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Study on the intervention effect of SMG health management in patients with ischemic stroke

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Abstract

Introduction: *The aim of the study was to explore the clinical effect of brain and heart health managers combined with the "SMG" health management mode on nursing intervention in ischemic stroke patients.*

Material and methods: *A total of 187 ischemic stroke patients divided into 96 patients in the observation group and 91 patients in the control group with the random number table method. The control group conducted the routine care intervention, and the observation group used the brain and heart health managers combined with the "SMG" health management model for the nursing intervention. The control of stroke risk factors was explored by comparing blood pressure, blood glucose and blood lipid and other indicators between the two groups before and after treatment.*

Results: *Compared with that before the intervention, the Stroke Self-Efficacy Questionnaire (SSEQ) score of both the observation group and the control group were significantly higher ($p < 0.05$), and the Hamilton Anxiety Scale (HAMA), Hamilton Depression Scale (HAMD), National Institutes of Health Stroke Scale (NIHSS) and modified Rankin scale (mRS) scores were all decreased ($p < 0.05$). The proportion of patients with treatment adherence did not differ significantly before and after the intervention in the control group ($p > 0.05$), and it increased significantly in the observation group after the intervention ($p < 0.05$). The observation group had higher SSEQ score and lower HAMA, HAMD, NIHSS, and mRS scores after the intervention compared with the control group, with statistically significant differences.*

Conclusions: *The combination of brain and heart health managers and "SMG" is more conducive to improving the self-efficacy of ischemic stroke patients, alleviating patient anxiety and depression, improving patient treatment compliance, controlling stroke risk factors, and promoting neurological function recovery.*

Key words: *ischemic stroke, brain and heart health manager, SMG, health management.*

Introduction

Stroke is a common disease that endangers human life and health [36], and has a high risk of lethality and disability. Stroke is mainly divided into two types: haemorrhagic stroke and ischemic stroke, and about 87% of the patients have ischemic stroke [3]. The global incidence of ischemic stroke has been reported to be 46.2% [16]. In China, the incidence of ischemic stroke is 19.7% and the mortality rate is 10.3% [31]. Ischemic stroke remains the leading cause of death and disability worldwide [24]. In addition, ischemic stroke patients are prone to disability and suffer from anxiety, depression and other bad emotions [37]. Early identification, early diagnosis, early treatment and early rehabilitation after stroke onset can promote the maximum recovery of patients [11].

Several studies have demonstrated that a nurse-led specialized intervention can greatly reduce stroke relapse [13]. Follow-up led by professional health managers has been widely used in the field of diabetes, and has achieved good results [5]. In order to improve the comprehensive management level and effect for

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stroke patients, China's Medium-and Long-term Plan for Chronic Disease Prevention and Treatment (2017-2025) [30] proposed that stroke centres should have special management to promote the construction of the centre. Brain and heart health manager is an emerging role, undertaking the comprehensive assessment, health management and professional follow-up for stroke patients inside and outside the hospital. They are professionally trained and assessed in multidisciplinary theoretical knowledge and communication skills [14]. Brain and heart health managers can provide patients with more timely and professional health interventions, giving patients better health-related knowledge [7]. Many studies have shown that in the rehabilitation process, the interventional management of brain and heart health managers can effectively improve the rehabilitation effect of patients [29,33].

At present, the workflow of brain and heart health managers mainly focuses on individual intervention and professional follow-up, which cannot fully mobilize patients' subjective initiative and stimulate internal motivation. The application of the "SMG" health management model may play a significant positive role during patient recovery [34]. The "SMG" health management model was created by researcher Zhang Chichen and used for empty-nesters in the community. According to the specific situation of the elderly, health management should be combined with the theory of community organization to manage the empty-nesters in multi-level steps so as to maximize the self-efficiency of the elderly [34]. The "SMG" health management mode includes self-management, mutual-management, and group-management, which is a phased integrated management mode to play the best health management efficiency through progressive implementation [34]. It is reported that the "SMG" health management model can significantly improve the self-efficacy and quality of life in stroke hemiplegia patients [12]. However, the intervention studies combining the "SMG" health management mode with the work of brain and heart health managers have not been reported yet. This study introduced the "SMG" health management mode combined with brain and heart health managers to explore its effectiveness in the recovery of ischemic stroke.

