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RESEARCH ARTICLE

Surgical and Early Oncological Outcomes of Laparoscopic Versus Open Rectal Surgery: A Comparative Study

Laparoskopik ve Açık Rektum Cerrahisinin Cerrahi ve Erken Dönem Onkolojik Sonuçları: Karşılaştırmalı Çalışma

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ABSTRACT

Aim: In this study, we aimed to evaluate the short-term clinicopathological outcomes of laparoscopic versus open surgery in patients undergoing rectal cancer surgery.
Method: Between May 2015 and July 2017, 46 patients who underwent curative surgery for rectal cancer were retrospectively analyzed. The patients receiving neoadjuvant therapy were administered long-term fractional chemoradiotherapy. All patients were divided into two groups as open surgery (Group 1, n=21) and laparoscopic surgery (Group 2, n=25). Data including demographic characteristics, type of surgery, postoperative complications, duration of surgery, length of hospital stay, the amount of intraoperative bleeding, and short-term oncological outcomes were recorded.
Results: Of the patients, 34 were males, and 14 were females. The median age was 55 (range= 28 to 82) years. The median follow-up was 20 months in Group 1 and 19 months in Group 2. The tumor was located in the upper rectum in 19 patients, in the mid-rectum in 14 patients, and the lower rectum in 13 patients. The median length of hospital stay was six days, and the median duration of surgery was 202.5 min. The recurrence rate was 13%, and the mortality rate was 6.5%. The rate of conversion from laparoscopic to open surgery was 21.8%. The complication rate was 54.3%. Anastomotic leak was detected in two patients. The amount of intraoperative bleeding was statistically significantly higher, and the length of the proximal surgical margin was statistically significantly longer in the open surgery group.
Conclusion: Our study results suggest lower hemorrhage with laparoscopic surgery and similar oncological outcomes with both laparoscopic and open rectal surgery.
Keywords: Rectal cancer, open surgery, laparoscopy, oncological outcomes

ÖZ

Amaç: Bu çalışmada rektal kanser cerrahisi yapılan hastalarda laparoskopi ve açık cerrahinin kısa dönem klinikopatolojik sonuçları değerlendirildi.
Yöntem: Mayıs 2015-Temmuz 2017 tarihleri arasında rektal kanser nedeniyle küratif cerrahi yapılan 46 hasta retrospektif olarak incelendi. Neoadjuvan tedavi verilen hastalara uzun dönem fraksiyonel kemoradyoterapi uygulandı. Hastalar açık cerrahi (Grup 1, n=21) ve laparoskopik cerrahi (Grup 2, n=25) olmak üzere iki gruba ayrıldı. Demografik özellikler, cerrahi türü, postoperatif komplikasyonlar, cerrahi süresi, hastanede kalış süresi, intraoperatif kanama miktarı ve kısa dönem onkolojik sonuçlar kaydedildi.
Bulgular: Hastaların 34'ü erkek, 14'ü kadın idi. Medyan yaş 55 (dağılım= 28-82) yıl idi. Medyan takip süresi Grup 1'de 20 ay, Grup 2'de 19 ay idi. Hastaların 19'unda tümör üst rektum, 14'ünde orta rektum ve 13'ünde alt rektum yerleşimliydi. Medyan hastanede kalış süresi altı gün ve medyan cerrahi süresi 202,5 dk idi. Rekürrens oranı %21,8 ve mortalite oranı %6,5 idi. Laparoskopik cerrahiden açık cerrahiye geçiş oranı %21,8 idi. Komplikasyon oranı %54,3 idi. İki hastada anastomoz kaçağı tespit edildi. Açık cerrahi grubunda intraoperatif kanama miktarı istatistiksel olarak anlamlı düzeyde daha fazla ve proksimal cerrahi sınır uzunluğu istatistiksel olarak anlamlı düzeyde daha uzundu.
Sonuç: Çalışma sonuçlarımız laparoskopik cerrahide daha az kanama ve laparoskopik ve açık rektum cerrahisi arasında benzer onkolojik sonuçlar elde edildiğini göstermektedir.
Anahtar Kelimeler: Rektum kanseri, açık cerrahi, laparoskopi, onkolojik sonuçlar

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Introduction

Surgical oncology has undergone a significant evolution over the last two decades. The fast-growing technological advancements have influenced the practice of new surgical techniques. As in many surgical fields, minimally invasive surgery, which has been widely used in cancer surgery, has become increasingly adopted by many surgeons in the practice of colorectal surgery owing to less tissue trauma and favorable outcomes. There is a growing number of clinical studies, systematic reviews, and meta-analysis comparing laparoscopic versus open rectal cancer surgery in the literature and oncological outcomes of both techniques are still debated.[1,2,3,4] In rectal cancer surgery, total mesorectal excision with specific rules has been adopted irrespective of the surgical technique applied.[5] In the present study, we aimed to evaluate the short-term clinicopathological outcomes of laparoscopic versus open surgery in patients undergoing rectal cancer surgery.

