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RESEARCH ARTICLE

Clinical Analysis of Feeding Jejunostomy and Optimal Selection of Enteral Nutrients (Report of 238 Cases)

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Abstract

The objectives of this study is to summarize and analyze the clinical and pathological data of patients with feeding jejunostomy, evaluate its clinical application value and risk, and study the optimal selection of enteral nutrients. The clinical data of 238 patients who underwent feeding jejunostomy in Beijing Shijitan Hospital, Capital Medical University, from September 1, 2017 to July 31, 2021 were retrospectively studied. The serious complications and treatment of patients were summarized and analyzed. Serious complications included anastomotic fistula, postoperative bleeding, and so on. Complications related to jejunal feeding stoma included: tube folded, intestinal stenosis at the stoma, and others. The symptoms of some enteral nutrition patients with abdominal pain, abdominal distension and diarrhea were improved by changing the type of enteral nutrients and increasing dietary fiber. Feeding jejunostomy can effectively solve the enteral nutrition problems of upper gastrointestinal anastomotic leakage, perforation, obstruction and functional eating disorder, can also be used as a separate means of enhance enteral nutrition support, but also can cause severe complications, and even death. Compliance with surgical indications is as important as mastery of surgical technical details. Reasonable use of enteral nutrients can achieve better nutritional support effect.

Introduction

The latest data shows that about 1/4 of the deaths of Chinese residents are caused by malignant tumors, which seriously threaten people's health and life span [1]. The incidence rate of malignant tumors in China has been rising in the past half century, and the mortality rate has the same trend [2]. The overall incidence rate and mortality rate of malignant tumors in China are in the middle and upper level in the world. Among them, the incidence rate and mortality rate of digestive tract tumors, including esophageal cancer, gastric cancer, liver cancer and other malignant tumors, even account for about half of the world's [3]. The situation of prevention and

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control is very serious. Statistics [4] show that in 2015, the incidence of gastric malignant tumors in Chinese residents was 403,000, the incidence rate was 29.3/100,000, the death was 291,000, and the mortality rate was 21.16/100,000; The incidence and the death of esophageal malignant tumor is 246,000 and 188,000, the incidence rate and the mortality rate is 17.9/100,000 and 13.7/100,000.

Most patients with esophageal and gastric cancer need to reconstruct the digestive tract while removing the tumor. Digestive tract reconstruction surgery is often accompanied by a certain proportion of anastomotic leakage. If the continuity of the digestive tract is destroyed, it is impossible to eat by mouth. Therefore, it is particularly important to establish an effective enteral nutrition pathway.

For patients undergoing upper gastrointestinal surgery such as gastric cancer and esophageal cancer, enteral nutrition perfusion through jejunal feeding stoma can provide early postoperative enteral nutrition support, promote the recovery of patients' body functions and early healing of anastomotic leakage. The feeding jejunostomy at the distal end of anastomosis has important clinical value [5,6]. Enteral nutrition has better tolerance than parenteral nutrition, and has advantages in reducing infection, promoting healing, and shortening hospitalization [7]. Compared with the nasojejunal tube and the nasoduodenal tube, the jejunal feeding stoma has the following advantages [8]: 1. Lower catheter displacement rate and tube removal rate; 2. The optimal scheme for the unresolvable digestive tract obstruction; 3. Lower incidence of lung infection; 4. Better social image; 5. Better tolerance. The disadvantage of jejunal feeding stoma is the relatively high complication rate, which needs to be made up and improved by strictly grasping the surgical indications and improving the surgical techniques.

How about the clinical application of jejunal feeding stoma? Therefore, this study collected the medical records of 238 patients with jejunal feeding stoma, analyzed its application in upper gastrointestinal tumor surgery and other situations, including various complications, so as to judge the practical application value of feeding jejunostomy in the treatment of these patients, summarize experience and lessons, and promote the improvement of the overall treatment level.

Materials and Methods

General information

This study collected the clinical data of 238 patients who underwent feeding jejunostomy for various reasons in Beijing Shijitan Hospital, Capital Medical University, from September 1, 2017 to July 31, 2021. Among the 238 patients, 179 were male and 59 were female, ranging in age from 23 to 86 years, with a median age of 63 years, and details were in table 1. The ethics committee of Beijing Shijitan Hospital, Capital Medical University, approved this study.

