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# Clinical impact of Evidence-Based Nasointestinal Tube Nursing Program on Enteral Nutrition Tolerance of Critically Ill Neurosurgical Patients

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## Abstract

This study aimed to assess the clinical impact of an evidence-based nasointestinal nursing program on enteral nutrition tolerance in critically ill neurosurgical patients. A total of 112 patients admitted to our hospital from January 2022 to January 2024 were randomly assigned to either a control group or an observation group, with 56 patients in each group. The control group received routine nasointestinal tube nursing, while the observation group received the evidence-based program. The observation group demonstrated reduced incidence of feeding intolerance symptoms compared to the control group. Additionally, the 7-day feeding compliance rate was higher in the observation group. The liquid diet time, exhaust time, and defecating time in observation group were shorter in comparison with those in control group. Both groups showed elevated hemoglobin, albumin, and prealbumin levels 7 and 14 days after tube placement compared to before placement. Furthermore, levels were higher in the observation group compared to the control group at these time points. No significant changes were observed in cholesterol and triglyceride levels within or between groups. In conclusion, the evidence-based nasointestinal nursing program demonstrated excellent efficacy in critically ill neurosurgical patients, accelerating gastrointestinal function recovery, improving feeding compliance and nutritional status, and reducing feeding intolerance symptoms. Its clinical application warrants further promotion and utilization.

**Keywords**: Critically ill neurosurgical patients; Enteral nutrition; Nasointestinal tube nursing; Tolerance

## Introduction

Critically ill neurosurgical patients often experience severe stress and high catabolism after surgery, requiring energy supplementation (1, 2). Nevertheless, certain patients may be unable to take food normally due to consciousness and swallowing dysfunctions and may even have complications such as malnutrition and aspiration pneumonia, which can exert adverse effects on prognosis (3). Thus, it is necessary to implement active and effective early enteral nutrition (EN) intervention for neurosurgical patients, which exerts clinical significance in maintaining gastrointestinal function (4, 5).

Nasointestinal tube is a medical device that utilizes nasogastric feeding to achieve EN infusion; some critically ill neurosurgical patients have lost their ability to eat autonomously, and they often apply nasogastric tube to ingest necessary nutrients (6). Nevertheless, nasointestinal tube requires high nursing techniques and has certain management difficulties; during provision of nursing, there is still a certain probability of tube placement failure and detachment (7). As a new type of nursing method, evidence-based nasointestinal tube nursing program refers to utilizing valuable and scientifically-based results as basis, raising relevant questions, searching for and applying relevant evidence, and implementing the best clinical nursing program for service

objects. Its core idea is to critically accept current professional knowledge and transform it into evidence that can be applied in clinical practice, thereby downregulating variability in nursing work, which has received wide application (8). Early nutrition support not only helps correct electrolyte imbalances and ameliorate various nutrient deficiencies in patients, but also effectively enhances resistance of the body, shortens ICU hospitalization time, and attenuates mortality. In recent years, guidelines and expert consensus on EN for critically ill patients have been established from different perspectives both domestically and internationally (9, 10). Relieving patients' intolerance, reducing gastrointestinal complications, and implementing a safe and standardized feeding program are urgent issues that need to be addressed in EN support nursing in China (11, 12).

This research aimed to clarify clinical role of evidence-based nasointestinal nursing program in EN tolerance in critically ill neurosurgical patients, which may provide scientific and standardized guidance for neurosurgical critical care work.

## *1. Materials and methods*

### 1.1 General data

The 112 critically ill neurosurgical patients admitted to our hospital from January 2022 to January 2024 received selection as research subjects. Inclusion criteria: Age ranged 18-75 years old; magnetic resonance imaging or CT results indicated severe traumatic brain injury; admission within 24 h after onset of illness; 3-8 points in Glasgow Coma Scale (GCS) and lasting for 24 h; family members (primary guardians) informed consent for this research. Exclusion criteria: Those with a history of mental illness or cognitive impairment; those complicated with coagulation dysfunction or immune system disorders; those with other contraindications for nasointestinal tube placement, such as intestinal obstruction and perforation; those with missing clinical data due to death or plant survival status during treatment. Patients received division into a control group (CG) and an observation group (OG) according to a random number table, with 56 cases each. This research obtained approval by the ethics committee of our hospital.

### 1.2 Methods

The CG received routine nasointestinal tube nursing program. Nursing staff should evaluate and judge patients' condition, observe basic indicators, and implement routine nasointestinal nursing such as prevention and treatment of complications.

