

Original Article

Totally Laparoscopic Sigmoidectomy with Transrectal Specimen Extraction

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Key Words

Totally laparoscopic colectomy;
Transrectal specimen extraction;
Intracorporeal colorectal anastomosis;
Sigmoid colon cancer

Background. Totally laparoscopic colectomy with natural orifice specimen extraction (NOSE) has been reported with great interest. We attempt to evaluate the feasibility of this technique for totally laparoscopic sigmoidectomy with NOSE and report immediate postoperative outcomes in patients with sigmoid colon cancer.

Methods. Patients with sigmoid cancer were selected depending on the size of the tumor and its distance from the anal verge. Demographic data, operative parameters, and postoperative outcomes were assessed. After complete resection of the tumor, all patients underwent an intracorporeal colorectal anastomosis following transrectal specimen extraction.

Results. Laparoscopic resection with our technique of intracorporeal anastomosis was successful in 33 patients. The average operative time was 191 ± 28 min and mean blood loss was 53 ± 18 cc. All patients experienced mild postoperative pain and the bowel function returned before POD 3 in most patients. They had an uneventful postoperative course with a median hospital stay of 6 days. Major perioperative complications or anastomotic leak were not encountered in this study. The mean size of the lesion was 3.6 ± 1.0 cm and the mean number of harvested nodes was 13 ± 6 . During the follow-up period, there were no functional disorders associated with the intracorporeal anastomosis or transrectal specimen extraction.

Conclusion. Totally laparoscopic colorectal surgery is a safe and effective procedure for patients with sigmoid colon malignancy.

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Since the advantages of rapid recovery and short hospital stay after laparoscopic colectomy have been well recognized this approach can be widely and increasingly adopted in more patients. The drawback of current laparoscopic colectomy is that the techniques require an additional incision on the abdominal wall for retrieval of the specimen and extracorporeal bowel anastomosis. Certainly, the creation of a mini-laparotomy wound may be associated with some post-

operative comorbidities leading to diminished advantages of laparoscopic surgery. The technique of intracorporeal anastomosis with natural orifice specimen extraction (NOSE) has been recently developed to avoid a big abdominal incision and to increase potential benefits of laparoscopic surgery.¹⁻³ However, these techniques are not widely adopted because of complicated and time-consuming procedures.^{4,5} Herein, we intend to describe our experience of intracorporeal

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anastomosis with natural orifice specimen extraction and report immediate postoperative outcomes in patients undergoing laparoscopic sigmoid resection.

Patients and Methods

Between the period of June 2013 and May 2015, 33 patients with sigmoid colon cancer were recruited into this study. Inclusion criteria for this technique were as follows: (1) patients with sigmoid colon cancer; (2) age between 18 to 90 years; (3) distance of tumor from the anal verge > 15 cm; (4) tumor size < 6.0 cm; and (5) BMI (body mass index) \leq 28. In this series demographic data, operative parameters, and postoperative outcomes were retrospectively reviewed.

All patients started a low-roughage diet 3 days prior to surgery, and drank only clear liquids the day before surgery. Two doses (45 ml/dose) of oral sodium phosphate (Fleet, C.B. Fleet Company, Inc. USA) with an interval of 8 hours and oral antibiotic (metronidazole 750 mg) were given the day before surgery.

Under general anesthesia, the patient was placed in Trendelenburg position. After preparing and draping, a pneumoperitoneum was created and the abdomen was entered with a 10-mm port in the umbilicus, followed by a 12-mm port in the right iliac fossa, and two 5-mm ports in the right and left hypochondria.

The abdominal cavity was then entered, and small bowel was placed in the right upper quadrant. The dissection of sigmoid colon began in a medial-to-lateral direction. The inferior mesenteric lymphovascular trunk was carefully identified and ligated at their root arising from the aorta. Once the vessels were divided, the sigmoid colon with its mesocolon was mobilized as the usual manner, using an energy device (ENSEAL® Ethicon Endo-Surgery, Johnson & Johnson, USA), and dissection then proceeded down into the pelvis. Once the sigmoid colon was entirely mobilized, two silk ligatures were applied proximal and distal to the tumor respectively. The proximal rectum was thoroughly irrigated with povidone iodine solution via a rectal tube and was then transected using a cautery device.

