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Original Article

The effects of continuous improvement in nursing quality on patients with cerebral hemorrhage accompanied by present-on-admission pressure ulcers

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Abstract: Objective: This study aims to explore the application of continuous quality improvement in the nursing (CQIN) of patients with cerebral hemorrhage accompanied by present-on-admission pressure ulcers (POAPU) and its effects on risk events, neurological function, and the prognostic survival of the patients. Methods: A prospective analysis of 174 patients with cerebral hemorrhage accompanied by POAPU was conducted, with the patients were randomized into a control group (81 cases which received routine nursing) and an experimental group (93 cases which received CQIN based on routine nursing) using a random number table. The rehabilitation of cerebral hemorrhage, the improvement of POAPU, the incidence rate of risk events, the nursing satisfaction score, the ability of daily living (ADL), and the neurological function recovery were compared between the two groups. The patients were followed up for 2 years, and their 2-year survival was recorded to evaluate their prognoses. Results: The effective rate of rehabilitation of POAPU in the experimental group was significantly higher than it was in the control group (P<0.01). The incidence rate of risk events in the experimental group was 1.08%, significantly lower than the 8.64% in the control group (P=0.017). The nursing satisfaction score in the experimental group was 87.24±6.17 points, significantly higher than the 75.33±8.04 points in the control group (P<0.001). Compared with the control group, the patients in the experimental group had significantly higher ADL scores (P<0.001) but significantly lower National Institutes of Health Stroke Scale (NIHSS) scores (P<0.001). The 2-year survival rate in the experimental group was 79.51%, significantly higher than the 51.40% in the control group (P=0.04). Conclusion: CQIN improves the rehabilitation, neurological function, and the daily living ability of patients with cerebral hemorrhage accompanied by POAPU and reduces their adverse events, so it has a great application value.

Keywords: Continuous quality improvement in nursing, cerebral hemorrhage, pressure ulcer, nursing satisfaction, National Institutes of Health Stroke Scale, daily living ability

Introduction

Cerebral hemorrhage, an extremely common cerebrovascular disease among middle-aged and elderly people, has been increasingly occurring among younger patients in recent years, and patients under 40 years old are more and more common [1-3]. The disease, characterized by an acute onset, a rapid deterioration, and a poor prognosis, usually causes damage to the brain center, so the patients generally suffer from body dysfunction [4, 5]. The rehabilitation of patients with cerebral hemorrhage has always been a clinical research hotspot. More and more studies at home and abroad show that the effective intervention of nursing quality is important in improving the prognosis of the patients [6-8]. Because the patients with cerebral hemorrhage are generally accompanied by dysfunction of the body, the traditional nursing mode commonly used in the clinic just lacks attention to the patients' daily actions and rehabilitation training. Malignant complications such as pressure ulcers and falls often occur due to limited movement [9, 10]. Therefore, there is an urgent need for an effective improved nursing intervention for the rehabilitation of patients with cerebral hemorrhage [11]. Nursing quality has been clinically proven to have excellent results in

improving the rehabilitation and prognosis of a variety of diseases [12-14]. At present, there are few applied studies in patients with cerebral hemorrhage. We speculate that the improvement of nursing quality can also significantly improve the adverse events such as pressure sores, falls and neuropathic pain in the rehabilitation process of patients with cerebral hemorrhage. And the experimental analysis was also carried out in order to demonstrate the importance of CQIN in hospital nursing and provide references for the clinical treatment of the disease.

Materials and methods

General information

Altogether 174 patients with cerebral hemorrhage admitted to the Affiliated Hospital of Chengdu University of Traditional Chinese Medicine from May 2015 to December 2016 were collected as research objects for a prospective analysis, including 103 males and 71 females, aged 45-72 years old with an average age of 52.1±11.6 years old. The patients were divided into a control group (81 cases which received routine nursing) and an experimental group (93 cases which received CQIN based on routine nursing). This experiment was approved by the Ethics Committee of the Affiliated Hospital of Chengdu University of Traditional Chinese Medicine, and all the patients signed an informed consent form.

