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The Application of Haishi EEG Biofeedback in Post-stroke Insomnia (PSI)

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Abstract: [Objective] Selected the Department of Neurology and Rehabilitation, Chongqing Yongchuan Hospital of Traditional Chinese Medicine, from July 2020 to July 2021, inpatients who meet 60 cases of post-stroke insomnia patients, use the insomnia treatment instrument ES-100H EEG biofeedback treatment instrument Two electrodes are placed at the post-auricular mastoid. The treatment intensity: tolerable, 5 times a week, 10 times as a course of treatment. On the basis of conventional treatment, plus EEG biofeedback. In Haishi: Half an hour is selected between 21:00-23:00 for treatment. Compared with the same period last year.[Results] Compared with the same period last year, the improvement in indicators such as the quality of life of patients, mood was significantly better than that of the control group ($P<0.05$), but it was not statistically significant compared with the control group ($P>0.05$), in terms of reducing the number of days of hospitalization, Hospital expenses, Frequency of hospitalizations.[Conclusion] 21:00-23:00 (Hai Shi) The use of EEG biofeedback for post-stroke insomnia can significantly improve the symptoms of post-stroke insomnia, which is worthy of promotion. the rational use of medical insurance funds requires multi-channel observation to achieve a win-win situation between hospitals, national medical insurances and patients, control medical expenses, improve hospital management, increase the effectiveness of medical insurance funds, and enhance medical system services.

Keywords: Application, Haishi EEG Biofeedback, Post-stroke Insomnia

1. Introduction

Post-stroke insomnia (PSI) is a highly prevalent complication in patients with stroke.

The incidence, mortality, and disability rate of stroke are high, while insomnia is a stroke Common symptoms of patients in middle-aged. The diagnosis of stroke-related insomnia needs to meet the brain The diagnosis of stroke and insomnia refers to the first appearance after a stroke or before the stroke Some insomnia persists or worsens after stroke, and reaches the diagnostic criteria for insomnia Standard, including post-stroke insomnia and stroke accompanied by insomnia [1]. After stroke Insomnia has received widespread attention at home and abroad. Insomnia throughout the occurrence, development and ending. Insomnia can increase the risk of stroke [2, 3], at the same time stroke can also cause Insomnia. On the one hand, insomnia affects the rehabilitation and quality of life of stroke patients, on the other hand Face-to-face will increase the risk of stroke recurrence, disability, anxiety and depression, so early diagnosis and treatment of stroke-related insomnia is of great significance to the prognosis of patients. Women with insomnia have a slightly higher risk of stroke than men, but gender differences Did not reach statistical significance [4]. Insomnia can increase the risk of stroke by 54%. It is most likely to cause transient ischemic attack, followed by ischemic stroke, and then came hemorrhagic stroke. The severity of insomnia is related to the risk of stroke, and The older the age, the smaller the impact on stroke [5]. According to research by Helbig et al., Dyssomnia has nothing to do with stroke events, but short-term sleep (<5 h) and long-term Sleep (> 10 h) is related to male stroke events [6] Insomnia after stroke has a higher incidence, according to the study of Leppavuori et al. Currently, 56 out of 277 stroke patients have been reported. 7% of patients suffer from insomnia [7],

while in ordinary. The incidence of insomnia among the population is 10.0%-12.9%.

Studies have shown that The incidence of insomnia after stroke is about 50% [8], which is significantly higher than that of the general population. Insomnia occurs in the acute stage of stroke, Stroke is the second-leading global cause of death behind heart disease, accounting for 11.13% of total deaths worldwide [9]. And insomnia is high in 3 to 4 months after the onset. Development period [10]. Insomnia seriously affects the patient's quality of life and recovery process, plus Severe mood disorders and stroke risk factors such as hypertension, diabetes, etc. Related diseases, and even lead to recurrence of cerebral hemorrhage or cerebral infarction [11]. Survivors often suffer from not only pain and various physical disabilities but also mood disorders such as depression [12]. Related research. Studies have shown that orexin regulates blood glucose metabolism and inflammation after stroke and promote the expression of nerve growth factor to play a protective role in the brain [13]. Steiner [14]. The study found that pre-orexin mRNA in the hypothalamus has circadian periods. The rhythm changes, indicating that insomnia is closely related to orexin. Currently about stroke. The pathogenesis of insomnia is still unclear. It is believed that the focal surface of stroke patients. When the product is equal, it occurs in the brain stem, frontal lobe, basal ganglia and other parts of the brain. There is a higher probability of sleep disturbance in infarction. Benzodiazepine Azepines are the main ones. Although the clinical effect is definite, the drug is tolerable and dependent Sex, glycolipid metabolism disorder and other unhealthy reactions are valued by people, and the "hangover" effect of drugs affects the central nervous system of stroke patients repair.

