Received: 14.10.2013 / Accepted: 28.03.2014
DOI: 10.5137/1019-5149.JTN.9503-13.1

Original Investigation

Enteral Nutritional Support in Patients with Head Injuries After Craniocerebral Surgery

Kafa Travmalı Hastalarda Kraniyoserebral Cerrahi Sonrasında Enteral Beslenme Desteği

Chun-Hua LI[1], Dong-Pu CHEN[2], Jing YANG[1]

[1]*The First Affiliated Hospital of Zhengzhou University, Department of Nutrition, Zhengzhou, China*
[2]*Changyuan County People's Hospital in Henan Province, Department of Neurosurgery, Xinxiang, China*

Corresponding Author: Jing YANG / E-mail: qingyangcn@126.com

ABSTRACT

AIM: To explore the effect of early enteral (EN) and parenteral nutritional (PN) support on head-injured patients after craniocerebral surgery.

MATERIAL and METHODS: We randomly divided 120 head trauma patients into two groups: those receiving EN and those receiving PN support (60 patients each). Physiological and biochemical indices, monitoring time and cost, and the incidence of complications were compared between the two groups.

RESULTS: More patients presented with complications in the PN than the EN group, and this difference was statistically significant (P <0.05). One week after surgery, albumin (ALB), alanine aminotransferase (ALT), and blood glucose (GLU) levels were 39.6 ± 3.3 U/L, 51.4 ± 5.6 U/L, and 9.6 ± 5.2 mmol/L, respectively, in the EN group, and monitoring time and cost were 4.0 ± 1.2 days and 1.2 ± 1.0 thousand yuan, respectively. In the PN group, ALB, ALT, and GLU levels were 34.3 ± 3.4 U/L, 65.5 ± 6.1 U/L, and 15.1 ± 4.0 mmol/L, respectively, and monitoring time and cost were 6.2 ± 1.5 days and 1.8 ± 2.0 thousand yuan, respectively. We detected significant differences between the two groups (P <0.05).

CONCLUSION: Early EN support is superior to PN support in head-injured patients after craniocerebral surgery.

KEYWORDS: Craniocerebral surgery, Enteral nutrition, Parenteral nutrition

ÖZ

AMAÇ: Kafa travmalı kraniyoserebral cerrahi sonrasında hastalarda erken enteral (EN) ve parenteral beslenme (PN) desteğinin etkisini inceleme.

YÖNTEM ve GEREÇLER: Kafa travması geçiren 120 hasta, EN desteği alanlar ve PN desteği alanlar olarak rastgele eşit iki gruba bölündü. Fizyolojik ve biyokimyasal indeksler, izleme süresi ve maliyeti, ve komplikasyon insidansı iki grup arasında karşılaştırıldı.

BULGULAR: PN grubunda EN grubuna göre daha fazla hastada komplikasyon görüldü ve bu durum istatistiksel olarak önemliydi (p<0,05). Cerrahiden bir hafta sonra, albümin (ALB), alanin aminotransferaz (ALT) ve kan glukozu (GLU) seviyeleri EN grubunda sırasıyla 39,6 ± 3,3 U/L, 51,4 ± 5,6 U/L ve 9,6 ± 5,2 mmol/L olup izleme süresi ve maliyeti sırasıyla 4,0 ± 1,2 gün ve 1,2 ± 1,0 bin Yuan şeklindeydi. PN grubunda, ALB, ALT, ve GLU seviyeleri sırasıyla 34,3 ± 3,4 U/L; 65,5 ± 6,1 U/L ve 15,1 ± 4,0 mmol/L olup izleme süresi ve maliyeti sırasıyla 6,2 ± 1,5 gün ve 1,8 ± 2,0 bin Yuan şeklindeydi. İki grup arasında önemli farklar saptandı (p<0,05).

SONUÇ: Kafa travmalı hastalarda kraniyoserebral cerrahi sonrasında erken EN desteği PN'ye üstündür.

