Original Article

A survey of the enteral nutrition practices in patients with neurological disorders in the tertiary hospitals of China

Ying-Ying Su MS[1], Dai-Quan Gao MS[1], Xiao-Yan Zeng MS[1], Rui-Juan Sha BSc[2], Xiao-Yuan Niu BSc[3], Chang-Qing Wang BSc[4], Dong Zhou MD[5], Wen Jiang MD[6], Fang Cui MD[7], Yi Yang MD[8], Su-Yue Pan MD[9], Xu Zhang BSc[10], Lian-Di Li BSc[11], Liang Gao MD[12], Bin Peng MD[13], Chun-Long Zhong MD[14], Zhen-Chuan Liu BSc[15], Li-Hong Li MD[16], Hong Tan BSc[17], Pei-Yuan Lv MD[18]

[1]*Xuanwu Hospital, Capital Medical University, Beijing, China*
[2]*Nangjing Brain Hospital Affiliated to Nanjing Medical University, Nanjing, China*
[3]*First Hospital of Shanxi Medical University, Shanxi, China*
[4]*First Hospital of Anhui Medical University, Anhui, China*
[5]*West China Hospital, Sichuan, China*
[6]*Xijing Hospital, Xi'an, China*
[7]*The General Hospital of Chinese People's Liberation Army, Beijing, China*
[8]*Norman Bethune University of Medical Science, Changchun, China*
[9]*Nanfeng Hospital, Guangzhou, China*
[10]*The First Affiliated Hospital of Wenzhou Medical College, Wenzhou, China*
[11]*The Affiliated Hospital of Qingdao University, Qingdao, China*
[12]*Huashan Hospital, Shanghai, China*
[13]*Peking Union Medical College Hospital, Beijing, China*
[14]*Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China*
[15]*Linyi People's Hospital, Linyi, China*
[16]*Tangdu Hospital, Xi'an, China*
[17]*The First Hospital of Changsha, Changsha, China*
[18]*Hebei General Hospital, Shijiazhuang, China*

Background and Objectives: With the development of enteral nutrition in patients with neurological disorders in China, related guidelines were published in 2011. The Chinese Society for Parenteral and Enteral Nutrition conducted a survey to evaluate the status quo of enteral nutrition practices in these patients. **Methods and Study Design:** This multicenter prospective investigation was conducted from April 2012 to April 2013 and involved 18 tertiary hospitals in China. The survey using standardized questionnaires sought information about the basic protocols for enteral nutrition (devices and staffing) and specific information about patients with neurological conditions who received nutrition by way of enteral feeding. **Results:** In the 18 hospitals from 13 provinces, 83.3% patients were configured with an enteral nutrition infusion pump, 77.8% had a percutaneous endoscopic gastrostomy (PEG) device, and 88.9% had a clinical nutrition support group. Four hundred four patients participated in this survey (259 men, 145 women; mean age 61.3±14.7 years), 85.7% had suffered a stroke, 83.9% had impaired consciousness, and 98.0% had dysphagia. Of the 10 guidelines for enteral nutrition practices, setting the energy target, choosing the enteral nutrition tube, and monitoring the patient received unsatisfactory ratings were in poor compliance (56.2%, 30.0% and 38.9%, respectively); the remaining seven guidelines were in good compliance (each >75%). **Conclusion:** The survey suggested that configuration of the enteral nutritional devices and staffing was adequate in China's tertiary hospitals. However, some associated practices had not yet reached the desired levels of competency, indicating a need for this to be understood and for improved training.

Key Words: neurological disorders, enteral nutrition, practices, tertiary hospitals, survey

Corresponding Author: Dr Yingying Su, Department of Neuro-Intensive Care Unit Xuanwu Hospital, Capital Medical University. No. 45 Changchun Street, Xicheng District, Beijing, China.

Tel: 86 (10) 83198475; Fax: 010-83198475
Email: tangsuyingying@sina.com
Manuscript received 15 May 2015. Initial review completed and accepted 24 June 2015.
doi: 10.6133/apjcn.092015.20

INTRODUCTION

Nutritional support for patients with neurological disorders has rapidly advanced in China, especially after the publication of "Indications consensus of enteral nutrition in patients with neurological diseases" and "Practices consensus of enteral nutrition in patients with neurological diseases" in 2011.[1,2] These provided formalized information to Chinese neurologists about enteral nutrition support.[3] To promote nutritional support in patients with neurological disorders, the Chinese Medical Association asked the Nutritional Support Group in Neurological Disorders to conduct a survey in 2012 of patients with those disorders where nutrition was provided by means of enteral feeding devices. First, in the foremost tertiary hospitals of major Chinese cities, nutritional support for neurological patients was assessed to identify problems and improve practices among hospital staff. These units were geographically central and could promote enteral nutrition support more widely in patients with neurological disorders.

