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Original Article

Application of transanal ileus tube in acute obstructive left-sided colorectal cancer

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Abstract: Objective: The efficacy of transanal ileus tube in acute obstructive left-sided colorectal cancer was discussed. Method: A total of 101 cases of acute obstructive left-sided colorectal cancer were divided into two treatment groups. For the experimental group consisting of 52 cases, decompression was performed using transanal ileus tube along with drainage and flushing as preparations for one-stage resection and anastomosis. For the control group consisting of 49 cases, the traditional preoperative preparation including fasting and water deprivation, gastrointestinal (GI) decompression, enema and nutritional therapy was performed. Results: After the ileus tube was indwelled for 3 days, the abdominal circumference, GI decompression amount, and maximum transverse diameter of colon proximal to obstruction changed significantly in the experimental group. The response rate within 24 h and the operation rate of one-stage resection and anastomosis were higher. The incidence and mortality rate after surgery were reduced, the hospitalization time was shorter, and less expenditures were incurred. Conclusion: Decompression using transanal ileus tube along with drainage and flushing as preparations for one-stage resection and anastomosis is a safe and effective method for treating acute obstructive left-sided colorectal cancer.

Keywords: Bowel obstruction, colorectal cancer, ileus tube, surgery

Introduction

The incidence of colorectal cancer is growing every year throughout the world, with the annual number of new cases amounting to about 850 thousand. More than 29% of the cases present with the early symptoms of acute complete or incomplete mechanical bowel obstruction [1]. Among these cases, carcinomatous obstruction accounts for 78% of all colorectal obstructions, and 77% cases are affected in the left-sided colon. The traditional treatment for obstructive colorectal cancer is staging surgery. For emergency one-stage surgery, palliative or radical tumor resection is performed with proximal colostomy. The two-stage surgery is colostomy with reduction. This technique reduces the occurrence of peritoneal infection and intestinal fistula, but prolongs the treatment cycle and adds to the pain and economic burden of the patients [2]. One-stage resection and anastomosis for acute obstructive colorectal cancer is currently gaining recognition due to its ability in improving the long-term survival and the survival quality of patients.

One-stage resection and anastomosis after intraoperative colonic lavage was first applied by Dudley et al. in 1980 for obstructive left-sided colon cancer. Besides the defects of complex procedure, high cost, long surgical time and high probability of spillage of feces, this surgical approach is most suitable for acute patients because of high risk related to one-stage resection and anastomosis [3]. These features have severely restricted its wide application.

Subtotal and total colectomy with one-stage anastomosis is safe and feasible for radical treatment of left-sided colon cancer. However, traumatic injuries can be caused by this approach, resulting in a high incidence of complications, and the restoration of peristalsis takes a longer time. So this surgical approach still evokes controversy [5].

Both emergency one-stage and second-stage surgeries have a higher mortality rate than elective surgery. The goals are to relieve obstruction, radically resect the tumors, and reduce

Table 1. Basic information of the cases in two groups (n, %, $\bar{X}$±s)

	Treatment group	*Control group*
Cases	52	49
Average age	63.22±12.34	67.17±13.00
Gender (Male/female)	23/29	22/27
Site of obstruction		
rectum	11 (21)	9 (18)
Sigmoid	17 (33）	15 (31)
Descending colon	20 (38)	18 (37)
Splenic flexure	4 (8)	7 (14)
differentiation		
High	47 (90)	45 (92)
Low	4 (8)	3 (6)
Mucinous adenocarcinoma	1 (2)	1 (2)
TNM Staging		
I	19 (37)	16 (33)
II	30 (58)	31 (63)
III	3 (5)	2 (4)

Note: Compared with the control, $P > 0.05$.

the mortality rate and complications related to emergency surgeries. Thus a new approach needs to be explored to "change" staging surgery to one-stage surgery or emergency surgery to elective surgery. At present, the ideal methods include enteral stent placement under the colonoscope and preoperative decompression followed by one-stage resection and anastomosis and the placement of transanal ileus tube followed by one-stage resection and anastomosis after decompression [6].

The former is to relieve the bowel obstruction by placing enteral metal stent. Oral administration of antibacterial agent and flushing using colonic hydrotherapy fluid are performed. Then radical surgery for colorectal cancer with one-stage resection and anastomosis is performed after about 2 weeks [7]. However, this surgical approach is usually associated with frequent short-term complications and the stent is costly.

