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Retrospective Study

Timing theory continuous nursing, resistance training: Rehabilitation and mental health of caregivers and stroke patients with traumatic fractures

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statement: This study was Approved by the Ethics Committee of Chengde Central Hospital.

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Abstract

BACKGROUND

Stroke is the leading cause of adult lifelong disability worldwide. A stroke is an acute cerebrovascular disease with a variety of causes and corresponding clinical symptoms. Around 75% of surviving stroke patients experience impaired nerve function, and some suffer from traumatic fractures, which can lead to special care needs.

AIM

To determine the effect of timing theory continuous care, with resistance training, on the rehabilitation and mental health of caregivers and stroke patients with traumatic fractures.

METHODS

Between January 2017 to March 2021, we selected 100 hospital admissions with post-stroke hemiplegia complicated with a traumatic fracture. Two participant groups were created: (1) Control group: given resistance training; and (2) Observation group: given timing theory continuous care combined with resistance training. The degree of satisfaction and differences in bone and phosphorus metabolism indexes between the two groups were compared. The self-perceived burden scale (SPBS) and caregiver burden questionnaire were used to evaluate the psychological health of patients and caregivers. The Harris hip function score, ability of daily living (ADL) scale, and global quality of life

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questionnaire (GQOL-74) were used to evaluate hip function, ability of daily living, and quality of life.

RESULTS

Data were collected prior to and after intervention. Alkaline phosphatase (ALP), osteocalcin, and vitamin D3 in the observation group and control group increased after intervention ($P < 0.05$), and carboxy-terminal peptide of type I collagen β Special sequence (β -CTX) decreased ($P < 0.05$). ALP and osteocalcin in the observation group were higher than in the control group ($P < 0.05$). There was no significant difference in β -CTX and vitamin D3 between the two groups ($P > 0.05$). The SPBS score of the observation group was lower and the ADL score was higher than the control group. The burden score was lower and the Harris hip function and GQOL-74 scores were higher than that of the control group ($P < 0.05$). The observation group's satisfaction rating was 94.00%, which was higher than the rating from the control group ($P < 0.05$).

CONCLUSION

Timing theory continuous nursing with resistance training can reduce hip dysfunction in stroke patients with a traumatic fracture and enhance quality of life and mental health of patients and caregivers.

Key Words: Timing theory continuous nursing; Resistance training; Stroke; Traumatic fracture; Mental health

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Core Tip: Through a retrospective study of patients with hemiplegia and traumatic fractures after stroke, we proved that the timing theory and continuous nursing combined with resistance training can reduce hip dysfunction in patients with traumatic fractures after stroke, and improve the quality of life of patients and nursing staff.

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INTRODUCTION

Patients with stroke that is complicated by a traumatic fracture after surgery often experience a partial or total loss of self-care ability, causing them to require assistance in their daily life and activities[1,2]. Currently, China's medical resources tend to be insufficient and unevenly available, and there is a lack of health human resources. Therefore, caregivers undertake a large part of patients' daily care[3-6]. Caring for patients who have experience both stroke and fracture require more difficult care. Patients often have limb dysfunction, and severe osteonecrosis can occur. Therefore, effective rehabilitation care can significantly improve the patient's prognosis. This study showed that caregivers are under considerable pressure, which is related in part to the health status of the patient. Adverse emotions, such as depression, seriously affect the recovery of patients, and the existence and influence of the burden of care is long-lasting[7]. However, there are very few reports about the continuation of nursing care in stroke patients with fractures.

This study analyzed the effect of timing theory continuous nursing combined with resistance training on the rehabilitation of stroke patients with traumatic fractures and the mental health of caregivers. The purpose is to provide guidance and a basis for clinical practice.

MATERIALS AND METHODS

Participant inclusion and exclusion criteria

Inclusion criteria: (1) Stroke was diagnosed by CT or MRI and stroke had not occurred previously; (2) ≥ 40 years old and ≤ 75 years old; (3) Disease duration was ≥ 6 mo; (4) Diagnosed with hemiplegia and muscle strength $<$ grade 4; (5) Diagnosed with a femoral neck fracture who had undergone hip arthroplasty; and (6) Complete clinical data.

Exclusion criteria: (1) Cognitive dysfunction and comprehension disorder; (2) Complications with brainstem and cerebellar infarction; (3) Long-term use of hormones and other drugs that can affect calcium and phosphorus metabolism; (4) Malignant tumor; (5) Liver and kidney dysfunction; and (6) Illiteracy.

