Int Surg 2015;**100**:979–983
DOI: 10.9738/INTSURG-D-14-00202.1

The Use of a Circular Side Stapling Technique in Laparoscopic Low Anterior Resection for Rectal Cancer: Experience of 30 Serial Cases

Eiji Oki, Koji Ando, Hiroshi Saeki, Yuichiro Nakashima, Yasue Kimura, Yukiharu Hiyoshi, Yu Imamura, Kippei Ohgaki, Shuhei Ito, Masaru Morita, Tetsuo Ikeda, Yoshihiko Maehara

Department of Surgery and Science, Graduate School of Medical Sciences, Kyushu University, Fukuoka, Japan

The double-stapling technique using a circular stapler (CS) to create an end-to-end anastomosis is currently used widely in laparoscopic-assisted rectal surgery. However, a high rate of anastomotic failure has been reported. We report new side-to-side anastomosis creation using a CS, the so-called circular side stapling technique (CST). After excising the rectum at the oral and anal sides of the tumor with a linear stapler, a side-to-side colorectal anastomosis was made on the anterior wall of the rectosigmoid colon and the anterior or posterior wall of the rectum with a CS. Between 2012 and 2013, we recorded 30 serial cases of rectal-sigmoid or rectal cancer that were treated with laparoscopic-assisted surgeries using this method. In the 30 cases, the mean age was 68 ± 12 years, operating time was 288 ± 80 minutes, and blood loss was 66 ± 67 mL. None of the patients suffered from anastomosis leakage or postoperative anastomotic bleeding, and none complained of their stool habits. Three months after the last surgery in this cohort, no anastomosis strictures were reported. Based on these results, we propose an alternative method of side-to-side anastomosis for low anterior resection by using a CS to prevent staple overlap. Our experience indicates that the CST is easy and safe. Therefore, this method is a useful alternative to the current method used in laparoscopic surgery.

Key words: Laparoscopy – Circular stapler – Colorectal cancer – Low anterior resection

Laparoscopic surgery for the treatment of colorectal disease has proven to be a safe and effective method compared with an open procedure.[1–3] Laparoscopy has the advantages of reduced

Corresponding author: Eiji Oki, MD, PhD, Department of Surgery and Science, Graduate School of Medical Sciences, Kyushu University, 3-1-1, Maidashi, Higashi-ku, Fukuoka 812-8582, Japan.
Tel.: 81 92 642 5466, ext. 5468; Fax: 81 92 642 5482; E-mail: okieiji@surg2.med.kyushu-u.ac.jp

