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*Original Article*

# Exploring the influence of continuous nursing based on the IMB model on quality of life and inflammatory factors in patients after thrombolysis

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**Abstract:** Objective: To explore the influence of continuous nursing based on the Information-Motivation-Behavioral Skills (IMB) model on life quality and inflammatory factors in patients who undergo thrombolysis after stroke. Methods: One hundred patients after thrombolysis of stroke were used as research subjects. All subjects were randomly divided into a control group or observation group on the basis of a digital table. The control group received routine care and the observation group had additional IMB model-based continuous nursing combined with the routine care. Patients' quality of life was assessed according to the World Health Organization Quality of Life assessment instrument. Enzyme-linked immunosorbent assay was employed to analyze the value of the contents of cytokines including S100 calcium binding protein B (S100B), neuron-specific enolase (NSE), high-sensitive C reaction protein (hs CRP) and tumor necrosis factor-α (TNF-α). Neural function was assessed by adopting the National institute of health stroke scale (NIHSS) and Modified Rankin Scale (MRS). Cognitive function of patients was estimated using Mini-mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA). Patients' psychological status was appraised using a Self-rating anxiety scale and Self-rating Depression Scale. Patients' satisfaction and disease recurrence were followed up and statistically analyzed. Results: Due to various factors during the study, the number of patients in the control group decreased by 10 and the observation group decreased by 11. Thus, the final number of subjects in the observation group and the control group was 39 and 40, respectively. Decreased NIHSS and MRS scores and significantly elevated MMSE and MOCA scores were all found in the two groups. However, the NIHSS and MRS scores of the observation group were significantly lower than those in the control group, while the MMSE and MOCA scores were significantly higher than those in the control group ($P<0.05$). Intervention measures used in our study significantly elevated the scores of physiology, psychology, independence, social relations, surroundings and consciousness, and the scores of the above indicators in the observation group were all significantly higher than those in the control group ($P<0.05$). Besides, the levels of S100B, NSE, hs CRP and TNF-α in the observation group were significantly lower than those in the control group ($P<0.05$). What is more, the satisfaction rate of patients in the observation group was significantly higher than that of the control group ($P<0.05$). Conclusion: Continuous nursing interventions based on the IMB model significantly improve the quality of life and cognitive rehabilitation of patients after thrombolysis of stroke, and reduces the level of inflammatory factors, which is worthy of clinical promotion.

**Keywords:** Information-motivation-behavioral skills model, continuous nursing, stroke, quality of life, inflammatory factors

## Introduction

The large population base of China, coupled with aging of the population structure, leads to a significant increase in the incidence of cardiovascular and cerebrovascular diseases [1-3]. Among which, Stroke is a frequent cerebrovascular disease characterized by high morbidity, high mortality and high disability rate. According to estimated statistics, at present, there are about 7 million stroke patients in China, which is still increasing at a rate of about 8% every year; which seriously damages people's ability to work and the quality of life of patients and their families [4-6]. Research shows that through scientific and reasonable nursing guid-

ance post discharge, the lack of knowledge about stroke in patients and their caregivers can be significantly improved, and the quality of life and compliance behavior of patients will also be significantly improved [7]. However, current clinical research mainly focuses on the nursing intervention before and during thrombolysis for stroke patients, but less on nursing research for stroke patients after thrombolysis [8]. In China, the care of stroke patients post discharge is mostly realized through community secondary prevention, which creates a failure in seamless nursing connections inside and outside the hospital. In addition, some areas have limited medical resources and backward economic conditions, so patients cannot get effective rehabilitation treatment guidance post discharge, resulting in poor prognosis [9, 10]. Therefore, it is of great clinical value and social significance to find a kind of post thrombolytic care plan for patients with stroke which is also in line with actual patient conditions. At present, patients with thrombolysis after stroke urgently need reasonable continuous care, and a lot of research data has demonstrated that the Information-Motivation-Behavioral Skills (IMB) model has a good application value in improving patients' treatment compliance [11, 12]. Chang et al. have confirmed that the IMB model can be used as a comprehensive and effective model for guiding the design, implementation and assessment of a self-care plan, and can effectively improve the quality of life of peritoneal dialysis patients, so as to strengthen their knowledge, motivation and behavioral skills, aimed at changing or maintaining self-care behavior [13].

