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Original Article

The application of a structural nutritional care management model in severe acute pancreatitis patients undergoing early enteral nutrition via nasal jejunal nutrition tubes

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Abstract: Objective: To investigate the advantages of a structural nutritional care management model (hereafter referred to as structural management) in severe acute pancreatitis (SAP) patients undergoing early enteral nutrition via nasal jejunal nutrition tubes. Methods: A total of 88 patients with SAP diagnosed and treated in our hospital were recruited as the study cohort and underwent enteral nutrition treatment. A random number table was used for the random grouping. The control group was routinely managed, and the study group was also administered structural management. In the study, we observed and compared the differences and changes in the relevant nutritional indexes (albumin (ALB), prealbumin (PA), and transferrin (TRF)) and the gastrointestinal hormone indexes (gastrin (MTL), vasoactive peptide (VIP), and 5-hydroxytryptamine (5-HT)) before and after the treatment. Between the two groups, we also compared the times required for the recovery of the relevant gastrointestinal physiological function indexes, the mechanical ventilation times, the hospitalization durations in the ICU, the complications, the satisfaction indexes and the satisfaction rates. Results: After the treatment, the relevant nutritional indicators, including ALB (35.26±3.35 g/L), PA (25.19±5.64 g/L), and TRF (2.82±0.54 g/L) in the study group were higher than the ALB (28.19±2.74 g/L), PA (21.29±4.32 g/L), and TRF (2.26±0.32 g/L) in the control group (all P<0.05). After the treatment, the relevant gastrointestinal hormone indicators, including MTL (269.72±37.18 pg/mL) and 5-HT (2214.61±432.95 ng/mL) in the study group were higher than the MTL (231.25±32.63 pg/mL) and 5-HT (1914.26±391.53 ng/mL) in the control group (all P<0.05). Moreover, the VIP in the study group was 53.13±6.17 pg/mL, which was significantly lower than the VIP in the control group (65.29±9.35 pg/mL, P<0.05). The time required for the recovery of the gastrointestinal function indexes in the study group was less than it was in the control group (P<0.05). The duration of the mechanical ventilation (8.16±1.93 days) and the hospitalization durations in the ICU (9.24±0.77 days) in the study group were significantly shorter than the duration of the mechanical ventilation (12.24±1.65 days) and the hospitalization durations in the ICU (13.23±0.88 days) in the control group (all P<0.05). The overall complication rate in the study group was significantly lower than it was in the control group (P<0.05), and the satisfaction rate in the study group was significantly higher than it was in the control group (P<0.05). Conclusion: The combined use of structural management in SAP patients undergoing enteral nutrition treatment significantly improved the relevant nutritional indicator and gastrointestinal hormone indicator levels. It also contributed to the recovery of the gastrointestinal function indicators in the SAP patients, reduced the durations of their mechanical ventilation, their hospitalization durations in the ICU, and their complications and contributed to a significant increase in their satisfaction with the nursing.

Keywords: Structural nutritional care management model, severe acute pancreatitis, enteral nutrition, nutritional indicators, gastrointestinal function

Introduction

Severe acute pancreatitis (SAP) is a critical illness in gastroenterology. Due to the high catabolic state SAP causes, nutritional reserves are rapidly consumed in a short time, and the body is prone to a negative nitrogen balance [1]. In order to make the pancreas "rest" enough and

reduce pancreatic fluid secretions, the early treatment is mostly focused on the prevention of co-infections and pancreatic necrosis, the correction of imbalanced endostasis, fluid resuscitation, and the maintenance of organ function. However, gastrointestinal decompression, fasting, and water deprivation can further aggravate patients' nutritional imbalance, and in severe cases, can lead to intestinal flora translocation, which can damage the absorption function of the gastrointestinal tract and lead to various infectious diseases. Therefore, nutritional support therapy and nursing care are always used in the treatment of SAP patients [2].