MATERIALS AND METHODS

Patients and setting

This study was a multicenter prospective research from April 2012 to April 2013 on the neurology departments of 18 hospitals, to which belonged the Nutritional Support Study Group of Chinese Medical Association. The survey comprised the following three parts: basic conditions of enteral nutrition support in patients with neurological disorders (device configuration and staffing), related information on patients receiving enteral nutrition support, and enteral nutrition practices on these patients.

Study protocols

Basic conditions of enteral nutrition support

The basic conditions of enteral nutrition support for patients with neurological disorders were height gauges, enteral feeding pump, a clinical nutritionist, weight measuring instruments (bed), the device configuration and staffing, an indirect calorimetry metabolic cart, the total number of beds in the neurology/neurological intensive care unit (NCU), an enteral nutrition support team (NST; physicians, nurses, clinical dietitian), and a percutaneous endoscopic gastrostomy/percutaneous endoscopic jejunostomy (PEG/PEJ) device.

Related patient information

For patients receiving enteral nutrition support, the related information comprised inclusion criteria, exclusion criteria, and basic patient data.

Inclusion criteria comprised acute NCU and general wards in which (7 d inside) patients with brain injuries with dysphagia and/or consciousness disorders; brain damage from stroke (cerebral infarction, cerebral haemorrhage, subarachnoid under haemorrhage), or traumatic brain injury (TBI) from two categories of diseases confirmed by CT/MR/DSA were treated. Dysphagia was confirmed using the Kubota water test (≥3 points) and consciousness was confirmed using the Glasgow Coma Scale (GCS) assessment method (≤12 points). Suspected eating disorders that could not be resolved within a short time (i.e., <7 d) were included. Patient ages were to be between 18 and 80 years.

Exclusion criteria comprised obviously unstable vital signs (excluding short-term unstable vital signs), such as respiratory frequency, respiratory amplitude, serious rhythm disturbances, PO_2 <60 mmHg, PCO_2 >80 mmHg; severe arrhythmia, BP <90/60 mmHg; serum lactate >3~4 mmol/L, or pH <7.2. Abnormal gastrointestinal function (not including transient gastrointestinal dysfunction) was indicated by frequent vomiting or diarrhea, acute gastric mucosal lesions associated with gastrointestinal bleeding (≥100 mL), acute complete or incomplete intestinal obstruction. Tube feedings time was <3 d. For patients with cancer and other diseases, the life expectancy was <3 months.

Basic patient data comprised age, sex, dyslipidemia, body mass, glucose levels, type of disease, brain injury site, abnormal serum protein, GCS, Kubota water test results, enteral nutrition time after gavage of 13 pneumonia content.

Implementation of enteral nutrition practices

To implement enteral nutrition practices the following 10 items must be determined: nutritious recipes, feeding monitoring, nutrition risk screening, energy supply target selection, nutrition infusion route, nutritional support start time, type of nutrition infusion, type of nutrition infusion hose, gastrointestinal intolerance and adjustment, and nutrition infusion stopping point the assessment.

Statistical analyses

The SSPS17.5 (SPSS Institute, Inc, Chicago, IL, USA) was used for data entry and analyses. Measurement data was given as $\overline{X} \pm S$; count data was given as a percentage.

RESULTS

Basic conditions

Within the 18 hospitals surveyed, NCUs were set up in 17 neurology or neurosurgery departments, which ranged from 9 to 600 beds, with 4 to 43 NCU beds. The average number of NCU beds accounted for 8.5% of the total beds. Of the 18 hospitals, only 1 department (5.6%) had an indirect calorimetry metabolic cart, 7 (38.9%) had a height meter, 15 (83.3%) had the required number of enteral

Table 1. Equipment and staffing on enteral nutrition support in patients with neurological disease

Items	Statistics
Average number of beds in NCU/average number of beds in departments (%)	16/188 (8.5)
Height measuring instruments number (%)	7 (38.9)
Weight measuring instruments number (%)[†]	17 (100)
Indirect calorimetry instruments number (%)	1 (5.6)
Enteral nutrition infusion pumps number (%)	15 (83.3)
Clinical nutritionists number (%)	15 (83.3)
Nutrition support teams number (%)[‡]	16 (88.9)
PEG/PEJ technology (%)[§]	14 (77.8)

[†]Weight measuring instruments include: vertical weight measuring instrument or weight measurement bed (ambulatory patients).
[‡]Nutrition support team: including physicians, nurses, clinical dietitian or clinical pharmacist.
[§]PEG/PEJ Technology: percutaneous endoscopic gastrostomy or percutaneous endoscopic intestinal fistula.

