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Electro-acupuncture for prolonged disorders of consciousness

Submission date	Recruitment status	[_] Prospectively registered
04/02/2026	No longer recruiting	[_] Protocol
Registration date	**Overall study status**	[_] Statistical analysis plan
06/02/2026	Completed	[_] Results
Last Edited	**Condition category**	[_] Individual participant data
05/02/2026	Signs and Symptoms	[X] Record updated in last year

Plain English summary of protocol

Background and study aims
To investigate the clinical effectiveness of electro-acupuncture at Cuanzhu (BL 2) and Sibai (ST 2) acupoints in individuals with prolonged disorders of consciousness and assess the therapeutic impact of arousal therapy on such patients.

Who can participate?
Patients with prolonged disorders of consciousness.

What does the study involve?
Participants were randomly divided into the control group and the electroacupuncture group by the random number table method. The electro-acupuncture group underwent treatment at Cuanzhu (BL 2) and Sibai acupoints (ST 2), and was given electrical stimulation (2/100 Hz), while the control group received sham electro-acupuncture stimulation for 3 weeks. Mismatch Negativity (MMN) tests were administered to both groups before and after the intervention. Comprehensive assessments were performed using the Coma Recovery Scale-Revised (CRS-R) and the Glasgow Coma Scale (GCS) to compare the arousal rate and prognosis between the two groups.

What are the possible benefits and risks of participating?
Benefits and risks not provided at time of registration.

Where is the study run from?
Handan Central Hospital, China.

When is the study starting and how long is it expected to run for?
April 2024 to October 2025.

Who is funding the study?
Investigator initiated and funded.

Who is the main contact?
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Contact information

Type(s)
Principal investigator, Public, Scientific

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Hebei Provincial Health Commission Approval Number
20251353

Study information

Scientific Title
Clinical efficacy of electro-acupuncture stimulation based on mismatch negativity in patients with prolonged disorders of consciousness

Study objectives
To investigate the clinical effectiveness of electro-acupuncture at Cuanzhu (BL 2) and Sibai (ST 2) acupoints in individuals with prolonged disorders of consciousness and assess the therapeutic impact of arousal therapy on such patients.

Ethics approval required
Ethics approval required

Ethics approval(s)
approved 18/06/2024, Ethics Committee of Handan Central Hospital (No. 59, Congtai North Road, Congtai District, Handan City, Hebei Province, 057150, China; +86 0310-2112510; jsypharm@126.com), ref: 014

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Active

Assignment
Parallel

Purpose
Treatment

Study type(s)

Health condition(s) or problem(s) studied
To investigate the clinical effectiveness of electro-acupuncture at Cuanzhu (BL 2) and Sibai (ST 2) acupoints in individuals with prolonged disorders of consciousness and assess the therapeutic impact of arousal therapy on such patients.

Interventions
Rehabilitation nursing focused on optimising limb positioning and managing artificial airways. Rehabilitation techniques included joint rangeofmotion exercises and breathing training.

In addition to selecting the appropriate acupoints of the V1 and V2 branches of the trigeminal nerve (the bilateral superior orbital foramen and inferior orbital foramen, corresponding to Cuanzhu and Sibai), the electro-acupuncture group also received Xingnao Kaiqiao acupuncture. The primary acupoints on the affected side were bilateral Neiguan, Renzhong, and Sanyinjiao, and the secondary acupoints were Jiquan, Chize, and Weizhong.

Cuanzhu (BL 2) and Sibai (ST 2) were chosen based on neuroanatomical and clinical evidence: these acupoints correspond to the exit points of the ophthalmic (V1) and maxillary (V2) branches of the trigeminal nerve. Electrical stimulation at these sites can activate the trigeminal nerve branches, which project to the thalamus and prefrontal cortex through the trigeminal–thalamic–cortical pathway. This activity may regulate the brainstem reticular activation system and prefrontal lobe functions related to consciousness. The stimulation parameters (2/100 Hz sparsedense wave, 1 mA) were selected based on previous Xingnao Kaiqiao acupuncture and trigeminal nerve stimulation studies. The 2/100 Hz frequency is commonly used in neurorehabilitation to balance excitatory and inhibitory neural activity, and 1 mA represents the maximum safe, tolerable intensity for patients. Studies have shown that this parameter combination can increase cerebral blood flow and promote neural cell survival.