A rectoscope (TEO, Karl Storz, Tuttlingen, Germany) for transanal endoluminal microsurgery was inserted transanally into the lower rectum and held in place outside the anal orifice. The anvil of a circular stapling device (CDH 29; Ethicon Endo-Surgery, Cincinnati, OH, USA) was delivered into the peritoneal cavity through the rectoscope transanally (Fig. 1). A sigmoid colotomy for introducing the anvil of the stapler was made and the sigmoid colon was divided proximally to the colotomy by a linear stapler and ready for anastomosis. The resected specimen was then extracted through the rectum and delivered transanally (Fig. 2). As the rectoscope was removed, the opened distal rectum was closed using the endoscopic linear stapler. In a patient with a tumor of 6.0 cm in diameter, the tumor could not be extracted freely through the lumen of the rectoscope. It was placed in the specimen bag and then the bag, being caught transanally by a grasping instrument, was simultaneously extracted along with the rectoscope that served as a dilator of

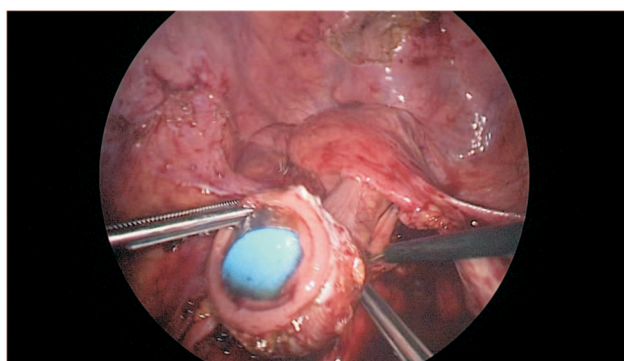


Fig. 1. The anvil of a circular stapling device is delivered into the peritoneal cavity.

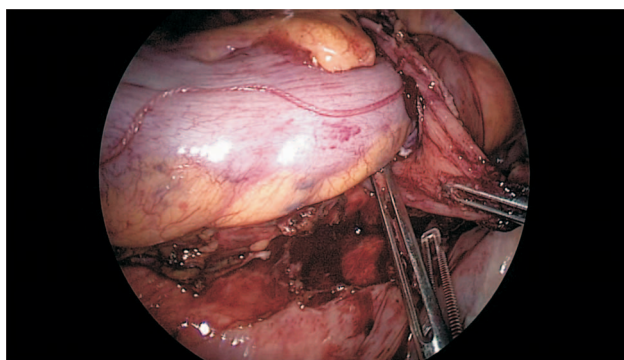


Fig. 2. The resected specimen is extracted through the rectal stump via a rectoscope.

the anorectal canal while it was being withdrawn.

A colorectal anastomosis was intracorporeally fashioned with the use of the CDH stapling device introduced transanally (Fig. 3). A suction drain was placed in the pelvis, and the 10-12-mm ports were closed with a Vicryl suture meticulously to reduce the risk of port site herniation.

Intraperitoneal fluid was collected for bacterial culture before the wounds were closed in all patients. Antibiotic prophylaxis with 1 g cefazolin was given intravenously at induction and additional 1 g was administered postoperatively every 8 hours for 24 hours in all patients with NOSE-colectomy. Postoperatively leukocyte count and CRP level were routinely monitored on the second postoperative day (POD) as the index of inflammatory response. A Patient-controlled analgesia (PCA) device was used for pain control postoperatively if necessary. The pain score was assessed with a visual analogue scale (VAS) (0, no pain; 10, worst conceivable pain) by an independent clinical assistant before pain control started. In patients without a PCA device, 50 mg meperidine four times daily was prescribed, as required. The pain score and the frequency of PCA used were also measured in POD1 (30 patients) and POD2 (3 patients).

Results

A total of 33 patients with sigmoid colon cancers were treated without any conversion to conventional technique. The demographic characteristics of patients and their postoperative outcomes with pain

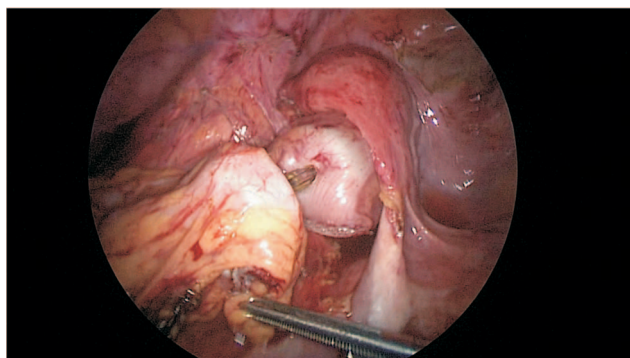


Fig. 3. A colorectal anastomosis is intracorporeally fashioned with the stapling device.

