ORIGINAL RESEARCH

Effect of Cluster Nursing on Recovery Effect and Hospitalization Time of Patients with Acute Cerebral Infarction After Thrombectomy

Peixiang Yang, Xiangxia Rong, Tao Wang, Xiuqun Gong, Chuanqing Yu, Bu Xu, Xiaoli Xing

Department of Neurology, The First Affiliated Hospital of Anhui University of Science and Technology (Huainan First People's Hospital), Huainan, Anhui, People's Republic of China

Correspondence: Xiangxia Rong, Department of Neurology, The First Affiliated Hospital of Anhui University of Science and Technology (Huainan First People's Hospital), Huainan, Anhui, People's Republic of China, Email rongxiangxia1584@163.com

Objective: To explore the effects of cluster nursing on self-care ability, length of hospital stay, complications and neurological function of patients with mechanical thrombectomy of large vessel occlusion in acute cerebral infarction.

Methods: A total of 83 patients with acute cerebral infarction who underwent thrombolectomy in a tertiary hospital in Anhui Province from June 2019 to March 2021 were randomly divided into observation group and control group. The observation group was treated with cluster nursing intervention mode, and the control group was treated with routine nursing mode. Barthel index scores and National Institute of Health Stroke Scale (NIHSS) scores were compared between the two groups at admission and at 1 week, 1 month and 3 months of nursing intervention. The length of stay and incidence of complications were compared between the two groups.

Results: There was no significant difference in baseline data, Barthel index and NIHSS score between the two groups at admission (P>0.05). The Barthel index at 1 week, 1 month and 3 months after operation in the observation group was significantly higher than that in the control group (P<0.05), while the NIHSS score, incidence of complications and length of hospital stay were significantly lower than those of the control group (P<0.05).

Conclusion: Cluster nursing can improve the neurological function, improve the self-care ability, reduce the incidence of complications, shorten the hospitalization period, improve the prognosis and promote the recovery of patients with acute cerebral infarction thrombolysis.

Keywords: acute cerebral infarction, cluster nursing, mechanical thrombectomy, complication, the quality of life

Introduction

Ischemic stroke, also known as acute cerebral infarction, has a high morbidity, mortality, and disability rate, and it remains the leading cause of morbidity and mortality in adults worldwide.[1] Domestic stroke epidemiological surveys show that the incidence, disability and mortality rates of stroke are 0.25%, 1.11% and 0.12%, respectively,[2] which shows that ischemic stroke seriously affects human life and health, and brings heavy burden to family and society. In addition, a study found that stroke can be the presenting manifestation of a specific hematological disease or a complication in the course of hematological disorders.[3] Correct diagnosis of potential hematological diseases is conducive to timely and appropriate treatment of stroke patients. Clinically, intravenous thrombolysis or intra-arterial thrombectomy is an effective strategy to treat ischemic stroke.[4] The prime time for intravenous thrombolysis is only 6 hours, while the time window for arterial thrombectomy is 24 hours, winning more treatment time for patients. Despite advances in the diagnosis, clinical management and critical care of patients with acute ischemic stroke, stroke complications have been a great threat to patient survival and quality of life.[4,5] During the rehabilitation phase after thrombectomy, patients are very prone to intracranial hemorrhage, reperfusion injury, pneumonia, decubitus ulcers, urinary tract infection and other complications due to long-term bed rest and poor resistance, which eventually affect the patient's recovery and leads to

death.[6] Therefore, it is important to provide high-quality, efficient and standardized nursing care after ischemic stroke thrombectomy for patients' prognosis.[7]

Cluster care is a new form of care, first introduced by the American Institutes of Health, which is a collection of evidence-based, comprehensive and integrated specialty care measures designed to provide proactive, sophisticated, personalized and high-quality care for patients and to promote high-quality, rapid recovery.[8] Related studies have reported that clustering care interventions have a significant impact on neurological recovery in ICU stroke patients and can significantly reduce anxiety in stroke patients.[9] However, the effect of clustering care interventions on the rehabilitation effect of stroke patients after thrombectomy has not been reported.

The First Affiliated Hospital of Anhui University of Science and Technology was awarded the National Advanced Stroke Center by the Brain Prevention Committee of the National Health and Health Commission in 2020, and cerebrovascular interventional procedures have been successfully carried out for more than 10 years. To maximize the prognosis of patients, our nursing team actively explores and strives to improve the quality of care. The clustering care for post-thrombectomy patients has achieved certain results, and the study is reported below.