Inclusion and exclusion criteria

Inclusion criteria: Patients diagnosed with cerebral hemorrhage; patients treated in the Affiliated Hospital of Chengdu University of Traditional Chinese Medicine after diagnosis; patients with present-on-admission pressure ulcer (POAPU) and limb movement disorder on admission; patients confirmed to meet the pressure ulcer staging guidelines (Stage I: The local soft tissue after being compressed has redness, swelling, heat, numbness or tenderness, which can be easily treated and recovered. Stage II: Local redness and swelling infiltrates and hardens outward; the surface of the compressed skin is purplish red, with small blisters which are easily ulcerated. Stage III: The blisters are enlarged, the epidermis is ulcerated, and the wound surface is exposed with yellow exudate; the wound surface after infection is covered with purulent secretions, which causes superficial tissue necrosis and obvious pain. Stage IV: The necrotic tissue invades the subcorium and muscle layer; the tissue with a severe infection can spread to the deep and surrounding tissues, with increased purulent secretions and a foul smell; the black necrotic tissue can cause septicemia) [15]; patients with complete medical records; patients who were conscious and agreed to cooperate with medical staff to complete the investigation; patients aged 30-80 years old; patients whose cerebral hemorrhages and pressure ulcers were the first attack. Exclusion criteria: Patients complicated with tumors; patients complicated with severe cardiovascular and cerebrovascular diseases; patients with severe organ failure; those with a history of mental illness.

Methods

A total of 174 patients with cerebral hemorrhage were treated with minimally invasive puncture and drainage performed by senior doctors in the neurology department. While in the hospital, the patients in the control group received routine nursing, and the patients in the experimental group received CQIN based on routine nursing. Routine nursing was as follows: 1) The nursing personnel observed changes in the patients' conditions, reported abnormalities to attending doctors, and carried out intervention measures. 2) The nursing personnel strengthened the management of unexpected risk events to prevent falls and pressure ulcers. 3) The nursing personnel psychologically guided and counseled the patients to reduce their negative emotions. CQIN based on routine nursing was as follows: 1) The cerebral hemorrhage nursing group was formed in order to summarize the patients' medical records, analyze advantages and disadvantages during nursing and formulate nursing content. 2) The concept of nursing personnel was improved and some in-depth training of the team members was carried out, so as to promote the nursing personnel to prevent the patients from getting pressure ulcer and from falling. The patients' symptoms were recorded and discussed daily to optimize the nursing content. 3) The probability of risk events was classified according to the patients' conditions, and different measures were carried out on the

patients with different grades: for low-risk patients, the ground was clean and dry, and warning signs for fall prevention were hung. For high-risk patients, the nurses paid close attention to their medication and activities, and special personnel assisted them in their activities. For patients with stage I pressure ulcers, they were assisted and guided to increase the number of times they turned over, and decompression patches were used to protect the parts vulnerable to pressure. For patients with stage II pressure ulcers, the liquid in the pressure ulcer was sucked out by a syringe and then the ulcer was treated with medication. For patients with stage III-IV pressure ulcers, the necrotic tissue was completely removed. The duration of nursing was determined after the patients were admitted to the hospital and lasted for 3 months or until the patients were discharged.