scores are shown in Table 1. No patient required conversion to traditional laparoscopic procedure or open surgery in this series. Major perioperative complications or anastomotic leak were not encountered in this study. However, two patients had postoperative ileus for 9 and 10 days respectively and one patient had trocar site infection which was treated successfully with sensitive antibiotic. The average operative time was 191 ± 28 min and blood loss was 53 ± 18 cc. All patients experienced mild postoperative pain with a mean VAS score of 3.6 ± 1.0 and their bowel function returned before POD 3 in most patients. PCA device was employed in 5 of 33 (15%) patients during the postoperative period. Surgical specimen was pathologically confirmed an adenocarcinoma in all patients and all surgical margins were free from cancer invol-

Table 1. Demographic data and clinical data for patients with NOSE

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Gender (male/female)	19/14
Ages (years)	67 ± 12 (44-88)
BMI (kg/m^2)	22.3 ± 2.3 (19-28)
Anesthesia (ASA)	I 4, II 22, III 7
TNM stage	
I	8
II	10
III	15
Clinical data	
Duration of procedure (min)	191 ± 28 (125-260)
Blood loss (ml)	53 ± 18 (35-110)
Length of specimen (cm)	15.5 ± 3.4 (7.1-29.3)
Tumor size (cm)	3.2 ± 1.5 (1.3-6.0)
Lymph node harvest	13 ± 6 (5-27)
Hospital stay (day)	6.4 ± 1.5 (5-11)
Complications	
Ileus	2
Trocar site infection	1
Pain score (VAS)	3.6 ± 1.0
Pain control	
PCA device	5/33
Narcotic injection	3/33
Dose (mg)	83 ± 29 (50-100)
CRP (mg/L)	87 ± 42
WBC	8500 ± 2300

BMI (body mass index); ASA (American Society of Anesthesiologists); TNM (Tumor-Node-Metastasis); VAS (visual analogue scale); PCA (patient-controlled analgesia); CRP (C-reactive protein); WBC (white blood cell).

vement. The mean tumor size was 3.2 ± 1.5 cm and the mean lymph nodes harvested were 13 ± 6 . The mean length of the surgical specimen was measured as 15.5 ± 3.4 cm. A patient with a sessile malignant colon polyp of 2 cm in size had resection of relatively short segment of 7.1 cm in length. Pathological examination of the surgical specimen revealed that no vascular or lymphatic invasion was identified and regional lymph nodes and its surgical margin were also free from cancer cell. All patients had an uneventful postoperative course with a median hospital stay of 6.4 days. During the follow-up period between 7 to 24 months, there was no case with anal dysfunction and all patients were continent. Neither anal fissure nor gross abnormality was found during the period of follow-up.

The positive rate of sample fluid culture was extremely high, up to 82% (27/33) of all patients with NOSE colectomy. Contamination of mixed aerobic and anaerobic pathogens was present in 7 patients. *Escherichia coli* was the most common aerobic pathogen, followed by *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, whereas in the anaerobic group, *Bacteroides fragilis* most frequently found, followed by *Peptostreptococcus sp* and *Clostridium perfringens*.

Discussion

In most traditional laparoscopic approaches, an abdominal minilaparotomy for extraction of the specimen or extracorporeal bowel anastomosis is inevitable after the colon has been laparoscopically mobilized. In order to alleviate the disadvantages resulted from the small incision, some techniques have been demonstrated regarding totally intracorporeal anastomosis combined with extraction of the specimen through natural orifices (NOSE) in the literature. Although technical complexity and difficulty with totally intracorporeal anastomosis have limited extensive acceptance of these procedures by most laparoscopic surgeons,^{4,5} the safety and feasibility of totally laparoscopic resection for colorectal cancer has been confirmed.¹⁻⁹ NOSE procedure may increase the benefit of laparoscopic surgery to a great extent by elimi-

nating the minilaparotomy wound. Additionally, intracorporeal bowel anastomosis is superior when compared to extracorporeal reconstruction in term of postoperative pain, return of bowel function, hospital stay, and morbidity.⁷