Material and methods

Study design

This study is a randomized controlled trial study. Study subjects were recruited among patients with ischemic stroke admitted to our hospital. Patients were screened according to the inclusion criteria and exclusion criteria. Patients enrolled in the study were randomly assigned to two groups, the observation group and the control group. The control group underwent routine care, and the observation group was managed by the brain and heart health manager combined with the "SMG" health management mode. Both groups were followed up for 3 months. Patient self-efficacy, negative emotions, treatment adherence, and neurological function were assessed before and after the intervention. The control of blood pressure, blood glucose, blood lipids and stroke risk factors were compared between the two groups (Fig. 1).

General information

The 200 ischemic stroke patients admitted to our hospital from December 2019 to November 2020 were selected as the study subjects. There were 100 cases in the observation group and the control group, respectively, with the random number table method. Three patients were lost to follow-up, one died in the observation group, 6 were lost to follow-up and 3 died in the control group. Finally, 96 cases were included in the observation group and 91 cases were included in the control group. Inclusion criteria: (1) diagnosis of ischemic stroke by computed tomography (CT) or magnetic resonance imaging (MRI); (2) normal communication; (3) National Institutes of Health Stroke Scale (NIHSS) score ≤ 15 points; (4) voluntary participation in the study. Exclusion criteria: (1) patients with a severe heart, kidney and liver failure; (2) patients with a history of mental illness; (3) patients with other serious medical diseases; and (4) patients who refuse to sign informed consent. The sample size selection for this study was obtained based on the calculation formula (Fig. 2), which showed that at least 59 cases were required for 90% validity. This study was approved by

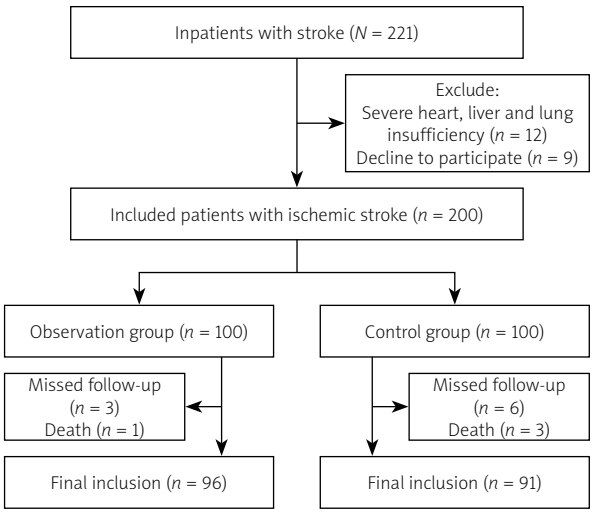

Fig. 1. Flow chart of randomized controlled trial.

Formulas
This calculator uses the following formulas to compute sample size and power, respectively:

$$n_A = \kappa n_B \text{ and } n_B = \left(1 + \frac{1}{\kappa}\right)\left(\sigma \frac{z_{1-\alpha}/2 + z_{1-\beta}}{\mu_A - \mu_B}\right)^2$$

$$1-\beta = \Phi\left(z - z_{1-\alpha/2}\right) + \Phi\left(-z - z_{1-\alpha/2}\right), z = \frac{\mu_A - \mu_B}{\sigma\sqrt{\frac{1}{n_A} + \frac{1}{n_B}}}$$

where
$\kappa = n_A/n_B$ is the matching ratio
σ is standard deviation
Φ is the standard normal distribution function
Φ^{-1} is the standard normal quantile function
α is type I error
β is type II error, meaning $1-\beta$ is power

Fig. 2. The calculation formula of sample size selection in this study.

the ethical review committee of our hospital (2019-ethic review-105). Informed consent was obtained and signed by all the patients included in the study.