ANAHTAR SÖZCÜKLER: Kraniyoserebral cerrahi, Enteral beslenme, Parenteral beslenme

INTRODUCTION

Head trauma patients typically suffer from severe consciousness disorder and dysphagia after surgery. This directly affects nutritional intake (17), can result in malnutrition, and can cause a variety of complications, including death (16). Therefore, in clinical practice nutritional support is being increasingly used. Effective nutritional support can accelerate patient recovery and reduce complications (2). Two methods of supportive nutritional care exist: enteral nutritional (EN) support (3), and parenteral nutritional (PN) support (8). Our study evaluated which method improves the patients' outcomes. We conducted a retrospective analysis of 120 randomly selected patients for from January to December 2012. Our data indicate that EN support was superior to PN support.

MATERIAL and METHODS

Patients

We randomly divided 120 head trauma patients into two groups: those receiving EN and those receiving PN support (60 patients in each group). All patients were administered supportive nutrition for 1 month starting 48 h after surgery. The EN group included 33 men and 27 women with a mean age of 52.3 ± 2.5 years (range 43–72 years), and the PN group included 31 men and 29 women with a mean age of 53.1 ± 3.7 years (range 45–73 years). The Nutritional Risk Screening (NRS 2002) was used to score the patients as 0–6, based on whether their nutritional risk were absent, mild, moderate, or severe. Patients with a total score of ≥3 were classified as nutritionally at risk and thus as requiring nutritional support. This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of Zhengzhou University. Written informed consent was obtained from all participants.

Nutritional Support

Enteral nutritional support group

A nasogastric tube was placed into the patients' stomachs before or after surgery, and nutritional support was initiated 48 h after brain surgery. A total of 45 g of full nutrients with fiber were added to 170 mL water at the first time (total volume 200 mL). Patients were fed 6–7 times daily by nasal feeding. If the patients had poor gastrointestinal function, digestible nutrient agents such as amino acids were used to feed the patients. Besides, according to physical condition, proper requirement was necessary for patients. Patients were required to raise their heads at an angle of about 30 degrees during EN feeding in case of bucking or pulmonary infection. If the patients' gastric juices exceeded 200 mL, nasal feeding was discontinued.

Parenteral nutritional support group

PN support was administered through a central venous catheter at a steady speed for 24 h starting 48 h after surgery. The nutritional fluid included glucose, fat milk, multi amino acids, vitamins, and trace elements. Central venous catheter feeding was replaced by nasal feeding 7–8 days after surgery.

The proportion of the non-protein calorie content (protein, fat, glucose) was identical in the two groups with the exception of nitrogen, which was 155:1 in the EN and PN support groups.

Enteral Nutrition Liquid Selection

As different patients had different needs (e.g., some patients were hyperglycemic whereas others experienced stress-related hyperglycemia), full nutrients of dietary fiber type were chosen for the patients. The selected diet was a comprehensive balanced diet and formulated according to the Dietary Reference Intake (DRI) standards (19). The main nutrients included in the diet are shown in Table I.

Statistical Analysis

Statistical analysis was performed using the SPSS 17.0 software. All data are presented as means ± standard errors of the mean (SEM). A Student's t-test was used to compare differences between the two groups. A P value <0.05 denoted a significant statistical difference.

RESULTS

Complications

In the EN group, 13 patients (21.7%) suffered from complications. These included pulmonary infection (3 cases), renal failure (2 cases), heart failure (2 cases), pressure sores (2 cases), stress ulcers (1 case), and constipation (3 cases). In contrast, 32 patients (53.3%) presented with complications in the PN group, including pulmonary infection (7 cases), renal failure (4 cases), heart failure (5 cases), pressure sores (5 cases), stress ulcers (6 cases), and constipation (5 cases). We found that more patients had complications in the PN than the EN group, and this difference was statistically significant (P <0.05).

Physiological and Biochemical Indices

The physiological and biochemical indices in two groups are shown in Table II. One week after surgery, albumin (ALB), alanine aminotransferase (ALT), and blood glucose (GLU) levels were 39.6 ± 3.3 U/L, 51.4 ± 5.6 U/L, and 9.6 ± 5.2 mmol/L, respectively, in the EN group and 34.3 ± 3.4 U/L, 65.5 ± 6.1 U/L, and 15.1 ± 4.0 mmol/L, respectively, in the PN group. ALB levels were significantly higher in the EN than the PN group (p<0.05), whereas ALT and GLU levels were significantly lower (p<0.05).

