



Application of semi-automated ultrasonography on nutritional support for severe acute pancreatitis

Ying Li^a, Yu Ye^{b,*}, Mei Yang^a, Haiying Ruan^a, Yuan Yu^a

^a Department of Critical Care Medicine, Second People's Hospital of Shenzhen, Shenzhen, 518035, PR China

^b Department of Neurosurgery, Longgang Central Hospital of Shenzhen, Shenzhen, 518116, PR China

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ABSTRACT

Objective: To evaluate the application value of semi-automated ultrasound on the guidance of nasogastrojejunal tube replacement for patients with acute severe pancreatitis (ASP), as well as the value of the nutritional support for standardized treatment in clinical practice.

Methods: The retrospective research was performed in our hospital, and 34 patients suffering from ASP were enrolled into this study. All these identified participants ever received CT scans in order to make definitive diagnoses. Following, these patients received semi-automated ultrasound examinations within 1 days after their onset, in order to provide enteral nutrition treatment via nasogastrojejunal tube, or freehand nasogastrojejunal tube replacement. In terms of statistical analysis, the application value of semi-automated ultrasound guidance on nasogastrojejunal tube replacement was evaluated, and was compared with tube replacement of no guidance. After cathetering, the additional enteral nutrition was provided, and its therapeutic effect on SAP was analyzed in further.

Results: A total of 34 patients with pancreatitis were identified in this research, 29 cases with necrosis of pancreas parenchyma. After further examinations, 32 cases were SAP, 2 cases were mild acute pancreatitis. When the firm diagnosis was made, additional enteral nutrition (EN) was given, all the patient conditions appeared good, and they all were satisfied with this kind of nutritional support. According to our clinical experience, when there was 200–250 ml liquid in the stomach, the successful rate of intubation appeared higher. Additionally, the comparison between ultrasound-guided and freehand nasogastrojejunal tube replacement was made. According to the statistical results, in terms of the utilization ratio of nutritional support, it was better in ultrasound-guided group, when compared with it in freehand group, within 1 day, after 3 days and after 7 days (7/20 versus 2/14; $P < 0.05$; 14/20 versus 6/14; $P < 0.05$; 20/20 versus 12/14; $P < 0.05$). Besides, the complications caused by cathetering between two groups was not statistically different ($P > 0.05$).

Conclusions: It can be indicated that semi-automated ultrasound guidance is a reliable method for nasogastrojejunal tube replacement, and should be substituted for no guidance of cathetering. In terms of therapeutic effect of EN, additional nutritional support contributed to significantly improve the prognosis of SAP patients, and should be widely recommended in clinical practice. Surely, this conclusion should be evaluated in further, by means of randomized controlled trials and economic evaluation.

1. Introduction

Pancreatitis can be defined as an complex inflammatory disorder to the pancreas, which can lead to structural injury of pancreatic cells and impairment of endocrine functions, and thereby result in significant morbidity and lethality (Al Mofleh, 2008; De Waele, 2010). Being regarded as a relatively common but fatal disease of digestive systems, the initial pathological change of severe acute pancreatitis (SAP) is just the limited inflammation of pancreatic tissue (Zerem, 2014; Yang et al.,

2015; Wittau et al., 2011), but can lead to multiple organ failure within a short time. Hence, SAP is an acute and progressive abdominal disorder, accompanied with severe systemic inflammatory response and multiple organ dysfunction, etc. (Sakhri et al., 2010; Rau et al., 2004). In further, the mortality of SAP appears high, ranging from 20% to 40%, complicated by shock, and even death, within the first 72 h after admission, in spite of the remarkable improvements of diagnostic and therapeutic approaches in recent years (Beger and Rau, 2007).

Hence, it is essential to establish the standardized treatment of SAP,

* Corresponding author.

E-mail addresses: yeyu2007@qq.com (Y. Li), 11i2y3y4y5@163.com (Y. Ye), yangmei3056@163.com (M. Yang), 122040090@qq.com (H. Ruan), 1503151@qq.com (Y. Yu).

especially in the first 48 h (Nathens et al., 2004). As far as we are concerned, the efficacy treatment to control illness in the early stage are essential and pivotal for patients with SAP (Besselink et al., 2007). One of the most essential and conventional treatment methods of SAP at initial stage are nutrition support. To our best knowledge, these critically ill patients are suffering from different levels of gastric emptying dysfunctions. The enteral nutrition support can contribute to improve the quality of life and prognosis of patients, which is consistent with the recommendation of international guidelines. The enteral nutrition treatment via nasogastrojejunal tube can reduce the probability of reflux and aspiration, increase nutrient utilization ratio, and provide adequate nutrition within a short time. Nevertheless, how to insert the nasogastrojejunal tube and improve the success rate of catheterization are still a hot but difficult issue in acute and critical medical field. So, this research aimed to investigate the efficiency of nutrition support at initial stage. In addition, at present, the semi-automated ultrasonography guidance can be regarded as a novel intervention in the management of SAP nutrition support (O'Keefe and Sharma, 2007). In the last decades, the traditional approaches of nutritional support including intestinal rest and parenteral nutrition, have been proven to be associated with an increased morbidity and an increased mortality risk, according to the latest publications (Al Samarrae et al., 2010). On the contrary, enteral nutrition (EN) using infusion through the jejunum beyond the ligament of Treitz to minimize pancreatic stress, can preserve intestinal microbial ecology, enhance intestinal perfusion, improve immune function and reduce infections. On the basis of previous authoritative literature, it can be illustrated that EN contributes to improve the clinical prognosis of patients with SAP. So, this research also attempted to assess the application value of semi-automated ultrasonography on nutritional support for SAP, and thereby to offer available references for clinical practice.