The OG received an evidence-based nasointestinal nursing program. A team of evidence-based nasointestinal nursing program should receive establishment, which should include 10 undergraduate medical staff, 1 neurosurgical attending surgeon, 1 resident physician, and 8 neurosurgical ward nurses (1 head nurse and 7 nurses).

**1)** As a group, medical and nursing staff should utilize Chinese National Knowledge Infrastructure, Wanfang data knowledge service platform, VIP Network, Wiley InterScience, IEEE, EBSCO, Science, Springer and other domestic and foreign literature websites to search for relevant literature and materials through keywords such as "Neurosurgical Critical Care", "Nasointestinal Tube", "Nutrition Support", and "Evidence-based Medicine", etc., and integrate high-quality literature and reports to address following nursing issues. **a**. How to improve one-time tube placement success rate for difficulty of nasointestinal tube placement in critically ill neurosurgical patients is marked. **b**. How to effectively reduce risk of complications for there is risk of complications during nasointestinal tube insertion, including common types such as aspiration, vomiting, reflux, hiccup, etc. **c**. How to improve deficiencies in nursing techniques for some neurosurgical intensive care unit nursing staff with limited operations or responsible doctor skills. **d**. How to take targeted nursing measures to prevent and solve such problems for there may be cases of indwelling tube detachment and unplanned extubation during nasointestinal tube placement. **e**. How to adopt reliable nursing methods to prevent such situations and develop targeted nursing plans to integrate nursing plans for some patients may experience complications such as diarrhea and feeding intolerance during nasointestinal intubation.

**2)** The specific implementation process of evidence-based nasal and intestinal nursing program. **a**. Elevate one-time tube placement success rate: During operation, patients should be placed in right lateral position; nursing staff should stand on right side of patients, with one hand holding a gauze cloth to support patients' nasointestinal tube and the other hand holding front end of nasointestinal tube; nursing staff should choose to insert a tube into upper nasal cavity, pay attention to gentle operation, and slowly remove guide wire after inserting tube. **b**. Prevent complications such as aspiration, vomiting, reflux, and hiccup: Nursing staff should combine characteristics and specific situations of patients in the department to construct a quality control scale for nasointestinal nursing of critically ill neurosurgical patients. The scale should combine above evidence-based contents, standardize evaluation methods for each operation process, main operating procedures, and prevention and management of common complications. Nursing staff should strictly follow scale when providing nursing interventions. Meanwhile, nursing staff should pay attention to providing patients with a feeding amount based on principles of low flow and low concentration, slowly increasing dosage, and extending feeding interval. **c**. Enhance operational skills and sense of responsibility of neurosurgical nursing staff: Neurosurgical critical care staff should receive training and strictly follow quality control scale for nasointestinal nursing of critically ill neurosurgical patients to carry out relevant nursing operations. **d**. Prevent indwelling tube detachment and unplanned extubation: Nursing staff should properly fix nasointestinal tube, administer sedatives to patients who have already experienced delirium, and develop relevant emergency plans. If patients suddenly experience shortness of breath, bucking, or coughing up nutrient solution, nursing staff should immediately stop inputting nutrient solution and adjust position of tubes in a timely manner to ensure that patients' respiratory tract is unobstructed. Moreover, medical staff should perform lung auscultation on patients, encourage them to cough autonomously, and suck out and remove foreign objects in airway. If above symptoms of patients cannot receive effective amelioration, emergency laryngoscopy or fiberoptic bronchoscopy should be considered to remove foreign bodies. Additionally, nursing staff should monitor patients' condition and perform CT scans after condition stabilizes. **e**. Elevate gastrointestinal tolerance of patients receiving nasointestinal tube placement: When implementing clinical nursing, nursing staff should strictly follow principle of sterile operation, and pay attention to infusion speed of nutrient solution, with concentration being from high to low. During feeding period, nursing staff also need to evaluate patients' gastrointestinal tolerance and select appropriate nutrient solutions to improve feeding tolerance and avoid burden and adverse effects on patients' gastrointestinal tract. Nursing staff should monitor nutrition related proteins, adjust nutrient solutions, and evaluate patients' feeding compliance rate.

### 1.3 Observation indicators

(1) Gastrointestinal function indicators: The postoperative liquid diet time, exhaust time, and defecating time between both groups received comparison.

(2) Hematological indicators: The hemoglobin (HGB), albumin (ALB), prealbumin (PA), cholesterol (TC), and triglycerides (TG) levels received measurement and comparison between both groups before, 7 days after, and 14 days after tube placement.

