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How I do it

Modified Delta-shaped Anastomosis via the Overlap Method Using Linear Staplers for Colon Cancer

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Abstract

Here, we describe the modified delta-shaped anastomosis (DSA) via the overlap method and how it was a beneficial intracorporeal anastomotic technique for four patients who underwent laparoscopic colectomy. After resecting the colon on both sides of the lesion, proximal and distal colon were laid in an overlap fashion and fixed using sutures. The entry hole was created using an ultrasound scalpel at a point 3 cm proximal to right colic stump and 7 cm distal to left colic stump on the anti-mesenteric side. Then, two arms of the linear stapler were inserted inside each lumen and fired. Finally, using the linear stapler, the common entry hole was closed in a delta-shaped manner. The mean duration of surgery was determined to be 218.4 (196-369) minutes, and amount of blood loss was measured to be 11 (5-25) mL. No intraoperative and postoperative complications were observed. Median postoperative hospital stay was 12 days. Thus, modified DSA via overlap method can be considered as a safe and simple IA technique.

Keywords

intracorporeal anastomosis, linear stapler, modified delta-shaped anastomosis via overlap method

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Introduction

Laparoscopic-assisted colectomy for patients with colon cancer has demonstrated short-term benefits with oncological safety[1]. Yet, the usual practice of extracorporeal anastomosis (EA) still requires the externalization of the specimen through open access for resection and anastomosis, with consequent increased surgical trauma and wound-related complications[2]. Lately, the focus has been shifted in improving laparoscopic techniques for better surgical outcomes, oncological benefits, and early patient recovery[3]. Total laparoscopic colectomy with intracorporeal anastomosis (TLC/IA) has been determined to alleviate the need for abdominal incision extension and externalization of the bowel, which reduces wound-related complications and ensures early return of bowel function and better cosmesis[4]. As has been reported by experienced surgeons, TLC/IA is associated with improved short- and long-term outcomes for excision of tumors in the right, left, and sigmoid colon[2-4].

In 2002, Kanaya et al. have described delta-shaped anastomosis (DSA), using linear staplers, as a novel IA technique[5]. Later, Inaba et al. described a new technique for end-to-side esophagojejunostomy called the overlap method[6]. Combining these two techniques, Zhou et al.[7] then adopted an overlapped DSA in TLC for colon cancer and reported it as a safe and feasible technique for suitable patients. However, there is little description of the detailed surgical procedure for colocolostomy after colectomy. Here, using a video, we describe the surgical procedure of a modified DSA via overlap method after laparoscopic colectomy.

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Table 1. Patient Details and Operative Outcomes.

S. N.	Age (years)	Sex	BMI (kg/m^2)	Diagnosis	Procedure performed	Blood loss (ml)	Size of minilaparotomy (cm)	Time required for anastomosis (min)	Overall duration of surgery (min)	Postoperative hospital stay (days)
1	70	M	26	Ascending colon cancer	Right colon resection	10	2.5	22	287	12
2	54	F	18	Transverse colon cancer	Partial right colon resection	5	4	37	196	12
3	53	M	23	Cecal cancer	Ileocecal resection	25	3	53	369	13
4	67	F	16	Cecal cancer	Ileocecal resection	4	3	32	240	11

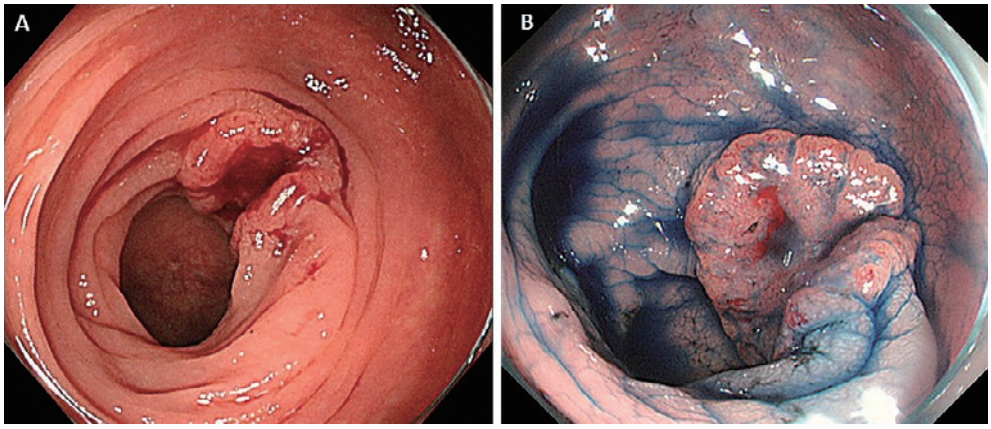

Figure 1. Colonoscopic images showing a type 2 tumor covering 1/3 of the circumference of the transverse colon (A) and (B).

