Effect of early enteral nutrition intervention on nerve function, systemic oxidative stress and inflammatory response in patients with hypertensive cerebral hemorrhage

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OBJECTIVE: To study the effect of early enteral nutrition intervention on nerve function, systemic oxidative stress and inflammatory response in patients with hypertensive cerebral hemorrhage.

METHODS: A total of 98 patients with hypertensive cerebral hemorrhage who received hospitalization in the hospital between April 2015 and February 2017 were collected and divided into control group and observation group by random number table method, 49 cases in each group. Control group received routine enteral nutrition intervention and observation group received early enteral nutrition intervention. The differences in serum levels of nerve function-related indexes, oxidative stress indexes and inflammatory mediators were compared between the two groups of patients before and after intervention.

RESULTS: Before intervention, the differences in serum levels of nerve function-related indexes, oxidative stress indexes and inflammatory mediators were not statistically significant between the two groups of patients. After 1 week of intervention, serum S100B, NSE, GFAP, MBP, LPO, MDA, PCT, IL-1β, IL-6 and TNF-α levels of both groups of patients were lower than those before intervention while GSH-PX levels were higher than those before intervention, and serum S100B, NSE, GFAP, MBP, LPO, MDA, PCT, IL-1β, IL-6 and TNF-α levels of observation group were lower than those of control group while GSH-PX level was higher than that of control group.

CONCLUSION: Early enteral nutrition intervention can effectively optimize the nerve function and suppress the systemic oxidative stress and inflammatory response in patients with hypertensive cerebral hemorrhage.

1. Introduction

Hypertensive cerebral hemorrhage is the main etiology of clinical intracerebral hemorrhage, patients should receive early craniotomy evacuation of hematoma, and the postoperative nutritional and immune status can directly influence the outcome of disease, so the specific mode and timing of nutrition intervention are focus and hotspot of the current research[1-3]. Parenteral nutrition is the most common way of nutrition intervention after neurosurgery, which effectively replenishes the nutrients necessary to human body, is without the risk of reflux aspiration and so on, but may delay the recovery of gastrointestinal function and increase the burden of liver[4]. At present, many scholars suggest the early application of enteral nutrition intervention in patients with cerebral hemorrhage after treatment, which helps neutralize the excessively secreted gastric acid in the stomach, promote intestinal peristalsis, increase the intestinal nutrient absorption and improve immunity[5,6]. In the research, conventional parenteral nutrition intervention and early enteral nutrition intervention were used in clinical hypertensive cerebral hemorrhage patients respectively, and the influence of different ways of nutrition intervention on nerve function, systemic oxidative stress and inflammatory response was specifically analyzed.

2. Information and methods

2.1 Diagnostic criteria for hypertensive cerebral hemorrhage

(1) With symptoms of neurological defects such as hemiplegia and aphasia that occurred rapidly during the activity/emotional agitation; (2) with clear history of hypertension; (3) combined with serious headache, consciousness disorder, etc.; (4) CT examination confirmed cerebral hemorrhage.
2.2 General information

A total of 98 patients with hypertensive cerebral hemorrhage who received hospitalization in the hospital between April 2015 and February 2017 were collected, and all patients signed informed consent. Random number table method was used to divide the patients into two groups, 49 cases in each group. Control group included 29 men and 20 women that were 48-72 years old; observation group included 27 men and 22 women that were 47-76 years old. There was no statistically significant difference in general information between the two groups.

Inclusion criteria: (1) meeting the diagnostic criteria for hypertensive cerebral hemorrhage; (2) the interval between cerebral hemorrhage onset and hospitalization was 6 h; (3) finishing all treatment and with complete data. Exclusion criteria: (1) combined with clear infectious diseases of other tissue viscera; (2) combined with cerebrovascular malformation; (3) with previous history of brain injury and cerebral infarction; (4) combined with severe heart, liver and kidney insufficiency.

2.3 Nutrition intervention

Control group of patients received conventional parenteral nutrition, including 7% amino acid injection (Beijing Double-crane Pharmaceutical Co., Ltd., approved by H11022576) and 20% fat emulsion (Shandong Cisen Pharmaceutical Co., Ltd., approved by H20063064) as well as human insulin, electrolytes, vitamins, etc., intravenous drip for continuous 24 h.

Observation group received early enteral nutrition intervention, which was as follows: the gastric tube was inserted through the nasal cavity within 48 h after onset and properly fixed after confirming it was in position. First of all, warm water 500-1 000 mL was provided, and Nutrison Fibre nutrient solution was infused from the second day, the patients condition, the whole day dosage was controlled at about 500 mL, and the infusion speed was 40-50 mL/h. 800-1 000 mL of Nutrison Fibre nutrient solution continued after the illness was stable.

