Original Article
Early rehabilitation nursing improves myodynamia, ability of daily living and quality of life in patients with hemiplegia

Yan Cheng¹, Bing Han², Huifang You³, Hui Li¹

¹Department of Rehabilitation Medicine, South District, The Second Hospital of Shandong University, Jinan 250033, Shandong Province, China; ²Department of Geriatrics, South District, The Second Hospital of Shandong University, Jinan 250033, Shandong Province, China; ³Department of Neurology, The Second Hospital of Shandong University, Jinan 250033, Shandong Province, China

Received June 5, 2020; Accepted August 26, 2020; Epub November 15, 2020; Published November 30, 2020

Abstract: Objective: To investigate the mechanism of early rehabilitation nursing on improving myodynamia, ability of daily living and quality of life in patients with hemiplegia caused by cerebral infarction. Methods: The clinical data of 103 patients with hemiplegia caused by cerebral infarction in our hospital from May 2015 to June 2018 were collected for retrospective analysis. According to the nursing methods, the patients were divided into group A (n=51) receiving routine care and group B (n=52) receiving early rehabilitation nursing in addition to the routine care. The NDS (neurologic impairment) scores, Fugl-Meyer scores, myodynamia, compliance, Barthel index and quality of life scores before and after intervention were compared between the two groups. Results: After intervention, patients in group B reported lower NDS scores, higher Fugl-Meyer scores, smaller number of cases with myodynamia at level 0, 1 and 2, larger number of cases of myodynamia at level 3, 4 and 5, and superior performance on total compliance (96.15%), Barthel index as well as scores for daily living skills, psychological functions and body functions than those in group A (P<0.05). Conclusion: Early rehabilitation nursing can improve limb movement, ability of daily living, compliance and quality of life in patients with hemiplegia caused by cerebral infarction by ameliorating their myodynamia and improving neurological functions.

Keywords: Early rehabilitation nursing, hemiplegia, myodynamia, ability of daily living, quality of life

Introduction
Cerebral infarction, which is one of the most common neurological diseases in clinical practice, refers to encephalomalacia or localized brain tissue necrosis caused by hypoxia, ischemia or other conditions due to disrupted blood supply to the brain [1, 2]. It is characterized by high incidence, high recurrence, high disability and high mortality [3, 4]. Studies have shown that more than 50% of surviving patients are accompanied by complications such as aphasia and hemiplegia to varying extent, leading to significant impact on the quality of life of patients [5, 6].

A study has shown that the plasticity of the nervous system can be further strengthened and consolidated by repeated rehabilitation training in early stages [7]. Some scholars believe that early rehabilitation nursing for patients with hemiplegia caused by cerebral infarction may significantly reduce the incidence of secondary disorders and improve rehabilitation. There is no unified time for implementation of early rehabilitation nursing in clinical practice [8, 9]. Most studies suggested that rehabilitation nursing performed within 48 hours of when the patient is in a stable condition is conducive to reducing incidence of complications such as thrombus of lower extremity veins, joint deformities and contractures of the affected limb [10]. The 2013 Guidelines for the Early Management of Acute Ischemic Stroke of ACC states that bedside activities can be performed 24 hours after onset for patients without severe cerebral edema or complications [11]. The individual variation of hemiplegia caused by cerebral infarction requires individualized and targeted nursing interventions according
Mechanism of early rehabilitation nursing in patients with hemiplegia

to the actual situation of patients and reasonable arrangement of rehabilitation activities and schedules.

In this study, early rehabilitation nursing was carried out to investigate the potential effects of improving myodynamia, motor function and ability of daily living, thereby improving the quality of life in patients with hemiplegia caused by cerebral infarction.

Materials and methods

Materials

The clinical data of 103 patients with hemiplegia caused by cerebral infarction in our hospital from May 2015 to June 2018 were collected for retrospective analysis. According to the nursing methods, the patients were divided into group A (n=51) receiving routine care and group B (n=52) receiving early rehabilitation nursing plus routine care. Group A included 29 males (56.86%) and 22 females (43.14%). Group B included 32 males (61.54%) and 20 females (38.46%). Patients in group A were 58-72 years old, with an average age of (62.25 ± 1.28) years, while those in group B were 59-74 years old, with an average age of (62.29 ± 1.32) years. (1) Inclusion criteria: Patients confirmed with cerebral infarction by cranial MRI or CT; first onset, of unilateral paralysis; and free of musculoskeletal or neurological diseases that could affect functional recovery. Patients or their families signed and provided informed consent. This study has been approved by the Medical Ethics Committee. (2) Exclusion criteria: Patient who had withdrawn midway; or who had cognitive dysfunction or mental disorder; or who had diseases of the articular system that would affect the myodynamia evaluation; or who had coronary atherosclerotic heart disease; or who had infectious diseases, malignant tumors, hematological diseases, severe heart, liver and kidney dysfunction, or lacunar infarction, cerebral embolism, hemorrhagic cerebral infarction, were excluded.