The use of ileus tube for the decompression of colon proximal to obstruction can quickly relieve the obstruction and to create favorable conditions for one-stage resection and anastomosis [8]. In recent years, transanal ileus tube has been used frequently and a good effect is achieved [9]. Compared with stent, transanal ileus tube is much cheaper and causes less complications. From January 2007 to November 2011, 101 cases of acute obstructive left-sided colorectal cancer were treated at our hospital, and 52 cases received one-stage resection and anastomosis after preoperative decompression using transanal ileus tube. All cases achieved good outcome.

Materials and methods

Clinical materials

Retrospective study was carried out with 101 cases divided into 2 groups according to treatment method (**Table 1**).

Treatment method

Treatment group: Colonoscopy was performed after lavage. CLINY ileus tube (Ileus Tube, Create Medic Co., Japan) was pushed forward under the colonoscope until it reached the bowels proximal to the obstruction. Negative pressure aspirator was used for decompression, and after catheterization fecal content was drained. Then the patients were returned to the ward and received colonic flushing with normal saline and Metronidazole injection. Colonic flushing was done once every 3 h with 100 ml of normal saline at 1-3 d, and 100 ml of Metronidazole injection was infused twice a day. The total flushing amount was 1000 ml/d. After 3 d, the amount of normal saline was increased according to the drainage amount, but the total flushing amount did not exceed 2000 ml/d. The flushing method was as follows. The infusion set was connected to the Y-shaped end of the ileus tube with the other end clipped. The flushing fluid was added dropwise at the speed of 5-10 ml/min. Then the outlet end was clipped to let the fluid remain in the intestinal lumen for 5-10 m. When the stool was softened, the outlet end was opened and the intestinal content was drained. The flushing was done for 5-7 days until the drainage fluid became clear with no or little fecal residue. The patients were fasted from solids and liquids. GI decompression, parenteral nutrition and fluid replacement therapy were given in addition to anti-infection treatment. When the obstruction was relieved and the patients showed flatus and defecation, liquid diet or enteral nutrition therapy was given and preoperative intestinal preparation was performed. One-stage resection and anastomosis was conducted electively.

Table 2. Comparison of abdominal circumference, GI decompression amount and maximum transverse diameter of bowels proximal to obstruction at 3 d after catheterization ($\bar{X}$±s)

	Abdominal circumference (cm)	*Decompression amount (ml)*	*Maximum transverse diameter of bowels proximal to obstruction (cm)*
Before catheterization	93.21±6.73	5.83±1.61	78.52±9.89[a]
3 d later	789.25±235.47	77.90±9.31[a]	1.94±0.72[a]

Note: Compared with that before catheterization, [a]$P < 0.001$.

Table 3. Decompression amount after catheterization (mL, $\bar{X}$±s)

	Drainage amount	*Flushing amount*	*Decompression amount*
1 d	679.21±245.93	792.39±223.05	-111.24±159.21
2 d	771.50±231.32	878.83±186.17	-105.65±173.03
3 d	971.75±319.51	921.27±151.33	52.59±252.70[a]
4 d	1923.74±687.17	1638.54±454.76	395.41±371.26
5 d	2352.73±576.70	1840.44±336.28	497.33±396.92

Note: Compared with 1 d, 2 d, 4 d and 5 d, [a]$P < 0.05$.

Control group: The patients were fasted from liquids and solids and underwent GI decompression, colonic lavage and anti-infection treatment along with parenteral nutrition and fluid replacement therapy. Of 49 cases in the control group, 47 received emergency staging surgery, emergency one-stage palliative or radical tumor resection, or proximal colostomy. Two-stage colostomy with reduction was performed 3 months later. Two cases received elective one-stage resection and anastomosis, followed by secondary surgery with preoperative intestinal preparation when the obstruction was relieved. Colostomy or one-stage resection and anastomosis was performed depending on tumor size, bowel wall edema and severity of obstruction.

Observation indicators

Efficacy evaluation of catheterization for the treatment group: (1) Abdominal circumference: Abdominal circumference at the umbilical level was measured; (2) Drainage amount of the gastric tube; (3) Maximum transverse diameter of bowel proximal to obstruction: X-ray films were taken in upright and supine position. The number of liquid-gas interfaces was read from film in upright position, and the degree of dilation of the bowels was read from film in supine position. The maximum transverse diameter of bowels proximal to obstruction was measured; (4) decompression amount was calculated by drainage amount minus flushing amount.

Indicators for efficacy evaluation: (1) Response rate within 24 h after hospitalization; (2) proportion of cases receiving one-stage resection and anastomosis; (3) incidence of postoperative complications and mortality rate; (4) total length of stay in hospital; (5) Total expenditures.

