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Comparison of trocar-site and conventional diverting ileostomy techniques in laparoscopic low anterior resection

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ABSTRACT

Introduction: Protective loop ileostomy is commonly performed following laparoscopic low anterior resection for rectal cancer to reduce the clinical consequences of anastomotic leakage. Traditionally, the stoma is created through a separate abdominal incision; however, enlarging an existing trocar site may represent a less invasive alternative. This study aimed to compare the surgical and postoperative outcomes of ileostomy creation by enlarging a laparoscopic trocar site with those created through a conventional incision.

Materials and Methods: This retrospective study included 92 patients who underwent laparoscopic low anterior resection with a protective loop ileostomy for rectal cancer between 2016 and 2024. Patients were divided into two equal groups according to the stoma creation technique. In Group T (n=46), the ileostomy was constructed by enlarging a 12-mm trocar site, whereas in Group C (n=46) a conventional abdominal incision was used. Operative time, postoperative complications (ileus, wound infection, and incisional hernia), length of hospital stay, and patient-reported aesthetic satisfaction were evaluated and compared between the groups.

Results: Baseline demographic and clinical characteristics were comparable between the two groups. Operative time was significantly shorter in Group T than in Group C. Postoperative wound infection occurred less frequently in the trocar-site group, whereas the rates of ileus and incisional hernia were similar between the groups. Patients in Group T also reported significantly higher aesthetic satisfaction. No significant difference was observed in the length of hospital stay.

Conclusions: Creating a protective loop ileostomy by enlarging a trocar site appears to be a safe and feasible alternative to the conventional incision technique. This approach may reduce operative time, decrease wound-related complications, and provide superior cosmetic outcomes in patients undergoing laparoscopic low anterior resection for rectal cancer.

Keywords: Ileostomy, laparoscopy, rectal cancer

Introduction

Data published by the American Cancer Society demonstrate that the incidence of colorectal cancer in men is exceeded by that of prostate and lung cancers, while in women colorectal cancer occurs less frequently than breast and lung malignancies.[1]

Robust evidence from large multicenter studies and rigorously designed randomized controlled trials supports the safety and clinical efficacy of laparoscopic surgery in the management of rectal cancer.[2,3]

In patients with rectal cancer, laparoscopic low anterior resection has been shown to confer several short-term

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benefits when compared with the open approach. These advantages include decreased intraoperative blood loss, reduced postoperative pain, more rapid resumption of oral intake, earlier restoration of bowel function, and have been associated with shorter length of hospital stay, as well as a lower incidence of incisional.[4,5]

Despite continuous refinements in surgical techniques, including minimally invasive laparoscopic approaches, the occurrence of postoperative anastomotic leakage (AL) cannot be entirely averted, particularly in the context of low rectal cancer surgery (LAR).[6] The clinical presentation of AL is highly heterogeneous, encompassing a spectrum that ranges from clinically silent or occult leakage beneath a protective stoma to catastrophic fecal peritonitis associated with multiple organ dysfunction. In its early, subclinical phase, AL may remain undetected and subsequently progress to chronic pelvic sepsis. Consequently, anastomotic leakage constitutes a severe and potentially life-threatening postoperative complication, with reported incidence rates varying widely between 1% and 30%.[7]

Adverse postoperative events, such as anastomotic failure, infectious complications, and postoperative bowel obstruction, may profoundly compromise functional recovery and health-related quality of life, and in severe circumstances can pose a serious threat to patient survival.[8]

In clinical practice, a substantial proportion of patients undergoing rectal cancer surgery routinely receive a diverting protective ileostomy with the aim of reducing the risk of clinically significant anastomotic leakage and other postoperative complications. Nevertheless, the routine necessity of ileostomy construction remains a matter of ongoing debate, as its benefits must be carefully weighed against procedure-related morbidity and the impact on patient quality of life.[9]

The optimal site for stoma creation is determined preoperatively and carefully marked prior to surgery by experienced stoma care nurses, taking into account anatomical landmarks and patient-specific factors to ensure appropriate postoperative function and care. Traditionally, the ileostomy is created through a new incision in the right lower quadrant. However, as laparoscopy involves multiple trocar insertions, we have proposed using one of these existing trocar sites—usually the right lower quadrant 12 mm port—for ileostomy exteriorization. This technique potentially eliminates the need for an additional incision, reduces tissue trauma, and improves cosmetic results. The present study aims to evaluate and compare surgical outcomes between trocar-site ileostomy and conventional-site ileostomy following laparoscopic LAR.

