Review Article
The effects of hierarchical nursing on patient satisfation and its efficacy on patients with cerebral infarction complicated with severe pulmonary infection

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Abstract: Objective: The present study was designed to investigate the effects of hierarchical nursing on patient satisfaction and its efficacy on patients with cerebral infarction complicated with severe pulmonary infection. Methods: Altogether 167 patients with cerebral infarction complicated with severe pulmonary infection admitted to and treated in the Affiliated Hospital of Inner Mongolia Medical University were selected as the study cohort, among which 98 patients who received hierarchical nursing during their hospitalization were enrolled in the observation group (OG), and the remaining 69 patients received routine nursing alone and were assigned to the control group (CG). The adverse reactions, nursing satisfaction, pain scale as determined by their Visual Analogue Scale (VAS) scores, psychological status, neurological function scores, and MMSE scores were compared between the two groups, and their quality of life was evaluated. Results: Compared with the CG, the OG showed a significantly lower incidence of total adverse reactions (P<0.05), and a markedly higher nursing satisfaction (P<0.05). After the treatment, the VAS scores in the OG were significantly lower than the VAS scores in the CG (P<0.05), and the psychological status as well as neurological function scores were dramatically better than those in the CG (P<0.05). The hospitalization time in the OG was profoundly shorter than it was in the CG (P<0.05), and the quality of life scores in the OG were markedly better than the scores in the CG (P<0.05). Conclusion: Hierarchical nursing can effectively reduce the incidence of adverse reactions and pain in patients with cerebral infarction complicated with pulmonary infection and can improve patients' nursing satisfaction, psychological status, and neurological function, so it is worthy of promotion in clinical use.

Keywords: Hierarchical nursing, cerebral infarction complicated with severe pulmonary infection, nursing satisfaction, adverse reactions

Introduction

Cerebral infarction, or ischemic stroke, refers to cerebral tissue ischemia and hypoxic lesion necrosis caused by regional blood supply failure due to various reasons [1]. According to the different pathogeneses, cerebral infarction can be divided into cerebral thrombosis, cerebral embolism, and lacunar cerebral infarction, among which cerebral thrombosis is the most common type [2]. At present, cerebral infarction is a very prevalent cerebrovascular disease worldwide, with an exceedingly high incidence among the middle-aged population [3]. It is estimated that the current global incidence of cerebral infarction is about 13.92% [4]. Moreover, cerebral infarction is a deadly disease with a very high disability rate [5] that can cause senescence of brain cells and disorders of brain function. In the mild cases, it will manifest as paralysis, dizziness, and aphasia, while in severe cases, it may cause consciousness disorders, paralysis, or even death [6, 7]. Pulmonary infection, as a common complication of cerebral infarction, is extremely prevalent in this disease [8]. Previous studies have confirmed that the prognoses of patients with cerebral infarction complicated by pulmonary infection is extremely high [9]. Due to the high incidence and risk of cerebral infarction, clinical efforts have been constantly devoted to exploring effective methods of diagnosis and the treatment of cerebral infarction. With the deepening of research, increasing studies have pointed out that nursing intervention can significantly enhance the clinical efficacy of patients with cardiovascular and cerebrovascular diseases [10, 11]. For example, Yu et al. [12]

proposed that the application of the nursing mode had a significant difference on cancer rehabilitation, while Lu et al. [13] confirmed that nursing intervention was closely related to gastric cancer. Among them, hierarchical nursing is a nursing mode that divides human needs into five levels, that is, physiology, safety, love and belonging, respect and self-realization, for customized nursing intervention based on the Maros theory, which has been proved to have an extremely high application value in tumor diseases [14]. However, the influence of hierarchical nursing on patients with cerebral infarction complicated with pulmonary infection is still unknown at present. Therefore, by exploring the influence of hierarchical nursing on patients with cerebral infarction complicated with pulmonary infection, this study aims to provide accurate guidance and reference for future clinical nursing intervention on patients with cerebral infarction.

