INPLASY PROTOCOL

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Treatment of Cathodal Transcranial Direct Current Stimulation on upper extremity motor impairment of Patients after stroke: A Systematic Review

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Review question / Objective: **To systematically evaluate the efficacy of cathodal transcranial direct current stimulation(c-tDCS) for the treatment of upper extremity motor impairment after stroke.**

Eligibility criteria: **① The research object is: stroke accompanied by upper limb motor dysfunction, no previous history of epilepsy, no severe center of gravity, lung and other diseases, and able to cooperate with treatment The experimental group adopts c-tDCS, while the control group adopts pseudo stimulation and/or common treatment methods with the experimental group. Both groups can be combined with routine rehabilitation and medication; ③ Clinical randomized controlled trials (RCTs); ④ The included studies used at least one of the following to evaluate treatment outcomes: the Upper Limb Fugl Meyer Assessment (UL-FMA), the Action Research Arm Test (ARAT), and the Barthel index (BI).**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 May 2023 and was last updated on 15 May 2023 (registration number INPLASY202350061).

INTRODUCTION

Review question / Objective: **To systematically evaluate the efficacy of cathodal transcranial direct current stimulation(c-tDCS) for the treatment of upper extremity motor impairment after stroke.**

Rationale: **VIP Database for Chinese Technical, China National Knowledge Infrastructure, Wanfang Data, Embase, PubMed, Cochrane Library and Web of science databases were searched for the randomized controlled trials (RCTs) of c-tDCS in the treatment of the upper extremities of patients with stroke from the date of establishment of the databases to January 2023. The quality of the literature**

of included studies was also evaluated. And Meta-analysis of combined data was performed for RCTs that met the same outcome metrics.

Condition being studied: Stroke is a common group of cerebrovascular diseases that cause damage to brain tissue due to sudden rupture of brain blood vessels or blockage of blood vessels. It is now the highest incidence disease in China with the highest disability rate and the second highest mortality rate. About 80% of survivors have residual motor dysfunction, and 50% of patients have not fully recovered their upper limb motor function, which brings enormous pressure to their families and society. Therefore, the recovery effect of motor function can greatly determine the living standards of patients returning to their families and society. Transcranial direct current stimulation (tDCS) is a new non-invasive technology that uses low intensity and constant micro current to stimulate the target area of the cerebral cortex, regulate the activity of neurons in the cerebral cortex, and provide a new way for the recovery of motor function. There are three types of stimulation methods. Under conventional conditions, anodic tDCS (a-tDCS) can enhance the excitability of neurons at the stimulation site; Cathodic tDCS (c-tDCS) reduces the excitability of neurons at the stimulation site; Pseudo stimuli are often used as control stimuli.
In most of the current studies, researchers place a-tDCS in the affected cerebral hemisphere to enhance the excitability of neurons in the motor cortex and promote the recovery of potential neuronal functions. However, there are few studies on the effect of c-tDCS on the healthy hemisphere to improve upper limb motor dysfunction. Therefore, this study systematically analyzes existing studies on the treatment of upper limb motor dysfunction after stroke with c-tDCS, while also paying attention to its safety.

METHODS

Search strategy: Through computer and manual searches on Weibo, CNKI, Wanfang Database, Embase, PubMed, Cochrane Library, and Web of Science, the search was conducted until January 2023. The search terms include: 'stroke, hemiplegia, cerebrovascular, cerebral hemorrage, cerebral infiltration, transcranial direct current stimulation, direct current stimulation, tDCS, movement function, motor function, motor improvements, motor regeneration'.

Participant or population: Patients with motor dysfunction after stroke.

Intervention: Cathodic direct current stimulation.

Comparator: Common treatment methods and/or pseudo stimuli with the intervention group.

Study designs to be included: Clinical randomized controlled trials (RCTs).

Eligibility criteria: ① The research object is: stroke accompanied by upper limb motor dysfunction, no previous history of epilepsy, no severe center of gravity, lung and other diseases, and able to cooperate with treatment The experimental group adopts c-tDCS, while the control group adopts pseudo stimulation and/or common treatment methods with the experimental group. Both groups can be combined with routine rehabilitation and medication; ③ Clinical randomized controlled trials (RCTs); ④ The included studies used at least one of the following to evaluate treatment outcomes: the Upper Limb Fugl Meyer Assessment (UL-FMA), the Action Research Arm Test (ARAT), and the Barthel index (BI).

Information sources: VIP Database for Chinese Technical, China National Knowledge Infrastructure, Wanfang Data, Embase, PubMed, Cochrane Library and Web of science databases.

Main outcome(s): According to the eligibility criteria, 15 studies were identified. Compared with the control group, there were a statistically significant

differences in the upper limb Fugl-Meyer Motor Function Scale scores of patients in the c-tDCS group [WMD=5.27 95%CI (3.16, 7.38)], and Barthel Index scores [WMD=6.94, 95%CI (3.17, 10.72)]. But the scores of Action ResearchArm Test was not statistically significantly different [WMD=0.65, 95%CI (-7.86, 9.16)].

Quality assessment / Risk of bias analysis: Using ROBINS-I for bias risk assessment, two authors conducted separate assessments. When there is disagreement, cross analysis and discussion were conducted to determine.

Strategy of data synthesis: Use GetData software to extract data from the charts, and use Review Manager 5.4 software to conduct quantitative analysis of various research data. Due to the fact that all outcome indicators included in the literature are continuous variables with consistent measurement units, weighted mean difference (WMD) and 95% confidence interval (CI) were used for meta-analysis. In addition, through χ The P-value and I2 of the 2-test are used to quantitatively evaluate the heterogeneity. If $P \geq 0.1$ and $I2 \leq 50\%$, it indicates that the heterogeneity between different studies is small, and a fixed effects model is used; If P50%, it indicates heterogeneity between studies, using a random effects model. Create forest and funnel maps and analyze the sources of heterogeneity.

Subgroup analysis: Due to moderate or above heterogeneity among the included studies, subgroup analysis was conducted based on stroke stage, c-tDCS stimulation site, c-tDCS current density, and treatment period.

Sensitivity analysis: Sensitivity analysis was conducted on UL-FMA and BI scores, and after removing each study one by one, the statistical results remained unchanged. When conducting sensitivity analysis on the ARAT score, the difference was statistically significant after excluding the data from the study by Qu Siwei et al. [21] when the stimulus current intensity was 2mA [WMD=3.46, 95% CI (1.06,5.85)].

Language restriction: Chinese and english.

Country(ies) involved: China.

Keywords: stroke; transcranial direct current stimulation; upper extremities; Meta-analysis; randomized controlled trial.

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