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Original Article

Application of details management in airway management of patients in the neurological intensive care unit

Yanhua Tan, Feng'e Sun, Shuxia Zhang

Department of Neurosurgical Intensive Care Unit, Liaocheng People's Hospital, Liaocheng, Shandong Province 252000, China

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Abstract: Objective: To investigate the application effect of details management method on airway management of patients receiving neurological intensive care. Methods: A total of 180 patients in the neurological intensive care unit (NICU) of Liaocheng People's Hospital receiving tracheal intubation from March 2015 to January 2017 were selected as objects of study, and randomly divided into two groups, with 90 cases in each group. The conventional airway management method was adopted in the control group, while the details management method was incorporated in the observation group based on the conventional method. The intubation time, length of stay in NICU, hospitalization expense, incidence rate of abnormal blood pressure, aspiration rate of sputum scab in the airway, positive rate of sputum culture, Glasgow coma scale (GCS) score, incidence rates of adverse reactions, final clinical outcome, and nursing satisfaction rate were compared and analyzed between the two groups. Results: The intubation time and length of stay in NICU in the observation group were significantly shorter than those in the control group, and differences were statistically significant (both $P < 0.05$). The average hospitalization expense in the observation group was significantly lower than that in the control group, and the difference was statistically significant ($P < 0.05$). In the observation group, there were 13 cases (14.44%) of positive sputum culture, 4 cases (4.44%) of respiratory tract infection, 3 cases (3.33%) of pulmonary infection, 7 cases (7.78%) of aspiration of sputum scab, and 32 cases (35.56%) of abnormal blood pressure, and differences were statistically significant (all $P < 0.05$). There was no statistically significant difference in the GCS score between the two groups of patients before operation, while the GCS score in the observation group after operation was significantly higher than that in the control group, and the difference was statistically significant ($P < 0.05$). The incidence rates of adverse reactions in the observation group were obviously lower than those in the control group, and differences were statistically significant ($P < 0.05$). The mortality rate in the observation group (n=2, 2.22%) was lower than that in the control group (n=12, 13.33%). The nursing satisfaction rate in the observation group was higher than that in the control group, and the difference was statistically significant ($P < 0.05$). Conclusion: Incorporating details management in airway management of patients receiving neurological intensive care based on conventional nursing can significantly shorten the intubation time and reduce the incidence rate of complications and mortality rate of patients, which is conducive to the rehabilitation of patients and able to improve nursing effectiveness and satisfaction, so it is worth popularizing.

Keywords: Details management, neurological intensive, airway management

Introduction

Cerebral trauma and hemorrhagic encephalopathy are major causes of cerebrovascular disease, and these diseases are characterized by acute onset, critical condition, high mortality rate, etc. [1, 2]. Most patients are accompanied by such symptoms as dyspnea, disturbance of consciousness, and decline in cough and expectoration ability, leading to aggravated cerebral edema and increased intracranial pressure, and causing further damage to the cranial nerve [3]. To relieve airway obstruction, ensure oxygen supply in the brain and promote recovery of neurological function of patients, tracheal intubation is needed [4].

The establishment of an artificial airway can improve ventilation and help clean up sputum, but there are still risks of abnormal blood pressure and pulmonary infection [5]. At the same time, long-term repeated vacuum sputum aspiration will cause damage to the tracheal mucosa and lead to adverse reactions, such as dys-

pnea [6]. Therefore, paying attention to every detail in nursing can reduce the incidence of secondary infection and adverse reactions, which has a greater impact on the prognosis and survival quality of patients [7]. However, details of airway management are often overlooked in actual intensive care nursing due to the large number of patients and severe disease [8].

Previous studies have proven that nursing patients with artificial airway established using details management can improve the prognosis of patients [9]. However, most studies, due to a single observation index, fail to fully evaluate whether details management has a greater advantage in airway management for critically neurological patients. This study, through more detailed observation indexes, aims to evaluate the improvement in the condition and prognosis of critically neurological patients via details management nursing model. On the basis of conventional nursing model, the details management method was further integrated to discuss the improvement of prognosis of critically neurological patients via details management.

Materials and methods

General materials

A total of 180 critically neurological patients admitted in Liaocheng People's Hospital from January 2015 to January 2017 were selected as objects of study, and randomly divided into the control group (n=90) and the observation group (n=90) using a random number table. Patients in control group received conventional nursing, while those in the observation group, based on the conventional nursing model, further applied the details management method.

