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Clinical Evaluation of Enteral Nutrition + Probiotics in the Treatment of Gastrointestinal Dysfunction After Severe Traumatic Brain Injury

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Abstract: *Objective:* To evaluate the therapeutic effect of enteral nutrition + probiotics in patients with gastrointestinal dysfunction after severe craniocerebral injury. *Methods:* From September 2018 to February 2023, 80 patients (20–82 years old) with gastrointestinal dysfunction who were admitted to the Intensive Care Unit at the Third People's Hospital of Xining were included in the study. Their primary condition was severe craniocerebral injury, and all of them received conventional symptomatic treatment. Group A received enteral nutrition + probiotic therapy, whereas group B received enteral nutrition only. The differences in the following indicators were compared before and after treatment: nutritional and biochemical indicators, gastrointestinal function indicators, Glasgow Coma Scale (GCS), Sequential Organ Failure Assessment (SOFA), APACHE II score, serum procalcitonin (PCT), neutrophil (N) ratio, and C reactive protein (CRP). *Result:* The nutritional and biochemical indicators in group A were higher than those in group B, $P < 0.05$; the time to first passage of flatus, time to first passage of stool, and bowel sound recovery time in group A were shorter than those in group B, $P < 0.05$; the GCS of group A was higher than that of group B, $P < 0.05$; the SOFA and APACHE II scores of group A were not different from those of group B, $P > 0.05$; and the PCT, N ratio, and CRP levels of group A were lower than those of group B, $P < 0.05$. *Conclusion:* In patients with gastrointestinal dysfunction after severe craniocerebral injury, enteral nutrition + probiotic therapy is highly effective and feasible, as it can optimize various nutritional indicators, shorten the gastrointestinal function recovery time, and reduce the body's stress response.

Keywords: Enteral nutrition; Probiotics; Severe craniocerebral injury; Gastrointestinal dysfunction; Efficacy

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1. Introduction

There are many causes of severe craniocerebral injury, the majority of which are related to external injuries, such as falls, traffic accidents, and falls from heights. The typical symptoms include confusion, headache, and vomiting. Secondary gastrointestinal disorders can affect the body's intake of nutrients and prolong the recovery of patients [1]. Therefore, it is necessary to provide enteral nutrition therapy to patients with severe craniocerebral injury to correct gastrointestinal dysfunction and supplement daily nutrition. Through clinical

practice, long-term malnutrition in patients with gastrointestinal dysfunction has been found to increase the permeability of intestinal mucosa, cause intestinal flora imbalance, reduce the resistance of patients, and even increase the risk of complications from traumatic brain injury [2]. In this study, 80 cases of gastrointestinal dysfunction caused by severe craniocerebral injury were included to explore the therapeutic effect of enteral nutrition + probiotics.

2. Materials and methods

2.1. Baseline data

From September 2020 to September 2022, 80 patients with gastrointestinal dysfunction were included in the study and randomly divided into two groups. All of the patients had severe traumatic brain injury, as the primary condition. In group A, the male to female ratio was 26:14, and the mean age was 45.71 ± 6.25; in group B, the male to female ratio was 27:13, and the mean age was 45.69 ± 6.21. There was no significant difference in baseline data between group A and group B, $P > 0.05$.

2.2. Inclusion and exclusion criteria

Inclusion criteria: (1) patients diagnosed with gastrointestinal dysfunction, with severe traumatic brain injury as the primary condition; (2) patients with GCS ≤ 8; (3) patients who had been informed of the study and signed the informed consent.

Exclusion criteria: (1) patients with a history of malignant tumor or thoracic and abdominal trauma; (2) patients with liver and kidney dysfunction; (3) patients in pregnancy; (4) patients with malnutrition; (5) patients in uncorrected shock.

2.3. Treatment methods

After admission, the patients in both groups were actively treated for the primary condition, and conventional symptomatic treatment including maintaining electrolyte and acid-base balance was initiated. All patients were given enteral nutrition by nasogastric tube feeding; Peptison Liquid, an enteral nutrition solution, was given to the patients at an initial dose of 500 mL. The adverse effects of nasal feeding, such as vomiting, abdominal distension, diarrhea, *etc*., were observed. According to the patient's caloric needs, the enteral nutrition solution was increased to 1,000–2,000 mL within 72 h and then maintained. Depending on the patient, a nutrient pump was used to pump in nutrient solution at a rate of 20–80 mL/h. The amount of gastric retention was checked by the nurses every 4 h. When gastric retention exceeded 200 mL, enteral nutrition infusion was suspended, but when gastric retention was 100–200 mL, the infusion rate was slowed down. Before and after nasal feeding, the lumen of the nasogastric tube was rinsed with 50 mL of warm water to ensure that the tube is functioning. Oral care and nasogastric tube fixation were carried out as well.