Baseline data

A total of 100 patients with post-stroke hemiplegia combined with trauma fractures that had been admitted to our hospital from January 2017 to March 2021 were divided into two groups according to the intervention plan. The comparison of general data between the two groups was not statistically significant ($P > 0.05$) (Table 1).

Method

The control group completed resistance training, and patients were guided on active ankle flexion training. Ankle flexion actions were performed with patients' maximum strength, and nursing staff held the lower third of their calf with the left hand to enable patients to perform the resistance training in the opposite direction with equal strength. In active ankle dorsiflexion exercises, patients performed active ankle dorsiflexion with their maximum strength, and nursing staff crossed their hands and placed them on the dorsum of patients' feet. The training was conducted with equal strength in the opposite direction. Each training session lasted for 5 s, 300 times each day, and patients were divided into 5 groups to gradually complete the exercise.

For the observation group, timing theory continuous care combined with resistance training was conducted and divided into 5 stages, which were determined based on literature reviews and expert consultation. The intervention content at each stage was based on the specific needs of the caregivers, and targeted intervention was implemented. A health education manual for patient caregivers was formulated according to the results of qualitative studies, from admission to 3 mo after discharge. Each manual included basic information about the disease, treatment methods, rehabilitation exercise guidance, daily nursing, discharge procedures, and post-operative complications and prevention. An intervention group was established to jointly control data collection, implementation of health education, follow-up after discharge, and the construction of a public platform. Duties were divided between team members depending on their personal expertise. They regularly shared reviewed articles and videos related to rehabilitation training, answered patients' questions, and encouraged the exchange of experiences among patients to form a mutual assistance team. Patients regularly attended group face-to-face lectures. Concurrently, those in the intervention group were asked to conduct three 30-minute lectures. Hand-in-hand demonstrations were performed. The resistance training method was the same as in the control group.

Standard for evaluation

The self-perceived burden scale (SPBS)[8] and caregiver burden questionnaire[9] were used to evaluate the mental health of the patients and caregivers, respectively. The Harris hip function score[10] (HHS), ability of daily living (ADL) scale, and comprehensive quality of life questionnaire (GQOL-74)[11] were used to evaluate the patients' hip function, ability of daily living and quality of life.

Detection method

Fasting venous blood (3 mL) was drawn and centrifugated at 2000 r/min for 30 min. The concentrations of ALP, osteocalcin, vitamin D3 and β -CTX were determined by Enzyme-linked immunosorbent assay using the Hitachi 7600i automatic biochemical analyzer provided by Nanjing Jianchi Biological Products Co. Ltd.

Statistical analysis

SPSS19.0 was used for data analysis and measurement data was expressed as mean \pm SD, a *t*-test was applied for comparison, and an χ^2 test was used for comparison of

Table 1 Comparison of two groups of general data, *n* (%)

General information	Control group (<i>n</i> = 50)	Observation group (<i>n</i> = 50)
Gender		
Male	29 (58.00)	27 (54.00)
Female	21 (42.00)	23 (46.00)
Age (yr)	62.32 ± 8.92	61.69 ± 9.22
Course of stroke (yr)	2.12 ± 0.56	2.09 ± 0.54
Body mass index (kg/m ²)	22.85 ± 3.23	22.80 ± 3.37
Stroke type		
Cerebral infarction	32 (64.00)	28 (56.00)
Cerebral hemorrhage	18 (36.00)	22 (44.00)
Education		
Primary plus junior	9 (18.00)	10 (20.00)
Technical secondary school, high school and College	23 (46.00)	19 (38.00)
Bachelor degree or above	18 (36.00)	21 (42.00)
Caregiver patient relationship		
Children	17 (34.00)	15 (30.00)
Spouse	24 (48.00)	24 (48.00)
Other	9 (18.00)	11 (22.00)

enumeration data. $P < 0.05$ was statistically significant.

