

Original Article

Effect of acupuncture combined with spiral nasojejunal intubation on enteral nutrition in critically ill patients

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Abstract: Objective: To investigate the effect of the combination therapy of acupuncture and spiral nasojejunal tubes on enteral nutrition in critically ill patients. Methods: During the period from January 2014 to December 2016, 70 critically ill patients with nutritional disorders admitted to the intensive care units in Tianjin Academy of Traditional Chinese Medicine Affiliated Hospital were enrolled as subjects. They were subdivided into the experiment group and the control group in terms of the random number table. The patients in the control group received conventional blind insertion of spinal nasojejunal tubes, whereas those in the experiment group received acupuncture therapy following blind insertion of spinal nasojejunal tubes. Success of intubation, the velocity of propelling nasojejunal tubes in the gastrointestinal tract, the intubation-related complications as well as the changes in the nutrition predictors after intubation were compared between the two groups. Results: The rate of successful nasojejunal tube placement in the experiment group was remarkably higher than that in the control group ($P=0.019$). At 24 h after intubation, the proportions of patients with the tip of nasojejunal tubes reaching the pylorus, the superior and descending, the horizontal part and the ascending part of the duodenum and beyond were substantially different between the two groups (All $P=0.000$). Besides, the incidence of intubation-related complications including vomiting, aspiration and gastric retention was also markedly different (All $P=0.000$). The rates of intubation-associated complications, vomiting, aspiration and gastric retention respectively were strikingly different between the two groups (All $P=0.000$). When compared with the control group, the serum albumin and prealbumin levels of the patients in the experiment group were significantly higher after intubation (All $P<0.001$). Conclusion: Acupuncture-combined spiral nasojejunal tube placement promotes the rate of successful intubation, accelerates the velocity of propelling nasojejunal tubes, and improves the intubation-related complications and nutrition predictors, thereby enhancing the efficiency of enteral nutrition in critically ill patients.

Keywords: Acupuncture, spiral nasojejunal tube, enteral nutrition, critically ill

Introduction

Enteral nutrition refers to a technique for nutrition support which delivers nutrient substance and energy essential to metabolism of the body into the gastrointestinal tract by means of oral gavage and is one of the most common modes of nutrition support in critically ill patients [1-3]. Most critically ill patients manifest disorders in gastrointestinal motility including reflux, delay in emptying, so they are inclined to develop aspiration pneumonia. Reasonable nutrition support is characterized by enhanced synthesis of protein in the body, well-regulated immune function and metabolism, reduced aspiration and other complications, and improved survival

of critical ill patients [4, 5]. Currently, blind insertion of nasojejunal tubes, as one of the major routes of enteral nutrition, has the advantages of small injury, low price, low risk etc. Thus, it has been extensively used in clinic practice [6]. Although some technical advances have been made in blind insertion in recent years, the technique also brings about pain in patients, and its successful rate is unsatisfactory [7]. Therefore, how to improve the rate of successful nasojejunal tube placement and reduce the incidence of complications has become the focus of clinical nutritionists.

In traditional Chinese medicine, there is much experience in the treatment of gastrointestinal

Effect of acupuncture-combined spiral nasojejunal tubes

diseases, especially its unique advantage in promoting gastrointestinal motility by the acupuncture of specific acupoints in the human body [8, 9]. Several studies have demonstrated that acupuncture at Zusanli point significantly improves the frequency of gastrointestinal peristalsis [10, 11]. The current study was designed to integrate the advantages of traditional Chinese acupuncture into contemporary tube placement, by treating critically ill patients with enteral nutrition by blind intubation of nasojejunal tubes coupled with concomitant acupoint intervention, in hope of laying experimental basis for the selection of enteral nutrition approaches.

Materials and methods

Participants

From January 2014 to December 2016, 70 patients admitted to the intensive care units of Tianjin Academy of Traditional Chinese Medicine Affiliated Hospital were enrolled in this study. Patients older than 18 years old were eligible for inclusion if they were critically ill patients meeting the criteria for enteral nutrition, including those with coma or disorders of consciousness, had neither primary gastrointestinal disease nor pulmonary infection before placement of nasojejunal tubes. Patients were excluded if any of the following criteria were present: enteral nutrition contraindications including gastric ulcer, gastrointestinal absorption dysfunction, bleeding in the digestion tract or malignant tumor in the gastrointestinal tract, previous abdominal or nasopharynx surgery, severe liver and kidney dysfunction or no cooperation in the study. The patients were randomly subdivided into two groups: the experiment group (n=35) and the control group (n=35). This study obtained approval from the Hospital Ethics Committee and each patient or their family members offered written informed consent.