Materials and methods

General information

From March 2014 to March 2016, 167 patients with cerebral infarction complicated with severe pulmonary infection admitted to the Affiliated Hospital of Inner Mongolia Medical University were selected as the study cohort, among which 98 patients who received hierarchical nursing during their hospitalization were enrolled in the OG, and the rest of the 69 patients were treated with routine nursing alone and were included in the CG. This experiment was carried out under the approval of the Ethics Committee of The Affiliated Hospital of Inner Mongolia Medical University, with a written informed consent acquired from all of the above subjects.

Inclusion and exclusion criteria

Inclusion criteria: All the patients were diagnosed and confirmed to have cerebral infarction complicated with severe pulmonary infection using imaging data such as brain magnetic resonance imaging (MRI). Each patient's admission time was within 48 h counted from the onset, with a stable and normal coagulation system and complete case information, and without any other serious medical diseases or tumor metastasis. The informed consent was signed by patients themselves or their next of kin.

Exclusion criteria: Patients with other malignant tumors; Patients with severe liver or kidney dysfunction; Patients with mental disorders; Patients who refused to cooperate or who had conflicts with the medical investigators; Patients with surgical contraindications; Patients with drug allergies; Patients with other cardiovascular or cerebrovascular diseases; Patients with other autoimmune diseases; Patients with other infectious diseases; Patients with physical disabilities who stayed in bed for long periods of time and who could not take care of themselves; Transfer patients.

Methods

The CG adopted the conventional nursing mode. The head nurse was responsible for the deployment of the nursing staff, the execution of the oral medical orders, infusion, vital sign monitoring and other work, and the unified management of the nursing staff. Hierarchical nursing management was performed with the OG. All the nursing staff in the department were divided into groups of head nurses, team leaders, responsible nurses, and assistant staff based on their ages, professional titles, skill levels, professional strength, and education levels, and they were assigned different jobs and tasks according to their grades. The head nurse was responsible for supervising and evaluating the work quality of the nursing staff and for the timely reporting and formulating solutions to the problems in the nursing work. The team leader was in charge of guiding the nursing staff to complete the nursing work, and supervising whether the professional skills of the nursing staff were sufficient. The responsible nurse needed to provide nursing services according to the patients' requirements, and the assistant was supposed to cooperate with the responsible nurse to complete the simple nursing work. The nursing shift system was rescheduled to a double shift or a three-shift system, and the senior and junior nursing staff were reasonably arranged in the process of scheduling. What's more, the head nurse arranged a learning group to conduct learning and training for the nursing personnel, regularly assessed the professional skills of the nursing personnel, and provided one-to-one coaching for those with an insufficient professional level or practical experience.

Table 1. Comparison of the patients' clinical data

	The OG (n=98)	The CG (n=69)	t or X^2	P
Age	53.6±6.8	53.4±7.1	0.184	0.854
BMI (kg/m²)	31.14±2.54	31.46±2.48	0.810	0.419
Blood glucose (mmol/L)	6.67±2.21	6.52±1.86	0.461	0.646
Platelet count (× 10⁹/L)	152.93±54.41	147.23±51.62	0.681	0.497
Previous medical history			1.745	0.418
Hypertension	21 (21.43)	17 (24.64)		
Diabetes mellitus	67 (68.37)	41 (59.42)		
No	10 (10.20)	11 (15.94)		
Smoking			0.051	0.821
Yes	68 (69.39)	49 (71.01)		
No	30 (30.61)	20 (28.89)		
Drinking			0.196	0.658
Yes	52 (53.06)	39 (56.52)		
No	46 (46.94)	30 (43.48)		
Gender			1.867	0.172
Male	81 (82.65)	51 (73.91)		
Female	17 (17.35)	18 (26.09)		
Residence			0.178	0.673
Urban	60 (61.22)	40 (57.97)		
Rural	38 (38.78)	29 (42.03)		
Education level			1.234	0.267
Below high school	54 (55.10)	32 (46.38)		
High school and below	44 (44.90)	37 (53.62)		

Outcome measures

Main outcome measures

Adverse reactions in the two groups: adverse reactions occurred during hospitalization, such as nausea and vomiting, dizziness and headache, abnormal creatine phosphokinase, and the incidences of the adverse reactions were calculated. Nursing satisfaction of patients in the two groups: an anonymous nursing satisfaction questionnaire was used to investigate the patients' satisfaction with nursing when they were discharged from the hospital. VAS pain in the two groups: the VAS pain scale was employed to investigate the patients' degrees of pain before and after the treatment. Comparison of the neurological function scores and the Mini-Mental State Examination (MMSE) scores in the two groups: the patients' neurological function score and MMSE scores before and after the treatment were evaluated and compared.

