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ORIGINAL ARTICLE

Effectiveness of a large-calibre transanal drainage tube on the prevention of anastomotic leakage after anterior resection for rectal cancer

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Summary

Purpose: *Anastomotic leakage (AL) is one of the most serious complications of colorectal surgery. We investigated whether the large-calibre transanal drainage tube (LTDT) placement could reduce AL after anterior resection for rectal cancer.*

Methods: *We restrospectively analyzed 222 patients who underwent anterior resection at our institution. The patients were divided into the large-calibre transanal drainage tube (LTDT) and non-transanal drainage tube (NTDT) groups according to whether the large-calibre transanal drainage tube was placed in the operation. Clinical characteristics and postoperative complication were compared between the LTDT and NTDT groups.*

Results: *In the LTDT group, AL occurred in 0 patient, whereas it occurred in 9 patients in the NTDT group. The rate of AL was significantly lower in the LTDT group (0 vs. 6.6%; p=0.015). Eight cases of AL were treated conservatively. One case developed severe peritonitis and underwent re-operation receiving temporary stoma.No perioperative death occurred in this series.*

Conclusions: *The large-calibre transanal drainage tube effectively prevented the occurrence of anastomotic leakage after anterior resection for rectal cancer and increased the safety of the surgery.*

Key words: *anterior resection, large-calibre transanal drainag tube, anastomotic leakage, rectal cancer*

Introduction

Rectal cancer is one of the common digestive tract tumors. According to statistics, there are about 1.2 million new cases every year world over [1]. Low anterior resection is the common method of treating middle and lower rectal cancer. With the intensive study of the biological behavior of rectal cancer and the local anatomy of rectum, the continuous innovation and progress of anastomosis technology, and the enhancement of perioperative treatment, the anal sphincter rate of rectal cancer is increasing year by year. However, as a result of the significant increase of sphincter preservation rate, there has been an increasing concern about AL following low anterior resection. Studies have reported the incidence of AL is 3-21% [2-5]. AL may lead to serious morbidity, panperitonitis and sepsis. It can also prolong hospitalization time, increase hospitalization costs and affect patient postoperative quality of life [6-9].

Recently, the defunctioning stomas (DS) are the most classic procedure for preventing AL, and it is also the most widely used. However, the DS has some disadvantages, such as inconvenience, patient feeling uncomfortable and reoperation for stoma closure [10]. A study has shown that the decrease of pressure in the anastomotic portion is very important for the prevention of AL [11]. As a result, we use the transanal drainage tubes for

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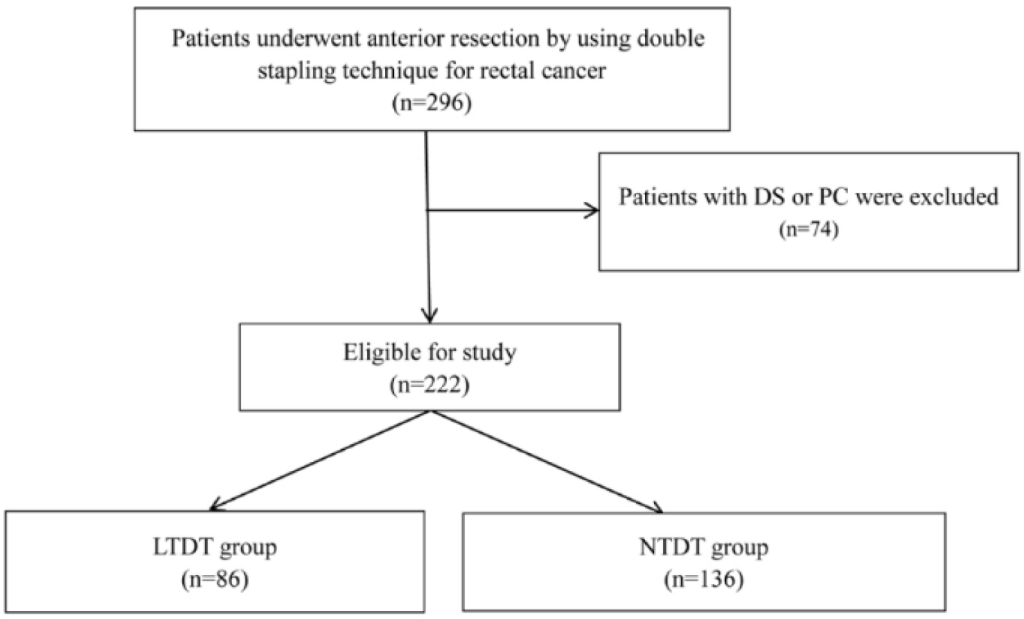

Figure 1. Study flowchart.

patients at high risk of anastomotic leakage after surgery. However, there are a few studies [12,13] on the effectiveness and safety of the transanal drainage tube. Therefore, the purpose of this study was to investigate whether the large-calibre transanal drainage tube placement can reduce AL after anterior resection for rectal cancer.