RESULTS

The comparison of bone phosphorus metabolism indexes between the two groups

Before the intervention, there was no statistically significant difference in the bone phosphorus metabolism indexes between the two groups ($P > 0.05$). After intervention, ALP, osteocalcin, and vitamin D3 increased in both the observation group and control group ($P < 0.05$), and carboxy-terminal peptide of type I collagen β Special sequence (β -CTX) decreased ($P < 0.05$) in both groups. ALP and osteocalcin in the observation group were higher than they were in the control group ($P < 0.05$) and there was no significant difference in β -CTX and vitamin D3 between the observation and control group ($P > 0.05$). Before intervention, there was no statistically significant difference in the SPBS scores between groups ($P > 0.05$). After intervention, the SPBS scores of patients in both groups decreased ($P < 0.05$), but they were lower for patients in the observation group than for those in the control group ($P < 0.05$). Before intervention, there was no statistically significant difference in ADL scores between groups ($P > 0.05$). After intervention, ADL scores of both groups increased ($P < 0.05$), and the ADL scores of the observation group were higher than those of the control group ($P < 0.05$) (Table 2).

Comparison of burden scores of caregivers between the two groups

Before intervention, there was no statistically significant difference between the two groups regarding the burden scores of caregivers ($P > 0.05$). After intervention, time-dependent, development-constrained, physiological, social, and emotional load and total score in the observation and control group decreased ($P < 0.05$) and the burden scores of caregivers in the observation group were lower than the control group ($P < 0.05$) (Table 3).

Comparison of HHS between the two groups

Before intervention, there was no statistically significant difference in the HHS ($P > 0.05$) between the two groups. After intervention, pain, function, gait, walking aid, walking distance, deformity, range of joint motion, and the total HHS between the two

Table 2 Comparison of bone phosphorus metabolism, self-perceived burden scale, ability of daily living in two groups (mean ± SD)

Group		Control group (n = 50)	Observation group (n = 50)
ALP (IU/L)	Before intervention	82.36 ± 12.05	83.01 ± 10.15
	After intervention	95.25 ± 13.65 ^a	101.14 ± 14.58 ^{a,c}
β-CTX (ng/mL)	Before intervention	182.02 ± 23.36	179.85 ± 25.11
	After intervention	164.02 ± 15.34 ^a	159.03 ± 12.74 ^a
Osteocalcin (μg/L)	Before intervention	9.56 ± 1.21	9.53 ± 1.26
	After intervention	12.36 ± 1.52 ^a	13.02 ± 1.61 ^{a,c}
Vitamin D3 (ng/L)	Before intervention	9.66 ± 2.85	9.71 ± 2.91
	After intervention	13.65 ± 3.12 ^a	14.02 ± 3.05 ^a
SPBS score	Before intervention	35.23 ± 4.56	34.95 ± 5.02
	After intervention	28.65 ± 3.36 ^a	22.01 ± 3.77 ^{a,c}
ADL score	Before intervention	31.25 ± 3.69	30.98 ± 4.05
	After intervention	65.74 ± 5.69 ^a	79.14 ± 6.33 ^{a,c}

^a*P* < 0.05 vs pre-intervention.^c*P* < 0.05 vs the control group.

ALP: Alkaline phosphatase; β-CTX: carboxy-terminal peptide of type I collagen β Special sequence; SPBS: self-perceived burden scale; ADL: Ability of daily living.

Table 3 Comparison of burden scores of caregivers between the two groups (mean ± SD, min)

Parameter	Control group (n = 50)		Observation group (n = 50)	
	Before intervention	After intervention	Before intervention	After intervention
Time dependent load	16.23 ± 3.24	10.23 ± 2.12 ^a	16.09 ± 3.36	7.82 ± 1.92 ^{a,c}
Development-constrained load	14.25 ± 2.96	7.56 ± 2.01 ^a	14.06 ± 3.11	5.23 ± 1.49 ^{a,c}
Physiological load	10.26 ± 2.13	5.87 ± 1.41 ^a	10.21 ± 2.06	3.96 ± 0.95 ^{a,c}
Social load	6.21 ± 1.25	2.58 ± 0.45 ^a	6.09 ± 1.33	1.51 ± 0.38 ^{a,c}
Emotional load	4.02 ± 1.02	1.85 ± 0.23 ^a	3.97 ± 0.91	1.02 ± 0.18 ^{a,c}
Total score	50.56 ± 5.36	28.63 ± 4.02 ^a	51.04 ± 4.98	19.85 ± 3.47 ^{a,c}

^a*P* < 0.05 vs pre-intervention.^c*P* < 0.05 vs the control group.

groups increased (*P* < 0.05) and were higher in the observation than in the control group (*P* < 0.05) as illustrated in Table 4.