Intervention methods

Routine care

The routine care measures adopted in the control group are as follows: (1) nursing evaluation of patients on admission, including vital signs, body mass index (BMI), past history, tobacco and alcohol addiction, educational level, and stress injury and fall risk assessment; (2) the responsible nurse formulates the corresponding nursing measures according to the evaluation content; (3) conducts stroke-related knowledge education, 0.5 h/d; the content includes diet, medication, rehabilitation and safety related knowledge; (4) observes and records the condition and medication response; (5) telephone follow-up at 1 month from discharge and outpatient follow-up of Neurology at 3 month to review the blood sugar and blood lipid and other indicators according to the doctor's advice.

Brain and heart health managers combined with the "SMG" health management mode

The observation group adopted the brain and heart health manager combined with the "SMG" health management mode for the nursing intervention. Brain and heart health managers are required to have a bachelor's degree and the title of nurse in charge, participate in the training organized by the Stroke Prevention and Treatment Engineering Committee of the National Health Commission, and obtain the qualification certificate. The main responsibilities of brain and heart health managers [8] mainly include the establishment of a stroke health management team and coordination, comprehensive evaluation of patients, guiding patients and their families to participate in health management, stimulating patients' awareness of active participation, promoting mutual assistance of stroke patients, establishing electronic follow-up files, and regular follow-up and intervention after discharge.

Intervention measures of brain and heart health managers combined with the "SMG" health management mode are as follows:

1. Establishing a stroke health management team: including 2 neurology experts, 1 rehabilitation therapist, 1 rehabilitation nurse, 2 brain and heart health managers and 1 specialist nurse. The brain and heart health manager is responsible for coordinating the team members. Among them, doctors conduct a dynamic assessment of the patients' physical conditions, rehabilitation therapists set personalized rehabilitation goals according to the professional scale evaluation content, and rehabilitation nurses and specialist nurses intervene in early rehabilitation nursing. Brain and heart health managers combined with the "SMG" health management mode formulate a patient health management plan, and carry out whole-process management in three stages of self-management, mutual-management, and group-management to ensure the implementation effect of various measures and follow-up management, and improve patient adherence.
2. Implementation of "SMG" health management mode during hospitalization: i) self-management stage (1-3 days after admission). After the patient admission, the brain and heart health manager conducts personalized health assessment, including basic patient information, lifestyle, family history, pre-hospital medication history, laboratory test and physical condition, and inputs the information into the national stroke data management platform. Establishing a WeChat communication platform with patients, explains the stroke controllable risk factors, identification methods and family first aid skills, pushes health management knowledge and concepts, conducts individualized medication, diet, nutrition guidance, 30 min/d, to help patients establish treatment and rehabilitation goals, actively participate in self-management, and improve self-efficacy. ii) Mutual-management stage (4 to 6 days of hospitalization). The health management team helps patients establish mutual management groups based on gender, age, cultural background, psychological state, physical spacing and disease symptoms, led by patients with a strong organizational capacity. Every afternoon, the group communicates for 30~40 min each time to share the treatment effect, current status and rehabilitation goals. Brain-heart health managers should provide supervision and guidance, give full play to the role of mutual promotion among

the group members, promote the communication and motivation among the patients, reduce the negative emotions such as anxiety and depression, and help the patients to face the disease with a positive attitude. iii) Group-management stage (hospitalization day 7 to discharge): Stroke health management team organizes various forms and rich content of collective activities, such as activities of daily living (ADL) skills training (1 h/d) and doctor-patient alliance (30 min/d). We encourage patients to actively participate in group activities, share health management experience in the activities. The team members are encouraged to urge each other, establish medical adherence behaviour, so that the stroke patients can have a sense of belonging during the hospitalization, have clear rehabilitation goals, give full play to their subjective initiative, and improve the treatment adherence.

3. Early rehabilitation nursing: after the patient condition is stable, the brain and heart health manager cooperates with the rehabilitation therapist to evaluate the patients, guide and urge the patients to perform functional exercise, actively participate in mutual management and team activities, and step by step to promote the effective recovery of the body.
4. Discharge follow-up: set up stroke health management follow-up clinic, establish follow-up file for patients management, use telephone or WeChat every week to conduct patients' health management, urge patients to follow the doctor's advice, eat a reasonable diet, strengthen rehabilitation training, and maintain a good attitude. Three months after discharge, the patient is contacted to visit the stroke Health Management clinic. The brain and heart health managers conduct a one-to-one visit to follow up the patients' stroke risk factors control, whether to follow the doctor's advice and whether there are new events, provide comprehensive services such as blood test, self-management, medication and rehabilitation guidance, and cooperate with doctors to evaluate the patient's neurological function.

