Annals of Medical Research

DOI: 10.5455/annalsmedres.2018.11.241 2019;26(3):360-5

Original Article

Specimen extraction and anvil placement methods in laparoscopic colorectal surgery: A single surgeon's experience

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Abstract

Aim: In minimally invasive surgery, incisions made for specimen extraction or anvil placement affect morbidity. The aim of this study was to analyze and share the experience of a single surgeon in laparoscopic colorectal surgery, specimen extraction, and anvil placement.

Material and Methods: Patients who underwent laparoscopic colorectal surgery were evaluated retrospectively. Patient characteristics, operative data, specimen extraction site, and anvil placement methods were assessed. Postoperative complications, length of hospital stay, and outpatient follow-up data were analyzed.

Results: A total of 27 patients were included in the study. The group included 6 females and 21 males with a mean age of 64.1±11.6 years. Mean body mass index was 28.9±5.8. Surgery was performed due to colorectal cancer in 20 patients, familial adenomatous polyposis in 3 patients, villous adenoma in 3 patients, and ulcerative colitis in 1 patient. Mean length of hospital stay was 8.8±7 days and mean follow-up time was 13.4±7.7 months. Mean operative time was 188.9±47.1 minutes and total blood loss was 67.4±46.1 mL.

Additional abdominal wall incisions were made for specimen extraction in 15 patients (56%). Natural orifice specimen extraction was performed in 10 patients (37%), while the ostomy site was used for specimen extraction in 2 patients (7%). In thirteen patients (48%) the additional abdominal wall incision was used for anvil placement. Of the remaining patients, the anvil was inserted through the transanal route in 3 patients (11%), ileostomy site in 2 patients (7%), and trocar site in 1 patient (4%). An anvil was not used for 8 patients (30%).

Conclusion: Specimen extraction and anvil placement in laparoscopic colorectal surgery can be achieved using different techniques, and the use of natural orifices and ostomy sites during the procedure is beneficial. Further research into this subject is needed.

Keywords: Anvil Placement; Colectomy; Hemicolectomy; Low Anterior Resection; Natural Orifice Surgery.

INTRODUCTION

Current advances in surgical instrumentation have enabled the implementation of minimally invasive procedures. These surgeries are gaining popularity due to advantages such as fewer incision-related complications, less pain, earlier mobilization, and shorter hospital stays. Colorectal surgery is an area of abdominal surgery in which laparoscopic techniques are most commonly utilized. Literature data have also revealed the beneficial aspects of the laparoscopic approach in colorectal surgery (1-3). Laparoscopic surgery is shown to yield oncologic outcomes comparable to those of open surgeries (4).

In spite of these advantages, retrieving the specimen from the abdomen or placing the anvil in the intestinal lumen during laparoscopy requires making incisions that are larger than trocar diameter. Suprapubic or midline incisions are often preferred for these purposes. Natural orifice specimen extraction (NOSE) is a notable alternative that overcomes this problem (5-7). For example, specimen extraction from the open rectal stump enables extracorporeal proximal resection and anvil placement, without the need for an additional incision. Specimen extraction by transanal eversion is enables safe resection under direct visualization, particularly with distal rectal tumors. However, not all NOSE procedures may facilitate anvil placement, in which case other methods are used for anvil insertion. Furthermore, ileostomy and colostomy sites may be useful for both purposes in some patients. The aim of this study was to analyze and share the

Received: 03.11.2018 **Accepted:** 17.12.2018 **Available online:** 26.12.2018

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experience of a single surgeon in laparoscopic colorectal surgery, specimen extraction, and anvil placement.

MATERIAL and METHODS

Patients who underwent laparoscopic colorectal surgery in Department of Gastroenterological Surgery in Samsun Training and Research Hospital, Turkey between August 2016 and September 2018 were analyzed retrospectively. Patients operated using laparoscopic methods were included in the study. Demographic and clinical data such as age, gender, body mass index, American Society of Anesthesiologists (ASA) score, diagnoses, and comorbidities were recorded. Operative data regarding the surgical procedures performed, specimen extraction sites, and anvil placement methods were evaluated. Postoperative complications, length of hospital stay, and outpatient follow-up data were analyzed. All data were saved in a Microsoft Excel spreadsheet.