However, how best to carry out the continuous nursing model based on the IMB model, also whether it will have a good effect on patients, as well as how long the effect lasts, and how long it will take to conduct secondary intervene, are all problems that still need to be solved.

## Material and methods

### *General materials*

This study was approved by The Fifth Affiliated Hospital of Xinjiang Medical University Ethics Committee. One hundred patients with thrombolysis after stroke in the neurology department of The Fifth Affiliated Hospital of Xinjiang Medical University from February 2018 to February 2019 were selected. All subjects were randomly divided into a control group or an observation group following a digital table. Informed consent was signed by patients and their families.

Inclusion criteria for patients: (1) In line with the diagnostic criteria specific for ischemic stroke adopted by the Fourth National Conference on cerebrovascular diseases [14]. (2) Twenty-four hours after onset, hospitalized and treated. (3) No previous history of stroke. (4) Aged between 50-80 years.

Exclusion criteria: (1) Patients with poor blood flow due to carotid atherosclerosis. (2) Patients with severe cardiovascular disease. (3) Patients with severe hepatorenal insufficiency. (4) Patients with malignant tumors of other organs. (5) Patients with contraindications of thrombolysis. (6) Patients who were lost in follow up.

### *Methods*

During the continuous nursing period, patients in the two groups took aspirin, enteric coated tablets (Bayer medical and health Co., Ltd., Germany, J20171021), 0.1 g once a day; Flunarizine Hydrochloride Capsules (Jiangxi Huiren Pharmaceutical Co., Ltd., H20033514), 1 capsule twice daily, if necessary; If the patient has hypertension, diabetes and hyperlipidemia, is reasonably antihypertensive, hypoglycemic and lipid-lowering drugs (statins) were given; In case of coronary heart disease, metoprolol tartrate (AstraZeneca Pharmaceutical Co., Ltd., H32025391), 50 mg/time, twice a day, combined with isosorbide mononitrate sustained-release tablets (Kunming Zhongkang Pharmaceutical Co., Ltd., H20010142), 60 mg/times, once a day, was given.

In the control group, the nurse in charge issued the rehabilitation instruction manual to the patients during their stay in the hospital. When the patients have questions, the nurse can explain and answer questions. The rehabilitation therapist carries out routine rehabilitation treatment according to the patients' conditions every day. At the time of discharge, discharge guidance is given, and follow-up is conducted once a month in the form of Wechat video or family visit for 6 consecutive months.

The observation group was given continuous nursing based on IMB model on the basis of the control group.

An IMB intervention group was set up, which was composed of 1 deputy chief physician and 3 responsible nurses. All members of the group passed the systematic training and knowledge assessment for the IMB model.

Information intervention: Nurses actively communicate with patients and asses the problems existing in the treatment and nursing process of patients and their families, including the inability to accurately distinguish between symptom relief and disease cure, any failure to grasp the high-risk factors that cause disease recurrence, the inability to effectively carry out self-monitoring of the disease, the inability to grasp the rational use of drugs, the inability to carry out rehabilitation training reasonably, and the inability to recognize the effects of standardized use of drugs on disease progression, as well as any nursing problems caused by a long course of treatment, heavy psychological burden and lethe. In the process of information intervention, face-to-face communication is adopted to evaluate the information needs of patients based on the facts that same day. Nursing staff explain and clarify the questions raised by patients, and provide the information support.

