Effect of enteral and parenteral nutrition on gastrointestinal hormone level in patients after gastric operation

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Abstract: Objective: To investigate the effect of enteral and parenteral nutrition on gastrointestinal hormone levels in patients after gastric surgery. Methods: Fifty-eight inpatients undergoing subtotal gastrectomy were selected for clinical study. Urinary urea nitrogen, urinary creatinine, fasting serum albumin, plasma motilin (MTL) and cholecystokinin (CCK) levels were measured in the early morning of 2,4 and 8 days after admission. Results: Serum Alb, Prealb and TFN in parenteral nutrition group and enteral nutrition group increased significantly after nutrition support ($P < 0.05$), while the two measured values in control group had no significant change. The number of normal electrogastrogram in 38 patients before operation was 25, accounting for 65.8%; The number of patients with abnormal gastric electricity was 13, accounting for 34.2%. Plasma MTL level in enteral nutrition group was significantly higher than that in parenteral nutrition group on the 4th and 8th day after admission ($P < 0.05$). On the 8th day after admission, CCK level in enteral nutrition group was significantly higher than that in parenteral nutrition group ($P < 0.05$). Conclusion: The levels of gastrin and motilin in patients with gastric cancer are significantly higher than those in normal people, and tend to increase gradually with the development of pathological stages of gastric cancer. The application of enteral nutrition after gastric surgery can increase the level of plasma cholecystokinin, promote the contraction of gallbladder and prevent the occurrence of gallbladder diseases such as cholestasis.

1. Introduction

Parenteral and enteral nutrition support therapy is an important progress in the field of modern surgery. This "metabolic nutrition" treatment provides patients with nutrients needed for metabolism (such as heat, essential and non-essential amino acids, vitamins, water, electrolytes and trace elements), and avoids the occurrence of malnutrition after surgery [1]. Clinical studies in recent years show that enteral nutrition has the advantages of fewer complications, better effect and lower cost than parenteral nutrition, especially enteral nutrition can directly nourish intestinal mucosa and promote the recovery of intestinal structure, blood supply and function [2-3].

At present, there is no definite conclusion on the pathogenesis and treatment of postoperative gastroparesis at home and abroad. There are few reports on the relationship between enteral nutrition, parenteral nutrition and gastrointestinal motility. There is no prospective, randomized and controlled clinical study on the relationship between enteral or parenteral nutrition and gastrointestinal hormones and gastric motility in patients after subtotal gastrectomy, and whether enteral nutrition can promote the recovery of gastric motility and gastrointestinal hormones more than parenteral nutrition.

Through prospective, randomized and controlled clinical research, this paper explores the regularity and correlation of gastrointestinal hormones and gastric motility recovery after gastric surgery, and compares the effects of enteral and parenteral nutrition on gastrointestinal hormones and gastric motility after gastric surgery, providing a useful clinical research basis for exploring the

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pathogenesis and treatment of gastric cancer after surgery.

2. Clinical data and methods

2.1. Research objects

A total of 58 inpatients undergoing subtotal gastrectomy were selected for clinical study. Entry criteria: 1. Age 18-75 years old; 2. Patients undergoing subtotal gastrectomy. Exclusion criteria: l, patients with diabetes; 2. Patients with total gastrectomy; 3. Patients with severe complications after operation need a second operation. According to the above criteria, a total of 58 cases in this study met the inclusion criteria, of which 20 cases were excluded and 38 cases were effective. In addition, 25 healthy volunteers were selected and their serum gastrin and motilin levels were measured.

2.2. Research design and method

(1)Parenteral nutrition method

Patients in the parenteral nutrition group were given PN support according to the expected amount on day 1-8 after admission. The total calories per day was 145.34 $kJ \cdot kg^{-1}$, the nitrogen intake was $g \cdot kg^{-1} \cdot d^{-1}$, and sufficient supplementation The amount of electrolytes and vitamins. The formula of parenteral nutrient solution (including fat milk, amino acids, 10% GS, 5% GNS, Yongle Vita, Vitalipide, Andamei, etc.) was formulated by doctors and mixed by nurses in laminar flow clean table. Parenteral nutrient solution was pumped in through central or peripheral vein at a constant speed for 12 ~ 16 hours.