Secondary outcome measures

Psychological status: The Self-Rating Anxiety Scale (SAS) and the Self-rating Depression Sca-

le (SDS) were applied to evaluate the psychological status of the patients in the two groups before and after the treatment. Systolic blood pressure (SBP), diastolic blood pressure (DBP) levels, and heart rates (HR) of the patients in the two groups were observed. Hospitalization time: the total time from admission to discharge of each patient was recorded and compared in the two groups. Quality of life of the patients in the two groups: the patients were followed up by telephone at 3 months after discharge, and their quality of life scores were recorded. The score included five items: body, role, emotional, cognition, and social functioning. The higher the score, the better the quality of life.

Statistical methods

The statistical analysis of data was processed using SPSS 22.0, and the required figures were plotted using GraphPad 8. The counting data were expressed as a percentage (%), and chi-square tests were adopted for the comparisons between groups. The measurement data were indicated as the mean ± standard deviation, and t-tests were applied for the inter-group comparisons. A statistically significant difference was assumed at P<0.05.

Results

There were no significant differences in the general patient information in the two groups

No significant differences were observed in age, BMI, blood glucose, platelet count, previous medical history, smoking, drinking, gender, residence, or education level between the two groups (P>0.050) (**Table 1**).

The incidences of adverse reactions in the OG were lower than they were in the CG

The observation of the incidences of adverse reactions after the nursing showed that the incidences of adverse reactions in the OG was 12.24%, while the incidences in the CG was

Table 2. Adverse reactions

Adverse reactions	The OG (n=98)	The CG (n=69)	X^2	t value
Nausea and vomiting	3 (3.06)	5 (7.25)		
Dizziness and headache	2 (2.04)	3 (4.35)		
Creatine phosphokinase abnormality	2 (2.04)	4 (5.80)		
Abdominal distension	2 (2.04)	3 (4.35)		
Abdominal pain	2 (2.04)	3 (4.35)		
Constipation	0 (0.00)	2 (2.90)		
Indigestion	1 (1.02)	2 (2.90)		
Incidence of total adverse reactions (%)	12 (12.24)	22 (31.88)	9.838	0.002

Table 3. Comparison of the nursing satisfaction

	The OG (n=98)	The CG (n=69)	X^2	P
Very satisfied	62 (63.27)	25 (36.23)	11.860	0.001
Satisfied	27 (27.55)	18 (26.09)	0.044	0.834
Improvement needed	7 (7.14)	15 (21.74)	7.542	0.006
Dissatisfied	2 (2.04)	11 (15.94)	10.900	0.001

31.88%. From the above data, it was obvious that the incidence of adverse reactions in the OG was notably lower than the incidence in the CG (P<0.05) (**Table 2**).

The nursing satisfaction in the OG was higher than it was in the CG

According to nursing satisfaction survey, there was no significant difference in the number of patients who were satisfied with the nursing in the two groups (P>0.05). Compared with the CG, the number of patients in the OG who were very satisfied was significantly higher (P<0.05), the number of patients in the OG who believed that the nursing needed to be improved was significantly lower (P<0.05), and the number of patients who were dissatisfied was significantly less (P<0.05) (**Table 3**).

The VAS pain scores in the OG were lower than they were in the CG

No significant differences were found in VAS scores in the two groups before the treatment (P>0.050). However, after the treatment, the VAS scores (3.04±1.26) points in the OG were remarkably lower than they were in the CG (4.37±1.39) points (P<0.05) (**Figure 1**).

The SAS and SDS scores in the OG were lower than those in the CG

The psychological status assessed by the SAS and SDS scores did not identify any sig-nificant differences in the patients in the two groups before the treatment (P>0.05). However, both the SAS and SDS scores dropped markedly in the two groups after the treatment (P<0.05). The post-treatment SAS scores of the RC were markedly lower than the scores in the CG (P<0.05), as was the case with the SDS scores (P<0.05) (**Figure 2**).

