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Research Article

Impact of Compulsory Exercise Rehabilitation Nursing Based on NIHSS Score on Exercise Ability and Balance Ability of Patients with Cerebral Infarction

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Abstrac

Objective: To analyze the impact of compulsory exercise rehabilitation nursing (constrained-induced movement therapy (CIMT) based on the National Institute of Health Stroke Scale (NIHSS) score on exercise ability and balance ability of patients with cerebral infarction (CI).

Methods: A retrospective analysis was conducted on the clinical data of CI patients admitted to our hospital in the past year. Totally 210 patients were selected as the research subjects and assigned equally to the control group and the CIMT group. The control group was given conventional exercise rehabilitation nursing, and the CIMT group was treated with compulsory exercise rehabilitation nursing for 2 cycles of 7 days. The NIHSS scores of the two groups were compared and analyzed.

Results: The NIHSS scores of the CIMT group were lower than those of the control group. The arm movement score of the CIMT group (2.1±1.8) was found to be markedly lower than that of the control group (4.5±2.1) (P<0.001). The CIMT group presented a significantly lower leg movement score (2.5±2.1) and a remarkably lower score of limb ataxia (0.6±0.5) compared to those of the control group (P<0.05). The CIMT group outperformed the control group in terms of the 8 NIHSS scores (P<0.05).

Conclusion: Compulsory exercise rehabilitation nursing is effective in upgrading the level of arm and leg movement of CI patients, improving their limb ataxia, and reducing their overall NIHSS score, which facilitates the recovery of exercise function and balance ability of CI patients, so it merits extensive clinical application.

Keywords: NIHSS score, compulsory exercise, rehabilitation nursing, cerebral infarction, exercise ability

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1 INTRODUCTION

Cerebral infarction (CI) is caused by insufficient blood supply to the brain. Prolonged ischemia may lead to necrosis of brain tissue or encephalomalacia, eventually causing different degrees of neurological obstruction, which consequently impairs the motor power of patients, or even leads to death in severe cases, and therefore severely compromises the quality of life and psychological status of patients. At present, the annual new CI cases have exceeded one million worldwide. The determination of clinical symptoms in CI patients is prerequisite for subsequent treatment. National Institute of Health Stroke Scale (NIHSS) is an assessment tool that provides a degree measure of the neurological impairment in CI patients, which is considered more objective and accurate than other measurements and is now widely used in practice[1-3]. Currently, conventional exercise rehabilitation nursing is the mainstay of care for CI patients who, however, tend to eschew active exercise. Constraint-induced movement therapy (CIMT) can improve the motor power and balance ability of CI patients through mandatory intervention, with which patients have to perform movement using the paralyzed limb as their healthy limb was immobilized during rehabilitation training, contributing to the limb rehabilitation of patients[4]. In this paper, 210 patients with CI admitted to our hospital in the past year were selected, of which 105 patients were given CIMT rehabilitation nursing, and the rehabilitation effect of the patients was evaluated based on NIHSS score after the nursing to explore the role of CIMT in the recovery of CI patients' exercise ability and balance ability. The experimental results are described as follows.

2 MATERIALS AND METHODS

2.1 General Data

A retrospective analysis was conducted on the clinical data of CI patients admitted to our hospital in the past year. Totally 210 patients were selected as the research subjects and equally randomized into two groups (each n=105). No significant differences were found in age, sex, course of disease and other general data between the two groups (P>0.05) (Table 1).

2.2 Inclusion Criteria

Inclusion criteria: (1) Patients who met the clinical diagnostic criteria adopted by the Fourth National Conference on Cerebrovascular Disease, and whose CI condition had been verified by brain computed tomography (CT) or magnetic resonance imaging (MRI); (2) Patients with de novo onset; (3) Patients with limb motor dysfunction and the limb muscle strength grade conforming to the requirements as specified by this study; (4) Patients with an onset duration over 2 weeks and stable vital signs; (5) The patients or their families signed informed consent forms after fully understanding the study procedures; (6) This study was reviewed and approved by the hospital ethics committee.