Methods

Patients

This was a single institution retrospective cohort study. Between January 2013 to June 2017, a total of 296 patients underwent anterior resection for rectal cancer. The study was approved by the institutional reviewed board of Putian College Hospital. The inclusion criteria for this study were histologically confirmed rectal adenocarcinoma, primary tumor located 10 cm of the anal verge and anterior resection using double stapler technique. We excluded 74 patients for the following reasons: transanal hand-sewn coloanal anastomosis, preoperative chemoradiation or diverting stoma. The eligible 222 patients were divided into two groups: those with LTDT and those with NTDT groups (Figure 1).

Surgical procedure

All patients were subjected to routine bowel preparation before surgery. All operations were performed by the same surgical team specializing in colorectal surgery. All patients underwent anterior resection according to the principles of total mesorectal excision (TME). The rectum was transected at a level at least 5 cm distal to the inferior margin of the tumor in the upper rectal cancer and 2-3 cm distal to the inferior margin of the tumor in the middle and lower rectal cancer. Lymph nodes were swollen across the mesenteric artery and vein roots. Intraoperative frozen section and/or post-

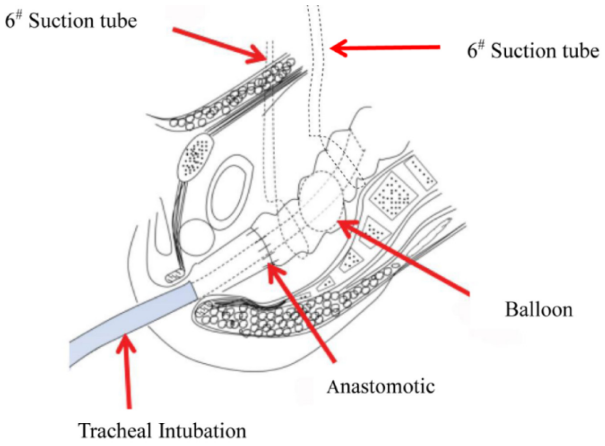

Figure 2. Large-calibre transanal drainag tube placement diagram.

operative paraffin section pathological examination revealed no residual in the stump. An end-to-end colorectal or colo-anal anastomosis was performed using double stapler technique in all patients and flushed the pelvis and rebuilded the pelvic floor. An abdominal drain was placed in all patients.

The LTDT tube used in this study was a 7.5# tracheal intubation. After the anastomosis was completed, a large-calibre drainage tube was gently inserted into the anus, and the balloon end was placed about 5 cm proximal to the anastomosis. The balloon was filled with 15ml of air to make it fit substantially with the intestinal wall. The end of the tracheal intubation was connected to the drainage bag. We performed a hole in the mesocolon corresponding to the lower end of the balloon using a vascular clamp. Then, a sunction catheter was twined around the bowel through the small hole. A small opening was performed in the left lower abdomen wall and then put the suction tube to the outside of the body. The ends of the suction tube were inserted into the drainage

bag (about 6mm in diameter). The suction tube was inserted above the airbag in the same manner (Figure 2). In most cases, the tube was removed if fecal discharge or the passage of flatus was continuously observed at approximately four to six days after operation.

Definition of anastomotic leakage

Clinical AL was defined as follows [14-16]: fever or septicaemia with the occurrence of pelvic abscess; discharge of faeces, pus, or gas from the abdominal drain; peritonitis and rectovaginal fistula. All cases of AL were confirmed by one or more of the following methods: multi-slice spiral computed tomography (CT), rectal examination, sigmoidoscopy or re-laparotomy.

Statistics

The collected patient data were reviewed. Statistical analyses were performed using SPSS 13.0 software package for Windows (SPSS, Chicago, IL, USA). X^2 test, Fisher's exact test, and Student's *t*-test for categorical variables were used for statistical comparison of clinical characteristics and complications of patients in the TDT and NTDT groups. A p value less than 0.05 was considered statistically significant.