The neurological scores in the OG were lower than the scores in the CG, and the MMSE score was higher than it was in the CG

The neurological function scores did not differ markedly between the two groups before the treatment (P>0.05), but they decreased significantly in both groups after the treatment, and the neurological function scores of the OG were profoundly lower than they were in the CG (P<0.05). As to the MMSE scores, though no significant difference was observed in them between the two groups before the treatment (P>0.05), the scores increased remarkably in both groups after the treatment, with the CG being markedly higher than the CG (P<0.05) (**Figure 3**).

The blood pressure and HR in the OG were lower than they were in the CG

The blood pressure levels did not differ significantly difference in the two groups before the nursing (P>0.05), but both the SBP and DBP were reduced after the nursing (P<0.05). Nor had we observed any marked difference in terms of the HR before the nursing (P>0.05), but it was decreased after nursing, and the HR in the OG was lower than it was in the CG (P<0.05) (**Figure 4**).
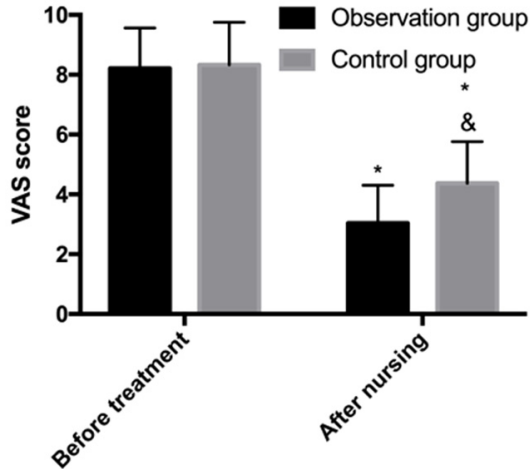
Figure 1. Comparison of the VAS scores in the two groups. & represents the comparison of the VAS scores with the OG after nursing, P<0.05; * represents the comparison of the VAS scores with the same group before treatment, P<0.05.

The hospitalization times in the OG were shorter than they were in the CG

The OG had remarkably shorter hospitalization times than the CG (P<0.05) (**Figure 5**).

The quality of life in the OG was better than it was in the CG

The comparison of the post-treatment quality of life between the two groups demonstrated that the physical, role, emotion, cognition, and social functioning scores in all dimensions of the quality of life in the OG were greatly superior to those in the CG (P<0.05) (**Table 4**).

Discussion

Cerebral infarction, a highly common disease worldwide, plagues middle-aged and elderly people [15]. At present, the clinical treatment of cerebral infarction is limited, and a completely effective method for curing cerebral infarction is still on the way [16]. Apart from that, the harm of cerebral infarction to the human body is not only reflected in the disease itself, but the disease-triggered complications are also one of the factors that determine the prognosis [17]. Among them, patients complicated with pulmonary infections are more prevalent, and their final clinical outcomes are worse. At present, the study of clinical nursing intervention in cerebral infarction complicated
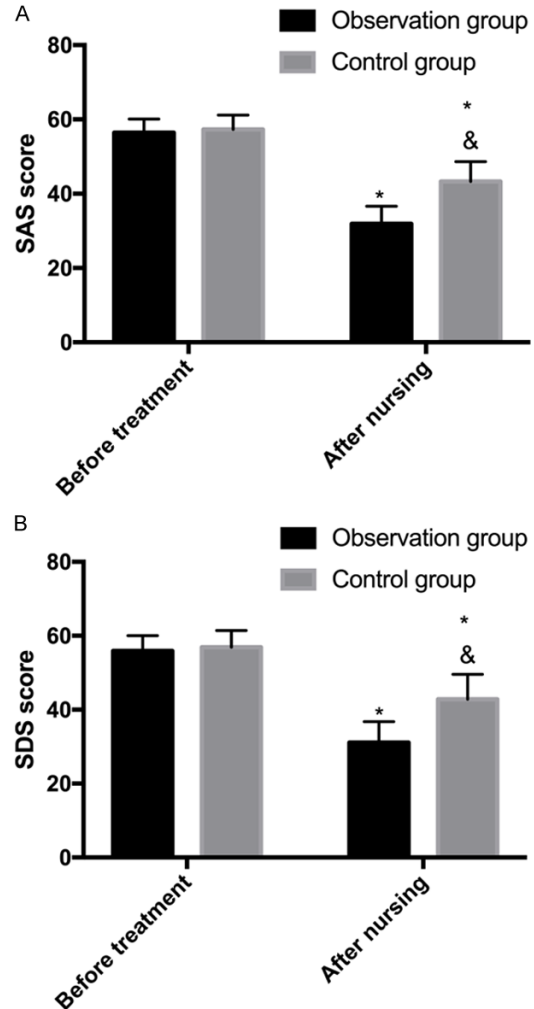