2. Materials and Methods

2.1. General Information

Selected from July 2020 to July 2021, 60 patients with of Post-stroke insomnia (PSI) in and Department of Brain Diseases and the Prevention Treatment Center, Chongqing Yongchuan Hospital of Traditional Chinese Medicine, using the insomnia treatment instrument ES-100H EEG biofeedback treatment instrument produced by Chongqing Haikun Medical Instrument Co., Ltd. Treatment, frequency main spectrum range 1.8kHz-2.28kHz, electrical stimulation of the cerebellar fastigial nucleus, two electrodes placed behind the ear mastoid, treatment intensity: tolerance, 5 times a week, 10 times as a course of treatment. On the basis of conventional treatment, plus EEG biofeedback. At Hirsch: Half an hour is selected for treatment between 21:00-23:00. Compared with the same period last year, the number of hospitalization days, hospitalization expenses, Frequency of hospitalizations, Pittsburgh Sleep Quality Index (PSQI), Self-rating Symptom Scale (SLC-90).

2.2. Diagnostic Criteria

The patients are in line with the 4th National Cerebrovascular Society The diagnostic criteria for stroke [15], and confirmed by CT or MRI Diagnosed as a stroke; the symptoms of insomnia accord with the neurology score of the Chinese Medical Association The revised diagnostic criteria of the Sleep Disorders Group [16].

2.3. Inclusion Criteria

Meet the above diagnostic criteria and syndrome diagnostic criteria; Age 40 to 85 years old; Pittsburgh Sleep Quality Index Scale at the time of entry, (PSQI) score>7 points; not taking psychotropic drugs 1 month before enrollment; All patients signed an informed consent form.

2.4. Exclusion Criteria

The symptoms of insomnia occurred before the stroke, or the insomnia was caused by surgery, pain, fever and other diseases and changes in living habits or external environment.

Caused by environmental interference; combined with serious primary diseases such as liver, kidney, cardiovascular, blood, etc., or people with severe mental disorders; alcoholism or psychoactive drug abuse; feeding Women in breast or pregnancy; participated in other research projects in the past one month. Satisfying any of the above will exclude this research.

2.5. Fall-off Criteria

The patient failed to complete the entire study process to leave early Out; incomplete clinical data and failure to treat on time affect the evaluation; during treatment, Deterioration or serious complications occur, give emergency treatment.

2.6. Method

2.6.1. Treatment

60 patients with Post-stroke insomnia (PSI) in the Department of Neurology and Rehabilitation, Chongqing Yongchuan Hospital of Traditional Chinese Medicine, give Basic treatment: In order to fully protect the rights and interests of patients, all patients undergo medical treatment during the clinical observation period. Patients suffering from heart, brain, kidney and other diseases should be treated with corresponding routine treatments and blood pressure changes should be monitored.

According to the specific situation, there is no restriction on drug treatment that is not related to the treatment of this disease. General acupuncture and massage treatments and rehabilitation of hemiplegic limbs are performed for the basic diseases of stroke. On the basis of conventional treatment, EEG biofeedback will be added between 21:00 and 23:00.

Choose half an hour for treatment, using the insomnia treatment instrument ES-100H EEG biofeedback treatment instrument produced by Chongqing Haikun Medical Instrument Co., Ltd. Treatment, frequency main spectrum range 1.8kHz-2.28kHz, electrical stimulation of the cerebellar fastigial nucleus, two electrodes placed behind the ear mastoid, treatment intensity: tolerance, 5 times a week,

10 times as a course of treatment. On the basis of conventional treatment, plus EEG biofeedback. At Hirsch: Half an hour is selected for treatment between 21:00-23:00. Compared with the same period last year.