RESULTS

A total of 27 patients (6 females, 21 males) underwent laparoscopic colorectal surgery. The mean age was 64.1±11.6 years. Mean body mass index was 28.9±5.8. ASA classification was as follows: 3 patients were in ASA I, 14 patients were in ASA II, and 10 patients were in ASA III. Comorbidities were hypertension in 16 patients, coronary artery disease in 8, diabetes mellitus in 5, chronic obstructive pulmonary disease in 3, active tuberculosis in 1, bladder cancer in 1, thyroid cancer in 1 and prostate cancer in 1. Five patients were smokers. A total of 7 patients underwent neoadjuvant therapy. Surgery was performed due to colorectal cancer in 20 patients, familial adenomatous polyposis in 3 patients, villous adenoma in 3 patients, and ulcerative colitis in 1 patient. Mean length of hospital stay was 8.8±7 days and mean follow-up period was 13.4±7.7 months (Table 1).

A total of 16 patients underwent laparoscopic low anterior resection (LLAR). Four patients had laparoscopic right hemicolectomy (LRH), 3 had laparoscopic total proctocolectomy and J-pouch ileoanal anastomosis (LTC-IPAA), 2 had laparoscopic sigmoid colectomy (LSC), and 1 patient had laparoscopic total colectomy and ileorectal anastomosis (LTC-IRA). One patient underwent a Hartmann's procedure. Suprapubic incisions were made for specimen extraction in 11 patients (40%). Ten patients (37%) underwent NOSE (transanal). NOSE methods used included transanal extraction of the resected specimen (Figure 1), transanal extraction of the distally excised specimen and extracorporeal proximal resection (Figure 2), and transanal eversion (Figure 3). Specimen extraction was done via median incision in 4 patients (15%), ileostomy site in 1 patient (4%), and colostomy site in 1 patient (4%). For anvil placement, suprapubic incision was used in 13 patients (48%), while the transanal route was used in 3 patients (11%), ileostomy site in 2 patients (7%), and trocar site in 1 patient (4%) (Table 2). An anvil was not used in 8 patients (30%) because the anastomoses were performed with linear staplers in 4 patients, hand-sewn in 3 patients and end colostomy was performed in one.

Mean operative time was 188.9±47.1 minutes and total blood loss was 67.4±46.1 mL. In terms of postoperative complications, 3 patients developed surgical site infections and 2 patients developed paralytic ileus which was managed medically. Anastomotic leakage occurred in 1 patient who underwent LRH, and was treated surgically. None of the patients died during follow-up (Table 3).

Table 1. Patient characteristics

Number of patients (n)	**27**
Age (y)	64.1±11.6
Sex (female/male)	6/21
Body mass index (kg/m²)	28.9±5.8
ASA class	
I	3
II	14
III	10
Diagnosis	
Rectum cancer	15
Ascending colon cancer	3
Familial adenomatous polyposis	3
Sigmoid colon cancer	2
Villous adenoma of rectum	2
Villous adenoma of ascending colon	1
Ulcerative colitis	1
Comorbidity	
Hypertension	16
Coronary artery disease	8
Diabetes Mellitus	5
Chronic obstructive pulmonary disease	3
Active tuberculosis	1
Bladder cancer	1
Thyroid cancer	1
Prostate cancer	1
Smoking history	5
Neoadjuvant therapy	7
Hospital stay (day)	8.8±7
Follow-up (month)	13.4±7.7