Materials and Methods

Between May 2015 and July 2017, all patients who underwent curative surgery for rectal cancer at our clinic were retrospectively analyzed. A single surgical team operated all patients. The patients receiving neoadjuvant therapy were administered long-term fractional chemoradiotherapy (1.8x28=50.4 Gy + 5-FU for 28 days). Chemoradiotherapy was applied to the patients with T3, T4, and/or N+ rectal cancer according to the tumor, node, metastasis staging system.[6] All patients were operated six to eight weeks after neoadjuvant therapy. Patients with missing data were excluded from the study. No written consent is required in such retrospective studies. The study protocol was approved by the Çukurova University Non-invasive Clinical Research Ethics Committee (01.02.2019/85). The study was conducted following the principles of the Declaration of Helsinki. Tumors were classified according to their distance to the anal verge: <8 cm lower rectum, 8-12 cm mid-rectum, and 12-15 cm upper rectum.[7] The patients were divided into two groups as open surgery (Group 1, n=21) and laparoscopic surgery (Group 2, n=25). Data including demographic characteristics such as age and sex, type of surgery, postoperative complications according to the Clavien-Dindo classification,[8] duration of surgery, length of hospital stay, the amount of intraoperative bleeding, and short-term oncological outcomes (location of the tumor, neoadjuvant therapy, radial surgical margin, proximal surgical margin, distal surgical margin, tumor stage, specimen size, the number of lymph nodes removed, recurrence, and survival) were recorded. The patients who were switched from laparoscopic to open surgery were included in the open surgery group (Group 1). In the surgical technique, high ligation of the inferior mesenteric artery, close ligation of the inferior mesenteric vein to treitz, and complete splenic flexure mobilization were performed similarly in all patients (both in laparoscopic and open technique). Total mesenteric artery ligation was performed in partial mesorectal excision of upper rectal tumors, in total mesorectal excision of mid-rectal and distal rectal tumors and in all operations (laparoscopic and open surgery) following oncological surgical principles.

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows version 22 statistical software (IBM Corp., Armonk, NY, USA). Continuous variables were expressed in median (minimum-maximum) values, and categorical variables were expressed in number and frequency. The chi-square test was used to analyze qualitative data. The Mann-Whitney U test was used to analyze quantitative data. A p value of <0.05 was considered statistically significant.

Results

A total of 46 patients were included in the study. Of these patients, 32 were males, and 14 were females. The median age was 55 (range=28 to 82) years. A total of 21 patients (45.7%) underwent open surgery (Group 1), while 25 patients (54.3%) underwent laparoscopic surgery (Group 2). The median follow-up was 19 (range=14 to 34) months in Group 1 and 20 (range=13 to 37) months in Group 2. The tumor was located in the upper rectum in 19 patients, in the mid-rectum in 14 patients, and in the lower rectum in 13 patients. The median length of hospital stay was six (range=3 to 17) days, and the median duration of surgery was 202.5 (range=90 to 375) min. The recurrence rate was 13% (6/46), and the mortality rate was 6.5% (3/46). Baseline demographic and clinicopathological characteristics of patients are shown in Table 1. Anterior resection was performed in 12 patients (n=3 laparoscopic and n=9 open surgery), abdominoperineal resection in seven patients (n=3 laparoscopic and n=4 open surgery), intersphincteric resection with pull-through coloanal anastomosis in three patients (n=2 laparoscopic and n=1 open surgery), and low anterior resection in 24 patients (n=17 laparoscopic and n=7 open surgery). The rate of conversion from laparoscopic to open surgery was 21.8% (10/46). The rate of complication was 54.3% (25/46). Anastomotic leak was detected in two patients and was treated with interventional radiological techniques and conservative methods without the need for surgery. Postoperative complications are summarized in Table 2. First flatus were seen between days postoperatively