Motivation intervention: After thrombolysis, patients with stroke have a long recovery period and poor prognosis, which leads to anxiety, pessimism and other adverse emotions, and poor compliance; which are not conducive to the recovery of the disease. Therefore, motivational interviewing is used for motivational intervention. Detailed methods for stroke patients after thrombolysis were as followed: (1) Pre-contemplation stage: In the early stage of education, establish a kind of mutual trust and medical relationship with patients, guide and encourage patients to express their own ideas and concerns, obtain the real psychological state and needs of patients, and try to achieve empathy as much as possible. (2) Contemplation stage: Let the patients realize the importance of rehabilitation training and taking medicine on time, and explain their correlation with the prognosis and outcome of stroke, in a timely manner correct the attitude of not paying attention to their psychology, and help them establish the confidence in recovery. (3) Preparation stage: Help patients to make rehabilitation goals and plans, and provide individualized and scientific advice for them. (4) Changing stage: Before the start of rehabilitation training, sort out the rehabilitation plan with the patients and their families, ask the patients if they need to modify the plan, if they are prepared to start, and help the patients to implement the rehabilitation plan. (5) Maintenance stage: Help patients make full use of social and family resources, establish a peripheral environment conducive to long-term rehabilitation training, and ensure the long-term and effective implementation of rehabilitation plan.

Behavioral skill intervention: The routine medication and rehabilitation training programs were improved according to the related problems that appeared in the process of information intervention, and patients were invited to join the Wechat group and QQ group about the rehabilitation treatment compliance intervention based on the IMB model. Regularly upload the disease-related knowledge videos, and make a follow-up visit for the patients, once a month, for 6 consecutive months.

*Observation index*

*Main index:* A total of 100 items, including 6 areas related to quality of life and 24 aspects were observed using the World Health Organization Quality of Life assessment instrument Chinese version of the scale [15]. The score of each field is based on the 100 point system, the higher the score, the better the quality of life. Two months after the treatment, 10 mL of venous blood was extracted using an EDTA tube (BD, USA, No.: 367841 367856 367861). The following indexes were evaluated through enzyme linked immunosorbent assay (ELISA) using microplate reader (Bio-Rad, USA): S100B (Boster, Wuhan, China, BM4087) and NSE (Boster, Wuhan, China, PA1061), which are used to evaluate the damage of nerve cells. The higher the value is, the more serious the damage is; high-sensitive C reaction protein (hs CRP) (Boster, Wuhan, China, EK1316) and tumor necrosis factor-α (TNF-α) (Boster, Wuhan, China, BP4901), which are used to evaluate the inflammatory state of the body, the higher the value, the more serious the inflammation.

**Table 1.** Comparison of general data ($\bar{x}$ ± sd, n (%))

| Group | Control group | Observation group | $t/\chi^2$ | P |
|---|---|---|---|---|
| Age (year) | 65.5±9.1 | 61.6±11.8 | 1.654 | 0.102 |
| BMI ($kg/m^2$) | 22.82±3.23 | 23.20±2.26 | 0.589 | 0.558 |
| Male/female | 15/25 | 17/22 | 0.104 | 0.747 |
| Length of stay (day) | 15.9±2.0 | 15.2±1.8 | 1.682 | 0.097 |
| Site of stroke (left/right/both side (s)) | 11/17/12 | 13/11/15 | 1.773 | 0.412 |
| Education level (primary school and below/junior middle school/high school and above) | 8/12/20 | 9/14/16 | 0.645 | 0.725 |
| Hypertension | 12 (30.00) | 13 (33.33) | 0.006 | 0.939 |
| Diabetes | 11 (27.50) | 14 (35.90) | 0.313 | 0.575 |
| Hyperlipidemia | 11 (27.50) | 13 (33.33) | 0.102 | 0.750 |

Note: BMI, body mass index.

*Secondary index:* Neural function was assessed using the National institute of health stroke scale (NIHSS) and the higher the score, the more serious the neurological deficit was; Neurological function at admission and 6 months after intervention were valued using Modified Rankin Scale (MRS) to measure the neurological recovery of patients after stroke and the higher the score, the more serious the nerve injury [16, 17]; The cognitive functions of patients were estimated using Mini-mental State Examination (MMSE) and Montreal Cognitive Assessment (MoCA) and higher score means better recovery of cognitive function [18, 19]; After 6 months of intervention, patients' satisfaction was assessed and was divided into three levels: very satisfied, satisfied and dissatisfied, among which satisfaction rate = (number of very satisfied patients + number of satisfied patients)/ total number.

