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Clinical Study

Impact of early enteral nutrition on short term prognosis after acute stroke

Tianheng Zheng [a], Xinpu Zhu [a], Huazheng Liang [a,b], Haixia Huang [a], Jiandao Yang [a], Shaoshi Wang [a,*]

[a] Department of Neurology, Branch of the People's First Hospital, 1878 North Sichuan Road, Hongkou District, Shanghai 200081, China
[b] Neuroscience Research Australia, Randwick, NSW, Australia

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ABSTRACT

We hypothesized that early enteral nutritional support would improve the short term prognosis of acute stroke patients with dysphagia, demonstrated by lower malnutrition rates, lower complication rates, and lower National Institutes of Health Stroke Scale (NIHSS) scores at 90 days post stroke. Nutrition support is an essential element in the care of stroke patients and many studies have investigated the effect of specific nutritional elements on stroke patients. However, few studies have looked at the impact of complete enteral nutrition on Chinese patients with acute stroke. To investigate this, we conducted a randomized controlled trial of 146 patients with acute stroke and dysphagia, among whom 75 were supported with nasogastric nutrition and 71 received family managed nutrition after randomization. Nutritional status, nosocomial infection and mortality rates were recorded on day 21 of hospitalization. Neurological deficits were evaluated by the NIHSS activities of daily living Barthel index (ADLBI) and the modified Rankin scale (mRS) and compared between the two groups. We found that the nasogastric nutrition group had a better nutritional status and reduced nosocomial infection and mortality rates after 21 days compared with patients in the family managed nutrition group. In addition, the nasogastric nutrition group showed a lower score on the NIHSS than the control group. However, the differences in the scores of the ADLBI and the 90 day mRS between the groups were not significant. Taken together, the present study shows that early enteral nutrition support improves the short term prognosis of acute stroke patients with dysphagia.

1. Introduction

Malnutrition is a potential complication during the rehabilitation of stroke patients. Its incidence varies from 6.1 to 62.0% among stroke patients due to the differences in methodologies and the time of evaluation of nutritional status [1]. It also increases the incidence of post stroke infection, recurrent stroke and mortality, resulting in a poor prognosis ([2]). It has been shown that the nutritional status of stroke patients is closely related to their long term clinical outcome [3]. Though a large number of studies have investigated the effect of specific nutrients on the recurrence of stroke such as vitamin B, folic acid ([4,5], antioxidants [6–8], and fat [9–12]), none have shown significant improvements in mortality and recurrence of stroke. There is no evidence to support the timing or choice of nutritional method which should be used in stroke patients. The present prospective study aimed to investigate the effect of early enteral nutrition on the short term outcomes of acute stroke patients by supplying all the necessary nutrients and comparing to patients whose nutrition was family managed.

2. Methods

2.1. Subjects

In this randomized controlled study, 146 acute stroke patients (including ischemic stroke and intracerebral hemorrhage) hospitalized during the period of July 2011 to December 2013 were included. Of these, 75 patients who were admitted to the comprehensive stroke unit were supported with nasogastric nutrition. Among them, 43 were men and the average age was 71.4 years ± standard deviation 9.3. The control group consisted of 71 patients who were admitted to the regular ward and received family managed nutrition. Among them, 42 were men and the average age was 71.8 years ± standard deviation 10.1. The distributions of stroke subtypes and baseline clinical characteristics in the two groups are presented in Table 1.

* Corresponding author. Tel.: +86 21 5666 3031.
E-mail address: wangshaoshi@126.com (S. Wang).

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Table 1
Baseline information of acute stroke patients

	Treatment group	Control group
Patients, n	75	71
Age, years (mean ± SD)	71.4 ± 9.3	71.8 ± 10.1
Male sex, n (%)	43 (57.3)	42 (59.2)
Type of stroke		
Hemorrhagic, n (%)	22 (29.4)	24 (33.8)
Ischemic, n (%)	49 (65.3)	45 (63.4)
Mixed stroke, n (%)	4 (5.3)	2 (2.8)
Co-morbidities		
Disturbance of consciousness, n (%)	25 (33.3)	21 (29.6)
Hypertension, n (%)	64 (85.3)	58 (81.7)
Diabetes, n (%)	29 (37.3)	25 (35.2)
Ischemic heart disease, n (%)	27 (38.7)	31 (43.7)
Past stroke, n (%)	27 (36.0)	23 (32.4)

SD = standard deviation.