2. Methods

2.1. General information

This retrospective research was carried out in our hospital, from May 2015 to May 2017. After rigorous screening, a total of 34 patients suffering from pancreatitis were identified into this study. All the medical records of patients were complete, and all these information were analyzed after they were determined to have met all inclusion and exclusion criteria, including all clinical characteristics (e.g. age and sex, etc.). The detailed exclusion criteria were as follows: 1. Age less than 18 years old, and more than 72 years old; 2. Accompanied with other serious complications; 3. Glasgow Coma Scale (GCS) score less than 5 points; 4. Without informed consent form beforehand; 5. Without complete and detailed medical records. A total of 34 patients with pancreatitis were identified in this research, and the average age 49.2 years old (range from 29 to 72 years old), 51 males and 36 females. In addition, the primary symptoms were nausea, vomiting, and severe abdominal pain, etc. And, a small percentage of patients suffered from hyperpyrexia, and even shock.

All the operations of nasogastrojejunal tube insertion were carried out by two senior nurses with more than 3 years experiences, who ever received professional training of tube insertion. And the whole process of nasogastrojejunal tube insertion was under the coordination with senior doctors, accompanied with the guidance of semi-automated ultrasonography. The identified ASP patients were assigned to control group or experimental group, and they received insertion treatment under the guidance of semi-automated ultrasonography or freehand, respectively. The pass rates through pyloric and time-consuming of cathetering were evaluated, on the day of intubation, after 3 days, and after in 7 days. Besides, the time that the standardized nutritional status can be achieved was compared, as well as the possible complications during catheterization.

2.2. Detailed insertion procedures and nutritional support

Before treatment, all these identified patients received CT examinations within 1 days after their onset, in order to make diagnoses. In the experimental group, following, they all received semi-automated ultrasound examinations, in order to provide enteral nutrition treatment via nasogastrojejunal tube (Manufacturer: Bai Tong in China). In terms of statistical analysis, the application value of semi-automated ultrasound guidance on nasogastrojejunal tube replacement was evaluated, and was compared with tube replacement of no guidance. After cathetering, the additional enteral nutrition was provided, and its therapeutic effect on SAP was analyzed in further. In terms of the detailed operation method of insertion, we gave the detailed information about it. (1) Evaluating the distance between nasogastrojejunal tube and stomach, and marked as the first marker. The second marker was the point out of 50 cm, and also was the distance between nasogastrojejunal tube and duodenum. (2) When the nasogastrojejunal tube was arced inserted into throat, the tube was then rotated 180 degrees, and was inserted into another 35 cm along the rear wall of throat. All these above procedures were monitored by ultrasound examinations. (3) When the tube reached the first marker, the bedside ultrasound was used to obtain the images of tube. If the "double track" image appeared, it could be concluded that the nasogastrojejunal tube had been inserted into stomach. (4) The method that we determined if the insertion was successful is described as follows. When the tube was inserted into 120 cm, 20 ml saline was injected quickly. And the water mist in stomach indicated that this attempt failed. Hence, the tube should be pulled out at 55–70 cm, and another insertion should be carried out again. If no water mist appeared in stomach, this attempt succeeded. In the control group, the tube was lubricated by paroline, and was inserted into stomach via oral cavity or nostril. The head of patient leaned back, and swallowed during tube insertion. When the tube was inserted into 15 cm, the head of patients raised, and the lower jaw should cling to the neck. When the insertion depth was 60 cm, air exhaust or air injection was carried out, in order to determine whether the tube was located into stomach. Following, another 15–25 cm was inserted. At last, the guide wire was extracted, and the free-end of tube was fixed. The general operation time of freehand insertion was 30 min, and the probability of repeating was approximate 60%. Besides, according to our clinical experience, when there was 200–250 ml liquid in the stomach, the successful rate of intubation appeared higher. Because the tube was easy to be folded when the liquid in stomach was more than 400 ml, and the gastric cavity could be clearly imaged when the liquid in stomach was less than 200 ml. Specifically, if 200–250 ml saline was injected into stomach beforehand, and the operation was guided by ultrasound, the probability of repeating was approximate 10%, and operation time of insertion was 10–13 min. After the essential diagnostic examinations, these patients received antibiotic therapy to prevent the possible infection, and received EN support to enhance recovery. Other instruments were adopted to monitor the vital organs of physiological functions, including cardiopulmonary system and urinary circulatory system. The patients were kept off food and water throughout the treatment, insulin and somatostatin were utilized to inhibit pancreatic secretion during treatment, and the supplementary of electrolytes was given to maintain internal environment homeostasis. When these patients were under homeostasis status and the intestines began to work again, the EN support was provided.

2.3. Statistical analysis

Two independent physicians reviewed the medical records, and the data analysis was performed by SPSS (PASW Statistics 17.0, IBM Inc., NY, USA). The measurement data were expressed as mean \pm standard deviation. The Pearson's Chi-square test or Fisher's exact test was utilized to analyze categorical variables, and the Student's t-test or Mann-Whitney U-test were utilized to analyze continuous variables. All

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