Self-rating anxiety scale (SAS) was used to evaluate the anxiety state of patients and higher score means higher the anxiety degree [20]. Self-rating Depression Scale (SDS) was used to evaluate the depression of patients and the higher the score was, the higher the degree of depression [21].

Recurrence refers to the aggravation of the original symptoms and signs or the appearance of new neurological deficit symptoms and signs after the original symptoms are basically cured or improved. Meanwhile, the brain CT scan or MRI imaging of the head indicates that there are new lesions or the expansion of the original lesions.

*Statistical analysis*

SPSS 21.0 software was used for statistical analysis. Measurement data were expressed as mean ± standard deviation, and count data were expressed as number of cases/percentage (n/%). T-test of independent samples was used for inter group comparison and paired t test was used for pre-and post-treatment intra-group comparisons. $P<0.05$ means that the difference was statistically significant.

## Results

*General data*

During the study, the number of patients in the control group decreased by 10, and the observation group decreased by 11; due to patient privacy, change of treatment methods and other reasons, etc. Thus, the final number of patients in the observation group and the control group was 39 and 40, respectively. There was no significant difference in age, BMI, gender, length of stay, type of stroke, education level, hypertension, diabetes, amount of hyperlipidemia between the two groups ($P<0.05$; **Table 1**).

*Comparison of neurological impairment and cognitive function between the two groups*

There was no significant difference in NIHSS, MRS, MMSE and MoCA scores between the two groups before the intervention ($P>0.05$). After intervention, NIHSS and MRS scores were both significantly decreased and MMSE and MOCA scores were elevated in both of the two groups. Besides, NIHSS and MRS scores of the observation group were signifi-

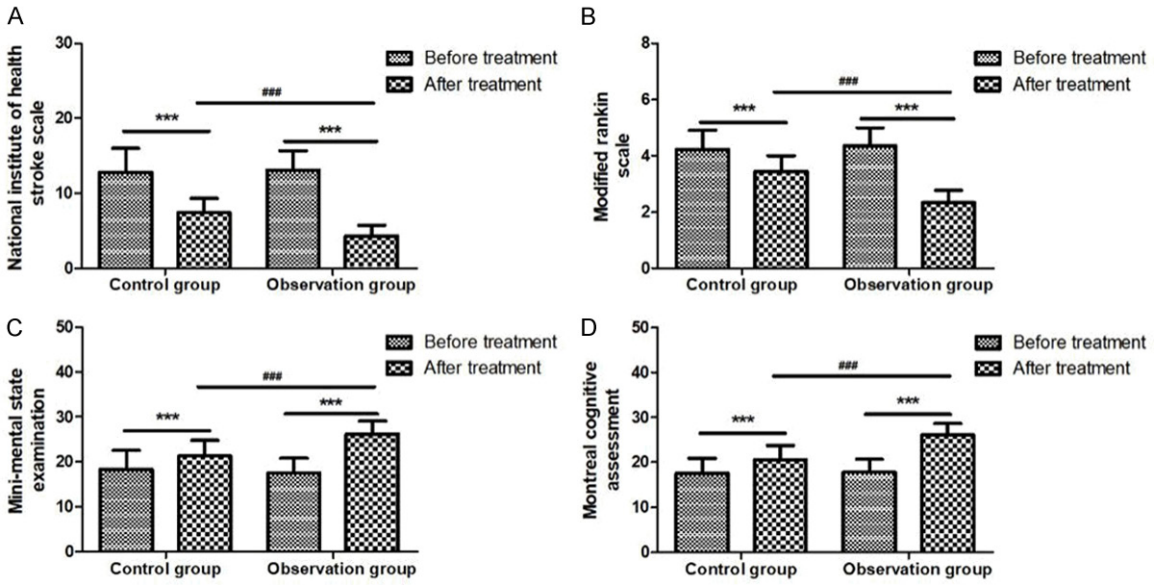


**Figure 1.** Comparison of neurological impairment and cognitive function between the two groups. A. National institute of health stroke scale. B. Modified Rankin Scale. C. Mini-mental State Examination. D. Montreal Cognitive Assessment. ***P<0.001, compared within two groups; ###P<0.001, compared between two groups.

cantly lower than the control group, and MMSE and MoCA scores were significantly higher than the control group, the difference was statistically significant (P<0.05; **Figure 1**).

