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Influence of effective enteral nutrition support on delirium in ICU patients with mechanical ventilation

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Abstract

To evaluate the influence of effective enteral nutrition support on delirium in ICU patients with mechanical ventilation. 51 patients were divided into observation group and control group according to the nutrition support. Patients in the observation group received enteral nutritional support within 48h after mechanical ventilation. The mechanical ventilation time, duration of delirium, ICU length of hospital stay, lymphocyte number before and after the intervention, body weight, complications, and nutritional intervention time and nutritional standard time of patients in the two groups were evaluated and compared. There were 21 patients in control group, while 30 patients in observation group. The number of lymphocytes and body weight in the observation group were significantly higher than those in the control group ($P < 0.05$). The complication rate in the observation group was significantly lower than that in the control group ($P < 0.05$). The time of patients reaching the nutritional target in the observation group was significantly earlier than that in the control group ($P < 0.05$). The enteral nutritional support on ICU patients with mechanical ventilation is particularly effective, which effectively reduce the occurrence of delirium and other complications, thus improving the prognosis, which is of clinical application value.

Keywords: ICU; mechanical ventilation; enteral nutritional support; comprehensive intervention; delirium.

Practical Application: Enteral nutritional support on ICU patients with mechanical ventilation is particularly effective.

1 Introduction

Delirium is an acute disorder of cognitive function and attention, which is usually manifested by recurrent fluctuations in the state of consciousness, acute changes, confusion of consciousness, confusion of thinking and attention deficit and clinical symptoms (Ganau et al., 2018). It was shown that the incidence of delirium in ICU patients reached more than 50% (Trogrlić et al., 2019). The delirium in ICU patients is mainly resulted from high catabolism state, weakened immune function, cell function damage and etc., which could directly increase the risk of iatrogenic pneumonia, leading to frequent complications such as pressure sores, reintubation and ulcers (Binda et al., 2017). ICU patients are often in a state of fasting or stress, and it is difficult for them to receive enough enteral nutrition. Enteral nutrition support was reported to improve the nutritional status of critically ill patients, promotes recovery of gastrointestinal function, and reduces complications (Correia & Waitzberg, 2003). However, the effective of enteral nutrition support on neurological symptoms of ICU patients was seldom investigated. Therefore, this study was designed to evaluate the influence of effective enteral nutrition support on delirium in ICU patients with mechanical ventilation.

2 Methods

2.1 Patients

A retrospective analysis was performed. Patients with mechanical ventilation in our hospital from July 1, 2017 to June 30, 2019 were selected. The inclusion criteria were (1) meeting the diagnostic criteria in *Severe Illness 2* (Sharshar, 2008) after clinical examination; (2) score of ICU delirium assessment scale (ICD-SC) in simplified Chinese was more than 4 points. Exclusion criteria were following: (1) patients with neurological diseases or mental disorders; (2) patients with severe organic brain injury, hearing or visual impairment; (3) effective enteral nutrition time less than 5 days; (4) the estimated survival time less than 24 h; (5) stay in ICU for less than 7 days; (6) the score of Glasgow was lower than 9. All patients were divided into observation group and control group according to the nutrition support. The study was approved by the Ethics Committee of our hospital. Informed consent was obtained.

2.2 Basic treatment

Patients' basic data should be collected. Psychological status, living habits and cognitive ability should be comprehensively evaluated, and the occurrence of delirium in ICU, length of stay in ICU, duration of delirium, status of consciousness, and clinical manifestations of all enrolled patients during ICU should be observed and analyzed. Fluctuation of mental state, loose attention, disordered thinking and the change of consciousness definition is evaluated from the degree of wakefulness, alertness, lethargy, and coma. At the same time, the patients were monitored for respiratory system, cardiovascular system, nutrition and metabolic diseases, cerebrovascular diseases and digestive system diseases.

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The auxiliary monitoring methods include generally electrolytes, ECG monitoring, blood routine monitoring, respiration, blood gas analysis, chest B ultrasound.

All patients received mechanical ventilation, and appropriate treatment was conducted after the patients' vital signs were stable. Specific treatment also needs to be combined with the patient's different causes of disease analysis. If patients with invasive ventilation has obvious symptoms of anxiety, fear and sleep disorder during the treatment, they can be given midazolam injection (Jiangsu Nhwa Pharmaceutical Co., Ltd, H10980025)) with 2-3 mg intravenous injection followed by 0.05 mg/(kg·h) intravenous drip, propofol injection (Jiangsu Nhwa Pharmaceutical Co., Ltd, H20123138) 0.3~0.4 mg/(kg·h) intravenous sedation therapy. When the patient with non-invasive ventilation has corresponding symptoms, estazolam tablets (Guangdong Taicheng Pharmaceutical Co., Ltd, H44021098) should be taken orally, 2 mg/time, 3 times/day, to improve sleep and mental state. Morphine (Shenyang No.1 Pharmaceutical Co., LTD., Northeast Pharmaceutical Co., LTD.) was administered at 1-2 mg/h according to the patient's pain degree. Midazolam (Jiangsu Enhua Pharmaceutical Co., LTD.) was continuously pumped according to the patients' analgesia, and the midazolam dose was 1-4 mg/h. At the same time, the patient should be accompanied by family members to eliminate adverse psychological factors.