Outcome indicators

Main outcome indicators

1. Self-efficacy: Stroke self-efficacy questionnaire (SSEQ) [25] was used to evaluate the self-efficacy with a reliability and validity of 0.969 and 8 items ranging from 13 to 130 points. The higher the score, the higher the self-efficacy.
2. Negative emotions: they were assessed using the Hamilton Anxiety Scale (HAMA) [32] and the Hamilton Depression Scale (HAMD) [27]. HAMA includes insomnia, fear, tension, anxiety, depression, cognitive function, behaviour, gastrointestinal, cardiovascular, respiratory symptoms during talking, a total of 14 items. Each item is 0~4 points, with a maximum of 56 points. HAMD is one of the most standard depression scales, including early going to bed, delay, suicide, agitation, suspicion, desperation, inferiority, sexual symptoms, systemic symptoms, a total of 24 items, with 0 to 4 points each and the maximum of 80 points. The higher the score value, the more serious the degree of anxiety and depression is.

Secondary outcome indicators

1. Treatment adherence: Patients were investigated using the MMAS-8 [28], with a scale reliability and validity of 0.763, a total score of 8, patients get 0-6 score, there no medication compliance. There has medication compliance when get 6 or over.
2. Ischemic stroke risk factors: Ischemic stroke risk factors include blood pressure, fasting blood glucose (FBG), homocysteine (tHcy), triglyceride (TG), and low density lipoprotein (LDL) levels. Test data for risk factors for ischemic stroke were all obtained from laboratory examinations. The pre-intervention test was done on the next day after admission, and the test was reviewed at follow-up at 3 months after discharge. Fasting venous blood was collected in the morning and tested using a Siemens ADVIA1800 fully automated biochemical analysis detector.
3. Neurological function: Patient cognitive function was assessed using the U.S. National Institutes of Health stroke scale (NIHSS) [6]. The reliability and validity of the scale was 0.861, including 13 items, ranging from 0 to 42. Impaired neurological function was positively correlated with the score. Patient disability was assessed using a modified Rankin scale (mRS) [1,23], with a scale reliability and validity of 0.740, a total score of 0 to 6, and 0 indicates no neurological dysfunction, and 6 indicates death.

Statistical analysis

All data were analysed using SPSS25.0. Measurement data are normally distributed and expressed as mean ± standard deviation ($x \pm s$). Paired *t*-test was used for intra-group comparisons before and after the intervention and independent sample *t*-test for comparisons between groups. The significance level $\alpha = 0.05$ and $p < 0.05$ means a statistically significant difference.

Results

Comparison of the baseline data between the two patient groups

A total of 200 patients were recruited according to the inclusion criteria and randomized into 100 patients

Table I. Comparison of the baseline data between the two patient groups

Item number	Control group	Observation group	χ^2/t value	*P* value
Age (years), $\bar{x}$ ±s	61.70 ±9.10	61.90 ±10.78	0.312	0.895
Sex, *n* (%)				
Male	55 (60.44)	65 (67.71)	1.074	0.300
Female	36 (39.56)	31 (32.29)		
Education level, *n* (%)				
Primary school and below	37 (40.66)	38 (39.58)	0.026	0.978
Junior high school	44 (48.35)	47 (48.96)		
University or above	10 (10.99)	11 (11.46)		
Risk factors, *n* (%)				
Smoking	26 (28.57)	25 (26.04)	0.151	0.698
Drinking wine	30 (32.97)	24 (25.00)	1.444	0.230
Hypertension	58 (63.74)	61 (63.54)	0.001	0.978
Diabetes	21 (23.08)	16 (16.67)	1.210	0.271
Coronary heart disease	10 (10.99)	8 (8.33)	0.379	0.538
BMI, $\bar{x}$ ±s	24.74 ±3.25	24.39 ±2.40	–0.842	0.401

each in the observation group and the control group. After follow-up of 3 months, 3 patients were lost to follow-up, 1 patient died in the observation group, 6 patients were lost to follow-up, and 3 patients died in the control group. Finally, 96 cases were included in the observation group and 91 cases were included in the control group. Comparison of the baseline data of patients between the two groups is presented in Table I. There was no significant difference in the demographic characteristics between the two groups ($p > 0.05$). Statistical analysis of the patients' chronic underlying diseases (hypertension, diabetes, coronary heart disease) showed no significant difference between the two groups ($p > 0.05$). These results imply a comparability between the two groups.

