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Observational Study

Effect of medical care linkage-continuous management mode in patients with posterior circulation cerebral infarction undergoing endovascular interventional therapy

Abstract

BACKGROUND

Acute cerebral infarction is a severe type of ischemic stroke that can be divided into anterior circulation cerebral infarction and posterior circulation cerebral infarction (PCCI). PCCI affects the structure of the posterior circulation brain, because posterior part of the brain, which has more complex anatomical structures and more prone to posterior circulation vascular variation. Therefore, improving the prognosis of PCCI patients is necessary.

AIM

To explore the effect of medical care linkage-continuous management mode (MCLMM) on endovascular interventional therapy (EIT) for PCCI.

METHODS

Sixty-nine patients with PCCI who received EIT and conventional nursing intervention were selected as the control group, and 78 patients with PCCI who received EIT and MCLMM intervention were selected as the observation group. The incidence of postoperative complications, compliance and disease self-management behavior after six months of intervention, modified Rankin scale (mRS) and Barthel index (BI) scores

in the acute phase and after one year of intervention, and recurrence within one year were compared between the two groups.

RESULTS

The total incidence rate of postoperative complications in the observation group (7.69%) was lower than that in the control group (18.84%) ($P < 0.05$). The scores for medical compliance behavior (regular medication, appropriate diet, and rehabilitation cooperation rates) and disease self-management behavior (self-will, disease knowledge, and self-care ability) in the observation group were higher than those in the control group ($P < 0.05$). After one year of intervention, in the observation group, the mRS score was significantly lower, and the BI score was significantly higher than those in the control group ($P < 0.05$). The recurrence rate within one year in the observation group (3.85%) was significantly lower than that in the control group (13.04%) ($P < 0.05$).

CONCLUSION

MCLMM can reduce the incidence of complications after EIT for PCCI, improve patient compliance behavior and disease self-management ability, and promote the recovery of neurological function.

INTRODUCTION

Posterior circulation cerebral infarction (PCCI) is an infarction of the brain tissues, including the brainstem, occipital lobe, and cerebellum, caused by a blood supply disorder of the vertebral-basilar artery system[1]. According to relevant international data[2-4], PCCI accounts for approximately 20%-25% of ischemic strokes, while the domestic proportion is approximately 17.07%. PCCI is dangerous, especially large-area infarction in important parts such as the brain stem, which is often accompanied by high mortality or severe disability rates. With the continuous development of the Chinese economy, the "treatment-centered" concept has gradually transformed into the

concept of "providing all-around full-cycle health services for patients." The traditional nursing model cannot meet the care needs of patients for subsequent rehabilitation. Patients with PCCI generally have sequelae, long recovery times, and weak disease self-care knowledge; therefore, the continuous management model is gradually advocated and applied. This is characterized by ensuring that patients can receive coordinated and continuous health services in different healthcare settings, such as hospitals, families, and communities[5]. Song[6] and Hu *et al*[7] applied a continuous management model to nursing postoperative breast cancer and post-coronary intervention patients, respectively, and achieved satisfactory results. In the conventional nursing model, doctors and nurses often work independently and lack interaction. Close cooperation between doctors and nurses is key to ensuring smooth progress in diagnosis and treatment. In this study, we adopted a medical care linkage-continuous management mode (MCLMM) based on the strengthening of medical and nursing cooperation. Additionally, medical and nursing care are closely allied to provide continuity of health services for patients with PCCI. To this end, this study explored the effect of the application of a MCLMM in patients with PCCI undergoing endovascular intervention. We provide theoretical data for innovation and deepening of the development of the clinical continuity management model to provide better health services for patients with PCCI undergoing endovascular intervention.

MATERIALS AND METHODS

Participants

In this study, 69 patients with PCCI who received endovascular intervention and conventional nursing intervention in our hospital between February 2018 and February 2019 were included in the control group, and 78 patients with PCCI who received endovascular intervention and were provided with the MCLMM intervention in our hospital between March 2019 and February 2020 were included in an observation group using retrospective analysis.

The inclusion criteria were diagnosis of cerebral infarction based on the diagnostic criteria of the China Guidelines for the Diagnosis and Treatment of Acute Ischemic Stroke 2018[8]. PCCI was diagnosed at our hospital and confirmed by magnetic resonance imaging (MRI) of the head (excluding hemorrhagic brain disease). Patients had obvious clinical manifestations of posterior circulation stroke such as dysphagia, dysarthria, and pupil and ocular movement disorders. According to the Guidelines for Endovascular Interventional Diagnosis and Treatment of Ischemic Cerebrovascular Diseases in China[9], the indications for vascular interventional therapy were all met.