Results

Between January 2013 and June 2017, a total of 222 patients who met the inclusion criteria underwent anterior resection for rectal cancer in our institution. There were 127 males and 95 females (the ratio of male to female was 1.34). The average age was 58.5 years (range, 32-84). The diameter of the tumor was 2.6-7.4 cm, with an average of 4.8 cm. The average body mass index (BMI) was 21.0 kg/m^2 (range, 10.5-32.6). According to Dukes staging, there were 53 cases in stage A, 93 cases

Table 1. Clinical characteristics of two groups

	LTDT group (n=86) n (%)	*NTDT group (n=136) n (%)*	*x^2 value or t value*	*p value*
Sex			0.609	0.435
Men	52 (60.5)	75 (55.1)		
Women	34 (39.5)	61 (44.9)		
Age, years			0.013	0.908
≥60	36 (41.9)	58 (42.6)		
<60	50 (58.1)	78 (57.4)		
BMI (kg/cm^2)	21.18+2.09	20.99+2.17	0.400	0.690
Hemoglobin (g/I)			0.243	0.622
≤90	10 (11.6)	13 (9.6)		
>90	76 (88.4)	123 (90.4)		
Serum albumin (g/i)				
≤30	12 (14.0)	9 (6.6)	3.310	0.06
>30	74 (86.0)	127 (93.4)		
Maximum diameter of tumor (cm)			0.000	0.992
≥5	48 (55.8)	76 (55.9)		
<5	38 (44.2)	60 (44.1)		
Distance between lower margin of tumor and dentate line (cm)			0.301	0.860
<5	30 (34.9)	48 (35.3)		
5-8	46 (53.5)	69 (50.7)		
≥8	10 (11.6)	19 (14.0)		
Dukes staging			2.692	0.442
A	16 (18.6)	37 (27.2)		
B	38 (44.2)	55 (40.4)		
C	31 (36.0)	41 (30.1)		
D	1 (1.2)	3 (2.2)		
Co-morbidities				
Diabetes	41 (47.7)	51 (37.5)	2.247	0.134
Hypertension	19 (22.1)	25 (18.4)	0.456	0.499
Ischaemic heart disease	0 (0.0)	5 (3.7)	3.235	0.072

Values are expressed as numbers (percents) or mean±standard deviation. BMI: body mass index

Table 2. Comparisons of operative details

Operative details	*LTDT group (n=86)*	*NTDT group (n=136)*	*t value*	*p value*
Operation time,min	298.08±51.13	234.20±53.95	6.32	0*
Blood loss, mL	260.92±125.73	250.30±99.05	0.426	0.671
Distance between anastomosis line and the anal verge, cm	3.95±1.34	4.6±1.93	-1.617	0.11

Values are expressed as mean±standard deviation. *p<0.05 is considered statistically significant

Table 3. Rate of anastomotic leakage

Rate	*LTDT group (n=86)* *n (%)*	*NTDT group (n=136)* *n (%)*	x^2	*p value*
Anastomotic leakage	0 (0.0)	9 (6.6)	5.932	0.015*

*p<0.05 is considered statistically significant

in stage B, 72 cases in stage C, and 4 cases in stage D. There were 86 patients in the LTDT group and 136 patients in the NTDT group. The clinical characteristics of two groups are shown in Table 1. No significant difference between the two groups in clinical characteristics was noted.

The surgical data of two groups are presented in Table 2. The mean operation time was longer in the LTDT group than in the NTDT group (298±51.13 vs 234.30±53.95, p<0.000). However, the amount of blood loss, distance between the anastomosis line and the anal verge showed no significant difference between the two groups.

Symptomatic AL occurred in 9 of the 222 patients. The AL of patients in two groups were compared and the data are shown in Table 3. AL occurred in 0 patient in the LTDT group, whereas it occurred in 9 patients in the NTDT group. The rate of AL was 0% in the LTDT group and 6.6% in the NTDT group. The LTDT group had a significant lower AL rate than the NTDT group (0 *vs.* 6.6%; p=0.015). Eight patients with AL were cured after conservative treatment, such as fasting, anti-infection, rehydration and other nutritional support treatments, simultaneously double-cannula saline flushing and negative pressure drainaging. One case developed severe peritonitis and underwent re-operation with temporary stoma. No in-hospital death occurred in either group.

Discussion

AL is one of the most serious complications of colorectal surgery. Despite advances in the surgical instruments, anastomotic techniques and surgical instruments, the incidence and consequences of AL have not changed significantly over the past 50 years. The occurrence of AL after anterior resection for middle and low rectal cancer has always been the biggest challenge for surgeons. Our study confirmed that the use of large-caliber transanal drainage tube can reduce the incidence of AL after rectal surgery, although the operation time was significantly longer in the large-caliber transanal drainage tube group than in the control group.