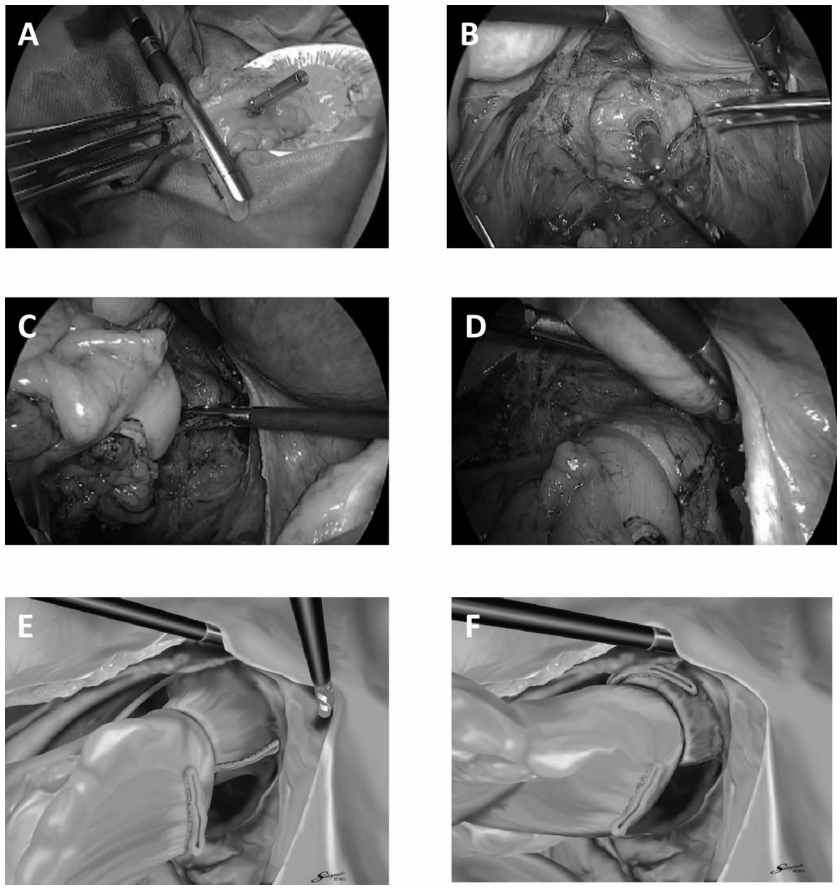

Fig. 1. Illustration of the procedure for creating side-to-side anastomosis. (A) An anvil is inserted through the open stump of the colon and the shaft is inserted through the antimesenteric site 1.5 cm from the closed stump of the colon. (B) The center rod of the instrument is inserted into the posterior rectal wall 1.5 cm from the closed stump. The side-to-side anastomosis is completed by using the antimesenteric side of the colon and the anterior wall of the rectum. (C) The anvil shaft and center rod are joined and closed. (D) The instrument is activated and then removed. (E) Illustration for creating side-to-side anastomosis. Anastomosis is at the anterior wall of the rectum. (F) Illustration for creating side-to-side anastomosis. Anastomosis is at the posterior wall of the rectum.

blood loss, hospital stay, and use of anesthetics as well as a better cosmetic outcome. Although many clinical studies have demonstrated the advantages and low complication rates of laparoscopic colectomy and low anterior resection,[1–5] a high rate of anastomotic leakage has been reported in laparoscopic rectal surgeries. The reported incidence of leakage after laparoscopic surgery for the treatment of rectum varies from 6% to 17%.[1–3] Additionally, anastomotic leakage might raise concerns about local recurrence and may limit the patients prognosis.[6–8] Therefore, despite great advances in laparoscopic surgery, the risks of anastomotic complications persist to a greater extent than those for other colonic resections.[6,7]

Recent reports have included proposed methods for reducing anastomotic leakage, and recently a transanal drainage tube has been recommended, because the high pressure experienced in the rectum could cause anastomotic failure.[9] Another group reported the use of anti-traction sutures supporting the anastomosis to reduce anastomotic leakage.[10] Despite these proposals, anastomotic failure has not been completely resolved.

In typical laparoscopic rectal surgery, a double-stapling technique (DST) with a circular stapler is used to create the anastomosis. This method is thought to be the only method available to complete an intracorporeal anastomosis of the rectum. However, the DST requires the excision of the stump of the staple line created by the linear stapler. Our previous endoscopic experience with anastomotic leakage shows that leakage occurs frequently at the point where the staples overlap in the DST.[11] In this study we demonstrate a new circular side stapling technique (CST), which does not require the excision of the linear staple line in a laparoscopic low anterior resection.

Methods

A schematic illustration of the operation is shown in Fig. 1. The entire laparoscopic low anterior resection procedure has previously been shown elsewhere.[11] In preparation, patients were placed in the modified lithotomy position. Two 12-mm Hasson trocars were umbilically inserted into the abdominal cavity, and three 5-mm trocars were inserted in the upper left,