On the basis of the enteral therapy above, *Bifidobacterium-Lactobacillus* triple live bacteria tablets (Inner Mongolia Shuangqi Pharmaceutical Co., Ltd.) were given at a single dose of 2.0 g, 3 times a day, for 15 days to patients in Group A.

2.4. Evaluation

(1) Nutritional and biochemical indicators: prealbumin, albumin, transferrin, and total protein levels.
(2) Gastrointestinal function indicators: time to first passage of flatus, time to first passage of stool, and bowel sound recovery time.
(3) Treatment indicators: GCS, SOFA score, and APACHE II score.

(4) Inflammatory indicators: PCT, N ratio, and CRP.

2.5. Statistical analysis

The data of patients were processed with SPSS 21.0. The measurement and count data were recorded as mean ± standard deviation and n (%), respectively; *t*-test and chi-squared test were performed. $P < 0.05$ indicates a statistically significant result.

3. Results

3.1. Nutritional and biochemical indicators

After 1 day of treatment, there was no difference in nutritional and biochemical indicators between the two groups, $P > 0.05$; however, after 15 days of treatment, the nutritional and biochemical indicators in group A were observed to be higher than those in group B, $P < 0.05$, as shown in **Table 1**.

Table 1. Comparison of nutritional and biochemical indicators

Group	Prealbumin (μg/mL)		Albumin (g/L)	
	After 1 day of treatment	After 15 days of treatment	After 1 day of treatment	After 15 days of treatment
Group A (n = 41)	204.15 ± 7.15	241.36 ± 9.52	39.64 ± 2.14	44.11 ± 3.25
Group B (n = 41)	204.21 ± 7.21	212.84 ± 8.73	39.62 ± 2.16	41.36 ± 3.08
t	0.0378	14.1380	0.0421	3.9326
P	0.9699	0.0000	0.9665	0.0002
Group	**Transferrin (ng/mL)**		**Total protein (g/L)**	
	After 1 day of treatment	After 15 days of treatment	After 1 day of treatment	After 15 days of treatment
Group A (n = 41)	326.71 ± 7.26	340.85 ± 9.48	60.33 ± 1.85	64.25 ± 2.11
Group B (n = 41)	326.68 ± 7.21	331.74 ± 8.16	60.31 ± 1.87	62.16 ± 2.24
t	0.0188	4.6635	0.0487	4.3488
P	0.9851	0.0000	0.9613	0.0000

3.2. Gastrointestinal function indicators

The time to first passage of flatus, time to first passage of stool, and bowel sound recovery time in group A were shorter than those in group B ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of gastrointestinal function indicators

Group	Time to first passage of flatus (h)	Time to first passage of stool (h)	Bowel sound recovery time (h)
Group A (n = 41)	27.64 ± 5.25	39.46 ± 6.73	24.11 ± 4.36
Group B (n = 41)	40.05 ± 7.19	54.19 ± 8.22	31.84 ± 5.88
t	8.9257	8.8781	6.7617
P	0.0000	0.0000	0.0000

3.3. Treatment indicators

After 1 day of treatment, there was no difference in GCS, SOFA score, and APACHE II score between group A and group B; however, after 15 days of treatment, the GCS in group A was observed to be higher than that in group B, $P < 0.05$. See **Table 3** for details.

Table 3. Comparison of treatment indicators

Group	GCS		SOFA score		APACHE II score	
	After 1 day of treatment	After 15 days of treatment	After 1 day of treatment	After 15 days of treatment	After 1 day of treatment	After 15 days of treatment
Group A (n = 41)	7.51 ± 0.89	13.11 ± 1.42	5.48 ± 1.85	2.29 ± 1.05	10.68 ± 2.35	5.08 ± 1.14
Group B (n = 41)	7.53 ± 0.91	10.43 ± 1.31	5.49 ± 1.87	2.28 ± 1.07	10.71 ± 2.37	5.09 ± 1.16
t	0.1006	8.8823	0.0243	0.0427	0.0576	0.0394
P	0.9201	0.0000	0.9806	0.9660	0.9542	0.9687

3.4. Inflammatory indicators

After 1 day of treatment, there was no difference in PCT, N ratio, and CRP levels between group A and group B; however, after 15 days of treatment, the PCT, N ratio, and CRP levels in group A were lower than those in group B, $P < 0.05$. See **Table 4** for details.