Inclusion criteria

Guardians of all patients were fully informed of the study content and signed the informed consent, and this study was approved by the Ethics Committee of Liaocheng People's Hospital. Artificial airway was established in all patients for assisted respiration within 72 h after admission, and patients had no history of respiratory system-related diseases. The Glasgow coma scale (GCS) score was 7-12 points during hospitalization. The type of disease was confirmed via CT examination.

Exclusion criteria

The following were exclusion criteria: Patients complicated with pulmonary infection, acute respiratory distress syndrome or respiratory failure within 48 h before or after admission; Patients with chronic obstructive pulmonary disease or advanced chronic wasting disease; Patients with severe multiple organ failure; Patients with severe mental illness or who failed to cooperate with the treatment; Patients with incomplete medical record; Patients' guardians required them to quit the study midway automatically.

Nursing methods

Conventional airway management measures were used in the control group [10]. If conditions permitted, the head of the bed was elevated for 15°-30°. The tracheal cannula was kept dry and clean, cleaned, and disinfected every week strictly following the aseptic principle. 3-5 mL 30 mg ambroxol was slowly added dropwise into 10 mL 0.9% sodium chloride solution (Zhejiang Medicine Co., Ltd. Xinchang Pharmaceutical Factory) using a syringe every hour. Sputum was excreted artificially via patting back once every 2 h [11]. The mouth was cared using chlorhexidine gargle regularly once per day [12].

The clinical nursing model of detailed airway management was adopted in observation group. a) The key links were strengthened as follows. 1) Nursing staffs received standardized training of airway management. 2) Patients with trachea cut lay on the back within 48 h, and then the head of bed was elevated for 15°-30°. Vomiting patients lay in a lateral position to avoid suffocation. 3) Under strictly aseptic conditions, 30 mg ambroxol in 10 mL 0.9% sodium chloride solution (Zhejiang Medicine Co., Ltd. Xinchang Pharmaceutical Factory) was given for continuous humidification, and pumped into the airway using a micropump. The humidification plan was adjusted according to the sputum density of patients. 4) The tracheal cannula was kept dry and clean, cleaned, and disinfected every week strictly following the double disinfection principle of disinfection-cleaning-re-disinfection. 5) The ventilator pipe should be cleaned and disinfected, replaced once per week, and stored in a sterile and dry place. 6) The mouth was cared

Table 1. Two groups of patients were generally compared

Group	Control group (n=90)	Observation group (n=90)	t/X^2	P
Age (year)	47.70±2.81	48.50±3.24	-1.770	0.079
Gender			0.201	0.654
Male	49	46		
Female	41	44		
Disease type			1.148	0.766
Cerebral hemorrhage	33	36		
Cerebral infarction	24	27		
Craniocerebral injury	18	13		
Fracture of skull base	15	14		
Artificial airway type			0.023	0.881
Tracheotomy	40	39		
Trachea cannula	50	51		
Preoperative GCS score	7.40±1.72	7.30±1.58	0.406	0.685

Note: GCS, Glasgow coma scale.

using chlorhexidine gargle for 3 times per day, and both oral cavity and nasal cavity were washed. 7) The sputum was excreted using a mechanical sputum excretion apparatus under a tapping frequency of 15-35 cps for 1-4 times per day (10 min on each side of chest) [13]. 8) The airbag pressure was maintained at 25 mmH_2O, and secretions in airbag were removed timely to avoid pipe obstruction [14]. 9) Adequate enteral nutrition support therapy was performed combined with nutritional status of patients, and the gastric residual volume was monitored every 4 h [15]. b) Training for medical staff: Medical staff participated in operation training every month, the operation procedures of medical care were standardized, and strict examination was conducted. c) Related system in intensive care unit (ICU) was improved: according to the characteristics of patients receiving neurological intensive care, their families could visit them once at 4 pm at 3-5 m away from the patient. The total bacterial count in the air of ward was kept ≤4 colony-forming unit, the temperature was kept at 20-22°C, and the relative humidity was kept at 50%-60%. According to product instructions, the time of dynamic sterilizer and air cleaner was set, and the ward was ventilated every 3 d and disinfected every week. The desktop and ground were wiped using Lysol disinfectant (Chengdu Puji Pharmaceutical Chemical Co., Ltd.). d) Importance was attached to the doctor-patient communication in ICU: patients communicated in a timely manner with family members of patients about patient's condition and treatment methods, obtaining the trust from patients and their families as much as possible.