Table 2. Basic information about enteral nutrition in patients with neurological disease

Items	Statistics
Age	
Years (mean)	19~93 (61.3±14.7)
<65 (numbers/%)	213 (52.7)
≥65 (numbers/%)	191 (47.3)
Sex (numbers/%)	
Men	259 (64.1)
Women	145 (35.9)
Categories (numbers/%)	
Cerebral infarction	204 (50.5)
Intracerebral haemorrhage	126 (31.2)
Subarachnoid haemorrhage	16 (4.0)
Traumatic brain Injury	58 (14.3)
Location of brain injury (numbers/ %)	
Hemisphere	261 (64.6)
Brainstem or cerebellum	78 (19.3)
Subarachnoid	30 (7.4)
Multisite in	35 (8.7)
Diabetes (numbers/%)	95 (23.5)
Hyperglycaemia (fasting blood sugar >7 mmol/L) (number /%)	168 (41.6)
Dyslipidemia (numbers/%)	98 (24.3)
Hypercholesterolemia (>5.72 mmol/L)	36 (8.9)
Hypocholesterolemia (<3.24 mmol/L)	62 (15.3)
Hypertriglyceridemia (>2.25 mmol/L)	57 (14.1)
Hypotriglyceridemia (<0.45 mmol/L)	9 (2.2)
Low serum albumin (numbers/%)	180 (44.6)
Low serum prealbumin (<0.17 g/L)†	119/348 (34.2)
Hypoalbuminemia (<35 g/L)	120 (29.7)
Anaemia (male <120 g/L, female <110 g/L) (number/%)	94 (23.3)
Weight (kg)	
BMI ($\overline{X} \pm S$)	23.6±3.06
Normal (BMI=18.5-24) (numbers/%)	219 (54.2)
Undernutrition (BMI <18.5) (numbers/%)	16 (4.0)
Overnutrition or obesity (BMI >24) (numbers/%)	169 (41.8)
Kubota water test (numbers/%)‡	
<3 points	8 (2.0)
≥3 points	396 (98.0)
GCS (numbers/%)	
>12 (points)	65 (16.1)
≤12 (points)	339 (83.9)
Start time of enteral nutrition (d, $\overline{X} \pm S$)	
Time after onset (d)	4.28±7.03
During time of enteral nutrition (d)	32.8±37.4
New onset of pneumonia after enteral nutrition (numbers/%)	120 (29.7)

†A few of hospitals can not detect serum prealbumin.
‡Coma, convulsions, hyperactivity, endotracheal intubation or tracheostomy patients at high risk, such as drinking water tests included Kubota water test ≥3 points.

nutrition infusion pumps, 16 (88.9%) had a clinical NST, and 14 (77.8%) had a PEG device (Table 1).

Enteral nutrition

Patient survey units were provided throughout China in Beijing, Shanghai, Guangzhou, Jiangsu, Shanxi, Anhui, Sichuan, Shaanxi, Jilin, Zhejiang, Shandong, Hebei, and Hunan for a total of 13 provinces and autonomous regions, 18 hospitals, and 404 cases of adult patients. Of these patients, 52.7% were <65 years old and more, 64.1% were male, 85.7% suffered from a stroke, and 64.6% suffered from damage to the cerebral hemispheres and more. Of the patients hospitalized, 46.6% suffered from high blood sugar, 24.3% from dyslipidemia, 44.6% from low serum albumin, and 41.8% from obesity or were overweight and had other metabolic anomalies. Most patients were admitted with impaired consciousness (GCS ≤12, 83.9%) and/or dysphagia (Kubota water test ≥3, 98%). All patients were within an average onset of 5 d of enteral tube feedings, and an average duration of >30 d. Of the total patients, 29.7% developed pneumonia after the tube feedings (Table 2).