Figure 2. Comparison of the psychological status in the two groups. A. Comparison of the SAS scores in the two groups. & represents the comparison of the SAS scores with the OG after the nursing, P<0.05; * represents the comparison of the SAS scores with the same group before the treatment, P<0.05. B. Comparison of the SDS scores between the two groups. & represents the comparison of the SDS scores with the OG after the nursing, P<0.05; * represents the comparison of the SDS scores with the same before treatment, P<0.05.

with pulmonary infection is still rare, and there is also a lack of evidence-based research that can be used for clinical guidance. Therefore, to confirm the effectiveness of the nursing program, the present study explored the application value of hierarchical nursing for patients with cerebral infarctions complicated with severe pulmonary infections, which is exceedingly valuable for the future clinical treatment of such patients.
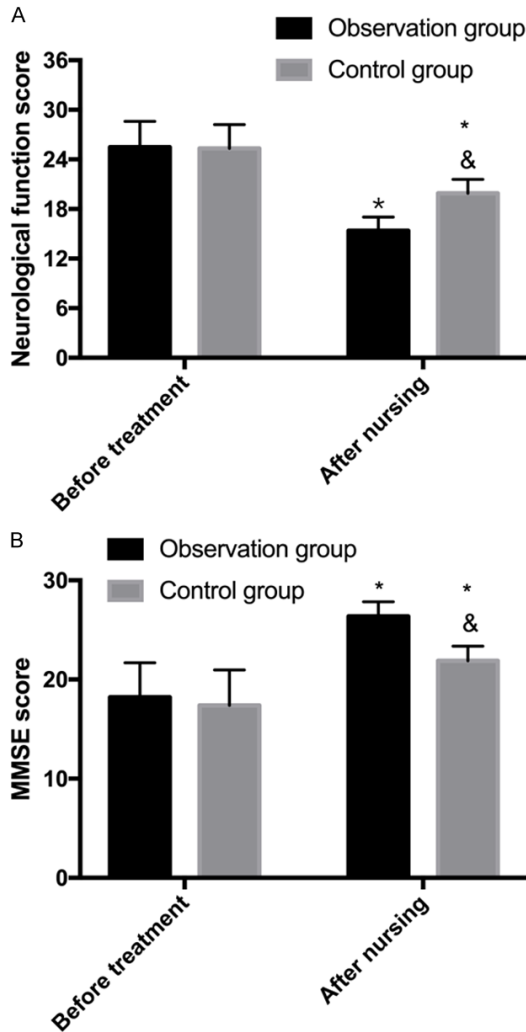
Figure 3. Comparison of the neurological function scores and the MMSE scores in the two groups. A. Comparison of the neurological functions score in the two groups. & represents the comparison of the neurological function scores with the OG after nursing, P<0.05; * represents the comparison of the neurological function score with the same group before the treatment, P<0.05. B. Comparison of the MMSE scores in the two groups. & represents the comparison of MMSE scores with the OG after the nursing, P<0.05; * represents the comparison of the MMSE scores with the same group before the treatment, P<0.05.

