Natural orifice specimen extraction with single-stapling anastomosis for distal colon resection: Feasibility and outcomes

Yu-Chun Huang, Sheng-Chi Chang, Hua-Che Chiang, Tao-Wei Ke, Hwei-Ming Wang, William Tzu-Liang Chen
Department of Colorectal Surgery, China Medical University Hospital, Taichung, Taiwan

Abstract

Background: The double-stapling technique (DST) and triple-stapling technique used in laparoscopic anterior resection are considered risk factors of leakage or anastomatic leakage. A high anastomotic leakage rate could be avoided by the single-stapling technique (SST).

Purposes: This study analyzed the feasibility, as well as the operative and immediate postoperative outcomes of natural orifice specimen extraction (NOSE) with single-stapled anastomosis.

Materials and Methods: We retrospectively analyzed the data of 82 patients from China Medical University Hospital who underwent elective surgery from January 2012 to April 2015 for benign or malignant lesions that were between 10 and 40 cm from the anal verge, ≤5 cm in diameter on radiological examination, and in stage T1-T3/Nx/M0. All patients were monitored according to the enhanced recovery after surgery protocol.

Results: NOSE with SST was feasible and showed intraoperative complication and morbidity rates of 2% and 7.3%, respectively. No patients needed conversion to open surgery. The rate of conversion to NOSE with DST was 6.1%. Moreover, the anastomotic leakage rate was 2.4%. Total hospital stay required was 4.8 ± 3.4 days. The first postoperative bowel movement observed was at 1.2 ± 0.5 days.

Conclusions: Although SST is technically challenging, NOSE with SST is as feasible and as NOSE with DST.

Keywords: Colorectal cancer, double-stapling, laparoscopic surgery, natural orifice specimen extraction, single-stapling

INTRODUCTION

Laparoscopic colectomy shows superior short-term outcomes and similar oncologic outcomes compared with those of open colectomy. Therefore, it is considered the standard treatment for colon cancer.1,2 In the past decade, laparoscopic colorectal surgery has increasingly evolved. Natural orifice specimen extraction (NOSE) can provide additional advantages for eliminating the morbidity and postoperative pain at the specimen extraction site.3,4

Various technical alternatives for performing colorectal anastomosis after laparoscopic anterior resection: Feasibility and outcomes.
resection (LAR) or NOSE exist, among which the double-stapling technique (DST) and triple-stapling technique (TST) are most frequently used. Although DST remains widely accepted, anastomotic leaks occur in 1%–19% of cases, possibly because of technical factors such as the crossing of linear and circular staple lines and “dog-ears” at each extremity of the linear staple line. The single-stapling technique (SST), which has been reported in open rectal surgery, could be used to avoid the disadvantages of DST or TST. However, SST outcomes for laparoscopic colorectal surgery remain unknown, particularly for NOSE with SST. Therefore, we evaluated the feasibility as well as the operative and immediate outcomes of NOSE with SST.

MATERIALS AND METHODS

We retrospectively analyzed the data of 82 patients from China Medical University Hospital, Taiwan, with a body mass index (BMI) ≤30 kg/m² and an American Society of Anesthesiology Score I–III. From January 2012 to April 2015, these patients underwent elective laparoscopic NOSE with SST for benign or malignant lesions that were between 10 and 40 cm from the anal verge, ≤5 cm in diameter on radiological examination, and in stages T1-3/Nx/M0. The Departmental and Institutional Ethical Committees approved the study. All patients were monitored according to the enhanced recovery after surgery (ERAS) protocol.