Outcome measures

The improvement in the pressure ulcers was evaluated after the end of the treatment course (3 months in total): According to the rehabilitation guidelines for pressure ulcers, cured means there are no clinical symptoms and the surface of the pressure ulcer is rehabilitated [15]. Effective: The symptoms are improved and 40-80% of the ulceration is healed. Invalid: The symptoms are not improved, and the ulceration is not healed or the healing area is <40%. The effective rate of rehabilitation of the pressure ulcers (effective rate of rehabilitation = cure rate + effective rate) were calculated. The incidence rate of risk events: Patients' falls, falling out of bed, neuralgia and nosocomial infection were recorded to calculate the incidence rate of risk events. Nursing satisfaction: The nursing satisfaction questionnaire developed by Aiken et al. was used for anonymous nursing satisfaction scoring at the time of discharge [16]. The questionnaire with 90 total possible points consisted of 15 items, and each item was scored as satisfied (6 points), needing improvement (3 points), or dissatisfied (1 point). Ability of daily living (ADL) [17]: The activity of daily living scale was used to judge the patients' daily living ability. Neurological function recovery: NIHSS was used as the criterion for investigating and evaluating the patients' neurological function recovery [18]. Prognostic evaluation: The patients were followed up for 2 years by telephone, reexamination and on-site follow-up to record their 2-year survival.

Statistical methods

SPSS 24.0 statistical software was used to analyze and process the data. The count data were expressed as a ratio, and a chi-squared test was used for the comparisons between groups. The measurement data were expressed as the mean ± standard deviation, and a *t* test was used for the comparisons between groups. Kaplan-Meier was used to calculate the survival rate and log-rank tests were used for its comparisons. $P<0.05$ indicates a statistically significant difference.

Results

No significant differences in the clinical baseline data between the two groups

There were no significant differences between the two groups in terms of age, course of the disease, body mass index (BMI), gender, smoking, dwelling environment, exercise habits, bleeding site, or pressure ulcer staging ($P>0.05$), proving that the two groups of patients were comparable. More details are shown in **Table 1**.

The rehabilitation of the pressure ulcers in the experimental group was better than it was in the control group

The effective rehabilitation rate of the pressure ulcers in the experimental group was significantly higher than it was in the control group ($P=0.009$). More details are shown in **Table 2**.

The incidence rate of risk events in the experimental group was lower than it was in the control group

The incidence rate of risk events in the experimental group was significantly lower than it was in the control group ($P=0.017$). More details are shown in **Table 3**.

The nursing satisfaction score in the experimental group was higher than it was in the control group

The nursing satisfaction score in the experimental group was significantly higher than it

Table 1. Comparison of clinical data (n, %)

Group	Experimental group (n=93)	Control group (n=81)	t/χ^2	P
Age (year)	53.1±10.2	52.3±11.1	0.495	0.621
Course of disease (day)*	9.14±2.36	9.52±3.11	0.914	0.362
BMI	22.83±3.97	23.52±4.36	1.092	0.276
Gender			0.086	0.769
Male	56 (60.22)	47 (58.02)		
Female	37 (39.78)	34 (41.98)		
Smoking			0.261	0.610
Yes	62 (66.67)	51 (62.96)		
No	31 (33.33)	30 (37.04)		
Dwelling environment			0.386	0.534
City	71 (76.34)	65 (80.25)		
Country	22 (23.66)	16 (19.75)		
Exercise habits			0.452	0.501
Yes	19 (20.43)	20 (24.69)		
No	74 (79.57)	61 (75.31)		
Bleeding site			1.164	0.884
Basal ganglia	43 (46.24)	34 (41.98)		
Frontal lobe	22 (23.66)	17 (20.99)		
Temporal lobe	10 (10.75)	12 (14.81)		
Pons	10 (10.75)	9 (11.11)		
Cerebellum	8 (8.60)	9 (11.11)		
Pressure ulcer staging			0.283	0.868
I	62 (66.67)	57 (70.37)		
II	19 (20.43)	15 (18.52)		
III	12 (12.90)	9 (11.11)		

Note: The course of the disease *represents the time in the hospital after patients are found to have clinical symptoms of cerebral hemorrhage. BMI: body mass index.