2.3 Exclusion Criteria

Exclusion criteria: (1) Patients with other serious organic diseases or abnormal organ function; (2) Patients with extremely mild CI condition and without obvious clinical manifestations; (3) Patients with recrudescence of CI; (3) Patients with cognitive impairment that hindered communication.

2.4 Methods

2.4.1 Control Group

In the control group, the Bobath method was used in combination with the Brunnstrom facilitation method to reduce spasticity and promote the recovery of balance (1) The patient's position was changed with the help of the nursing staff at regular intervals to prevent abnormalities, and the patients was instructed to perform turning exercises in a decubitus position; (2) The nursing staff assisted the patient with balance training in a seated position; (3) The patient was instructed to perform head, neck, and shoulder joint exercises; (4) In a supine position, the patient was instructed to extend the upper or lower limb of the healthy side, to passively exercise the affected side by resisting flexion and extension; (5) The patient was given walking guidance training. The nursing staff helped the patient control the balance, by optional auxiliary means; (6) Exercises on the patient's limbs were performed from proximal to distal based on the neurodevelopmental sequence; (7) The muscle tone and frequency of spasms were maintained at a low incidence; (8) The proactive exercises of the affected limb were emphasized to accelerate the change from passive movement to active movement[5-9]. The control group was treated for 2h/d, 6 times/week, 2 cycles of 7 days in total.

2.4.2 CIMT Group

The CIMT group was given compulsory exercise rehabilitation nursing. (1) CIMT training of upper limb: The patient's healthy upper limb was immobilized by wearing a fixation belt, for which the patient can only perform movement using the affected limb. The patient was instructed to put on the fixation belt for 6h/d; (2) CIMT training of the lower limb: The lower limb training varied from person to person according to their physical fitness. The training included sitting up, weight bearing on one leg, etc., with 50times/d as the lower limit and 200times/d as the upper limit for sitting up. To enhance the leg muscle activity ability, the seat height was slowly reduced during the training process, with a minimum height of 20cm. The patient was first given leg lifting training before performing leg weight-bearing, and each leg lifting exercise should be performed around 35 times which could be increased accordingly; the leg lifting exercise was performed twice a day. Weight training was carried out after a good performance of the patient in leg lifting training, with a minimum weight of 0.5kg and a gradual increase up to a maximum of 2kg. Lower limb training was performed 4h/

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Table 1. Comparison of General Data from Patients

Group	n (*n*=210)	CIMT Group (*n*=105)	Control Group (*n*=105)	X^2/t	*P*
Gender				0.072	0.787
Male	110	56	54		
Female	100	49	51		
Age (year)				0.205	0.651
≥50	156	76	80		
<50	54	29	25		
NIHSS (point)	210	21.52±3.42	22.15±3.09	1.013	0.313
Smoking history				0.105	0.746
Yes	76	39	37		
No	134	66	68		
Alcohol history				0.036	0.849
Yes	55	27	28		
None	155	78	77		
Hypertension history				2.564	0.109
Yes	78	34	44		
No	132	71	61		
Course of disease (M)	210	8.6±3.0	8.7±2.9	0.178	0.859
Cerebral injury site				0.109	0.741
Basal ganglia	165	81	84		
Other sites	45	24	21		
Hemiplegia side				0.076	0.784
Left	106	54	52		
Right	104	51	53		

day[10-13]. In light of the patient's reluctance to the mandatory CIMT, the patient was provided with corresponding psychological counseling. Moreover, the patient was promptly informed of his/her progress in motor function to encourage him/her further cooperation with the treatment. In addition to the fixation belt and lower limb training, the patient was given auxiliary training in other exercises and balance training programs to enhance the effectiveness of the CIMT model and further consolidate the rehabilitation nursing results. The CIMT group was treated 6times/w, 2 cycles of every 7d in total.

In addition to the exercise rehabilitation nursing program, baseline interventions were also carried out according to the treatment regimen for CI patients, such as close monitoring of vital signs, observation of the physical characteristics and pupillary changes, prevention of muscle atrophy or infection. Education of the disease knowledge, medication guidance and active communication were conducted to alleviate the patient's negative emotions and help the patient maintain a positive state of mind to actively cooperate with the exercise rehabilitation training[14-16].

