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Analysis of the Impact of Predictive Rehabilitation Nursing Model on the Quality of Emergency Transport for Patients with Acute Cerebral Hemorrhage

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Abstract: *Objective*: To analyze the impact of the predictive rehabilitation nursing model on the quality of emergency transport and rehabilitation outcomes for patients with acute cerebral hemorrhage (ICH). *Methods*: A total of 62 patients with acute cerebral hemorrhage admitted to the hospital from January 2022 to December 2024 were selected as the study subjects. The observation group (n = 31) received conventional nursing combined with the predictive rehabilitation nursing model during the emergency process, while the control group (n = 31) received conventional nursing. The recovery conditions (Fuel-Meyer Assessment (FMA) score, Barthel Index (BI)), incidence of complications, nursing satisfaction, and time to regain consciousness were compared between the two groups. *Results*: After the intervention, the FMA and BI scores of the observation group were significantly higher than those of the control group, with statistically significant differences. The incidence of complications in the observation group was significantly lower than that in the control group. In terms of nursing satisfaction, the scores of various indicators in the observation group were higher than those in the control group, with statistically significant differences. The time to regain consciousness in the observation group was (48.72 ± 11.76) minutes, compared to (64.29 ± 14.58) minutes in the control group, with the observation group regaining consciousness earlier than the control group. *Conclusion*: The application of the predictive rehabilitation nursing model in the emergency transport process of patients with acute cerebral hemorrhage can reduce the incidence of complications, shorten the duration of consciousness disorder, improve the quality of transport, and enhance functional rehabilitation levels.

Keywords: Predictive rehabilitation nursing model; Acute cerebral hemorrhage; Functional rehabilitation; Quality of transport; Nursing satisfaction

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1. Introduction

Acute cerebral hemorrhage (ICH) is a sudden and severe cerebrovascular disease characterized by high incidence, high mortality, and high disability rates [1]. Patients in the early stages of onset require prompt professional medical treatment to reduce the risk of death and disability [2, 3]. Timely and safe transport to medical institutions with appropriate treatment capabilities is crucial in the management of patients with acute cerebral hemorrhage [4]. Various risks and complications may arise during the transport process, necessitating close monitoring and timely intervention by professional nursing staff [5–7]. The predictive nursing model is a patient-centered approach that emphasizes assessment and intervention before patient needs arise, aiming to prevent potential problems and complications, thereby improving transport quality and patient satisfaction [8].

Acute cerebral hemorrhage is a severe medical condition that requires rapid and accurate diagnosis and treatment, as well as high-quality early rehabilitation and nursing intervention [9]. During the emergency transport of patients with acute cerebral hemorrhage, the predictive rehabilitation nursing model may positively impact the quality of transport, patient nursing satisfaction, and subsequent functional rehabilitation [10, 11]. Based on this, this study selected 62 patients with acute cerebral hemorrhage within the time frame from January 2022 to December 2024, aiming to analyze the impact of applying the predictive rehabilitation nursing model in the emergency process of patients with acute cerebral hemorrhage.

2. Materials and methods

2.1. General information

From January 2022 to December 2024, sixty-two patients with acute cerebral hemorrhage who are admitted to the emergency department of the hospital are selected as study subjects. They are divided into two groups based on whether the predictive rehabilitation nursing model is applied. The control group consisted of 31 patients (18 males and 13 females) aged between 50 and 73 years (mean age 61.28 ± 2.83 years) with hematoma volumes ranging from 22 to 37 mL (mean volume 30.28 ± 2.81 mL). The observation group also consisted of 31 patients (19 males and 12 females) aged between 51 and 74 years (mean age 61.47 ± 2.62 years) with hematoma volumes ranging from 21 to 36 mL (mean volume 30.13 ± 2.62 mL). The baseline characteristics (gender, age, hematoma volume) of the two groups are comparable ($P > 0.05$). This study complies with the Helsinki Declaration and has been approved by the Medical Ethics Committee of the hospital (2020023I-C2).

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria

(1) Diagnosed with intracerebral hemorrhage (ICH) by cranial MRI.