Procedure:
The patient lies in the supine position. After disinfecting the skin with 75% ethanol, a disposable 0.35 mm × 40 mm Huatuo acupuncture needle (Suzhou Medical Supplies Factory Co., LTD., Suzhou Medical Device Standard 20162200970) is inserted. The electroacupuncture device is connected and set to sparsedense waves at 2/100 Hz, 1 mA, with the patient’s maximum tolerance used as the upper limit. Each treatment lasts 30 minutes, once daily, five days per week, for three weeks.

The control group also received Xingnao Kaiqiao acupuncture. Although connected to the electroacupuncture device, they did not receive electrical stimulation. The electro-acupuncture group followed the same treatment schedule. During all treatments, practitioners monitored patients closely for any adverse reactions and responded promptly if they occurred.

Primary outcomes
MMN detection:
The NeuronSpectrum4/EPM digital neuroelectrophysiological system (Neurosoft, Russia) was used to measure MMN before and after treatment. Reference electrodes were placed on the posterior mastoid processes, the ground electrode at FPz, and recording electrodes at Cz and Fz, with electrode impedance kept below 5 kΩ following the International 10–20 system. The Oddball paradigm was used, with 750 total stimuli. The analysis window was −100 to 500 ms, and the amplifier bandwidth was 0.1–30 Hz. MMN was defined as the difference waveform between standard and deviant stimuli, requiring the presence of N1 (the largest negative wave between 100–300 ms) in both stimulus types. Amplitude and latency at Fz and Cz were recorded.

Clinical scales:
CRSR: Within seven days before treatment, two trained neurologists performed five CRSR assessments, with the highest score taken as the final score. The scale ranges from 0 to 23 points; higher scores indicate better consciousness. Six subdomains (auditory, visual, motor, oromotor/verbal, communication, and arousal) were scored individually, with detailed results reported in the Results section.
GCS: Two neurologists assessed each patient's GCS before treatment. Lower scores indicate more severe impairment at one week.

Awakening rate:
Based on the Chinese Expert Consensus on the Diagnosis and Treatment of Prolonged Disorders of Consciousness, "awakening" was defined as an improvement of at least one consciousness level (e.g., VS to MCS, MCS to MCS+, or MCS+ to EMCS), confirmed by both increased MMN amplitude (falling within the higher consciousness range) and elevated CRSR scores. Since MMN amplitude correlates with consciousness level, an increase to a higher category after treatment suggests improvement compared with baseline.

Secondary outcome
Prognosis:
Three months after treatment, patients' prognoses were evaluated via structured telephone interviews with family members or caregivers using the Glasgow Outcome Scale (GOS). The GOS classifies outcomes into five categories (from death to good recovery, corresponding to scores of 1–5).

Intervention Type
Behavioural

Primary outcome(s)
1. Mismatch Negativity (MMN) paradigm measured using Neuron-Spectrum-4/EPM digital neuroelectrophysiological equipment at three weeks

2. Levels of consciousness measured using the Coma Recovery Scale-Revised (CRS-R) and the Glasgow Coma Scale (GCS) at one week

3. Awakening rate, defined as an improvement in the patient's consciousness level by at least one grade (e.g., from VS to MCS-, MCS- to MCS+, or MCS+ to EMCS), measured using both MMN changes (amplitude increase to the corresponding consciousness grade range) and CRS-R score elevation at three weeks

Key secondary outcome(s))

1. Prognosis measured using the Glasgow Outcome Scale (GOS) in structured telephone interviews with the patient's family members or caregivers at three months

Completion date
14/10/2025

Eligibility

Key inclusion criteria
1. Fulfill the requirements for a chronic DOC diagnosis
2. Perform CT or magnetic resonance imaging scans to confirm that the patient has brain trauma, cerebral hemorrhage or cerebral infarction, etc
3. Sign the informed permission form

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
50 years

Upper age limit
66 years

Sex
All

Total final enrolment
48

Key exclusion criteria
1. Known hearing impairment
2. History of severe cardiopulmonary diseases or other neurological disorders
3. Metal implants that may interfere with EEG or electro-acupuncture treatment
4. Taking sedative-hypnotic drug intake during the MMN test
5. Incomplete clinical data or loss to follow-up
6. Presence of skin damage at the electrode placement site

Date of first enrolment
01/04/2024

Date of final enrolment
30/04/2025

Locations

Countries of recruitment
China

Sponsor information

Organisation
Handan Central Hospital

Funder(s)

Funder type

Funder Name
Health Commission of Hebei Province

Alternative Name(s)
Hebei Provincial Health Commission,

Funding Body Type
Government organisation

Funding Body Subtype
Local government

Location
China

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available