Materials and Methods

Research Subjects

Patients with acute cerebral infarction who received interventional thrombectomy treatment in our hospital from June 2019 to March 2021 were selected and randomly divided into observation and control groups according to the order of admission. Inclusion criteria: (i) the diagnosis met the criteria of the Chinese Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke (2018 edition); (ii) the patients were all within 24 h of onset and had indications for thrombectomy; (iii) the patients or the delegates signed an informed consent. Exclusion criteria: (i) severe cardiac, pulmonary, hepatic and renal insufficiency; (ii) intraoperative failure of thrombectomy. A total of 104 patients who met the enrollment criteria for thrombectomy were admitted during the study period, 6 cases of surgical failure and 15 cases of death within 3 months after surgery were excluded (Cause of death: sudden cardiac death 2; Multiorgan failure: 2 cases; Reinfarctions, 4.0; Intracranial hemorrhage, 3; Other causes, 4; Mortality: 14.4%), and finally 83 patients were included in this study, 42 cases in the observation group and 41 cases in the control group. The study was approved by the ethics committee of the First Affiliated Hospital of Anhui University of Science and Technology.

Methods

The control group was cared for according to conventional nursing methods, including receiving, examination and monitoring, and carried out routine observation of the condition, nursing records, psychological guidance and health education. In the observation group, on the basis of conventional care, clustering care was adopted, and all treatment and care of patients in the observation group were taken care of by the clustering care team.

Establishment of a Clustering Care Team

The QC team leader was a national brain and heart health manager, and the team members were composed of municipal brain and heart health managers, neurocritical care specialist nurses, stroke qualified nurses, rehabilitation therapists and full-time greenway nurses. The personnel of the clustering care team (hereinafter referred to as the team personnel) were qualified to participate in and guide the care of patients in the observation group throughout the whole process.

Preoperative Care

Patients were admitted to the green channel immediately after admission and were accompanied by a full-time green channel nurse to complete relevant examinations; nursing team personnel provided preoperative health education, psychological care and preoperative preparation.

Postoperative Care

Blood Pressure Management

The strict management of postoperative blood pressure played a key role in the patient's prognosis. Vital signs were recorded every hour for 72 h after surgery and every 15–30 minutes when the condition was unstable, and blood pressure

was strictly controlled by nurses according to the doctor's advice depending on the vascular open condition. The blood pressure of patients with mTICT grade 2b or 3 should be controlled at less than 140/90 mmHg or lower than the basal blood pressure by 20 mmHg, but not less than 100/60 mmHg; for patients with poor vascular opening, mTICT grade ≤ 2a or risk of vascular occlusion, the blood pressure control level should be relaxed appropriately.

Care of Complications

① Intracranial hemorrhage: blood pressure management was the key to prevent intracranial hemorrhage, requiring blood pressure control below 180/105 mmHg from preoperative to 24 hours postoperative, on which basis, postoperative blood pressure was strictly controlled according to doctor's advice depending on the opening of blood vessels. Clustering care required nurses to be timely and accurately predict the patient's condition, focusing on observing the patient's consciousness, pupils, the location, nature and degree of headache, and the presence or absence of symptom aggravation, in order to detect abnormalities early.

②Reperfusion injury: blood pressure was strictly controlled by nurses, and patients were visited every 15–30 minutes to closely monitor blood pressure to avoid cerebral reperfusion injury due to continuous or sudden elevation of blood pressure, and once the manifestation of cerebral reperfusion injury appeared, it was quickly reported to the doctor and resuscitation measures were given according to the doctor's advice to reduce reperfusion injury.

③ Lower limb deep vein thrombosis: The patient's condition was strictly observed by the nurse, and the handover was carefully done. The leg circumference was measured and recorded daily, and the dorsalis pedis artery pulsation, skin temperature and color were dynamically observed and recorded. The team implemented daily education and guidance to the patient and family members, taught the patient's family members to passively move the patient's limbs and good limb position placement, and to wear elastic stockings if the condition allowed, to prevent the occurrence of deep vein thrombosis in the lower limbs.

④ Pulmonary infection: Patients with cerebral infarction were restricted in respiratory movement due to swallowing dysfunction and prolonged bed rest, and respiratory secretions stayed in the lungs for a long time, resulting in a large number of pathogenic bacteria gathering in the lungs or misaspiration, leading to an increased chance of pulmonary infection. If there was no contraindication, the patient should be placed in a semi-recumbent position with the upper body elevated by 30~40°, turn and tap the back on time to promote sputum expulsion, and give nebulization treatment if necessary; the patient's swallowing function should be assessed by the water swallow test, and if the score reached grade III or above, a gastric tube should be placed as prescribed by the doctor to prevent choking and aspiration, and oral care should be given every morning and evening.

