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The Impact of Neurorehabilitation on the Motor Function and Independence Patients with Post-Stroke Hemiplegia

Chuan Sun*

Zhaoyuan Hospital of Chinese Medicine, Yantai 265400, Shandong Province, China

Corresponding author: Chuan Sun, yiwuke_zy@163.com

Abstract: *Objective*: To explore the effect of neurorehabilitation on the motor function and independence of patients with post-stroke hemiplegia. *Methods*: 62 stroke patients from August 2020 to August 2022 with hemiplegia were selected for this study. The patients were randomly divided into a study group (neurorehabilitation) and a control group (conventional rehabilitation). Gait changes, National Institutes of Health Stroke Scale (NIHSS), activities of daily living (BI index), motor function (Fugl-Meyer), quality of life (SF-36) and treatment satisfaction of both groups were compared. *Results:* The stride length (SL) and the fastest walking speed within 10 m (10 mMWS) of the research group were better than those of the control group ($P < 0.05$). The NIHSS, Barthel Index, Fugl-Meyer, SF-36, and other scores of the research group were better than those of the control group ($P < 0.05$). The treatment satisfaction of the study group was higher than that of the control group, $P < 0.05$. *Conclusion:* Neurorehabilitation is highly effective and feasible in improving walking speed, increasing stride length, and reducing nerve function damage in stroke patients with hemiplegia.

Keywords: Stroke hemiplegia; Neurorehabilitation; Motor function; Independence

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1. Introduction

Stroke is a type of organic brain injury characterized by both diffuse and localized damage to brain tissue. It can be divided into two types: hemorrhagic and ischemic. There is a high risk of hemiplegia after a stroke. Hemiplegia refers to the movement disorders of the ipsilateral muscles, upper limbs, lower limbs, and tongue muscles. In mild cases, patients can walk independently but exhibit an abnormal posture. In severe cases, they lose their ability to walk independently [1]. Therefore, hemiplegia after stroke should be diagnosed and treated as soon as possible. Traditional stroke hemiplegia rehabilitation programs primarily aim to minimize complications and slow down its progression, offering limited curative results. In recent years, some scholars have explored neurorehabilitation approaches to enhance neurological and motor function recovery in stroke hemiplegia patients, but research in this area remains limited. In this paper, 62 patients with post-stroke hemiplegia were treated from August 2020 to August 2022 to explore the value of neurological rehabilitation.

2. Materials and methods

2.1. General information

62 patients with stroke and hemiplegia that were treated between August 2020 and August 2022 were included in this study, and they were randomly divided into two groups: research group and control group. There were 18 males and 13 females in the research group, aged 46-80 years, with an average of 51.24 ± 3.19 years old. There were 19 males and 12 females in the control group, aged 47–81 years, with an average of 51.31 ± 3.25 years old. The baseline data of both groups were comparable, $P > 0.05$.

2.2. Inclusion and exclusion criteria

Inclusion criteria: patients that are in good mental state, conscious, have signed an informed consent, and have limb hemiplegia.

Exclusion criteria: patients with congenital limb deformities, organ dysfunction, mental illness, or cardiovascular diseases.

2.3. Treatment methods

The patients were given conventional treatments such as fluid rehydration, lowering intracranial pressure, and lowering blood pressure. At the same time, antiplatelet drugs and neurotrophic drugs were given, and the neurological function of the patients was evaluated to actively prevent and control complications such as pneumonia, pressure ulcers, and malnutrition.