Exclusion criteria were as follows: (1) serious diseases of other organs, such as the heart, lungs, liver, and kidneys; (2) malignant tumors; (3) severe cognitive impairment and inability to communicate normally; (4) poor learning ability; (5) poor compliance; and (6) death during treatment or follow-up.

Methods

Patients in the control group were treated using the traditional responsibility nursing mode. The details are as follows: 8:00 am unified medical and nursing shifts organized by head nurse rounds. Routine nursing for patients included preoperative nursing (understanding history of allergy, guiding patients with preoperative fasting for 4 h, guiding patients with intraoperative cooperation and bed defecation, stress counseling, *etc.*), intraoperative nursing, and postoperative nursing [(1) Observation of postoperative conditions: monitoring vital signs of patients and paying attention to patients with headache, vomiting, aphasia, epilepsy, and other neurological symptoms. If abnormal, notifying doctors in a timely manner; (2) Diet nursing: encouraging patients to drink 1000 mL water within 4 h to promote contrast agent discharge; (3) Complication nursing: observation and recording of the puncture point with or without bleeding, cyanosis, hematoma, paying attention to the dorsal pedis artery pulsation, advising patients not to strain while defecating or coughing, avoiding increases in abdominal pressure, patients lying in bed for 24 h every 2 h, and massaging the puncture site of the limbs to prevent venous thrombosis; (4) Psychological counseling:

providing patients with severe pain with analgesics to relieve their anxiety, encouraging adherence to 12 h puncture lower-limb braking, and actively overcoming difficulties; and (5) Discharge education: guiding patients to eat appropriately, take their medication regularly, adhere to reasonable rehabilitation exercises, avoid bad lifestyles such as smoking and staying up late, issuing publicity materials on the prevention and treatment of cardiovascular and cerebrovascular diseases, and reminding patients to return to the hospital after six months].

The observation group was integrated into the MCLMM based on the control group. The details are as follows: (1) A leading group of the MCLMM was established, led by the head nurse of the department which included two key doctors and nursing staff. According to the requirements of the medical-nurse linkage-continuity management mode, the daily nursing work of patients was streamlined, refined, and standardized, nursing staff in the department were organized to learn the new nursing intervention model, and assessment criteria were formulated and quantified in the form of scores. According to the quality of nursing work and the feelings of patients, the performance management of nursing staff; (2) MCLMM of ward rounds: Based on the daily group handover and ward rounds in the control group, the content of the handover was increased to include a discussion of critical conditions and formulation of corresponding emergency measures. Every Wednesday and Friday, after the regular ward round, the department director led the doctors and nurses to check critical and special patients to evaluate and explain their conditions, so that the doctors and nurses had a good understanding of such patients and understood the risk factors that may lead to deterioration of the disease, made records and carry out targeted prevention; (3) Hospital health services under the MCLMM: Patients were assessed jointly by the attending physician and nurse on duty, and personalized care measures were discussed and developed (*e.g.*, after the vascular intervention, each patient may have different risk factors which may lead to different complications and targeted care according to different risk factors). Once the patient's condition improved, two medical staff in the rehabilitation department and two medical staff in our department were invited to form

a hospital disease knowledge promotion group every afternoon. Family members and patients were encouraged to learn about cerebral infarction and vascular intervention, and videos of exercise rehabilitation training were played. The medical staff personally demonstrated and led the patients to cooperate to correct their bad habits, and answered their questions. For patients with severe psychological diseases, psychological specialists were consulted to jointly develop solutions; and (4) Out-of-hospital health services under the MCLMM: Doctors and nurses jointly carried out health education for discharged patients, distributed promotional materials, sketched and emphasized important content of the explanation with pens, and asked the patients whether they could understand it. Patients were invited to join a WeChat group for cerebral infarction management. The WeChat group was established by medical staff in the cardiovascular surgery, rehabilitation, and psychological consultation departments of our hospital. Weekly, on Mondays from 4:00 p.m. to 5:00 p.m. in the WeChat group, one or two videos were sent providing knowledge about the disease and home disease self-management methods and skills, including rehabilitation training videos. In the WeChat group, a daily duty officer attended to the problems. Telephone follow-up was conducted on the last working day of each month to understand patient recovery, progress, new disease signs, knowledge and implementation of patient self-management of the disease, and patient opinions to facilitate the improvement of follow-up services.