Surgical technique

The patients were placed in the Trendelenburg position. A 10 mm transumbilical port for the camera, two 5 mm working ports on either side of the camera port, and a 5 mm port was inserted in the right lower quadrant of the abdomen. All the following steps were standardized for performing NOSE with SST: mobilization of the splenic flexure, dissection along the Toldt’s fascia, and ligation of the inferior mesenteric vein near the Treitz ligament. Depending on the tumor site, high or low ligation of the inferior mesentery artery was performed. Partial mesorectal excision was performed. The distal resection margin (usually more than 5 cm distal to the tumor) was identified. The lumen of the rectum was occluded by the placement of an intracorporeal free-tie suture proximal to the proposed line of rectal division to prevent intra-abdominal contamination. After the rectal stump irrigation, the rectum was divided with scissors. According to rectal stump length, either a transanal endoscopic operation (TEO) port (Karl Storz, Tuttingen, Germany) [Figure 1] for long rectal stumps (10–20 cm) or a double-ring wound protector (Alexis wound retractor, Applied Medical, Rancho Santa Margarita, CA, USA) [Figure 2] for short rectal stumps (6–10 cm) was introduced through the anus. The transected bowel was pulled out in continuity through the TEO port or wound protector. Extra- or intracorporeal anvil head fixation was performed at the proximal bowel end. An intracorporeal purse-string suture was placed around the rectal stump using polypropylene 2-0.

Statistical analysis

Continuous variables were recorded as means ± standard deviations and were compared using Student t-test. Categorical variables were recorded as numbers or percentages and were compared using Fisher’s exact test or Chi-square tests, as appropriate. Statistical calculations were performed using SPSS (version 17.0) software (SPSS, Inc., Chicago, IL, USA).

RESULTS

The basic characteristics of the 82 patients are shown in Table 1. The mean age and BMI were 63.3 ± 13.9 years and 24.4 ± 4.2 kg/m², respectively. Nine (11%) patients had undergone previous abdominal surgeries. The tumor site was the sigmoid colon and rectosigmoid junction in 69 (84.1%) patients and the upper rectum in 13 (15.8%) patients [Table 1].

The operative time was 227.9 ± 55 min. The mean number of retrieved lymph nodes was 17.

All patients were monitored according to the ERAS protocol. Postoperative meperidine requirement was 29.3 ± 53.9 mg.
Moreover, the total hospital stay was 4.8 ± 3.4 days. The first postoperative bowel movement occurred at 1.2 ± 0.5 days. The overall readmission rate was 3.2% [Table 2].

No patient needed the conversion to open surgery. The intraoperative complication rate was 2% (2/82). Two patients underwent blood transfusion because of bleeding caused by injury to adjacent viscera. No mortality occurred among the enrolled patients. In addition, the morbidity rate was 7.3% (6/82). Two patients suffered from anastomotic leakage, one experienced anastomotic bleeding, and one had prolonged ileus. A postoperative anal fissure was identified in two patients [Table 3]. The conversion rate of NOSE with SST to NOSE with DST was 6.1%

DISCUSSION

The anastomosis performed in NOSE with SST was completely circular, thereby avoiding “dog-ears” and reducing anastomotic leakage. The purse-string technique for the rectal stump has been described by Kim et al. and Hisada et al. Purse-string closure of the rectal stump prevented further distal rectal stump dissection and mechanical linear stapler applications. Thus, the risk of anastomotic leakage was eliminated. The anastomotic leakage rate (2.4%) in our study is close to the lower end of the range reported in the literature (2%–10%).

Mareck et al. and Nachiappan et al. have reported the possibility of extracting the colon specimen through the anus after a natural orifice transluminal endoscopic surgery procedure. Thereafter, many reports have described the use of NOSE-LAR with coloanal anastomosis or DST. Subsequently, NOSE-LAR has been used for sigmoid and upper rectal tumors with similar outcomes to that of conventional LAR.

In addition to superior cosmesis, the absence of an abdominal incision for specimen extraction in NOSE results in less postoperative pain, early return of gastrointestinal function, and early ambulation as observed in our study. Hisada et al., as well as a recently published randomized study by Wolthuis et al., also reported similar results. Moreover, NOSE may reduce the occurrence of surgical site infection and incisional hernia. However,
Huang, et al.: Laparoscopic surgery, NOSE, double-stapling, single-stapling

a postoperative anal fissure was noted in two patients who underwent NOSE with SST, possibly because of anal canal stretching during specimen extraction.

