Antidepressant efficacy of high-frequency transcranial magnetic stimulation over the left dorsolateral prefrontal cortex in double-blind sham-controlled designs: a meta-analysis  

Schutter DJ

CRD summary
This review concluded that high frequency transcranial magnetic stimulation over the left dorsolateral prefrontal cortex was superior to sham in the treatment of depression. The author's conclusion appeared supported by the evidence presented. However, due to the lack of reporting on methodological processes, and the small sample sizes of included studies, the reliability of this conclusion is unclear.

Authors' objectives
To evaluate the effectiveness of high frequency transcranial magnetic stimulation (rTMS) of the left dorsolateral prefrontal cortex (DLPFC) for treatment of depression.

Searching
PubMed and Web of Science were searched between January 1980 and November 2007 for articles published in peer-reviewed English-language journals. Search terms were reported. Reference lists of previous meta-analyses and reviews were searched.

Study selection
Eligible studies were double-blind sham controlled trials that applied at least five sessions of high-frequency (>5Hz rTMS with an intensity of >80% motor threshold) 45 degrees and 90 degrees from the scalp or sham coil over the left DLPFC of adults with major depressive episode without psychotic features according to DSM-IV criteria.

The primary outcome measures were: baseline corrected percentage change scores on the Hamilton Depression Rating Scale (HAMD) or the Montgomery-Asberg Depression Rating Scale (MADRS).

In most studies patients were treatment resistant and the HAMD score was used. Mean patient age (range 38.9 to 66.5 years), motor threshold (range 80% to 110%), pulses per session (range 250 to 3,000) and number of sessions (range 5 to 20) varied between studies.

The author did not state how papers were selected for the review.

Assessment of study quality
Study quality was assessed using the criteria of random allocation, double blinding (patient and assessor blinded), sham controlled, parallel design and intention to treat analysis.

The author did not state how many reviewers performed the study quality assessment.

Data extraction
Data were extracted in order to calculate an effect size (Hedges' g) for the difference in the absolute and percentage change in outcome score from baseline to after the final session between active and sham rTMS. Study authors were contacted for missing/ incomplete data.

The author did not state how many reviewers performed the data extraction.

Methods of synthesis
Weighted effect sizes were combined in a random-effects model. Publication bias was assessed using a funnel plot and by the calculation of a fail-safe N (the number of new, unretrieved or unpublished studies with non-significant results that would be required to make the meta-analysis statistically non-significant). Differences in effect size between medication resistant and non medication resistant depression and between motor thresholds (<100% and 100-120%) were determined using analysis of variance. Statistical heterogeneity was assessed using the $X^2$ test.
Results of the review
Thirty RCTs were included in the meta analysis (1,166 patients). Sample size ranged from six to 277. Seventeen studies were performed in patients with medication resistant depression. Eight studies were in patients with non-medication resistant depression. Five studies did not state whether patients had medication resistant or non medication resistant depression. Publication bias was assessed and reported to be absent. The fail-safe N was 269.

The overall weighted mean effect size for treatment was 0.39 (95% CI 0.25 to 0.54). There was no evidence of statistically significant heterogeneity. There was no statistically significant difference in effect size between medication resistant (17 studies) and non medication resistant depression (eight studies) and between studies that applied <100% motor threshold (14 studies) and 100% to 120% motor threshold (16 studies).

Treatment was reported to be generally well tolerated. No deaths were reported. The most common side effects with rTMS were headaches, dizziness, nausea and painful local sensation. It was reported that one person (in the sham arm) experienced a seizure.

Authors’ conclusions
High frequency rTMS over the left DLPFC was superior to sham in the treatment of depression.

CRD commentary
The review addressed a clear research question and was supported by adequate inclusion criteria. The search strategy was limited to articles published in peer-reviewed English-language journals only, which meant that relevant unpublished or non-English studies may have been missed. However, publication bias was assessed and reported to be absent. Methods used used to select studies, extract data and perform study quality assessment were not reported, so any efforts made to reduce reviewer error and bias were unknown.

The study quality criteria were appropriate for the included study design. Adequate details of primary studies were provided and appropriate synthesis methods, including assessment of statistical heterogeneity, were used.

The author’s conclusion that high frequency rTMS over the left DLPFC was superior to sham in the treatment of depression appeared supported by the evidence presented. However, due to the lack of reporting on study selection, data extraction and study quality assessment, and the small sample sizes of the included studies, the reliability of the author’s conclusion is unclear.

Implications of the review for practice and research
Practice: The author stated that rTMS treatment may be an alternative for patients who had major (non-psychotic) depression, and especially for those patients who did not tolerate the side-effects associated with regular pharmacological treatment.

Research: The author stated that there was a need for controlled trials with sufficiently long follow-up assessments to establish the temporal course of rTMS-related antidepressant effects and to elucidate the underlying physiological mechanisms.

Funding
Innovational Research Grant (VENI 451-04-070) from the Netherlands Organization for Scientific Research (NWO).

Bibliographic details

PubMedID
18447962

DOI
10.1017/S0033291708003462
Original Paper URL
http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=2942844

Indexing Status
Subject indexing assigned by NLM

MeSH
Adolescent; Adult; Aged; Analysis of Variance; Depressive Disorder /psychology /therapy; Double-Blind Method; Humans; Middle Aged; Placebos; Prefrontal Cortex; Randomized Controlled Trials as Topic; Transcranial Magnetic Stimulation /methods /psychology; Treatment Outcome; Young Adult

AccessionNumber
12009104610

Date bibliographic record published
05/08/2009

Date abstract record published
20/01/2010

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.