This anastomotic technique was carried out in four patients who underwent colectomy for colon cancer as well as for Crohn's disease. We believe this technique is safe and useful as an intracorporeal anastomotic technique after laparoscopic colectomy.

Case Report

The study was approved by the institutional review board, and informed consent was obtained from all patients to undergo the needed examinations and procedures. The procedure was performed in four colon cancer patients. The inclusion criteria were as follows: age between 20 and 80 years old with histologically proven colon cancer; tumors located in any part of the colon; T1 lesion, node stages N0, and metastasis stage M0; and American Society of Anesthesiologists physical status classification of ≤ III. The details and characteristics of the patients are given in Table 1. We describe the procedure in one patient. An asymptomatic 54-year-old female tested positive for fecal occult blood during routine examination. The clinical history and physical examination were unremarkable. A subsequent colonoscopy revealed a 20-mm large type 2 tumor covering 1/3 of the circumference of the transverse colon (Figure 1A, 1B). The biopsy showed adenocarcinoma. Preoperative diagnosis of cT2 (MP) N0 M0 cStage I transverse colon carcinoma was made as per the UICC staging system. The patient was then planned for laparoscopic colectomy with modified DSA via the overlap method using linear staplers. Preoperative mechanical bowel preparation was done using sennoside oral tablet for 2 days before surgery and magnesium citrate oral solution for 1 day before surgery. Preoperative intravenous antibiotics were administered 30 mins before the surgery, wherein it was continued for 2 days.

The patient was kept in the dorsal lithotomy position. The location of the tumor on the left side of the transverse colon was confirmed, followed by marking the excision site 7 cm away from the tumor on either side. The transverse colon was then lifted up, and its mesentery was incised at the root of the middle colic artery (MCA). MCA was isolated, and its left and right branches were confirmed. The left branches of the MCA and middle colic vein (MCV) were ligated and cut. D2 lymph node dissection was carried out. The transverse colon mesentery was dissected, and the gastrocolic

