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Repetitive transcranial magnetic stimulation for late-life depression: a systematic review and meta-analysis of randomized clinical trials

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 25 May 2025 and was last updated on 25 May 2025.

INTRODUCTION

Review question / Objective Repetitive transcranial magnetic stimulation (rTMS) is considered a potential treatment of choice for late-life depression, but its efficacy is still unclear. Therefore, we undertook a systematic review and meta-analysis to investigate the efficacy of rTMS.

Condition being studied Late-life depression (LLD) is a common disorder with a primary diagnosis of major depression, dysthymia, or minor depression according to DSM-IV criteria in older adults. The prevalence of clinically significant depressive symptoms ranges from approximately 8% to 16% among community-dwelling older adults. Meanwhile, the most large-scale epidemiological investigations reported that the prevalence of major depressive disorder (MDD) in community samples of adults aged 65 and older ranges from 1-5%. Depression is associated with a higher risk for stroke and stroke-related mortality, and there is also an increased all-cause mortality rate in the depressed population. Older adults with late-life depression are more likely to have cognitive deficits, especially executive functional impairment, and are more likely to develop dementia subsequently. Therefore, as its serious consequences on life quality, the management of late-life depression is an important public health issue.

METHODS

Participant or population Participants were elderly adult patients (male or female >55 years of age), who met a diagnosis of the depressive disorder according to a standardized diagnostic interview the DSM-IV (SCID), or ICD-10 criteria, and presented typical clinical symptoms of depression with scoring above a validated cut-off on a depressive rating scale, such as Hamilton depression rating scale (HDRS).

Intervention The intervention included rTMS or combined therapy (rTMS plus antidepressant treatments).

Comparator The compaator received sham stimulation or usual treatment.

Study designs to be included The study design was a randomized controlled trial.

Eligibility criteria We included studies that met the following criteria: (1) The study design was a randomized controlled trial; (2) Participants were elderly adult patients (male or female >55 years of age), who met a diagnosis of the depressive disorder according to a standardized diagnostic interview the DSM-IV (SCID), or ICD-10 criteria, and presented typical clinical symptoms of depression with scoring above a validated cut-off on a depressive rating scale, such as Hamilton depression rating scale (HDRS); (3) Patients in the intervention group received rTMS or combined therapy (rTMS plus antidepressant treatments), and was compared with patients in a control group received sham stimulation or usual treatment; (4) The primary outcome was the effect of therapy measured by the mean change in the depression rating scales, remission rates, or response rates. No language restrictions were applied to the included studies.

Information sources Four large electronic databases (PubMed, Embase, Cochrane Library, and PsycINFO) were searched to identify relevant clinical studies which investigated the efficacy of rTMS on LLD from inception to December 2024 without restrictions regarding language. The search was performed by using different combinations of the following keywords and medical subject headings (MeSH): “depression”, “late-life”, “geriatric” and “transcranial magnetic stimulation”. In addition, we manually searched the reference lists of identified relevant reviews and included articles to identify articles that might not have been captured in the database literature search. We will contact the corresponding author for detailed data if possible.

Main outcome(s) The primary outcome was the effect of therapy measured by the mean change in the depression rating scales, remission rates, or response rates. No language restrictions were applied to the included studies.

Quality assessment / Risk of bias analysis The same two reviewers used version 2 of the Cochrane risk-of-bias tool for randomized trials (www.training.cochrane.org/handbook) to evaluate the quality of included studies independently. The tool included seven domains: 1) random sequence generation; 2) allocation sequence concealment; 3) blinding of participants and personnel; 4) blinding of outcomes assessment; 5) incomplete outcome data; 6) selective outcome reporting; and 7) other sources of bias. The risk of bias was assessed and rated as “low risk” (all domains were rated as “low risk”), “high risk” (one or more domains were rated as “high risk”), or “unclear risk” (all other situations). Any disagreements between reviewers were resolved through discussion or consulting a third reviewer (H.-L.L.).

Strategy of data synthesis We performed the meta-analysis with Reviewer Manager Software 5.4.1 (Cochrane Collaboration, Oxford, UK). We calculated the pooled estimates using the standardized mean difference (SMD) with 95 % confidence intervals (CI) for continuous outcomes and odds ratio (OR) with 95 % CI for dichotomous outcomes. The heterogeneity across included studies was assessed using the I 2 value, which measures the percentage of total variation across trials. An I2 value greater than 50.0 % was recognized as significant heterogeneity. When significant heterogeneity existed, a random effects model was used to analyze the pooled data, otherwise, a fixed effects model was used.

Subgroup analysis The subgroup analysis was conducted to assess the efficacy outcome of rTMS according to different stimulationintensities.

Sensitivity analysis We removed every single trial in all the analyses sequentially, and the changes in results and heterogeneity were observed to test the robustness of the results.

Country(ies) involved China.

Keywords repetitive transcranial magnetic stimulation, late-life depression, efficacy.

Contributions of each author
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