The research group underwent neurorehabilitation. (1) The Bobath technique was applied to promote neurodevelopment. (i) Key point control: manual intervention was performed on the head, trunk, and middle and lower sternum to reduce muscle tension and inhibit abnormal postural reflexes, which helped restore muscle tension and correct abnormal postures. (ii) Reflex suppression: If there is tension in the flexor muscle of the patients, the patients were instructed to maintain a hyperextended neck position to reduce the flexor muscle tension; the patients were rotated to adjust muscle tension, while maintaining a constant pelvic position during the rotation. For example, the tension of the flexor muscle was increased by blocking the external rotation of the limbs, the tension of the abductor muscle was increased by blocking the internal rotation of the limbs, and the spasticity of the flexor muscles of the upper arm was inhibited by the symmetrical extension of the limbs. (iii) Reflex promotion: During the positive response phase, the doctor instructed the patients to rotate their head, stimulating trunk rotation. When the patients were in a supine position, they turned their head to one side, which would in turn move the thoracolumbar spine and lower limbs, and they then returned to the original position. To develop the patients' ability to turn over their bodies, and the doctor guided the patients to tilt their trunk while keeping their heads upright. When the patient was in a sitting position, the doctor instructed the patient to tilt their trunk left and right to enhance head control, while simultaneously twisting the lower body to further exercise the patient's ability to turn over. (2) Reconstruction of brain function: Motor relearning strategies were adopted to exercise the patients' motor function and enhance their ability to live independently. This involved balancing exercise, walking exercise, and other compulsory treatments. (3) TCM intervention: Acupuncture and moxibustion were carried out according to the patients' condition. The acupoints were stimulated with "turning, twisting, and lifting" techniques, and if necessary, infrared physiotherapy was carried out to treat the local area.

The control group received conventional rehabilitation: The patients were instructed to abduct, internally rotate, and lift up their upper limbs. When the patients were able to tolerate these exercises, the patients were instructed to flex, externally rotate, lift, and adduct their lower limbs. Each session of training lasted for 20–30 min, and the patients performed 1 session per day. When the patients were stable, they were encouraged to eat, dress, and brush their teeth independently.

2.4. Observation indicators

Gait: The stride length (SL), the fastest walking speed within 10 m (10 mMWS), and other indicators of the patients were measured. Rehabilitation indicators: The National Institutes of Health Stroke Scale (NIHSS) score indicates the severity of neurological deficits, with higher scores reflecting more severe deficits. The BI index measures the recovery of the motor functions, with higher scores indicating better recovery. The Fugl-Meyer score assesses motor function recovery in hemiplegic patients, with higher scores signifying better recovery. The SF-36 score evaluates the quality of life, with higher scores indicating better quality of life. Treatment satisfaction: the degree of satisfaction of the patients towards the treatment was evaluated.

2.5. Statistical analysis

The data of post-stroke hemiplegic patients were analyzed using SPSS 21.0. Count data were presented as percentages and analyzed using a χ^2 test, while measurement data were presented as mean ± standard deviation and analyzed using a *t*-test. Significant contrast differences were observed, with a significance level of $P < 0.05$.

3. Results

3.1. Gait

Before treatment, there were no significant differences in the SL and 10 mMWS indexes between the study group and the control group ($P > 0.05$). Following treatment, the study group exhibited significantly better SL and 10 mMWS indexes compared to the control group ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of the patients' gait (mean ± standard deviation)

Group	SL (cm)		10 mMWS (m/min)	
	Before treatment	After treatment	Before treatment	After treatment
Research group (n = 31)	63.14 ± 2.11	89.14 ± 3.49	24.54 ± 1.84	41.25 ± 2.11
Control group (n = 31)	63.19 ± 2.19	73.62 ± 3.02	24.51 ± 1.82	33.87 ± 2.03
t	0.0789	16.1273	0.0556	12.0880
P	0.9375	0.0000	0.9559	0.0000

3.2. Rehabilitation indicators

Following treatment, the patients in the study group exhibited significantly better NIHSS, BI index, Fugl-Meyer, and SF-36 scores compared to those in the control group (P < 0.05). However, before treatment, there were no significant differences in these scores between the study group and the control group (P > 0.05), as indicated in **Table 2**.

Table 2. Comparison of rehabilitation indicators (mean ± standard deviation)

Group	NIHSS (points)		BI index (points)		Fugl-Meyer (points)		SF-36 (points)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After t reatment
Research group (n = 31)	21.87 ± 2.41	9.08 ± 1.05	24.85 ± 2.43	85.11 ± 4.85	4.18 ± 1.25	11.48 ± 2.25	46.25 ± 2.74	68.18 ± 3.87
Control group (n = 31)	21.91 ± 2.39	13.64 ± 1.76	24.91 ± 2.49	49.15 ± 3.71	4.21 ± 1.27	6.75 ± 2.06	46.31 ± 2.72	57.49 ± 3.26
t	0.0565	10.6708	0.0827	28.2428	0.0807	7.4360	0.0745	10.1317
P	0.9552	0.0000	0.9345	0.0000	0.9360	0.0000	0.9409	0.0000

3.3. Treatment satisfaction

96.77% of patients with stroke and hemiplegia in the study group were satisfied with treatment compared to the control group (80.65%), with $P < 0.05$, as shown in **Table 3**.

