

## Laparoscopic total mesorectal excision with natural orifice specimen extraction

Quan Wang, Chao Wang, Dong-Hui Sun, Punyaram Kharbuja, Xue-Yuan Cao

Quan Wang, Chao Wang, Dong-Hui Sun, Punyaram Kharbuja, Xue-Yuan Cao, Department of Gastric and Colorectal Surgery, Jilin University First Hospital, Changchun 130021, Jilin Province, China

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Correspondence to: Xue-Yuan Cao, MD, PhD, Department of Gastric and Colorectal Surgery, Jilin University First Hospital, No. 71, Xin Min Street, Changchun 130021, Jilin Province, China. [ccmzc32jdycao@yahoo.com.cn](mailto:ccmzc32jdycao@yahoo.com.cn)

Telephone: +86-431-88783953 Fax: +86-431-88782889

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### Abstract

**AIM:** To introduce transvaginal or transanal specimen extraction in laparoscopic total mesorectal excision surgery to avoid an abdominal incision.

**METHODS:** Between January 2009 and December 2011, 21 patients with rectal cancer underwent laparoscopic radical resection and the specimen was retrieved by two different ways: transvaginal or transanal rectal removal. Transvaginal specimen extraction approach was strictly limited to elderly post-menopausal women who need hysterectomy. Patients aged between 30 and 80 years, with a body mass index of less than 30 kg/m<sup>2</sup>, underwent elective surgery. The surgical technique and the outcomes related to the specimen extraction, such as duration of surgery, length of hospital stay, and the complications were retrospectively reviewed.

**RESULTS:** Laparoscopic resection using a natural orifice removal approach was successful in all of the 21 patients. Median operating time was 185 min (range,

122-260 min) and the estimated blood loss was 48 mL. The mean length of hospital stay was 7.5 d (range, 2-11 d). One patient developed postoperative ileus and had an extended hospital stay. The patient complained of minimal pain. There were no postoperative complications or surgery-associated death. The mean size of the lesion was 2.8 cm (range, 1.8-6.0 cm), and the mean number of lymph nodes harvested was 18.7 (range, 8-27). At a mean follow-up of 20.6 mo (range, 10-37 mo), there were no functional disorders associated with the transvaginal and transanal specimen extraction.

**CONCLUSION:** Transvaginal or transanal extraction in L-TME is a safe and effective procedure. Natural orifice specimen extraction can avoid the abdominal wall incision and its potential complications.

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**Key words:** Laparoscopic total mesorectal excision; Natural orifice specimen extraction; Rectum cancer; Transvaginal; Transanal

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### INTRODUCTION

A number of single and multicenter randomized trials and meta-analysis have demonstrated that the laparoscopic total mesorectal excision (L-TME) was superior to the open approach. Laparoscopic surgery resulted in faster postoperative recovery and fewer long-term complications than open surgery without apparently compromising the long-term oncologic outcomes<sup>[1-3]</sup>. However, this typically requires an abdominal incision for specimen

removal, which is commonly associated with postoperative pain. Surgical wound complications, mainly infection and postoperative hernia, continue to be major problems after both open and laparoscopic colorectal surgery, and the mini-laparotomy is often the most important source of postoperative pain after L-TME. Avoidance of the abdominal wall extraction site may be desirable to improve the short-term outcome of L-TME and limit the high cost of wound complication management<sup>[4-6]</sup>.

The concept of natural orifice transluminal endoscopic surgery (NOTES) has gained interest in the surgical and gastrointestinal community as a technique to potentially reduce the surgical wound complications and trauma associated with conventional surgery<sup>[7,8]</sup>. However, NOTES has been limited because of lack of suitable instruments and platforms to facilitate a safe performance of such complex procedures. The combination of standard laparoscopy and specimen extraction through a natural orifice has the potential to reduce wound-related complications<sup>[9,10]</sup>. Natural orifice specimen extraction (NOSE) using either the anus or vagina as a route eliminates the need for abdominal wall incision for specimen extraction and anastomosis construction<sup>[11]</sup>. The NOSE concept is appealing as it maximizes the benefits of laparoscopic surgery while reducing potential wound complications and provides experience for cautious progression toward less incision surgery<sup>[12]</sup>.

In this report, we adopted the technique of L-TME and transvaginal or transanal extraction in a series of 21 rectal cancer patients who required anterior rectal resection. Technique, results, morbidity, and mortality were described.

## MATERIALS AND METHODS

### Study participants

All consecutive patients operated on for rectal cancer using laparoscopic TME anterior rectal resection approach and transanal or transvaginal extraction of the specimen from January 2009 to December 2011 at First Hospital of Jilin University were enrolled in the study. Patients were aged between 30 and 80 years, had a body mass index of less than 30 kg/m<sup>2</sup>, and underwent elective surgery. Patients operated on in an emergency setting and those who underwent Hartmann or abdominal perineal resection procedures were excluded. Written informed consent was obtained from all subjects and the study protocol was approved by the Ethics Committee of the First Hospital, Jilin University. The procedures were performed by a team consisting of experienced laparoscopic general surgeon and gynecologist. All patients underwent an oral magnesium citrate bowel preparation the day before surgery.