(2)Enteral nutrition method

Jejunostomy was performed during operation and jejunal nutrition tube was placed. Enteral nutrient solution (made by Nutricia Company) was dripped on the first day after operation, which was 1/3 and 2/3 of the estimated total amount on the first and second days after operation, and reached the estimated total amount (1500ml) on the third day after operation. Enteral nutrient solution was pumped by a constant speed pump for 12 ~ 16 hours.

(3)Research design

The control group and the study group were given equal nitrogen and equal calorie parenteral or enteral nutrition respectively. The fasting blood routine, liver and kidney function, serum gastrin, plasma motilin and plasma cholecystokinin were measured before and on the 7th day after operation, and the fasting electrogastrogram was measured before and after operation, and the daily gastric juice drainage was recorded.

2.3. Detection Indicator

On the 2nd, 4th and 8th day after admission, the nutritional indexes of the two groups were measured: 24-hour urinary urea nitrogen, creatinine, nitrogen balance, creatinine height index and cholecystokinin. Detection of serum albumin concentration: Peripheral venous blood was taken on an empty stomach in the morning, and BCG colorimetry was used. ELISA method was used, peripheral venous blood was taken on an empty stomach in the morning and placed in EDTA anticoagulation tube, peroxidase reacted with substrate, and the absorbance at 450 nm was measured by enzyme-linked immunosorbent assay (ELISA). The CCK content was determined by comparing the results with the standard curve.

In clinical practice, besides observing the general condition, body temperature, heart rate, respiration and blood pressure, we should focus on observing and recording the symptoms of digestive tract such as abdominal distension, abdominal pain, nausea, vomiting and diarrhea, and accurately record the time when the anus resumed exhausting.

2.4. Statistical treatment

The results of this study were statistically processed by paired and group comparison T-test. $P < 0.05$ is significant.

3. Result

3.1. Changes of nutritional evaluation indexes before and after nutritional support

Serum Alb, Prealb and TFN in parenteral nutrition group and enteral nutrition group increased significantly after nutrition support ($p < 0.05$), while the two measured values in control group had no significant change. Hb of the three groups decreased slightly, but the difference was not significant ($p > 0.05$). There was no significant difference in nutritional indexes between parenteral nutrition group and enteral nutrition group, but albumin and prealbumin in the two nutrition groups were significantly higher than those in the control group ($P < 0.05$).

3.2. Gastric motility index

Electrogastrogram (EGG) is an electrical signal that records the gastric myoelectric activity through the abdominal surface electrode. The frequency, amplitude and regularity of slow wave of gastric smooth muscle can be obtained from EGG [4]; The electrogastrogram corresponds to the myoelectric activity of 2/3 of the distal stomach [5].The electrogastrogram index usually reflects the slow wave frequency of the stomach, with a normal range of 2.4 ~ 3.7 beats/min (cpm). Less than 2.4cpm indicates that the electrogastrogram rhythm is too slow, and more than 3.7cpm indicates that the electrogastrogram rhythm is too fast. Both cases can inhibit gastric motility.

The ratio of normal gastric electric rhythm in the distribution of gastric electric rhythm should be ≥ 65%, and the smaller the ratio, the greater the inhibition degree of gastric motility.

The number of normal electrogastrogram in 38 patients before operation was 25, accounting for 65.8%; The number of patients with abnormal gastric electricity was 13, accounting for 34.2%. It indicated that gastric motility of patients with gastric cancer was inhibited in different degrees.

On the 7th day after operation, only 3 patients had normal electrogastrogram, accounting for 7.9%, and 35 patients had abnormal electrogastrogram rhythm, accounting for 92.1%, which was significantly different from that before operation ($P < 0.01$). It shows that subtotal gastrectomy obviously interferes with the gastric electric rhythm and inhibits gastric peristalsis.

3.3. Gastrointestinal hormone monitoring results

The test results of two groups of patients are shown in Table 1

Table 1 Changes of gastrointestinal hormones in two groups after admission

Testing time	Plasma motilin($pg \cdot mL^{-1}$)		Cholecystokinin ($pg \cdot mL^{-1}$)	
	Enteral nutrition group	Parenteral nutrition group	Enteral nutrition group	Parenteral nutrition group
On the 2nd day after admission	281.74±71	288±74	14±5	15±3
The 4th day after admission	300±66	273±44	18±3	9±4
On the 8th day after admission	315±54	270±58	21±8	13±3

Plasma MTL level in enteral nutrition group was significantly higher than that in parenteral nutrition group on the 4th and 8th day after admission ($P < 0.05$). On the 8th day after admission, CCK level in enteral nutrition group was significantly higher than that in parenteral nutrition group ($P < 0.05$).