Table 3. Comparison of treatment satisfaction [*n* (%)]

Group	Very satisfied	Satisfied	Dissatisfied	Total satisfaction rate
Research group (n = 31)	23 (74.19)	7 (22.58)	1 (3.23)	96.77
Control group (n = 31)	16 (51.61)	9 (29.03)	6 (19.35)	80.65
χ^2	-	-	-	4.0260
P	-	-	-	0.0448

4. Discussion

Stroke has a high clinical incidence rate and is closely linked to acute cerebrovascular diseases. It exhibits characteristics of both diffuse and localized brain tissue damage, resulting in impaired brain function, and falls within the category of organic brain injuries. Based on its pathological features, it is categorized into different types, including hemorrhagic and ischemic types. Hemiplegia is a common sequela of stroke, which can cause dyskinesia of the tongue, facial muscles, and upper and lower limbs, thereby affecting the daily life of patients [2]. However, it should be noted that untimely diagnosis and treatment of stroke hemiplegia and improper treatment can lead to aggravation of hemiplegia, which will affect the patients' quality of life. Therefore, in order to improve the prognosis of patients with post-stroke hemiplegia and restore their motor function, early diagnosis and treatment is required [3,4]. Studies showed that the high-level brain center has strong plasticity. Proper rehabilitation can stimulate the movement of hemiplegic limbs and enhance the motor function of hemiplegic patients. The earlier the rehabilitation is carried out, the better the effect. Although conventional rehabilitation can delay the progress of hemiplegia and enhance the patients' motor function, it is difficult to achieve a curative effect. Some scholars have tried drug therapy combined with conventional rehabilitation, but the overall effect was unsatisfactory [5]. With further studies, it was found that neurorehabilitation can enhance the curative effect and improve the quality of life of post-stroke hemiplegia patients [6,7]. Neurorehabilitation involves a wide range of contents, including myoelectric biofeedback, direct current stimulation, massage, acupuncture, etc., which can effectively improve the neurological function of patients and avoid muscle atrophy [8,9]. In addition, neurorehabilitation therapy can also reshape the patient's neural pathways to meet the rehabilitation needs of hemiplegic patients.

In this study, the SL and 10mMWS indexes of the research group were better than those of the control group ($P < 0.05$). Besides, 96.77% of patients in the research group were satisfied with treatment compared to the control group (80.65%), with $P < 0.05$.Therefore, it can be concluded that neurorehabilitation can improve patients' activities of daily living, quality of life, increase patients' stride length, and promote the patients' recovery. This is because the neurorehabilitation plan involved many aspects like neurodevelopment, acupuncture and moxibustion of traditional Chinese medicine, and reconstruction of brain function, making the treatment program more comprehensive [10,11]. In neurorehabilitation, the Bobath approach was used to lower muscle tension, correct posture, and address issues like abnormal muscle strength, including extensors and flexors. It improved exercise strategies to restore limb movement function. Targeted functional training was tailored to the patient's rehabilitation status to enhance limb coordination. During neurological rehabilitation treatment, careful attention was given to the patient's responses, and treatment procedures were gradually introduced. Training intensity was adjusted based on the patient's actual physical and mental state, with the goal of restoring the patient's capability for daily life activities [12]. The reconstruction of brain function treatment can protect neurological function, train neurologically damaged hemiplegic patients to develop new behaviors, and achieve effective retraining. Traditional Chinese medicine interventions like acupuncture and infrared physiotherapy, it can enhance blood circulation, alleviate blood stasis, open meridians, stimulate local microcirculation, increase brain blood flow, and facilitate the absorption of cerebral edema [13]. Moreover, during acupuncture and moxibustion treatments, the selection of specific acupoints based on syndrome differentiation can bidirectionally regulate brain cell excitability, boost the transmission of motor signals in the cerebral cortex, activate central motor nerves, shorten limb function recovery time, and thereby enhance motor abilities and self-care capabilities, ultimately improving the patients' quality of life [14,15].