Nursing intervention of brain and heart health managers combined with the "SMG" health management mode can improve patients' self-efficacy

To explore the improvement of patient self-efficacy during nursing care, this study assessed the self-efficacy in both groups using the SSEQ score. The results are shown in Table II. There was no significant difference in the SSEQ scores between the two groups before the intervention ($p > 0.05$). After the intervention, the SSEQ score was significantly higher in both groups ($p < 0.001$), and in the observation group it was significantly higher than that in the control group (105.11 ±13.13 vs. 96.19 ±14.13, $p < 0.001$). This implies that brain and heart health managers combined with a "SMG" health management model intervention work better than a routine care intervention in improving patient self-efficacy.

Table II. Comparison of SSEQ scores between the two groups

Group [cases (*n*)]	SSEQ scores	
	Before intervention	After intervention
Control group ($n = 91$)	83.76 ±17.97	96.10 ±14.13*
Observation group ($n = 96$)	83.58 ±18.62	105.11 ±13.13*a
t value	–0.065	4.478
P value	0.948	< 0.001

*Compared with that before intervention *p < 0.001; compared with the control group [a]p < 0.001*

Nursing intervention of brain and heart health managers combined with "SMG" health management mode can significantly relieve patients' negative emotions

Anxiety and depression are the most common psychiatric complications in stroke patients. In this study, the HAMA and HAMD scales were used to evaluate the effects of different care interventions on anxiety and depression in stroke patients. Results found no significant difference in HAMA and HAMD scores between the two groups before the intervention ($p > 0.05$). After the intervention, the HAMA and HAMD scores were reduced in both groups ($p < 0.001$), which indicates that the intervention care can reduce patient anxiety and depression after stroke. After the intervention, both the HAMA scores and HAMD scores in the observation group were significantly lower than those in the control group ($p < 0.05$). This implies that brain and heart health managers combined with the

Table III. Comparison of HAMA and HAMD scores between the two groups

Group [cases (*n*)]	HAMA scores		HAMD scores	
	Before intervention	After intervention	Before intervention	After intervention
Control group (*n* = 91)	8.50 ±2.03	6.62 ±1.82*	16.27 ±2.50	12.49 ±2.20*
Observation group (*n* = 96)	8.53 ±2.09	3.17 ±1.53*a	16.23 ±2.86	5.02 ±1.51*a
t value	0.085	–14.021	–0.116	–27.237
P value	0.805	0.033	0.077	0.002

*Compared with that before intervention *p < 0.001; compared with the control group [a]p < 0.05*

"SMG" health management model can better reduce anxiety and depression and relieve negative emotions after stroke, compared with routine care interventions. The results are shown in Table III.

Nursing intervention of brain and heart health managers combined with "SMG" health management mode can improve patient treatment adherence

The medication adherence of stroke patients can affect their rehabilitation effect. In our study, the proportion of patients with medication adherence after the intervention was not significantly different in the control group compared with that before the intervention ($p > 0.05$). In the observation group, the proportion of patients with medication adherence after the intervention was significantly higher compared with that before the intervention ($p < 0.05$). After the intervention, the rate of medication adherence in the observation group (93.75%) was higher than that in the control group (79.12%) ($p < 0.05$). These results indicate that the intervention of brain and heart health managers combined with "SMG" health management mode can effectively improve medication adherence (Table IV).