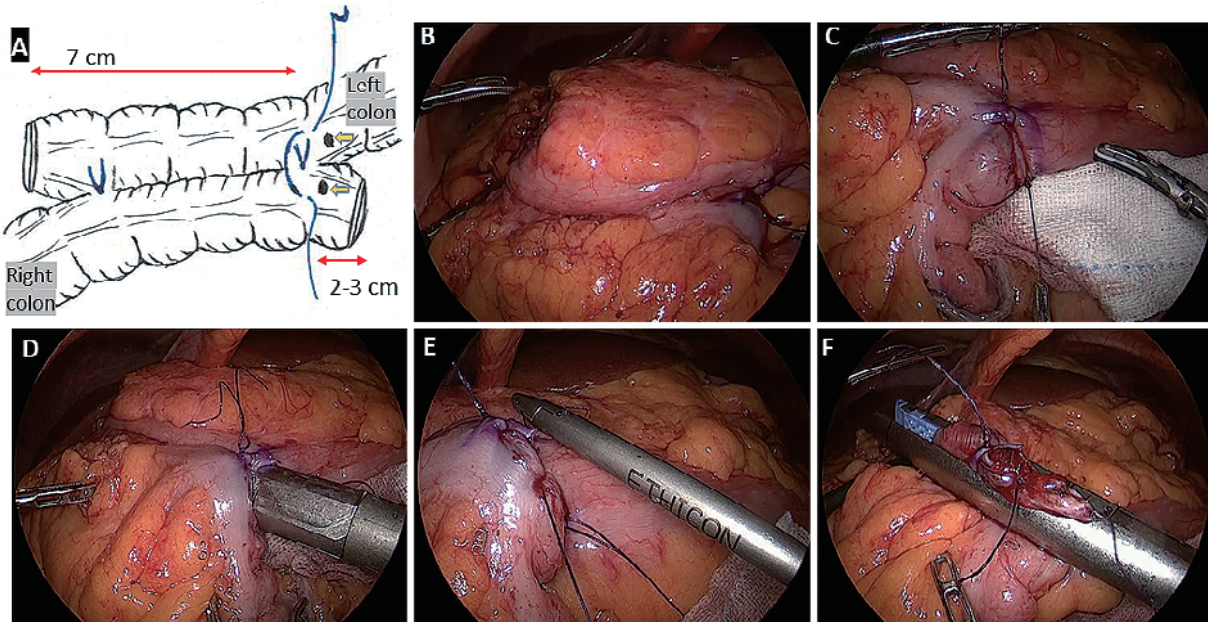

Figure 2. Schematic diagram representing the anastomotic technique (A). Intraoperative image showing right and left colon overlapped (B); both colic stumps being fixed with two stay sutures at a point 3 cm proximal to the right colic stump and 7 cm distal to the left colic stump (C); after performing enterotomy on both colons using an ultrasonic scalpel, each anvil of the linear stapler was inserted into the entry holes and fired (D); the common entry hole was then fixed with one suture in the middle creating a delta-shaped lumen (E); and the entry holes were closed using an endoscopic linear stapler (F).

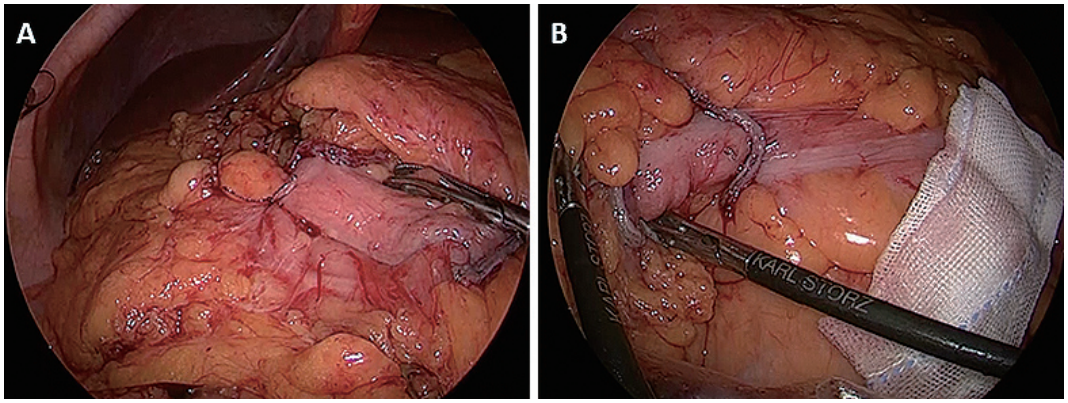

Figure 3. The final surgical field with completed modified overlapped delta-shaped anastomosis (A) and (B).

ligament was excised. The proximal and distal colon was later transected at the markings on either side of the tumor using an endoscopic linear stapler (ECHELON FLEX™ ENDOPATH® Staplers - Ethicon, USA), and two stapler limbs were created. A schematic diagram was provided, representing the anastomotic technique (Figure 2A). The right and left colic limbs were laid in an overlapped fashion with each other (Figure 2B). Both limbs were fixed with two stay sutures at a point 3 cm proximal to the right colic stump and 7 cm distal to the left colic stump (Figure 2B). Enterotomy was performed on both colon segments using an ultrasound scalpel at the center of the sutures (Figure 2C). Then, each anvil of the linear stapler was inserted into the entry holes and fired (Figure 2D). The suture line was inspected for integrity and hemorrhage. The common entry hole was fixed with a suture in the middle to create a delta-shaped lumen (Figure 2E) and was further closed by performing an enterotomy using an endoscopic linear stapler (Figure 2F). Thus, a delta-shaped anastomosis via the overlap method was completed. Figure 3A, 3B show the final surgical field. The operative field was cleaned and checked for hemostasis. Indwelling drainage was kept at the right paracolic gutter,

and the abdomen was then closed. The postoperative outcomes of all the four cases are provided in Table 1.

The surgical procedure is described in the video "Supplemental digital content 1."