5. Conclusion

In summary, neurorehabilitation can improve the motor function of patients with post-stroke hemiplegia, enhance their activities of daily living of patients, repair damaged nerve function, and improve the prognosis of patients. Therefore, it should be promoted in clinical practice.

Disclosure statement

The author declares no conflict of interest.

References

[1] Liu L, Zhao K, 2022, Application of Neuromuscular Stimulation Therapeutic Apparatus Combined with Rehabilitation Training in Stroke Hemiplegia. Clinical Journal of Traditional Chinese Medicine, 34(12): 2351–2354.

[2] Wu J, Wu M, Wei P, et al., 2022, Clinical Observation of Early Comprehensive Rehabilitation Therapy on Improving Motor Function and Daily Living Ability of Middle-Aged and Elderly Stroke Patients with Hemiplegia. Chinese General Medicine, 20(12): 2123–2126.

[3] Shi H, 2022, Clinical Observation of Intermediate Frequency Pulse Therapeutic Apparatus on Rehabilitation of Hemiplegia After Stroke. China Medical Device Information, 28(22): 160–162.

[4] Zang L, Qu J, Wang X, et al., 2022, Clinical Efficacy Analysis of Neuromuscular Electrical Stimulation Therapy Device Combined with Early Rehabilitation Training in the Treatment of Stroke Patients with Hemiplegia. Chinese Practical Medicine, 17(18): 184–186.

[5] Song W, Yang Y, Liu B, 2022, Clinical Efficacy of Neuromuscular Electrical Stimulation Therapy Device Combined with Early Rehabilitation Training in the Treatment of Stroke Hemiplegia. Shenzhen Journal of Integrated Traditional Chinese and Western Medicine, 32(12): 106–109.

[6] Wan Y, 2022, The Effect of Medium Frequency Pulse Therapy Instrument Combined with Comprehensive Rehabilitation Nursing on the Rehabilitation Effect of Stroke Patients With Hemiplegia. Heilongjiang Medicine, 46(12): 1489–1491.

[7] Zheng S, Huang S, Zeng A, et al., 2022, Effects of Early Rehabilitation Treatment on Nerve, Motor Function and Self-Care Ability of Hemiplegic Patients with Cerebral Infarction. Health Medicine Research and Practice, 19(05): 74–76.

[8] Wu Y, 2022, Effect of Neurorehabilitation Treatment on Movement and Life Ability of Hemiplegia Patients After Stroke. China Health Standard Management, 13(07): 85–88.

[9] Li X, Zhang Y, 2022, Discussion on the Effect of Neuromuscular Electrical Stimulation Therapy Device Combined with Early Rehabilitation Training on the Rehabilitation and Psychological Status of Stroke Patients with Hemiplegia. Journal of Aerospace Medicine, 33(01): 24–26.

[10] Zeng H, 2021, Effect Analysis of Neuromuscular Electrical Stimulation Therapy Device Combined with Early Rehabilitation Training on Stroke Hemiplegia. Chinese and Foreign Medical Research, 19(33): 158–161.

[11] Wang X, Wang B, 2020, Effects of Acupuncture Combined with Comprehensive Rehabilitation Training on Motor Function, Nerve Function and Daily Living Ability of Stroke Patients with Hemiplegia. China Science and Technology of Traditional Chinese Medicine, 27(05): 814–815.

[12] Li Xia, Li B, Liu Y, 2020, Efficacy of Neurorehabilitation Therapy in Improving Motor Function and Activities of Daily Living in Patients with Hemiplegia after Stroke. Psychological Monthly, 15(07): 179.

[13] Liu L, 2020, Study on the Effect of Neurorehabilitation Therapy on Improving Motor Function and Activities of Daily Living in Patients with Hemiplegia after Stroke. Capital Food and Medicine, 27(07): 24.

[14] Guo L, 2020, Efficacy of Neurorehabilitation Therapy in Improving Motor Function and Activities of Daily Living in Patients with Hemiplegia after Stroke. Famous Doctors, 8(02): 216.

[15] Zhang Q, 2019, Efficacy of Neurorehabilitation Therapy in Improving Motor Function and Activities of Daily Living in Patients with Hemiplegia after Stroke. Massage and Rehabilitation Medicine, 10(18): 12–13.

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