(2) Onset time ≤ 72 hours.

(3) Informed consent from the patient's family.

2.2.2. Exclusion criteria

(1) Cerebral hemorrhage caused by non-vascular factors such as vascular malformations.

(2) Presence of mental illness or cognitive impairment.

(3) Incomplete clinical data.

2.3. Methods

2.3.1. Control group

Patients in the control group received routine nursing care. Assist patients to turn over every 2–4 hours without pulling or dragging them. Massage limbs and provide oxygen therapy, adjusting the oxygen flow rate as needed. Clear respiratory secretions to ensure smooth breathing. Monitor blood oxygen saturation, blood pressure, heart rate, and body temperature. If the patient has a fever, use physical cooling methods such as a warm water bath. If ineffective, administer antipyretic drugs. Observe for abnormal pulse, elevated blood pressure, and abnormal pupils, and provide dehydration and intracranial pressure reduction treatment if necessary. During the acute phase, patients should consume low-fat, high-calorie, and high-quality protein foods, with strict control of sodium intake. If the patient is comatose, provide nasogastric feeding. Observe the color and characteristics of vomit and stool, assess skin condition, and clean the skin with warm water. Properly secure drainage tubes, check for patency, and record the characteristics of the drainage fluid. If the patient is agitated, provide sedation. Educate the family about cerebral hemorrhage using simple language and appropriate images, explain the rescue process, soothe family emotions, inform them of the patient's condition, and provide case studies.

2.3.2. Observation group

In addition to routine care, patients received predictive rehabilitation nursing intervention. Pre-emergency risk assessment and contingency planning. For consciousness status, the Glasgow Coma Scale (GCS) is commonly used to quickly assess the degree of consciousness impairment by observing the patient's eye-opening, verbal, and motor responses. Vital signs monitoring focuses on blood pressure, heart rate, respiratory rate, and body temperature, with sudden or unstable blood pressure and abnormal heart rate indicating the severity of the condition. The assessment of bleeding volume can be preliminarily judged through on-site symptoms and subsequent imaging examinations, such as severe headache and frequent vomiting, often indicating a large amount of bleeding.

Personalized transport plans need to be designed based on the assessment results. If the patient is unconscious and has unstable breathing, a portable ventilator is required; if there are significant blood pressure fluctuations, antihypertensive or pressor medications should be prepared. Emergency transport process optimization and complication prevention. Preparatory work before transport is the foundation for ensuring patient safety. Equipment checks include various instruments in the ambulance, such as ECG monitors, defibrillators, and suction devices, to ensure their good performance. Medication preparation should be comprehensive, including hemostatic drugs, antihypertensive drugs, and dehydrating agents.

Airway management is crucial. According to cardiopulmonary rehabilitation principles, the patient's head should be turned to one side, and oral secretions should be cleared in time to prevent aspiration. If necessary, an oropharyngeal airway or endotracheal intubation should be placed. Intracranial pressure control can be achieved by elevating the head of the bed by about 30° and administering dehydrating agents such as mannitol to reduce intracranial pressure. There are many risks during transport, such as sudden brain herniation and asphyxia. For brain herniation, if the patient exhibits symptoms like unilateral pupil dilation and worsening consciousness impairment, rapid intravenous infusion of mannitol should be administered, and transport speed should be increased. For asphyxia risk, continuous monitoring of the patient's breathing is necessary, and if asphyxia occurs, suction and cardiopulmonary resuscitation should be performed promptly.

A detailed framework for multi-system collaborative rehabilitation nursing should emphasize coordinated

care across key physiological systems. Respiratory support, circulatory monitoring, and skin protection need to be coordinated. Respiratory support involves adjusting the oxygen delivery method and concentration based on the patient's respiratory status, and mechanical ventilation may be used if necessary; circulatory monitoring involves continuous attention to blood pressure, heart rate, and blood oxygen saturation, with timely adjustments to the dosage of vasoactive drugs. Skin protection involves measures such as regular turning and using pressure-relieving mattresses to prevent pressure ulcers.