Methods

This retrospective comparative study included patients who underwent laparoscopic low anterior resection (LAR) with a diverting loop ileostomy for rectal adenocarcinoma between January 2016 and December 2024 at a single tertiary referral center.

Inclusion criteria were defined as follows:

- Patients aged ≥18 years
- Histologically confirmed rectal adenocarcinoma,
- Elective laparoscopic LAR with double-stapled anastomosis
- Construction of a diverting loop ileostomy.

Exclusion criteria included:

- Patients undergoing emergency, open surgery or conversion to open surgery
- Absence of a diverting ileostomy
- Recurrent rectal cancer
- Synchronous malignancies
- Incomplete clinical data
- Patients lost to follow-up.

Patient selection and group allocation were performed based on operative technique (trocar-site versus conventional-site ileostomy). To enhance transparency and minimize potential selection bias, a patient flow diagram illustrating the inclusion and exclusion process is provided (Fig. 1).

Study Design and Population

This retrospective comparative study included patients who underwent laparoscopic LAR with a diverting loop ileostomy for rectal adenocarcinoma between January 2016 and December 2024 at a single tertiary referral center. All procedures were performed by the same colorectal surgical team.

This retrospective, single-center study was conducted at the Department of General Surgery, Kartal Dr.Lutfi Kirdar City Hospital, between January 2016 and December 2024.

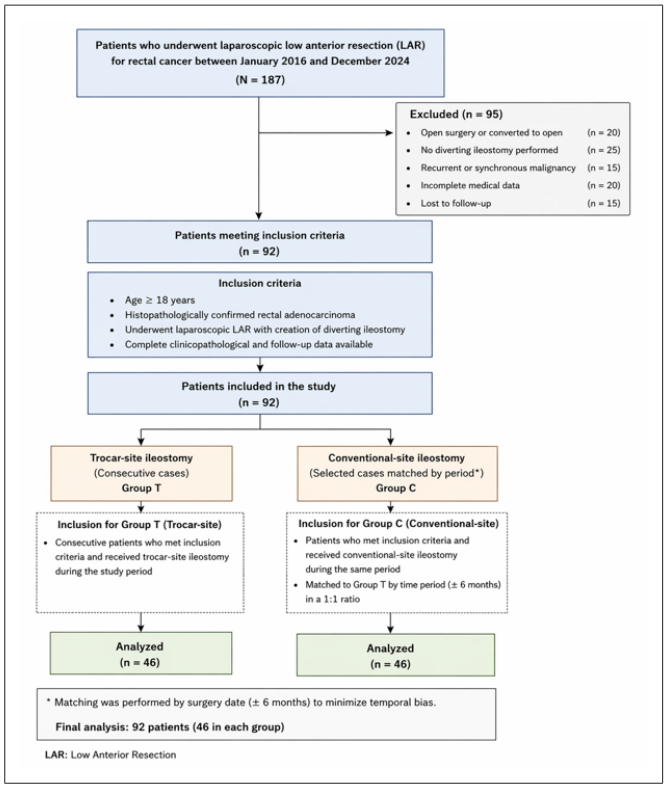


Figure 1. Patient flow diagram illustrating the inclusion and exclusion process

Ethical approval was obtained from the institutional review board (IRB No. 2025/010.99/23/23) and the study is conducted according to Declaration of Helsinki. A total of 92 patients who underwent laparoscopic LAR for rectal cancer were included in the analysis.