(3) Feeding intolerance symptoms: The occurrence of feeding intolerance symptoms between both groups, including gastric retention, aspiration, diarrhea, abdominal distention, nausea and vomiting received comparison. Gastric retention refers to residual food in stomach still over 200 ml over 8 h after fasting. Aspiration refers to patients experiencing coughing, difficulty breathing, and suctioning or coughing up nutrient-like sputum. Diarrhea refers to having over 3 watery stools per day (with water content exceeding 85% of total amount of feces) and a fecal weight exceeding 200 g per day (13). Abdominal distension refers to absence of gas in anus, weakening or disappearance of bowel sounds, and swelling of abdomen (14). Nausea and vomiting refer to discharge of gastric contents from oral cavity, or conscious patients complaining of nausea.

(4) Feeding compliance: The feeding compliance rates between both groups 7 days after tube placement received comparison. The feeding compliance rate refers to percentage ratio of actual feeding amount of patients to planned feeding amount (15). According to actual situation of patients, required feeding amount received calculation with the Nutritional Risk Screening in 2002 (NRS2002) scale, and actual daily feeding amount of patients received monitoring and recording.

***Statistical analysis***

SPSS 27.0 statistical software received application to analyze data. Counting data received expression in %, followed by $\chi^2$ test. Quantitative data that conform to a normal distribution received representation by ($x \pm s$), followed by t-test. The difference was statistically significant with $P < 0.05$.

## *2. Results*

### 2.1 There are no marked differences in general data between both groups

No statistical significance in general data exhibited between both groups ($P > 0.05$; Table 1).

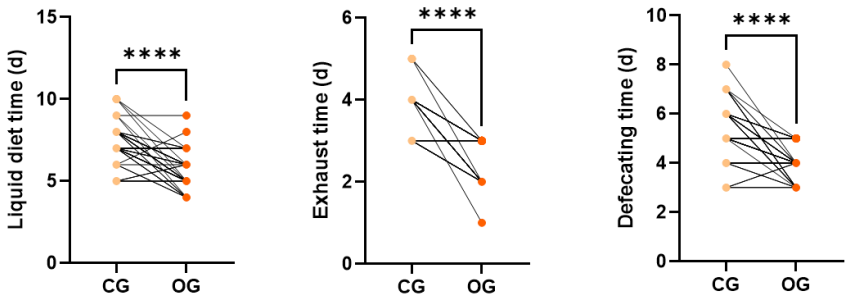
**Table 1. General data in both groups**

| General data | | CG | OG | $\chi^2$/t | P |
|---|---|---|---|---|---|
| N | | 56 | 56 | | |
| Gender [n (%)] | Male | 30 (53.57) | 28 (50.00) | | |
| | Female | 26 (46.43) | 28 (50.00) | 0.143 | 0.705 |
| Age (years) | | 50.20±10.20 | 51.05±10.15 | 1.453 | 0.149 |
| Disease types [n (%)] | Massive cerebral infarction | 6 (10.71) | 7 (12.50) | | |
| | Basal ganglia hemorrhage | 35 (62.50) | 31 (55.36) | | |
| | Intracranial aneurysm rupture hemorrhage | 15 (26.79) | 18 (32.14) | 0.592 | 0.744 |
| GCS scores (points) | | 4.85±1.01 | 4.89±1.00 | 0.535 | 0.593 |
| APACHE II scores (points) | | 22.63±4.25 | 22.68±4.00 | 0.499 | 0.619 |

***Evidence-based nasointestinal nursing program accelerates gastrointestinal function recovery in OG***

The liquid diet time, exhaust time, and defecating time in OG demonstrated attenuation in comparison with those in CG, indicating statistical significance ($P < 0.05$; Figure 1).