Operation methods

Feeding jejunostomy: Freka-CH9 jejunal nutrition stoma device produced by Fresenius kabihuarui Pharmaceutical Co., Ltd. was used in 237 patients, a thick wall latex tube with a mushroom head was used in one patient(the freka-CH9 tube was absent at that time), and no other types of pipelines were selected. In the case of Bill roth type I operation or esophagogastrostomy, the feeding tube was inserted into jejunal cavity, 15cm ~ 20cm distal from the Treitz ligament. It is inserted 20cm ~ 25cm distal from the anastomosis in the case of Bill roth type II operation. The puncture point of the abdominal wall is selected as appropriate when the intestinal canal was not angled between the umbilicus level and the lower edge of the rib arch. The jejunostomy tube is placed about 30cm along the puncture needle which inserted into the jejunal cavity previously. The nutrition tube was double purse string sutures, and the nutrition tube is embedded about 5cm through the intestinal wall tunnel. The catheter is fixed to the abdominal wall through 3 sutures in the abdominal cavity and led out from the puncture point of the abdominal wall.

Laparoscopic feeding jejunostomy: The procedure of laparoscopic feeding jejunostomy is similar to that of laparotomy, but the difficulty was that all sutures and fixation need to be performed through laparoscopic instruments.

Statistical methods

SPSS 19.0 was performed for statistical analysis. $\chi 2$ test was used for counting data comparison, and the difference was of statistical significance when $p < 0.05$.

Results

Overall complications and outcomes

Among the 238 patients, anastomotic leakage occurred in 21 patients (17 cases were cured and 4 cases died), postoperative bleeding occurred in 8 patients(6 cases were cured and 2 cases died), 1 case died of abdominal infection due to intestinal fistula at jejunostomy,1 case died from gastric perforation with abdominal infection, 1 case died from pulmonary infection, 1 case with tracheotomy for dyspnea caused by recurrent laryngeal nerve paralysis, and 1 case of respiratory and cardiac arrest was successfully resuscitated. Among the 238 patients, 9 died, and the total mortality rate was 3.78% (9/238).

Complications related to jejunal feeding stoma included: 1 case of nutrition tube folded, 1 case of intestinal stenosis at the stoma, 1 case of jejunal bleeding and final death, 3 cases of abdominal infection due to intestinal fistula at jejunostomy (2 cases were cured and 1 case died).

Treatment and outcome of anastomotic fistula

The incidence of anastomotic leakage was 9.29% (21/238). There are 17 patients with anastomotic leakage cured and discharged after full drainage, enteral nutrition parenteral nutrition, anti-infection and other conservative treatments. The cure rate of anastomotic fistula reached 81%, of which enteral nutrition given through jejunal feeding stoma played a key role; Because of long-term abdominal infection and severe malnutrition, 4 patients with anastomotic leakage died (1 patient with anastomotic leakage after gastric cancer surgery, 3 patients with intrathoracic esophageal fistula after esophageal cancer surgery), although they were actively treated. Among them, 3 cases of intrathoracic esophageal fistula were also treated with metal covered stent under endoscopy, but the outcome of death was still not avoided. All patients were followed up for 3 to 6 months after discharge, and there was no abdominal or systemic inflammation.

Complications and outcomes of feeding jejunostomy

Among the 238 cases of feeding jejunostomy, 1 case died due to stomal bleeding, abdominal wall and abdominal cavity infection due to intestinal fistula at jejunostomy occurred in 3 cases (2 cases were cured and 1 case died). Folding of nutrient tube occurred in 1 case, and intestinal obstruction caused by stenosis of jejunum at stoma occurred in 1 case. The rate of complications related to jejunal feeding stoma was 2.52% (6/238), and the mortality was 0.84%(2/238). Laparoscopic feeding jejunostomy was performed in

Table 1: Primary diseases and digestive tract reconstruction.

Primary diseases	Number of cases	Upper gastrointestinal reconstruction	Colonectomy and anastomosis	Simple feeding Jejunostomy
Esophageal malignant tumors	113	Yes	No	No
Esophageal gastric junction malignant tumors	28	Yes	No	No
Gastric malignant tumors	66	Yes	No	No
Colon malignant tumors	4	No	Yes	No
cholangiocarcinomas	5	Yes	No	No
pancreatic benign /malignant tumors	5	Yes	No	No
Liver cancers	2	Yes	No	No
Duodenal tumors	3	Yes	No	No
Ampullary cancer	2	Yes	No	No
Chronic pancreatitis	2	Yes	No	No
Laryngopharyngeal cancers	2	No	No	Yes
Gingival cancer	1	No	No	Yes
Tongue cancer	1	No	No	Yes
Esophagotracheal fistula	1	No	No	Yes
Gastric perforation	1	No	No	Yes
Intestinal perforation	1	No	No	Yes
Dysphagia	1	No	No	Yes

12 cases, and abdominal wall infection occurred in 1 case, which was cured after conservative treatment. Open feeding jejunostomy was performed in 226 cases, complications occurred in 5 case and 2 cases of death. There was no significant difference in the incidence of complications ($\chi 2$ = 1.737, p = 0.269) and mortality ($\chi 2$ = 0.107, p = 1.000) between the two groups (Table 2).