Implementation of enteral nutrition practices

Of the 10 enteral nutrition practices, nutritious recipes, nutrition risk screening, feeding intolerance adjustments, nutrition infusion route selection, nutritional support start time, nutrition infusion pipeline options, and nutrition infusion stopping point (Table 3, Figure 1) were assessed as having a correct implementation rate of 77-100%; while nutrition infusion, energy supply target, and infusion process monitoring had a low implementation rate of 38.9, 56.2, and 30.0, respectively). In 37.1%, the feeding processes resulted in varying degrees of gastrointestinal

Table 3. Enteral nutrition questionnaire on the implementation of NS practices

Items	Qualified rate		
	Numbers (n=404)	NCU (n=267)	General ward (n=137)
Nutritional risk screening (numbers/%)	380 (94.1)	253 (94.8)	127 (92.7)
Caloric supply target (numbers/%)	227 (56.2)	166 (62.2)	61 (44.5)
Choosing of NS route (numbers/%)	311 (77.0)	184 (68.9)	127 (92.7)
Start time of NS (≤7 d, numbers/%)	359 (88.9)	246 (92.1)	113 (82.5)
Choosing of EN formula (numbers/%)	334 (82.7)	221 (82.8)	113 (82.5)
Choosing of EN pipeline (numbers/%)	404 (100)	267 (100)	137 (100)
Infusion process of EN (numbers/%)	121 (30)	117 (42.2)	4 (3.1)
Head of bed elevation ≥30°	377 (93.3)	244 (91.4)	133 (97.1)
Capacity control of EN	259 (64.1)	215 (80.5)	44 (32.1)
Speed control of EN	221 (54.7)	204 (76.4)	17 (12.4)
Pipeline rinse with warm water	258 (63.9)	170 (63.7)	88 (64.2)
Monitoring of enteral nutrition process (numbers/%)	158 (39.1)	136 (50.9)	22 (16.1)
Weight	379 (93.8)	249 (93.3)	130 (94.9)
Blood glucose	311 (77)	221 (82.8)	90 (65.7)
Lipids	237 (58.7)	181 (67.8)	56 (40.9)
Albumine	324 (80.2)	236 (88.4)	88 (64.2)
Intake and output	305 (75.5)	258 (96.7)	47 (34.3)
Serum electrolyes	320 (79.2)	223 (83.5)	97 (70.8)
Gastrointestinal symptoms	404 (100)	267 (100)	137 (100)
Depth of feeding tube	382 (94.6)	248 (92.9)	134 (97.8)
Gastric residual	404 (100)	267 (100)	137 (100)
Adjustments of gastrointestinal intolerance (numbers/%)			
Total intolerance rate	150 (37.1)	113 (42.3)	37 (27)
Regulation rate	129 (86)	92 (81.4)	37 (100)
Incidence of abdominal distension	15 (3.7)	11 (4.1)	4 (2.9)
Regulation rate	11 (73.3)	7 (63.6)	4 (100)
Incidence of diarrhea	52 (12.9)	44 (16.5)	8 (5.8)
Regulation rate	37 (71.2)	30 (68.2)	7 (87.5)
Incidence of constipation	65 (16.1)	41 (15.4)	24 (17.5)
Regulation rate	59 (90.7)	35 (85.4)	24 (100)
Incidence of gastrointestinal bleeding	8 (2.0)	7 (2.6)	1 (0.7)
Regulation rate	8 (100)	7 (100)	1 (100)
Incidence of gastric retention	48 (11.9)	46 (17.2)	2 (1.5)
Regulation rate	37 (77.1)	36 (78.3)	1 (50)
Stopping of EN (numbers/%)	358 (88.6)	231 (86.5)	127 (92.7)

NS: nutrition support; EN: enteral nutrition.

intolerance, but most (86.0%) were resolved with feeding adjustments (Table 3, Figure 2). Gastrointestinal intolerance occurred because of dominant aspiration in six patients, comprising two cases in patients from injection of a nutrient solution (1.6% of 118 patients) and four cases from the nutrient solution infusion (1.3% of 286 patients); three patients suffocated, two from the nutrient solution injection (1.6%) and one from the nutrient solution injection pump (0.3%).

DISCUSSION

The survey was given to the neurology departments to which belonged the units of a nutritional support study group of the Chinese Medical Association. The study aimed to evaluate the status quo of clinical nutrition and nutritional practices, and to make these units available for standardized training in enteral nutrition to help local hospitals use the correct protocols in the implementation of enteral nutrition. Survey results showed that other than the need for an indirect calorimetry metabolic cart, most of the enteral nutrition equipment and staffing was satisfactory. Of the 10 enteral nutrition practice guidelines, seven showed satisfactory results. The results were unsatisfactory for the energy supply target completion, monitoring the feeding process, and the feeding completion time of two. The problems exposed by the study group will be used to strengthen the training of staff for future patients.