Treatment method

Tube placement was performed by appointed senior clinicians who had received trainings on enteral nutrition theories and intubation procedures regarding critically ill patients. Flocare spiral nasojejunal tubes (Nutricia, Holland) were used during the tube replacement. Patients in the control group were placed in a

semi-supine position, and then had both nasal cavities cleaned, the distance from the tip of the nose to subxyphoid and to the ear lobes was measured and the nasojejunal tubes labelled. The nasojejunal tube was slowly inserted from the nasal cavity, via the oral cavity, pharynx and esophagus into the stomach, till reaching the labelled site according to the blind insertion approach. The nasojejunal tube was confirmed to reach the stomach cardia by inflating the air into the stomach and hearing the sound of the air through the channel. After that, 100 ml of normal saline was injected into the stomach via the nasojejunal tube, which was propelled slowly by a clinician along with the gastrointestinal peristalsis. When the clinician felt with his or her hand that a breakthrough was made in forward propelling, it suggested that the nasojejunal tube had advanced into the duodenum through the pylorus region, and then the tube was delivered slowly. An immediate bedside imaging of the abdominal radiographs confirmed that the nasojejunal tube had reached below the Treitz ligament via the pylorus region, where the tube was fixed.

The patients in the experiment group received acupuncture in addition to conventional tube placement given to those in the control group. The locations of the acupoints including Zhongwan, Tianshu (double), Shousanli (double), Zusanli (double), Quchi (double), and Hegu (double) were confirmed according to *The National Criteria for locations of the Acupoints in People's Republic of China*. After conventional intubation and local skin disinfection, a filliform needle (Huatuobrand; 0.3 mm * 50 mm-60 mm; Suzhou Medical Supplies, China) was inserted vertically into the site (approximately 1 inch deep), with the depth of the needle depending on the needling sensation which was optimal when the muscle twitched. Acupuncture was performed once every 5 min for 30 min. After intubation, acupuncture was made once every 6 hours for 5 days.

Outcome measures

Rate of successful intubation: The success of intubation was assessed by the criteria that the spiral nasojejunal tube reached inside the intestine via the pylorus region within the first 24 h after intubation and enteral nutrition was available through the tube. The intubation failed if the spiral nasojejunal tube failed to get

Effect of acupuncture-combined spiral nasojejunal tubes

Table 1. Comparison of general data among the patients in the two groups

Variable	Male/ Female (n)	Age (year)	APACHEII score	Disease type (n)		
				HCH	ICI	TBI
Experiment	23/12	47.6±4.75	16.6±4.17	17	11	7
Control	25/10	50.8±6.05	17.2±4.82	18	9	8
t/ χ^2 value	3.024	5.176	1.134	2.412		
P value	0.417	0.178	0.763	0.657		

Note: HCH denotes hypertensive cerebral hemorrhage, ICI ischemic cerebral infarction, and TBI traumatic brain injury.

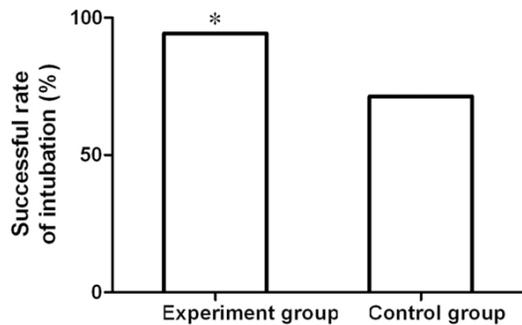


Figure 1. Comparison of the successful rate of intubation between the control group and the experimental group. Compared with the control group, *P<0.05.

access to the intestine within the first 24 h after intubation.

Velocity of propelled spiral nasojejunal tubes: The proportions of patients in whom the spiral nasojejunal tubes reached the pylorus, the superior, descending, horizontal and ascending parts of the duodenum and beyond were observed at 6, 12, and 24 h after intubation, respectively and comparisons were made.

Intubation-associated complications: Vomiting, during or after nasojejunal tube feeding, gastric contents including gastric juice, food and drugs outflow from the mouth via the cardia and esophagus; aspiration, the patients had sudden cough, dyspnea or cyanosis, or coughed out or aspirated gastric content-like sputum from the airway; gastric retention, within the first 24 h after nasojejunal tube-feeding placement, the gastric contents were pumped back from the patients once every 6 h, with gastric residual volume greater than 200 mL.