Wolthuis et al\[4\] reported that in NOSE with DST, more time was necessary required to perform the purse-string closure of the rectal stump. However, in that study, the operative time had no significance in both groups. In some cases, the increased surgical duration could be because of the time required to create the purse string in the rectal stump and in the proximal colon.

In addition, the conversion rate of NOSE with SST to NOSE with DST was 6.1%. An inability to transanally retrieve the bulky specimen or a difficulty in purse-string suturing because of a deep, narrow pelvis is the possible reason for SST failure. Despite the technical difficulty of SST, an acceptable perioperative morbidity rate (9.8%) was observed.

Limitation

Our study has several limitations: first, this is a single-center study, and this could result in recusal bias. Second, the level of this retrospective case series study is not as high as that of other controlled studies.

CONCLUSIONS

Although SST is technically demanding, NOSE with SST is as feasible and safe as NOSE with DST.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. van der Pas MH, Haglind E, Cuesta MA, Fürst A, Lacy AM, Hop WC, et al. Laparoscopic versus open surgery for rectal cancer (COLOR II): Short-term outcomes of a randomised, phase 3 trial. Lancet Oncol 2013;14:210-8.

2. Kang SB, Park JW, Jeong SY, Nam BH, Choi HS, Kim DW, et al. Open versus laparoscopic surgery for mid or low rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): Short-term outcomes of an open-label randomised controlled trial. Lancet Oncol 2010;11:637-45.

3. Jeong SY, Park JW, Nam BH, Kim S, Kang SB, Lim SB, et al. Open versus laparoscopic surgery for mid-rectal or low-rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): Survival outcomes of an open-label, non-inferiority, randomised controlled trial. Lancet Oncol 2014;15:767-74.

4. Wolthuis AM, Fieuws S, Van Den Bosch A, de Buck van Overstraeten A, D’Hoore A. Randomized clinical trial of laparoscopic colectomy with or without natural-orifice specimen extraction. Br J Surg 2015;102:630-7.

5. Hisada M, Katsumata K, Ishizaki T, Enomoto M, Matsudo T, Kassuya K, et al. Complete laparoscopic resection of the rectum using natural orifice specimen extraction. World J Gastroenterol 2014;20:16707-13.

6. Xingmao Z, Hairoo Z, Jianwei S, Fuerong H, Junjie H, Xizhiang Z. Totally laparoscopic resection with natural orifice specimen extraction (NOSE) has more advantages comparing with laparoscopic-assisted resection for selected patients with sigmoid colon or rectal cancer. Int J Colorectal Dis 2014;29:1119-24.

7. 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.

8. Wolthuis AM, Penninckx F, D’Hoore A. Laparoscopic sigmoid resection with transrectal specimen extraction has a good short-term outcome. Surg Endosc 2011;25:2034-8.

9. Franklin ME Jr., Liang S, Russek K. Integration of transanal specimen extraction into laparoscopic anterior resection with total mesorectal excision for rectal cancer: A consecutive series of 179 patients. Surg Endosc 2013;27:127-32.

10. 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.

11. Wolthuis AM, Van Geluwe B, Fieuws S, Penninckx F, D’Hoore A. Laparoscopic sigmoid resection with transrectal specimen extraction: A systematic review. Colorectal Dis 2012;14:1183-8.

12. 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.

13. Choi GS, Park JJ, Kang BM, Lim KH, Jun SH. A novel approach of robotic-assisted anterior resection with transanal or transvaginal retrieval of the specimen for colorectal cancer. Surg Endosc 2009;23:2831-5.