Enteral nutrition can effectively protect the intestinal function of SAP patients and reduce the risk of pancreatic necrosis and bacterial translocation [3]. However, conventional clinical nutritional support increases the risk of adverse effects such as malabsorption, reflux, and abdominal distension during its implementation, reducing its effectiveness [4]. Structural nutritional care management (hereinafter referred to as structural management) is mainly implemented through different management treatment modules for patients undergoing enteral nutrition treatment. Its advantages mainly include targeting, comprehensiveness, and it is multi-structural and multi-modular, and it can effectively improve the clinical nutrition treatment [5]. In this study, we analyzed the effectiveness of structural management in SAP patients undergoing early enteral nutrition via nasal jejunal nutrition tubes, aiming to provide a scientific basis for the nutritional support care of SAP patients.

Materials and methods

Study population

In this study, 88 patients with SAP diagnosed and treated in our hospital from September 2019 to September 2020 were recruited as the study cohort. Using a random number table, they were divided into the study group or the control group, with 44 cases in each group. The included patients met the clinical diagnostic criteria for SAP [6]. Their times from onset to admission were less than 24 h. The patients and their family members provided informed consent for this study. Exclusion criteria: patients comorbid with severe organ dysfunctional insufficiency, patients with a combination of related chronic diseases, such as diabetes mellitus, hypertension, etc., patients with a combination of related immune diseases, and patients who were breastfeeding. The study was reviewed and approved by our hospital's ethics committee.

Reagents and instruments

Motilin (MTL), vasoactive peptide (VIP), and 5-hydroxytryptamine (5-HT) detection kits (Beijing East Asia Institute of Immunology, China), automatic biochemical analyzer (Model AU5800B, Beckman Coulter, USA) Special Company.

Methods

Control group: Conventional nursing management [7]. In accordance with doctor's advice, the responsible nurse administered the patients daily enteral nutrition treatment and carried out routine care. They paid attention to the speed of the nutrient solution infusions and the smoothness of the pipelines. If there was a problem with the infusion process, they dealt with it promptly.

Study group: Structural management [8]. The first part was health education instruction, which included the purpose, significance and methods of nutritional support. There was also the operational method of the jejunal nutrition tube, and the precautions and adverse reactions of the tube. We provided psychological counseling for the patients with possible discomfort. Second, the assigned nurse monitored the patients' body positions. When implementing the enteral nutrition support, they made sure that the position of the head of the bed was elevated about 30° to 45°. It could be adjusted quickly based on patient comfort. Third was the constant management of the nutrition solution temperature. During the input of the nutrition fluid, we maintained it at a constant temperature of 37°C. A thermostatic heater was used in the operation, but the performance of the heater needed to be tested during each shift. The heater was wrapped to prevent the patients' skin from being scalded. It was also possible to heat the infusion tube at multiple points and change positions frequently to avoid softening. Fourth was the management of the infusion standard of the nutrition solution. We used Risu and Neng Qi as nutri-

tional preparations, and used saline to dilute the solution to about 75% of the original concentration for the infusion. Fifth was to keep records of the shifts. Sixth was reasonable self-examination and quality control. We set up a three-level team for quality control. The first-level quality control was the head nurse, who monitored the patients' enteral nutrition support once a day to assess the quality of the work. The responsible nurse would check for omissions twice a day during the handovers. The patrol nurses made relevant observations and recorded the nursing quality and any problems that occurred during the implementation of the enteral nutrition support and other care. In the weekly quality control meetings, they raised the problem of the quality of the care, and they formulated solutions to improve the quality of the nursing work.

Outcome measures

(1) Nutritional indicators: before and after the treatment, 3 mL of 12-hour fasting venous blood samples were drawn, and the albumin (ALB), prealbumin (PA), and transferrin (TRF) levels were measured using a biochemical analyzer.

(2) Gastrointestinal hormone indicators: before and after the treatment, 3 mL of 12-hour fasting venous blood samples were drawn to separate the serum (separation specification: 3,500 r/min, 15 min), and then radioimmunoassays were used to measure the motilin (MTL), vasoactive peptide (VIP), and 5-hydroxytryptamine (5-HT) levels [9].

(3) The time required for the recovery of the gastrointestinal physiological function indicators: during the treatment, we recorded the time it took for the two groups of patients to recover their bowel sounds, exhaust, first bowel movements, and relieve their abdominal distension.