Methods

Group A received routine care: patients were admitted to the hospital for routine care such as water and electrolytes balancing, improvement of cerebral circulation, and prevention and cure of cerebral edema, as determined by the nursing staff according to the patient conditions.

Group B received early rehabilitation nursing in addition to routine care.

Psychological rehabilitation nursing: is an important factor affecting the success of early rehabilitation nursing. Patients with cerebral infarction have difficulty taking care of themselves due to limb dysfunction, and often experience depression, inferiority, anxiety and other unhealthy emotions, which have a significant impact on their initiative and enthusiasm for recovery. In early stages, targeted psychological guidance can be given to patients according to their psychological characteristics and conditions to reduce unhealthy emotions and promote functional rehabilitation.

Bed training: In general, there is a complementary relationship between nursing in a lying position and early rehabilitation exercises, and nursing in a lying position nursing can reduce the rate of disability. The medical staff instructed the patient to take the correct lying position, and provided nursing care including joint movement, massage and other care to help prevent complications, reduce the areas of spasm and edema and strengthen myodynamia. The patient was in the lateral decubitus position, supplemented by a horizontal position and keep the affected upper limbs extended while avoiding shoulder stretch, and the lower limbs flexed (the knees and hips flexed and the ankles neutral) to prevent external or internal hip rotation. Alternately in a different position, the patient would be helped to turn over every 2 h. In the event of pain, swelling, or other conditions, near-heart massage may be used from far away to near by the heart to promote the lymph and blood circulation. After relieving the swelling and pain, off-heart massage can be performed to strengthen myodynamia and limb motor function. Massage activities can be offered for 5-10 min, twice a day. After massage, the affected joints were subjected to passive movements from small to large, such as knuckle flexion and extension, forearm rotation, shoulder abduction, each for 10-20 reps, twice a day.

Training in sitting position: Considering the patients’ condition, patients were guided to sit in bed, at the bedside, and/or moving the body from bed to wheelchair and from wheelchair to bed. For the first time, the patient shall be in sitting position assisted by the head of the bed at 30°, 45°, 60°, & 80° successively (if the
patient can hold the position for 30 min without any sign of postural hypotension, then increase the angle in order to effectively prevent orthostatic hypotension instead of a sudden 90° upright position. Later, the patient was guided to use the healthy leg to assist the affected one to move to the bedside, to use the healthy hand to support the body with shoulders forward and the head up while the center of balance shifted to the hip, and then to sit up and avoid falling. As moving to a wheelchair, patients were guided to use the strength of the healthy upper arm to support the body and lead the center of balance to the lower healthy limb and trunk together with the hip transferred to the wheelchair.

Standing training: When to the patient’s body is stable enough to move from lying to sitting position, standing training can be performed. At the beginning, the nursing staff can help the patient to stand against the wall, and carefully observe the occurrence of symptoms such as nausea and dizziness. If the symptoms do not appear, the stance time is allowed to be appropriately extended, and if the patients feel good, the nursing staff can tell them to stand independently for about 5 min (to prevent drastic fluctuation in blood pressure) or longer (based on the tolerance and response). If the patient is in poor condition and has difficult with training, the nursing staff standing in front helps the patient stand on a platform. The patient uses the healthy hand to support themselves on the handrail of the corridor. The affected hand is held by the nursing personnel, who with the other hand supports the affected side armpit and helps the patient to make full use of the strength of above the waist to stand up with the center of gravity moved from the lower healthy limb to the affected side. After confirming the correct posture, the nursing staff can stand on the affected side to ensure the patient’s safety. After 10-15 min without feeling tired, the patient may start to move forward slowly.

Ambulation training: this is allowed when the patient can stand alone with the affected leg bearing more than 1/2 of the body weight. The time for ambulation training could be as early as possible considering that the elderly are prone to disuse syndrome. By training, full attention should be paid to the ankle and back muscles, knee flexors and the bearing capacity of the affected side. First, the patient is instructed to take a standing position with support for several times and then to stand unaided. When walking formally, marching on the spot should be the first step and the walking speed is controlled.

