Application of Early Nutrition Support in Neurosurgical Coma Patients

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Abstract The present study was conducted to investigate the clinical efficacy of early parenteral and enteral nutrition (PN + EN) support in neurosurgical coma patients. Eighty cases of neurosurgical coma patients were randomly divided into intervention group and control group. The intervention group received early PN + EN support, and the control group received only total enteral nutritional (TEN) support. The levels of hemoglobin (HGB), serum albumin (ALB), prealbumin (PA), and retinol-binding protein (RBP) in two groups on days 1, 10, and 20 were observed. The incidences of pneumonia, stress ulcer, abnormal liver function, abdominal distension, and diarrhea between two groups were also compared. Results found that, on day 10, compared with the control group, the levels of HGB, PA, and RBP in the intervention group were significantly increased ($P < 0.05$). On day 20, ALB in the intervention group significantly increased ($P < 0.05$), and the incidences of pneumonia, abdominal distension, and diarrhea in the intervention group were significantly lower than those in the control group ($P < 0.05$). Compared with only TEN support, early PN + EN support can obviously improve the nutritional status of neurosurgical coma patients and reduce the occurrence of complications.

Keywords Coma · Enteral nutrition · Parenteral nutrition · Support

Introduction

In the neurosurgery intensive caring unit, the severe unconscious patients often have poor prognosis, high invalidism,

and mortality rate. These comatose patients might suffer from severe complications such as dysphagia, neurogenic gastrointestinal dysfunction, and basal metabolic disturbance as well as severe malnutritional risks [1, 2]. As an independent factor, nutrition support could affect the patients' prognosis [3]. Failure in replenishment might cause serious shortage in nutrition, decrease in immune function, and slowness in wound healing, even affect the restoration and functional compensation of the central nervous system, which might lead to increase in mortality rate [3]. However, for patients receiving nutritional support, too much supply may cause overfeeding and increase viscera load [4]. Nutritional support has become an important part of the comprehensive treatment, so this essay studied the clinical effects of parenteral and enteral nutrition support in early period, and compared with only enteral nutrition support, via the patients' nutrition status and the complications.

Patients and Methods

Patients

Eighty acute fatal comatose patients in neurosurgery intensive care unit of our hospital were enrolled in this study from Jan. 2010 to Jan. 2011. Eighty cases were randomly divided into intervention group and control group. Inclusion criteria were the following: GCS < 12 , based on the odevity, 40 cases of them (No. 1, 3, 5, 7...) in the intervention group were given early parenteral and enteral nutrition (PN + EN) support and another 40 (No. 2, 4, 6, 8...) in the control group were given total enteral nutrition (TEN) support. There was no significant difference of age, gender, and neurological function deficiency between two groups (Table 1). Exclusion criteria were the following: hemodynamic instability, serious obstacle to liver and kidney function as well as celiac disease, and patients who

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Table 1 General information of patients

Index	Control group (n=40)	Intervention group (n=40)
Age (mean±SD, years)	44.5±8.8	46.8±7.9
Male (n, %)	24 (60.0)	23 (57.5)
Craniocerebral trauma (n, %)	17 (42.5)	19 (47.5)
Cerebral hemorrhage (n, %)	13 (32.5)	14 (35.0)
Aneurysm rupture and subarachnoid bleeding (n, %)	6 (15.0)	6 (15.0)
Surgery of cerebral tumor (n, %)	3 (7.5)	2 (5.0)

No significant difference between two groups

fail to complete 20 days' treatment. This study was approved by the ethics committee of Wuxi Second Hospital Affiliated to Nanjing Medical University. The informed consent was obtained from all patients.

Treatment

Two groups of patients were given nutritional support after 24 to 48 h in ICU. The two groups adopted the same caloric supplying standard. In acute phase of posttraumatic stress, patients were given 20–25 kcal·kg⁻¹·d⁻¹ level of nutrition. After the metabolism returned to normal, the given nutrition level was increased to 30–35 kcal·kg⁻¹·d⁻¹.