Our findings are consistent with those of Nishimura¹⁰ showing that totally laparoscopic sigmoid colectomy is feasible, safe and oncologically acceptable for selected cases. The concern that laparoscopic colectomy with intracorporeal anastomosis might be associated with a significantly longer operating time compared to the open technique has been addressed. Published clinical data has suggested that either transvaginal or transanal NOSE do not prolong operating time for laparoscopic colorectal surgery.⁸ It has been documented in a study that the short-term outcomes of totally laparoscopic right colectomy are encouraging, including low incidence of major complications and preservation of oncologic principles, without extending operative time. On the contrary, another case-control study indicated that NOSE still took longer time to perform intracorporeal suturing and anastomosis than the conventional laparoscopically assisted procedure.⁵ In this study, surgical dissection was greatly facilitated by the use of the laparoscopic energy device to reduce the operation time and control bleeding. Blood loss in our surgery was minimal.

The risk of pelvic contamination with bacteria and tumor cell during NOSE procedure via an opened bowel lumen is frequently concerning. A measurable contamination rate of 100%, with no cases of clinically significant peritoneal infection has been published in the literature.¹¹ Although high risk of peritoneal contamination was evident and there was elevation of CRP level in the POD 2 in our series, no patient developed peritoneal infection clinically. Recent study has confirmed that intracorporeal bowel opening for anastomosis completion did not increase the risk of infection during colorectal surgery.¹² In addition, another study reported that the risk of tumor seeding during transvaginal delivery was no higher than that associated with transabdominal extraction if a specimen bag was used.¹³ We believe that adequate colon preparation and distal rectal washout prior to their transaction and delivering the surgical specimen

via the rectum are essential for prevention of pelvic contamination. The use of a rectoscope to extract the specimen serves to decrease local soiling, to protect rectal trauma and to prevent rectal prolapse. One study showed polybacterial growth in all peritoneal culture samples without affecting infectious morbidity.¹¹ It has been emphasized that in NOSE-colectomy series, nosocomial infections hardly occurred.¹⁴

It should be distinctly emphasized that the NOSE technique is challenging in obese patients with high body mass index. Furthermore, it is not recommended in patients with locally advanced transmural cancer or very large and bulky tumors due to the difficulties of tumor resection and specimen extraction, and high risk of tumor cell seeding. It has been reported that avoiding a minilaparotomy to extract the specimen might significantly reduce analgesic requirement postoperatively in NOSE patients.^{15,16} Our results also confirmed low VAS score in the NOSE population, therefore, the use of analgesic in the recovery period can be reduced. Moreover, our findings suggest that NOSE techniques do not prolong either operative time or length of hospitalization for laparoscopic colorectal surgery as compared with published data in multicentre trials.^{2,17} Because of the differences in operative technique and small population of included patients, it is impossible to make comparison of the data on operative details and postoperative outcomes such as duration of surgery, complications and length of hospital stay among various studies. However, in reviewing the literature regarding NOSE surgery, our short-term postoperative outcomes seem to be comparable to those of available studies. We conclude totally laparoscopic colectomy with intracorporeal anastomosis and NOSE is a safe and effective procedure, and can be considered as an alternative treatment for patients with sigmoid tumors.