Observation indexes

Major observation indexes: (1) The intubation time from tracheal intubation to extubation, length of stay in neurological intensive care unit (NICU), and hospitalization expense were recorded. (2) The incidence rates of adverse reactions: airway mucosal injury, sputum obstruction, respiratory tract infection, pulmonary infection (definitely diagnosed based on the patient's symptoms, signs, relevant laboratory examination and pulmonary CT results), and pipe shedding and obstruction. When airway mucosal injury, sputum obstruction, and pipe shedding and obstruction occurred, symptomatic treatment was performed. When respiratory infection and pulmonary infection occurred, clinical treatment was performed according to relevant laboratory examination results. (3) The final clinical outcome was compared between the two groups of patients, including complete healing (the patient's symptoms were improved significantly, and the machine was withdrawn successfully), improvement (the patient's symptoms were improved, and the machine could be withdrawn intermittently) and death.

Secondary observation indexes: (1) The incidence rate of abnormal blood pressure (before and after sputum aspiration or patting back, elevation of systolic blood pressure > 20 mmHg was recorded as abnormality), aspiration rate of sputum in the airway (either small sputum scab observed in sputum aspiration or sputum scab attached to the inner wall of artificial airway indicated the formation of sputum scab), and positive rate of sputum culture. (2) GCS scores of two groups of patients before and after surgery were recorded. (3) Nursing satisfaction rate: The satisfaction degree of patient's families about overall nursing quality was evaluated using the questionnaire according to the situation of Liaocheng People's Hospital. The questionnaire included a total of 20 items (a

Table 2. Clinical indicators were compared between the two groups

Group	Control group (n=90)	Observation group (n=90)	t/X^2	P
Catheterization time (d)	19.40±4.13	13.50±3.17	10.750	< 0.001
NICU hospital stays	13.70±4.76	10.10±3.59	5.728	< 0.001
Hospitalization expenses (yuan)	13,645.20±238.47	8,175.90±198.81	167.12	< 0.001
Abnormal blood pressure (n, %)	47 (52.22)	32 (35.56)	5.076	0.024
Sputum aspiration rate (n, %)	16 (17.78)	7 (7.78)	4.038	0.045
Sputum culture positive rate (n, %)	26 (28.89)	13 (14.44)	5.532	0.019

Note: NICU, neurological intensive care unit.

Table 3. Comparison of GCS score between the two groups of patients

Group	Preoperative GCS score	Postoperative GCS score
Control group (n=90)	7.40±1.72	7.60±1.84
Observation group (n=90)	7.30±1.58	8.20±1.69
t	0.406	2.278
P	0.685	0.024

Note: GCS, Glasgow coma scale.

total of 100 points). Scoring criteria were as follows: ≥85 points (satisfactory), 60 points ≤ total score < 85 points (basically satisfactory), and < 60 points (not satisfactory). Satisfaction rate = (satisfactory + basically satisfactory)/ total case * 100%.

Statistical analysis

All data were statistically analyzed using SPSS 22.0 software analysis. Measurement data are presented as mean ± standard deviation (mean ± SD), and t test was used for the intergroup comparison. Enumeration data were presented as rate, and Chi-square test and Fisher's exact probability method were used for the intergroup comparison. $P < 0.05$ suggested that the difference was statistically significant.

Results

General materials

There were no statistically significant differences in general materials, such as age, gender, GCS score, establishment mode of artificial airway and type of disease, between the two groups of patients (all $P > 0.05$) [16] as shown in **Table 1**.

Comparisons of differences in clinical indexes of critically neurological patients receiving different nursing methods

The intubation time and length of stay in NICU in the observation group were significantly shorter than those in the control group, and differences were statistically significant (both $P < 0.05$). The average hospitalization expense in the observation group ((8,175.90±198.81) yuan) was lower than that in the control group ((13,645.20±238.47) yuan), and the difference was statistically significant ($P < 0.05$). The incidence rate of abnormal blood pressure in the observation group (35.56%) was lower than that in the control group (52.22%), and the difference was statistically significant ($\chi^2=5.076$, $P=0.024$). The sputum aspiration rate in the observation group (7.78%) was also lower than that in the control group (17.78%, $\chi^2=4.038$, $P=0.045$). However, the positive rate of sputum culture in the observation group (14.44%) was lower than that in the control group (28.89%), and the difference was statistically significant ($X^2=5.532$, $P=0.019$) as shown in **Table 2**.