Statistical process

SPSS17.0 software was used for statistical analyses. Count data were analyzed by chi-square test. Measurement data were expressed as mean ± standard deviation. Intergroup means were analyzed by paired t-test. Length of stay in hospital and total expenditures were analyzed by ANOVA. $P < 0.05$ was considered as statistically significant.

Results

Efficacy evaluation before and after catheterization

Changes of abdominal circumference, GI decompression amount and maximum transverse diameter of bowels proximal to obstruction: The abdominal circumference, GI decompression amount and maximum transverse diameter of bowels proximal to obstruction were obviously reduced at 3 d after catheterization in 52 cases ($P < 0.001$). See **Table 2**.

Changes of decompression amount: Decompression was performed for 5-7 d in the treatment group with an average of 6.84±1.61 d. The daily flushing amount and drainage amount are shown in **Table 3**.

Efficacy

Response rate within 24 h and surgical method: The two groups differed significantly in response rate within 24 h. For the control group, 47 cases received emergency staging surgery and 2 cases received elective one-stage resection and anastomosis. All cases in the treatment group received elective one-

Table 4. Response rate within 24 h and surgical method in the two groups

Group	*n*	*Response rate within 24 h (%)*	*One-stage resection and anastomosis (n)*	*Staging surgery (n)*
Experimental	49	8	2	47
Control	52	92[a]	52[a]	0[a]

Note: Compared with control, [a]$P < 0.01$.

Table 5. Incidence of complications and mortality rate in the two groups (%)

Group	n	Incidence of complications	Mortality rate
Control	49	24	6
Experimental	52	8[a]	2

Note: Compared with control, [a]$P < 0.05$.

Table 6. Length of stay in hospital and hospitalization expenditures in the two groups ($\overline{X} \pm s$)

	n	Length of stay in hospital (d)	Total expenditures (Yuan)
Control	49	29.63±1.31	34187.90±2498.33
Experimental	52	25.44±3.32[a]	18676.64±1962.44[a]

Note: Compared with control, [a]$P < 0.01$.

stage resection and anastomosis ($P < 0.01$). See **Table 4**.

Postoperative complications and mortality rate: The two groups showed significant differences in incidence of postoperative complications ($P < 0.05$). The mortality rate in the treatment group was lower than that of the control group (**Table 5**).

Length of stay in hospital and total expenditures: The cases in the treatment group had a shorter length of stay in hospital and lower hospitalization expenditures ($P < 0.01$) (**Table 6**).

Discussion

Comparison of different approaches of one-stage resection and anastomosis for acute obstructive left-sided colorectal cancer

Acute obstructive left-side colorectal cancers are generally complete bowel obstructions with elderly people as the most vulnerable population. Acute care surgery is usually needed to relieve the obstruction. Staging surgery is the traditional treatment method consisting of colostomy (or combined with tumor resection) as emergency one-stage surgery and colostomy with reduction as the second-stage surgery. However, this surgical approach has the disadvantages of long treatment cycle, high cost, high probability of tumor metastasis and high risk. According to Liu et al., the mortality rate of one-stage resection and anastomosis for obstructive left-sided colorectal cancer was 5.1% [10]. The main concern for the surgeons is to successfully perform one-stage resection and anastomosis and to reduce the complications for obstructive left-sided colorectal cancer. The common methods of one-stage resection and anastomosis include one-stage resection and anastomosis with colonic lavage, colonoscopically aided stent placement, one-stage resection and anastomosis following preoperative decompression, and placement of transanal ileus tube and preoperative decompression followed by one-stage resection and anastomosis.

One-stage resection and anastomosis with intraoperative colonic lavage as an emergency surgery can greatly prolong the surgical time and increase the possibility of intraoperative peritoneal contamination [11]. Moreover, since the colonic edema has not subsided, there is a large difference in the diameter of colon segments proximal and distal to the tumor. This not only lead to difficult anastomosis, but also higher incidence of anastomotic leak and infection [12]. Fewer reports have been published concerning this surgical approach in recent years, probably due to the high risk of on-stage resection and anastomosis. On the contrary, there are more studies on colonoscopically aided stent placement with preoperative decompression. However, the use of metal stent may induce frequent complications, and the cost of stent is high [13]. So this method is not suitable in clinical application.