2.4 Observation indexes

Immediately after admission and after 1 week of nutrition intervention, 5.0 mL of fasting cubital venous blood was extracted from the two groups of patients at the same point in time, anticoagulated and centrifuged at low temperature (3 500 r/min, 10 min) to get the supernatant fluid, which was cryopreserved at profound hypothermia. RIA method was used to detect the serum contents of nerve function-related indicators, including S100B protein (S100B), neuron-specific enolase (NSE), glial fibrillary acidic protein (GFAP) and myelin basic protein (MBP).

Enzyme-linked immunosorbent assay (ELISA) was used to determine the serum contents of oxidative stress indexes, including glutathione peroxidase (GSH-PX), lipid peroxide (LPO) and malondialdehyde (MDA). ELISA was used to detect serum contents of inflammatory mediators, including procalcitonin (PCT), interleukin-1 β (IL-1 β), interleukin-6 (IL-6) and tumor necrosis factor (TNF-α).

2.5 Statistical processing

Nerve function-related indexes, oxidative stress indexes and inflammatory mediators were in terms of mean ± standard deviation, and comparison between two groups before and after treatment was by t test. SPSS 23.0 was used to process the data in the study and P<0.05 was set as the standard of statistical significance in differences.

3. Results

3.1 Nerve function–related indexes

Comparison of serum nerve function-related indexes S100B (μg/L), NSE (ng/L), GFAP (ng/L) and MBP (μg/L) levels between two groups of patients before and after intervention was as follows: before intervention, the differences in serum S100B, NSE, GFAP and MBP levels were not significant between the two groups of patients (P>0.05); after 1 week of intervention, serum S100B, NSE, GFAP and MBP levels of both groups of patients were lower than those before intervention, and serum S100B, NSE, GFAP and MBP levels of observation group were lower than those of control group (P<0.05), shown in Table 1.

3.2 Oxidative stress indexes

Comparison of serum oxidative stress indexes GSH-PX (U/mL), LPO (mmol/mL) and MDA (nmol/mL) levels between two groups of patients before and after intervention was as follows: before intervention, the differences in serum GSH-PX, LPO and MDA levels were not significant between the two groups of patients (P>0.05); after 1 week of intervention, serum GSH-PX levels of both groups of patients were higher than those before intervention while LPO and MDA levels were lower than those before intervention, and serum GSH-PX level of observation group was higher than that of control group while LPO and MDA levels were lower than those of control group (P<0.05), shown in Table 2.

Table 1.
Comparison of nerve function-related index levels.

| Groups       | n  | Before intervention | After intervention | Before intervention | After intervention | Before intervention | After intervention | Before intervention | After intervention |
|--------------|----|---------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Control group| 49 | S100B               | NSE                | GFAP               | MBP                |
|              |    | Before              | After              | Before              | After              | Before              | After              | Before              | After              |
|              |    | intervention        | intervention       | intervention        | intervention       | intervention        | intervention       | intervention        | intervention       |
| Before        |    | 1.73±0.26           | 2.23±0.26          | 22.63±2.85         | 22.63±2.85         | 13.72±1.62         | 16.15±2.04         | 6.23±0.71          | 7.10±0.35          |
| After         |    | >0.05               | <0.05              | >0.05              | <0.05              | >0.05              | <0.05              | >0.05              | <0.05              |
| P             |    | <0.05               | >0.05              | >0.05              | >0.05              | >0.05              | >0.05              | >0.05              | >0.05              |

Note: compared with same group before intervention, *P<0.05.
Neural functional recovery in patients with hypertensive cerebral hemorrhage is on the one hand, directly related to the hematoma removal and normal neural tissue damage degree during surgery, and on the other hand, closely related to postoperative nerve cell nutrition supply[13,14]. Under the premise that the operation mode and effect are roughly the same, different modes of nutrition intervention can result in difference recovery and speed of neurological function. S100B, NSE, GFAP and MBP are all specific nerve injury indexes, they are in neurons and glial cells under physiological state, nerve tissue ischemia hypoxia injury occurs after cerebral hemorrhage, the above factors are released into the outside of cells through the damaged membrane, further cross through the blood brain barrier whose permeability changes and enter into the circulating blood[15-17]. In the study, analysis of the changes in above neural function-related parameters in serum before and after the intervention showed that compared with those before intervention, serum S100B, NSE, GFAP and MBP levels of both groups of patients decreased after the intervention, showing that different ways of nutrition intervention help the patients with neural functional recovery; further compared with those of control group, serum S100B, NSE, GFAP and MBP levels of observation group were lower after the intervention, confirming that early enteral nutrition intervention can be more effective to optimize neural function in patients with hypertensive cerebral hemorrhage.