Nutritional support combined with psychological intervention significantly enhances patient compliance. Early administration of nasal feeding or intravenous nutrition ensures sufficient energy and nutrient intake to promote physical recovery. Psychological intervention involves proactive communication between nursing staff and patients and their families, patiently answering questions to alleviate their anxiety and tension. Comparative data show that after implementing multi-system collaborative rehabilitation nursing, patient compliance significantly improved. Interdisciplinary collaboration plays a crucial role in this process, with doctors, rehabilitation therapists, and nurses jointly participating to formulate comprehensive nursing plans, significantly enhancing patient care quality and functional rehabilitation outcomes.

2.4. Evaluation indicators

2.4.1. Functional rehabilitation indicators

The Fugl-Meyer Assessment (FMA) is used to evaluate limb motor function, with a score range of 0–100 points. The Barthel Index (BI) is used to quantify daily living abilities, also with a score range of 0–100 points. Standardized double-blind assessments are conducted, and reliability and validity are verified by retesting every 24 hours.

2.4.2. Complication rate

The incidence of neurological complications during hospitalization, such as lung infections and deep vein thrombosis, is recorded based on ICD-11 standards. Real-time records are maintained through the medical record system. The total incidence rate (number of cases/total number of cases × 100%) is calculated and compared between groups using the chi-square test.

2.4.3. Satisfaction evaluation

Satisfaction is evaluated across five dimensions: nursing response, operational standards, health guidance, humanistic care, and environmental comfort. Each dimension is scored out of 20 points, with a total score of 100 points. An anonymous third-party questionnaire survey is conducted before discharge, and reliability is tested using Cronbach's α. The average scores are compared and analyzed.

2.4.4. Time to consciousness

Consciousness is defined as a Glasgow Coma Scale (GCS) score of ≥ 13 maintained for 24 hours. The time from onset to consciousness (in hours) is recorded. Kaplan-Meier survival analysis and Log-rank tests are used to compare differences between groups, calculating the median time to consciousness and the 95% confidence interval (CI).

2.5. Statistical analysis

Statistical analysis is conducted using GraphPad Prism 10.0 software. Categorical data are expressed as rates and

percentages, and the chi-square test is used for comparisons. Continuous data that follow a normal distribution are expressed as mean ± standard deviation ($\bar{x}\pm s$) and analyzed using the t-test. A *P*-value of < 0.05 indicates a statistically significant difference.

3. Results

3.1. The functional rehabilitation conditions of the two groups of patients before and after the intervention

Before the intervention, there was no statistically significant difference in FMA and BI scores between the two groups ($P > 0.05$). After the intervention, the FMA and BI scores in the observation group were significantly higher than those in the control group, with a statistically significant difference ($P < 0.05$), as shown in **Table 1**.

Table 1. Comparison of recovery status

Group	FMA		BI	
	Before intervention	After intervention	Before intervention	After intervention
Control(*n*=31)	40.27 ± 2.83	64.28 ± 2.34[a]	33.91 ± 5.38	54.81 ± 7.23[a]
Observation(*n*=31)	40.73 ± 2.47	72.13 ± 5.38[a]	33.48 ± 5.23	70.23 ± 7.46[a]
t	0.681	13.095	0.319	8.264
P	0.498	0.000	0.750	0.000

*Note: Compared with the same group before intervention, $P < 0.05$.

3.2. Incidence of complications in both groups

The incidence of complications in the observation group was lower than that in the control group, with a statistically significant difference ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of complication incidence

Group	Urinary tract infection	Pulmonary infection	Gastrointestinal bleeding	Complication
Control (*n*=31)	1(3.23)	2(6.45)	1(3.23)	4(12.90)
Observation (*n*=31)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
x^2	-	-	-	4.275
P	-	-	-	0.038

3.3. Nursing satisfaction in both groups

The nursing satisfaction indicators in the observation group were higher than those in the control group, with a statistically significant difference ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of satisfaction scores

