

## Original Article

# Comparison of improved three-port laparoscopic surgery and traditional five-port laparoscopic surgery for rectal cancer

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**Abstract:** Objective: The aim of this study was to explore the feasibility and safety of laparoscopic rectal cancer surgery with the improved three-port method. Methods: Patients who underwent improved three-port laparoscopic rectal resection (n=22) or traditional five-port laparoscopic rectal resection (n=25) for rectal cancer from February 2012 to July 2012 were analyzed retrospectively. Operative parameters and outcomes were compared between groups, such as operating time, blood loss, postoperative exhaust time, length of hospital stay, tumor diameter, the number of lymph nodes dissected, the length of distal resection margin and sample, the incidence of anastomotic leakage and anastomotic bleeding. Results: Slightly longer operative time and more blood loss were observed in three-port laparoscopic surgery group compared with that in traditional five-port laparoscopic surgery group, but there were no significantly different ( $P>0.05$ ). Postoperative exhaust time, time for extracting catheter, length of hospital stay, the number of lymph nodes dissected, the length of distal resection margin and sample, and rate of postoperative complications did not differ significantly ( $P>0.05$ ). Conclusions: Improved three-port laparoscopic rectal resection for rectal cancer was similar to traditional five-port laparoscopic surgery in safety, feasibility, and curative effect. Moreover, three-port surgery contributed to reduce the surface scar and decrease the physical and psychological trauma for patients.

**Keywords:** Rectal cancer, laparoscope, three-port laparoscopic surgery

## Introduction

Rectal cancer is one of the most common malignancies in digestive tract, and surgery is still the main treatment for rectal cancer [1, 2]. With the continuous development of minimally invasive surgical techniques represented by the laparoscopic technology, it has been confirmed that laparoscopic rectal resection can achieve the same effect as open surgery [3-5]. To date, over five pathways for minimally invasive surgery of rectal cancer were developed, such as laparoscopic surgery, hand-assisted laparoscopic surgery, robotic laparoscopic surgery, single-port laparoscopic surgery and natural orifice transluminal endoscopic surgery (NOTES) [6-9]. Currently, laparoscopic rectal surgery (LCS) requires 4-5 ports to com-

plete the operation. In clinic, we observed the deficient in daily supply of the endoscopic instruments with the increasing amount of laparoscopic surgery. Therefore, further investigations are essential for laparoscopic technique. Specially, how to develop the technology of laparoscopic rectal cancer resection was important, including two-port surgery, single-port surgery, even NOTES. In addition, how we can accomplish the operation with smaller wounds, less path and reducing laparoscopic assistant?

In our department, improved three-port laparoscopic rectal resection for rectal cancer was performed in February 2012 to July 2012. In this study, we aimed to evaluate the feasibility and safety of improved three-port laparoscopic

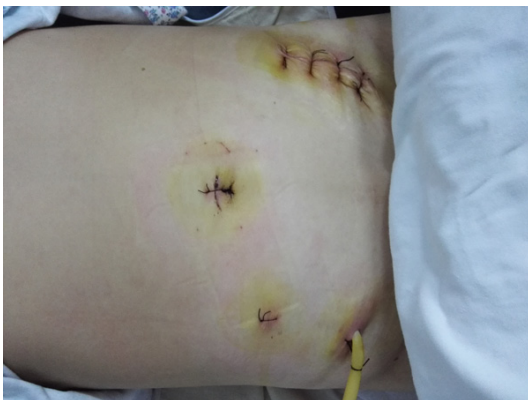
# Three-port laparoscopic surgery for rectal cancer

**Table 1.** Clinical characteristics of the three-port group and five-port group

Group	Three port (n=22)	Five port (n=25)	P
Age (y)	64.2±6.7	62.1±9.8	0.445
Sex (n)			
Male	12	13	0.409
Female	10	12	
Distance to anal (cm)	9.2±3.6	9.9±3.1	0.378
Tumor invasion			
T1	1	2	
T2	2	3	
T3	7	6	
T4	11	14	



**Figure 1.** Trochar placement for three-port laparoscopic rectal resections. The three port were one abdominal observation port, one main operating port and one auxiliary operating port.