Observation indicators

Postoperative wound bleeding or hematoma, venous thrombosis of the lower limbs, intracranial hemorrhage, hyperperfusion, and other complications were observed and recorded in both groups.

Evaluation of patient compliance behavior and disease self-management behavior: The evaluation time was six months after the nursing intervention. Compliance behavior was investigated using a self-made questionnaire in our hospital (Cronbach's α coefficient = 0.857, based on reliability and validity tests). The scale mainly evaluates

regular medication, appropriate diet, and patient cooperation during rehabilitation. It included 20 (yes/no) questions with 0–1 points for each question. A total score > 16 was classified as compliance, 12–16 as partial compliance, and < 12 as non-compliance. The qualified rate = (compliance cases + partial compliance cases)/total number of cases × 100%. A self-made questionnaire on disease self-management in our hospital (Cronbach's α coefficient = 0.861) was also used. This questionnaire included three aspects: self-willingness, disease knowledge, and self-care skills. Self-willingness (to understand the subjective enthusiasm of the patients for disease self-management) was assessed with ten (yes/no) questions with 0–1 point for each question and 0–10 points for the total score; disease knowledge (to understand the patients' mastery of cerebral infarction and vascular intervention) was assessed with ten (yes/no) questions with 0–1 point for each question and 0–10 points for the total score; and self-care skills (to understand the patients' mastery and implementation of self-care skills, such as self-symptom monitoring of cerebral infarction, constipation response, prevention and control of high-risk factors (hypertension, hyperglycemia, smoking, *etc.*), and negative emotion regulation) was assessed with 15 questions with 1–5 points for each question, and total score of 15–75 points.

The modified Rankin Scale (mRS), Barthel Index (BI) score, and recurrence evaluation[10,11]: The recovery of neurological function in the two groups was evaluated using the mRS at the acute stage of the disease and one year after the intervention. This scale is divided into 0–5 Levels. The patient was asymptomatic at level 0. The higher the level, the more severe are the symptoms. Level 5 was defined as severe disability. The Barthel index was used to evaluate the daily living ability of patients in the two groups at the acute stage of onset and one year after intervention. This scale contains 10 items on daily life operations such as eating, defecation, and walking up and down stairs. A score > 60 points indicated that daily life involved self-care. A score of 40–60 points indicates that daily life requires assistance. A score of 20–40 points indicates that daily life involves dependency. A score < 20 points indicates that daily life is completely dependent. The criteria for recurrence of cerebral infarction included new neurological

dysfunction symptoms or aggravated clinical manifestations of the primary infarction (progressive cerebral infarction was excluded) confirmed by MRI. The follow-up period for recurrence was one year, and the follow-up was conducted by telephone, and the patients came to the hospital.

Statistical analysis

Statistical analysis was performed using the IBM SPSS Statistics for Windows, Version 19.0. (IBM Corp, Armonk, NY, USA). The measurement data were expressed as mean ± SD and analyzed using *t*-tests. Count data were expressed as a percentage and analyzed using the chi-square test. A $P < 0.05$ was considered statistically significant.

RESULTS

Comparison of general data between the two groups

There were no significant differences in the general data between the two groups ($P > 0.05$) (Table 1).

Comparison of the incidence of postoperative complications between the two groups

The total incidence of postoperative complications in the observation group (7.69%) was significantly lower than that in the control group (18.84%) ($P < 0.05$) (Table 2).

Comparison of compliance behavior and self-health management behavior between the two groups

The scores for compliance (regular medication, reasonable diet, and rehabilitation cooperation rates) and self-management (self-willingness, disease knowledge, and self-care ability) behaviors of the observation group were significantly better than those of the control group ($P < 0.05$) (Table 3).

Comparison of mRS, BI score, and recurrence rate between the two groups

Compared with the acute phase of the same group, the mRS scores of the two groups significantly decreased and the BI scores significantly increased after one year ($P < 0.05$). There was no significant difference in mRS and BI scores between the two groups at the acute stage ($P > 0.05$). After one year of intervention, the mRS score of the observation group was significantly lower, and the BI score was significantly higher, than the corresponding scores of the control group ($P < 0.05$). The recurrence rate within one year in the observation group (3.85%) was significantly lower than that in the control group (13.04%) ($P < 0.05$) (Table 4).

