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Original Article

An effect analysis of vestibular rehabilitation training in vertigo treatment

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Abstract: Objective: This study aimed to explore the clinical safety and effectiveness of vestibular rehabilitation training in the treatment of vertigo. Methods: Patients with vertigo were randomly divided into an experimental group (51 cases) or a control group (51 cases) and were treated for 4 weeks. The Berg balance scale scores (BBS), the vestibular symptom index (VSI) scores, the balance experiment scores, the UCIA vertigo scores, and the vertigo symptom changes before and after the treatment were recorded, and the treatment success was investigated. At the same time, the patient satisfaction scores and the dizziness handicap inventory (DHI) scores were recorded, and the quality of life after the treatment was evaluated. Results: After four weeks of treatment, the BBS, VSI, balance test, and UCIA vertigo scores in the experimental group were higher than the corresponding scores in the control group ($P<0.05$). Meanwhile, the total effective rate and the patient satisfaction in the experimental group were higher than they were in the control group ($P<0.05$). Compared with the control group, the total index and sub-indexes of the DHI (DHI-P (physical), DHI-F (function), and DHI-E (emotion)) in the experimental group were significantly improved, and the differences were statistically significant ($P<0.05$). The BBS, VSI, balance test, and UCIA vertigo scores in the two groups after the treatment were better than they were before the treatment ($P<0.05$). Conclusion: Compared with drug therapy alone, vestibular rehabilitation training combined with common drug therapy can significantly improve the patients' quality of life, better eliminate their vertigo symptoms, and improve their satisfaction.

Keywords: Vestibular rehabilitation training, vertigo disease, validity, quality of life

Introduction

Vertigo refers to a disorder of the human body's positioning in space, which leads to the wrong positioning of its own movement or position. Research has shown that this is due to some functional obstacles in the human body's balance system, and its clinically-related manifestations are dizziness and the inability to walk normally [1, 2]. In serious cases, this will affect the normal life and work of patients [3]. The pathogenesis of this disease is complex, and the effect of the diagnosis and treatment with ordinary drugs alone is not ideal. Therefore, it is urgent to seek other treatment methods. The vestibular nervous system is mainly responsible for the human body's spatial orientation and balance, and vestibular rehabilitation training is the main physical therapy currently applied for vertigo patients [4, 5]. This kind of training is a physical therapy method that integrates a variety of sports training. It continuously stimulates the central nervous system moderately, increases the compensation of vestibule, helps the brain to rebuild the state of balance, and thus relieves the symptoms of vertigo [6-8]. Some studies have confirmed that vestibular rehabilitation training can treat some vertigo diseases, such as benign paroxysmal vertigo, Meniere's disease, and vestibular neuritis [9, 10]. However, few studies have confirmed the superiority of vestibular rehabilitation training combined with drug therapy. The purpose of this study is to evaluate the clinical

safety and effectiveness of vestibular rehabilitation training combined with drug therapy for vertigo patients, so as to provide a safer and more effective treatment for vertigo patients.

Materials and methods

Research participants

The patients who were admitted to Cangzhou Central Hospital for treatment from July 2019 to June 2020 were recruited as the study cohort and randomly divided into the experimental group (applied common drugs combined with vestibular rehabilitation training) or the control group (applied common drugs only), with 51 cases in each group. Inclusion criteria: (1) Patients who were diagnosed with peripheral vertigo with benign paroxysmal vertigo, Meniere's disease, vestibular neuritis, or sudden deafness, and who were hospitalized for systematic treatment [11]. (2) Patients aged 18-85 years old. (3) Patients who volunteered to participate in the experiment. Exclusion criteria: (1) Patients with severe organ damage. (2) Patients with mental-illness related diseases. (3) Patients who could not actively comply. (4) Patients who quit voluntarily. (5) Patients with previous craniocerebral injuries or who suffered cerebrovascular accidents. The experiment was approved by the Ethics Committee of Cangzhou Central Hospital, and the patients or their families signed the informed consent forms.

