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Effect of gastric bypass on intestinal flora in patients with type 2 diabetes mellitus.

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Abstract

Objective: To explore the effect of gastric bypass on the recent intestinal flora in patients with type 2 diabetes mellitus.
Methods: A total of 82 patients with type 2 diabetes mellitus treated in our hospital from January 2016 to January 2017 were enrolled in this study. The patients were randomly divided into two groups: 41 patients in each group. The patients in control group underwent open surgery and those in observation group were treated with gastric bypass. Recent intestinal flora, improved clinical indicators and the incidence of complications were compared between the two groups.
Results: The level of intestinal flora in type 2 diabetic patients in observation group after 15 d treatment was better than that in control group (P<0.05). The improvement of clinical indexes was more effective than that of control group (P<0.05), and the incidence of post-surgical complications in the observation group was significantly lower (P<0.05).
Conclusion: The treatment of type 2 diabetes mellitus with gastric bypass can regulate the intestinal flora, improve the clinical indexes such as blood glucose, reduce the incidence of complications and have high clinical value.

Keywords: Type 2 diabetes, Gastric bypass, Recent intestinal flora.

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Introduction

Insufficient insulin secretion and insulin resistance are the pathophysiological basis of type 2 diabetes [1], leading to glucose metabolism disorders, and even vascular disease, digestive diseases and other complications [2]. Related studies have demonstrated that surgery can prevent relevant in obese diabetics and control blood glucose, and intestinal flora, which to a certain extent affect the occurrence and development of type 2 diabetes [3]. Gastric bypass treating the patients with severe type 2 diabetes mellitus has been used for long time [4]. The long-term following up for the patients treated with gastric bypass approach by Chinese studies indicated that this method could palliate the type 2 diabetes mellitus stably for a long time and reduce correlated complications, which develops a novel modality for the treatment of type 2 diabetes mellitus [4]. Another study reported that gastric bypass and sleeve gastrectomy are effective in inducing T2DM remission in obese patients [5]. Therefore, this study is aimed to explore the effect of gastric bypass on intestinal flora of type 2 diabetes patients and provide reference for relevant in obese diabetics.

Material and Methods

Material

82 patients with type 2 diabetes mellitus (January 2016 to January 2017) treated in our hospital were randomly divided into observation group and control group, each group of 41 patients.

Observation group: 24 males and 17 females, aged 33~80 y (average years of 55.71 ± 7.68), duration of 1 to 12 y (6.44 ± 1.23).

Control group: 25 males and 16 females, aged 35 to 79 (55.79 ± 7.56 y), course of disease from 1 to 13 (6.52 ± 1.27 y).

Methods

The patients with type 2 diabetes mellitus in observation group were treated with gastric bypass. The anesthesia method was the same. 10 cm long incision was in the middle of the upper jaw, laparoscopy was used to explore the stomach, liver and pancreas. Along the side of the cardia 3-6 cm in the left retinal artery junction, the stapler will close the stomach and separate the stomach, so that the capacity of proximal gastric sacs maintained at 100-150 ml. The jejunum was pulled to the distal duodenal suspensory transversal transection, the distal jejunum was raised and matched to the stomach, and the proximal 100-150 cm of jejunum was anastomosed side with gastrointestinal. The length of the input loop and the output loop jejunum is determined by the patient's insulin, body weight, and fasting blood glucose. In the appropriate location, the jejunum was cut off, the proximal gastric cavity and distal jejunum were anastomosed. After the reconstruction of the digestive tract, the small mesenteric was closed.

The patients in control group were treated with open surgery. Tracheal intubation combined intravenous inhalational anesthesia were used. 12-15 cm incision was in the middle of the abdomen. The greater curvature and small curvature were set for free. In the left gastric vein and the third branch and the large bend line perpendicular to the body will be closed sideways. Proximal gastric cavity volume in the 200-300 ml, the length of the bowel circulation loop weight was calculated according to the body weight. In the appropriate location, the jejunum was cut off, the proximal gastric cavity and distal jejunum were anastomosed. After the reconstruction of the digestive tract, the small mesenteric was closed.

Patients over 33 y old with type 2 diabetes mellitus were eligible for inclusion. Patients who have other chronic diseases were excluded from the study.

After surgery, the patients were administrated with glucose, and the blood glucose indicators were determined every 4 h. The amount of insulin was adjusted based on changes in blood glucose levels.

Observation index

1. The bacterial culture method was used for determination of fresh fecal sample of two group patients, and the recent intestinal flora situation was observed before and after surgery.

2. The levels of fasting blood glucose (FPG) , glycosylated hemoglobin (HbAlc), fasting insulin (FINS) and β-cell function index (HOMA-β) [6] were measured before and after operation, and early insulin secretion Index (L30/G30) were detected before and after surgery [7].

3. The incidence of complications of the patients with type 2 diabetes mellitus in the two groups was calculated and compared.

Statistical method

The data were recorded into SPSS20.0 software for statistical processing. The count data were presented as (%) and the incidence of complications as (n (%)). The chi-square was applied in data test. The measurement data represent the mean ± standard deviation indicates. The recent intestinal flora and FPG, HbAlc, FINS, HOMA-β and L30/G30 was compared with t test. P value less than 0.05 indicated that data of the patients with type 2 diabetes in the two groups were significantly different, with statistical significance.