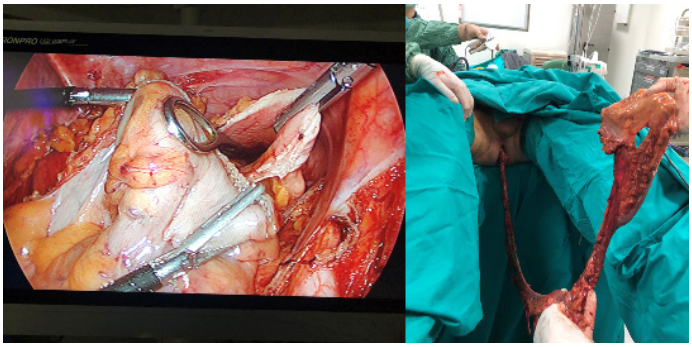

Figure 1. Transanal extraction of the resected specimen

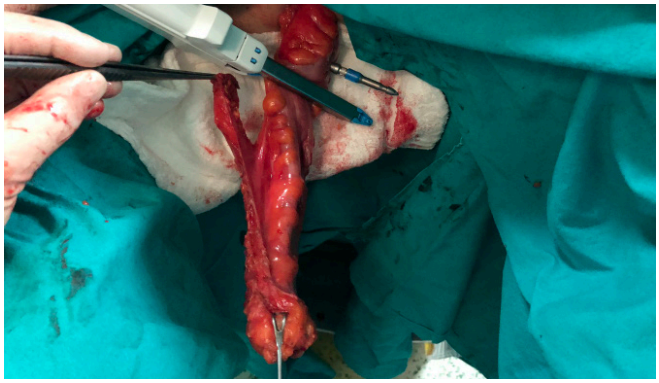

Figure 2. Transanal extraction of the distally excised specimen and extracorporeal proximal resection

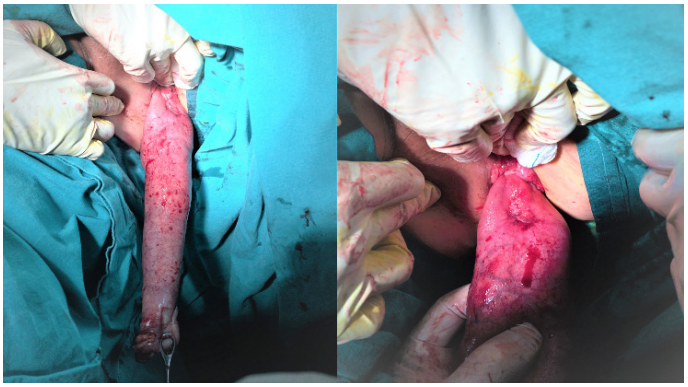

Figure 3. Transanal eversion

Table 2. Technical details of procedures

patient	age	gender	diagnosis	laparoscopic procedure	specimen extraction	anvilplacement
1	79	male	ascending colon cancer	right hemicolectomy	median incision	no anvil
2	54	male	ascending colon cancer	right hemicolectomy	median incision	no anvil
3	80	male	ascending colon cancer	right hemicolectomy	median incision	no anvil
4	53	male	familial adenomatous polyposis	total proctocolectomy and J-Pouch ileoanal anastomosis	transanal	ileostomy site
5	52	female	familial adenomatous polyposis	total proctocolectomy and J-Pouch ileoanal anastomosis	ileostomy site	ileostomy site
6	25	female	familial adenomatous polyposis	total proctocolectomy and J-Pouch ileoanal anastomosis	transanal	no anvil
7	74	male	rectum cancer	Hartmann's procedure	colostomy site	no anvil
8	50	male	rectum cancer	low anterior resection	transanal	no anvil
9	66	female	rectum cancer	low anterior resection	transanal	no anvil
10	69	male	rectum cancer	low anterior resection	suprapubic	suprapubic
11	78	male	rectum cancer	low anterior resection	suprapubic	suprapubic
12	61	male	rectum cancer	low anterior resection	suprapubic	suprapubic
13	66	male	rectum cancer	low anterior resection	suprapubic	suprapubic
14	61	male	rectum cancer	low anterior resection	suprapubic	suprapubic
15	66	male	rectum cancer	low anterior resection	suprapubic	suprapubic
16	62	female	rectum cancer	low anterior resection	suprapubic	suprapubic
17	73	female	rectum cancer	low anterior resection	suprapubic	suprapubic
18	69	male	rectum cancer	low anterior resection	transanal	suprapubic
19	56	male	rectum cancer	low anterior resection	transanal	suprapubic
20	64	male	rectum cancer	low anterior resection	transanal	transanal
21	72	female	rectum cancer	low anterior resection	transanal	transanal
22	75	male	sigmoid colon cancer	sigmoid colectomy	suprapubic	suprapubic
23	59	male	sigmoid colon cancer	sigmoid colectomy	suprapubic	suprapubic
24	70	male	ulcerative colitis	total colectomy and ileorectal anastomosis	transanal	transanal
25	76	male	villous adenoma of right colon	right hemicolectomy	median incision	no anvil
26	57	male	villous adenoma of rectum	low anterior resection	suprapubic	suprapubic
27	65	male	villous adenoma of rectum	low anterior resection	transanal	trocar site