2.5 Efficacy Evaluation Criteria

The efficacy evaluation criteria were based on the NIHSS score, which mainly included level of consciousness, horizontal eye movement, vision test, facial paralysis test, arm movement, leg movement, limb ataxia, sensation, optimal language/aphasia, dysarthria, regression, and inattention. Arm movement and leg movement scores were used to evaluate their exercise function, limb ataxia score to evaluate their balance ability, and the remaining items to evaluate their comprehensive rehabilitation level. The score ranged from 0-2, 0-3, or 0-4 for different items. 0 was considered asymptomatic, and higher scores indicated more severe symptoms. The specific score was divided according to the NIHSS scoring criteria.

2.6 Statistical Analyses

The SPSS 20.0 was used for data analysis, and GraphPad Prism7 (GraphPad Software, San Diego, USA) for visualization of the data into required graphics. Measurement data included in the study were analyzed by t-test. When $P<0.05$, the difference was statistically significant.

3 RESULTS

3.1 Exercise Function Score

The scores of left arm movement, right arm movement, and arm movement in the CIMT group were significantly lower than those in the control group ($P<0.001$) (Figure 1).

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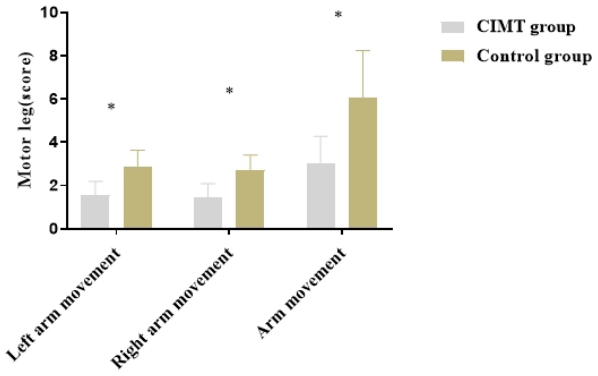

Figure 1. NIHSS arm movement scores in the two groups. The horizontal axis in the chart signifies left arm movement, right arm movement and arm movement from left to right, respectively. In CIMT group, the scores of left arm movement, right arm movement, and arm movement were (1.1±0.9), (1.0±0.9), and (2.1±1.8), respectively; in control group, the scores of left arm movement, right arm movement, and arm movement were (2.3±1.1), (2.2±1.0), and (4.5±2.1), respectively (*denotes P<0.001).

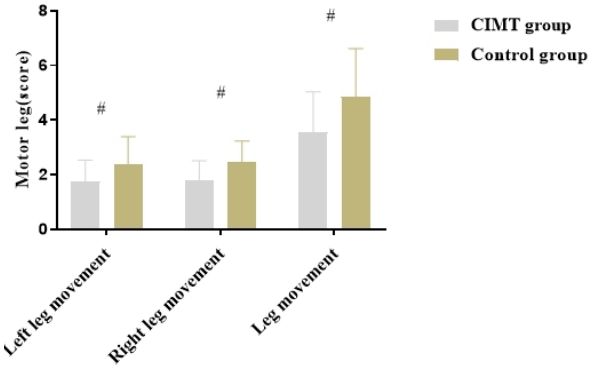

Figure 2. NIHSS leg movement scores in the two groups. The horizontal axis in the chart signifies left leg movement, right leg movement and leg movement from left to right, respectively. In CIMT group, the scores of left leg movement, right leg movement and leg movement were (1.2±1.1), (1.3±1.0), and (2.5±2.1), respectively; in control group, the scores of left leg movement, right leg movement and leg movement were (1.7±1.4), (1.9±1.1), and (3.6±2.5), respectively (# denotes P<0.05).

The scores of left leg movement, right leg movement, and leg movement in the CIMT group were markedly lower than those in the control group (P<0.05) (Figure 2).

3.2 Balance Ability Score

The balance ability scores of the two groups declined significantly after treatment, with significantly lower results observed in the CIMT group than those in the control group (P<0.05) (Figure 3).

3.3 Comprehensive Rehabilitation Level Scores

The CIMT group showed significantly lower NIHSS scores than the control group (P<0.05). See Figures 4 and 5.