Rehabilitative Care

According to the patient's physical condition, early rehabilitation training was started once the vital signs were stabilized. During the rehabilitation exercise process, the rehabilitation therapist and the charge nurse jointly implemented rehabilitation guidance for the patients, closely observed the activities of the patients' paralyzed limbs, assisted the patients in implementing passive limb movements, and gradually transitioned to active training as their conditions recovered to promote their functional recovery. The group, with the consent of the patient's family or patient in the observation group, used online communication and other means to guide the patient's self-rehabilitation exercise through the exercise video of self-care ability taken by our hospital; the nursing team members were responsible for the response to the patient's or the patient's family's consultation questions and rehabilitation guidance, to ensure that the patient takes fewer detours on the road to rehabilitation.

Psychological Care

Members of the nursing team provided psychological counseling to patients in the observation group every morning and evening, and encouraged patients with unsatisfactory treatment results not to lose confidence and to work together to overcome the difficulties in rehabilitation treatment so that they could actively cooperate with the treatment to achieve satisfactory treatment results.

Continuing Care

After the patients were discharged from the hospital, nurses used online guidance, weekly telephone follow-up, and 1st month and 3-month face-to-face visits to follow up and guide the patients' medication, diet and rehabilitation to ensure that they took their medication on time, recovered actively, avoided unhealthy lifestyles, and gave them guidance timely for any problems.

Evaluation Indicators

National Institute of Health Stroke Scale (NIHSS) Scores

The NIHSS score was used to evaluate the patients' neurological deficits, and the higher the score, the more severe the neurological deficits were.

Barthel Index Evaluation

The Barthel index was used to evaluate the patients' self-care ability. The scale consisted of 10 components: eating, grooming, bathing, dressing, controlling large and small bowel movements, entering and leaving the toilet, bedside chair transfer, walking on level ground, and walking up and down stairs, with a total score of 100 points, with higher scores indicating better self-care ability.

Other Indicators

Complications identification: patients were identified as having complications when one or more of intracranial hemorrhage, upper gastrointestinal bleeding, reperfusion injury, lower extremity deep vein thrombosis, pulmonary infection, and subcutaneous hematoma at the puncture site occurred after surgery. Length of hospitalization: the period of time between patient admission and discharge.

Statistical Methods

SPSS 22.0 was used for statistical analysis. The measurement data were analyzed according to the Kolmogorov–Smirnov test for normal distribution, and those conforming to the normal distribution were expressed as mean ± standard deviation and compared between groups using the independent samples t test; those not normally distributed were expressed as median and interquartile spacing and compared between groups using the Mann–Whitney U-test. The statistical data were expressed as numbers (percentages) and analyzed by chi-square test or Fisher's exact test. $P < 0.05$ indicated that the difference was statistically significant.

Results

Comparison of General Information Between the Two Groups of Patients

Of the 83 patients included in this study, 55 (66.3%) were male and 28 (33.7%) were female. The mean age of the control group was (67.5 ± 12.1) years and the mean age of the observation group was (64.4 ± 11.9) years, with no statistically significant difference between the mean ages of the patients in the two groups ($P> 0.05$). Other baseline information of the patients in the two groups did not differ significantly, and the results are shown in Table 1.

Comparison of NIHSS Scores and Length of Stay Between the Two Groups

The results in Table 2 show that there was no statistically significant difference in NIHSS scores between the two groups of patients at admission ($P>0.05$). After clustering care, the NIHSS scores of patients in the observation group were significantly lower than those in the control group at 1 week, 1 month and 3 months after surgery ($P<0.05$). The number of hospital days was 16.0 (13.0–22.0) in the control group and 14.0 (12.0–17.0) in the observation group, and the number of hospital days in the observation group was shorter than that in the control group ($P<0.05$).