Table 3. Surgical Outcomes	
	n=27
Laparoscopic Procedures	
Low anterior resection	16
Right hemicolectomy	4
Total proctocolectomy and J-Pouch ileoanal anastomosis	3
Sigmoid colectomy	2
Total colectomy and ileorectal anastomosis	1
Hartmann's procedure	1
Specimen Extraction	
Suprapubic	11
Transanal	10
Median incision	4
Stoma site	
Ileostomy site	1
Colostomy site	1
Anvil placement	
Suprapubic	13
Transanal	3
Ileostomy site	2
Trocar site	1
No anvil	8
Operative time (min)	188.9±47.1
Blood loss (mL)	67.4±46.1
Postoperative complications	
Surgical site infection	3
Paralytic ileus	2
Anastomotic leak	1
Postoperative mortality	None

DISCUSSION

One of the main advantages of minimally invasive colorectal surgery is that it reduces incision-related morbidity. However, wound site infection, pain, and incisional hernia continue to pose problems postoperatively due to incisions made in the abdominal wall (8-10). Therefore, it is extremely important to reduce incisional complications by making small incisions. The results of single-port laparoscopy provide especially valuable insights to this matter. Compared to conventional laparoscopic surgery, single-incision laparoscopic procedures are associated with higher risk of trocar site hernia (11). This indicates that incision size rather than number is the primary factor associated with morbidity. Nevertheless, even if tools smaller than 5 mm are used in laparoscopy, the resected specimen is extracted either by widening the trocar site or making an additional incision. This partially negates the benefits of using the minimally invasive approach. In this respect, NOSE seems to be beneficial and is making significant contributions (5-7,12,13). It is believed that using natural orifices rather than making additional incisions in suitable patients may help retain the advantages provided by minimally invasive surgery.

In the cases presented here, suprapubic incision, median incision, transanal route, and stoma sites were used for specimen extraction. The site of specimen extraction was not determined preoperatively, but was instead selected intraoperatively based on the surgery's progress and the patient's comfort. Two of the patients who had suprapubic transabdominal specimen extraction underwent LSC and the others underwent LLAR. Of the 10 patients who had NOSE, 7 underwent LLAR. Transanal eversion was used in 4 of these cases. Three patients had transanal extraction of the distally transected specimen for extracorporeal proximal resection. Transanal specimen extraction was successfully performed in 2 patients who underwent LTC-IPAA.

In another patient undergoing LTC-IPAA, the ileostomy site was used for specimen extraction. Because that patient was diagnosed with familial adenomatous polyposis, there was no mass to present an obstacle and the specimen was easily extracted from the ileostomy site. After specimen extraction, ileostomy site was also used for ileal J-pouch in a total of 3 LTC-IPAA patients. In one patient who underwent LLAR, anastomosis was not done due to tumor-related colonic obstruction, and an end colostomy was performed. In that patient, the specimen was extracted through the colostomy site. Because using ostomy sites avoids subjecting the patient to additional procedures, it was preferred if the specimen did not contain a large mass. Considering its convenience, this method should be kept in mind during minimally invasive applications to make effective intraoperative use of ostomy sites before ostomy maturation. Meanwhile, it is worth mentioning that using a laparoscopic linear stapler makes our work considerably easier when making an ileal J-pouch through the ileostomy site. This makes it possible to avoid pulling the ileal loop towards the extracorporeal zone. Median incision was only used for specimen extraction in LRH procedures, because this incision is convenient when manual assistance is needed in ileotransversostomy anastomosis.