(4) The mechanical ventilation times and hospitalization durations in the ICU: we compared the mechanical ventilation times and the hospitalization durations in the ICU in the two groups of patients.

(5) Complications: during the treatment, we counted and compared the incidences of reflux aspirations, vomiting, abdominal distension, diarrhea, perianal and pancreatic infections in the two groups.

(6) Satisfaction index: before each patient's discharge from the hospital, a department-made satisfaction assessment scale was administered to carry out a satisfaction assessment in the two groups of patients. The medical staff who underwent the uniform training would help the patients complete the assessments. In the process of the instruction, there was no intentional language or actions on the part of the nurses. The satisfaction score level ranged from 0 to 100 points, and a lower score indicated a lower satisfaction level. A satisfaction score >85 points indicated extremely satisfied, 70 points to 85 points indicated satisfied, and <70 points indicated dissatisfied [10]. Satisfaction rate = (extremely satisfied people + satisfied people)/total number of people *100%.

Statistical analysis

SPSS 22.2 was used for data analysis in the current study. The measurement data were expressed as the mean ± standard deviation ($\bar{x}$±sd), two independent sample t tests were used for the comparisons of the means between the two groups, and paired t tests were used for the comparisons of the means before and after the treatment in the same group. χ^2 tests were used for the comparisons of the rates. P<0.05 was considered statistically significant.

Results

Comparison of the baseline data

There were no statistically significant differences in the baseline data of the two groups of patients, such as gender, age, and onset factors (P>0.05), as shown in **Table 1**.

The nutritional indicators (ALB, PA, and TRF)

Before the treatment, there were no significant differences in the ALB, PA, or TRF levels between the two groups of patients (P>0.05). After the treatment, the ALB and PA levels in the two groups were significantly lower than they were before the treatment, and the TRF levels were significantly higher than they were before the treatment (P<0.001). The indicators in the study group after the treatment were sig-

Table 1. Comparison of the baseline data in the two groups

Group	Control group	Study group	t/χ^2	P
Numbers	44	44		
Gender (number)			1.800	1.180
Male	17	18		
Female	27	26		
Average age (years)	46.2±2.9	46.1±2.7	0.167	0.867
Pathogenic factors (cases)			0.480	0.787
Overeating	6	7		
Alcoholic	7	9		
Biliary	31	28		

nificantly better than the indicators in the control group (P<0.001), as shown in **Figure 1**.

Related gastrointestinal hormone indicators (MTL, VIP and 5-HT)

Before the treatment, there were no significant differences in the MTL, VIP, or 5-HT levels between the two groups of patients (P>0.05). In the two groups, after the treatment, the MTL and 5-HT levels were significantly higher than they were before the treatment, and the VIP levels were lower than they were before the treatment (P<0.05), and the indicators in the study group after the treatment were significantly better than the indicators in the control group (P<0.05), as shown in **Figure 2**.

Time required for the recovery of the gastrointestinal physiological function indexes

The times required for the patients to recover their bowel sounds, flatulence, first defecation, and recovery from the abdominal distension in the study group were significantly shorter than they were in the control group (P<0.001), as shown in **Table 2**.

Durations of the mechanical ventilation and the hospitalization durations in the ICU

The mechanical ventilation times and the hospitalization durations in the ICU in the study group were shorter than they were in the control group, and the differences were statistically significant (P<0.001), as shown in **Table 3**.

Complications

The total incidences of complications in the study group were significantly lower than they were in the control group, and the difference was statistically significant (P< 0.01), as shown in **Table 4**.

Satisfaction

The satisfaction rate of the patients in the study group was significantly higher than it was in the control group, and the difference was statistically significant (P<0.05), as shown in **Table 5**.

Discussion

Severe acute pancreatitis (SAP) is an extremely common type of acute and critical general surgery disease in clinical practice [11]. Patients with SAP are in a state of stress and their energy expenditure can increase by about 50% compared to their base values, while increasing their catabolic proteins [12, 13]. Studies have pointed out that SAP patients lose approximately 40 g of protein per day, casing a state of negative nitrogen balance to occur [14]. Coupled with the need for fasting and various therapeutic treatments among SAP patients, this can lead to severe malnutrition in SAP patients and can affect their prognoses [15-17]. Therefore, in the process of giving clinical therapeutic treatments to SAP patients, systemic support treatments need to be actively implemented, and nutritional support is one of the essential treatments [18].