Nutrition predictors: On day 5, the nutritional status including the levels of serum albumin and prealbumin of all the participants were recorded.

Statistical analysis

All the data in the experiment were analyzed with the use of the SPSS statistical software, version 19.0. Measurement data were represented as mean \pm standard deviation, and an independent samples t-test was utilized for inter-group comparison. Count data were expressed as percentages, and the chi square test was applied for inter-group comparison. P values less than 0.05 were deemed as statistical significance.

Results

General data

Of the 70 patients, 48 were male and 22 female. They were 36-60 years old (mean, 49.2 \pm 5.63 years) and had a mean APACHEII score of 16.9 \pm 4.65. Among them, 35 had hypertensive cerebral hemorrhage, 20 had ischemic cerebral infarction and 15 had traumatic brain injury. No noticeable differences were found in gender, age, APACHEII score and disease type between the experiment group and the control group (P>0.05, **Table 1**).

Rate of successful intubation

The rate of successful nasojejunal tube placement in the experimental group was considerably higher than that in the control group [94.3% (33/35) vs 71.4% (25/35)], ($\chi^2=7.683$, P=0.019; **Figure 1**).

Velocity of propelling nasojejunal tubes after intubation

The proportions of patients with the tip of the spiral nasojejunal tube reaching the pylorus of the stomach, the superior, descending, horizontal and ascending parts of the duodenum and beyond in the two groups were insignificantly different at 6 and 12 after intubation (P=0.176); however, at 24, the proportions were markedly different at diverse sites (All P=0.000; **Figure 2**).

Incidence of complications after intubation

After intubation, in the experiment group, vomiting occurred in 2 patients, aspiration in 1 and gastric retention in 3; in the control group, vomiting occurred in 9 patients, aspiration in 7 and gastric retention in 10. The rates of vomiting, aspiration and gastric retention were strikingly