Comparison of GQOL-74 scores between the two groups

Before intervention, there was no statistically significant difference in GQOL-74 scores between the two groups (*P* > 0.05). After intervention, GQOL-74 scores for physical and mental health, material life, and social function in the two groups increased (*P* < 0.05), and the GQOL-74 score in the observation group was higher than the control group (*P* < 0.05) (Table 5).

Comparison of satisfaction between the two groups

In the observation group, there were 30 very satisfied cases and 17 basically satisfied cases; the overall satisfaction rating was 94.00%, which was higher than the control group. The difference was statistically significant (*P* < 0.05) (Table 6).

Table 4 Comparison of Harris hip function scores between the two groups (mean ± SD, min)

Parameter	Control group (n = 50)		Observation group (n = 50)	
	Before intervention	After intervention	Before intervention	After intervention
Pain degree	8.56 ± 1.65	35.69 ± 4.12 ^a	8.70 ± 1.71	40.52 ± 4.56 ^{a,c}
Daily activity function	2.96 ± 0.52	10.12 ± 2.02 ^a	3.05 ± 0.45	11.89 ± 2.14 ^{a,c}
Gait	1.85 ± 0.63	7.12 ± 1.63 ^a	1.87 ± 0.59	9.36 ± 1.45 ^{a,c}
Walking aid	1.63 ± 0.36	5.24 ± 0.96 ^a	1.68 ± 0.30	7.11 ± 1.41 ^{a,c}
Walking distance	1.98 ± 0.37	6.36 ± 1.32 ^a	1.95 ± 0.31	8.05 ± 1.17 ^{a,c}
Deformity	2.03 ± 0.41	3.12 ± 0.29 ^a	2.06 ± 0.35	3.56 ± 0.31 ^{a,c}
Joint range of motion	1.98 ± 0.29	3.22 ± 0.37 ^a	2.03 ± 0.26	3.69 ± 0.41 ^{a,c}
Total score	20.36 ± 2.12	70.52 ± 6.02 ^a	20.13 ± 2.23	83.12 ± 7.02 ^{a,c}

^a*P* < 0.05 vs pre-intervention.^c*P* < 0.05 vs the control group.**Table 5 Comparison of global quality of life questionnaire scores between the two groups (mean ± SD, min)**

Group		Control group (n = 50)	Observation group (n = 50)
Physical health	Before intervention	51.02 ± 9.63	50.29 ± 10.13
	After intervention	75.69 ± 11.05 ^a	82.34 ± 10.53 ^{a,c}
Mental health	Before intervention	68.36 ± 10.26	66.95 ± 12.97
	After intervention	81.36 ± 8.66 ^a	87.96 ± 9.43 ^{a,c}
Material life	Before intervention	61.62 ± 8.63	62.05 ± 9.34
	After intervention	66.36 ± 7.44 ^a	73.05 ± 8.05 ^{a,c}
Social function	Before intervention	59.02 ± 7.14	58.36 ± 7.74
	After intervention	67.36 ± 5.98 ^a	75.45 ± 8.06 ^{a,c}

^a*P* < 0.05 vs pre-intervention.^c*P* < 0.05 vs the control group.**Table 6 Comparison of satisfaction between the two groups, n (%)**

Group	Number of cases	Very satisfied	Basically satisfied	Dissatisfied	Satisfaction
Control group	50	21 (42.00)	18 (36.00)	11 (22.00)	39 (78.00)
Observation group	50	30 (60.00)	17 (34.00)	3 (6.00)	47 (94.00) ^a

^a*P* < 0.05 vs the control group.

DISCUSSION

Timing theory advocates that during hospitalization, nurses provide appropriate interventions for caregivers by identifying the stage of the patient and strengthening the caregivers' performance through repeated guidance. The goal is to improve caregivers' ability to provide care, the quality of care, and the effectiveness of patients' rehabilitation[9]. A continuous nursing care plan, guided by post-discharge timing theory, can reduce the pressure on caregivers' through the application of a variety of intervention tools and measures, ensuring the effectiveness of post-discharge patient rehabilitation[12]. The continuous nursing model based on timing theory and combined with resistance training was used for patients with stroke that had been complicated with a traumatic fracture and incorporated both patients and caregivers.