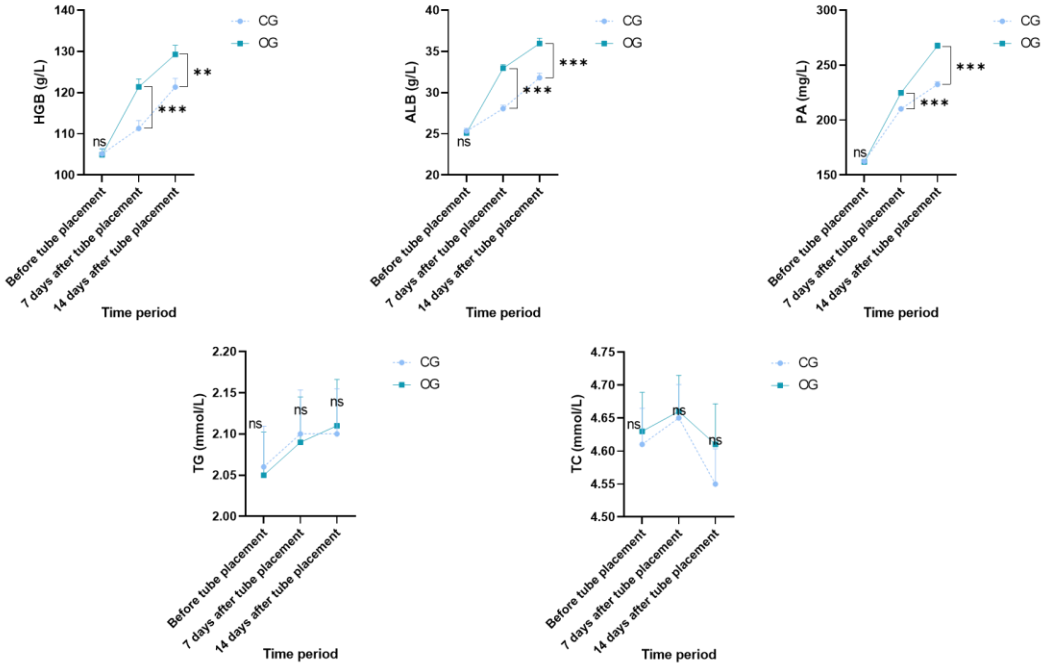
**Figure 1. Gastrointestinal function indicators in both groups**



***Evidence-based nasointestinal nursing program ameliorates nutritional status in OG***

Before tube placement, no statistical significance in HGB, ALB, and PA levels exhibited between both groups ($P > 0.05$). The HGB, ALB, and PA levels in both groups 7 days and 14 days after tube placement exhibited elevation relative to those before tube placement, indicating statistical significance ($P < 0.05$); HGB, ALB, and PA levels in both groups 14 days after tube placement exhibited elevation relative to those 7 days after tube placement, indicating statistical significance ($P < 0.05$); 7 days and 14 days after tube placement, HGB, ALB, and PA levels in OG exhibited elevation relative to those in CG, indicating statistical significance ($P < 0.05$). No remarkable changes in TC and TG levels exhibited in the same group before, 7 days after, and 14 days after tube placement, and no statistical significance in TC and TG levels exhibited between both groups during the same period ($P > 0.05$; Figure 2).

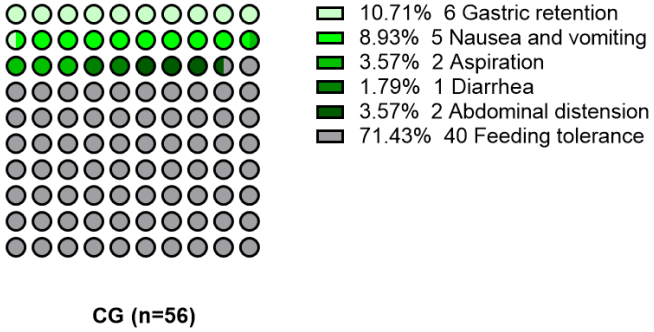
**Figure 2. Hematological indicators in both groups**

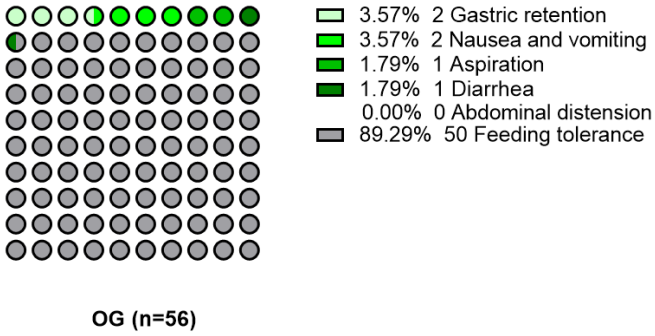



***Evidence-based nasointestinal nursing program mitigates feeding intolerance symptoms in OG***

The incidence of feeding intolerance symptoms in OG exhibited depletion relative to that in CG, indicating statistical significance ($P < 0.05$; Figure 3).

**Figure 3. Feeding intolerance symptoms in both groups**






***Evidence-based nasointestinal nursing program attenuates feeding compliance rates in OG after tube placement***

The 7-day feeding compliance rate in OG exhibited elevation relative to that in CG, indicating statistical significance ($P < 0.05$; Table 2).