Nursing intervention of brain and heart health managers combined with the "SMG" health management mode significantly reduced the risk factors for ischemic stroke

Reducing risk factors for ischemic stroke through nursing intervention has a positive effect on reducing the stroke recurrence rate. Blood pressure, fasting blood glucose (FBG), homocysteine (tHcy), triglyceride (TG), and low density lipoprotein (LDL) levels were all risk factors for ischemic stroke. Our results showed no significant difference in these indicators between the two groups before the intervention ($p > 0.05$). After the intervention, only diastolic blood pressure and LDL level in the control group decreased compared with those before the intervention ($p < 0.05$), and there was no significant change in other risk factors. In the observation group, the values of all indicators decreased after the intervention compared with those before the intervention, and the difference was statistically significant ($p < 0.05$). After the intervention, the indicator values in the observation group were lower than those in the control group ($p < 0.05$). Therefore, it is found that nursing intervention of the brain and heart health managers combined with the "SMG" health management mode has a positive effect on improving the risk factors for ischemic stroke (Tables V-VII).

Nursing intervention of brain and heart health managers combined with the "SMG" health management mode is conducive to the improvement of neurological function in patients with ischemic stroke

Ischemic stroke is a devastating neurological disorder that leads to neurological dysfunction in patients. Our study evaluated the neurological function of patients in both groups by using the NIHSS score and the mRS score, and the results are shown in Table VIII. There was no significant difference in the NIHSS and mRS scores between the two groups before the intervention ($p > 0.05$). After the intervention, although the NIHSS and mRS scores of both groups decreased ($p < 0.001$), the NIHSS and mRS scores in the observation group were lower than that in the control group, with statistically significant differences ($p < 0.05$), which implied that nursing intervention of the brain and heart health managers combined with the "SMG" health management mode was better in

Table IV. Drug compliance of the two groups [*n* (%)]

Group [cases (*n*)]	Drug compliance	
	Before intervention	After intervention
Control group (*n* = 91)	61 (67.03)	72 (79.12)
Observation group (*n* = 96)	65 (67.71)	90 (93.75)*a
χ^2 value	1.074	8.632
P value	0.300	0.003

*Compared with that before intervention *p < 0.001; compared with the control group [a]p < 0.05*

Table V. Comparison of blood pressure between two groups before and after intervention (mm Hg, 1 mm Hg = 0.133 kPa)

Group [cases (*n*)]	Systolic pressure		Diastolic pressure	
	Before intervention	After intervention	Before intervention	After intervention
Control group (*n* = 91)	145.84 ±22.42	144.66 ±21.75	91.05 ±15.05	86.03 ±11.62**
Observation group (*n* = 96)	147.48 ±20.92	138.51 ±17.85*a	90.35 ±12.91	81.99 ±10.08*a
t value	0.519	–2.118	–0.342	–2.545
P value	0.605	0.035	0.735	0.012

*Compared with that before intervention *p < 0.001; compared with that before intervention **p < 0.05; compared with the control group [a]p < 0.05*

Table VI. Comparison of FBG and tHcy between the two groups before and after intervention

Group [cases (*n*)]	FBG (mmol/l)		tHcy (μmol/l)	
	Before intervention	After intervention	Before intervention	After intervention
Control group (*n* = 91)	6.08 ±2.48	5.73 ±1.64	13.73 ±5.71	13.20 ±6.64
Observation group (*n* = 96)	5.79 ±2.04	5.26 ±0.87**a	13.91 ±6.99	11.24 ±6.30*a
t value	–0.878	–2.491	0.196	–2.069
P value	0.381	0.014	0.845	0.040

*Compared with that before intervention *p < 0.001; compared with that before intervention **p < 0.05; compared with the control group [a]p < 0.05*

Table VII. Comparison of triglyceride (TG) and low density lipoprotein (LDL) between the two groups before and after intervention (mmol/l)

Group [cases (*n*)]	TG		LDL	
	Before intervention	After intervention	Before intervention	After intervention
Control group (*n* = 91)	1.73 ±1.77	1.57 ±0.74	2.62 ±0.90	2.36 ±0.96*
Observation group (*n* = 96)	1.63 ±1.00	1.37 ±0.55**a	2.71 ±0.82	2.04 ±0.88*a
t value	–0.471	–2.137	0.688	–2.398
P value	0.638	0.034	0.492	0.017

*Compared with that before intervention *p < 0.001; compared with that before intervention **p < 0.05; compared with the control group [a]p < 0.05*

Table VIII. Comparison of neurological disorder and function between two groups before and after intervention