2.3 Intervention

Patients in the observation group received enteral nutritional support within 48 hours after mechanical ventilation. Patients were continuously pumped with enteral nutritional emulsion (Huarui Pharmaceutical Co., Ltd. and Nutricia Pharmaceutical Co., Ltd.) at 10-80 /h for 1-2 days after admission. The patient received nutrition input through tube feeding, and a gastric tube was placed above the stomach or duodenum in a progressive manner. In the initial stage, the patient was selected with a concentration of 0.7 kcal/ml, the drop rate was controlled at 98-123 ml/h. The intake was controlled at about 1000 ml/d, which could be adjusted according to the patient's detailed situation. After 2-3 days, the concentration of 1.45 kcal/ml can be adjusted to the full capacity, with an intake of about 2000 kcal/d.

Patients in the control group received parenteral nutrition support within 48 hours after mechanical ventilation, and enteral nutrition support after 48 hours. Parenteral nutrition support was provided by medium/long chain fat emulsion injection. After 48 hours, enteral nutritional support was the same as that in the observation group.

2.4 Outcomes

The mechanical ventilation time of the two groups was recorded within 48 hours after the patients were admitted to the ICU, the incidence of delirium was recorded after 48 hours, and the length of stay in the ICU was recorded. The lymphocyte number, serum albumin concentration and body weight of patients in the two groups were measured before and after the intervention. The complications, including gastric retention, pneumonia, constipation and anabrosis, occurred within 48 hours after treatment of patients in the two groups were counted. The starting time of enteral nutrition and the time reaching nutritional target were compared between the two groups. The patient's tolerated calorie supply was recorded and the nutritional goal was 25 kcal/(kg·d).

2.5 Statistical analysis

All data were analyzed using SPSS22.0 software, and the measurement data were represented with ($\bar{x}\pm s$) and compared with Student t test. The counting data were represented with (%) and evaluated with Chi-square test. $P < 0.05$ was considered as statistically significant.

3 Results

3.1 Basic characteristics

Fifty-one patients were finally included and divided into two groups. In the observation group, there were 30 patients, 17 males and 13 females, aged 24~83 years old, with an average age of (63.13 ± 1.89) years old. There were 1 cases of subarachnoid hemorrhage, 1 case of sepsis, 1 case of congenital heart disease, 1 case of tetanus, 1 case of postoperative cerebral hemorrhage, 1 case of interstitial lung disease, and 8 cases of pneumonia with severe pneumonia, 2 cases of empyema, 1 case of cerebrovascular malformation after operation, 2 cases of craniocerebral injury, 1 case of meningioma after operation, 1 case of AECOPD1, 1 case of multiple injuries, 1 case of cerebral hemorrhage, and 1 case of myasthenia gravis, 1 case of aneurysm intervention after operation, 1 case of resection of four ventricular lesions, 1 case of double diabetic foot with gangrene, 1 case of cerebral infarction, 1 case of acute myocardial infarction, 1 case of dilated heart disease. In the control group, there were 21 cases, 15 males and 6 females, aged 44~88 years old, with an average age of (63.02 ± 2.04) years old. there were 1 case of tetanus, 1 case of cerebral hemorrhage after operation, 3 cases of pneumonia with severe pneumonia, 2 cases of brain injury, 1 case of meningioma after operation, 1 case of AECOPD2, 1 case of multiple injury, 1 case of cerebral hemorrhage, 2 cases of high paraplegia, Among them, there were 2 cases of abdominal hemorrhage and abdominal injury, 1 case of rheumatic heart disease, 2 cases of digestive tract perforation, 1 case of left femur fracture, and 1 case of intestinal resection and anastomosis. There was no significant difference in general data such as gender and age between the two groups ($P > 0.05$).

3.2 Comparison of mechanical ventilation, incidence of delirium and length of ICU stay

The mechanical ventilation, incidence of delirium and ICU stay in the observation group were significantly lower than those in the control group ($P < 0.05$). (Table 1) (Figure 1).