Discussion

The current practice of laparoscopic-assisted colectomy, as compared to open colectomy, has been determined to achieve early patient recovery, shorter postoperative hospitalization, lesser use of parenteral and oral analgesics with similar oncologic benefits, and a reduced rate of intraoperative complications, 30-day postoperative mortality, complications at discharge and 60 days, and hospital readmission and reoperation. However, it still leads to substantial morbidity that includes postoperative ileus, pain-associated pulmonary dysfunction, and wound-related complications, like infection and hernia, which are assumed to be consequences of minilaparotomy for EA[8]. While performing IA, specimens can be extracted through a smaller abdominal incision and in a flexible location (such as suprapubic, transvaginal), leading to reduced pain and fewer incisional site infections and incisional hernias[8,9]. Likewise, it also minimizes the dissection of the colon and traction of the mesenteries, which results in increased surgical trauma, especially in obese patients, that may lead to postoperative paralytic ileus[3]. Jian-Cheng et al. described lower intraoperative blood loss, early recovery of bowel function, and lower postoperative pain scores in patients undergoing total laparoscopic right hemicolectomy with three-step IA compared to EA[4]. Moreover, van Oostendrop et al., in their meta-analysis comparing intracorporeal and EA in 1492 patients, have reported a decreased length of hospitalization and early return of bowel functions[8]. No significant difference was noted in the operating time between EA and IA groups[8]. The use of an endoscopic stapler further shortens the duration of surgery, which makes it technically easier[4]. Furthermore, the learning curve of DSA is suggested to be relatively short for gastrointestinal surgeries[10]. The cost of stapling devices is high, but the consequent benefits like early postoperative recovery, fewer short-term morbidities, less incision site-related pain, shorter hospitalization, and better cosmesis should be taken into consideration too.

Zhou et al. described the overlapped DSA technique for colon surgery in his first 20 cases with good results[7]. In this report, we described a modified overlapped DSA via the overlap method as a more simplified procedure. We put stay sutures before creating an entry hole to ensure its easy closure using one suture and immediately perform enterotomy of the common entry hole using an endoscopic linear stapler to avoid bacterial contamination. The third stapler line was applied vertical to the long axis of the colon to avoid narrowing of the lumen. We then created an entry hole 3 cm proximal to the end of the proximal right colon and 7 cm distal to the end of the distal left colon in order to maintain adequate blood perfusion during enterotomy of the common entry hole. This procedure can be adopted to any part of the colon following laparoscopic colectomy. In our case, the mean duration of surgery was 270 (174-470) minutes, and amount of blood loss was 16 (0-55) ml. The average size of minilaparotomy for the extraction of specimen was 3.1 cm (range 2.5-4 cm). No intraoperative and postoperative complications were observed. The median postoperative hospital stay was 12 days.

This study has inherent limitations of a retrospective study wherein we focused on a surgical technique in a small number of patients. Therefore, larger prospective studies are necessary to optimize the benefits and application of this technique. The second limitation of this study is that the mean duration of surgery was 218.4 minutes. The duration of surgery can vary depending on the procedure performed, and it reflects the learning curve of the operating surgeon. In this study, the average time required for anastomosis construction was 36 minutes. Since the procedure in patient 3 was performed by an inexperienced laparoscopic surgeon, longer duration for anastomotic construction was required compared to other cases performed by an experienced laparoscopic surgeon. The third limitation of this study is the concern of contaminations with fecal and cancer cells. Adequate preoperative bowel preparation and anterior retraction of enterotomy segment with the stay sutures can alleviate the risk of spillage of colonic contents.

In conclusion, modified DSA via the overlap method is a safe, useful, and simple intracorporeal anastomotic technique that ensures minimally invasive surgery and early patient recovery.

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Conflicts of Interest

There are no conflicts of interest.

Author Contributions

PN and SM conceived and designed the study and were involved in data collation. YK, KT, KB, KS, HK, TA, and KM participated in designing the study, coordination, and data analysis. PN drafted the manuscript. SN participated in manuscript preparation and critical revision. All authors have read and approved the manuscript.

Approval by Institutional Review Board (IRB)

Approved by the Ethics Committee of Kagoshima University Hospital. IRB approval code 200009.

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Supplementary Files

Supplementary digital content 1.

Please find supplementary file(s);
http://dx.doi.org/10.23922/jarc.2020-013