*Comparison of quality of life between the two groups*

Before the intervention, there was no significant difference in physiology, psychology, independence, social relationship, surroundings and consciousness between the two groups (P>0.05). However, the scores of the above index in the two groups were all sharply elevated after intervention, and the scores of these related indicators in the observation group were significantly higher than those in the control group (P<0.05; **Figure 2**).

*Comparison of psychological status scores between the two groups*

Before nursing intervention, no difference existed in SAS and SDS scores between the two groups (P>0.05). After nursing intervention, the scores of SAS and SDS in the observation group were significantly decreased over those in the control group (P<0.05; **Figure 3**).

*Comparison of inflammatory factors*

Before treatment, no significant difference was found in S100B, hs CRP, NSE and TNF-α between the two groups (P>0.05). After treatment, levels of S100B, hs CRP, NSE and TNF-α in the observation group were significantly suppressed compared to those in the control group (P<0.05; **Figure 4**).

*Comparison of patients' satisfaction and recurrence rate between the two groups*

The satisfaction of the patients in the observation group was more strongly higher than that in the control group (P<0.05). Besides, the recurrence rate of the observation group was sharply lower than that of the control group (P<0.05; **Table 2**).

## Discussion

Stroke means that there exists an obstacle in cerebral circulation, leading to local or comprehensive functional damage of the brain. About 4/5 of patients who undergo stroke will have brain dysfunction and corresponding physical disorders; the main clinical manifestations are poor initiative, increased inertia and decreased consciousness, so the follow-up rehabilitation task is very important and arduous [22]. Most patients would choose to go home for rehabilitation treatment after passing the acute period, but the patients and their families lack disease-related knowledge, thus the nursing measures after discharge are usually not in place. Studies have