Training for daily life skills: According to the condition, training for daily life skills includes wearing and taking off shoes and socks, pants, and clothes, lifting the upper limbs to comb hair, eating with a spoon in the affected hand, etc.

Outcome measures

NDS score: NDS scores were used to evaluate the neurologic impairment in patients of the two groups before and after intervention. The total score is 45. A score of 0-15 stands for mild neurological dysfunction, 16-30 for moderate neurological dysfunctions, and 31-45 for severe neurological dysfunctions [12].

Fugl-Meyer score: Fugl-Meyer Assessment (FMA) scale was used to assess motor functioning in patients of the two groups before and after intervention. The total score is 100, and a higher score indicates better recovery of motor functioning [13].

Myodynamia: Myodynamia in patients of both groups was measured before and after intervention, with scores of 0-5. Level 0 indicates completely paralyzed. Level 1 indicates slight contractility of the muscles but difficult to move. Level 2 indicates ability of moving limbs horizontally. Level 3 indicates that the limbs can be removed from the bed. Level 4 suggests resistance to general obstruction, and level 5 shows normal myodynamia [14].

Compliance: Compliance of the patients of the two groups in the nursing process was evaluated, which can be assessed as full compliance, partial compliance and non-compliance. The total compliance is the sum of full and partial compliance [15].

Barthel index: Barthel index was used to assess ability of daily living before and after intervention, including going up and down stairs, walking, transferring, toilet use, bladder control, dressing, eating, etc. The total score is 100. The ability of daily living is directly proportional to the score [16].

Quality of life: General quality of life questionnaire (prepared by Yang Desen and Li Lingjiang)
Mechanism of early rehabilitation nursing in patients with hemiplegia

was used to evaluate the quality of life of the two groups of patients before and after intervention, including life function, psychological function and body function. The quality of life is proportional to the score [17].

| Table 1. General data of the two groups of patients [n (%)]/ \( (\bar{x} \pm s) \) |
|----------------|----------------|----------------|--|--|
| Item           | Group A (n=51) | Group B (n=52) | \( t/\chi^2 \) | \( P \) |
| Sex (case)     | M 29 (56.86)   | 32 (61.54)     | 0.233          | 0.629 |
|                | F 22 (43.14)   | 20 (38.46)     |                |      |
| Age (year)     | 62.25±1.28     | 62.29±1.32     | 0.156          | 0.876 |
| Complications (case) |
| Hyperlipidaemia| 15 (29.41)     | 16 (30.77)     | 0.125          | 0.998 |
| Diabetes       | 12 (23.53)     | 11 (21.54)     |                |      |
| Diabetes       | 13 (25.49)     | 15 (28.85)     |                |      |
| Affected side (n) |
| Left           | 26 (50.98)     | 28 (53.85)     | 0.557          | 0.771 |
| Right          | 25 (49.02)     | 24 (46.15)     |                |      |

| Table 2. NDS scores in both groups (\( \bar{x} \pm s \), scale) |
|----------------|----------------|----------------|
| Group          | Before intervention | After intervention |
| Group A (n=51) | 32.15±1.28       | 28.52±1.06*     |
| Group B (n=52) | 32.19±1.25       | 19.02±1.02**    |
| \( t \)        | 0.160            | 46.351          |
| \( P \)        | 0.873            | 0.000           |

Note: * indicates \( P<0.05 \) as compared with that before intervention; ** indicates \( P<0.05 \) as compared with that in group A.

**Statistical analysis**

SPSS 22.0 was used for data analysis. The measurement data were expressed as mean ± standard deviation (mean ± SD) where those following the normal distribution were determined by \( t \) test, otherwise Mann-Whitney U test was applied. Enumeration data were expressed as \([n \%(\%)]\). Intergroup comparisons were subject to chi-squared test. \( P<0.05 \) indicated statistical significance.

**Results**

**Comparison of general information between the two groups**

There were little differences in terms of gender distribution, age, complications, or affected side as shown in general data between the two groups \( (P>0.05) \) (Table 1).

**Comparison of NDS scores between the two groups**

Before intervention, there were little differences in NDS scores between the two groups \( (P>0.05) \). After intervention, the NDS scores decreased in both groups \( (P<0.05) \), showing significant difference. After intervention, the NDS scores in group B were lower than those in group A, indicating significant difference \( (P<0.05) \) (Table 2).

