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ORIGINAL ARTICLE

Early Enteral Combined with Parenteral Nutrition Treatment for Severe Traumatic Brain Injury: Effects on Immune Function, Nutritional Status and Outcomes△

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Key words: enteral nutrition; parenteral nutrition; severe traumatic brain injury; immune function; complication

Objective To compare the conjoint effect of enteral nutrition (EN) and parenteral nutrition (PN) with single EN or PN on immune function, nutritional status, complications and clinical outcomes of patients with severe traumatic brain injury (STBI).

Methods A prospective randomized control trial was carried out from January 2009 to May 2012 in Neurological Intensive Care Unit (NICU). Patients of STBI who met the enrolment criteria (Glasgow Coma Scale score 6~8; Nutritional Risk Screening ≥3) were randomly divided into 3 groups and were administrated EN, PN or EN＋PN treatments respectively. The indexes of nutritional status, immune function, complications and clinical outcomes were examined and compared statistically.

Results There were 120 patients enrolled in the study, with 40 pationts in each group. In EN+PN group, T lymthocyte subsets CD3+%, CD4+%, ratio of CD3+/CD25+, ratio of CD4+/CD8+, the plasma levels of IgA, IgM, and IgG at 20 days after nutritional treatment were significantly increased compared to the baseline(t=4.32-30.00, P<0.01), and they were significantly higher than those of PN group (t=2.44-14.70;

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$P<0.05$,or $P<0.01$) with exception of CD4+/CD8+, higher than those of EN group (t=2.49-13.31, $P<0.05$, or $P<0.01$) with exceptions of CD3+/CD25+, CD4+/CD8+, IgG and IgM. For the nutritional status, the serum total protein, albumin, prealbumin and hemoglobin were significantly higher in the EN (t=5.87-11.91; $P<0.01$) and EN+PN groups (t=6.12-13.12; $P<0.01$) than those in PN group after nutrition treatment. The serum prealbumin was higher in EN+PN group than that in EN group (t=2.08; $P<0.05$). Compared to the PN group, the complication occurrence rates of EN+PN group were significantly lower in stress ulcer (22.5% *vs*. 47.5%; χ^2= 8.24, $P<0.01$), intracranial infection (12.5% vs 32.5%;χ^2= 6.88, $P<0.01$) and pyemia (25.0% *vs*. 47.5%; χ^2= 6.57, $P<0.05$). Compared to the EN group, the complication occurrence rates of EN+PN group were significantly lower in aspirated pneumonia (27.5% *vs*. 50.0%; χ^2= 6.39, $P<0.05$), hypoproteinemia (17.5% *vs*. 55.0%; χ^2= 18.26, $P<0.01$) and diarrhea (20.0% *vs*. 60.0%; χ^2= 20.00, $P<0.01$). The EN+PN group also had significant less length of stay in NICU (t=2.51, 4.82; $P<0.05$, $P<0.01$), number of patients receiving assisted mechanical ventilation (χ^2= 6.08, 12.88; $P<0.05$, $P<0.01$) and its durations (t=3.41, 9.08; $P<0.05$, $P<0.01$), and the death rate (χ^2=7.50, 16.37; $P<0.05$, $P<0.01$) than those of EN or PN group.

Conclusion Early EN+PN treatment could promote the recovery of the immune function, enhance nutritional status, decrease complications and improve the clinical outcomes in patients with severe traumatic brain injury.

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NEUROLOGICAL patients with severe traumatic brain injury (STBI) are at high risk for developing nutrition-related complications due to primary injury and secondary injury cascade that ensues.[1] The STBI patients are metabolic hyperactivity and in stringent state.[2] Immunological function, especially cellular immune function which induces anti-infection capability, was depressed in most of STBI patients.[1, 3-6] One of important reasons may be lack of enough nourishment intake due to the state of unconsciousness for a long time. Malnutrition not only delays neurofunctional recovery and depresses organism immunity, but also induces some grave complications，which could increase the mortality and prolong hospitalization of STBI.[7-8] Nutritional support, which may improve neurological outcome of brain injury, has been considered as an important issue in trauma care in the past three decades, but its timing and route have not been well established.[9] Nutrition for STBI patients could be provided by both parenteral and enteral route, and the latter is commonly considered as a better choice for critically ill patients. The benefit of enteral nutrition (EN) on mucosal integrity and the prevention of enterogenic infection may well explain the superiority of EN over parenteral nutrition (PN).[5, 10] However, STBI patients may not tolerate enteral feeding well and regurgitant pneumonia may occur commonly.[11] Early EN has an important influence on nonspecific cellular immunity and specific cellular immunity.[4] EN intolerance generally manifests itself in the form of increased gastric residuals, gastro-oesophageal reflux, vomiting, abdominal distention and diarrhea.[3] Due to the restricted speed and dose of enteral feeding and thereafter insufficient energy delivery, a combined approach of EN and PN may be the best choice for nutrition treatment.

In this prospective randomized control trial, we compared the treatment effect of EN, PN and EN+PN on immune function, clinical complications and outcomes of patients with STBI in Neurological Intensive Care Unit (NICU).

PATIENTS AND METHODS

Study design and patients enrollment

This single centric prospective and observational randomized control trial was carried out from January 2009 to May 2012 in NICU. Consecutive eligible patients were assigned to EN group, PN group and EN+PN groups randomly according to the sequence of their assigned hospital record number. This study had been approved by the local institutional review board and the Human Ethics Committee of the Affiliated Hospital of Qingdao University. Informed consent had been acquired by patients' guardians. Our study abides by the Declaration of Helsinki, the related laws and regulations.

Patient who was admitted to the NICU with the diagnosis of STBI were enrolled in the study if met the inclusion criteria: 1) Glasgow Coma Scale (GCS) score: 6-8; 2) Nutritional Risk Screening (NRS) $\geqslant$ 3. The exclusion criteria including: 1) Glucocorticoid and blood products were used during study; 2) Hemodynamic instability; 3) Immunosuppressive drug was used in the past 6 months; 4) Patients