After cerebral hemorrhage, the body is in obvious stress state, which is one of the most important causes of stress gastric ulcer[18]. In the stress state, the body catabolism is strong, a large number of oxygen free radicals are produced, and they neutralize and consume antioxidants and cause the oxidation/anti-oxidation balance to be broken[19]. MDA and LPO are typical oxidative metabolites, and their contents are highly consistent with the systemic oxidative stress; GSH-PX is an antioxidant factor, and its decline indicates that the antioxidant capacity of the body is weakened[20]. In the study, analysis of the changes in above oxidation and anti-oxidation factors in serum before and after the intervention showed that compared with those before intervention, serum MDA and LPO levels of both groups of patients decreased while GSH-PX levels increased after intervention; further compared with those of control group, serum MDA and LPO levels of observation group were lower while GSH-PX content was higher after nutrition intervention, showing that early enteral nutrition intervention can more effectively equalize the

### 3.3 Inflammatory mediators

Comparison of serum inflammatory mediators PCT, IL-1, IL-6 and TNF-α levels between two groups of patients before and after intervention was as follows: before intervention, the differences in serum PCT, IL-1, IL-6 and TNF-α levels were not significant between the two groups of patients (P>0.05); after 1 week of intervention, serum PCT, IL-1, IL-6 and TNF-α levels of both groups of patients were lower than those before intervention, and serum PCT, IL-1, IL-6 and TNF-α levels of observation group were lower than those of control group (P<0.05), shown in Table 3.

### 4. Discussion

Nutrition intervention mode selection for patients with hypertensive cerebral hemorrhage is closely related to the final treatment outcome, and in consideration of the recovery of gastrointestinal function in the past, early parenteral nutrition was mostly selected to avoid complications such as intestinal obstruction and reflux aspiration[7,8]. The latest studies have pointed out that stress gastric ulcer easily occurs in patients with hypertensive cerebral hemorrhage after surgery, and severe cases can induce hemorrhage of upper gastrointestinal tract and endanger the lives of patients. The occurrence of stress gastric ulcer is because that the gastrin is massively secreted in stress state and leads to excessive gastric acid generation, and the decreased gastric mucosal blood flow further causes gastrointestinal mucosal ischemia state, eventually leading to the mucosal necrosis and ulcer[9,10]. Enteral nutrition can neutralize the excessively secreted gastric acid in the stomach and promote the gastric mucosa cell renewal and gastric mucosa growth, which provides the nutrition, also protects the normal gastrointestinal mucosa function and maintains the intestinal ecological balance[11,12]. In this study, enteral and parenteral nutrition intervention methods were both used for patients with hypertensive cerebral hemorrhage, and the differences in their effects on optimizing nerve function, adjusting oxidative stress and inflammatory reaction and other aspects were compared in order to provide reference for subsequent nutrition mode selection for similar patients.
oxidation/anti-oxidation balance and inhibit oxidative stress reaction. Oxidative stress is closely linked to inflammation, oxidative stress can stimulate the production of a variety of inflammatory mediators, and massive inflammatory mediator aggregation can prompt the generation and secretion of oxidative metabolites, thus forming a vicious circle[21,22]. PCT is a new late inflammatory mediator, which can increase in brain hemorrhage, trauma, severe infection and tumor disease. IL-1β, IL-6, and TNF-α are typical proinflammatory mediators, which can induce mononuclear/macrophages and neutrophils to aggregate and stimulate the production of other inflammatory factors[23,24]. In the study, analysis of the changes in above inflammatory mediators in serum before and after the intervention showed that serum PCT, IL-1β, IL-6 and TNF-α levels of both groups of patients decreased significantly after intervention. This indicates that both types of nutrition intervention can help reduce systemic inflammatory response in patients; further analysis of the differences in inflammatory mediators in serum between the two groups after intervention showed that serum PCT, IL-1β, IL-6 and TNF-α levels of observation group were lower than those of control group after intervention. It proves that the early enteral nutrition intervention can more effectively control the postoperative systemic inflammation of patients with hypertensive cerebral hemorrhage, which is consistent with its effect on inhibiting the oxidative stress of the body.

Compared with traditional parenteral nutrition intervention, early enteral nutrition intervention can more effectively improve the nerve function and curb the systemic oxidative stress and inflammation in patients with hypertensive cerebral hemorrhage, it is an important means of nutrition to promote disease recovery, and it is worthy of popularization and application in clinical practice in the future.

References