Caregivers have multidimensional needs during the nursing period, and the primary needs changed over time depending on the patient's stage of disability. Therefore, to better meet the needs of caregivers, nursing staff should be cognizant of the characteristics of caregivers' needs when formulating health education content and nursing intervention measures to achieve comprehensive and multi-dimensional support. Staff should also be aware of changes in caregivers' needs so they can provide timely and corresponding needs support. After discharge, through regular telephone follow-up, WeChat groups, and public account information pushes, caregivers and patients can continue to acquire health knowledge. This can assist the caregivers in regularly evaluating the patient's disease status and adjusting their individualized care plan accordingly. This can help them to effectively manage a variety of problems in the process of rehabilitation and can encourage multi-directional and multi-channel access to health resources.

In this study, the SPBS and load scores of both patients and caregivers in the observation group was lower after intervention, suggesting that the use of timing theory continuous nursing, combined with resistance training, can reduce patients' sense of self-burden as well as caregivers' sense of load in patients with stroke combined with a traumatic fracture. Continuous nursing based on timing theory can effectively reduce the caregivers' psychological pressure and improve their caring ability[13-17]. Caregivers can share their caring experiences and emotional communication, thereby effectively relieving the psychological pressure. The study also found that the ADL score of the observation group after intervention was higher than that of the control group, and the Harris hip function score of the observation group after intervention was higher than that of the control group. By improving the hip joint function score, the quality of daily life is improved.

According to the study, after intervention, ALP, osteocalcin, and ADL scores in the observation group were higher than those in the control group, suggesting that timing theory continuous nursing, combined with resistance training, can be conducive to bone phosphorus metabolism recovery and improvement. Both ALP and osteocalcin are important indicators in the process of bone metabolism, so active rehabilitation care is of great significance for regulating human bone metabolism. The quality of daily life in patients with stroke combined with a traumatic fracture. The GQOL-74 and HHS in the observation group, after intervention, were higher than those in the control group, indicating that the application of this model can enable patients and caregivers to adapt to the new role of caring more quickly for patients and rearranging their work and life. Over time, the caregivers can slowly accept the reality of the disease, adapt to the reality of caregiving, and accumulate further care experience, while the patients' own functional defects and their self-care ability can gradually improve[18].

Timing theory has been applied in a variety of disease groups abroad, but it is rarely applied in stroke patients with a traumatic fracture in China[19,20]. In this study, the specific needs of patients at different stages and the timing to meet these needs were analyzed. An investigation was conducted according to patients' needs. Based on this, intervention measures conforming to the characteristics of caregivers' needs were formulated and implemented, and positive intervention effects were achieved. However, there was a short follow-up time in this study, so the long-term effects cannot be identified. The sample size and sampling range were small. Future studies should increase the sample size and conduct longer continuous intervention studies to understand their long-term effects.

CONCLUSION

In conclusion, timing theory continuous nursing combined with resistance training can reduce the hip function of stroke patients with a traumatic fracture, improve their ability of daily life and quality of life, and promote the mental health of both patients and their caregivers.

ARTICLE HIGHLIGHTS

Research background

Stroke is the main cause of lifelong disability in adults worldwide. It refers to acute cerebrovascular diseases with multiple etiologies and corresponding clinical

symptoms. Approximately 75% of surviving stroke patients have neurological impairment. Because of this, some patients are prone to traumatic fractures and require special care.

Research motivation

Provide new methods and ideas for the nursing of patients with traumatic fracture and stroke.

Research objectives

The authors aimed to determine the effect of timing theory continuous care, with resistance training, on rehabilitation and mental health of caregivers and stroke patients with traumatic fractures.

Research methods

We conducted a study on 100 patients with traumatic fractures who came to our hospital from January 2017 to March 2021 due to post-stroke hemiplegia.

Research results

After the intervention, compared with before the intervention, the observation group and the control group increased alkaline phosphatase (ALP), osteocalcin, and vitamin D3, and type I collagen β -carboxy terminal peptide (β -CTX) decreased. ALP and osteocalcin in the observation group were higher than those in the control group. There was no statistically significant difference between the two groups of β -CTX and vitamin D3. The SPBS score of the observation group was lower than that of the control group, and the ability of daily living score of the observation group was higher than that of the control group. The burden score was lower than that of the control group, Harris hip joint function and global quality of life questionnaire scores were higher than that of the control group, and the satisfaction degree was higher than that of the control group.

Research conclusions

Timing theory continuous nursing with resistance training can reduce hip dysfunction of stroke patients with a traumatic fracture and enhance quality of life and mental health of patients and caregivers.

Research perspectives

In the subsequent treatment, it can improve the ability of daily living and quality of life of patients with traumatic fracture of stroke, and promote the mental health of patients and their caregivers.

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