Comparison of Barthel Index Between the Two Groups

There was no significant difference in Barthel index between the two groups of patients at admission ($P>0.05$). After clustering care, the Barthel index of patients in the observation group was significantly higher than that of the control

Table I Comparison of General Information Between the Two Groups of Patients

Variables	Observation Group (n = 42)	Control Group (n = 41)	t-value, Z-value or χ² value	P value
Age (years, $\bar{x} \pm s$)	64.4 ± 11.9	67.5 ± 12.1	−1.206	0.231
Gender (n, %)			0.723	0.395
Male	26 (61.9)	29 (70.7)		
Women	16 (38.1)	12 (29.3)		
Hypertension (n, %)	26 (61.9)	22 (53.7)	0.579	0.447
Diabetes mellitus (n, %)	7 (16.7)	9 (22.0)	0.372	0.542
Atrial fibrillation (n, %)	17 (40.5)	16 (39.0)	0.018	0.893
Time to onset (hours, M, IQR)	4.8 (3.2–6.9)	5.3 (4.0–6.2)	−1.157	0.247
Site of vascular occlusion (n, %)			0.012	0.994
Middle cerebral artery	21 (50.0)	20 (48.8)		
Internal Carotid Artery	15 (35.7)	15 (36.6)		
Vertebrobasilar system	6 (14.3)	6 (14.6)		

Table 2 Comparison of NIHSS Scores and Hospital Days Between the Two Groups

Group	Number of Cases (n)	NIHSS Score| (Points)				Number of Days in Hospital (Days)
		At the Time of Admission	I Week After Surgery	I Month After Surgery	3 Months After Surgery	
Observation group	42	14.0 (11.0–18.0)	6.0 (3.0–8.3)	4.0 (3.0–6.3)	3.0 (2.0–4.3)	14.0 (12.0–17.0)
Control group	41	15.0 (13.0–17.5)	14.0 (8.0–17.5)	13.0 (6.5–18.0)	10.0 (5.0–14.5)	16.0 (13.0–22.0)
Z-value or χ2 value		−1.316	−4.960	−5.154	−5.404	−2.088
P value		0.188	<0.001	<0.001	<0.001	0.037

group at 1 week, 1 month and 3 months after surgery, and the difference was statistically significant (P<0.05). (The results are shown in Table 3).

Comparison of Complication Rates Between the Two Groups

There were one case of gastrointestinal bleeding, six cases of intracranial hemorrhage, one case of reperfusion injury, three cases of pulmonary infection, and one case of subcutaneous hematoma in the control group. In contrast, only one case of intracranial hemorrhage complication occurred in the observation group. The incidence of complications in the observation group was significantly lower than that in the control group, and the difference was statistically significant (P<0.05). The results are shown in Table 4.

Table 3 Comparison of Barthel Index Between Two Groups of Patients

Group	Barthel Index Score (Points)			
	At the Time of Admission	I Week After Surgery	I Month After Surgery	3 Months After Surgery
Observation group	20.0 (13.8–40.0)	40.0 (20.0–60.0)	50.0 (33.8–70.0)	65.0 (53.8–76.3)
Control group	20.0 (5.0–35.0)	20.0 (0.0–40.0)	35.0 (10.0–60.0)	45.0 (20.0–60.0)
Z-value or χ2 value	−0.460	−3.161	−3.310	−4.229
P value	0.646	0.002	0.001	0.000

Table 4 Comparison of Complication Rates Between the Two Groups [Cases (%)]

Group	Number of Cases	Gastrointestinal Bleeding	Intracranial Hemorrhage	Reperfusion Injury	Pulmonary Infection	Subcutaneous Hematoma	Total
Observation group	42	0 (0)	1 (2.4%)	0 (0)	0 (0)	0 (0)	1 (2.4%)
Control group	41	1 (2.4%)	6 (14.6%)	1 (2.4%)	3 (7.3%)	1 (2.4%)	12 (29.3%)
χ^2							11.618
P							0.040

Notes: P < 0.05 indicated that the difference was statistically significant.

Discussion

Ischemic stroke has a rapid onset and changes rapidly, so it is crucial to reopen the occluded vessel in every second. Mechanical thrombectomy is a quick and effective way to remove occlusion or stenosis by inserting a thrombus stent into the occluded vessel and suctioning the thrombus out of the vessel, which is widely used.[10,11] After thrombectomy, patients are very prone to intracranial hemorrhage, reperfusion injury, pneumonia, decubitus ulcer, urinary tract infection and other complications due to poor resistance and long-term bed rest, which eventually affect the recovery of patients and leads to death.