**Table 2. Feeding compliance rates in both groups after tube placement**

| Groups | N | 7-d feeding compliance rate [n (%)] |
|---|---|---|
| CG | 56 | 39 (69.64) |
| OG | 56 | 52 (92.86) |
| $\chi 2$ | | 9.905 |
| P | | 0.002 |

## Discussion

Critically ill neurosurgical patients often have varying degrees of consciousness disorders during onset of illness, which can easily lead to respiratory complications, especially in patients who have already developed coma and are complicated with swallowing or gastrointestinal dysfunction (16). According to survey data, incidence of stress ulcers and other digestive system diseases in patients with severe traumatic brain injury after neurosurgery is 30%-55%, which has led to multiple adverse effects on their early nutrition (17). Furthermore, neurosurgical patients have a higher metabolic rate and faster protein renewal. If required energy cannot be replenished in a timely manner, it poses a threat to repair and compensatory function of nervous system, affecting immune function of the body (18). Currently, nasointestinal tubes receive application in clinical practice to provide nutrition support for critically ill patients, in order to alleviate high catabolic metabolism of the body and enhance gastrointestinal function. Nevertheless, due to difficulty of operating nasointestinal tube, accidents are prone to occur after intubation, and there is a certain risk of tube detachment and other complications. Thus, it is of great clinical significance to provide active and effective interventions for such patients to ensure high feeding compliance.

Evidence-based medicine is to provide patients with corresponding healthcare interventions through application of the latest scientific and technological knowledge and clinical work experience to obtain clinical data, guidelines, and other information resources, facilitating improvement of medical decision-making (19). This research applied evidence-based nasointestinal nursing program to critically ill neurosurgical patients. The results demonstrated that liquid diet time, exhaust time, and defecating time in OG demonstrated attenuation in comparison with those in CG . This indicates that evidence-based nasointestinal nursing program excellently protect integrity of patients' intestinal mucosa, thereby elevating patients' gastrointestinal function and enabling rapid recovery of gastrointestinal activity. This nursing method emphasizes science as basis, and nursing staff combine past clinical experience to organize and analyze difficulties and problems, and formulate effective solutions, fundamentally elevating nursing effectiveness, consistent with previous research (20).

Feeding intolerance is a vital element that restricts smooth implementation of EN in critically ill patients and can directly affect their prognosis and clinical outcomes (21). Herein, incidence of feeding intolerance symptoms in OG exhibited depletion relative to that in CG, indicating that this nursing method can alleviate intolerance symptoms in critically ill neurosurgical patients. This may have relation to following measures taken by OG: When implementing clinical nursing, nursing staff should strictly follow principle of sterile operation, and pay attention to infusion speed of nutrient solution, with concentration being from high to low. During feeding period, nursing staff also need to evaluate patients' gastrointestinal tolerance and select appropriate nutrient solutions to improve feeding tolerance and avoid burden and adverse effects on patients' gastrointestinal tract. Additionally, 7-day feeding compliance rate in OG exhibited elevation relative to that in CG. This nursing method has developed an evidence-based nursing practice program and implementation strategy based on domestic and international guidelines for EN in critical neurological patients. A skilled and responsible nursing team, as well as a scientific and standardized EN treatment process, can reduce adverse effects of EN and elevate nutritional compliance rate.

Serum proteins have become one of the widely circulated sensitive indicators for monitoring nutritional status (22). EN can

provide necessary proteins for patients' recovery, facilitate wound healing, and enhance recovery efficacy of the body. Early initiation of EN is beneficial for tissue and organ repair in critically ill patients, maintain stable internal environment, elevate immunity and enhance metabolic function recovery (23). Herein, HGB, ALB, and PA levels in both groups 7 days and 14 days after tube placement exhibited elevation relative to those before tube placement; HGB, ALB, and PA levels in both groups 14 days after tube placement exhibited elevation relative to those 7 days after tube placement; 7 days and 14 days after tube placement, HGB, ALB, and PA levels in OG exhibited elevation relative to those in CG; no remarkable changes in TC and TG levels exhibited in the same group before, 7 days after, and 14 days after tube placement, and no statistical significance in TC and TG levels exhibited between both groups during the same period. This indicates that early EN based on evidence-based nasointestinal nursing can elevate protein indicators of patients to a certain extent and improve their nutritional status. This is because the body of critical neurological patients is in a state of high consumption and high catabolism, and EN provides sufficient energy to patients with traumatic brain injury, supplementing proteins and fat consumed by patients; thus, hematological indicators related to nutrition of patients are also accompanied by changes.

## Conclusion

Application effect of evidence-based nasointestinal tube nursing program in critically ill neurosurgical patients is excellent and can improve patient nutritional status, accelerate gastrointestinal function recovery, enhance feeding compliance, and reduce incidence of feeding intolerance symptoms, which is worth further promotion and application in clinical practice.

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