Experimental methods

In the control group, only ordinary drugs were applied, and betahistine (Eisai (China) Pharmaceutical Co., Ltd.) was given to the patients using an intravenous drip of 500 mL (qd). Two weeks later, it was changed to 6 mg orally (tid), and dihydroergotoxine (Tianjin Huajin Pharmaceutical Co., Ltd.) was administered 1 mg orally (tid). The experimental group underwent vestibular training in addition to the common drug treatment. The ease of the vestibular training and the length of the training were determined according to each patient's specific condition. The general training time was 20-40 minutes, about 3 times a day. The training methods were as follows: (1) Visual intensive rehabilitation training. (2) Rehabilitation training of gait function: timed standing up and walking, walking with the heel and tip in a line, and dynamic gait. (3) Rehabilitation training for center of gravity change: center of gravity change, functional forward extension, walking and hip rotation. (4) Peripheral vestibular rehabilitation training: head rotation and visual fixation, eye movement and visual fixation, alternate visual fixation, and reverse motivation and visual fixation. (5) Rehabilitation training of muscle strength: sitting up five times, standing on one leg, lifting heels and toes. (6) Alternative rehabilitation training: reflective saccade, cervico-ocular reflex, memory VOR and memory saccade. (7) Balanced and coordinated rehabilitation training: horse stance and waving hands like clouds, lunge passing and toe walking. (8) Central vestibular rehabilitation training: VOR inhibition, anti-saccade, memory VOR and memory saccade. Both groups underwent the treatment for four weeks. All these treatments were carried out by the same group of doctors, and each patient's condition during the treatment was closely monitored. If there were patients who were unable to adapt to the training or whose condition worsened, they were advised to quit the experiment and apply other treatment methods.

Outcome measures

Main outcome measures

The Berg balance scale scores (BBS), the vestibular symptom index (VSI) scores, the balance test scores, the UCIA vertigo scores, and the vertigo symptom changes before and after the treatment were recorded, and the treatment success was investigated.

The treatment success was divided into: recovered, markedly effective, effective, and ineffective. Recovered indicated that the patient recovered completely and was able to live freely; markedly effective indicated that the symptoms were significantly improved, and the otolith returned to the correct position without recurrence; effective indicated that the dizziness was partially improved; ineffective indicated that the patient's symptoms did not change or even worsened or recurred. The effective rate was calculated as: (recovery number + markedly effective number + effective number)/total number * 100%.

Secondary outcome measures

The patient satisfaction scores and dizziness handicap inventory (DHI) scores were recorded, and the patients' quality of life after the treatment was evaluated.

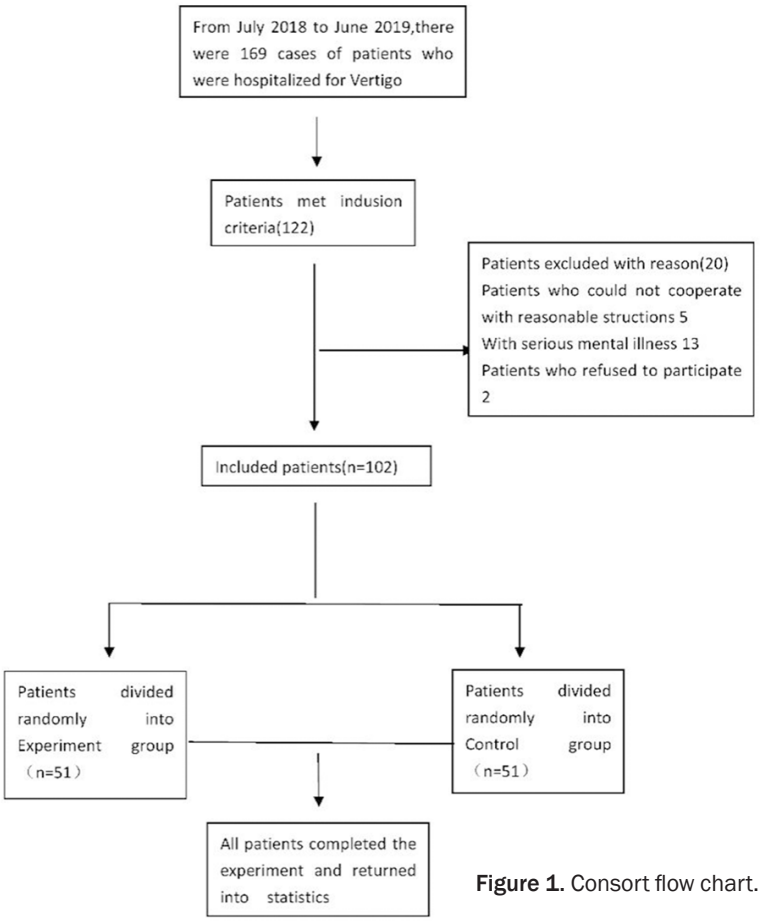

Figure 1. Consort flow chart.

Satisfaction score: after four weeks of treatment, the patients' levels of satisfaction with the treatment were determined, looking at the treatment effect, quality of life, related discomfort during the treatment, and symptom recovery, with a total possible score of 100 points. Scores of 81 points or above indicated that the patients were very satisfied, 61 to 80 points indicated that the patients were satisfied, and 60 points or below indicated that the patients were dissatisfied. The satisfaction levels of the patients and their families = (very satisfied cases + satisfied cases)/total cases * 100%.