Comparison of GCS score between the two groups of patients

GCS score was given to the two groups of patients again after operation. The score in the observation group was significantly higher than that in the control group, and the difference was statistically significant ($P < 0.05$) as shown in **Table 3**.

Comparisons of incidence rates of adverse reactions in different nursing plans

The incidence rates of airway mucosal injury, sputum obstruction and pipe shedding and obstruction in the observation group were significantly lower than those in the control group, and differences were statistically significant (all $P < 0.05$). At the same time, the incidence

Table 4. Comparison of adverse reactions between the two groups (n, %)

Group	Control group (n=90)	Observation group (n=90)	X^2	P
Damage to the tracheal mucosa	13 (14.44)	5 (5.56)	3.951	0.047
Phlegm obstruction	19 (21.11)	6 (6.67)	7.850	0.005
Respiratory tract infection	10 (11.11)	4 (4.44)	4.390	0.036
Pulmonary infection	12 (13.33)	3 (3.33)	5.891	0.015
Pipe shedding and blocking	7 (7.78)	1 (1.11)	4.709	0.030

Table 5. The final clinical outcomes were compared between the two groups

Group	Complete healing	Improvement	Death	Efficiency (n, %)
Control group (n=90)	45	33	12	78 (86.67)
Observation group (n=90)	51	37	2	88 (97.78)
t		7.745		
P		0.005		

Table 6. Nursing satisfaction rate of two groups of patients

Group	Satisfaction	General satisfaction	Dissatisfaction	Satisfaction rate (%)
Control group (n=90)	66	17	7	92.22
Observation group (n=90)	73	16	1	98.89
t		4.709		
P		0.030		

rates of respiratory tract infection and pulmonary infection in the observation group were also lower than those in the control group, and differences were statistically significant (both $P < 0.05$) as shown in **Table 4**.

Comparison of final clinical outcome between the two groups of patients

A total of 12 patients died due to aggravated disease in the control group, and 2 patients died in the observation group. The clinical efficacy rate in the observation group (97.78%) was significantly higher than that in the control group (86.67%), and the difference was statistically significant ($P < 0.05$) as shown in **Table 5**.

Comparison of nursing satisfaction rate between the two groups of patients

The nursing satisfaction rate of patients in the observation group (98.89%) was significantly higher than that in the control group (92.22%), and the difference was statistically significant ($P < 0.05$) as shown in **Table 6**.

Discussion

Due to disturbance of consciousness, long-term bed, slow swallowing reflex and other reasons, secretions are detained in the airway of critically neurological patients, obstructing the airway, easily leading to such complications as pulmonary infection and dyspnea, thus inducing multiple organ failure and seriously affecting the life and health of patients [17, 18]. Establishing artificial airway can improve the ventilatory dysfunction of patients, prevent hypoxia-induced brain damage and reduce the mortality rate of patients [19]. However, the artificial airway established changes the entry route of air into the lungs. The incidence rate of adverse reactions will be increased if there is no careful and standardized nursing, causing unnecessary suffering and financial burden on patients [20]. The airway nursing model of details management focuses on each management link, which has been widely used in bedside management, so as to improve the condition and increase the cure rate of patients [21]. In this study, conventional airway nursing model and airway nursing model of details management were adopted for 180 patients in NICU in Liaocheng People's Hospital, and it was found that the total effective rate of treatment in the observation group was 97.78%, significantly higher than that in the control group, proving that the airway nursing model of details management is helpful to improve the clinical outcome of patients. However, the intubation time, length of stay in NICU and other indexes were compared between the two groups of patients, and it was found that the time in the observation group was significantly shorter than that in

the control group, suggesting that adopting details management in NICU is conducive to improving the patient's condition, which lays a good foundation for receiving rehabilitation therapy in the general ward as soon as possible. This is because the nursing mode in the observation group focused on all aspects of airway management, thus reducing the possibility of complications, such as aspiration and ventilator-associated pneumonia, and enhancing enteral nutrition in critically ill patients, which is helpful for the recovery of patient's body function. There was no statistically significant difference in the GCS score before establishment of artificial airway between the two groups. The GCS score in the observation group receiving details management nursing was increased compared with that in the control group, proving that the degree of coma in patients is improved significantly, which is similar to the conclusion in previous reports [22].