**Comparison of Fugl-Meyer scores between the two groups**

In group A, the Fugl-Meyer score was \((25.16 \pm 5.52)\) before intervention and \((42.58 \pm 6.28)\) after intervention, while in group B, the score was \((25.19 \pm 5.49)\) before intervention and \((62.96 \pm 6.98)\) after intervention. There was no significant difference in Fugl-Meyer score between the two groups before intervention \( (P>0.05) \). After intervention, the Fugl-Meyer scores increased in both groups \( (P<0.05) \), showing significant difference. After intervention, the Fugl-Meyer scores in group B were higher than those in group A, indicating significant difference \( (P<0.05) \) (Figure 1).
Comparison of myodynamia between the two groups

No significant difference was found in myodynamia between the two groups before intervention ($P>0.05$). After intervention, the number of cases with levels 0, 1, 2, 3, 4, and 5 in group A were 2, 10, 9, 14, 10, and 6, respectively, accounting for 3.92%, 19.61%, 17.65%, 27.45%, 19.61%, and 11.76%, separately. The numbers in group B were 0, 3, 3, 18, 18, and 10, respectively, accounting for 0.00%, 5.77%, 5.77%, 34.62%, 34.62%, and 19.23%, respectively. After intervention, group B had fewer patients with levels 0, 1 and 2, but more patients with levels 3, 4 and 5 compared with group A, indicating a significant difference ($P<0.05$) (Figure 2).

Comparison of compliance between the two groups

Group A had 18 patients with full compliance, 19 in partial compliance, and 14 cases of non-compliance, with a total compliance rate of 72.55%. Group B had 26 patients in full compliance, 14 in partial compliance, and 2 cases of non-compliance, with a total compliance rate of 96.15%. The total compliance of group B was higher than that of group A, indicating a significant difference ($P<0.05$) (Table 3).

Comparison of Barthel index between the two groups

Little difference was found in the Barthel index between the two groups before intervention ($P>0.05$). After intervention, the Barthel index increased in both groups, showing a significant difference. ($P<0.05$). After intervention, the Barthel index in group B was higher than that in group A, indicating a significant difference ($P<0.05$) (Table 4).

---

**Table 3. Compliance of the two groups of patients [n (%)]**

<table>
<thead>
<tr>
<th>Group</th>
<th>Full compliance</th>
<th>Partial compliance</th>
<th>Non-compliance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n=51)</td>
<td>18 (35.29)</td>
<td>19 (37.25)</td>
<td>14 (27.45)</td>
<td>37 (72.55)</td>
</tr>
<tr>
<td>Group B (n=52)</td>
<td>26 (50.00)</td>
<td>14 (26.92)</td>
<td>2 (3.85)</td>
<td>50 (96.15)*</td>
</tr>
</tbody>
</table>

$\chi^2$ 10.934, $P=0.001$

Note: *indicates $P<0.05$ as compared with that in group A.

**Table 4. Barthel index in the two groups ($\bar{x}\pm s$, scale)**

<table>
<thead>
<tr>
<th>Group</th>
<th>Before intervention</th>
<th>After intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A (n=51)</td>
<td>65.25±2.18</td>
<td>78.52±2.96*</td>
</tr>
<tr>
<td>Group B (n=52)</td>
<td>65.28±2.13</td>
<td>92.28±2.99*</td>
</tr>
</tbody>
</table>

$t=0.071$, $P=0.944$; $t=23.468$, $P=0.000$

Note: *indicates $P<0.05$ as compared with that before intervention; *indicates $P<0.05$ as compared with that in group A.
Comparison of quality of life scores between the two groups

There was no significant difference in quality of life scores between the two groups before intervention (P>0.05). After intervention, the scores of life function, psychological function and body function were (23.25 ± 2.18), (25.62 ± 2.12), and (22.18 ± 2.19), respectively in group B; all of which were higher than those of (15.16 ± 1.05), (15.28 ± 0.63), and (16.11 ± 1.13) in group A respectively, indicating a significant difference (P<0.05) (Figure 3).

Analysis of CT images of the two groups

CT examination of patients in group A revealed patchy low-density shadows in the right cerebellar hemisphere, and multiple punctate and patchy low-density shadows in the radiocoronal area of bilateral basal ganglia (Figure 4). CT examination of patients in group B showed large patchy low-density shadows in the right cerebral hemisphere, and multiple punctate low-density shadows in the radiocoronal area of bilateral basal ganglia (Figure 5).