Ileus tube is flexible and easily manipulated in one-stage resection and anastomosis for acute obstructive left-sided colorectal cancer, and the success rate can be as high as 84%-98% [14]. The incidence of complications is much lower and the cost of ileus tube is only 1/4 that of the metal stent, so ileus tube is more suitable for bowel obstruction distal to splenic flexure. After the successful placement of ileus

tube in our cases, no major complications were reported except the discomfort or pain of the anal region. The treatment seemed to be well tolerant in all cases without perforation and bleeding. The effect was satisfactory after the placement of ileus tube. We believe that changing emergency surgery into elective surgery with the alleviation of obstruction followed by one-stage resection and anastomosis is the preferred strategy for acute obstructive left-sided colorectal cancer. It is safer and more effective with the use of transanal ileus tube for decompression [15].

Changes of decompression amount

In the present study, the flushing amount in the first 3 days after the placement of ileus tube was greater than the drainage amount, and the decompression amount was a negative value. The decompression amount gradually increased since the fourth day, reaching about 300-1000 mL/d. The decompression amount can be used as the basis for flushing: (1) intensive flushing is not appropriate at the early stage after ileus tube placement when the stool is thick and large in amount. Over-flushing may lead to unsmooth drainage and aggravation of obstruction; (2) the stool becomes less thick after the first 3 days, and the drainage amount increases. Intensive flushing at this stage can keep the intestinal tract clean, but over-flushing may injury the intestinal mucosa. The flushing amount can be set as below 2000 ml/d; (3) the cleanness of the intestinal tract can be determined by the amount and components of decompression, and fluid replacement therapy can be given based on the loss of intestinal juice.

Advantages of transanal ileus tube

Our research indicates that transanal ileus tube has the following advantages in treating acute obstructive left-sided colorectal cancer: (1) The use of transanal ileus tube during emergency surgery can quickly relieve the obstruction and abdominal symptoms and alleviate bowel wall edema; (2) Compared with emergency surgery, elective surgery allows more time for preoperative preparation and intraoperative treatment, such as correcting water-electrolyte imbalance, acid-base imbalance, anemia and hypoproteinemia. The difficulty of surgery can be reduced, with less risk of peritoneal contamination caused by intraoperative colonic lavage, shortened surgical time and reduced incidence of complications; (3) When performing one-stage resection and anastomosis instead of staging surgery, transanal ileus tube can achieve effective preoperative decompression, and the cleanness of the intestinal canal is guaranteed by flushing. These measures can increase the success rate of one-stage resection and anastomosis; (4) The transanal ileus tube is a closed drainage system, which can be used to maintain water-electrolyte balance by fluid replacement therapy according to the drainage amount.

Matters needing attention with the use of transanal ileus tube

(1) The insertion of transanal ileus tube should be performed by special doctors with the aid of colonoscopy and X-ray to track the guide wire. Any violent manipulation may cause the penetration of the edematous bowel wall and mistaken insertion into the peritoneal cavity, resulting in bleeding, perforation and peritonitis [16]; (2) After placement, flushing and drainage need to be done with normal saline to clear the stool in the intestinal lumen proximal to the obstruction so as to relieve the symptoms [17]; (3) On the day of placement, GI decompressor is used for drainage with intermittent negative pressure drainage based on the drainage amount. From the 2 d after surgery, the flushing amount can be increased depending on the thickness of stool and the drainage amount. Intensive flushing should be avoided in the face of obstructed drainage. Flushing with less normal saline combined with intermittent negative pressure drainage can help ensure the water-electrolyte balance. The flushing amount should not exceed 2000 ml/d. After the flushing fluid becomes clear, the interval between two flushing operations can be increased using high-permeability saline so as to relieve bowel wall edema and to increase the success rate of anastomosis; (4) There may be a considerable loss of intestinal juice due to repeated flushing, so water-electrolyte balance needs to be carefully maintained; (5) From 3 d after surgery, reexamination should be done using X-ray scan to evaluate the decompression effect. When the abdominal symptoms subside, the patients can resume liquid diet or oral administration of enteral nutrition; (6) Routine medical care is also necessary to prevent blockage and falling off of the tube.

Transanal ileus tube has not been used in acute obstructive left-sided colorectal cancer until recently, and many problems need to be resolved. Preliminary researches have confirmed the safety and effectiveness of transanal ileus tube that makes one-stage resection and anastomosis possible [18]. Besides being economical and convenient, transanal ileus tube causes less trauma and pain and greatly improves the life quality of patients. Transanal ileus tube has a huge potential in treating acute obstructive left-sided colorectal cancer.

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Disclosure of conflict of interest

None.

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