Surgical Technique

The patients were positioned supine with the legs apart in low lithotomy position, with slight hip flexion. A full Trendelenburg position was applied, along with full right sided tilt. All pressure points were carefully padded. Trocar placement was as follows: a 10-mm trocar was inserted infraumbilically, a 12-mm trocar was placed in the right lower quadrant, a 5-mm trocar was inserted near the right mid-quadrant, and an additional 5-mm trocar was placed in the left lower quadrant. In all patients, the anastomosis was created using a double-stapling technique.

- Group T (Trocar site): The right lower 12 mm trocar site was extended by 2–3 cm and used for ileostomy exteriorization.
- Group C (Conventional site): A separate incision was made at the traditional right lower quadrant location (McBurney line).

Data Collection

The following parameters were analyzed:

- Operative time (min)
- Estimated blood loss (mL)
- Postoperative complications (ileus, wound infection, incisional hernia)
- Hospital stay (days)
- Cosmetic satisfaction score (0–10 Visual Analogue Scale, VAS)[10]

Cosmetic outcomes were assessed using a 10-point Visual Analog Scale (VAS). In addition, validated scar assessment tools such as the Patient and Observer Scar Assessment Scale (POSAS) have been widely used in recent literature for comprehensive evaluation of scar quality.

Statistical Analysis

Statistical analyses were performed using SPSS version 26.0. Continuous variables were compared using the Student's t-test and categorical variables using the Chi-square test. Statistical significance was defined as $p < 0.05$.[11]

Results

A total of 92 patients who underwent total laparoscopic low anterior resection with a defunctioning ileostomy between January 2016 and December 2024 were included in the analysis. Among these patients, ileostomy construction was performed either at the trocar site (Group T) or at a conventional abdominal site (Group C). Baseline demographic and clinical characteristics were comparable between the two groups. Baseline demographic and clinical characteristics were comparable between Group T and Group C. There were no statistically significant differences between the two groups in terms of mean age or sex distribution. Similarly, body mass index and preoperative serum albumin levels did not differ significantly between groups. The distribution of American Society of Anesthesiologists (ASA) physical status scores was also comparable. In addition, the prevalence of smoking and diabetes mellitus was similar in both groups. These findings indicate a well-balanced baseline profile, allowing for a reliable comparison of postoperative outcomes between the two groups (Table 1).

Tumor distance from the anal canal was preoperatively assessed using colonoscopy and measured in centimeters

Table 1. Demographic and clinical characteristics of patients

Variable	Trocar site (n=46)	Conventional site (n=46)	p
Mean age (years)	58.2±8.1	56.3±6.9	NS
Sex			
Male	20	18	NS
Female	26	28	
BMI (kg/m²)	27.6±3.9	26.9±4.2	NS
Albumin (g/L)	32±4	31±6	NS
ASA score			
2	12	14	NS
3	34	32	
Tobacco use	18	22	NS
Diabetes mellitus	10	13	NS
Distance from anal verge (cm)	6±3.1	6±2.8	NS
Neoadjuvant Radiotherapy	42	44	NS

BMI: Body mass index; ASA: American Society of Anesthesiologists; NS: Difference not significant (P>0.05).

by an experienced colorectal surgeon. The mean tumor-to-anal canal distance was comparable between Group T (6±3.1 cm) and Group C (6±2.8 cm). No statistically significant difference was observed between the two groups with respect to tumor location. These findings indicate a similar anatomical distribution of rectal tumors across both groups. Such comparability minimizes location-related bias and supports the validity of subsequent comparisons of surgical and postoperative outcomes (Table 1).

A total radiation dose of 50.4 Gy was prescribed to the pelvis and delivered in daily fractions of 1.8 Gy, five days per week, over a treatment period of approximately 28 days. The clinical target volume encompassed the primary rectal tumor, mesorectal compartment, presacral region, and regional pelvic lymph nodes, in accordance with standard contouring guidelines. Long-course neoadjuvant radiotherapy was administered to 42 patients in Group T and 44 patients in Group C. There was no statistically significant difference between the two groups with respect to the proportion of patients receiving neoadjuvant radiotherapy.