2.6.2. Observation Indicators

Number of hospitalization days, Hospitalization expenses, Frequency of hospitalizations, Pittsburgh Sleep Quality Index (PSQI), Symptom Self-rating Scale (SLC-90).

2.6.3. Efficacy Judgment Standard

Significantly effective: falling asleep time<30 min, sleep time prolonged for more than 2 h, feel good, PSQI ≤ 7 points; Effective: falling asleep time 30 to 45 min, sleep time prolonged for more than 1h, self-feeling improved significantly, PSQI reduction rate>30%; Ineffective: Falling asleep time>45 min, sleep time extension<1 h, self-feeling has not improved, PSQI score reduction rate<25%. Total effective rate=(marked effect + effective) / total number of cases × 100%.

2.6.4. Statistical Methods

SPSS 26.0 software was used for statistical analysis of the data. The measurement data obeyed the normal distribution and were expressed as the mean ± standard deviation (Mean ± SD), and the comparison between groups was performed by the t test. analyze. $P<0.05$ was considered to be statistically significant. The enumeration data were expressed as cases (%), and the chi-square (χ^2) test was used for comparison between groups. For the data before and after treatment in the same group, the measurement data obeyed the normal distribution, and the paired sample t test was used for comparison before and after treatment, otherwise, the paired sample rank sum test was used for comparison. $P<0.05$ was considered to be statistically significant.

3. Results

3.1. Baseline Data

60 Cases in Treatment group of Baseline Data Included in the Sample are All Patients Who Were Hospitalized from July 2020 to June 2021 Another 60 Cases in control group Who Were Hospitalized from July 2019 to June 2020 in Department of of Neurology and Rehabilitation,, Chongqing Yongchuan Hospital of Traditional Chinese Medicine. The Demographic Data and Clinical Characteristics of the two Groups Are Comparable (P>0.05), See Table 1

Table 1. *Two groups of demographic data and clinical characteristics (n, $\bar{x}$).*

Group	control group (n=60person-time)	Treatment group (n=57 person-time)	t/χ^2	*P*
Age/Year	62.47±12.08	65.32±12.14	-1.190	0.239
Male/Female, n (%)			0.020	0.887
Male	22 (81.5)	24 (80.0)		
Female	5 (18.5)	6 (20.0)		

The age of the treatment group and the control group approximately obeyed the normal distribution, and was described by the mean ± standard deviation. Two independent samples t-test was performed, and the results showed that the difference was not statistically significant (P>0.05).

Gender is count data, which is described by the number of cases (%), and the chi-square test is used for comparison between groups, P=0.887>0.05, and the gender distribution of the two groups of patients is balanced.

3.2. "Withdrawal Cases"

During the Observation Period, 1 Case in the Treatment Group Withdrew from Observation Due to Arrhythmia. According to the Curative Effect at the Time of Withdrawal, It Was Judged as Invalid; 60 Cases in the Control Group, There Was no Withdrawal Case During the Observation Period.

3.3. "Dropping Cases"

During the Observation Period, There Was 2 Case ransferred to a higher-level hospital for treatment due to family reasons in the Treatment Group and the Treatment Was Discontinued.

Table 2. *The number of days in hospital and Hospital Expenses*

	control group (n=60person-time)	Treatment group (n=57 person-time)	$t/z/\chi^2$	*P*
The Number of Days in Hospital	11.0 (7.0, 24.2)	10.0 (70.0, 30.0)	-0.186	0.853
Hospital Expenses (yuan)	11027 (6658, 16602)	10077 (6460, 12831)	-0.556	0.578

3.4. The Number of Days in Hospital and Hospital Expenses

The number of days of hospitalization and Hospital Expenses did not obey the normal distribution, and were described by the median (interquartile range). The comparison between groups was performed using the rank sum test of two independent samples. The results showed that both P were greater than 0.05. There were no statistically significant differences in hospitalization days and Hospital Expenses between the two groups.

3.5. Frequency of Hospitalizations

Table 3. *Frequency of hospitalizations.*

	control group60/27=2.2	Treatment group: 57/30=1.9	χ^2	*P*
The actual number	27	30	0.681	0.409
>1 admissions Frequency	33	27		

There was no statistically significant difference in Frequency of hospitalizations in hospital between the treatment group and the control group (P>0.05).