Effect of acupuncture-combined spiral nasojejunal tubes

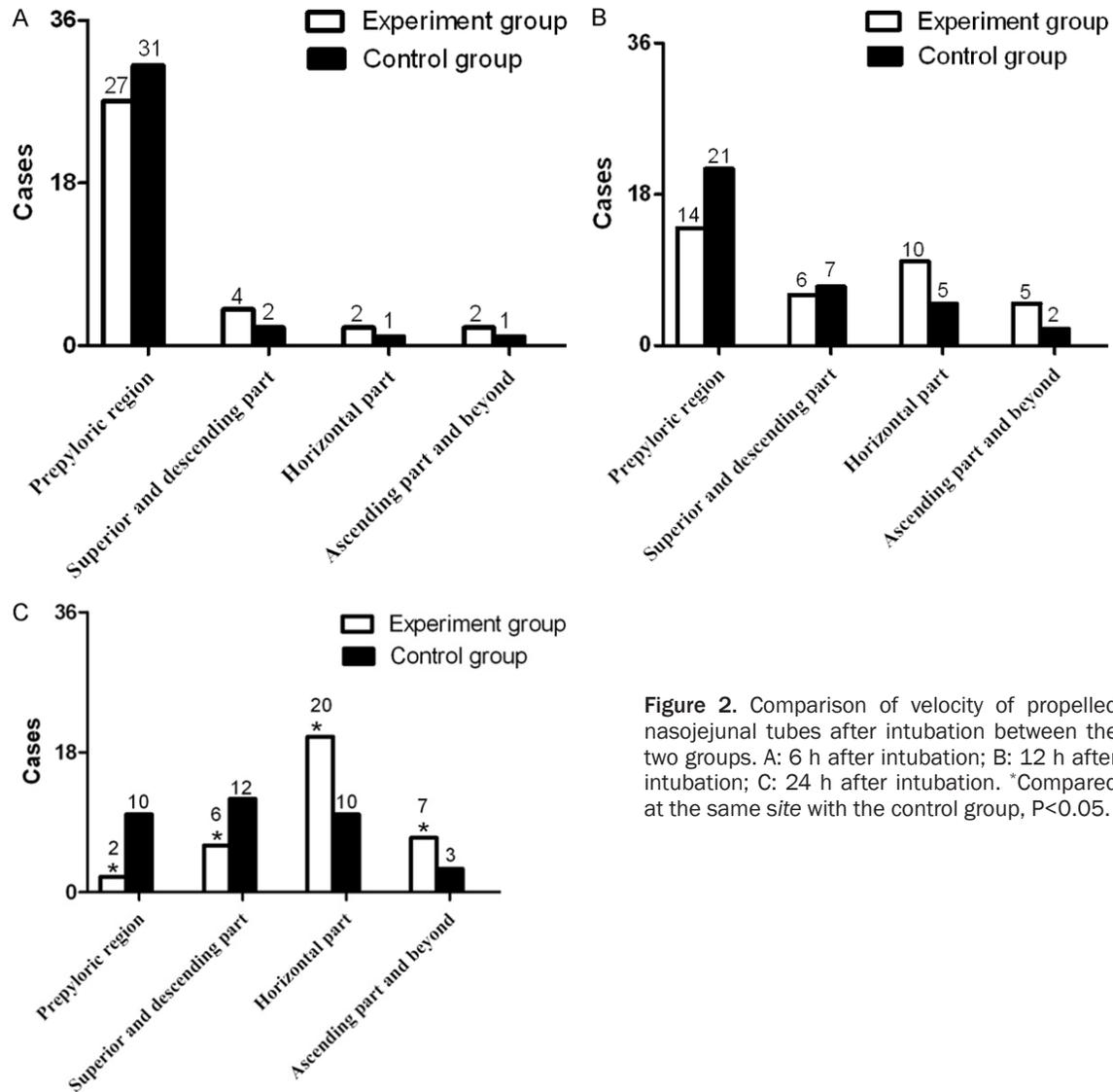


Figure 2. Comparison of velocity of propelled nasojejunal tubes after intubation between the two groups. A: 6 h after intubation; B: 12 h after intubation; C: 24 h after intubation. *Compared at the same site with the control group, $P < 0.05$.

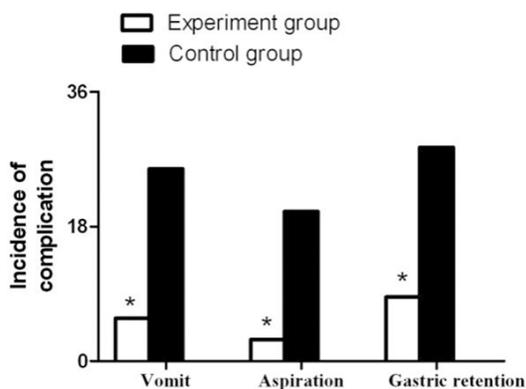


Figure 3. Comparison of the incidence of postoperative complications between the two groups. Compared with the controls, $*P < 0.001$.

different between the two groups (All $P < 0.001$; **Figure 3**).

Nutrition predictors after intubation

The serum albumin and prealbumin levels in the experiment group differed insignificantly before intubation ($P > 0.05$) but were significantly higher after intubation as compared with the control group (All $P < 0.001$, **Figure 4**).

Discussion

Blind insertion of spiral nasojejunal tubes is a practical and crucial method of enteral nutrition for critically ill patients, and a key guarantee for successful intubation is to keep normal

Effect of acupuncture-combined spiral nasojejunal tubes

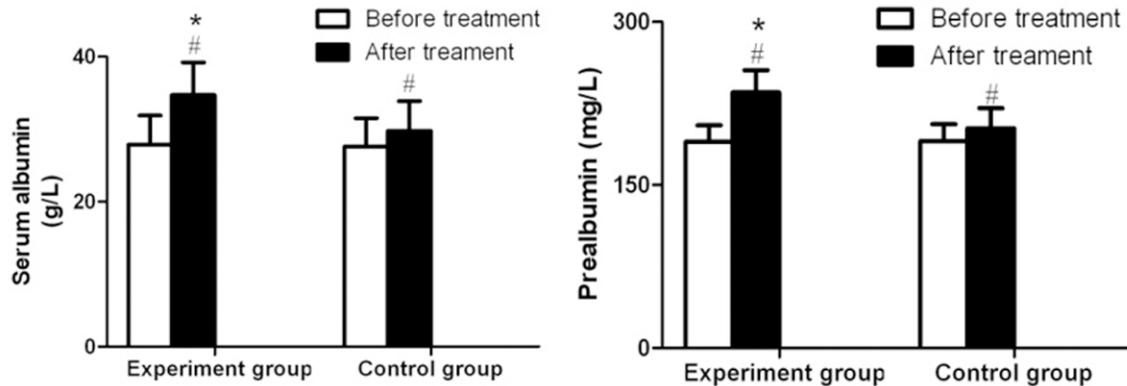


Figure 4. Comparison of serum albumin and prealbumin levels after intubation between the two groups. For comparison with those before intubation, * $P < 0.001$; for comparison with those in the control group, # $P < 0.001$.