During the mechanical ventilation therapy after establishment of artificial airway, infection is the most common complication with a morbidity rate of 16%-60% and a fatality rate as high as 30%-50% [23]. Moreover, patients need to undertake high medical expenses, so preventing the occurrence of infection should be paid attention to in the medical treatment. The immune system function of most patients with craniocerebral injury declines, combined with poor self-purification ability of airway, so the incidence rate of pulmonary infection is higher, dominated by multidrug-resistant strains [24]. In this study, nurses in the observation group chose the right position for patients, and prevented pulmonary infection in vomiting patients due to aspiration. At the same time, the control and treatment of nosocomial infection were enhanced from the details in the aspects of sputum aspiration, oral care, and disinfection of trachea cannula and ventilator pipe. It could be seen from research results that respiratory tract infection, pulmonary infection and positive rate of sputum culture in observation group were significantly decreased compared with those in control group, not only reducing the incidence rate of complications, but also avoiding the abuse of antibiotics and reducing the financial burden on patient's families, which conformed to research results of Fields et al. [25]. Moreover, the incidence rates of airway mucosal injury, sputum obstruction and pipe shedding in observation group were significantly lower than those in the control group, because details management was stressed in the nursing process, increasing the nursing quality and ensuring the nursing safety. During hospitalization, patients with the possibility of sputum obstruction and accidental pipe shedding were evaluated and the monitoring was strengthened, thus ensuring the patient's safety, which is consistent with the result in previous studies [26].

At present, two sputum excretion methods are commonly used: artificial patting back and mechanical sputum excretion. In this study, mechanical sputum excretion was used in observation group. The advantage of mechanical sputum excretion is that metabolites and mucus in the airway become loose after being shaken, and the chance of sputum excretion in the small airway is increased, ensuring the oxygen supply in the brain; however, certain skills and techniques are required in artificial sputum excretion, and improper operation will have a negative impact on sputum excretion, resulting in cardiac impulse and abnormal blood pressure, which is consistent with the finding in previous studies [13].

After the establishment of artificial airway, the airway opens to the outside directly, losing the processes of physiological cleaning, filtration and humidification of the nasal cavity. The incidence of pulmonary infection will be increased with the decreased degree of airway humidification [27]. Continuous humidification was adopted in the observation group, and the incidence rates of abnormal blood pressure and sputum aspiration rate were significantly decreased compared with those in the control group. This is because continuous airway humidification reduced the possibility of instantaneous elevation of blood pressure and the risk of intracranial re-bleeding, while ensuring airway moist, and reducing formation of sputum scab and airway mucosal injury, which are consistent with the research results of Jiang et al. [22].

At present, the bio-psycho-social medical model is advocated. Therefore, psychological intervention is of great significance in the treatment of diseases. Hu et al. studied and proved that establishing artificial airway in critically neurological patients as soon as possible can avoid the peak of cerebral edema and ensure

the airway patency. After the patient's families understand and cooperate via active communication, such as environmental intervention and accompany management, nursing work can be done orderly and effectively [28]. In this study, the nursing satisfaction rate in the observation group receiving details management was 98.89%, significantly higher than that in the control group, indicating that acceptance can be gained from patients and their families, and conflicts between doctors and patients can be reduced through careful nursing and patient communication, thus benefiting the early extubation and rehabilitation of patients.

In conclusion, the nursing model used in detailed airway management throughout the process from admission to extubation ensures the airway patency and sputum excretion, increases oxyhemoglobin saturation and oxygen partial pressure of patients, has very small impacts on the heart and blood pressure of patients, reduces the incidence of infection, and benefits the oxygen supply of the brain and recovery of brain function, so it is worthy of clinical promotion. The advantage of this study lay in many observation indexes, fully confirming the effectiveness of nursing model of details management for the rehabilitation of critically neurological patients. However, due to the small sample size, short follow-up time and incomplete long-term prognostic evaluation, further improvement is expected in future studies.

Disclosure of conflict of interest

None.

Address correspondence to: Shuxia Zhang, Department of Neurosurgical Intensive Care Unit, Liaocheng People's Hospital, No.67 Dongchang West Road, Liaocheng, Shandong Province 252000, China. Tel: +86-0635-8505600; E-mail: zhangshuxia274@163.com

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