4. Discussion

Enteral nutrition and parenteral nutrition are two indispensable ways in clinical nutrition support. Enteral nutrition is widely used because of its physiological status, benefit to the recovery of gastrointestinal function and structure, and economy. However, the traditional concept holds that trauma and stimulation after abdominal surgery, especially digestive tract surgery, will cause paralysis of gastrointestinal tract for about 3 days, which hinders digestion and absorption of nutrients in intestinal tract. Therefore, parenteral nutrition is still the main method for early

postoperative nutritional support.

In recent years, it has been found that if the function of small intestine is normal before abdominal surgery or trauma, the movement and absorption function of small intestine can be restored after operation. At the same time, some studies have confirmed that stomach and colon are the main causes of gastrointestinal paralysis after abdominal surgery [6], which provides a theoretical basis for the implementation of early postoperative enteral nutrition. In this study, 22 patients in the enteral nutrition group can tolerate enteral nutrition within 24 hours after operation, 5 patients have mild abdominal distension, 2 patients have increased stool frequency, and there is no other serious digestive tract dysfunction, which can be relieved by adjusting dripping speed and taking astringent antidiarrheal drugs. Early enteral nutrition can also promote the recovery of intestinal function. In this study, the anal exhaust time of enteral nutrition group was significantly earlier than that of TPN and control group, and the difference was statistically significant.

Serum gastrin and motilin levels in patients with gastric cancer were significantly higher than those in normal subjects, which was consistent with the report [7]. We analyzed the possible reasons for the increase of gastrin: tumor destroyed normal parietal cells, decreased gastric acid secretion, and caused excessive gastrin secretion by g cells; Abnormal parietal cell structure or gastrin receptor in gastric cancer patients is insensitive to gastrin, which leads to excessive gastrin secretion by G cells. This study found that with the development of pathological staging of gastric cancer, the levels of gastrin and motilin increased before operation, but they could not be used as tumor-associated antigens. Because the content of gastrin and motilin, as a tumor-related antigen, increased significantly during the canceration of cells and decreased significantly after radical operation, this study found that the levels of gastrin and motilin recovered to the preoperative level 7 days after operation, which indicated that they could not be used as tumor-related antigen or as an index to evaluate the curative effect of surgery.

Gastrointestinal motility is mainly influenced by gastrointestinal nervous system and humoral factors. Gastrointestinal hormones are important factors to regulate gastrointestinal motility. Gastrointestinal hormones related to gastric motility are MTL and CCK. This study found that the MTL level of patients in enteral nutrition group was significantly higher than that of patients in parenteral nutrition group on the 4th and 8th day after admission, mainly because EN was applied earlier after admission, and nutrients entered gastrointestinal tract to stimulate Mo cells in duodenal and upper jejunum mucosa to secrete MTL. MTL has high affinity with receptors on gastrointestinal smooth muscle cells, which leads to contraction of gastrointestinal smooth muscle and promotes gastrointestinal peristalsis. At the same time, patients in enteral nutrition group were given nutrition earlier after admission. After the jejunum was stimulated by nutrient solution, I cells in its mucosa secreted CCK, so the CCK level of patients in enteral nutrition group was significantly higher than that of patients in parenteral nutrition group on the 8th day after admission, which was consistent with the report in literature [8]. The main function of CCK is to constrict gallbladder, which can obviously reduce the occurrence of gallbladder diseases such as cholestasis [9].

5. Conclusions

The levels of gastrin and motilin in patients with gastric cancer were significantly higher than those in normal subjects, and tended to increase gradually with the development of pathological stages of gastric cancer. The application of enteral nutrition after gastric surgery can increase the level of plasma cholecystokinin, promote the contraction of gallbladder and prevent the occurrence of gallbladder diseases such as cholestasis. Preoperative determination of gastrin, motilin, cholecystokinin and electrogastrogram can not be used as indicators to predict the occurrence of gastric cancer after operation.

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