DISCUSSION

Stroke is associated with high mortality and disability rates, and is one of the most concerning public health problems in China. Relevant data[12] show that the proportion of cerebral infarction in stroke is approximately 10%, mostly occurring in middle-aged and older individuals, with a high incidence during winter and mortality of approximately 10%–15%. PCCI is more serious and complex, its recurrence rate is higher than that of anterior circulation infarction; it is often difficult to achieve satisfactory therapeutic results with previous intravenous thrombolytic therapy[13]. Cerebrovascular interventional therapy is an intravascular treatment combined with imaging and clinical medicine that opens up a new method for the reopening of cerebral vessels in patients with acute cerebral infarction that effectively improves the rehabilitation rate of patients with cerebral infarction. However, there is also a risk of postoperative recurrence. Therefore, follow-up disease management is particularly important[14]. Continuing care is an extension of in-hospital health services, where patients can enjoy health care guidance at home during the recovery process. Continuing care was first proposed within the United States in 1947, and the effect of continuing care on the management of chronic diseases has been affirmed; China is currently in the beginning and exploration stages with this innovation[15]. Close cooperation and support between medical and nursing care is an important prerequisite for improving the quality of treatment. In this study, we adopted the MCLMM to

provide better health services for patients with cerebral infarction and improve their quality of life. Although cerebrovascular interventional therapy has gradually matured, postoperative complications remain a great threat to patient rehabilitation. If the pressure bandage is inadequate or the patient does not cooperate with the puncture limb braking after vascular intervention, the puncture site is prone to bleeding or hematoma. At the same time, long-term braking is also an important cause of venous embolism in the lower limbs. Improper heparin dosage and elevated blood pressure are important causes of postoperative intracranial hemorrhage. Vascular reopening and high perfusion can also cause secondary damage to the brain tissue, resulting in brain edema and intracranial hypertension[16,17]. Therefore, prevention and nursing of postoperative complications are key to the success of interventional surgery and rehabilitation of patients. However, routine nursing is only evaluated by nursing staff lacking medical cooperation and linkage, and evaluation can be less targeted and comprehensive. In this study, a MCLMM was adopted, and the results showed that the total incidence of postoperative complications in the observation group (7.69%) was lower than that in the control group (18.84%) ($P < 0.05$) This indicates that the MCLMM was superior to the conventional nursing model in reducing the complications of endovascular intervention in PCCIs. The MCLMM is jointly evaluated by the attending physician and the nurse on duty. Personalized nursing programs are formulated according to the different risk factors of each patient, and targeted nursing and prevention of possible adverse events is undertaken. For special and critical cases, the director of the department leads the medical staff to undertake ward rounds to evaluate the patient's condition. At the collective morning meeting, such patients will also be emphasized, treatment difficulties and nursing priorities will be analyzed, and an emergency plan will be formulated so that the medical staff can make the work focus prominent, face crises calmly, cooperate closely, and reduce the occurrence of adverse events. The results of this study show that compliance behavior (regular medication, reasonable diet, and rehabilitation cooperation rates) and self-management behavior (self-willingness, disease knowledge, and self-care ability) of the observation group

were significantly better than those of the control group ($P < 0.05$). Thus, the MCLMM has great advantages in improving patients' compliance behaviors and disease self-management abilities. As China's aging population has become increasingly prominent, chronic disease rates have increased, causing a high burden for healthcare and the economy[18]. Cerebrovascular diseases are both preventable and controllable. Good compliance behaviors and disease self-management abilities are particularly important in preventing disease recurrence. In this study, medical and nursing care were jointly involved in disease management of patients with cerebral infarction after discharge from the hospital. Through the establishment of a WeChat group, online disease knowledge promotion, in-hospital personal simulation, rehabilitation exercise demonstration, active answering of patients' questions, and regular telephone follow-up to encourage patients to implement dynamic tracking management were achieved and out-of-hospital WeChat rehabilitation exercise demonstration videos were disseminated. Simultaneously, with the joint participation of medical and nursing teams, the departments of neurology, rehabilitation, and psychological counseling provided comprehensive health management and services, which allowed patients to receive more professional and comprehensive content and make faster progress. This is consistent with the multidisciplinary integration, collaboration, and continuity of health services in the continuity of care model[19,20]. The results of this study showed that after one year, the mRS score of the observation group was lower than that of the control group, and the BI score was higher than that of the control group ($P < 0.05$). The recurrence rate in the observation group (3.85 %) was significantly lower than that in the control group (13.04%) ($P < 0.05$). The results support the MCLMM as a means to promote the recovery of neurological function, including the independent living abilities of patients, which is of great significance for the prevention of disease recurrence. It also improved the compliance behavior and disease self-management ability of patients in this mode.