4 DISCUSSION

Cerebral infarction is a disease with a high mortality and disability rate, which can be physically and emotionally devastating for patients. The reorganization of functional areas of the brain has been observed in patients after CI. This compensatory process contributes to the recovery of CI patients' neurological function. With the continued intervention of normal movement patterns in the rehabilitation training, the motor functions of patients can be restored to the maximum extent, and earlier treatment contributes to better outcomes[17]. However, CI patients mostly suffer negative emotions which prevent them from cooperating with the rehabilitation training, which necessitates coercive rehabilitation nursing interventions. CIMT rehabilitation nursing prevents muscle atrophy of the affected limbs, and rejuvenates the damaged cortex, thereby improving their exercise function and balance ability, and ultimately leading to a higher quality of life[18].

In this study, patients treated with CIMT had significantly lower NIHSS scores than those of the control group. The arm movement score in the CIMT group (2.1±1.8) was markedly lower than that in the control group (4.5±2.1) (P<0.001), and the leg movement score in the CIMT group (2.5±2.1) was also significantly lower than that in

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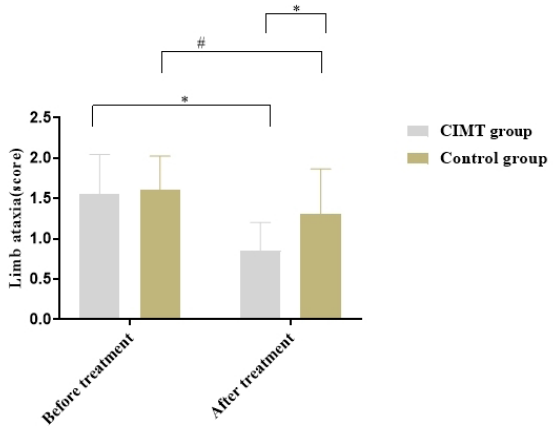

Figure 3. Limb ataxia scores before and after treatment in the two groups. The horizontal axis in the chart indicates before treatment and after treatment from left to right, respectively. The limb ataxia score in the CIMT group was (1.2±0.7) before treatment and (0.6±0.5) after treatment; the limb ataxia score in the control group was (1.3±0.6) before treatment and (0.9±0.8) after treatment (* denotes *P*<0.001, # denotes *P*<0.05).

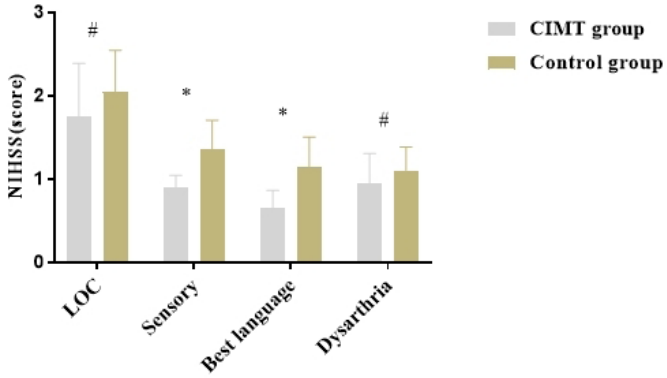

Figure 4. Comparison of comprehensive rehabilitation level (group 1). The horizontal axis in this chart indicates level of consciousness, sensation, optimal language/aphasia, and dysarthria from left to right. In the CIMT group, the scores of consciousness level, sensation, optimal language/aphasia, and dysarthria were (1.3±0.9), (0.8±0.2), (0.5±0.3), and (0.7±0.5), respectively; in the control group, the scores of consciousness level, sensation, optimal language/aphasia, and dysarthria were (1.7±0.7), (1.1±0.5), (0.9±0.5), and (0.9±0.4), respectively (* denotes *P*<0.001, #denotes *P*<0.05).