and valid gastrointestinal motility and peristalsis [12-14]. Acupuncture can improve gastrointestinal function in many ways, providing good gastrointestinal conditions for early enteral nutrition support. Currently, the clinical practice has revealed that acupuncture can regulate motility, secretion and digestion and absorption in the gastrointestinal tract [15]. Multiple studies have demonstrated patients with severe acute pancreatitis tend to be accompanied by reduced amplitude and intensity of autonomic gastrointestinal contraction, as well as gastrointestinal transit disorders, but acupuncture therapy can reduce inflammation and increase intestinal peristalsis, thereby improving the gastrointestinal motility [16, 17]. To our knowledge, acupuncture is also effective in protecting the gastrointestinal tract from injury, repairing mucosa and preventing imbalance and translocation of microbiota in the gastrointestinal tract. Additionally, animal experiments have also proved that Zusanli acupuncture can effectively improve the blood flow in the gastric mucosa, contributing to better protection of the gastric mucosa [18]. In a stress state, the gastrointestinal tract of critically ill patients is inhibited and even paralyzed. Acupuncture at relevant gastrointestinal acupoints is conducive to ameliorating gastrointestinal motility and stimulating the intestinal tract [19, 20]. Up till now, few studies have been involved in the technique of acupuncture-combined blind insertion of nasojejunal tubes across the world. In the current study, the acupoint selection for acupuncture-combined therapy is based on the basic theory of TCM and the system of meridians and collaterals. The

results showed that the rate of successful intubation of nasojejunal tubes in the experiment group was markedly higher as compared to that in the control group. The proportions of patients with the tip of the spiral nasojejunal tubes reaching the pylorus, the superior and descending part, the horizontal part and the ascending part of the duodenum and beyond in the two groups were significantly different at 24 after intubation. In other words, the nasojejunal tubes were propelled deeper and farther forward in the gastrointestinal tract among the patients in the experiment group. All the patients had better safety but no severe complications whether they had undergone blind insertion of nasojejunal tubes alone or in combination with acupuncture following blind insertion of nasojejunal tubes. However, the incidence of intubation-associated complications including vomiting, aspiration and gastric retention were considerably lower in the experiment group versus the control group. The present study suggests that optimal repeated acupuncture can stimulate the motility in the paralytic gastrointestinal tract as the early gastrointestinal function in critically ill patients is highly suppressed. When acupuncture excites the gastrointestinal tract, gastrointestinal motility becomes faster, gastric emptying is accelerated and gastrointestinal pneumatosis is also reduced [21-23]. As a result, the nasojejunal tube is fast propelled further into the intestinal tract with the gastrointestinal peristalsis, leading to higher rate of successful intubation and lower intubation-associated complications.

In addition, plasma protein is one of the most commonly used nutrition predictors in clinical

Effect of acupuncture-combined spiral nasojejunal tubes

practice since it can reflect the nutritional status of proteins in the body. The half-life period of serum prealbumin is significantly shorter than that of serum albumin, so the serum prealbumin level rapidly reflects the negative or positive balance of nutrient intake. The results of the current study revealed that the serum albumin and prealbumin levels in patients with acupuncture-combined nasojejunal tubes were improved substantially as compared with those of the control group, which may be attributed to the fact that acupuncture therapy could improve the blood flow in the gastrointestinal mucosa and the digestion and absorption functions.

In conclusion, acupuncture-combined spiral nasojejunal tube can accelerate the propelled velocity of the nasojejunal tube in the gastrointestinal tract, improve the rate of successful intubation, reduce the incidence of intubation-associated complications, and elevate the nutrition of patients. It can offer correct nutrition route for critically ill patients, therefore, it is worthy of clinically extensive use. There are some limitations in the present study, including the small sample size, relatively limited source of cases, and failure to rule out the defects of folding and bending of the nasojejunal tube in the stomach. In the future, a multicenter, randomized controlled study with large sample size is needed for further validation.

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Disclosure of conflict of interest

None.

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