Table 4. Comparison of inflammatory indicators

Group	PCT (pg/L)		N ratio (%)		CRP (mg/L)	
	After 1 day of treatment	After 15 days of treatment	After 1 day of treatment	After 15 days of treatment	After 1 day of treatment	After 15 days of treatment
Group A (n = 41)	13.91 ± 2.84	4.98 ± 0.82	85.49 ± 1.87	73.25 ± 0.48	208.41 ± 11.25	65.11 ± 4.26
Group B (n = 41)	13.93 ± 2.82	6.99 ± 1.36	85.51 ± 1.88	80.39 ± 0.96	208.39 ± 11.39	83.23 ± 6.17
t	0.0320	8.1043	0.0483	42.5955	0.0080	15.4746
P	0.9746	0.0000	0.9616	0.0000	0.9936	0.0000

4. Discussion

Gastrointestinal dysfunction is likely to occur after severe craniocerebral injury. The most common pathological change is gastrointestinal motility disorder, which can affect the excretion of toxins and bacteria from the body and also increase the permeability of intestinal mucosa, thereby laying the foundation for bacterial reproduction and translocation [3,4]. In addition, long-term gastrointestinal dysfunction can increase the risk of organ failure, sepsis, infection, *etc*., as well as induce abdominal distension and vomiting. As a result, immunity decreases and the risk of death from severe traumatic brain injury increases [5]. At present, gastric motility drugs are often used to treat gastrointestinal dysfunction caused by severe head injury, such as metoclopramide, domperidone, and others; however, their curative effect is limited [6]. In recent years, scholars have suggested that enteral nutrition support should be given to patients with gastrointestinal dysfunction, so as to supplement the nutrients required for normal physiological functions in patients with severe traumatic brain injury, maintain the balance of enteral nutrition environment, and promote the secretion of gastrointestinal hormones [7]. In addition, enteral nutrition therapy can also protect the gastrointestinal barrier, which is beneficial to maintaining the cell structure and the integrity of the gastrointestinal mucosa, thereby reducing the risk of enterogenous infection. Enteral nutrition

has certain advantages over other nutritional programs, including low cost, simple operation, and high patient tolerance. However, it is difficult to correct intestinal flora disorders with simple enteral nutrition support. Therefore, probiotics should be used alongside enteral nutrition [8]. In the present study, *Bifidobacterium-Lactobacillus* triple live bacteria tablets were administered orally. These tablets can rebuild the probiotic flora in the gastrointestinal tract, thereby inhibiting the reproduction of pathogenic bacteria, optimize the intestinal micro-ecological environment, enhance the gut flora protective barrier, aid in the repair of damaged gastric mucosa, and relieve symptoms of gastrointestinal dysfunction [9].

According to our study, the nutritional and biochemical indicators in group A were higher than those in group B, $P < 0.05$; the time to first passage of flatus, time to first passage of stool, and bowel sound recovery time in group A were shorter than those in group B, $P < 0.05$; the GCS of group A was also higher than that of group B, $P < 0.05$; however, the SOFA and APACHE II scores of group A were not different from those of group B, $P > 0.05$; the PCT, N ratio, and CRP levels of group A were lower than those of group B, $P < 0.05$. Our results suggest that enteral nutrition + probiotic therapy can promote the recovery of patients. Analyzing the cause, patients with severe craniocerebral injury often have gastrointestinal hormone imbalance, which in turn induces gastrointestinal dysfunction. Enteral nutrition can supplement the daily nutrient consumption of the body; combined with probiotic treatment, it can correct the intestinal flora imbalance, restore the stability of the local intestinal environment, and stimulate the body to secrete gastrointestinal hormones, which is conducive to improving intestinal nutrient absorption, enhancing the nutritional status of the body, promoting the repair of brain tissue, relieving the body's inflammatory state, restoring gastrointestinal function, and improving gastrointestinal health. All these are beneficial to the long-term prognosis of patients [10].

In conclusion, the value of enteral nutrition + probiotics in gastrointestinal dysfunction after severe craniocerebral injury is evident by the shortened recovery time of intestinal function, the improved nutritional state of patients, and the repair of patients' brain tissue and cranial nerves.

Disclosure statement

The authors declare no conflict of interest.

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