**Figure 2.** Postoperative image of patient. The ports were remodeled, and a drainage tube was placed through a 5-mm port site.

rectal resection in terms of operative factors and postoperative outcomes.

## Patients and methods

### Patients

We identified 152 cases of rectal cancer between February 2012 and July 2012. Among them, 22 cases undergoing improved three-port laparoscopic rectal resection (three-port group) and 25 cases undergoing traditional five-port laparoscopic rectal resection (five-port group) were included in the study. Pre-operative rectal examination, computed tomography (CT), biopsy and postoperative pathological examination were performed to diagnose rectal cancer. No distant metastasis and encroaching surrounding organs and tissues were observed in patients in two groups. Data on age, sex, tumor location and tumor invasion were obtained from the medical records, as shown in **Table 1**. All the patients gave a written informed consent.

The inclusion criteria in this study were as follows: preoperatively diagnosis as rectal adenocarcinoma according to the colonoscopy and pathology; single primary tumor and the length between tumor lower margin and anus  $\leq 15$  cm; no endoscopic resection, anal resection or sacral resection before operation. Cases of IV stage, palindromia, emergency surgery owing to acute ileus or perforation or hemorrhage, multiple primary cancer, combined with malignant tumor in other organs, combined with other parts of surgery, combined with intraoperative radiotherapy were excluded.

### Surgical techniques

All patients were placed in the lithotomy position in Trendelenburg. In the improved three-port group, an upper-umbilical incision 10 mm in length was made as the abdominal observation port. A 10-mm or 12-mm trocar was made in the 2 cm of interior of right anterior superior iliac spine. An additional 5-mm trocar was placed on the right side of the abdominal wall umbilicus or slightly higher level of umbilical cord. **Figures 1** and **2** presented the port setting. In consideration of the exposure of the operation area, it is better with right approach, or combining with bilateral approach. For female patients, uterus was fixed with titanium clips. The remaining surgical procedures and requirements were similar to the traditional five-port laparoscopic rectal resection [10]. All laparoscopic surgical procedures strictly fol-

## Three-port laparoscopic surgery for rectal cancer

**Table 2.** Operative variables in three-port group and five-port group

Group	Three port (n=22)	Five port (n=25)	P
Operating time (min)	162.2±31.3	153±29.1	0.436
Estimated blood loss (ml)	97.5±78.1	73.1±65.9	0.451
Time of first flatus (days)	2.7 ±0.6	3.1±0.2	0.412
Postoperative catheterization (days)	4.3 ±2.3	4.3±1.3	1.000
Postoperative hospital stay (days)	12.1±1.2	12.6±1.4	0.410

**Table 3.** Comparison of the tumor resection between three-port group and five-port group

Group	Three port (n=22)	Five port (n=25)	P
Tumor diameter (cm)	3.5±0.8	3.7±0.9	0.521
Number of lymph nodes dissected (n)	13.1±2.1	12.9±1.9	0.494
The length of distal resection margin (cm)	2.7±0.6	2.5±0.5	0.412
The specimen length (cm)	12.3±1.1	12.6±1.3	0.409
Anastomotic fistula	0	0	
Anastomotic bleeding	1	1	

lowed the principle of total mesorectal excision (TME) and pelvic autonomic nerve preservation (PANP). The operation was performed by the same surgeon.

### Parameters

Operative parameters and outcomes were compared between groups, such as operating time, blood loss, postoperative exhaust time, length of hospital stay, tumor diameter, the number of lymph nodes dissected, the length of distal resection margin and sample, the incidence of anastomotic leakage and anastomotic bleeding.