14. McDermott FD, Heaney A, Kelly ME, Steele RJ, Carlson GL, Winter DC. Systematic review of preoperative, intraoperative and postoperative risk factors for colorectal anastomotic leaks. Br J Surg 2015;102:462-79.

15. Sadahiro S, Kameya T, Iwase H, Ishikawa K, Suzuki T, Tokunaga N, et al. Which technique, circular stapled anastomosis or double stapling anastomosis, provides the optimal size and shape of rectal anastomotic opening? J Surg Res 1999;86:162-6.

16. Ito M, Sugito M, Kobayashi A, Nishizawa Y, Tsunoda Y, Saito N. Relationship between multiple numbers of stapler firings during rectal division and anastomotic leakage after laparoscopic rectal resection. Int J Colorectal Dis 2008;23:703-7.

17. Leroy J, Jamali F, Forbes L, Smith M, Rubino F, Mutter D, et al. Long-term outcomes. Surg Endosc 2004;18:281-9.

18. Kim HJ, Choi GS, Park JS, Park SY. Comparison of intracorporeal single-stapled and double-stapled anastomosis in laparoscopic low anterior resection for rectal cancer: A case-control study. Int J Colorectal Dis 2013;28:149-56.

19. Spanjersberg WR, Reurings J, Keus F, van Laarhoven CJ. Fast track surgery versus conventional recovery strategies for colorectal surgery. Cochrane Database Syst Rev 2011;2:CD007635. doi:10.1002/14651858.CD007635.pub2.

20. Rocco R, Graham M, Martin W, Werling C. Fast-track protocol in colorectal surgery. UpToDate; 2016.

21. Takayama H, Yamamoto H, Hata T, Takahashi Y, Ohtsuka M, Nonaka R, et al. A novel single-stapling technique for colorectal anastomosis: A pre-ligation single-stapling technique (I-SST) in a porcine model. Surg Endosc 2015;29:2571-6.

22. Marecik SJ, Chaudhry V, Pearl R, Park JJ, Prasad IM. Single-stapled double-pursestring anastomosis after anterior resection of the rectum. Am J Surg 2007;193:395-9.

23. Nachiappan S, Askari A, Currie A, Kennedy RH, Faiz O. Intraoperative assessment of colorectal anastomotic integrity: A systematic review. Surg Endosc 2014;28:2513-30.
24. Person B, Vivas DA, Wexner SD. Totally laparoscopic low anterior resection with transperineal handsewn colonic J-pouch anal anastomosis for low rectal cancer. Surg Endosc 2006;20:700-2.
25. Whiteford MH, Denk PM, Swanström LL. Feasibility of radical sigmoid colectomy performed as natural orifice translumenal endoscopic surgery (NOTES) using transanal endoscopic microsurgery. Surg Endosc 2007;21:1870-4.
26. Wexner SD. Restorative proctectomy with colon pouch-anal anastomosis by laparoscopic transanal pull-through: An available option for low rectal cancer? Surg Endosc 2007;21:1679.
27. Palanivelu C, Rangarajan M, Jategaonkar PA, Anand NV. An innovative technique for colorectal specimen retrieval: A new era of “natural orifice specimen extraction” (N.O.S.E). Dis Colon Rectum 2008;51:1120-4.
28. 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 Suppl 7:28-31.
29. Leung AI, Cheung HY, Li MK. Advances in laparoscopic colorectal surgery: A review on NOTES and transanal extraction of specimen. Asian J Endosc Surg 2014;7:11-6.
30. Saad S, Hosogi H. Natural orifice specimen extraction for avoiding laparotomy in laparoscopic left colon resections: A new approach using the McCartney tube and the tilt top anvil technique. J Laparoendosc Adv Surg Tech A 2010;20:689-92.
31. Hsieh MH, Chang SC, Chen William TL. Short-term outcome of laparoscopic anterior resection with natural orifice specimen extraction (NOSE) for left-sided colon cancer. J Soc Colon Rectal Surg (Taiwan) 2015;26:22-9.