Monitoring Time and Cost

Monitoring time and cost after surgery were 4.0 ± 1.2 days and 1.2 ± 1.0 thousand yuan, respectively, in the EN group and 6.2 ± 1.5 days and 1.8 ± 2.0 thousand yuan, respectively, in the PN group (Table III). The monitoring time in the EN group was significantly shorter in the EN than the PN group (p<0.05), and the cost was significantly lower (p<0.05).

Table I: Composition and Content of Enteral Nutrition Liquid

Nutrients	Unit	Content (per 100g)
Calories	kcal	412
Protein	g	18.0
Fat	g	12.6
Glutamine	g	02.0
Carbohydrate	g	59.0
Dietary fiber	g	5.0
Vitamin A	ug	178
Vitamin D	ug	1.1
Vitamin E	mg	3.0
Vitamin B1	mg	0.32
Vitamin B2	mg	0.32
Vitamin B6	mg	0.32
Vitamin C	mg	24.0
Folic acid	ug	90
Nicotinic acid	mg	3.20
Ca	mg	200
P	mg	100
Na	mg	440
K	mg	450
Zn	mg	2.00
Fe	mg	6.0
Cr	ug	10.0

Table II: Physiological and Biochemical Indices in Two Groups

Groups	ALB (U/L)	ALT (U/L)	GLU (mmol/L)
EN	39.6±3.3	51.4±5.6	9.6±5.2
PN	34.3±3.4	65.5±6.1	15.1±4.0
p	< 0.05	< 0.05	< 0.05

Table III: Monitoring Time and Cost in Two Groups

Groups	Monitor time (days)	Cost (thousand Yuan)
EN	4.0±1.2	12.0±1.0
PN	6.2±1.5	18.0±2.0
p	< 0.05	< 0.05

DISCUSSION

After brain surgery, the metabolisms of various organs are changed in the stress state, resulting in an increase in carbohydrate utilization and fat hydrolysis. Moreover, proteolysis and urinary nitrogen excretion are increased, even happened to negative nitrogen balance (20). Furthermore, patients suffer from impaired unconsciousness and dysphagia after surgery, causing inadequate nutritional intake and energy. Inadequate nutrition, resulting in malnutrition, impairs the patients' immune functions, which can lead to an increase in infections and complications, including death (4). A recent study indicated that the intestinal tract plays a crucial role in stress associated with severe diseases (18). After severe traumatic stress, EN support can ensure the integrity of the intestine mucosal structure and function (1), decrease the incidence of enterogenic infection (13), and avoid the occurrence of intestinal mucosal nutritional damage caused by impaired immune function and decreased blood flow (14). PN support often causes complications in patients with metabolic disorders (12). It has been demonstrated that EN support was better for head trauma patients after surgery (16). The major purpose of early EN support is to provide energy to patients after brain surgery to protect their cells' normal metabolic function. Early EN support can change disease prognosis and decrease the incidence of complications to improve survival rates. Patients undergoing brain surgery were shown to suffer from impaired consciousness and nutritional deficiency and presented with complications such as pulmonary infection, organs failure, or stress ulcers (10). Our results indicate that early EN support improved the patients' nutritional status. EN is similar to the physiological process (5), reduces liver and renal damage, prevents bacterial infection in the intestinal tract (11), increases ALB, and decreases ALT and GLU levels. This process improves immune function and reduces the incidence of complications such as pulmonary infection, organ failure, and pressure sores. It can promote rapid postoperative recovery, with decreased monitoring time and cost. Thus, EN is superior to PN support (6).

Head trauma patients after surgery have been shown to have weak gastrointestinal function and significantly looser cardiac sphincters than other trauma patients (21). EN support is typically initiated 48 h after surgery, meaning that some patients might suffer from stress-related hyperglycemia (15). Thus, full nutrients of dietary fiber type were properly chosen. First, little fiber was taken in by patients, and the nutritional intake doses were then gradually increased to physical doses (7). Glutamine was added to the diet to protect the gastric mucosa and promote defecation (9). In particular, some patients required not only EN but also PN support to ensure that adequate nutrition was provided for early head-injured patients after surgery.