Group [cases (*n*)]	NIHSS scores		mRS scores	
	Before intervention	After intervention	Before intervention	After intervention
Control group (*n* = 91)	3.29 ±2.58	2.52 ±2.16*	1.62 ±1.24	0.91 ±1.08*
Observation group (*n* = 96)	3.45 ±3.06	1.94 ±1.83*a	1.61 ±1.28	0.57 ±0.94*a
t value	0.391	–1.978	–0.004	–2.295
P value	0.696	0.049	0.997	0.023

*Compared with that before intervention *p < 0.001; compared with the control group [a]p < 0.05*

improving the neurological function of ischemic stroke patients than the routine nursing.

Discussion

The results of this study show that nursing intervention of the brain and heart health managers combined with the "SMG" health management mode can improve patient self-efficacy and relieve their negative emotions after stroke, compared with the routine care intervention. Nursing intervention of brain and heart health managers combined with "SMG" health management mode can significantly improve the medication adherence of ischemic stroke patients and weaken the risk factors for their ischemic stroke, which is conducive to enhancing the recovery of patients and reducing the possibility of stroke recurrence. In addition, it can significantly improve the neurological function of patients with ischemic stroke, which can reduce the burden of patients and their caregivers.

Ischemic stroke has the characteristics of sudden onset and tendency to neurological impairment.

Patients often have aphasia, limb dysfunction and other symptoms, which are not easy to relieve in a short time [20]. Worldwide, stroke is the second leading cause of death and the leading cause of disability [10]. Patients with ischemic stroke suffer from hemiplegia, aphasia, and inability to take care of themselves, while those with more severe stroke have coma, or even death, which brings a heavy burden to patients and their families, and also causes serious economic pressure to the society [21]. Although with the improvement of medical technology, the mortality rate of stroke shows a downward trend, a large number of people still suffer from post-stroke neurological deficiency symptoms, decreased daily life ability, post-stroke cognitive dysfunction, post-stroke depression and other complications, severe cases are difficult to take care of themselves [18]. Therefore, the rehabilitation of stroke patients is a crucial part of the whole disease course. In China, in order to protect people's health, the Stroke Prevention and Control Engineering Committee of the National Health Commission (the National Brain Prevention and Control Commission) has focused on promoting stroke prevention and control since 2011, and has achieved certain results. The National Brain Prevention and Control Commission began to implement a training program for brain and heart health managers in 2017. They have skilled professional knowledge and rich clinical experience, use the national stroke management information platform to undertake the comprehensive evaluation, professional guidance and rehabilitation enhancing of patients in the hospital, are responsible for the regular follow-up and health management of patients outside the hospital, and realize the whole process management of stroke patients. Previous studies have shown that the comprehensive intervention of brain and heart health managers in stroke patients is conducive to the standardizing patients' health behaviour, enhancing the rehabilitation, promote the recovery of neurological function, and improve the social function [4,22]. However, the professionalism of brain and heart health managers makes them focus on the rehabilitation of body function and lack of attention to the mental state of patients. The "SMG" health management model created by Zhang Chichen [34] focuses on activating patients' internal motivation and improving patients' self-efficacy. A study [12] has shown that the integration of "SMG" health management mode in stroke hemiplegia patients can improve their self-efficacy and quality of life. Therefore, it is speculated that brain and heart health managers combined with the "SMG" health management mode for patients with ischemic stroke may have better results on patients' rehabilitation. To verify this guess, this study used brain and heart health managers combined with the "SMG" health management mode to conduct nursing intervention for patients with ischemic stroke to explore its effect. Our study found that after 3 months of nursing intervention with the brain and heart health managers combined with the "SMG" health management mode, the patient self-efficacy was significantly improved, higher than the routine care intervention. Obviously, there are efficient to combine the brain and heart health manager with "SMG" health management model. In the process of nursing intervention of "SMG" health management mode, the brain and heart health managers gradually implement self-management, mutual-management and group-management for patients. In the self-management stage, we can evaluate the existing health problems, enhance the patients' "awareness of danger", and actively seek solutions. In the stage of mutual-management and group-management, we should fully "authorize" patients to constantly stimulate their internal motivation, so as to improve patients' self-efficacy and make them actively participate in health management.