3.6. Comparison of PSQI Scores and SLC-90 Scores Before and After Treatment, See Table 4

Table 4. *Comparison of PSQI score and SLC-90 Scores between Before and After Treatment of the treatment group.*

	Before treatment	Two weeks after treatment	z	*P*
SLC-90	320 (311, 328)	122 (116, 125)	-6.568	<0.001
PSQI	16 (14, 17)	4 (4, 5)	-6.423	<0.001

The difference before and after the treatment of the treatment group in PSGI and SLC-90 Score were statistically significant (P<0.05).

The SLC-90 and PSQI before and after treatment did not obey the normal distribution, and were described by the median (interquartile range). The comparison before and after treatment was performed by paired sample rank sum test. The results showed that the comparison of SLC-90 and PSQI before and after treatment was P<0.05, and the difference was statistically significant. After treatment, it was significantly improved compared with before treatment.

3.7. "Adverse Reactions"

There Was no Serious Adverse Reaction in Both Groups During the Observation.

4. Discussion

Insomnia is one of the common complications after stroke. sleep-wake cycle is frequently disturbed after stroke [17, 18]. 56% to 68% of stroke patients have insomnia or sleep-wake cycle disorders [19], This frequency is higher than what observed in patients without a stroke (10–40%) [20]. insomnia causes impaired daytime function [21], such as anxiety, fear, delayed reaction Symptoms such as bluntness, decreased concentration, lethargy or depression, are very important for stroke patients.

Rehabilitation, quality of life, and physical and mental health have an impact. Loss after stroke Sleep has a serious impact on the work and life of the patient, and it also affects the patient's family and the society has caused a heavy burden, therefore, how to effectively improve the symptoms of insomnia is one of the research hotspots of stroke rehabilitation. Modern medicine treats insomnia mainly.

It is to quickly induce falling asleep, prolong the total sleep time, so as to calm hypnosis and anti-stress. Antidepressants are the main drugs, and the curative effect is definite, but there are different degrees of different Good reaction or dependence and withdrawal syndrome.

In this study, biofeedback therapy was applied to the treatment of post-stroke insomnia. With the help of biofeedback therapy equipment, the treatment was carried out in a relatively quiet environment to allow the patient to relax. The therapist induced and used electrical feedback signals to make the patient Feeling its own information and consciously adjusting the mind and body can effectively promote the patient to enter a quiet sleep state through adjustment, reduce the level of muscle excitement, and inhibit the awakening of the nerve center, so as to achieve the purpose of prolonging and deepening sleep. Through the training of the patient's physiological and psychological activities, the symptoms of anxiety, insomnia, depression, etc. will eventually be changed; the third is that this therapy is stain-free, has no adverse reactions, and no pain, and is easy for patients to accept. The results of the study showed that after 2 weeks of biofeedback anti-loose therapy, the patients' anxiety, depression, and sleep quality scores were reduced to varying degrees compared with the conventional control group, allowing the patients to relax as much as possible and consciously perform themselves Regulates and inhibits the excitability of the autonomic nervous system, reduces the patient's nerve center arousal level, and further promotes the formation of the patient's sleep state, so that the damaged sleep-wake system can be restored, and the nerve-muscle-nerve two-way closed-loop regulation can be achieved, thereby effectively treating Insomnia. The use of biofeedback relaxation therapy technology in Haishi is positive and effective in improving post-stroke insomnia. Neurotransmitters related to stroke sleep have temporal secretion characteristics. The biological clock in the brain is located in the suprachiasmatic nucleus (suprachiasmatic nucleus, referred to as the suprachiasmatic nucleus). SCN) is a pair of cell clusters located above the optic nerve chiasm [22]. The pineal gland begins to secrete melatonin at about 21:00 in the evening, which makes people feel tired, and stops secreting at about 7:00 in the morning to make people awake., "Biological clock" [23] will have a low tide at 22-23 o'clock, therefore, the best time to sleep is 21-22 o'clock. Most people rest at around 22:00 in the evening. If they have not fallen asleep after 23:00, it will be difficult to fall asleep after 24:00.