Comparative analysis revealed statistically significant differences between Group T and Group C in several perioperative and postoperative outcomes. Operative time and intraoperative blood loss differed significantly between the two groups. In addition, the incidence of wound infection showed a statistically significant variation. The time to ileostomy closure after surgery was 6.5±2.7 months in Group T and 7.7±3.2 months in Group C, with no statistically significant difference between the groups. Cosmetic outcomes, as assessed by the visual analog scale (VAS), were also significantly different between Group T (8.7±0.7) and Group C (7.2±1.0) (Table 2).

There were no statistically significant differences between Group T and Group C in terms of postoperative ileus rates, length of hospital stays or parastomal hernia. In the present study, a parastomal hernia was observed in only one patient, who belonged to Group C. This complication was

Table 2. Operative, post operative and follow up of patients

Variable	Trocar site (n=46)	Conventional site (n=46)	p
Operative time (min)	178±25	201±31	<0.01
Blood loss (mL)	72±15	84±21	0.04
Wound infection (%)	2(4.3)	6(13.0)	0.04
Postoperative ileus (%)	3(6.5)	5(10.8)	NS
Hospital stay (days)	5.2±1.3	5.6±1.4	NS
Parastomal hernia (%)	0	1(2,2)	NS
TNM stage			NS
I	4	3	
II	8	14	
III	24	16	
IV	10	13	
Adjuvant Therapy	37	34	NS
Ileostomy closure after surgery (month)	6.5±2.7	7.7±3.2	NS
Cosmetic VAS score	8.7±0.7	7.2±1.0	<0.01
Ileostomy closure site hernia	1	2	NS
Follow up (month)	12±3.1	12±2.8	NS

TNM: Tumor, node, metastasis; VAS: Visual analog scale; NS: Difference not significant (p>0.05).

detected on the third postoperative day and was managed successfully with same-day surgical revision using primary absorbable 2-0 sutures. In addition, pathological TNM staging was comparable between the two groups. These findings suggest that the two surgical approaches resulted in similar short-term postoperative recovery and oncological staging outcomes (Table 2).

Ileostomy closure–site hernia was observed in one patient in Group T and in two patients in Group C, with no statistically significant difference between the groups. The mean follow-up duration was 12±3.1 months in Group T and 12±2.8 months in Group C. These findings indicate comparable long-term follow-up and similar rates of stoma-related late complications between the two groups (Table 2).

These findings suggest that trocar-site ileostomy is a feasible alternative to conventional-site ileostomy in patients undergoing laparoscopic rectal cancer surgery.

Discussion

Despite ongoing advances in laparoscopic techniques, anastomotic leakage remains a significant and unresolved concern following anterior resection, with reported incidence rates ranging from 1.4% to 15.2%.[12,13] The wide variability in incidence reflects differences in patient-related factors, tumor characteristics, and operative complexity. When anastomotic leakage occurs, it may lead to serious and potentially life-threatening complications, including generalized peritonitis, pelvic abscess formation, and rectovaginal fistula.[14,15] Given these severe consequences, the construction of a prophylactic diverting stoma has been commonly employed as a protective measure, particularly in patients undergoing laparoscopic surgery for low rectal cancer.[16]

From an interpretative perspective, our results suggest that the choice between trocar-site and conventional-site construction of a temporary defunctioning ileostomy during laparoscopic low anterior resection does not introduce baseline demographic or clinical bias. The absence of statistically significant differences in patient characteristics between the two groups supports the comparability of the cohorts and strengthens the validity of subsequent outcome comparisons.