Table 2. Comparison of the rehabilitation of pressure ulcers (n, %)

Group	Experimental group (n=93)	Control group (n=81)	χ^2	P
Cured	62 (66.67)	35 (43.21)		
Effective	25 (26.88)	30 (37.04)		
Invalid	6 (6.45)	16 (19.75)		
Effective rate (%)	93.55	80.25	6.935	0.009

was in the control group (P<0.001). More details are shown in **Table 4**.

The daily living ability in the experimental group was better than it was in the control group

There was no significant difference in the ADL scores between the experimental and control groups before treatment (P>0.05), but after the treatment, the ADL score in the experimental group was significantly higher than it was in the control group (P<0.001). In the two groups, the ADL score after the treatment was significantly higher than it was before the treatment (P<0.001). More details are shown in **Table 5**.

Neurological function in the experimental group was better than it was in the control group

There was no significant difference in the NIHSS scores between the experimental and control groups before the treatment (P>0.05), but after treatment, the NIHSS score in the experimental group was significantly lower than it was in the control group (P<0.001). In the two groups, the NIHSS scores after treatment were significantly lower than they were before treatment (P<0.001). More details are shown in **Table 6**.

Comparison of the prognoses

Altogether, 174 patients were followed up for 2 years, with a success rate of 100%. The 2-year survival rate in the experimental group was 79.51%, significantly higher than the 51.40% in the control group (P=0.04). More details are shown in **Figure 1**.

Discussion

Accompanied by vertigo, stroke, hypertension and decreased muscle strength, patients with cerebral hemorrhage generally have poor control over their own bodies and limited joint mobility, so their resistance to pressure ulcers and falls is extremely low [19, 20]. Moreover, drugs taken during treatment mainly act on the brain tissue, and their side effects on the nerve centers and brainstems may be strong, which possibly leads to slower responses and poorer

Table 3. Comparison of the incidence rate of risk events (n, %)

Group	Experimental group (n=93)	Control group (n=81)	χ^2	P
Falls	0 (0.00)	3 (2.70)		
Falling out of bed	0 (0.00)	2 (2.47)		
Neuralgia	1 (1.08)	1 (1.23)		
Nosocomial infection	0 (0.00)	1 (1.23)		
Total incidence rate	1 (1.08)	7 (8.64)	5.651	0.017

Table 4. Comparison of the nursing satisfaction score

Group	Experimental group (n=93)	Control group (n=81)	t	P
Nursing satisfaction score	87.24±6.17	75.33±8.04	11.042	<0.001

Table 5. Comparison of daily living ability

Group	Experimental group (n=93)	Control group (n=81)	t	P
Before treatment	58.72±8.56	59.14±9.05	0.314	0.754
After treatment	82.38±4.52*	70.86±6.14*	14.212	<0.001

Note: Compared with before treatment in the same group, *P<0.001.

Table 6. Comparison of NIHSS

Group	Experimental group (n=93)	Control group (n=81)	t	P
Before treatment	11.24±2.24	11.16±2.05	0.244	0.807
After treatment	4.16±2.86*	6.58±2.17*	6.214	<0.001

Note: Compared with before treatment in the same group, *P<0.001. NIHSS, National Institutes of Health stroke scale.

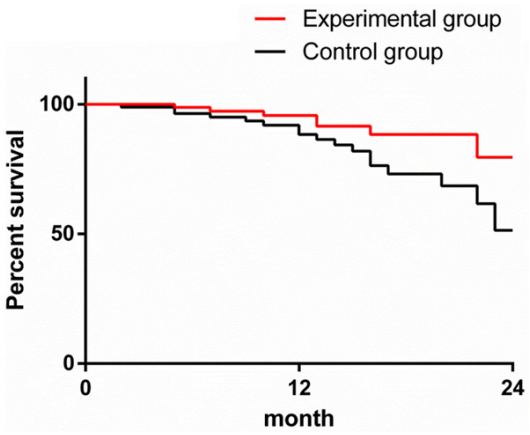

Figure 1. Comparison of the 2-year survival rate.

limb coordination [21]. Risk events reduce the patients' rehabilitation effects and rate, and they may even aggravate their negative emotions and worsen the doctor-patient relationship, thereby greatly reducing treatment compliance [22]. Therefore, CQIN is crucial. It has been widely used in medical quality management and has obtained remarkable research results, with an extremely high application value in the medical fields [23, 24]. This is particularly true for neurology, because patients with central nerve injury need to be nursed in more meticulous and targeted ways to improve their prognoses.