Group	Nursing attitude	Operational skills	Psychological counseling	Health guidance	Nurse-Patient communication
Control(n=31)	83.27 ± 2.83	86.65 ± 2.45	85.27 ± 2.16	84.12 ± 2.51	85.71 ± 2.45
Observation(n=31)	89.71 ± 2.46	92.84 ± 2.54	93.72 ± 2.47	92.43 ± 2.46	93.13 ± 2.50
t	9.562	9.765	14.338	13.164	11.802
P	0.000	0.000	0.000	0.000	0.000

3.4. Analysis of consciousness recovery time in both groups

Comparison of consciousness recovery time: the observation group had a significantly shorter recovery time of (48.72 ± 11.76) minutes compared to the control group, which had a recovery time of (64.29 ± 14.58) minutes. The difference was statistically significant (t = 13.2561, $P < 0.05$).

4. Discussion

Acute cerebral hemorrhage is a severe cerebrovascular disease primarily caused by the rupture of cerebral blood vessels, leading to blood influx into the brain parenchyma [12]. The pathological characteristics of this condition include a sudden onset and rapid progression, often resulting in a sharp increase in intracranial pressure within a short period [13]. This increased pressure compresses the surrounding brain tissue, causing a series of severe neurological dysfunctions [14]. These sudden changes present numerous challenges for emergency treatment [6]. On one hand, the condition of patients with cerebral hemorrhage changes rapidly, with complex and diverse symptoms, requiring medical personnel to make accurate judgments and decisions in a short time [7, 15]. On the other hand, due to the special nature of brain tissue, any slight mishap during treatment can lead to severe complications, further exacerbating the patient's condition and increasing the risk of death and disability [16, 17].

The predictive rehabilitation nursing model plays a crucial role in the treatment of acute cerebral hemorrhage [18, 19]. By anticipating and assessing the patient's condition in advance, rehabilitation therapists and nurses can take targeted measures during the golden hour of emergency care, effectively shortening the emergency response time [20]. For example, by preparing the necessary emergency equipment and medications in advance, they can ensure that treatment can be promptly initiated upon the patient's arrival at the hospital [21]. Additionally, predictive rehabilitation nursing can preemptively address potential complications of cerebral hemorrhage, such as lung infections and pressure sores, by formulating preventive measures in advance [22]. This reduces the incidence of complications, thereby alleviating the patient's suffering and lowering the mortality and disability rates [23].

The data from this study indicate that, after the intervention, the recovery scores for FMA and BI were significantly higher in the observation group compared to the control group, with a statistically significant difference ($P < 0.05$). For the time to regain consciousness, the observation group had a mean time of (48.72 ± 11.76) minutes, whereas the control group had a mean time of (64.29 ± 14.58) minutes, showing a significantly shorter time in the observation group ($P < 0.05$). The reason lies in the fact that predictive rehabilitation nursing, through early assessment and preparation, effectively shortens the emergency response time and the time taken for CT diagnosis. This provides more rescue time for patients, thereby increasing the success rate of emergency interventions. Consequently, it shortens the patient's awakening time and improves their prognosis and rehabilitation outcomes.

The results indicate that the incidence of complications in the observation group is lower than that in the control group, with a statistically significant difference ($P < 0.05$), fully demonstrating the effectiveness of predictive rehabilitation nursing. For pulmonary infection, measures such as cardiopulmonary rehabilitation management before transport and respiratory support during transport reduce the risk of aspiration and lower the likelihood of pulmonary infection. For pressure ulcers, regular turning and skin protection measures effectively prevent prolonged pressure on local skin. For deep vein thrombosis, appropriate limb positioning and activity reduce the possibility of blood stasis leading to thrombosis. It is evident that targeted rehabilitation nursing measures closely correspond to the mechanisms of complication occurrence, effectively preventing complications. Comparing the scores of nursing satisfaction indicators, the observation group scores are higher than those of the control group, with a statistically significant difference ($P < 0.05$).

5. Conclusion

In conclusion, the application of predictive rehabilitation nursing in the emergency transport of patients with acute cerebral hemorrhage can reduce the incidence of complications, shorten the duration of consciousness impairment, and improve the quality of transport and functional rehabilitation levels. This study provides new insights for enhancing the emergency transport and rehabilitation levels of patients with acute cerebral hemorrhage.

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