In this study, inclusion criteria for transvaginal specimen extraction were as follows: It is suitable for elderly post-menopausal women who need hysterectomy; female patients who were diagnosed with uterine myoma along with irregular vaginal bleeding, hemochezia, and receive



**Figure 1** Computed tomography scan showed a rectal tumor combined with uterine myoma in a female patient.

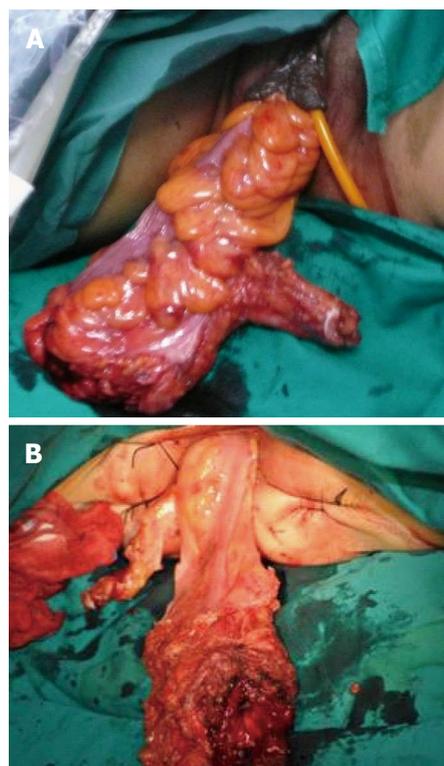
L-TME combined with uterine myomectomy (Figure 1). All patients received preoperative gynecologic examination to rule out vaginal stenosis and congenital abnormalities. Women with a history of endometriosis, narrow vagina, virgins, extensive pelvic adhesions, and lesions > 6 cm, and refusal of the procedure were not considered candidates for the transvaginal removal route. All of the decision was made after consulting with gynecologist.

### Transvaginal method

The patients were placed in the supine split leg or modified lithotomy position to allow for vaginal access. Abdominal and vaginal preparations were performed. After vascular control, mesocolic dissection, mobilization of tumor was performed, and the rectum distal to tumor was transected using stapler laparoscopically leaving the proximal rectum in the abdominal cavity. Then, with the assistance of gynecologist, laparoscopic hysterectomy was performed. Next, the specimens were placed in the specimen bag, which is then closed. The proximal rectum with tumor and uterus were delivered transvaginally and the rectum tumor was resected proximally outside body (Figure 2A). The anvil of the circular stapler was then inserted into the proximal colon and closed using purse string suture. The proximal colon was then returned into abdomen with the anvil transvaginally. Bowel anastomosis was completed by inserting the circular stapler via anal canal. Posterior fornix of the vagina was sutured. Final laparoscopic visualization was carried out to ensure hemostasis in the mesentery and inspect the anastomosis site.

### Transanal method

The patients were placed in the lithotomy position. Briefly, a three-trocar laparoscopic approach was generally employed for mesenteric dissection and sigmoid colon and rectum mobilization. (1) Laparoscopically TME dissection was done and the upper and lower margins of the tumor determined and rectum was transected by endocutter stapler. Then, the anus was dilated, rectal stump was washed out with a 500 mL povidone-iodine normal saline solution; (2) After transanal lavage was performed,



**Figure 2** Natural orifice specimen extraction in laparoscopic total mesorectal excision surgery. A: Transvaginal; B: Transanal specimen extraction.

the end of distal rectum was opened by ultrasonic scalpel and the specimen was extracted transanally with the specimen bag; (3) The anvil of circular end-to-end anastomosis stapler was introduced to peritoneal cavity transectally and simultaneously put purse string suture by 2-0 prolene in the proximal colon stump; and (4) Finally, the head of the circular stapler was passed per anal, and a circular anastomosis was created (Figure 2B).

## RESULTS

Within a 3-year time period, all 21 laparoscopic resections were performed successfully using a natural orifice removal approach. None of the patients were converted to open operation. The median age was 62 years (range, 50-80 years). Two of 14 patients (14%) had undergone abdominal surgery previously. The mean body mass index was 23.6 kg/m<sup>2</sup> (range, 18-30 kg/m<sup>2</sup>). Median operating time was 185 min (range, 122-260 min) and the estimated blood loss was 48 mL. All patients underwent a same postoperative protocol: patient-controlled analgesia for the first 24 to 48 h. The diet was started as tolerated. The mean length of hospital stay was 7.5 d (range, 2-11 d). One patient developed postoperative ileus and had an extended hospital stay. The patient complained of minimal pain. There were no postoperative complications like rupture of the rectus, bleeding or leakage of the anastomosis, anastomosis stenosis or surgery-associated death. All margins in the resected specimens were macroscopically and microscopically free of any tumor. The mean

