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A Study on the Differences in Adverse Reactions and Reorientation Ability between Right Unilateral and Bilateral Electroconvulsive Therapy for Severe Depressive Disorder

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Abstract: To investigate the difference of repositioning ability between right and bilateral electroconvulsive therapy in patients with major depression. A total of 40 hospitalized patients with severe depression were randomly divided into right unilateral group (n=20) and bilateral group (n=20).On the basis of original drug treatment, right unilateral and bilateral ECT were administered, respectively. The treatment course was set at 3 times a week for a total of 8 sessions (3 times per week in the first 2 weeks and 2 times in the last week). Both groups also took antidepressants. The Hamilton Depression Rating Scale (HAMD), Hamilton Anxiety Rating Scale (HAMA), Treatment Emergent Symptom Scale (TESS) and clinical observation of adverse reactions were used to evaluate efficacy and safety. The orientation recovery time was tested using an orientation test to study differences in reorientation ability. The study found that both unilateral and bilateral ECT improved symptoms of major depressive disorder. The reduction time after right spasm is shorter than that after bilateral spasm, and the safety is better.

1. Introduction

Depressive disorder is a severe mental illness with high morbidity, high recurrence rate and high suicide rate [1]. A 1993 World Health Organization survey of 15 countries found that 12.5% of people suffered from depression and adverse mood [2]. Modified electroconvulsive therapy (MECT) is one of the commonly used treatment options for depressive patients, with high safety and good efficacy, and is especially an effective rapid treatment for those with severe anorexia and strong suicidal ideation and behaviors [3]. Electroconvulsive therapy (ECT) is a treatment method that controls psychiatric symptoms by inducing a brief, appropriate direct current electric stimulation to the brain, causing patients to lose consciousness and have generalized cortical seizures and systemic convulsions. In clinical practice, intravenous injection of anesthetics and muscle relaxants before

ECT can significantly reduce convulsions, fear and other reactions in patients' skeleton muscles, known as modified ECT (MECT). It is one of the most widely used physical therapies in psychiatry, especially irreplaceable in treating acute and refractory mental disorders. Although the efficacy of ECT is significant, its mechanism of action remains unclear. Meanwhile, due to its major impact on memory function and longer reorientation recovery time, patients often experience strong discomfort and poor compliance, which greatly hinders its clinical application. Depending on the electrode position, MECT can be divided into bitemporal, bifrontal and right unilateral stimulation. Bitemporal stimulation is generally 1.5 times the seizure threshold, bifrontal 2.5 times, and right unilateral stimulation 6 times. Research shows comparable clinical efficacy among the three, while right unilateral stimulation has less impact on cognitive function and bitemporal MECT has a faster symptom improvement in the early stage [4]. Since it was first officially reported by D'Elia in 1970 [5], right unilateral modified ECT (RUL-MECT) has been a hot topic in the field of psychiatric physical therapy research and application. Right unilateral stimulation is also known as non-dominant hemisphere stimulation. Bilateral stimulation is more commonly used in China. Drug resistance is the most common indication for MECT, which is often used as an augmentation therapy for refractory depression. Since its initial application, RUL-MECT has always been considered to have lower efficacy and slower onset than bilateral stimulation, with longer treatment courses but milder cognitive impairment. Meta-analysis shows [6] high dose RUL-MECT (6 times seizure threshold) has comparable antidepressant efficacy to bitemporal stimulation, shorter reorientation time and less memory impairment. This study focused on the differences in reorientation recovery time between right unilateral and bilateral ECT for severe depressive disorder. Details are reported as follows:

2. Subjects and Methods

2.1. Subjects

From June 2022 to June 2023, inpatients with severe depressive disorder were enrolled from the inpatient department of Chongqing Mental Health Center after obtaining informed consent and randomly assigned to the right unilateral ECT group (intervention group) and bilateral ECT group (control group), 20 cases in each group. Inclusion criteria: (1) meeting DSM-5 diagnostic criteria for severe depressive disorder; (2) 18-60 years old; (3) junior high school education or above; (4) right-handed; (5) signing informed consent to participate in this study. Exclusion criteria: (1) severe physical illness or organic brain disease; (2) diagnosed schizophrenia spectrum or substance use disorders; (3) excluding patients in depressive episodes of bipolar disorder; (4) having contraindications for ECT. There were no statistically significant differences in baseline clinical data between the two groups ($P>0.05$). See Table 1 for details.

2.2. Methods

2.2.1 Study design

A randomized, double-blind, controlled study design was adopted. 40 subjects with severe depressive disorder were randomly divided into a study group and a control group, 20 in each, using Excel to explore the efficacy and safety of modified right unilateral ECT. After randomization, the study group received modified right unilateral ECT, specifically set as the electrode being positive throughout, electrical stimulation applied about 2 min 30 sec after anesthesia, measuring the seizure threshold using the MT method, ultra-brief pulse of 0.3ms, 6 times the seizure threshold for stimulation, using the classic D'Elia right unilateral electrode placement, with propofol as anesthetic and succinylcholine as muscle relaxant. The treatment course was set at 3 times a week for a total of

8 sessions (3 times per week in the first 2 weeks and 2 times in the last week). The control group received bitemporal stimulation at 2.5 times the seizure threshold, with other treatment settings the same as above. Both groups also took antidepressants.