(po) 2-5 days (median=3), oral intakes were started po 1-4 days (median=2) days, urinary catheters were removed between po 2-10 days (median=3), drainage catheters were removed between po 2-7 days (median=3), mobilization was started between po 0-2. days (median=1), and pain relief intake was left to the patient's request after performed routine at po 0-1. days. There was no significant difference between laparoscopic and open surgery groups in terms of first flatus, oral intake, urine catheter removal, drainage catheter removal, need of painkiller (p>0.05). The number of patients receiving neoadjuvant chemoradiotherapy was statistically significantly higher in Group 2 than Group 1 (p=0.009). The amount of intraoperative bleeding was statistically significantly higher in Group 1 than Group 2 (p=0.000). The length of the proximal surgical margin was statistically significantly longer in Group 1 than Group 2 (p=0.048). However, there was no statistically significant difference in the length of distal and radial surgical margins between Group 1 and Group 2 (p=0.666 and p=0.277, respectively). Also, there was no statistically significant difference in the duration of surgery, length of hospital stay, the need for diverting ileostomy, number of lymph nodes dissected, specimen size, and recurrence rate between Group 1 and Group 2 (p>0.05 for both). The clinicopathological outcomes of both patient groups are presented in Table 3.

Table 1. Demographic and clinicopathological characteristics of patients (n=46)

Variable	Values n (%), median (range)
Age	55 (28-82)
Gender	
Male	32 (69.6)
Female	14 (30.4)
Stage	
1	10 (21.7)
2	17 (37)
3	19 (41.3)
Tumor location	
Upper rectum	19 (41.3)
Middle rectum	14 (30.4)
Lower rectum	13 (28.3)
Neoadjuvant chemoradiotherapy	
Yes	25 (54.3)
No	21 (45.7)
Operative time (min)	202.5 (90-375)
Length of hospital stay (day)	6 (3-17)
Amount of bleeding (mL)	440 (80-520)
Complication	
No	21 (45.7)
Grade 1-2	11 (23.9)
Grade 3-5	14 (30.4)
Surgical margins	
Distal (cm)	9.5 (0.5-10)
Proximal (cm)	15 (4-44)
Radial (mm)	13.5 (1-100)
Specimen size (cm)	23 (18-64)
Number of lymph nodes	11 (5-48)
Recurrence rate	6 (13)
Status	
Death	3 (6.5)
Alive	43 (93.5)
Median follow-up (month)	20 (13-37)

Discussion

Conventional treatment of rectal cancer includes open surgery and total mesorectal resection.[5] Currently, laparoscopic surgical techniques have been increasingly used in colorectal surgery, and it is a safe and feasible technique in colon surgery.[4,9,10] Although favorable non-oncological outcomes of laparoscopy have been reported in rectal surgery, there is still a controversy among surgeons since some have advocated that laparoscopy yields poor oncological outcomes.[1,2] The open versus laparoscopic surgery for mid-rectal or low-rectal cancer after neoadjuvant chemoradiotherapy trial[11] and the Colorectal cancer Laparoscopic or Open Resection II trial[12] demonstrated oncological equivalence with both techniques. However, the Australasian laparoscopic cancer of the rectum trial[1] and the American College of Surgeons Oncology Group-Z6051 trial[2] failed to show non-inferiority of surgical outcomes

Table 2. Postoperative complications (n=46)

Complication type	n (%)
Wound infection	6 (13)
Eventration	2 (0.04)
Intraabdominal abscess	1 (0.02)
Enteric fistula	1 (0.02)
Ileus	4 (0.08)
Anastomosis leak	2 (0.04)
Ureter injury	3 (0.06)
Urogenital problems	5 (0.1)
Bladder dysfunction	1 (0.02)
Erectile dysfunction	2 (0.04)
Ejaculation problems	2 (0.04)
Anastomotic stenosis	4 (0.08)

for laparoscopic vs. open resection. In a meta-analysis including 2.319 patients, Creavin et al.[13] reported that the mesorectal quality was slightly better with open surgery than laparoscopy; however, minor defects did not affect oncological outcomes. In a study, Yang et al.[14] concluded that laparoscopy was more likely effective in achieving complete total mesorectal excision. In another meta-analysis, including 3.258 patients with rectal cancer, Vennix et al.[15] reported similar long-term survival rates between laparoscopic and open rectal surgery. In our study, despite the lack of long-term outcomes, we found oncopathological equivalence with both surgical methods in the short-term; however, the length of proximal surgical margin was longer in open surgery. Longer proximal margin maybe because of the comfort of the surgeon in open surgeries regarding the decision of point of proximal margin. Also, none of the patients had positive surgical margins in any of the groups.