Compared with the control group, the patients in the experimental group had significantly better neurological functions and daily living abilities, but a significantly lower incidence rate of risk events. This is also consistent with the results of Kronick et al. in the study of continuous improvement of nursing quality in cardiopulmonary resuscitation and emergency cardiovascular care, which can support the results of this experiment [25]. We speculate that there are differences in various observational indicators between the two groups, which may be due to: 1) The importance of nursing personnel. Nursing personnel lack knowledge and experience in treating acute diseases of patients with cerebral hemorrhage, which may result in poor nursing during the rehabilitation and the worsening of the disease [26]. CQIN greatly changes the concept of the nursing personnel and emphasizes the major contents of nursing, so the personnel could take the best measures to protect patients' lives and health, thus improving the patients' rehabilitation. 2) Patients' poor treatment compliance. There are many patients who show resistance and rebellion towards the medical staff, so it is more likely that they fail to follow the doctor's advice to make reasonable arrangements in the course of rehabilitation, which may cause secondary damage [27]. Nursing staff can teach patients

and their families disease-related knowledge. On the one hand, nurses can reduce patients' resistance to medical staff and enhance their trust in hospitals, and on the other hand, they can improve patients' basic medical knowledge, know how to seek benefits, and avoid disadvantages in the process of activities and rehabilitation, and improve the compliance of treatment. This also further strengthens the rehabilitation effect of patients. 3) Classification management system. Drugs taken by patients may cause neurological and behavioral dysfunction, which is also a main reason for frequent falls. Risk classification and the management of patients' conditions greatly reduce falls. Moreover, the system greatly reduces the repetitiveness of the work, which not only reduces the pressure and burdens of the nursing personnel, but also enables patients to obtain the best nursing. This is the same as rehabilitation management of pressure ulcers. The best rehabilitation based on different pressure ulcers greatly improves the therapeutic efficiency and the effective rate of rehabilitation of pressure ulcers. 4) Doctor-patient relationship. During hospitalization, patients and their families, due to the pain and the fear of death, are usually filled with negative emotions, which greatly affect the doctor-patient relationship. Communications between medical staff and patients greatly improve patients' confidence in the success of the treatment and therapeutic efficiency, and boost the doctor-patient relationship. The improvement of patients' trust in medical staff also promotes their rehabilitation. Compared with the control group, the patients in the experimental group had a significantly higher ADL score but a significantly lower NIHSS score, indicating that CQIN can improve patients' rehabilitation of cerebral hemorrhage and neurological function. The 2-year survival in the experimental group was significantly better than it was in the control group, suggesting that CQIN greatly improves patients' prognosis.

This experiment aimed to explore the application value of CQIN for patients with cerebral hemorrhage accompanied by POAPU. However, there are still deficiencies due to the limited experimental conditions. For example, the research objects were few in number, so a statistical analysis using big data (data from more than 2000 cases) cannot be performed. At present, the continuous improvement of nursing quality applied to patients with intracerebral hemorrhage pressure ulcer still lacks authoritative operating guidelines. The implementation plan of this study was mainly based on cumulative cases and previous experience, so there may be deficiencies in the details of the patients, which also need further improvement. Therefore, a follow-up investigation over a longer time period will be conducted to improve this experiment and obtain the best experimental results.

In summary, CQIN improves the rehabilitation of patients with cerebral hemorrhage accompanied by POAPU and reduces their adverse events, so it has a great application value.

Disclosure of conflict of interest

None.

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