This study found that the incidences of adverse reactions in patients in the OG using hierarchical nursing intervention was notably lower than it was in the CG using conventional nursing alone, suggesting that hierarchical nursing can reduce adverse reactions during the hospitalization of patients with pulmonary infection complicated by cerebral infarction. This is also consistent with the research of Damico et al.
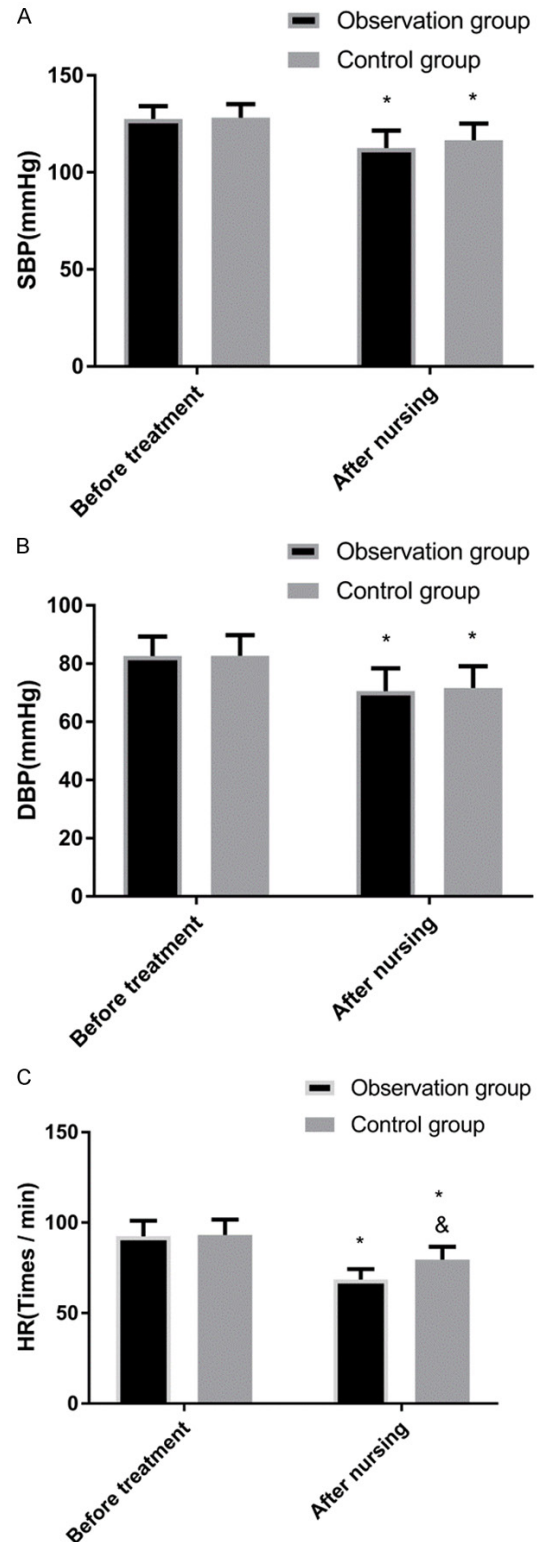
Figure 4. Changes in blood pressure and HR. A. SBP before and after the nursing in the two groups; B. DBP before and after the nursing in the two groups; C. HR before and after the nursing in the two groups, * represents the comparison with the same group before treatment, P<0.05, & represents the comparison with the OG after nursing, P<0.05.
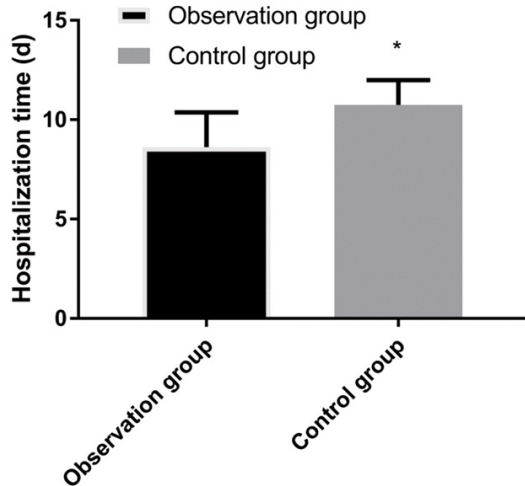
Figure 5. Comparison of the hospitalization times in the two groups. * represents the comparison of hospitalization times with the OG, P<0.05.