Many factors have been reported to be associated with AL [17-24]. It is currently believed that the occurrence of AL after rectal surgery is mainly due to poor anastomosis and local blood supply disorder. Manual anastomosis techniques, such as improper use of stapler and other iatrogenic factors can cause poor anastomosis, improper operation or damage to the blood vessels that nourish the rectum, can cause distant and near anastomotic blood supply disorders, especially TME surgery is easy to perform. Unfavorable factors such as distal bowel blood supply disorder and excessive anastomotic tension can also affect the reliability of the anastomosis and local blood supply. At the same time, the occurrence of AL may also be related to individual factors like tumor factors, such as tumor size, tumor location, Dukes stage, surgical factors, such as surgeon skills, anastomotic sites, operation time, blood loss, blood flow to anastomosis, tension anastomosis, surgical area contamination and intestinal preparation and patient factors such as gender, smoking, obesity, nutritional status and co-morbidities. In our study there were no significant differences between the two groups regarding risk factors for AL such as gender, age, clinical stage, and co-morbidities. In addition, the LTDT group involved more cases with lower anastomotic site and longer operation time compared with the NTDT group. In other words, the LTDT group had many high-risk cases of AL. Despite this, the incidence of AL in large-caliber transanal drainage tube group

was significantly reduced. According to this result, placement of the large-caliber transanal drainage tube was very effective in preventing AL.

AL after anterior resection usually occurred in the early postoperative period (2-8 days) [23], with an average time to leakage of 4 days after surgery [4]. In the early postoperative period, the anal sphincter is mostly in a tight contraction state, resulting in higher endoluminal pressure. In addition, when the patient's intestinal contents or gas rushed to the anastomosis portion with peristalsis, the anal sphincter could not relax in time, further causing a suddenly increase in endoluminal pressure, and severely impacting the anastomosis that had not completely healed, thereby causing AL. Therefore, we speculated that postoperative endoluminal pressure may be a risk factor for AL. Studies have shown that the transanal decompression and drainage can reduce the occurrence of AL [25-28]; however, the ordinary drainage tube has a small caliber. It mainly drains gas, and the drainage effect on the feces is not good; what's more, it should be fixed to the buttocks, which bring some pain to patients. By chance, we used a tracheal intubation to make a large-diameter transanal drainage tube, and found that in addition to drainage of gas and liquid, it can also drain the stool. Our study found that the placement of large-caliber transanal drainage tube can significantly reduce the incidence of AL after anterior resection of rectal cancer, and no AL occurred in the large-caliber transanal drainage tube group.

The advantages of large-caliber transanal drainage tube for preventing AL after anterior resection of rectal cancer are as follows: First, it is convenient to take the material and easy to prepare: a 7.5# tracheal intubation with balloon, and the tail is connected with the drainage bag, which is simple and practical. Second, the inflatable tube is connected with a syringe to inject the air, then the balloon is self-fixed after inflation, which avoids the invasive suture of the needle thread, reducing thus the discomfort to the patient. Next, a 7.5# tracheal intubation has larger diameter and the drainage decompression effect is significant. It not only can discharge gas and fluid after surgery, but also can drain the loose stool, effectively reducing the endoluminal pressure, which is conducive to anastomosis heal. Finally, large-caliber transanal drainage tube contributes to anal sphincter relaxation. We found that some patients may have thick outflow between the drainage tube and the anal gap in the early postoperative period (3 days) and it is speculated that placement of the large-caliber transanal drainage tube may contribute to anal sphincter relaxation.

Although large-caliber transanal drainage tube is easy and convenient, we have found that we should pay attention to the following matters in practice. Firstly, when placing the large-caliber transanal drainage tube, we should apply a proper amount of liquid paraffin on the head of the tube to avoid violent operation. Second, the indwelling time of the anal canal should be appropriate. It should not be too long or too short. If the time is too short, the purpose of protecting the anastomosis cannot be achieved. If it is too long, it will easily cause dead space and cause bacteria to multiply. Generally, it can be removed after about 1 week.

Conclusions

The large-calibre transanal drainage tube can effectively prevent the occurrence of AL after anterior resection for rectal cancer and increase the safety of the operation. It is worthy of further research and promotion.

Conflict of interests

The authors declare no conflict of interests.

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