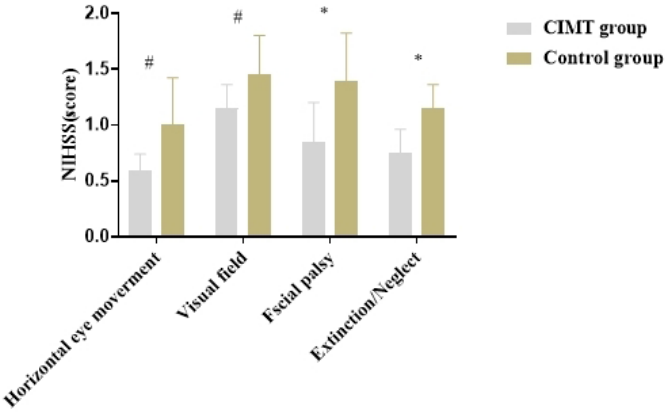

Figure 5. Comparison of comprehensive rehabilitation level (group 2). The horizontal axis in the chart indicates horizontal eye movement, visual field test, facial paralysis test, regression and inattention from left to right, respectively. In the CIMT group, the scores of horizontal eye movement, visual field test, facial paralysis test, and regression and inattention were (0.5±0.2), (1.0±0.3), (0.6±0.5), and (0.6±0.3), respectively; in the control group, the scores of horizontal eye movement, visual field test, facial paralysis test, and regression and inattention were (0.7±0.6), (1.2±0.5), (1.1±0.6), and (1.0±0.3), respectively (* denotes *P*<0.001, # denotes *P*<0.05).

the control group (P<0.05). Thus, CIMT n outperformed conventional exercise rehabilitation nursing in the recovery of exercise ability. In terms of limb ataxia scores, both groups obtained better data after rehabilitation nursing, with a lower score (0.6±0.5) was observed in the CIMT group than that of the control group (P<0.05), confirming a better improvement in the balance ability of CIMT patients. Furthermore, the CIMT group showed better outcomes than those of the control group in terms of sensation, optimal language/aphasia, facial paralysis test, regression, and inattention (P<0.05). Results of this study confirmed that CIMT rehabilitation nursing was of positive significance to improving the exercise ability and balance ability of patients. In the study conducted by Kim et al., CIMT has also been confirmed to be effective in improving the balance ability of patients, and DomenK et al., in Japan, concluded that CIMT was more effective in ameliorating their exercise ability during long-term treatment by comparing their FMA score and exercise quality[19,20], which is consistent with the results obtained in this paper.

In summary, compulsory exercise rehabilitation nursing is more effective than conventional rehabilitation nursing in upgrading the exercise ability and balance ability of CI patients, which merits extensive application in clinical practice.

Acknowledgements
Not applicable.

Conflicts of Interest
These authors declared no conflict of interest.

Author Contribution
Li Y was responsible for the initial draft writing, design of the article, interpolation of data, data Curation; Zhou L the article, and was in charge of project administration; Shang L revised the initial draft writing, visualizd the figures; All authors approved the final version.

Abbreviation List
CIMT, Constrained-induced movement therapy
CI, Cerebral infarction
CT, Computed tomography
MRI, Magnetic resonance imaging
NIHSS, National Institute of Health Stroke Scale

References

[1] Chalos V, van der Ende NAM, Lingsma HF et al. National Institutes of Health Stroke Scale: an alternative primary outcome measure for trials of acute treatment for ischemic stroke. *Stroke*, 2020: 51: 282-290. DOI: 10.1161/STROKEAHA.119.026791.

[2] Siniscalchi A, Sztajzel R, Malferrari G et al. The National Institutes of Health Stroke Scale: its role in patients with posterior circulation stroke. *Hospital topics*, 2017; 95: 79-81. DOI: 10.1080/00185868.2017.1322888.

[3] Lyden P. Using the national institutes of health stroke scale: a cautionary tale. *Stroke*, 2017; 48: 513-519. DOI: 10.1161/STROKEAHA.116.015434.

[4] Kim H, Yoo EY, Jung MY et al. The effects of mental practice combined with modified constraint-induced therapy on corticospinal excitability, movement quality, function, and activities of daily living in persons with stroke. *Disabil Rehabil*, 2018; 40: 2449-2457. DOI: 10.1080/09638288.2017.1337817.

[5] Díaz-Arribas MJ, Martín-Casas P, Cano-De-La-Cuerda R et al. Effectiveness of the Bobath concept in the treatment of stroke: a systematic review. *Disabil Rehabil*, 2020; 42: 1636-1649. DOI: 10.1080/09638288.2019.1590865.