[18] who studied the application of hierarchical nursing in intensive care units, which can corroborate the results of this experiment. When comparing the nursing satisfaction of patients in the two groups, we found that the nursing satisfaction of the OG was significantly higher than it was in the CG, indicating that hierarchical nursing can better enhance patients' nursing experiences. What's more, we compared the VAS, SDS and SAS scores in the two groups before and after the treatment and found that the pain remission and improvement in the psychological status of the OG was more significant than it was in the CG. The observation of the neurological function between the two groups showed that its improvement in the OG was also more significant, which also indicated that the hierarchical nursing had a certain improvement effect on the neurological function of the patients with cerebral infarction. Furthermore, after observing the changes in the HR of the two groups of patients after the nursing, it was found that the HR was more stable, and the hospitalization time was much shorter in the OG than it was in the CG, validating the finding that the application effect of hierarchical nursing was significantly helpful to the rehabilitation of patients. The main reason for the difference in outcomes between the two groups was the implementation of the nursing plan. Cerebral infarction is such a common but difficult disease that the traditional nursing management mode can hardly achieve an

ideal nursing effect. Therefore, in adhering to the patient-centered concept, an appropriate reform of the traditional nursing model can help to improve and meet the desired clinical nursing effect. The key point of hierarchical nursing is to start with patients as the basis, and carry out hierarchical and step-by-step nursing arrangements, which breaks through the limitations of the traditional nursing management mode, makes the details of each nursing management more specific, and provides mutual support, thus greatly improving the quality of nursing [19, 20]. Currently, there has been a certain consensus on the application of hierarchical nursing in clinical practice. Teams such as Ellis, Schofield, and Chambers have achieved remarkable results in the exploration of its application value [21, 22]. We believe that the key to improving the clinical effect of hierarchical nursing in patients with cerebral infarction complicated with pulmonary infection may be as follows: 1. More detailed arrangement of work details. Rather than the traditional working mode of "one person, one post", the setup of the group responsibility system gives a new insight in their work content, which enables them to better implement their job responsibilities and mobilizes their enthusiasm to participate in the comprehensive care of patients, thus fully improving the closeness and enthusiasm of services. 2. Through the management mode of hierarchy, continuity, responsibility and balance, nursing staff at different nursing levels can give full play to their maximum advantages in nursing at all levels, which can improve the happiness of the nursing staff at work. Meanwhile, in the process of participation, the nursing staff can improve their nursing operation levels and continue to learn from the superior nurses, thus optimizing the quality of nursing. 3. Through hierarchical work arrangements, the advantages among the nursing staff at all levels are maximized. Nurses with strong professional abilities can provide professional guidance to the lower level nurses, while nurses with poor foundations can cooperate with the upper level nurses to complete more difficult nursing contents. All levels are closely linked to make up for each other's shortcomings, magnify the advantages of the nursing services, and improve the effectiveness of nursing services. Moreover, the quality of life of patients in the

Table 4. Comparison of the quality of life in the two groups

	The OG	The CG	t value	P value
Physical functioning	92.32±4.23	84.42±4.35	11.750	<0.001
Role functioning	85.67±3.51	71.22±3.14	27.350	<0.001
Emotional functioning	86.53±3.19	70.66±3.48	30.490	<0.001
Cognitive functioning	92.72±3.82	84.67±3.55	13.800	<0.001
Social functioning	65.21±4.13	55.73±3.67	15.280	<0.001

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OG after nursing was significantly higher than that in the CG, which also confirmed that the application of hierarchical nursing not only significantly improved the clinical efficacy of patients, but also greatly improved the prognosis of the patients, further verifying its application value in patients with cerebral infarction complicated with pulmonary infection.

This study set out to probe into the clinical value of hierarchical nursing for patients with cerebral infarction complicated with pulmonary infection. However, due to the limited experimental conditions, there are still some deficiencies. For example, there are many nursing intervention programs currently used in clinical practice, but in this study, only conventional nursing was used as a control, so this does not rule out the possibility that the advantage of hierarchical nursing is not so significant in comparison with other nursing modes. In addition, due to the short experimental period, we cannot judge the long-term effect of hierarchical nursing on the prognosis of patients, a question will be the focus of our follow-up research for further experimental analysis. We will conduct a more in-depth and comprehensive analysis on the application of hierarchical nursing in cerebral infarction, so as to obtain more representative and comprehensive results.

To sum up, hierarchical nursing can effectively reduce the incidences of adverse reactions and pain in patients with cerebral infarction complicated with pulmonary infection, and it can improve patients' nursing satisfaction, psychological status, and neurological function, so it is worthy of popularization in clinical practice.

Disclosure of conflict of interest

None.

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