REFERENCES

1. August DA, Huhmann MB: A.S.P.E.N Clinical guidelines: Nutrition support therapy during adult anticancer treatment and in hemapoietic cell transplantation. JPEN 33:472-500, 2009
2. Bengmark S, Jeppsson B: Gastrointestinal surface protection and mucosa reconditioning. JPEN 19: 410, 1995
3. Bowling TE: Enteral nutrition. Hosp Med 65: 712-716, 2004
4. Brun J, Gray DA: Targeting the ubiquitin proteasome pathway for the treatment of septic shock in patients. Crit Care 13: 311, 2009
5. Fearon KC, Luff R: The nutritional management of surgical patients: Enhanced recovery after surgery. Proc Nutr Soc 62: 807-811, 2003
6. Gabor S, Renner H, Matzi V, Ratzenhofer B, Lindenmann J, Sankin O, Pinter H, Maier A, Smolle J, Smolle-Jüttner FM: Early feeding compared with parenteral nutrition after oesophageal or oesophagastric resection and reconstruction. Br J Nutr 93: 509-513, 2005
7. Gatt M, MacFie J: Randomized clinical trial of the impact of early enteral feeding on postoperative ileus and recovery. Br J Surg 94: 555-561, 2007
8. Giovannini I, Giuliante F, Chiarla C, Ardito F, Vellone M, Nuzzo G: Non-surgical management of a lymphatic fistula, after laparoscopic colorectal surgery, with total parenteral nutrition, octreotide, and somatostatin. Nutrition 21:1065-1067, 2005
9. Han T, Li XL, Cai DL, Zhong Y, Geng SS: Effects of glutamine-supplemented enteral or parenteral nutrition on apoptosis of intestinal mucosal cells in rats with severe acute pancreatitis. Eur Rev Med Pharmacol Sci 17: 1529-1352, 2013

10. Honda M, Sase S, Yokota K, Ichibayashi R, Yoshihara K, Masuda H, Uekusa H, Nomoto J, Sugo N, Kishi T, Seiki Y: Early cerebral circulation disturbance in patients suffering from different types of severe traumatic brain injury: A xenon CT and perfusion CT study. Acta Neurochir Suppl 118: 259-263, 2013
11. Li JY, Yu T, Chen GC, Yuan YH, Zhong W, Zhao LN, Chen QK: Enteral nutrition within 48 hours of admission improves clinical outcomes of acute pancreatitis by reducing complications: A meta-analysis. PLoS One 8: e64926, 2013
12. Mesquita J, Varela A, Medina JL: Trauma and the endocrine system. Endocrinol Nutr 57: 492-499, 2010
13. Mulvey MA, Schilling JD, Martinez JJ, Hultgren SJ: From the cover: Bad bugs and beleaguered bladders-Interplay between uropathogenic Escherichiacoli and innate host defenses. Proc Natl Acad Sci USA 97: 8829-8835, 2000
14. Mulvey SA, Hultgren SG: Cell biology: Bacterial spelunkers. Science 289: 732-733, 2000
15. Olveira G, García-Luna PP, Pereira JL, Rebollo I, García-Almeida JM, Serrano P, Irles JA, Muñoz-Aguilar A, Molina MJ, Tapia MJ: Recommendations of the GARIN group for managing non-critically ill patients with diabetes or stress hyperglycaemia and artificial nutrition. Nutr Hosp 27: 1837-1849, 2012
16. Sigalet DL, Mackenzie SL, Hameed SM: Enteral nutrition and mucosal immunity: Implications for feeding strategies in surgery and trauma. Can J Surg 47: 109-116, 2004
17. Stelling H, Graham L, Mitchell P: Does cranioplasty following decompressive craniectomy improve consciousness. Br J Neurosurg 25: 407-409, 2011
18. van Hall G: Cytokines: Muscle protein and amino acid metabolism. Curr Opin Clin Nutr Metab Care 15: 85-91, 2012
19. Wang ZJ, Zheng Y, Yang XQ: Dietary fiber and constipation. Chin J Clin Oncology 35: 174-175, 2007
20. Wijnands KA, Brink PR, Weijers PH, Dejong CH, Poeze M: Impaired fracture healing associated with amino acid disturbances. Am J Clin Nutr 95: 1270-1277, 2012
21. Zaghiyan K, Felder S, Ovsepyan G, Murrell Z, Sokol T, Moore B, Fleshner P: A prospective randomized controlled trial of sugared chewing gum on gastrointestinal recovery after major colorectal surgery in patients managed with early enteral feeding. Dis Colon Rectum 56: 328-335, 2013