The survey focused on the incidence and mortality of neurological disorders, the disability rate from stroke,[4] and TBI from two categories of diseases. According to 2012 data provided by the China Health Yearbook, cerebrovascular disease is the second cause of death for Chinese residents.[5] TBI deaths accounted for 85% of the total number of brain trauma cases with an increasing trend.[6] Once a patient suffers a severe brain injury, metabolic demands change rapidly. Increases in blood glucose, decreases in serum albumin, and decreases in blood lipids are the most representative metabolic changes.[6] Similar to findings in previous studies of stroke and TBI, 40.0 and 17.4% of patients, respectively, had elevated blood glucose,[7,8] 19.0 and 31.1%, respectively, had hypoalbuminemia,[9,10] and all were associated with a poor prognosis ($p<0.01$).[11] In addition, because of the disturbance of consciousness, 24.3-52.6% of stroke patients and 50.0% of TBI patients had short-term dysphagia (<4 weeks) and/or received long-term (>4 weeks) enteral nutrition.[12] Therefore, neurologists must focus on stroke and TBI

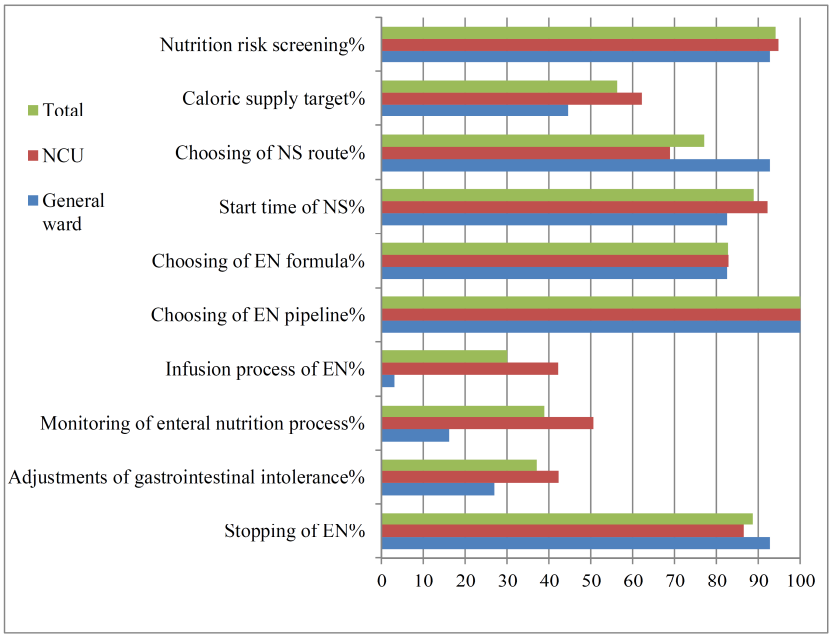

Figure 1. Correct implementation of enteral nutrition practices

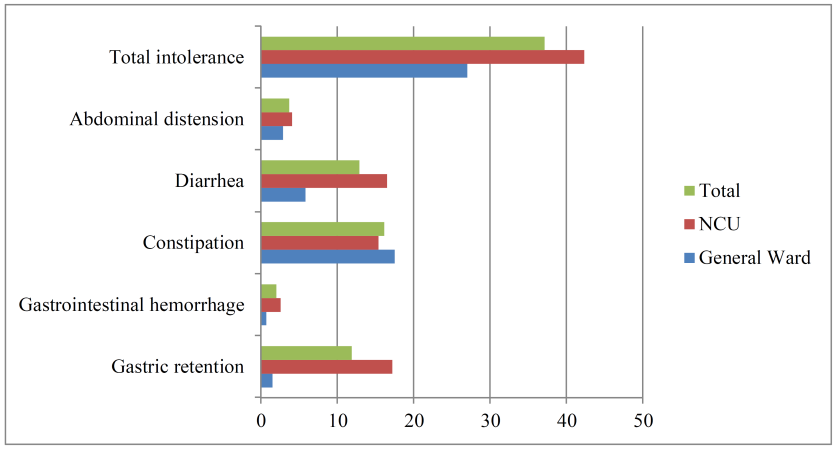

Figure 2. Enteral nutrition intolerance

patients to reduce mortality, reduce complications and improve neurological function by strengthening clinical nutrition support.