References

1. Akamatsu H, Omori T, Oyama T, Tori M, Ueshima S, Nakahara M, et al. Totally laparoscopic sigmoid colectomy: a simple and safe technique for intracorporeal anastomosis. *Surg Endosc* 2009;23:2605-9.
2. Franklin ME Jr, Kelley H, Kelley M, Brestan L, Portillo G, Torres J. Transvaginal extraction of the specimen after total laparoscopic right hemicolectomy with intracorporeal anastomosis. *Surg Laparosc Endosc Percutan Tech* 2008;18:294-8.
3. Knol J, D'Hondt M, Dozois EJ, Vanden Boer J, Malisse P. Laparoscopic-assisted sigmoidectomy with transanal specimen extraction: a bridge to NOTES? *Tech Coloproctol* 2009;13:65-8.
4. Nishimura A, Kawahara M, Suda K, Makino S, Kawachi Y, Nikkuni K. Totally laparoscopic sigmoid colectomy with transanal specimen extraction. *Surg Endosc* 2011;25:3459-63.
5. Park JS, Choi GS, Kim HJ, Park SY, Jun SH. Natural orifice specimen extraction versus conventional laparoscopically assisted right hemicolectomy. *Br J Surg* 2011;98:710-5.
6. Msika S, Iannelli A, Flamant Y, Hay JM. Laparoscopic sigmoid colectomy with intracorporeal hand-sewn anastomosis. *Surg Endosc* 2000;14:866.
7. Grams J, Tong W, Greenstein AJ, Salky B. Comparison of intracorporeal versus extracorporeal anastomosis in laparoscopic-assisted hemicolectomy. *Surg Endosc* 2010;24:1886-91.
8. Franklin ME Jr, Liang S, Russek K. Natural orifice specimen extraction in laparoscopic colorectal surgery: transanal and transvaginal approaches. *Tech Coloproctol* 2013;17(Suppl 1):S63-7.
9. D'Hoore A, Wolthuis AM. Laparoscopic low anterior resection and transanal pull-through for low rectal cancer: a Natural Orifice Specimen Extraction (NOSE) technique. *Colorectal Dis* 2011;13:28-31.
10. Nishimura A, Kawahara M, Suda K, Makino S, Kawachi Y, Nikkuni K. Totally laparoscopic sigmoid colectomy with transanal specimen extraction. *Surg Endosc* 2011;25:3459-63.
11. Leroy J, Costantino F, Cahill RA, D'Agostino J, Morales A, Mutter D, et al. Laparoscopic resection with transanal specimen extraction for sigmoid diverticulitis. *Br J Surg* 2011;98:1327-34.
12. Bucher P, Wutrich P, Pugin F, Gonzales M, Gervaz P, Morel P. Totally intracorporeal laparoscopic colorectal anastomosis using circular stapler. *Surg Endosc* 2008;22:1278-82.
13. McKenzie S, Baek JH, Wakabayashi M, Garcia-Aguilar J, Pigazzi A. Totally laparoscopic right colectomy with transvaginal specimen extraction: the author's initial institutional experience. *Surg Endosc* 2010;24:2048-52.
14. Wolthuis AM, de Buck van Overstraeten A, Fieuws S, Boon K, D'Hoore A. Standardized laparoscopic NOSE-colectomy is feasible with low morbidity. *Surg Endosc* 2015;29:1167-73.
15. Wolthuis AM, Meuleman C, Tomassetti C, D'Hooghe T, Fieuws S, Penninckx F, et al. Laparoscopic sigmoid resection with transrectal specimen extraction: a novel technique for the treatment of bowel endometriosis. *Hum Reprod* 2011;26:1348-55.

16. Costantino FA, Diana M, Wall J, Leroy J, Mutter D, Marescaux J. Prospective evaluation of peritoneal fluid contamination following transabdominal vs. transanal specimen extraction in laparoscopic left-sided colorectal resections. *Surg Endosc* 2012;26:1495-500.
17. Wolthuis AM, de Buck van Overstraeten A, D'Hoore A. Laparoscopic natural orifice specimen extraction-colectomy: a systematic review. *World J Gastroenterol*. 2014;20:12981-92.

原 著

全腹腔鏡乙狀結腸切除術並經由直腸取出樣本

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目的 全腹腔鏡大腸切除並經由自然孔道取出樣本的手術已有文獻報導且也獲得越多人感興趣。我們以全腹腔鏡乙狀結腸切除術並經由自然孔道取出樣本，治療乙狀結腸癌的患者，並進一步探討其結果。

方法 我們收集乙狀結腸癌的患者，紀錄其手術前的資料、腫瘤的大小和肛門邊緣的距離，且對手術後的結果進行分析。這些患者皆接受全腹腔鏡大腸切除、腹內結腸直腸吻合術且經由自然孔道取出樣本。

結果 我們進行腹腔鏡切除及腹內結腸直腸吻合術，成功地治療 33 例乙狀結腸癌。平均手術時間為 191 ± 28 分鐘，平均出血量為 53 ± 18 毫升。所有的患者皆出現輕度術後疼痛，但在術後三天可回復腸道功能。他們的平均住院天數為 6 天。所有患者皆未發生重大手術併發症或吻合口瀉漏的情況。標本中病灶的平均大小為 3.6 ± 1.0 厘米，淋巴結獲取的平均數為 13 ± 6 。所有病人在術後的追蹤期間，並未發現有因體內吻合或經直腸標本取出術造成的肛門功能障礙。

結論 全腹腔鏡大腸切除術治療乙狀結腸癌是安全且有效的方式。

關鍵詞 全腹腔鏡大腸切除術、經直腸樣本取出、體內結腸直腸吻合術、乙狀結腸癌。