Results

Comparison of recent intestinal flora in the patients of the two groups

There was no significant difference in the intestinal flora between the two groups at 7 d before operation. After taking different surgical regimens, the two groups of patients with type 2 diabetes had higher *Bifidobacteria* and lactic acid bacteria, and decreased enterobacterium, but the improvement in observation group was more obvious, with statistical difference (Table 1).

Table 1. *Comparison of intestinal flora in the patients of the two groups (n=41).*

Group	*Bifidobacterium* (Log N/g)		Enterobacterium (Log N/g)		*Lactobacillus* (mmol/L)	
	7 d before operation	15 d after operation	7 d before operation	15 d after operation	7 d before operation	15 d after operation
Observation group	7.86 ± 0.37	8.74 ± 0.42	9.23 ± 0.64	8.15 ± 0.38	2.17 ± 0.29*	3.75 ± 0.53*
Control group	7.82 ± 0.39	8.21 ± 0.38	9.19 ± 0.58	8.94 ± 0.46	2.23 ± 0.31*	2.56 ± 0.45*
Note: *p<0.05						

Comparison of clinical indicators in the patients of the two groups

Before treatment, the difference of clinical indicators between the two groups was less. After treatment, the clinical indicators in the observation group was superior to those of the control group (P<0.05, Table 2).

Table 2. *Comparison of clinical indicators in the patients of the two groups.*

Group	Time	FPG (mmol/L)	HbAlc (%)	FINS (mu/L)	HOMA-β	L30/G30
observation group	Before treatment	10.11 ± 2.25*	11.43 ± 2.58*	7.39 ± 1.64*	14.36 ± 5.54*	4.13 ± 1.02*

	After treatment	5.05 ± 1.14*	5.37 ± 1.52*	15.76 ± 2.75*	35.13 ± 6.66*	7.45 ± 1.38*
Control group (n=41)	Before treatment	10.19 ± 2.31*	11.38 ± 2.61*	7.45 ± 1.59*	14.41 ± 5.62*	4.10 ± 0.96*
	After treatment	6.87 ± 1.72*	6.96 ± 1.84*	11.56 ± 2.42*	27.53 ± 6.45*	6.27 ± 1.25*
Note: *p<0.05						

Comparison of the incidence of complications in the patients of the two groups

As shown in Table 3, the incidence of complications in type 2 diabetic patients in the observation group was significantly lower than that in the control group (P<0.05).

Table 3. *Comparison of the incidence of complications in the patients of the two groups (n, (%)).*

Group	Cases	Gastroplegia	Ileus	Infection	Diarrhea	Overall incidence
Observation group	41	1	1	1	2	12.20*
Control group	41	4	3	3	4	34.15*
Note: *p<0.05						

Discussion

Intestinal flora is normal human microbes [8,9], which can synthesize a variety of vitamins to promote human growth and development, and participate in carbohydrate and protein metabolism, so important for human health. Intestinal flora imbalance can lead to chronic inflammation, obesity and other diseases [10], and is involved in the development of type 2 diabetes. The related mechanism is intestinal flora imbalance caused by the diet, which will promote the body to produce adverse metabolites, resulting in metabolism endotoxemia and systemic inflammatory response [11], eventually the emergence of insulin resistance and type 2 diabetes. Related study showed that the regulation of intestinal flora can make full use of the biological antagonism [12], gastric bypass relieved the occurrence and development of obesity related type 2 diabetes [4].

Surgical treatment and drug therapy is the main treatments of type 2 diabetes [13]. Due to the effect of changes of the intestinal islet axis hormone postoperation, [14] the blood glucose and insulin resistance of the patients will be decreased, the digestive areas for nutrients were changed, and then the function of intestinal hormones and islet β-cell changed [15,16], leading to intestinal flora imbalance. To a certain extent, open gastrointestinal surgery can improve intestinal flora imbalance [17,18], but its effect is inferior to gastric bypass surgery.

With the development of laparoscopic technique, gastric bypass is used in the treatment of type 2 diabetes, with more ideal effect. After gastric bypass surgery, the gastric volume of type 2 diabetes patients will be decreased to reduce postprandial blood glucose levels [19,20]. In addition, the study found that when fasting blood glucose increased, enterobacteria of type 2 diabetes patients will increase, *Bifidobacterium* and lactic acid bacteria reduced [21], indicating that the gastric bypass can regulate intestinal flora. At 15 d after surgery, bifidobacteria, lactic acid bacteria and enterobacterium increased up to (8.74 ± 0.42 Log N/g), (3.75 ± 0.53 mmol) and (8.15 ± 0.38 Log N/g) in the observation group, which were significantly higher than that in the control group (P<0.05)/L).

Gastric bypass [22] can shorten the time of food into the ileum, stimulate the small intestinal epithelial cells, improve pancreatic β-cell function and regulate the secretion function of islets [23,24], and then control the blood glucose levels. The FPG (5.05 (15.76 ± 2.75 mu/L), HOMA-β (35.13 ± 6.66) and L30/G30 (7.45 ± 1.38) of the observation group after surgery were better than those in the control group, (P<0.05), suggesting gastric bypass is superior to the control group in improving blood glucose level and islet function. Compared with open gastrointestinal surgery, gastric bypass surgery can reduce the incidence of complications such as infection and diarrhea, due to small wound [25]. The study data showed that the complications rate in the observation group (12.20%) was lower than that of the control group (34.15%). P less than 0.05 indicated that the prognosis of gastric bypass surgery was good.

In summary, gastric bypass can regulate intestinal flora of patients with type 2 diabetes, thereby reducing the patient's blood glucose.

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