2.2.2 Evaluation methods

The Hamilton Depression Rating Scale (HAMD), Hamilton Anxiety Rating Scale (HAMA), Treatment Emergent Symptom Scale (TESS) were used before and after treatment to measure the efficacy and safety of right unilateral ECT. An orientation test was used to test the orientation recovery time of subjects.

2.2.3 Statistical analysis

SPSS 17.0 was used for statistical analysis. Count data were expressed as (n, %) and measurement data as mean ± standard deviation ($\bar{x} \pm s$). The Kolmogorov-Smirnov K-S test examined whether the data conformed to a normal distribution. Chi-square test was used for count data and t-test for normally distributed measurement data to analyze all enrolled subjects. $P<0.05$ was considered statistically significant.

3. Results

A total of 40 adult patients with severe depressive disorder were enrolled and randomly divided into two equal groups (right unilateral ECT intervention group, 20 cases, 6 males and 14 females; bilateral ECT control group, 20 cases, 5 males and 15 females). There were no statistically significant differences in gender, age, disease course between the two groups ($P>0.05$). The comparisons of HAMD scores before ($t=1.626$, $P=0.112$) and after ($t=0.978$, $P=0.334$) treatment between the two groups had no statistical significance. The comparisons of HAMA scores before ($t=0.566$, $P=0.575$) and after ($t=1.568$, $P=0.125$) treatment between the two groups had no statistical significance. The comparison of orientation recovery time between the two groups after treatment was statistically significant ($t=4.422$, $P=0.001$), indicating a shorter orientation recovery time after right unilateral ECT compared to bilateral ECT. (Table 1)

Table 1: Comparison of baseline data, pre- and post-treatment HAMD, HAMA scores and orientation recovery time

Item	Right Unilateral	Bilateral	t	p
HAMD pre-treatment	35.90±4.35	33.85±3.59	1.626	0.112
HAMD post-treatment	7.65±4.23	8.95±4.17	0.978	0.334
HAMA pre-treatment	30.10±6.03	31.30±7.32	0.566	0.575
HAMA post-treatment	6.85±3.28	8.80±4.49	1.568	0.125
Orientation time (sec)	470.05±90.17	629.85±134.13	4.422	0.001
Age	29.40±15.12	28.40±12.07	0.231	0.818
Disease course	15.45±11.22	13.50±8.45	0.621	0.538
Gender male/female	6/14	5/15	Chi-square value =0.125	0.723

No serious adverse events occurred in either group during treatment. Analysis of adverse events in the 40 patients showed no serious adverse reactions in either group. The main adverse reactions included:

Constipation: 4 cases (right unilateral 1 case, 5%; bilateral 3 cases, 15%)
Headache: 2 cases (right unilateral 0 cases, 0%; bilateral 2 cases, 10%)
Dizziness: 1 case (right unilateral 1 case, 5%; bilateral 0 cases, 0%)
Nausea and vomiting: 3 cases (right unilateral 2 cases, 10%; bilateral 1 case, 5%)
Hypertension: 1 case (right unilateral 0 cases, 0%; bilateral 1 case, 5%)
Cardiac arrhythmia: 1 case (right unilateral 0 cases, 0%; bilateral 1 case, 5%)
Loose teeth: 1 case (right unilateral 1 case, 5%; bilateral 0 cases, 0%)
Hypotension: 1 case (right unilateral 0 cases, 0%; bilateral 1 case, 5%)
No cases of delirium or anesthetic allergy occurred. (Table 2)

Table 2: Adverse Event Table

Group Adverse Events	Constipation		Headache		Nausea and Vomiting		Hypertension Cardiac		Arrhythmia		Loose Teeth		Hypotension	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Right unilateral (n=20)	1	5	0	0	2	10	0	0	0	0	1	5	0	0
Bilateral (n=20)	3	15	2	10	1	5	1	5	1	5	0	0	1	5

4. Discussion

MECT efficacy and side effects are influenced by stimulation site, course and dose. The initiation site of seizures has greater impact than propagation areas [7]. Since the medial temporal lobe and hippocampus are closely associated with cognitive function, direct stimulation of the bilateral temporal lobes should be avoided .D'Elia first reported the standard paradigm of RUL-MECT in 1970. Randomized controlled trials in 2000 showed comparable efficacy between 6 times seizure threshold RUL-MECT and 2.5 times bilateral, with faster onset for RUL [8]. Since then, RUL-MECT dose has been set at 6 times threshold, with variations of up to 8 or 10 times threshold [9].RUL-MECT has slower onset than bilateral stimulation and may need slightly more sessions. Frequency is 2-3 per week, adjustable to bilateral if efficacy is poor .This study used D'Elia right unilateral electrode placement with 6 times seizure threshold stimulation to avoid direct bilateral temporal stimulation. Efficacy was comparable to bilateral but reorientation time was shorter, suggesting potentially milder cognitive impact. Further research with larger samples is needed to confirm this finding and establish right unilateral ECT as an equal or preferred choice for severe depression. More clinical studies are still needed.

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