The standardized and anticipatory monitoring of the patient's condition by nurses after the removal of the embolus can prevent the patient's condition from worsening in time, improve the success rate of the procedure, promote the patient's recovery and improve the patient's quality of life.[12] Clustering care is a kind of targeted nursing measures taken according to the treatment method performed by patients when they receive treatment, so that more difficult-to-treat diseases can be effectively prognosticated, and its purpose is to provide quality nursing services for patients and make them receive effective care.[13]

In this study, the observation group was given intensive care, and the final results showed that the NIHSS scores of patients in the observation group were significantly lower than those in the control group at 1 week, 1 month and 3 months after surgery, and the recovery of neurological function was significantly better than that in the control group. The Barthel index of patients in the observation group was significantly higher than that of the control group at 1 week, 1 month and 3 months after surgery, and the recovery of self-care ability was significantly better than that of the control group, which showed that the clustering care intervention had a more obvious effect on promoting the recovery of neurological function in patients with ischemic stroke after thrombectomy, and was also beneficial to the recovery of patients' self-care ability after surgery. Clustering care interventions had a significant effect on the prognosis of patients, which is consistent with the results of previous studies.[9] The results of this study showed that the number of days of hospitalization in the observation group was significantly lower than that in the control group, which indicated that the clustering care could reduce the length of hospitalization of patients and thus reduce the economic burden of patients' families.

Data from studies show that the overall complication rate of thrombectomy is 5%-20%.[14] The rate of complications after thrombectomy is an important factor in the length of hospitalization and patient prognosis. Hanna Styczen et al retrospectively analyzed patients undergoing mechanical thrombectomy at seven tertiary care centers from January 2013 to May 2020, and the incidence of postoperative symptomatic intracranial hemorrhage was 19%.[15] The preoperative care in the clustering care adopted in our institution can minimize the elevation of blood pressure due to fear or emotional agitation of patients; the close postoperative observation of the condition can detect abnormal fluctuation of blood pressure in time, which can minimize the occurrence of postoperative intracranial hemorrhage and reperfusion injury. In this study, the incidence of intracranial hemorrhage was 2.4% in the observation group compared with 14.6% in the control group, and no reperfusion injury occurred in the observation group compared with 2.4% in the control group. This study highlights the significant impact of clustering care on reducing the incidence of postoperative complications.

Many studies have shown that standardized perioperative care for patients with acute cerebral infarction with mechanical thrombectomy can significantly improve the prognosis of patients.[16] In our hospital, we set up a clustering care team to implement standardized nursing interventions for patients undergoing thrombectomy for acute cerebral

infarction from preoperative preparation, postoperative management, rehabilitation exercises to psychological care, complications and continuity of care, and to provide comprehensive and standardized nursing care for patients with negative emotions in the form of words, attitudes and bodies, combined with typical successful cases, to eliminate patients' negative emotions and relieve their psychological stress to achieve the best prognosis.

Although many hospitals have carried out thrombectomy in recent years, the recovery effect after surgery is not satisfactory due to the lack of standardized care. In the face of the new technology, scientific and effective care measures must be applied to patients in order to make the vascular opening technology play a better role.[17–19] In this study, we found through clinical data analysis that, compared with conventional care, centralized care can effectively reduce the recovery of neurological function and self-care ability of patients with acute cerebral infarction after thrombectomy, reduce the incidence of complications, shorten the length of hospitalization, and help patients recover after surgery.

There are still some limitations of this study, and there is some risk of bias in the sample selection process of this study. In addition, this study is a single-center clinical study, and further exploration in multi-center clinical studies is needed for follow-up. Finally, the sample size included in this study is relatively small, and the next step will be to continue to expand the sample size to further verify the reliability of the findings. In addition, because the pathophysiology, prognosis and clinical features of lacunar stroke are different from other cerebral infarcts,[20] it will be very interesting to predict the effect of cluster nursing in lacunar versus non-lacunar ischemic strokes and also in the other different ischemic stroke subtypes (atherothrombotic, cardioembolic, unusual, essential infarcts) in future research.

Conclusion

The use of thrombectomy with clustering care can maximize the recovery of neurological function and self-care ability of patients with ischemic stroke, reduce the occurrence of complications, shorten the hospitalization period, promote the recovery of patients, and effectively reduce the burden caused to families and society.

Ethics Approval and Consent to Participate

This study was conducted in accordance with the declaration of Helsinki.This study was conducted with approval from the Ethics Committee of The First Hospital of Anhui University of Science & Technology. Written informed consent was obtained from all participants.

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Disclosure

All of the authors reported no personal, financial, commercial, or academic conflicts of interest in relation to this work.

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