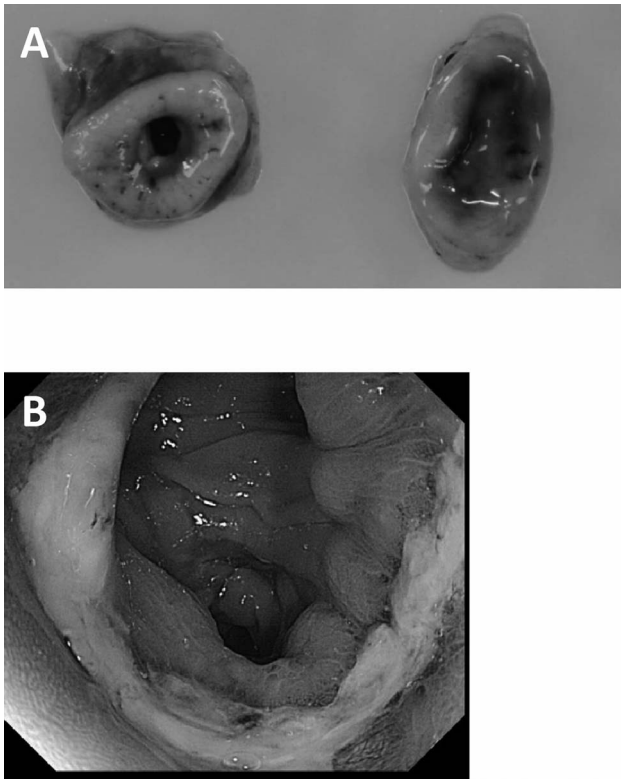

Fig. 2 (A) The colon and rectal tissues that are removed by the circular stapler. Complete rings are formed. (B) Endoscopic examination 7 days after the procedure.

lower left, and upper right quadrants of the abdomen. A 12-mm trocar was also inserted in the lower right quadrant of the abdomen. The superior rectal artery was lifted ventrally and the mesenteric attachments were incised. The superior hypogastric nerve plexus was preserved and dorsally separated from the superior rectal artery. Dissection was extended from the dorsal superior rectal artery to the left lateral attachment of the sigmoid colon. The mesorectum was separated along the plane of the previous mesorectal incision. After complete division of the mesorectum around the elected rectal transection site, a detachable atraumatic intestinal clip (PL541S, Aesculap, Tuttlingen, Germany) was applied by using clip removal forceps (PL531R, Aesculap). Next, the rectum was irrigated and the Echelon 60 GOLD Endopath Stapler (Ethicon Endo-Surgery Inc, Cincinnati, Ohio) was applied to the rectum from the lower right quadrant port along the anal side of the intestinal clip. After the rectum was cut, the rectum section with the tumor was removed via the navel port site, which was opened to 4 cm and set with a retractor. After the oral side of the tumor was incised and the tumor was removed, the anvil was inserted through the opening stump of the colonic lumen. The Proximate ILS curved 25-mm intraluminal stapler was used (CDH 25, Ethicon Endo-Surgery) as the stapling device. The anvil shaft was penetrated via the antimesenteric side 1.5 cm from opening stump of the colon (Fig. 1A). The opening stump was cut by using the Echelon 60 Green Endopath Stapler (Ethicon Endo-Surgery). The oral stump with the anvil was then return to the abdominal cavity. The cartridge-carrying instrument was inserted into the rectum via the anus and advanced to the closed stump of the lumen. The center rod of the instrument was inserted through the side wall of the rectum 1.5 cm from the closed stump (Fig. 1B). The anvil shaft and center rod were joined and closed (Fig. 1C and 1D). The instrument was activated and then removed. An illustration of the procedure for creating end-to-end anastomosis is shown in Fig. 1E and 1F. The center rod of the instrument was inserted through the anterior or posterior rectal wall of rectum. The formation of complete rings was confirmed after removal of the instrument in all cases (Fig. 2A).

The study was conducted according to the principles set forth in the Declaration of Helsinki and the Good Clinical Practice guidelines of the International Conference on Harmonisation. Informed consent was obtained from all patients prior to the operation. All retrospective cohort research was inspected by the Institutional Ethical Review Board and disclosed to them in the hospital homepage. Statistical analysis was performed using Microsoft Excel 2010 software (Redmond, Washington). No comparison was performed statistically.