In the intervention group, in the early stage of PN + EN support, PN method was used as follows: vein infusion of glucose, 30 % fat emulsion and amino acid, etc. Glucose to fat ratio was 5:5, and glucose to insulin ratio was 8:1. The total parenteral nutrition provided 60 % of energy (kcal) requirement. In the first 3 days, patients were given residue rice soup. During the fourth to the seventh day, patients were given total protein EN preparation (1.5 kcal/ml) 500 ml, and the dose increased by the day until it reached 1000 ml in 2 weeks (adjusted to the PN according to EN).

In the control group, patients received TEN support (1.5 kcal/ml). Dose, from less to more, was 500 ml for the first day and reached the total volume in 2 to 5 days. Speed, from slow to fast, was 20–50 ml/h on the first day and, if no untoward effect like abdominal distention diarrhea showed, increased to 80–100 ml/h the next day, and the infusion was finished in 12–24 h.

Observe Indexes

We checked hemoglobin (HGB), serum albumin (ALB), prealbumin (PA), and retinol-binding protein (RBP) of the patients on days 1, 10, and 20 after they received the nutrition treatment in the ICU, and recorded the occurrences of complication, such as pulmonary infection, stress ulcer, dysfunction of liver, and abdominal distention diarrhea.

Statistical Analysis

Two groups were compared using the *t* test and χ^2 test for the statistics processing, which was in normal distribution, represented by mean±SD. *P*<0.05 was considered statistically significant. Data analysis was performed with SPSS 18.0 software.

Results

Comparison of Nutritive Indexes on Days 1, 10, and 20 in ICU

HGB, PA, RBP on the 10th day in the intervention group were significantly higher than those in the control group (*P*<0.05). On the 20th day, ALB in the intervention group was also significantly higher than that in the control group (*P*<0.05). There was no significant difference in HGB, ALB, PA, and RBP between two groups at other time points (*P*>0.05) (Table 2).

Occurrence of Complications

Compared with the control group, the incidences of pneumonia, abdominal distention, and diarrhea in the intervention group were significantly lower (*P*<0.05). There was no significant difference of stress ulcer and hepatic dysfunction between two groups (*P*>0.05) (Table 3).

Discussion

Nutrition support treatment is still controversial [5]. Current opinions range from the hypocaloric strategy as PN, which found if it kept longer, the rates of the complications by the nutritional negative balance would increase [6], to the first EN, afterwards, combining with PN + EN when necessary [7]. This essay studied the nutritional support method on the neurosurgery coma patients. At the early stage after trauma, the body is still in stress state, the energy needs increase and metabolism as well as protein degradation speeds up, and the gastrointestinal function can be in disorder, so that the nutrition cannot be successfully adsorbed from gastrointestinal tract [8, 9]. Then delayed nutritional support may quickly induce malnutrition which cannot be fixed by the later nutritional support [10]. Researches showed that patients with EN insufficiency and malnutrition should get PN support [11]. Therefore, this essay chose neurosurgery coma patients to compare the clinical differences between the patients receiving both early PN and EN and the patients receiving only TEN.

In the American guidelines, the nutrition support therapy not only shows the assistant support effect, but it also plays an

Table 2 Comparison of nutritive indexes on days 1, 10, and 20 between two groups

Group	Albuminous substances (g/l)	Prealbumin (g/l)	Hemoglobin (g/l)	RBP (mg/l)
Intervention group (40)				
The 1st day	34.74±4.4	0.24±0.02	133.4±15.34	55.13±8.3
The 10th day	30.27±3.1	0.21±0.03*	122.4±10.56*	39.24±7.8*
The 20th day	32.88±4.1*	0.22±0.06	126.2±20.23	44.43±4.1
Control group (40)				
The 1st day	34.28±3.9	0.25±0.04	135.4±18.47	54.09±9.2
The 10th day	29.74±7.5	0.16±0.03	102.4±19.23	29.34±3.9
The 20th day	28.70±3.9	0.22±0.05	124.4±15.23	45.78±9.3

