**Results of the review**

The review included 46 studies (8,001 participants). The included studies were cohort studies (8 without controls, 886 participants; 12 with controls, 3,903 participants), comparisons with general anaesthetics (2 non-randomised studies, 132 participants; 15 randomised studies, 1,569 participants) and comparisons of anaesthesia techniques (9 studies, 1,511 participants).

7- to 21-day assessments.

Three of the 4 cohort studies without controls reported a decline in cognitive function, ranging from 41 to 71% of patients; the result of the fourth study was unclear. Six of the 7 cohort studies with a control group reported a decline in cognitive function, ranging from 6.8 to 31% of patients.

It appeared from the review that the elderly are more at risk of post-operative cognitive decline than younger patients. Three studies found that age over 70 years is associated with a higher risk of post-operative cognitive dysfunction in comparison with younger patients. Three other studies with similar methodology found greater rates of post-operative cognitive dysfunction in patients aged over 60 compared with those aged 40 to 59 years (25.8 to 32.7% versus 19.2%).

22-day up to 6-month assessments.

The results from these studies were mixed. Five out of 17 studies reported no decline. Two out of 9 controlled studies found a significant difference in cognitive decline between the surgical and control groups; the results from other studies were either not clear, or showed no difference or no statistically significant difference between the groups.

Over 6 months.

Nine of 14 studies reported no decline or an improvement in cognitive function; two stated than a decline could be shown. Eight studies that tested significance stated that there was no difference, or that it was not statistically significant, and some results were unclear.

There was little evidence to suggest a difference in post-operative cognitive dysfunction comparing general versus local anaesthesia at 7 to 21 days, or in follow-up to 6 months.

**Authors’ conclusions**

There is some evidence of a risk of post-operative cognitive dysfunction in the early weeks after major noncardiac surgery, with higher risks in elderly people. There is insufficient evidence to establish whether these risks persist, but it may be that a small proportion of people show signs up to 6 months after major surgery.

**CRD commentary**

The objective of the review was clear, as were the inclusion criteria for the interventions, participants, study design and outcomes. The search strategy for published studies was comprehensive, although the language restriction and the fact that unpublished data were not eligible for the review mean that there is a possibility of bias having been introduced during the selection process. In addition, attempts to minimise reviewer error or bias in the study selection and data extraction processes were not described. There was no formal validity assessment, although the authors commented throughout the review about the possible problems with the study methodology. This brings into question the reliability of the results. There was a wide range of definitions of cognitive decline used in the studies included in the review; the authors had no description of what might be clinically meaningful on the scales used.

The authors’ conclusions were based on a wide range of evidence levels, with much of the evidence being poor quality.

Given the concerns about the methodology of the review and the quality of the included studies, the results may not be reliable.
Implications of the review for practice and research

Practice: The authors did not state any implications for practice.

Research: The authors stated that future studies should consider the role that pain and/or analgesic medication might have in affecting post-operative cognitive dysfunction. Agreeing on a limited set of tests to be used in future studies would facilitate the pooling of data. It is also recommended that change in cognitive function is measured on a continuous scale.

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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.