Results

Table 1 outlines demographic information of the patients, including 16 rectosigmoid, 7 upper rectal, and 7 lower rectal cancer patients. In total, the mean age was 68 ± 12 years, operating time was 288 ± 80 minutes, and blood loss was 66 ± 67 mL. An ileostomy was created in 4 patients; 3 patients had the tumor located in the lower rectum, and 1 had a previous right nephrectomy. In 28 patients, a 25-mm circular stapler was used; only 2 patients required a 28- or 29-mm circular stapler. The anterior rectum was used for the anastomosis in 14 patients; the posterior wall was used in the other patients. All patients started taking food orally by postoperative day 4 (Table 1), and there were no reports of postoperative anastomotic leakage or bleeding, and none of the patients complained of

Table 1 Patient characteristics and outcomes after CST

Variables	Value
Age, y	68.0 ± 12.1
Gender, No.	
Male	13
Female	17
Location, No.	
Rectosigmoid	16
Upper rectum	7
Lower rectum	7
Anastomotic site, No.	
Anterior	14
Posterior	16
Size of the circular stapler, No.	
25 mm	28
28 or 29 mm	2
Temporal ileostomy, No.	
Present	4
Absent	26
Bleeding, mL	63.7 ± 79.5
Operation time, min	287.6 ± 80.3
Hospital stay, d	12.1 ± 4.0
Complications of anastomosis	None

serious stool habits. No other postoperative complication was noted. Of the 30 patients, the first 10 underwent a postoperative colonoscopic examination at our hospital. For these patients, the anastomosis ring was patent (Fig. 2A), and no stool residue was found in the blind pocket (Fig. 2B).

Discussion

Although the DST has been widely adopted for use in laparoscopic low anterior resections, anastomotic leakage remains an important issue for any surgeon undertaking rectal resection. Our previous endoscopic experience with anastomotic leakage shows that in the DST, leakage occurs frequently at the point where the staples overlap.[11] Therefore, the point where staples overlap is the major reason for the leakage. We conducted a comparison of anastomotic strength among several anastomosis methods by using animal models, and we showed that side-to-side anastomosis created by using a circular stapler was the strongest anastomosis in artificial pressure experiments.[12] Therefore, we extended the side-to-side anastomosis created by using a circular stapler in clinical situations for 30 serial cases of rectosigmoid or rectal cancer (Table 1). In these 30 patients, none suffered from anastomosis leakage. Although the present study is a small case control study, this method offers an effective choice for reducing anastomotic leakage.

We chose to use a 25-mm circular stapler to create the rectal anastomosis because it is difficult to create sufficient space for a larger circular stapler in the anterior or posterior side of the rectal wall. The 25-mm circular stapler was thought to be too small for creating rectal DST anastomoses, and a high stricture rate was reported previously.[13] However, when creating side-to-side anastomoses, the 25-mm circular stapler was wide enough for stool passage. We observed postoperatively the first 10 cases with endoscopy, and the anastomosis site showed a clear circle holding its 25-mm diameter (Fig. 1F). A clear circle anastomosis was formed because there are no overlapping staples in the side-to-side anastomosis created with the circular stapler. In the 3-month period after the last surgery for this cohort, no anastomosis strictures were reported.

Usually, an antimesenteric site is used for the creation of the side-to-side anastomosis by using a linear stapler. It is widely used for colon cancer surgery and is called a functional end-to-end method. We have also chosen the antimesenteric anterior wall of the rectum for the side-to-side anastomosis. However, it is sometimes difficult to create the rectal anastomosis, because the vagina or prostate is located anterior to the rectum. Therefore, the posterior wall was used in lower rectum cases. Using the posterior wall is technically easier because the posterior wall is usually exfoliated from the anterior sacrum. There is no serious issue of blood supply to the rectum, because its supply is from both the lateral and mesenteric sides.[14] Another factor to consider is the length from the stump of the linear staple line to the anastomosis. To maintain the blood supply to the anastomotic stump, the anastomosis with circular stapler should not be created very close to the line of linear staple. However, we created the anastomosis with circular stapler very close to the stump (Fig. 1). There was no patient whose stump fell into necrosis in these serial 30 cases.