In this study, the nutritional indicator levels were higher in the study group than they were in the control group after the treatment, and the relevant gastrointestinal hormone indicator levels improved and were better in the control group. Huang Yubo et al. applied structural management to patients with early postoperative transnasal jejunal nutrition tube enteral nutrition after gastric cancer surgery, and the results showed that the patients' serum total albumin, ferritin, albumin and hemoglobin levels were significantly higher than the levels in the conventional care group [8]. This is consistent with the results of our study. The structural management carefully sorted out the relevant nutritional care contents in the process of receiving nutritional support, and analyzed the influencing factors relevant to the effect of nutritional support and complications. By replacing clinical routine care with practical, efficient, reasonable and comprehensive struc-

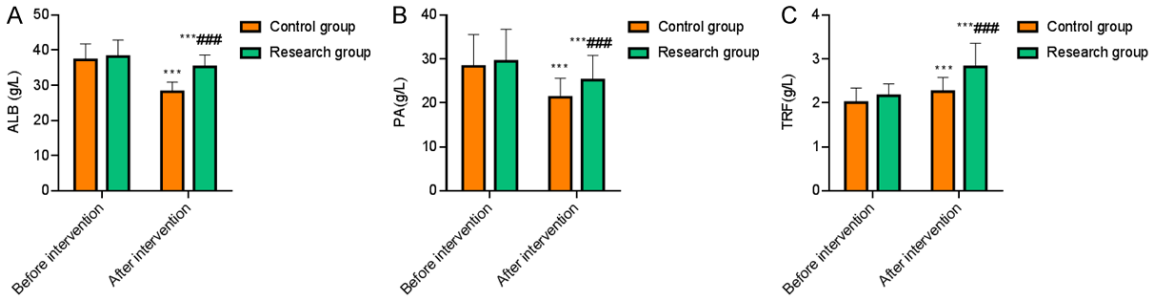

Figure 1. The nutritional indicators (ALB, PA, and TRF). A: ALB; B: PA; C: TRF. Compared with the same group before the treatment, ***P<0.001; compared with the control group after the treatment, ###P<0.001. ALB: albumin; PA: prealbumin; TRF: transferrin.

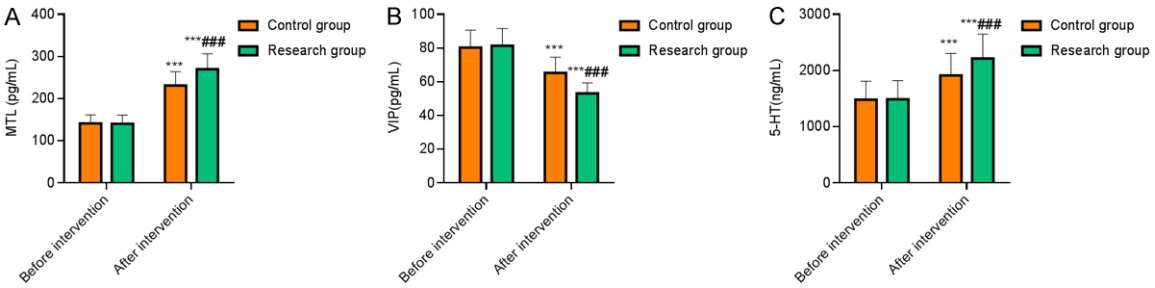

Figure 2. The gastrointestinal hormone indicators (MTL, VIP, and 5-HT). A: MTL; B: VIP; C: 5-HT. Compared with the same group before the treatment, ***P<0.001; compared with the control group after the treatment, ###P<0.001. MTL: Motilin; VIP: vasoactive peptide; 5-HT: 5-hydroxytryptamine.