Statistical methods

SPSS 22.0 was used to process and analyze the relevant data, and the count data were represented as the rate and compared using χ^2 tests. The measurement data were represented as the mean ± standard deviation ($\bar{x}$ ± sd) and compared using independent sample t-tests. Paired sample t-tests were used for the comparisons before and after the treatment. When P<0.05, a difference was considered statistically significant.

Results

General data

After analyzing the inclusion and exclusion criteria, a total of 102 patients were included in this experiment. 51 of the patients were randomly placed in the experimental group, and 51 of the patients were randomly placed in the control group. No uncontrollable accident or midway evacuation occurred during the treatment, and the experiment was ended after the patients successfully participated in the groups (**Figure 1**). The basic data of the two groups were recorded and compared, and there were no significant differences (P>0.05; **Table 1**).

Comparison of the BBS, VSI, balance test, and UCIA vertigo scores

After 4 weeks of treatment, the BBS, VSI, balance test, e and UCIA vertigo scores in the experimental group were significantly different from those in the control group (P<0.01; **Table 2**). After 4 weeks of treatment, the BBS, VSI, balance test, and UCIA vertigo scores in both groups were all improved compared to the scores recorded before the treatment (P< 0.001).

Comparison of the total effective rate and the satisfaction with the treatment

At the same time, the total effective rate and satisfaction level of the experimental group were higher than they were in the control group (P<0.05; **Tables 3**, **4**).

Comparison of the DHI total index and sub-index levels

There were significant differences in the total index and sub-index (DHI-P (physical), DHI-F

Table 1. Comparison of the general information ($\bar{x}$ ± sd, n)

	Experimental group (n=51)	Control group (n=51)	χ^2/t	P
Age (years)	61.4±9.5	62.6±8.9	-0.399	0.767
Body mass index (kg/m^2)	27.13±5.57	28.08±5.72	0.334	0.742
Weight (kg)	71.43±11.45	72.78±12.24	-0.455	0.562
Gender (n)			0.375	0.366
Male	25	27		
Female	26	24		
Vertigo type (n)			0.706	0.872
Meniere's disease	11	13		
Benign paroxysmal vertigo	15	13		
Vestibular neuritis	19	17		
Sudden deafness	6	8		
Basic diseases combined (n)			0.363	0.563
Yes	31	34		
No	20	17		
Malnutrition (n)			0.165	0.456
Yes	15	14		
No	36	37		

Table 2. Comparison of the BBS, VSI, balance test scores and UCIA vertigo scores ($\bar{x}$ ± sd)

	Experimental group (n=51)	Control group (n=51)	t	P
BBS				
Before treatment	9.57±2.31	9.91±1.85	0.820	0.414
After treatment	45.23±11.32	26.34±7.65	4.321	0.000
t	22.042	14.098		
P	0.000	0.000		
VSI				
Before treatment	39.41±5.66	40.12±4.83	0.681	0.497
After treatment	26.33±7.39	30.24±8.41	3.213	0.003
t	10.035	7.275		
P	0.000	0.000		
Balance test scores				
Before treatment	30.18±5.27	29.89±6.62	0.245	0.807
After treatment	127.13±10.23	98.98±2.44	4.883	0.000
t	60.165	69.933		
P	0.000	0.000		
UCIA vertigo scores				
Before treatment	13.63±4.12	12.57±4.06	1.309	0.194
After treatment	4.32±1.00	6.80±1.65	5.314	0.000
t	15.682	9.402		
P	0.000	0.000		

Note: BBS: Berg balance scale score; VSI: vestibular symptom index.

(function), DHI-E (emotion)) levels between the control group and the experimental group (P<0.001; **Table 5** and **Figure 2**).

Discussion

Vertigo is a common clinical syndrome, and increasing age will accelerate its incidence, so it has a higher incidence among the elderly. Due to the influence of people's living habits and work stress, the incidences of vertigo tends to occur in younger patients, so it has attracted the attention of medical circles at home and abroad [12]. Moreover, vertigo is a kind of disease that is difficult to cure, and patients' bodies and minds are greatly injured, and it seriously affects patients' quality of life, so the treatment drugs and methods need to be explored urgently, and now most treatment methods rely on drug treatment [13]. Drug treatment mainly includes vestibular nerve sedatives such as diazepam. If vertigo causes vomiting, drugs for vomiting should be prescribed, while betahistine and other vasodilators can be used to treat Meniere's syndrome and vascular headaches. Patients with headaches and dizziness can use ergotamine, which constricts cerebral vessels, some can use diuretics and hormones, and some are treated with traditional Chinese medicine. All of the above are symptomatic drugs, so they cannot fundamentally solve the problem, and the application of these drugs will bring certain side effects. For example, sedatives can make people sleepy, and hormones can make people fat and cause osteoporosis. Drug treatment cannot completely cure or control the dis-