To our knowledge, this is the first report of side-to-side anastomosis creation by using a circular stapler, the so-called circular side stapling technique. This method is easy and feasible for laparoscopic rectal surgery, and it addresses historical problems with anastomoses. However, it is necessary to confirm these clinical advantages by performing studies in larger patient groups.

References

1. Buunen M, Veldkamp R, Hop WC, Kuhry E, Jeekel J, Haglind E *et al*. Survival after laparoscopic surgery versus open

surgery for colon cancer: long-term outcome of a randomised clinical trial. *Lancet Oncol*. 2009;**10**(1):44–52
2. Clinical Outcomes of Surgical Therapy Study Group. A comparison of laparoscopically assisted and open colectomy for colon cancer. *N Engl J Med*. 2004;**350**(20):2050–2059
3. Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM *et al*. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet*. 2005;**365**(9472):1718–1726
4. Vignali A, Fazio VW, Lavery IC, Milsom JW, Church JM, Hull TL *et al*. Factors associated with the occurrence of leaks in stapled rectal anastomoses: a review of 1,014 patients. *J Am Coll Surg*. 1997;**185**(2):105–113
5. Rose J, Schneider C, Yildirim C, Geers P, Scheidbach H, Kockerling F. Complications in laparoscopic colorectal surgery: results of a multicentre trial. *Tech Coloproctol*. 2004; **8**(suppl 1):s25–s28
6. Leroy J, Jamali F, Forbes L, Smith M, Rubino F, Mutter D *et al*. Laparoscopic total mesorectal excision (TME) for rectal cancer surgery: long-term outcomes. *Surg Endosc*. 2004;**18**(2):281–289
7. Yeh CY, Changchien CR, Wang JY, Chen JS, Chen HH, Chiang JM *et al*. Pelvic drainage and other risk factors for leakage after elective anterior resection in rectal cancer patients: a prospective study of 978 patients. *Ann Surg*. 2005; **241**(1):9–13
8. Krarup P, Nordholm-Carstensen A. Anastomotic leak increases distant recurrence and long-term mortality after curative resection for colonic cancer: a nationwide cohort study. *Ann Surg*. 2014;**259**(5):930–938
9. Okuda J, Tanaka K, Kondo K, Asai K, Kayano H, Yamamoto M *et al*. Safe anastomosis in laparoscopic low anterior resection for rectal cancer. *Asian J Endosc Surg* 2011;**4**(2):68–72
10. Gadiot RP, Dunker MS, Mearadji A, Mannaerts GH. Reduction of anastomotic failure in laparoscopic colorectal surgery using antitraction sutures. *Surg Endosc*. 2011;**25**(1):68–71
11. Ikeda T, Kumashiro R, Taketani K, Ando K, Kimura Y, Saeki H *et al*. Endoscopic evaluation of clinical colorectal anastomotic leakage. *J Surg Res*. 2015;**193**(1):126–134
12. Ikeda T, Kumashiro R, Oki E, Taketani K, Ando K, Aishima S *et al*. Evaluation of techniques to prevent colorectal anastomotic leakage. *J Surg Res* (in press)
13. Miller K, Moritz E. Circular stapling techniques for low anterior resection of rectal carcinoma. *Hepatogastroenterology.* 1996;**43**(10):823–831
14. Wang GJ, Gao CF, Wei D, Wang C, Meng WJ. Anatomy of the lateral ligaments of the rectum: a controversial point of view. *World J Gastroenterol*. 2010;**16**(43):5411–5415