* $P<0.05$ compared with control group

important role in the treatment [12, 13]. ESPEN guidelines also suggest that those who can endure EN (enough for what they need) do not need extra PN; otherwise, they take the PN support, not overfeeding. However, the question is which therapy will be suitable for the severe malnutrition patients with chronic diseases, and they give the baseline of the EN, over 25–30 kcal·kg⁻¹·d⁻¹, if not, they should take the extra PN supply [14, 15]. There were more random controlled trials, and system evaluation confirmed that early nutritional support after the surgery could improve the prognosis of traumatic brain injury patients [16]. The early nutritional support focused on the protection of intestinal barrier function and the reduction of translocation of intestinal bacteria and bacterial endotoxin. About 40–60 % of nutritional support on the critical patients is enough to protect the intestinal barrier function [17]. Therefore, the intervention group took both early PN and EN (in 24–48 h), among which the PN supplies 60 % of the permissive low calorie. The EN supply should be given considering the ability of the patients and do not increase gastrointestinal burden. Nutrition biochemical index of this research adopted HLB, ALB, PA, and RBP. HLB was the most direct indicator of anemia, and ALB (keeping osmotic pressure of the blood and prolong the half-life period to about 20 days) was a later indicator of nutrition. The half-life period of PA was 2 days and RBP 12 h (an early sensitive indicator of nutritional state owing to its quick reflection of the positive and negative balance state of metabolism) [18]. Compared with the control group, ALB of the intervention group rose significantly on the 20th day which showed a statistical

significance ($P=0.017$). The nutritional intake and absorption level was different in the two groups. The intervention group used the combined nutritional support of EN and PN. The control group only received TEN support. By this way, the nutritional absorption of the intervention group was more sufficient than that of the control group. Therefore, HLB, PA, and RBP of the intervention group, compared with the control group, rose significantly on the 10th day which showed a statistical significance ($P<0.05$). Researches have proven that 10 g/l reduction of ALB could increase mortality rate by 137 % and complications by 89 %, and the period in ICU by 28 and 71 % [19]. The statistics difference also showed that parenteral and enteral nutrition support does much better than total enteral nutrition support.

Research also showed that the total EN supply might add gastrointestinal burden and cause nausea, vomiting, abdominal distension, and diarrhea of the patients. Furthermore, regurgitation and vomiting might cause aspiration pneumonia. The occurrence rates of lung infection, bloating, diarrhea, and other complications of the intervention group were lower than those of the control group which showed a statistical significance ($P<0.05$). And this might result from the early infusion of nutrition followed by the reduction of aspiration. Dysfunction of liver and stress ulcer showed no statistical significance, which might reflect that the intake of permissive low calorie (parenteral and enteral nutrition) would not result in dysfunction of liver caused by PN. Reasonable parenteral nutrition energy should be provided with sugar and fat (fat takes up 30 to 50 % of non-protein calories) [4]. Great glucose load might lead to overfeeding and turn into fat inside the body, causing fatty liver, dysfunction of liver, and cholestasis [13]. EN's effect is considered to enhance the patients' ability to protect gastric mucosa and reduce stress ulcer.

Table 3 Occurrence of complications in two groups

Group	Pulmonary infection	Stress ulcer	Hepatic dysfunction	Abdominal distension	Diarrhea
Intervention group (40)	6	11	10	5	4
Control group (40)	14	13	8	12	11
<i>P</i>	0.035	0.404	0.395	0.05	0.042

Conclusion

Early PN and EN support can not only supply nutrition to neurosurgery coma patients but also protect gastrointestinal tract. This will improve recovering and prognosis.

Conflict of Interest The author declares that there is no conflict of interest with this manuscript.

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