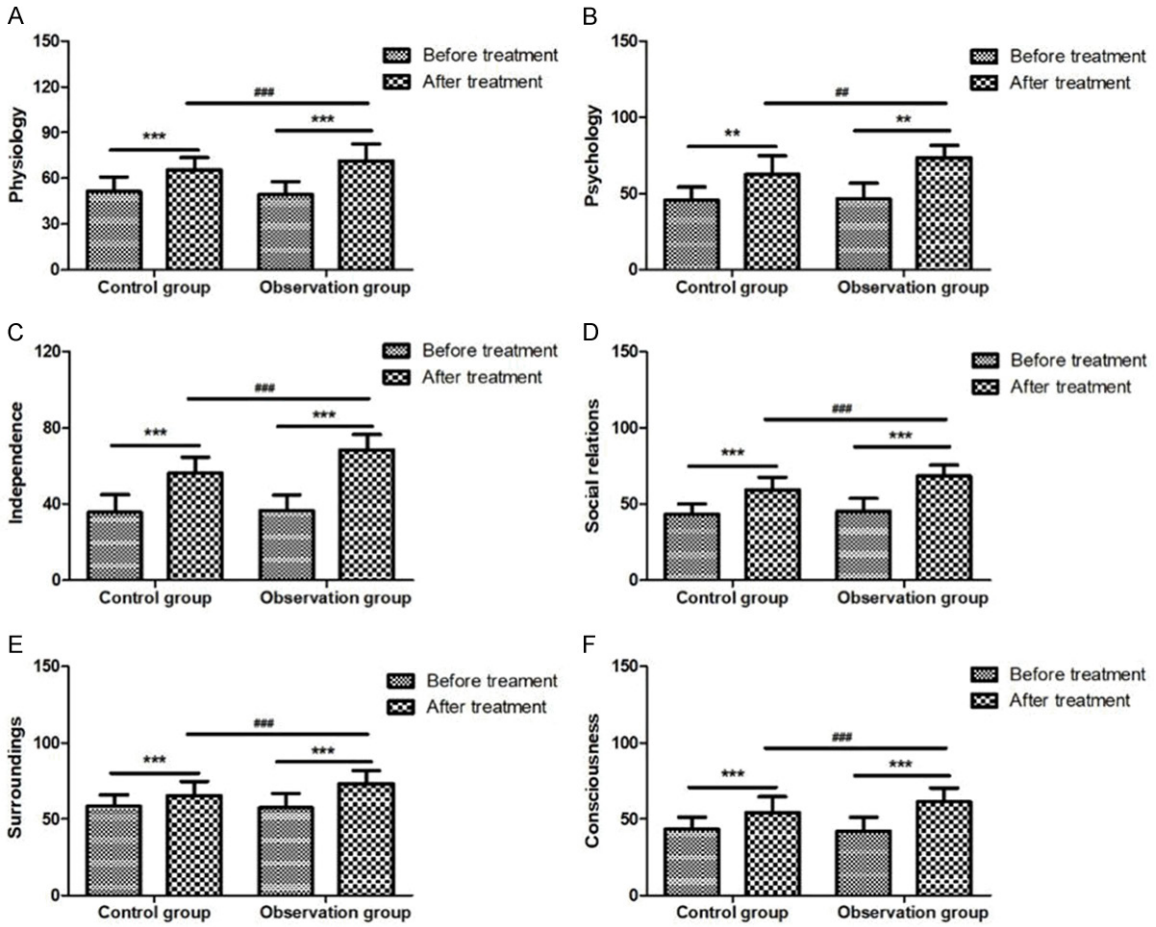


**Figure 2.** Comparison of quality of life between the two groups. A. Scores of physiology. B. Scores of psychology. C. Scores of independence. D. Scores of social relations. E. Scores of surroundings. F. Scores of consciousness. ***P<0.001, compared within two groups; ###P<0.001, compared between two groups.

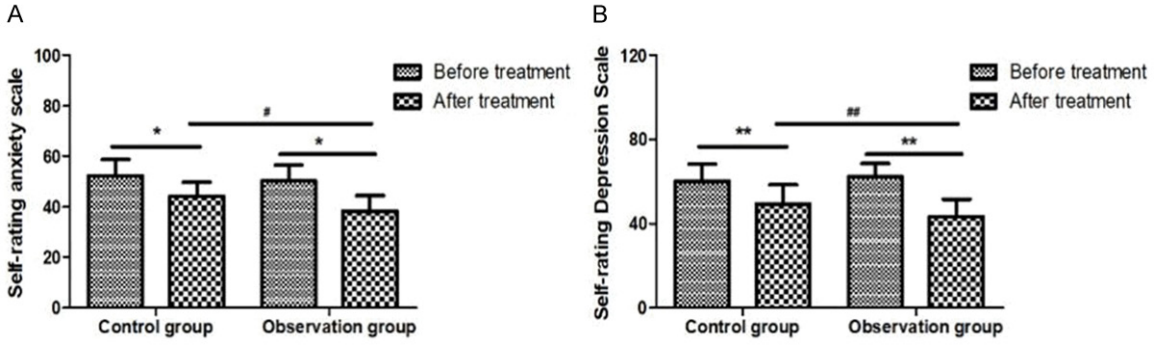


**Figure 3.** Comparison of psychological status scores between the two groups. A. Self-rating of anxiety. B. Self-rating of depression. *P<0.05, ***P<0.001, compared within two groups; #P<0.05, ###P<0.001, compared between two groups.

shown that up to 1/5 of the patients with ischemic stroke have recurrence within 1 year after treatment, and the patients with recurrent stroke have more sequelae and worse prognosis [23]. Other studies have confirmed that the recurrence of stroke is closely related to the lack of stroke related knowledge and poor ability to implement healthy behaviors [24].