The selection criteria included: (1) cerebral infarction, intracranial hemorrhage or both confirmed with a CT scan or MRI within 72 hours of onset; (2) all patients who met the diagnostic standard of the Fourth National Cerebrovascular Events Conference (Chinese Neuroscience Society and Chinese Neurosurgery Society); (3) patients who might have a medical history of stroke but no apparent neurological deficit remaining prior to the onset of the current stroke; (4) focal neurological signs and dysphagia. Exclusion criteria included transient ischemic attack, subarachnoid hemorrhage, severe endocrine or metabolic disorders, hematological disorders, malignancies, chronic lung and heart dysfunction, severe liver or kidney failure, stress ulcer of the digestive system, and those who died within a week of admission. Patients who received thrombolytic therapy were not included in the present study.

The two groups received similar pharmacological treatments. For hemorrhagic stroke patients, medications were used to reduce intracranial pressure (mannitol, furosemide), stabilize blood pressure and maintain optimal metabolism of neurons (monosialotetrahexosyl ganglioside). For ischemic stroke patients, antiplatelets, antithrombotic agents and statins were administered. Patients who were confirmed to have dysphagia were supported with nasogastric nutrition within 72 hours of admission and this lasted at least 10 days. Dysphagia refers to a difficulty in swallowing and Grade 3 or more in Kubota's drinking test (Kubota et al., 1982) or unconsciousness.

2.2. Nutrition regimen

The treatment group received either Nutrison fiber (Nutricia; Groupe Danone, Paris France), Swiss High (RAE; 4.18–6.27 kJ/ml), or a solution with high nutrition content made by nutritionists in our hospital and based on condition, body weight, and nutritional status. Energy requirements were in the range of 83.68–125.52 kJ/kg/day ($1kcal_{th} = 4.184$ kJ). These solutions were infused by gravity under the supervision of nurses with a starting speed of 40–60 ml/hour. If there were no adverse events such as reflux, diarrhea or flatulence the speed was adjusted to 100–125 ml/hour. The total volume for the first day was 500 ml followed by an increase of 500 ml/day until the requirement was met. The control group received regular food from their families which consisted of milk, soymilk, juice, vegetable juice, broth, congee and eggs. Nutritional status was measured with physical measurements and laboratory tests. These included the thickness of the triceps skinfold of the unparalyzed side (TSF), arm muscle circumference (AMC), hemoglobin (Hb), albumin (Alb) and triglyceride (TG). If TSF or AMC of the patient was 10% lower than the standard of the normal population and Alb lower than 35 g/l, the patient was considered to be malnourished [13].

2.3. Measurements

Two doctors, who were blinded to the treatment regimen, received training before the trial and started performing measurements after they reached a high inter-rater agreement. The measurements taken and time points were as follows:

1 Nutritional status and rate of malnutrition: calculated TSF, AMC, Hb, Alb, TG and the rate of malnutrition on the first, seventh, and twenty-first day of admission.
2 Nosocomial infection and mortality rates.
3 Neurological evaluation: National Institutes of Health Stroke Scale (NIHSS) [14], activities of daily living Barthel index (ADLBI) [15], and modified Rankin scale (mRS) [16] on the first and twenty-first day of admission.

2.4. Statistical analyses

SAS (version 6.12; SAS Institute Inc., Cary, NC, USA) was used to analyze the differences in indices between the two groups. Continuous data were presented as the mean ± standard deviation and compared by t-test. Categorical data were compared by the chi-squared test. Statistically significant differences were indicated by $p < 0.05$.

3. Results

3.1. Characteristics of subjects

In general, there were no significant differences in age, sex, type of stroke and past medical history between the two groups (Table 1).

3.2. Changes in nutritional status

There were no significant differences in nutritional indices on the first day of admission ($p > 0.05$). These indices decreased on the seventh day of admission compared to the first day, and AMC of the control group was significantly smaller than that of the treatment group (t-test 2.240; $p = 0.027$). These indices continued to decrease after 21 days of admission but there was a trend of increase in Hb and Alb in the treatment group. TSF (t-test 2.124; $p = 0.036$), AMC (t-test 3.161; $p = 0.002$), Hb (t-test 2.428; $p = 0.017$), Alb (t-test 2.554; $p = 0.012$), and TG (t-test 2.262; $p = 0.025$) of the treatment group were statistically significantly higher than those of the control group (Table 2).

3.3. Rate of malnutrition

The rate of malnutrition on the first day of admission was 17.3% in the treatment group (13/75) and 15.4% in the control group (11/71). There was no significant difference between the two groups ($p > 0.05$). This rate increased to 21.3% in the treatment group and 28.2% in the control group on the seventh day of admission. It continued to rise to 27.1% (19/70) in the treatment group and 48.3% (28/58) in the control group after 21 days (chi-squared 6.096; $p = 0.014$).

3.4. Nosocomial infection and mortality rates and the underlying causes of mortality

In the treatment group, 25 patients (33.3%) had infections of the lungs, digestive tract, urinary tract and decubitus. In comparison, 37 patients (52.1%) from the control group had these infections. The infection rate in the treatment group was significantly lower