The smooth implementation of enteral nutrition protocols relies on good basic equipment configuration and staffing. The survey of enteral nutrition infusion pump configuration reveals that there are not enough available (in 83.3% hospitals). Injection of a nutrient solution using an enteral nutrition infusion pump has become routine for patients who are unconscious, have swallowing disorders, or have gastrointestinal motility disorders. A prerequisite to pipeline feeding is to assess its value and relationship to the risk of aspiration or choking, and determine gastrointestinal tolerability and nutrition goals. The survey showed that the bolus aspiration rate (1.6%) was higher than that of the pump injection (1.3%), and asphyxia (1.6%) was five times higher than that in infusion (0.3%). Shang[13] forward-looking crossover study showed that 4.76, 0, 0, and 0%, respectively, of patients who had pumping nutrient solution had regurgitation, vomiting, aspiration, and pneumonia, but that 34.52, 13.09, 11.9, and 10.71%, respectively, of those who had gravity infusion had these same reactions (p<0.05). Obviously, pumping nutrient solution depends on patient consciousness, swallowing disorders, and gastrointestinal motility disorders, and continued tube feedings provide security and reduce the risk of adverse events.

The survey showed that equipment to measure indirect energy needs (calorimetry metabolic cart) was the most lacking. There are reports in the literature that different parts, different metabolic rates, and the impact of different levels of nerve injury on the body at different times, as measured by the indirect measurement of the energy metabolism of the actual resting energy expenditure, could be calculated (Harris–Benedict formula) at 100 to 200% of accuracy in extreme cases and could reach 300%;[14] therefore, the predictive value of energy metabolism might underestimate the patient's actual energy consumption. In addition, in some special cases, such as hypothermia and/or the administration of sedatives/muscle relaxants, the actual energy consumption is only 87.2±10% of the predicted value so the patient's energy consumption could be overestimated.[15] In China, the equipment for the measurement of indirect energy metab-

olism is clearly not adequate. In patients with severe metabolic changes to complex physiological and pathological functions and in the treatment with complex measures to reduce volatility and bring the body back to normal, accurate energy measurements or calculations are very important.

The survey of the clinical NST is promising, and ~92.8% of neurology departments are staffed with an NST. NST has improved the standardization and sustainability of health care by being composed of physicians, nurses, clinical dietitians, and clinical pharmacist to provide nutritional support organizational security. In spite of its late start, China's NST program compares with that of other countries,[16] but the number and distribution of rapid growth and expansion of the scope.

The survey of enteral nutrition to support implementation of standardized health care is more important, because enteral nutrition is a systematic process, particularly with neurological disorders or consciousness and swallowing disorders. Establishing a feeding tube timeline from start to finish takes a long time and can encounter several problems. Ten enteral nutrition practices were identified in this survey. Of them, implementation of correct nutrition infusion (pass rate, 25.7%) and monitoring the nutrition infusion process (pass rate, 38.7%) received unsatisfactory scores. Also surveyed were nutrition infusion with the head elevated ≥30°, enteral feeding tolerance, and the capacity to feed less or more and the associated feeding speeds. Patients with severe brain injury were less tolerant of enteral feeding (>50%) abdominal distension, nausea, vomiting, and gastric retention. Gastric retention, which is the most common complaint because of its involvement with the central and autonomic nervous systems and because it is related to vomiting,[17] also raised concerns about improper feeding tubes, including supine gavage infusion, excessive food, and rapid infusion rate.[18] The investigation showed that feeding intolerance was 36.2%, lower than (46%)[19] that reported in other literature data, but with more standardized feeding protocols using nutrition infusion tubes, intolerance might be further reduced. Monitoring the feeding process involves tracking nutritional and metabolic changes (weight, blood glucose, serum proteins, lipid levels), a constant internal environment (fluid intake and output, serum electrolytes, renal function), gastrointestinal safety (bloating, diarrhea, constipation, gastrointestinal bleeding, gastric retention), tube feeding safety (feeding tube depth), and two other aspects in the course of the ability to detect and resolve problems and reach the ultimate goal of highly satisfactory protocols and patient responses. The guidelines for enteral nutrition in critically ill patients of U.S. in 2009 particularly emphasize the importance of strengthening the monitoring of nutrition infusion process.[20] The survey showed that although classified projects qualified rate is not low (58.7-100%), but to do all the monitoring of qualified projects (38.9%) is not easy; therefore, monitoring specifications need to be strengthened and improved to refine systematically manage enteral nutrition in China.

Conclusions

The survey examined the status quo of nutritional support in patients with the two major neurological conditions, stroke and TBI, in tertiary hospitals in China's large cities. While configuration of the enteral nutritional device and staffing were satisfactory in these hospitals, some protocols did not reach acceptable standards, necessitating more analysis and training.