### Statistical analysis

The Student's *t* test and Pearson's  $X^2$  test were used for statistical analyses. All statistical analyses were performed using the SPSS 13.0 for windows. All differences were considered significant at  $P < 0.05$ .

### Results

#### Comparison of the short-term effects between two operations

Perioperative results of two operations were presented in **Table 2**. Slightly longer mean operative time and more mean blood loss were observed in three-port laparoscopic surgery

group, although not significantly, than that for traditional five-port laparoscopic surgery (162.2 vs. 153.0 min,  $P = 0.436$ ; 97.5 vs. 73.1,  $P = 0.451$ ). There were no significant differences in the postoperative exhaust time, time for extracting catheter and length of hospital stay.

#### Comparison of the tumor resection between two operations

There were no significant differences in the number of lymph nodes dissected, the length of distal resection margin and sample, and rate of postoperative complications ( $P > 0.05$ ), as shown in **Table 3**. No positive invasion was

observed in the postoperative pathologic examination.

### Discussions

Since the first report of laparoscopic rectal cancer surgery by Jacobs et al in 1990, less traumas or even no scar surgery with safety and effectiveness was the same goal of surgeons and patients [11]. To date, mounting evidence show that laparoscopic rectal cancer surgery is considered as a reasonable alternative approach for colorectal cancer [12, 13]. Lindsetmo et al expounded a standardized laparoscopic procedure for rectal resections and suggested that four-port or five-port was enough for the operation [14]. Recently, single-port or NOTES was developed in minimally invasive surgery for rectal cancer [15]. In our department, traditional five-port laparoscopic rectal resection is utilized and we accumulate several clinical experience. To investigate more improved laparoscopic technique, we attempt to develop the three-port laparoscopic rectal resection to reduce operative port and scars.

This study compared the effect of improved three-port laparoscopic rectal surgery and traditional five-port laparoscopic rectal surgery. The results indicated that slightly longer mean operative time and more mean blood loss were observed in three-port laparoscopic surgery

## Three-port laparoscopic surgery for rectal cancer

group, although not significantly, than that for traditional five-port laparoscopic surgery. There were no significant differences in the postoperative exhaust time, time for extracting catheter and length of hospital stay. The longer mean operative time and more mean blood loss of three-port surgery might owe to the primary phase of this technique at present. In respect to the tumor resection, there were no significant differences in the number of lymph nodes dissected, the length of distal resection margin and sample, and rate of postoperative complications. These data indicated that the feasibility and safety of improved three-port laparoscopic rectal resection for rectal cancer was similar to traditional five-port laparoscopic surgery. Moreover, three-port surgery contributed to reduce the surface scar and decrease the physical and psychological trauma for patients.

We launched the three-port surgery primarily and made some improvement as followed. Firstly, upper-umbilical port was made and two operative ports were retained. For female patients with large pelvis, uterus was fixed with titanium clips. To obtain better operative field and safety, an operating port for assistant of 5-mm incision was sometimes made in the interior of left anterior superior iliac spine. Secondly, the patients were placed in Trendelenburg position. The operative bed is inclined to the direction of the operation. Then the gut will shift naturally with the gravity to obtain a good operating field. This position decreased the bowel traction and tissue damage. Thirdly, the operation could be completed by one operator, with one mirror handing and one scrub nurse. When the assistant was unfamiliar with the laparoscopic surgery, the assist operation will interrupt the views. Skilled laparoscopic technique was required for the operator performing three-port surgery.

In conclusion, traditional five-port laparoscopic surgery was gradually developed to the three-port laparoscopic surgery in our department. And there were no significant difference in the feasibility and safety of the two surgeries. However, three-port laparoscopic surgery needs less port, which was artistic and humanized. In addition, three-port laparoscopic surgery provided an alternative way for the hospitals with inadequate surgical person.

### Disclosure of conflict of interest

None.

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## Three-port laparoscopic surgery for rectal cancer

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