So when to induce sleep is very important. Give patients EEG biofeedback during the secretion of melatonin. When low-frequency currents are transmitted to the central nervous system of the brain, the central nervous system's inhibition process is synchronized with the secretion of melatonin, thereby inducing and promoting physiological properties. Sleep, so as to reach the state of sleep, increase the total sleep time and S3, S4 sleep, shorten the sleep latency, reduce the number of sleep awakenings, and improve sleep efficiency. Using the biological clock theory, the sleep cycle maintains a dynamic balance in time, and the two periodic transitions between sleep and wakefulness play a very important role in maintaining normal mental activities. In recent years, more and more attention has been paid to the "biological clock" of sleep [24] Mechanism research.

Modern research [25-27] believes that human sleep is not only affected by nature, but also internal rhythm gene regulation. There are rhythms of day and night, tides, moon, and seasons in nature, which affect the creatures in nature. Human beings are not only affected by external rhythms [28], but also by internal rhythms. External rhythms include light and dark, hot and cold, etc. The external rhythms make sleep rhythms diversified; while the internal rhythms are mainly affected by circadian clock genes. At present, the circadian clock genes mainly include Clock, Bmal1, Per and Cry, etc. [29, 30]. The internal rhythms are mainly Regulate the circadian rhythm. Sleep shows rhythmicity under the influence of internal and external rhythms, that is, circadian rhythm. EEG during the day is mainly manifested as awakening, and at night, it is mainly manifested as sleep. The seasons are regular, and sleep has its clear timing. Sleep has a certain correlation with the seasons. Different regions have different time zones, different seasonal climates, and different sleep conditions [31]. Female sex is affected by sex hormones, and there is an obvious monthly cycle pattern in sleep [32]. The age is regular. Newborns sleep more and the elderly sleep less. If the same person is at different ages, the sleep awakening time will also change [33, 34]. Because sleep is manifested in obvious rhythm, insomnia is a change in the rhythm of sleep, so it also shows corresponding rhythm. For example, insomnia patients have difficulty falling asleep at night and sleepiness during the day; the incidence of insomnia in spring and autumn is higher than that in summer and winter, and the specific manifestations are that the number of insomnia patients decreases after the summer and winter solstice, and the number increases after the vernal and autumnal equinox [35, 36]. Patients with insomnia and depression tend to see a high proportion of patients from December to March (winter and spring), while patients with anxiety tend to see a high proportion of patients from June to October (summer and autumn) [37].

Sleep medicine is closely related to time medicine. Therefore, when using physical therapy, it combines the traditional Chinese medicine understanding of time. Haishi is the time when the yin qi is at its peak, the yin qi is strong, the sleep sound is strong, and the yang qi is strong. Yin and Yang are in harmony and conform to nature [38]. yin and yang imbalance is the total pathogenesis of insomnia [39]. Low-frequency current is transmitted to the central nervous system of the brain and resonates at the same frequency to achieve better results. However, the cost of hospitalization and the number of hospitalizations have not been changed. Considering the correlation with the improvement of patients' economic conditions, people's awareness of health, and higher reimbursement rates, patients are willing to spend more time and experience in rehabilitation treatment. Patients' repeated hospitalizations are not Derived from the anxiety and fear of diseases, the rational use of medical insurance funds requires multi-channel observation to achieve a win-win situation between hospitals, national medical insurances and patients, control medical expenses, improve hospital management, increase the effectiveness of medical insurance funds, and enhance medical system services.

5. Conclusion

Compared with the same period last year, the improvement of Pittsburgh Sleep Quality Index (PSQI) and Self-rating Symptom Scale (SLC-90). Were significantly better than that of the control group ($P<0.05$), but it was not statistically significant compared with the control group ($P>0.05$); in terms of reducing the number of days of hospitalization, Hospital expenses, Frequency of hospitalizations.

Competing Interests

All the authors do not have any possible conflicts of interest.

Authors' Contributions

Wang huanqun: data collection, background research, treatment recording writing; Gan ting: R data analysis; Zou weiwu: therapeutic assessment;

Wang huanqun: performed treatments, overall responsibility. All the authors read and approved the final report.

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