AUTHOR DISCLOSURES

The authors have no conflicts of interest to declare.

REFERENCES

1. Chinese Society for Parenteral and Enteral Nutrition. Consensus of enteral nutrition support indications for neurological diseases (2011 edition). Chinese Journal of Neurology. 2011;44:785-7. (In Chinese)
2. Chinese Society for Parenteral and Enteral Nutrition. Consensus of enteral nutrition practice criterion for neurological diseases (2011 edition). Chinese Journal of Neurology. 2011;44:787-91. (In Chinese)
3. Su YY, Gao DQ, Ma LS, Feng HH, Wang L, Zhang YZ et al. Compliance and effectiveness of enteral nutrition practices for neurological diseases. Chinese Journal of Neurology. 2012;45:843-8. (In Chinese)
4. FOOD Trial Collaboration. Poor nutritional status on admission predicts poor outcomes after stroke: observational data from the FOOD trial. Stroke. 2003;34:1450-6. doi: 10.1161/01.STR.0000074037.49197.8C.
5. Ministry of Health of the People's Republic of China. China Health Statistics Yearbook 2012. Peking: Peking Union Medical College Press; 2012.
6. Zhang S, Zhi DS. Our efforts to improve trauma care system and brain monitoring technology. Journal of Chinese Neurosurgery. 2005;21:195-6. (In Chinese)
7. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM et al. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American heart association/American stroke association. Stroke. 2013; 44:870-947. doi: 10.1161/STR.0b013e318284056a.
8. Laird AM, Miller PR, Kilgo PD, Meredith JW, Chang MC. Relationship of early hyperglycemia to mortality in trauma patients. J Trauma. 2004;56:1058-62. doi: 10.1097/01.TA.0000123267.39011.9F.
9. Schirmer-Mikalsen K, Vik A, Gisvold SE, Skandsen T, Hynne H, Klepstad P. Severe head injury: control of physiological variables, organ failure and complications in the intensive care unit. Acta Anaesthesiol Scand. 2007; 51:1194-201. doi: 10.1111/j.1399-6576.2007.01372.x.
10. Gariballa SE, Parker SG, Taub N, Castleden M. Nutritional status of hospitalized acute stroke patients. Br J Nutr. 1998; 79:481-7. doi: 10.1079/BJN19980085.
11. Babu MS, Kaul S, Dadheech S, Rajeshwar K, Jyothy A, Munshi A. Serum albumin levels in ischemic stroke and its subtypes: correlation with clinical outcome. Nutrition. 2013; 29:872-5. doi: 10.1016/ j.nut.2012.12.015.
12. Foley NC, Martin RE, Salter KL, Teasell RW. A review of the relationship between dysphagia and malnutrition following stroke. J Rehabil Med. 2009;41:707-13. doi: 10.2340/16501977-0415.
13. Shang E, Geiger N, Sturm JW, Post S. Pump-assisted enteral nutrition can prevent aspiration in bedridden percutaneous endoscopic gastrostomy patients. JPEN J Parenter Enteral Nutr. 2004;28:180-3. doi: 10.1177/0148607104028003180.
14. Mehta NM, Bechard LJ, Leavitt K, Duggan C. Severe weight loss and hypermetabolic paroxysmal dysautonomia following hypoxic ischemic brain injury: the role of indirect calorimetry in the intensive care unit. JPEN J Parenter

Enteral Nutr. 2008;32:281-4. doi: 10.1177/0148607108316196.
15. Osuka A, Uno T, Nakanishi J, Hinokiyama H, Takahashi Y, Matsuoka T. Energy expenditure in patients with severe head injury: controlled normothermia with sedation and neuromuscular blockade. J Crit Care. 2013;28:218-9. doi: 10.1016/j.jcrc.2012.05.012.
16. Xia SM, Cai Wei, Tang QY. Nutritional Support Group: Birth operation and value. JPEN J Parenter Enteral Nutr. 2002;9:186-9.
17. Acosta EJ, Herrero MI, Conejero GR. Guidelines for specialized nutritional and metabolic support in the critically-ill patient. Update. Consensus of the Spanish Society of Intensive Care Medicine and Coronary Units-Spanish Society of Parenteral and Enteral Nutrition (SEMICYUC-SENPE): neurocritical patient. Med Intensiva. 2011;35(Suppl 1):77-80. doi: 10.1016/S0210-5691(11)70016-X.
18. McClave SA, DeMeo MT, DeLegge MH, DiSario JA, Heyland DK, Maloney JP et al. North American Summit on Aspiration in the Critically Ill Patient: consensus statement. JPEN J Parenter Enteral Nutr. 2002;26(6 Suppl):S80-5. doi: 10.1177/014860710202600613.
19. Mentec H, Dupont H, Bocchetti M, Cani P, Ponche F, Bleichner G. Upper digestive intolerance during enteral nutrition in critically ill patients: frequency, risk factors, and complications. Crit Care Med. 2001;29:1955-61. doi: 10.1097/00003246-200110000-00018.
20. McClave SA, Martindale RG, Vanek VW, McCarthy M, Roberts P, Taylor B, Ochoa JB, Napolitano L, Cresci G. Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). JPEN J Parenter Enteral Nutr. 2009;33:277-316. doi: 10.1177/0148607109335234.