Discussion

Cerebral infarction is one of the common cerebrovascular diseases in China. It is a generic term for ischemic stroke, with an incidence rate of 70% in regard to all strokes [18-20].

A study has shown that the rehabilitation of motor dysfunction caused by nerve damage in stroke is closely correlated with the treatment time and nursing intervention [21]. Many experts advocate early rehabilitation nursing for its promotion of compensation and reorganization of brain functions, and believe that the sooner the rehabilitation nursing is implemented, the shorter the duration of rehabilitation [22, 23]. In this paper, group B expressed smaller NDS scores, higher Fugl-Meyer scores and Barthel index, and larger groups of patients with myodynamia of level 3, 4 or 5 (P<0.05), suggesting that early rehabilitation nursing for patients with hemiplegia caused by cerebral infarction may be beneficial to reduce neurologic impairment, improve myodynamia, and improve limb movement and ability of daily living. Another study also found that the Fugl-Meyer score and Barthel index of patients in the early exercise rehabilitation nursing group were higher than those in the conventional nursing group [24], which was highly consistent with the results of this study. To analyze its mechanism of action, this may be explained by early training in bed, sitting or standing position, and walking as well as that of daily living.
Mechanism of early rehabilitation nursing in patients with hemiplegia

Figure 4. Analysis of CT images of group A. Patchy low-density shadows were observed in the right cerebellar hemisphere, and multiple punctate and patchy low-density shadows were observed in the radiocoronal area of bilateral basal ganglia.

promotes the functional and structural remodeling of posterior cerebral nuclei and mitochondrial biogenesis together. It also accelerates cerebral angiogenesis, reduces the infarct volume and lays a good foundation for the recovery of brain function; it enhances neural stem cell migration and increases proliferation of infarcted neural stem cells.

Rehabilitation is not only related to the lesion site, drugs, admission, etiology, age, and severity of the disease, but also closely related to some brain region reactivation [25]. As long as the patient has been in stable condition with all vital signs normal, rehabilitation training can be conducted so as to prevent secondary damage. The results showed that the total compliance of group B was 96.15%, which was higher than that of group A, and scores of life quality, psychological, and body functions in group B were superior to those in group A as well (P<0.05), suggesting that early rehabilitation nursing promotes the recovery of limb function while improving compliance and quality of life. The reason was that in early rehabilitation training, the medical staff took into consideration both physical and mental health. Targeted psychological guidance based on the psychologi-
Mechanism of early rehabilitation nursing in patients with hemiplegia

Figure 5. Analysis of CT images of group B. Large patchy low-density shadows were observed in the right cerebral hemisphere, and multiple punctate low-density shadows were observed in the radiocoronal area of bilateral basal ganglia.

cal characteristics and conditions of each patient removed their unhealthy emotions, leading to positive mental state for functional recovery and increased compliance [26, 27]. Additionally, early rehabilitation nursing helps activate genes that limit lesions and promote reconstruction of collateral circulation, which may restore the function of affected limbs.
Mechanism of early rehabilitation nursing in patients with hemiplegia

[28]. Although early rehabilitation nursing showed ideal effects, it is necessary to manage the range of actions. Individual differences, together with habits, age, and severity of illness, determine the training methods. It is recommended to start with simple training and gradually move on to more complex activities. With activities regarding walking, standing, sitting, and turning over with correct motor patterns, repeated stimulations of afferent impulse and efferent impulse formed new neural pathways around the lesion to maximize the compensatory role of the central nervous system. Besides, right functioning patterns helps to improve motor functioning and ability of daily life.

In summary, early rehabilitation nursing may ameliorate the myodynamia and nerve functions of patients with hemiplegia caused by cerebral infarction, and improve limb movement, ability of daily living, compliance and quality of life.

Despite the results of this study, due to the small sample size, more attention paid is needed in the future research with a larger sample size, more comprehensive or longer duration of investigation.

Disclosure of conflict of interest

None.

Address correspondence to: Hui Li, Department of Rehabilitation Medicine, South District, The Second Hospital of Shandong University, No. 3668, Wangyue Road, Shizhong District, Jinan 250033, Shandong Province, China. Tel: +86-531-82789385; E-mail: lihuiyaxx@163.com

References


Mechanism of early rehabilitation nursing in patients with hemiplegia