3.3 Comparison of lymphocyte number, serum albumin expression and body weight before and after intervention

After intervention, the lymphocyte number and body weight in the two groups showed an increasing trend, while the

increase in the observation group was more obvious than that in the control group ($P < 0.05$) (Table 2)

3.4 Comparison of complications during the intervention

The incidence of complications in the observation group was significantly lower than that in the control group ($P < 0.05$). (Table 3) (Figure 2)

3.5 Comparison of starting time of enteral nutrition and the time reaching nutritional target

There was no significant difference of the starting time of enteral nutrition between the two groups ($P > 0.05$) (Table 4). The time of patients reaching the nutritional target in the observation group was significantly earlier than that in the control group ($P < 0.05$) (Table 4).

4 Discussion

Most patients in ICU are of severe illness and shortness of onset. It has been proved that it is more difficult to treat ICU patients than conventional wards (Simone et al., 2017). Delirium, one of the common and multiple consciousness disorders in ICU, is prone to cause functional changes and cognitive structure changes and present irregular recurrent attacks. At the same time, it could also cause the difficulties of patients with mechanical ventilation in weaning, accidental extubation and other adverse conditions (Shaw, 2018), which would prolong the length of ICU stay, increase the risk and economic burden

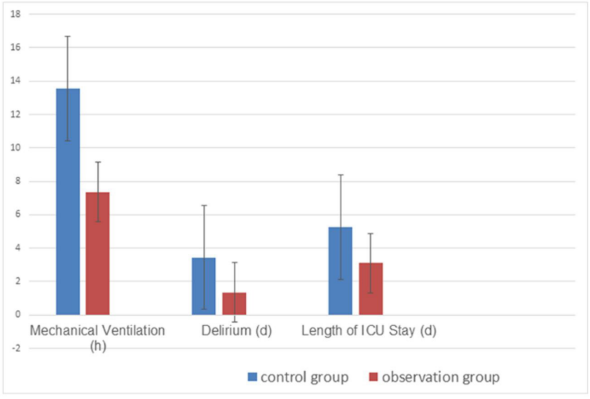

Figure 1. Comparison of mechanical ventilation, delirium duration and length of ICU stay between the two groups.

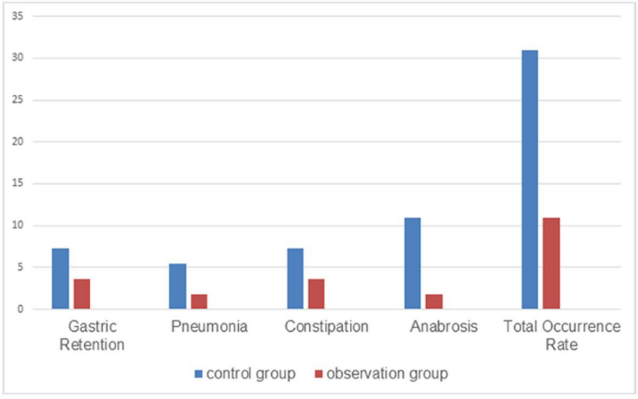

Figure 2. Comparison of complications between the two groups during intervention (%).

Table 1. Comparison of mechanical ventilation, incidence of delirium and length of ICU stay between the two groups ($\bar{x} \pm s$).

Group	Cases	Mechanical Ventilation (h)	Incidence of Delirium (%)	Length of ICU Stay (d)
Control group	21	13.56 ± 1.36*	7 (33.33) *	5.26 ± 1.26*
Observation group	30	7.36 ± 0.87	4 (13.33)	3.10 ± 0.89
t	-	19.868	11.181	7.184
P	-	0.000	0.001	0.000

Notes: Compared with the observation group, *$P < 0.05$.

Table 2. Comparison of lymphocyte number, serum albumin and body weight of between the two groups before and after intervention ($\bar{x} \pm s$).

Group	Cases	Lymphocyte Number (pcs.)		Body Weight (kg)	
		Before Intervention	After Intervention	Before Intervention	After Intervention
Control group	21	1123 ± 105	1206 ± 145*	61.25 ± 9.04	53.47 ± 7.46*
Observation group	30	1120 ± 101	1520 ± 169*	61.82 ± 9.11	64.22 ± 8.44*
t	-	0.103	6.913	0.221	4.691
P	-	0.919	0.000	0.826	0.000

Notes: compared with that before intervention. *$P < 0.05$.

Table 3. Comparison of complications between the two groups [n (%)].

Group	Cases	Gastric Retention	Pneumonia	Constipation	Anabrosis	Total Occurrence Rate
Control group	21	3 (14.29)	1 (4.76)	2 (9.52)	1 (4.76)	7 (33.33) *
Observation group	30	1 (3.33)	0 (0.00)	2 (6.67)	1 (3.33)	4 (13.33)
x^2	-	7.476	4.876	0.546	0.263	11.181
P	-	0.006	0.027	0.460	0.608	0.001

Notes: Compared with the observation group. *$P < 0.05$.