Table 3. Comparison of total effective rates (n, %)

	Experimental group (n=51)	Control group (n=51)	χ^2	P
Recovery	26	16	5.455	0.035
Markedly effective	17	13		
Effective	6	10		
Ineffective	2	12		
Total effective rate	96.08%	76.47%	5.765	0.023

Table 4. Comparison of satisfaction levels with the treatment (n, %)

	Experimental group (n=51)	Control group (n=51)	χ^2	P
Very satisfied	28	20	6.754	0.033
Satisfied	15	11		
Dissatisfied	8	20		
Satisfaction degree	84.31%	60.78%	6.988	0.008

Table 5. Comparison of the DHI total index and sub-indexes ($\bar{x} \pm sd$)

	Experimental group (n=51)	Control group (n=51)	t	P
Total DHI index	15.23±3.67	24.33±5.38	3.632	0.000
DHI-P	5.43±0.99	8.02±1.38	3.321	0.000
DHI-F	5.94±1.23	8.42±2.03	3.417	0.000
DHI-E	4.82±1.20	7.82±1.52	3.457	0.000

Note: DHI: dizziness handicap inventory.

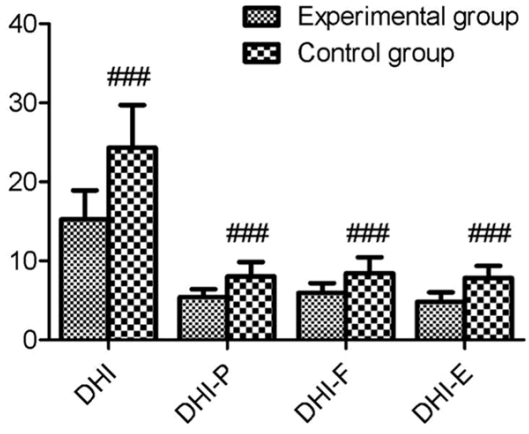

Figure 2. Comparison of the DHI total index and sub-index scores. Compared with the experimental group, ###P<0.001. DHI: dizziness handicap inventory.

ease, so other methods need to be discovered urgently [14, 15].

The vestibular nervous system is in charge of the human body's spatial orientation and balance. By starting training, standing training, walking training, and other methods, the compensation of the vestibule can be accelerated, thus alleviating a series of symptoms such as patients' imbalance and dizziness, and further improving the stability of posture. This method shoots two hawks with one arrow, thus alleviating the symptoms [7, 16, 17]. Our study found that the vestibular rehabilitation training combined with the drug treatment is superior to the drug-only group in all the vertigo scores, and the treatment success was more accurate. Vestibular rehabilitation training can promote the generation of vestibular compensation in the form of adaptation and substitution. After the formation of the current vestibular compensation, it can be maintained for a period of time and can retain vestibular compensation for a period of time in the state of stimulation [18-20].

In this study, the patients in the experimental group began vestibular rehabilitation training upon admission, which increased the opportunities and the times of the patients' early activities, increased the time of communication between the doctors and patients, improved the patients' training compliance and treatment confidence, and improved the vertigo symptoms of the patients with vertigo diseases to the greatest extent [21, 22]. Therefore, the total index and sub-index of DHI of the patients in the experimental group were improved, mainly due to the patients' trust in the doctors, the increased face-to-face communication opportunities between the doctors and the patients, and the advantages of vestibular rehabilitation training itself [23, 24].

This study concluded that the patient satisfaction in the experimental group was significantly improved, which may be related to the more significant treatment effect in the patients. However, the small size of the study cohort and the short follow-up time may lead to a relative deviation of the results. Therefore, in order to further confirm the therapeutic effect of vestibular rehabilitation training, we will recruit a larger cohort and follow up for a longer time period. Moreover, this study only studied the comparison of drug therapy alone with the com-

bination therapy of drugs and vestibular rehabilitation training. It is not clear whether the treatment effect can be achieved using vestibular rehabilitation training alone. We speculated that the training may play a better role in addition to the drug therapy, and the amount of drugs used in the combination therapy was not decreased. If the combined vestibular rehabilitation training can still have a good treatment effect under the condition of drug reduction, the advantages of vestibular rehabilitation training can be truly reflected. This conjecture needs further confirmation.

To sum up, vestibular rehabilitation training combined with common medicine treatment can better eliminate the symptoms of vertigo, improve patients' quality of life, and make the patients more satisfied with the treatment, so it will accelerate the progress of their rehabilitation and improve their quality of life.

Disclosure of conflict of interest

None.

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