Stroke patients are prone to emotional disorders, and anxiety and depression are the most common, leading to depressed spirits and treatment adherence [35]. In this study, brain and heart health managers conducted comprehensive evaluation of diet, medication and psychology, and combined with the "SMG" health management mode, implemented systematic management of patients. Team members negotiated with each other, shared the best treatment plan, excluded psychological barriers in rehabilitation, and actively responded to the current situation. The results of this study showed that after nursing intervention of brain and heart health managers combined with the "SMG" health management mode, the HAMA score and HAMD score were lower than those with the routine care intervention, and that the proportion of patients with medication adherence was significantly increased. These results suggest that the brain and heart health managers combined with the "SMG" health management mode can effectively relieve patients' negative emotions and improve patients' medication adherence.

In the general population, the risk factors for stroke are divided into non-intervenable factors (age, sex, family tendency, or genotype) and intervenable factors [19]. Intervenable factors include the management of underlying comorbidities (e.g., hypertension, diabetes, hyperlipidaemia, homocysteine, etc.) or lifestyle (such as smoking, etc.) [19]. Long-term hypertension promotes endothelial cell dysfunction, lipid infiltration into the vessel wall and accelerates atherosclerosis formation, leading to a decrease in vessel wall compliance. At the same time, hypertension causes cell and tissue damage [9]. Diabetes [15] and hyperlipidaemia [2] can

accelerate the process of atherosclerosis, and subsequently induce stroke. Carotid plaque stiffness was correlated with serum homocysteine levels in ischemic stroke patients, as shown in the study by Shang *et al.* [26]. This study showed that at 3-month follow-up, systolic blood pressure, diastolic blood pressure, fasting glucose, triglycerides, LDL-C, tHcy levels in patients with nursing intervention of brain and heart health managers combined with "SMG" health management mode improved significantly compared with routine care intervention ($p < 0.05$), indicating that brain and heart health managers combined with "SMG" health management mode can help patients control the risk factors for stroke, which will help to inhibit stroke recurrence in patients.

Ischemic stroke is defined as a sudden new focal neurological deficit for more than 24 h, a disruptive neurological disorder that leads to neurological dysfunction in patients [17]. Neurological dysfunction due to ischemic stroke brings great distress and burden to patients, their families and caregivers. The rehabilitation phase after ischemic stroke has been dedicated to the recovery of neurological function. The NIHSS [6] and mRS [23] are internationally recognized scales evaluating neurological outcomes and outcomes before and after treatment in stroke patients. In this study, after 3 months of nursing intervention of brain and heart health managers combined with "SMG" health management mode, patients' NIHSS score and mRS score improved significantly compared with routine care intervention. Stroke patients have improved self-efficacy and negative emotions, which can stimulate patients to actively participate in health management and promote neurological recovery. In this study, based on the assessment of the special rehabilitation scale, the brain and heart health managers implemented early rehabilitation care and targeted functional exercise for the patients. Combined with "SMG" health management mode, they make patients form the correct cognition and maintain good emotional state, give full play to patients' internal motivation, help patients with reasonable diet, medication adherence and exercise, urge patients in the process of follow-up to establish self-care behaviour, actively participate in disease rehabilitation, control risk factors so as to effectively improve the patients' neurological outcome and the quality of life.

There are also several limitations included in this study. First, the sample size of this study was limited. Second, this study is a single-centre study, which limits the generalizability and applicability of the conclusions. In future studies, we will conduct multi-centre studies with a large sample size to verify our conclusions. Third, the follow-up time was short, and the statistical analysis of the stroke recurrence rate is lacking. In the future, we will extend the follow-up time, design more rigorous studies to demonstrate and promote our findings, and explore new ideas for the mass prevention and treatment of stroke.

Conclusions

The use of brain and heart health managers combined with "SMG" health management mode in our hospital can improve the self-efficacy, negative emotions and treatment adherence of ischemic stroke patients, control risk factors, effectively improve neurological function, promote body rehabilitation, and play a very important role in strengthening the prevention and treatment of stroke in our hospital.

Disclosure

The authors report no conflict of interest.

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