Original Article

A survey of the enteral nutrition practices in patients with neurological disorders in the tertiary hospitals of China

Ying-Ying Su MS[1], Dai-Quan Gao MS[1], Xiao-Yan Zeng MS[1], Rui-Juan Sha BSc[2], Xiao-Yuan Niu BSc[3], Chang-Qing Wang BSc[4], Dong Zhou MD[5], Wen Jiang MD[6], Fang Cui MD[7], Yi Yang MD[8], Su-Yue Pan MD[9], Xu Zhang BSc[10], Lian-Di Li BSc[11], Liang Gao MD[12], Bin Peng MD[13], Chun-Long Zhong MD[14], Zhen-Chuan Liu BSc[15], Li-Hong Li MD[16], Hong Tan BSc[17], Pei-Yuan Lv MD[18]

[1]*Xuanwu Hospital, Capital Medical University, Beijing, China*
[2]*Nangjing Brain Hospital Affiliated to Nanjing Medical University, Nanjing, China*
[3]*First Hospital of Shanxi Medical University, Shanxi, China*
[4]*First Hospital of Anhui Medical University, Anhui, China*
[5]*West China Hospital, Sichuan, China*
[6]*Xijing Hospital, Xi'an, China*
[7]*The General Hospital of Chinese People's Liberation Army, Beijing, China*
[8]*Norman Bethune University of Medical Science, Changchun, China*
[9]*Nanfeng Hospital, Guangzhou, China*
[10]*The First Affiliated Hospital of Wenzhou Medical College, Wenzhou, China*
[11]*The Affiliated Hospital of Qingdao University, Qingdao, China*
[12]*Huashan Hospital, Shanghai, China*
[13]*Peking Union Medical College Hospital, Beijing, China*
[14]*Renji Hospital, Shanghai Jiao Tong University School of Medicine, Shanghai, China*
[15]*Linyi People's Hospital, Linyi, China*
[16]*Tangdu Hospital, Xi'an, China*
[17]*The First Hospital of Changsha, Changsha, China*
[18]*Hebei General Hospital, Shijiazhuang, China*

中国三甲医院神经疾病患者肠内营养支持操作规范调查

背景和目的：随着中国神经疾病营养支持工作的快速推进，相关指南已于2011 年发表和推广。中华医学会肠外肠内营养学分会神经疾病营养学组在中国大城市展开调查，以评估神经疾病营养支持工作的现状。**方法和研究设计：**本研究为多中心前瞻性调查研究。调查资料来自 2012 年 4 月至 2013 年 4 月中华医学会肠外肠内营养分会神经疾病营养支持学组成员单位的 18 家医院。内容包括：神经疾病肠内营养支持基本条件（设备配置与人员配备）、接受肠内营养支持患者相关信息。**结果：**18 家医院来自 13 个省市自治区，83.3%配置了肠内营养输注泵，77.8%具有经皮内镜下胃肠造瘘技术，88.9%配备临床营养支持小组。共调查 404 例成人患者（男性 259 人，女性 145 人；平均年龄为 61.3±14.7 岁），脑卒中占 85.7%，意识障碍占 83.9%，吞咽障碍占 98%。在具体操作过程中，能量供给目标、营养输注方式和营养输注过程监测共 3 项操作规范的正确执行率偏低（56.2%，30%和 38.9%）；而其余 7 项规范操作的正确执行率较高（均>75%）。**结论：**这项调查显示，中国三甲医院的肠内营养设备和人员配置是足够的。然而，一些相关的做法还没有达到所需的水平，提示该项工作需要进一步被理解和改进培训。

关键词：神经疾病、肠内营养支持、操作规范、三甲医院、调查