Our study has some limitations. First, all patients were cared for by the medical staff, introducing observer bias. Second, a relatively small sample size was enrolled, and

whether the selected sample was representative of the target population is worth further investigation. Third, our clinical trial was a retrospective study that cannot completely avoid missing data and measurement bias. Therefore, more candidate biomarkers are needed to develop predictive models in the future.

CONCLUSION

The MCLMM can effectively reduce the incidence of postoperative complications after vascular intervention for PCCI and significantly improve the compliance behavior and disease self-management ability of patients. It was useful in promoting the recovery of neurological function and daily living ability of patients, and preventing disease recurrence. Thus, it is worthy of clinical application.

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

Group	Age (yr)	Sex		Weight Index (kg/m²)	Basic disease			Smoking history	Education level		
		Male	Female		Coronary heart disease	Hypertension	Diabetes		Primary school and below	Junior high school	High school or above
Observation group (*n* = 78)	56.57 ± 10.74	42 (53.85)	36 (46.15)	22.23 ± 2.09	10 (12.82)	24 (30.77)	13 (16.67)	37 (47.44)	17 (21.79)	41 (52.56)	20 (25.64)
Control group (*n* = 69)	55.46 ± 10.42	38 (55.07)	31 (44.93)	22.31 ± 2.04	9 (13.04)	25 (36.23)	10 (14.49)	34 (49.28)	11 (15.94)	39 (56.52)	19 (27.54)
t/χ^2 value	0.634	0.022		0.234	0.001	1.129	0.131	0.049	0.813		
P value	0.527	0.881		0.815	0.967	0.287	0.717	0.823	0.665		

Table 2 Comparison of the incidence of postoperative complications between the two groups, *n* (%)

Group	Wound bleeding or hematoma	Lower extremity venous thrombosis	Intracranial hemorrhage	Hyperperfusion	Total rate
Observation group (*n* = 78)	2 (2.56)	0 (0.00)	1 (1.28)	3 (3.85)	6 (7.69)
Control group (*n* = 69)	5 (7.25)	1 (1.45)	2 (2.90)	5 (7.25)	13 (18.84)
χ^2 value	-	-	-	-	4.043
P value	-	-	-	-	0.044

Table 3 Comparison of compliance behavior and self-health management behavior between the two groups

Group	Compliance Behavior, *n* (%)			Self-health management behavior (mean ± SD, score)		
	Regular medication	Rational diet	Rehabilitation cooperation	Self-willingness	Disease knowledge	Self-care ability
Observation group (*n* = 78)	72 (92.31)	69 (88.46)	67 (85.90)	8.86 ± 0.83	8.14 ± 1.42	62.49 ± 6.23
Control group (*n* = 69)	55 (79.71)	52 (75.36)	49 (71.01)	7.42 ± 1.05	6.87 ± 2.01	54.27 ± 7.46
χ^2/t value	4.943	4.315	4.873	9.273	4.462	7.277
P value	0.026	0.037	0.027	< 0.001	< 0.001	< 0.001

Table 4 Comparison of the modified Rankin scale, Barthel index, and recurrence rate between the two groups

Group	mRS (score)		BI (score)		Recurrence
	Acute phase	After one year	Acute phase	After one year	
Observation group (*n* = 78)	2.51 ± 0.81	1.72 ± 0.51[a]	76.39 ± 11.11	90.14 ± 5.84[a]	3 (3.85)
Control group (*n* = 69)	2.48 ± 0.80	2.04 ± 0.64[a]	77.02 ± 12.27	85.77 ± 5.79[a]	9 (13.04)
t/χ^2 value	0.209	3.133	0.327	4.546	4.131
P value	0.834	0.002	0.744	0.011	0.042

[a]*P* < 0.05 *vs* acute phase.

mRS: Modified Rankin scale; BI: Barthel index.

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