Specimen extraction is not the only issue related to incision size in laparoscopy. Inserting stapler anvils also requires a wider incision because they are larger than trocars. The most efficient NOSE procedures are those that can also be utilized for anvil insertion (14-16). Of the 10 NOSEs performed in the current study, the transanal route was used for anvil placement in only 3 patients. There were 4 LLAR cases in which the specimen was extracted using transanal eversion. In these patients, the rectal mass was 10-20 mm from the dentate line and resection was only possible with eversion. In one of the patients, the anvil was sutured to a 10 F tube, inserted transanally and advanced proximally, after which the specimen was everted and resected. Of the other patients who underwent eversion, suprapubic incision was preferred for anvil placement in 2 patients and abdominal trocar site in 1 patient. In the other

patient who had transanal anvil placement and LLAR, the distally resected specimen was extracted transanally followed by extracorporeal anvil placement and specimen transection. In the LTC-IRA procedure, the anvil was inserted transanally following specimen extraction and was positioned in the proximal end intracorporeally. Because anastomoses were made manually in 2 patients with rectal cancer and 1 patient with familial adenomatous polyposis who underwent intersphincteric resection, an anvil was not used even if transanal specimen extraction was used. In one patient with LTC-IPAA, the specimen was extracted transanally but the anvil was positioned in the J-pouch via the ileostomy site.

Colorectal surgery is also challenging in terms of wound site complications. Surgical site infection is among the major complications, with a risk of approximately 15-30%; however, this rate has been reduced to below 10% by minimally invasive surgery (17,18). The incidence of surgical site infection in our study was 11%, and all of the infections occurred at specimen extraction sites. One of these patients was also the only patient in the study with anastomotic leak. This patient underwent LRH with transabdominal specimen extraction through an upper median incision and had a history of diabetes mellitus, prostate cancer, and coronary bypass surgery. No disseminated peritonitis was observed in the intraabdominal exploration, the anastomosis was resected, and ileotransversostomy was repeated. There were no complications after revision anastomosis. The patient was treated with open wound care and antibiotherapy and discharged on postoperative day 40. One of the other two patients with surgical site infection had also undergone LRH with specimen extraction through an upper median incision. The third patient had undergone LLAR with specimen extraction through a suprapubic incision. These patients were successfully managed with medical treatment. None of the patients for whom NOSE methods were used developed surgical site infection. This indicates that transanal extraction effectively reduces morbidity in colorectal surgery.

CONCLUSION

The outcomes of patients analyzed in this study suggest that laparoscopic procedures can be used safely in colorectal surgery. Limits for specimen extraction have not yet been established. In the present study, none of the patients in whom NOSE was applied had bulky tumors. Many alternative methods were utilized in this series, including transanal extraction of a resected specimen, transanal extraction of the distal end of the specimen for extracorporeal proximal resection, and transanal eversion for specimen resection. The method used was selected primarily according to mass location and ease of the procedure. Anvil placement was done independently via a suitable route chosen to minimize trauma. Larger case series will yield stronger conclusions regarding the methods used in minimally invasive colorectal surgery. The data presented here suggest that specimen extraction and anvil placement in laparoscopic colorectal surgery can be achieved using various techniques. Randomized studies including larger patient numbers are needed.

Competing interests: The authors declare that they have no competing interest.
Financial Disclosure: There are no financial supports
Ethical approval: I did not submit the study to the ethical committee beacuse it is a retrospective study.

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