Optimal selection of enteral nutrients

All 238 patients received enteral nutrition via feeding stoma of jejunum. On the premise that the feeding tube and intestinal tract were unobstructed, there were still 31 patients with abdominal distension or/and diarrhea during tube feeding. The following reasons were analyzed: the patients' intestinal digestion and absorption function was poor, and they could not tolerate whole protein nutrients; Short bowel syndrome, insufficient effective intestinal length; Inadequate intake of dietary fiber and probiotics; The concentration, temperature and infusion rate of nutrients were not good. After replacement with amino acid and short peptide enteral nutritients, aboat two third patients' abdominal distension and diarrhea symptoms improved significantly.

Removal of nutrient tubes

In general, a strong tunnel will form one month after the placement of a jejunal nutrition tube, and infection around the tube may occur after three months due to corrosion and rejection. The removal time of the jejunal nutrition tube in this study was mostly between 1-3 months after surgery. For those who need to continue feeding enteral nutrition through tube feeding, if the tube is in good condition, they should continue to be kept, otherwise they should be replaced by other tube feeding methods.

Discussion

Some studies have shown that [9], after radical resection and reconstruction of upper digestive tract tumors, early oral feeding is difficult, but early enteral nutrition can be carried out through jejunum feeding stoma, which can promote the recovery of intestinal function, improve the nutritional status of patients, shorten hospital stay, and also provide enteral nutrition support for patients with anastomotic leakage and promote early healing. Naso intestinal tube or naso duodenal tube can also be used for enteral nutrition support treatment for patients with anastomotic fistula, but it needs to be inserted through the nasal cavity, has poor tolerance to long-term use, affects social image, and is easy to be displaced, which affects its wider use, and does not occupy much advantage compared with jejunal feeding tube [10]. Jejunal feeding stoma can not reduce the incidence of anastomotic fistula, but it can provide more effective enteral nutrition treatment for patients with anastomotic fistula. Jejunal feeding stoma can increase enteral nutrition intake while leaking, fully nourish intestinal mucosa, improve immunity, and reduce enterogenic infection [11]. The addition of jejunal feeding stoma during abdominal surgery should be a routine step, which is more conducive to dealing with anastomotic leakage and the need for early postoperative enteral nutrition.

Among the 238 cases of feeding jejunostomy, 1 case died due to stomal bleeding, and 3 cases were abdominal wall and abdominal cavity infection due to intestinal fistula at jejunostomy (2 cases were cured and 1 case died). Folding of nutrient tube occurred in 1 case, and intestinal obstruction caused by stenosis of jejunum at stoma occurred in 1 case. The rate of complications related to jejunal feeding stoma was 2.52%, and the mortality was 0.84%.

One patient died of bleeding after jejunal feeding stoma. He was a 68 year old male with advanced gastric cancer, cardiac obstruction, abnormal coagulation mechanism and severe malnutrition. After the open jejunal feeding stoma was performed, the patient had intraperitoneal bleeding and melena, and the jejunostomy tube also drained bleeding liquid.

Table 2: Complications and deaths.

Outcomes	Laparoscopic[*n*(%)]	Open [*n*(%)]	χ^2value	*p* value
Complications				
Yes	1(8.33%)	5 (2.21%)	1.737	0.269
No	11(91.67%)	221(97.79%)		
Deaths				
Yes	0(0.00%)	2(0.88%)	0.107	1.000
No	12(100%)	224(99.12%)		

With the gradual development of liver failure and renal failure, after multiple blood transfusions, the outcome did not change, and eventually he died. The causes of bleeding and death were analyzed as follows: 1. The terminal state of gastric cancer caused multiple organ failure; 2. Abnormal coagulation mechanism; 3. The double purse string technology is used, but the intestinal wall tunnel is not made; 4. The nutrition tube is a thick wall latex tube with a mushroom head (the freka-CH9 tube was absent at that time).

There were 3 cases of abdominal wall and abdominal cavity infection caused by intestinal fistula at jejunostomy (2 cases were cured and 1 case died). Among 3 patients with advanced gastric cancer, 2 received open surgery and 1 received laparoscopic surgery. Two patients with open jejunal feeding stoma surgery were accompanied by ascites, which may cause poor healing at the puncture point and form intestinal fistula due to the immersion of ascites. One patient (female, 50 years old) healed after draining ascites and strengthening enteral nutrition, and the other patient (male, 50 years old) died of abdominal infection. One case (female, 71 years old) of laparoscopic jejunal feeding stoma healed after drainage and nutritional support treatment because of the leakage of nutrient solution caused by the lack of intestinal wall tunnel.

