Objective cognitive performance associated with electroconvulsive therapy for depression: a systematic review and meta-analysis
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CRD summary
The review found that cognitive impairments following ECT appeared mostly to be limited to the three days after treatment and that subsequently most functions improved beyond baseline levels. Evidence was lacking about several cognitive domains. Although the review was generally well conducted, some caution is advisable in interpreting the conclusions due to a failure to assess study validity.

Authors' objectives
To evaluate cognitive changes associated with electroconvulsive therapy (ECT) for depression.

Searching
MEDLINE, EMBASE, PsycARTICLES, PsycINFO and PsycLIT were searched from inception to January 2009 for published articles in any language. Search terms were reported. Reference lists of reviews and relevant articles were checked.

Study selection
Studies of adults (at least 18 years) diagnosed with depression and that compared cognition before and after ECT were eligible for inclusion. Studies were required to use specific methods described in the review for diagnosis of depression and for measurement and reporting of cognitive outcomes. Studies were required to provide electrode placement details: only studies that used bitemporal, right unilateral d'Elia or Lancaster positions were included. Case reports and studies that used self-reported measures were excluded.

Mean or median age of participants in the review ranged across study groups from 31 to 80 years (where reported). Most participants had unipolar or bipolar major depression/depressive episode. Generally ECT was given two to three times a week as a brief pulse or sine wave. Total number of sessions ranged from one to 29. The anaesthetic used varied widely. The studies used 22 different standardised neuropsychological tests and reported on 24 cognitive variables. Outcomes (cognitive domains) reported in the review were: global cognitive status, processing speed, attention/working memory, verbal episodic memory, visual episodic memory, spatial problem solving, executive functioning and intellectual ability. No suitable data on retrograde memory were found.

Two reviewers independently selected the studies. Disagreements were resolved by consensus.

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

Data extraction
Mean change from baseline (effect size) and standard deviation were extracted or calculated for each cognitive variable. The t statistic was used to calculate the standard deviation, if necessary. Data were adjusted for small sample bias. Mean effect sizes were interpreted as very large (≥1.30), large (≥0.80), medium (≥0.50) and small (≥0.20). Outcomes were classified as subacute (zero to three days between final treatment and testing), short-term (four to 15 days) or long term (more than 15 days). Variables were included if they appeared in at least three studies.

Two reviewers independently extracted the data. Disagreements were resolved by consensus. Authors of the primary studies were contacted for more information where required.

Methods of synthesis
Studies were pooled using Cooper and Hedge’s fixed-effect model to calculate pooled effect size for each cognitive variable. Heterogeneity was assessed using the Q statistic (p=0.01 or less was considered statistically significant). Different tests of the same function using the same methods were pooled. Where heterogeneity was found, the effects
of age, electrode placement, number and frequency of sessions, mean charge and stimulus waveform were examined. Where 10 or more samples reported the same outcome, publication bias was assessed using funnel plots, Begg rank correlation tests and file drawer analyses.

**Results of the review**

Eighty-four studies were included in meta-analysis (2,981 participants).

In the subacute period there was a significant decrease from baseline in cognitive performance in 72% of variables measured. The decrease in effect size ranged from -1.10 (95% CI -1.53 to -0.67) to -0.21 (95% CI -0.40 to 0.01). At short-term follow-up there was no significant change or an increase from baseline in all variables except one. At long-term follow-up there was no ongoing deficit in any variable and there was a small to medium improvement from baseline in 57% of variables, which included measures of processing speed, anterograde memory and some aspects of executive functioning. Where improvements occurred, effect sizes ranged from 0.35 (95% CI 0.07 to 0.63) to 0.75 (95% CI 0.43 to 1.08).

There was statistically significant heterogeneity for six of 18 subacute variables and for two of 21 short and long-term variables. Moderators had little impact on cognitive outcomes after three days post ECT.

There was no evidence of significant publication bias.

**Authors' conclusions**

Cognitive impairments following ECT appear mostly to be limited to the three days after treatment. Subsequently, most functions improved beyond baseline levels. Evidence was lacking about several cognitive domains.

**CRD commentary**

The objectives and inclusion criteria of the review were clear. Relevant sources were searched without language restrictions. The restriction to published studies meant that some studies may have been missed, although no significant evidence of publication bias was found. Steps were taken to minimise risks of reviewer bias and error by having more than one reviewer independently select studies and extract data. Inclusion was limited to studies that used well-validated cognitive tests and compensated for practice effects. It appeared that study quality was not systematically assessed, which made it difficult to assess the reliability of the findings. Appropriate statistical techniques were used to combine data and to assess and explore statistical heterogeneity.

The authors noted that the review was limited by lack of evidence about some cognitive domains known to be dysfunctional in depression. Although the review was generally well conducted, some caution is advisable in interpreting the conclusions due to the failure to assess study validity.

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

**Practice:** The authors stated that patients may find it help to know that cognitive impairments associated with ECT appeared to be limited to the first three days after treatment and that most cognitive functions subsequently improved beyond baseline. The authors noted that this applied only to the cognitive functions analysed in the review.

**Research:** The authors stated that standardised and validated measures of memory for events before the onset of depression or before beginning ECT would be useful in future studies. They recommended research on: whether delayed recall impairments in the subacute period related to retention or retrieval of material; the impact of other potential moderators of cognitive outcomes following ECT (such as persisting depressive symptoms and anaesthesia); effects of ECT on other cognitive domains; and the cognitive profile of successfully treated patients.

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**Bibliographic details**

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.