Table 4. Comparison of starting time of enteral nutrition and the time reaching nutritional target between the two groups ($\bar{x} \pm s$).

Group	Cases	Starting Time (h)	Reaching time (d)
Control group	21	28.57 ± 3.52	11.65 ± 2.65*
Observation group	30	27.64 ± 4.32	8.70 ± 1.02
t	-	0.815	5.556
P	-	0.419	0.000

Notes: compared with the observation group. *$P < 0.05$.

of patients, and greatly affect the improvement of prognosis. Due to acute trauma or surgery, ICU patients with mechanical ventilation are always in different degrees of stress response for a long time, which causes malnutrition (Shaw, 2018; Cahill et al., 2017). This situation would promote the injury of the body function and prolong the rehabilitation of the patient. Previous study have shown that the principle of treating severe delirium in ICU is to change the biological quality of viscera, and to improve viability (Wang et al., 2017). Therefore, it is necessary to strengthen nursing intervention when providing nutritional support to ICU patients with severe delirium. It was found that the duration of mechanical ventilation, incidence of delirium and ICU stay in the observation group were lower than those in the control group, which was similar to the results one previous study (Bashar et al., 2018). It indicated that this strategy could effectively improve the clinical symptoms of patients and shorten the length of stay in hospital.

Effective nutritional support therapy is mainly aimed at supplementing electrolytes, acids, bases and other substances of the body, timely correcting PH disorders in the body, and alleviating malnutrition of the body from the source. Brück et al. (2018) considered that that such nutritional support therapy could effectively reduce the mortality. Effective enteral nutrition support therapy has been applicated in patients with normal intestinal mucosa absorption capacity, as the main way to airframe nutrition supplement. Enteral nutrition support through nasogastric gavage would effectively reduce physical stimulation, speed up the recovery. It could not only supply enough nutrition for the body in a timely manner, but also prompt intestinal mucosal blood flow speed, promote intestinal digestive juices and raging hormones, thus effectively restoring intestinal epithelium, improving the gastrointestinal tract environment and preventing bowel function failure.

In our study, the number of lymphocytes, serum albumin and body weight of the observation group after intervention were all higher than that of the control group, which was consistent with previous study (Eghbali-Babadi et al., 2017). The intestinal tract of patients will get an adaptation process by gradually increasing the number of lymphocytes, serum albumin, and improving the body malnutrition, thus improving the body mass. In this study, patients in the observation group had less time to reach the nutrition target than patients in the control group, which might be due to that enteral nutrition can provide more capacity compared with parenteral nutrition. However, due to the short period of this study, the changes of nutritional indicators in the later period of patients cannot be obtained.

Meanwhile, the incidence of complications in the observation group was much lower than that in the control group, suggesting that strengthening comprehensive intervention measures in effective nutritional support therapy can consolidate the treatment effect, ensure the safety of patients, effectively alleviate the inner insecurity of patients through psychological intervention, and improve the degree of treatment coordination (Mychailyszyn, 2017).

Though there was no significant difference of the time for nutritional intervention between the two groups, the patients with effective nutritional support reached the required nutritional standards earlier, indicating that the intervention of effective nutritional support for ICU patients with mechanical ventilation could promote their early achievement of the relevant nutritional standards, having a positive effect on the recovery of patients' physical functions.

Pain intervention will effectively improve the comfort level of patients, reduce the inadaptability in the treatment process, and thus enhance the self-confidence of active treatment. The sleep-wake cycle intervention will ensure sufficient rest time, effectively relieve delirium symptoms, improve the quality of life and prognosis of patients.

There were still some limitations of this study. The sample size was relatively small. Enteral nutrition support was only evaluated in patients with mechanical ventilation in ICU for 48 hours, and no classification treatment was performed on patients with different diseases. Therefore, further study with lager sample size and longer study period was still needed.

In conclusion, enteral nutritional support on ICU patients with mechanical ventilation is particularly effective, which effectively reduce the occurrence of delirium and other complications, thus improving the prognosis, which is worthy of promotion.

Abbreviations

ICD-SC: ICU delirium assessment scale.

Ethic approval

The study was approved by the Ethics Committee of Shanxi Provincial People's Hospital hospital. Informed consent was obtained.

Conflict of interest

There are no potential conflicts of interest to disclose.

Author contributions

LS is resposible for the guarantor of integrity of the entire study, definition of intellectual content, literature research, clinical

studies, manuscript preparation & editing & review; QMG is resposible for the study design; BPL and JHC are resposible for the data acquisition; XML is resposible for the data analysis; LLZ is resposible for the statistical analysis; DW is resposible for the study concepts. All authors read and approved the final manuscript.

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