[6] Vaughan-Graham J, Cott C, Wright FV. The Bobath (NDT) concept in adult neurological rehabilitation: what is the state of the knowledge? A scoping review. Part I: conceptual perspectives. *Disabil Rehabil*, 2015; 37: 1793-1807. DOI: 10.3109/09638288.2014.985802.

[7] Benito García M, Atín Arratibel MÁ, Terradillos Azpiroz ME the bobath concept in walking activity in chronic stroke measured through the international classification of functioning, disability and health. *Physiother Res Int*, 2015; 20: 242-250. DOI: 10.1002/pri.1614.

[8] Pandian S, Arya KN, Davidson EWR. Comparison of Brunnstrom movement therapy and motor relearning program in rehabilitation of post-stroke hemiparetic hand: A randomized trial. *J Bodyw Mov Ther*, 2012; 16:330-337. DOI: 10.1016/j.jbmt.2011.11.002.

[9] Naghdi S, Ansari NN, Mansouri K et al. A neurophysiological and clinical study of Brunnstrom recovery stages in the upper limb following stroke. *Brain injury*, 2010; 24:1372-1378. DOI: 10.3109/02699052.2010.506860.

[10] Mccluskey A, Massie L, Gibson Get al. Increasing the delivery of upper limb constraint-induced movement therapy post-stroke: A feasibility implementation study. *Aust Occup Ther J*, 2020; 67: 237-249. DOI: 10.1111/1440-1630.12647.

[11] Rijntjes M, Hamzei F, Glauche V et al. Activation changes in sensorimotor cortex during improvement due to CIMT in chronic stroke. *Restor Neurol Neuro*, 2011; 29: 299-310. DOI: 10.3233/RNN-2011-0600.

[12] Al-Helow MR, Zamzam ML, Fathalla MM et al. Efficacy of modified constraint-induced movement therapy in acute stroke. *Eur J Phys Rehab Med*, 2015; 51: 371-379.

[13] Corbetta D, Sirtori V, Castellini Get al. Constraint-Induced movement therapy for upper extremities in people with stroke. *Stroke*, 2015. DOI: 10.1002/14651858.CD004433.pub3.

[14] Han KT, Park EC, Kim SJ et al. Effective strategy for improving health care outcomes: Multidisciplinary care in cerebral infarction patients. *Health Policy*, 2015; 119: 1039-1045. DOI: 10.1016/j.healthpol.2015.06.005.

[15] Theofanidis D, Gibbon B. Nursing interventions in stroke care delivery: An evidence-based clinical review. *J Vasc Nurs*, 2016; 34:144-151. DOI: 10.1016/j.jvn.2016.07.001.

[16] Young, Tong B. Highlights from the 2017 cardiovascular and stroke nursing clinical symposium. *J Am Heart Assoc*, 2017; 6: e007895. DOI: 10.1161/JAHA.117.007895.

[17] Sheppard L, Dewey H, Bernhardt J et al. Economic Evaluation

Plan (EEP) for A Very Early Rehabilitation Trial (AVERT): An international trial to compare the costs and cost-effectiveness of commencing out of bed standing and walking training (very early mobilization) within 24h of stroke onset with usual stroke unit care. *Int J Stroke*, 2016. DOI: 10.1177/1747493016632254.

[18] Azab M, Al-Jarrah M, Nazzal M et al. Effectiveness of constraint-induced movement therapy (CIMT) as home-based therapy on Barthel Index in patients with chronic stroke. *Top Stroke Rehabil*, 2009: 16: 207-211. DOI: 10.1310/tsr1603-207

[19] Kim NH, Cha YJ. Effect of gait training with constrained-induced movement therapy (CIMT) on the balance of stroke patients. *J Phys Ther Sci*, 2015; 27: 611-613. DOI: 10.1589/jpts.27.611.

[20] Takebayashi T, Marumoto K, Takahashi K et al. Differences in neural pathways are related to the short-or long-term benefits of constraint-induced movement therapy in patients with chronic stroke and hemiparesis: a pilot cohort study. *Top Stroke Rehabil*, 2018; 25: 203-208. DOI: 10.1080/10749357.2017.1399231.