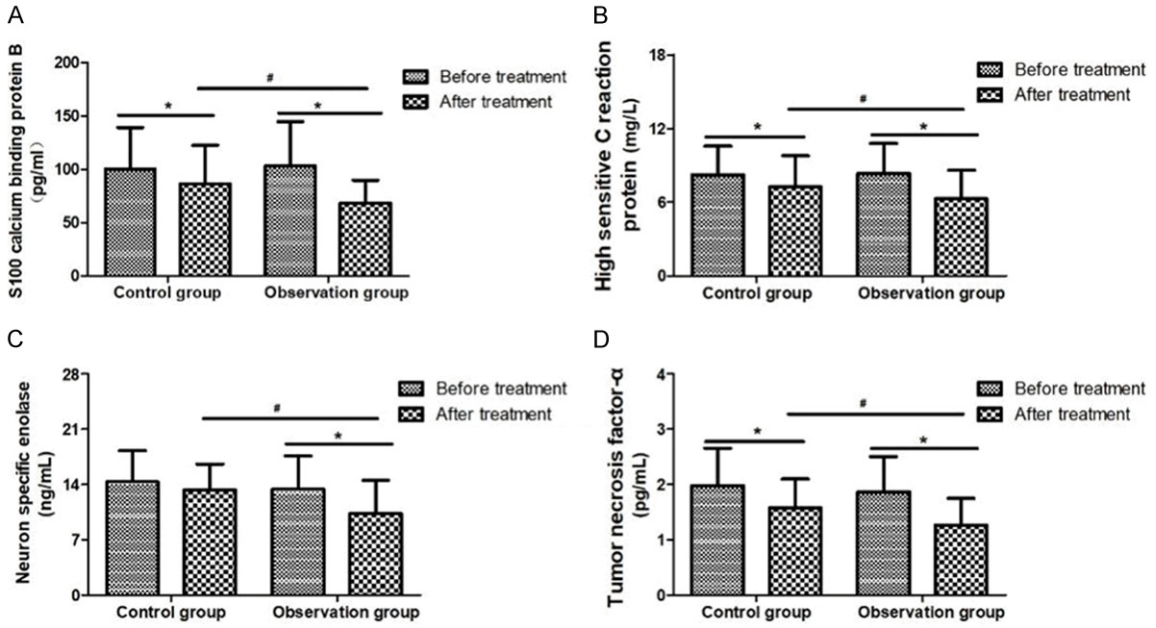


**Figure 4.** Comparison of inflammatory factors between the two groups. A. Level of S100 calcium binding protein B. B. Level of high-sensitive C reaction protein. C. Level of neuron-specific enolase. D. Level of tumor necrosis factor-α. ***P<0.001, compared within two groups; ###P<0.001, compared between two groups.

**Table 2.** Comparison of patients' satisfaction and recurrence rate between the two groups (n, %)

| Groups | Satisfaction | | | Recurrence rate after 6 months |
|---|---|---|---|---|
| | Very satisfied | Satisfied | Dissatisfied | |
| Control group (n=40) | 18 (45.00) | 12 (30.00) | 10 (25.00) | 10 (25.00) |
| Observation group (n=39) | 28 (71.80) | 9 (23.08) | 2 (5.13) | 2 (5.13) |
| $t/\chi^2$ | | 7.924 | | 4.609 |
| P | | 0.019 | | 0.032 |

Therefore, we are urged to establish a set of medical and nursing technology systems to improve the quality of life of patients with stroke and reduce the burden of society and family. Most studies have shown that continuous nursing is an effective nursing measure, but it is carried out later in China, especially for patients with stroke after thrombolysis. Therefore, it is of great importance to find a continuous nursing plan suitable for China's national conditions to care for patients with thrombolytic stroke [25].