Previous studies have well-demonstrated that laparoscopic surgery is associated with favorable short-term non-oncological outcomes including shorter hospital stay, less pain, less postoperative complications, less scarring and less scar-related problems, a lower need for blood transfusion, a lower amount of bleeding and a lower rate of postoperative ileus, despite prolonged duration of operation, and that open surgery is associated with higher morbidity and mortality.[3,10,16] In the present study, consistent with the literature, we observed a statistically significantly lower amount of bleeding during laparoscopy compared to open surgery. However, we found no significant difference in the duration of operation, length of hospital stays, and complication rates between the two techniques. This discrepancy can be attributed to the small sample size and to the fact that more eligible cases for laparoscopic surgery were selected in our study. Furthermore, the number of patients receiving neoadjuvant chemoradiotherapy was statistically significantly higher in the laparoscopy group than open surgery in our study, and this can be explained by the non-homogeneous distribution of the patients due to the retrospective nature of the study and the small sample size. Also, the rate of conversion from laparoscopic to open surgery was 21.8%, which is consistent with the literature data [14.5% (range=0 to 35%)].[15] In their study, Yang et al.[14] reported a significantly shorter length of hospital stay in the laparoscopy group than open surgery

Table 3. Clinicopathological outcomes of open and laparoscopic rectal surgery

Variable	Group 1 (n=21) open surgery	Group 2 (n=25) laparoscopic surgery	p value
Age	61 (38-77)	48 (28-82)	0.014
Operative time (min)	205 (90-375)	200 (150-300)	0.446
Length of hospital stay (day)	7 (4-17)	5 (3-16)	0.074
Number of lymph nodes	12 (5-48)	11 (5-25)	0.264
Distal margin (cm)	4 (0.5-9)	3.5 (0.8-10)	0.666
Proximal margin (cm)	18 (4-44)	13 (6-25)	0.048
Radial margin (mm)	10 (3-30)	17.5 (1-100)	0.277
Amount of bleeding (mL)	310 (240-520)	150 (80-200)	0.000
Specimen size (cm)	24 (20-64)	22 (18-36)	0.057
Neoadjuvant chemoradiotherapy			
Yes	7/46 (15.2%)	18/46 (39.1%)	0.009
No	14/46 (30.4%)	7/46 (15.2%)	
Recurrence			
Yes	3/46 (6.5%)	3/46 (6.5%)	0.819
No	18/46 (39.1%)	22/46 (47.8%)	
Complication			0.302
1-2*	4/25 (16%)	7/25 (28%)	
3-4-5*	8/25 (32%)	6/25 (24%)	
Median follow-up (month)	19 (14-34)	20 (13-37)	0.930

*According to the Clavien-Dindo classification (8th reference)

(5.2±1.8 days vs. 7.0±2.1 days, respectively). In our study, we also found a shorter median length of hospital stay in the laparoscopy group (5 days vs. seven days, respectively), although it did not reach statistical significance. Also, the rate of wound infections was 13% in our study, consistent with the literature.[17] The rate of ureter injury was 3% in our study, which is also consistent with previous studies reporting a rate of 1 to 8%.[18] On the other hand, we found sexual dysfunction in 4% of our patients; however, this rate varies from 19 to 69% in the literature.[16] This discrepancy in the results can be attributed to the small sample size in our study and its retrospective design since we were unable to evaluate the complaints of the patients in detail. Also, the rate of anastomotic leak was significantly lower in our study (<1%) than reported in the literature.[19,20] This can be explained by the fact that there might be anastomotic leaks that were clinically undiagnosed in our series, as we performed diverting ileostomy in the majority of the patients who underwent lower anterior resection. In the present study, the rate of other postoperative complications is consistent with previous studies. The retrospective design with a small sample size is the main limitation of this study. Also, the non-homogeneous distribution of the patients can be regarded as another limitation. Lastly, the other limitation is that the majority of the patients have a diagnosis of upper rectal cancer in the study. Therefore, we recommend further large-scale prospective studies to establish a definite conclusion.

Conclusion

In conclusion, our study results showed similar oncological outcomes with both laparoscopic and open rectal surgery. However, the amount of intraoperative bleeding was higher, and the length of the proximal surgical margin was longer in the open rectal surgery group. Nonetheless, there was no significant difference in other clinical and short-term oncopathological outcomes between laparoscopic and open rectal surgery. Based on these findings, we suggest that both surgical techniques have oncological equivalence. However, further prospective, randomized clinical studies in a large-scale, homogeneous patient group are needed.

Ethics

Ethics Committee Approval: The study protocol was approved by the Çukurova University Non-invasive Clinical Research Ethics Committee (no: 01.02.2019/85).

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: N.İ., A.D., E.Ç., C.K.P., Concept: N.İ., A.D., Design: N.İ., A.D., Data Collection or Processing: N.İ., A.D., E.Ç., C.K.P., Analysis or Interpretation: N.İ., E.Ç Literature Search: N.İ., Writing: N.İ., A.D., E.Ç., C.K.P.

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