Laparoscopic low anterior resection with temporary diverting ileostomy was performed in accordance with established oncological principles. Patients were positioned in a fully reverse Trendelenburg position with right-sided tilt. A standardized trocar placement was adopted, consisting of one infraumbilical trocar and two trocars placed in the right abdomen, an additional one trocar placed in the left lower quadrant according to operative requirements. A wound protector was routinely applied prior to specimen extraction. In both groups, a temporary diverting ileostomy was routinely constructed under laparoscopic guidance by exteriorizing the terminal ileum approximately 25–30 cm proximal to the ileocecal valve. The bowel was secured to the anterior rectus sheath and skin using interrupted absorbable sutures, after which the temporary ileostomy was fashioned. Based on the site of ileostomy construction, patients were categorized into two groups: trocar-site ileostomy (Group T) and conventional-site ileostomy (Group C).

The significantly shorter operative time and reduced intraoperative blood loss observed in the present study are in agreement with the findings reported by Peng et al.[17], who similarly demonstrated statistically significant improvements in these parameters. In contrast, Karakayalı et al.[18] did not identify a significant difference in operative duration between the compared techniques. Notably, in our cohort, both operative time and blood loss were significantly lower in Group T. These results suggest that trocar-site ileostomy formation may enhance operative efficiency, potentially by eliminating the need for an additional abdominal incision. Variations among published studies may be explained by differences in surgical expertise, institutional protocols, and patient selection criteria.

Lee et al.[19] reported no statistically significant differences in postoperative ileus rates or length of hospital stay between the study groups. Consistent with these findings, our study likewise did not demonstrate any statistically significant differences with respect to postoperative ileus or duration of hospitalization. This concordance with previously published data further supports the reliability and external validity of our results. However, although previous literature has suggested a shorter hospital stay in the conventional incision group, no statistically significant difference was observed in our study. This apparent discrepancy may be attributed to the single-center design of our study, as well as potential differences in patient characteristics, perioperative management, and institutional protocols.

In our study, no statistically significant differences were observed between Group T and Group C with respect to the interval from primary surgery to ileostomy closure or the

incidence of ileostomy closure–site hernia. These findings are consistent with previously published data, including the studies reported by Peng et al.[17] and Karakayalı et al.[18], which likewise demonstrated no significant differences between comparison groups for these outcomes. The concordance of our results with the existing literature further supports the robustness and generalizability of our findings.

To the best of our knowledge, this study is the first to comparatively evaluate different temporary ileostomy extraction sites in terms of cosmetic outcomes. Cosmetic assessment was performed using the Cosmetic Visual Analog Scale (VAS)[10], and a statistically significant advantage was observed in favor of Group T. These findings suggest that trocar-site ileostomy construction may provide superior aesthetic results without compromising surgical safety.

Limitations

This study has several limitations that should be acknowledged. First, due to its retrospective design, the study is inherently subject to selection bias and unmeasured confounding factors. Although consecutive patients were included in the trocar-site ileostomy group, the conventional-site ileostomy group was selected, which may have introduced allocation bias despite attempts to ensure comparability between groups.

Second, the equal number of patients in both groups was achieved through a selection process rather than randomization, which may limit the generalizability of the findings. Although efforts were made to minimize bias by applying strict inclusion and exclusion criteria and by maintaining comparable baseline characteristics, residual confounding cannot be excluded.

Third, this was a single-center study with a relatively limited sample size, which may affect the external validity of the results. Finally, the retrospective nature of data collection may have led to incomplete or missing variables that could influence outcomes.

Future prospective, randomized, and multicenter studies are needed to validate these findings.

Conclusion

Trocar-site exteriorization of diverting ileostomy during laparoscopic low anterior resection offers comparable safety, shorter operative time, lower wound morbidity, and superior cosmetic outcomes compared to the conventional right lower quadrant approach. This technique may be considered a standard alternative for selected patients in minimally invasive rectal surgery.

Disclosures

Ethics Committee Approval: The study protocol was reviewed and approved by the Kartal Dr. Lütfi Kırdar City Hospital Ethics Committee (Date:30/12/2015, No:2025/010.99/23/23)

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare that they have no conflicts of interest.

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