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The effect of repetitive transcranial magnetic stimulation on functional rehabilitation in patients with spinal cord injury: a Meta-Analysis

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Preliminary searches.

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 22 September 2023 and was last updated on 22 September 2023.

INTRODUCTION

Review question / Objective Evaluating the effect of repeated transcranial magnetic stimulation on functional rehabilitation in patients with spinal cord injury.

Rationale Currently, there is a plethora of clinical research on the application of repetitive transcranial magnetic stimulation (rTMS) in the treatment of patients with spinal cord injury (SCI) addressing neuropathic pain, motor dysfunction, spasms, and related aspects. Due to varying research objectives and emphasis in these studies, substantial differences exist in study design and outcome measures, resulting in disparate research findings. Consequently, relying solely on the improvement of a single metric to assess the degree of functional recovery in SCI patients lacks persuasiveness.This study aims to address this challenge by not only considering functional outcome measures but also incorporating relevant indicators such as pain and emotional parameters. Through a systematic, quantitative, and comprehensive meta-analysis of multiple independent studies of a similar nature, we aim to provide an integrated assessment of the existing literature regarding the functional recovery effects of repetitive transcranial magnetic stimulation on patients with spinal cord injuries. Furthermore, we endeavor to explore its potential role in the context of rehabilitative therapy.

Condition being studied Spinal cord injury (SCI) is a serious disabling disease in the field of orthopedics and neuroscience caused by a series of internal and external factors, and its resulting dysfunction seriously affects the quality of life of patients. Repetitive transcranial magnetic stimulation (rTMS), as a non-invasive brain stimulation technique, can regulate cortical

excitability, synaptic structure, and function in SCI patients, promoting their functional recovery.Therefore, we will evaluate the effect of rTMS on functional rehabilitation (motor function, Activities of daily living) of SCI patients.

METHODS

Search strategy We will searched both Chinese(CNKI, Wanfang, VIP and CBM) and English(PubMed, Embase, Cochrane Library and Web of Science)databases for randomized controlled trials.According to the combination of subject words and free words, the search terms are as follows:Spinal Cord Injuries, Spinal Cord Ischemia, Central Cord Syndrome, spine, spinal, vertebrae, fracture, wound, trauma, injur, damage, spinal cord, contusion, laceration, transection, myelopathy, traumatic, post-traumatic, SCI, central cord injury syndrome, central spinal cord syndrome, tetraplegia, quadriplegia, tetraplegia, Transcranial Magnetic Stimulation, rTMS, Randomized Controlled Trial, Controlled Clinical Trial, randomized, placebo, randomly, trial.

Participant or population Patients with spinal cord injury.

Intervention Repetitive transcranial magnetic stimulation.

Comparator Sham stimulation or placebo or blank control.

Study designs to be included Randomized controlled trials (RCT).

Eligibility criteria Exclusion criteria: Patients combined brain injury, acute cerebrovascular disease and other brain diseases.

Information sources We will searched both Chinese(CNKI, Wanfang, VIP and CBM) and English(PubMed, Embase, Cochrane Library and Web of Science)databases for randomized controlled trials (from database inception until June 24th, 2023).

Main outcome(s) Spinal Cord Independence Messure (SCIM-III),motor evoked potential (MEP) and resting motor threshold (RMT).

Additional outcome(s) Functional Independence Measure (FIM),visualanalogue scale(VAS),Walking Index for SCI (WISCI-II),Lower Extremity Motor Score(LEMS),Hamilton Anxiety Scale(HAMA), Hamilton Depression Scale(HAMD).

Data management Two researchers independently performed data extraction, which mainly included the study characteristics (title, first author, publication year, language of publication), participant characteristics (sample size, sex, and mean age, country), intervention program (stimulation method, frequency, intensity, number of treatment sessions,treatment duration), and outcome index.

Quality assessment / Risk of bias analysis Two reviewers independently assessed the bias of the included studies according to the Cochrane Handbook for Systematic Reviews of Interventions, and disagreements were resolved by discussing with the third reviewer. The assessment items included selection bias, performance bias, detection bias, attrition bias, reporting bias, and other biases. Each item was rated as "high","low", or "unclear".

Strategy of data synthesis We used RevMan 5.4 to perform the meta-analysis.We used the Cochrane Q statistic to qualitatively determine whether heterogeneity existed among the included studies (test level α=0.05), while the I^2 statistic to quantitatively determine the magnitude of heterogeneity. If $P \geq 0.1$ and $I^2 \leq 50\%$, the heterogeneity was considered to be insignificant and we selected the fixed-effects (FE) model. Conversely, we selected the random-effects (RE) model.The results for the continuous variables were expressed as standardized mean differences (SMDs) with 95% confidence intervals (CIs).

Subgroup analysis None.

Sensitivity analysis Sensitivity analysis was performed by sequential deletion tests to test the stability of the main results. That is,after the deletion of any one study, the combined results of the remaining literature are not significantly different from those that would have passed the sensitivity analysis if it had not been deleted.

Country(ies) involved China.

Keywords Spinal cord injury; Repetitive transcranial magnetic stimulation.

Contributions of each author

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