**Table 1** Clinical data and outcomes of 21 rectal cancer cases

	Transvaginal	Transanal	P value
Patients (n)	n = 5	n = 16	
Sex			> 0.05
Male	0	4	
Female	5	12	
Age, yr (median)	61	62	
Site of tumor [distance to the edge of the anus (cm)]			> 0.05
5-10	4	9	
10-15	1	7	
Operative time (min)	195 ± 35	187 ± 35	> 0.05
Operative bleeding (mL)	36 ± 15	45 ± 20	> 0.05
Post-op flatus (d)	2.0 ± 1.5	1.0 ± 0.8	> 0.05
Post-op hospitalization (d)	7.0 ± 1.2	6.5 ± 1.5	> 0.05
Intra-abdominal infection	0	0	> 0.05
Anastomosis leak	0	0	
Ileus	0	1	
Number of removal lymph node	16 ± 3	18 ± 2	> 0.05
Differentiation			> 0.05
Well	2	4	
Moderate	2	10	
Poor	1	2	
TNM stage			> 0.05
Stage I	1	3	
Stage II	3	11	
Stage III	1	2	
Stage IV	0	0	

size of the lesion was 2.8 cm (range, 1.8-6.0 cm), and the mean number of lymph nodes harvested was 18.7 (range, 8-27). Patients' demographics and pathologic details are shown in Table 1. At a mean follow-up of 20.6 mo (range, 10-37 mo), no patient experienced pain, drainage from the vaginal extraction site, and dyspareunia, and there was no incisional hernia (Figure 3).

## DISCUSSION

At present, despite the advantages of laparoscopic colorectal surgery, during the specimen retrieval through substantial incisions, there is an increased postoperative pain, wound infections, and incisional hernias. Along with the development of the minimally invasive surgery, abdominal wall scarless surgery becomes the new goal for people who pursue laparoscopic surgery<sup>[13,14]</sup>. In order to leave no scar on the abdominal wall, to achieve fast recovery from surgery using a more minimally invasive technique, and better cosmetic appearance, the idea of the scarless surgery started from NOTES<sup>[15,16]</sup>. In the era of NOTES, incisionless transrectal or transvaginal approaches for colorectal resections have been investigated with promising results. Transanal retrieval of specimen in laparoscopic TME has been described but not widely adopted<sup>[17-21]</sup>.

Because the NOTES requires advanced technique and equipment, and requests the surgeon to have a higher strain capacity of the anatomy and the techniques. So, at present, it is still at the initial step in many countries. Recently, we have performed fast track rehabilitation in laparoscopic colorectal resection for elderly patients<sup>[22]</sup>.



Figure 3 Postoperative scars.

In this article, we described two different ways to retrieve the specimen based on the technique of the traditional laparoscopic radical surgery for rectal cancer, and experienced no additional difficulty during surgery, no needs of specific equipment.

Some additional hints which are helpful during above procedures as follows: First, if the tumor is a medium-lower rectal cancer, large in size or in the fat patient, mesocolon is generally fleshy and contracted, making it shorter and difficult when transanal retrieval of specimen is done. Secondly, before transanal retrieval of specimen, when the upper and lower margin tie off, it is very important to repeat transanal irrigation by povidone iodine solution and saline. This can reduce the chances of infection and tumor cell implantation in the pelvis. Finally, it is important to put the sample in the plastic bag in the abdominal cavity, which will reduce the chances of infection and helps in smooth extraction of specimens<sup>[23,24]</sup>.

In conclusion, the present study showed that NOSE is safe and feasible to perform L-TME for rectal cancer and extract the specimen without scar on abdominal wall. NOSE is an applicable option for patients requiring L-TME and appears to be associated with little incisional pain and rapid recovery. Future randomized controlled trials are necessary to show the superiority of this approach with regard to postoperative pain and morbidity, hospital stay, recovery, function and cosmesis. NOSE constitutes a stepping stone in the transition to future incisionless NOTES colectomy<sup>[25,26]</sup>.

## COMMENTS

### Background

Despite the advantages of laparoscopic total mesorectal excision rectal surgery, the need for an incision in the abdominal wall to remove the surgical specimen is a morbid factor.

### Research frontiers

The development of natural orifice transluminal endoscopic surgery and natural orifice specimen extraction (NOSE) appears to be the next major frontier in minimally invasive surgery.

### Innovations and breakthroughs

Present research showed that laparoscopic total mesorectal excision (L-TME) with transvaginal or transanal extraction is a safe and effective procedure. This technique is feasible and simple to perform, avoids the abdominal wall incision and its potential complications.

## Applications

Natural orifice specimen extraction may provide both an attractive way to reduce abdominal wall morbidity and a bridge to pure natural orifice transluminal endoscopic surgery for rectal surgery.

## Terminology

NOSE in colorectal surgery prevents the need for an enlarged port site or mini-laparotomy to extract the surgical specimen. The current trend to develop less invasive laparoscopic techniques by reducing the number and size of abdominal incisions has spurred new interest in practice.

## Peer review

The authors performed laparoscopic total mesorectal excision with NOSE, which is associated with rapid recovery. They conclude that NOSE is technically feasible for L-TME. It could be better if the authors could provide data from prospective control study showing that the recovery parameters of this approach is superior to those of L-TME with trans-abdominal incision.

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