The IMB model was first proposed by Fisher et al. in the study of high-risk behaviors of AIDS in 1992. Now it has been applied to many fields and is widely recognized as one of the theoretical models of behavior change. The IMB model mainly solves the clinical problems from the following four aspects: information factors, motivation factors, behavior skill factors and prevention behavior factors [26]. Jeffrey et al. conducted an IMB skill model-based intervention study on the high-risk behavior of 1577 urban high school students. The results showed that prevention behavior remained good in the third month and one year post intervention, while the maintenance effect of the preventive behavior in the control group was poor in the same period, indicating that the intervention based on the IMB model had a long-term effect [27]. Gavgani et al. pointed out that most interventions for diabetic patients are based on theoretical knowledge, mainly focused on education, and some health education which is not even consistent with improving blood glucose control ability. However, the intervention based on the IMB model can provide a simple rehabilitation framework, thus enhancing indi-

vidual behavior motivation and providing corresponding behavioral skill training [28]. Cuizhen Yuan et al. confirmed that the implementation of a six-month IMB mode-based lifestyle intervention in patients with heart failure can improve the compliance of lifestyle changes and health-related quality of life of patients [29].

In this study, the continuous nursing based on the IMB model puts all the factors that may affect the rehabilitation of patients after thrombolysis in one frame, takes the patients' own feelings into account, and gradually stimulates the patients' subjective initiative to hope for good rehabilitation. On the basis of improving the relevant theoretical knowledge of patients, through face-to-face communication over many times, we can get at the real psychological state and concerns of patients, give patients the greatest emotional and psychological support, and help patients actively carry out rehabilitation treatment and training. The above behaviors lay a solid foundation for improving patients' compliance behavior, and ultimately achieve the goal that patients can recover and live in a positive and healthy way. In our study, we found that NIHSS and MRS scores of patients in the observation group were clearly lower than those in the control group, while MMSE and MoCA scores were evidently higher than those in the control group. There are also studies abroad that have confirmed that nursing based on the IMB model is able to significantly improve the quality of patients' family life in the self-management of stroke patients after discharge, especially after combining information, motivation and related application skills [30]. This is consistent with the results of this study which showed that the scores of physiology, psychology, independence, social relations, surroundings and consciousness of the patients in the observation group were all much higher than those in the control group. Miller et al. believe that continuous nursing in the treatment of patients with ischemic stroke has significant effects, which can improve the treatment compliance of patients to ensure the smooth implementation of treatment and better promote the recovery of patients [31]. Serum inflammatory factors are a sensitive index of chronic persistent inflammatory stimulation, which can reflect the health state of patients to a certain extent, and has a high predictive value for the occurrence of various complications. In this study, levels of S100B, hs CRP, NSE and TNF-α in the observation group were evidently lower than those in the control group, which indicated that the continuous nursing based on the IMB model could effectively inhibit the expression of inflammatory factors and promote the rehabilitation of patients. In addition, the IMB mode-based follow-up method can promote the establishment of a harmonious nurse-patient relationship, so that patients' needs can be met to the greatest extent, and the patients' psychological state can be well mastered. When patients have problems, psychological counseling and technical guidance can be timely provided. Therefore, intervention behavior in the observation group visibly elevated satisfaction of patients over that of control group. Besides, the recurrence rate within 6 months in the observation group was clearly suppressed compared to that of the control group.

However, the number of patients involved in this study is relatively small, and the inconsistent physical and psychological quality of patients may also lead to some differences in the degree of postoperative recovery. In addition, there are some differences in the cognition of disease-related knowledge between the two groups of patients and their families. In fact, there are few opportunities for face-to-face communication with the patients after discharge. So, when the patients suffer from functional damage, inferiority complex and fear, they may lose confidence in rehabilitation, resulting in the loss of follow-up opportunities. Therefore, we should establish a good nurse-patient relationship, guidance on diet and exercise scientifically, to help avoid complications.

In conclusion, the continuous nursing intervention based on the IMB model can significantly improve the quality of life and cognitive rehabilitation of stroke patients after thrombolysis, reduce the level of inflammatory factors, which is worthy of clinical promotion.

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## Disclosure of conflict of interest

None.

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