Table 2. Time required for the recovery of the gastrointestinal physiological function indexes ($\bar{x}\pm sd$)

Group	Control group (n = 44)	Study group (n = 44)	t	P
Bowel sounds (days)	3.65±0.87	2.06±0.53	10.353	<0.001
Exhaust (days)	4.82±0.93	3.36±0.77	8.021	<0.001
First bowel movement (days)	4.91±0.72	3.66±0.45	9.766	<0.001
Abdominal distension (days)	6.73±1.05	4.02±0.65	14.557	<0.001

Table 3. Mechanical ventilation times and hospitalization durations in the ICU ($\bar{x}\pm sd$)

Group	Mechanical ventilation time (days)	hospitalization time in ICU (days)
Control group (n = 44)	12.24±1.65	13.23±0.88
Study group (n = 44)	8.16±1.93	9.24±0.77
t	10.659	22.634
P	<0.001	<0.001

tural management, more comprehensive and systematic enteral nutrition treatments were able to be administered to the patients, which ultimately led to a significant improvement in the nutritional treatment effects in the SAP patients.

In this study, the time required for the recovery of the gastrointestinal function indicators, the mechanical ventilation times and the hospitalization durations in the ICU were shorter in the study group than they were in the control group. In the process of the nutritional treatment, the medical staff was able to implement care management for the patients using different treatment modules of structural management. This might help them to effectively sort out the content of their care management, and compre-

Table 4. Complications (n, %)

Group	Control group (n = 44)	Study group (n = 44)	χ^2	P
Reflux aspiration	3 (6.82)	1 (2.27)		
Vomiting	4 (9.09)	2 (4.55)		
Abdominal distension	3 (6.82)	1 (2.27)		
Diarrhea	2 (4.55)	1 (2.27)		
Perianal and pancreatic infections	1 (2.27)	0 (0.00)		
Total	13 (29.55)	5 (11.36)	6.798	0.009

Table 5. Satisfaction levels (n, %)

Group	Control group (n = 44)	Study group (n = 44)	χ^2	P
Extremely satisfied	18 (40.91)	23 (52.27)		
Satisfied	15 (34.09)	18 (40.91)		
Dissatisfied	11 (25.00)	3 (6.82)		
Satisfaction rate	75.00%	93.18%	5.436	0.020

hensively evaluate the potential risk factors [19]. The different types of nursing behaviors were taken into account as the basis for the implementation of the block management of actual nursing care, which shortened the recovery times of the patients' gastrointestinal functions and promoted faster recoveries. He Guoqin et al. found that structural management for patients with early enteral nutrition via nasal jejunal nutrition tubes after gastric cancer surgery can make the patients' hospitalization durations significantly shorter than the hospitalization durations of conventional care groups, which is consistent with the results of our study [20].

The results of this study suggest that the total complication rate was lower in the study group than in the control group, and the patient satisfaction level in the study group was significantly higher than it was in the control group. Structural management provided faster and higher quality health instructions including speed control, concentration management, temperature, and positioning through specific, practical, clear and definitive care-related management behaviors. It also enabled a cyclical improvement in the effectiveness of the nutritional support management through a quality control system, which effectively reduced the risk factors of the related complications, resulting in a significant reduction in the incidence of complications. In a study by Zhou Haiyan, the introduction of structural management in early enteral nutrition after radical gastric cancer surgery was able to significantly reduce the risks and rates of the related complications in patients, which is consistent with the results of our study [21].

Time constraints and a small sample size might have had some impact on the results of this study. Additionally, this study was conducted using only our patients, so no multicenter study was conducted. It is hoped that a larger sample size and a multicenter observation and study will be conducted in the future to provide a stronger conclusion to further promote the application of structural management for SAP patients.

In conclusion, the combination of structural management with enteral nutrition treatment in SAP patients can significantly increase the relevant nutritional indicator levels and improve the relevant gastrointestinal hormone indicator levels in SAP patients. This would lead to a faster return to normal gastrointestinal physiology and a reduction in the durations of mechanical ventilation and hospitalization in the ICU. It also reduces complications in SAP patients and leads to a significant increase in care satisfaction.

Disclosure of conflict of interest

None.

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