One patient, male, 59 years old, with esophageal cancer, only underwent jejunal feeding stoma operation. The nutrition tube folded in the jejunum cavity, causing difficulty in intestinal nutrition infusion. It is analyzed that the reason is intestinal retrograde peristalsis caused by postoperative nausea and vomiting (Figure 1). After pulling out part of the catheter, it could be used smoothly.

One case of intestinal stricture at the stoma, male, 55 years old, was a patient with esophageal cancer. He underwent radical resection of esophageal cancer with jejunal feeding stoma. After the operation, it was found that the intestinal stricture at the stoma was accompanied by obstruction, and conservative treatment was ineffective. He was reoperated. The surgeons performed end-to-side jejunal anastomosis for him, after the 5cm narrow jejunum was removed. The new jejunal feeding tube was inserted 20 cm distal from the end-to-side jejunal anastomosis. The reoperated patient gradually resumed jejunal feeding and oral feeding after surgery, and was discharged successfully.

During the operation of jejunal feeding stoma, it is very important to make intestinal wall tunnel. After double purse suture and fixation of feeding tube is completed, a 5cm long intestinal wall tunnel needs to be made to embed the tube, which can greatly reduce the risk of intestinal fistula at the puncture point. It is also necessary to avoid lumen stenosis caused by excessive suture.

A large amount of ascites soaked in the intestinal wall of feeding jejunostomy may cause intestinal fistula, which should be considered as a relative surgical contraindication of feeding jejunostomy. Effective ascites drainage is the premise of fistula healing.

Folding of the catheter in the jejunum cavity is very rare, and pulling out part of the catheter can alleviate this situation, but accurate measurement is required to avoid the catheter from coming out. The reversion of intestine may be related to it. Folding and displacement of nutrient tube can be solved by proper fixation of the end.

Enteral nutrition can be divided into two categories according to the source of protein [12]: (1) amino acid and short peptide (elemental type) enteral

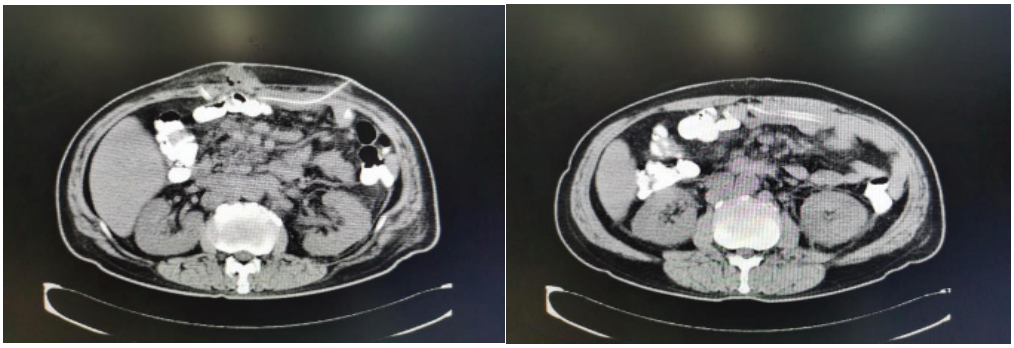

Figure 1 A folded catheter in the jejunum lumen.

nutrients; (2) whole protein (non-elemental type) enteral nutrients. The amino acid and short peptide (elemental type) enteral nutrients have the following characteristics [13]: (1) comprehensive nutrition; (2) It can be directly or nearly directly absorbed without digestion; (3) The composition is clear; (4) No residue or very little residue, which significantly reduces the number of feces; (5) No lactose, suitable for lactose intolerant; (6) The smell and taste are poor, so tube feeding is preferred for this kind of preparation.

Conclusion

Jejunal feeding stoma is safe on the whole, can enable patients to get early and effective enteral nutrition support, has a wide range of applications. Jejunal feeding stoma is very important for patients with anastomotic leakage after operation, and it can save lives. For patients with advanced tumors, the complications of jejunal feeding stoma (bleeding, intestinal fistula) may increase, which is related to the overall functional status of patients (abnormal coagulation mechanism, catabolism and ascites). We need to be vigilant. In short, accurate assessment of surgical risks, strict specification of surgical techniques and active response to complications can make jejunal feeding stoma play a greater role in clinical practice. Reasonable use and choice of enteral nutrients can achieve better nutritional support effect.

Disclosure

Zhanzhi Zhang and Yu Zhang wrote the main manuscript text. Xugang Zhang and Yu Zhang collected the data. Hanping Shi and Benqiang Rao analyzed the data. The final manuscript was read and approved by all authors.

Conflict of Interest

The authors declare no interest conflict.

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