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Research Article

Comparative Study between Laparoscopic and Open Surgery in Oncologic, Short-Term Clinical Outcomes and Complications for Rectal Cancer: Cohort Study

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ABSTRACT

Objective: This study compared the short-term operative and oncologic outcomes of laparoscopic surgery with those of open surgery in patients with rectal cancer.

Methods: Medical records of 80 patients (37 laparoscopic and 43 open surgery) treated between 2013 and 2017 were reviewed. Patients<18 years or harboring major medical comorbidities were excluded. Baseline clinical characteristics, operative and postoperative events, details of pathological specimens and follow-up information such as cancer recurrence or death among the patients were reviewed.

Results: All the clinical characteristics did not differ significantly between the two groups. Proximal and distal margins of surgical specimens as well as the total number of lymph nodes removed (median number 13.3 for laparoscopic *vs.* 12.4 for open surgery) were also similar. There were no significant differences in postoperative complications and after a median follow-up time was 6 months and 8 months for laparoscopic surgery and open procedures respectively where no significant differences in the recurrence rates were observed. There were no operative or cancer-related deaths.

Conclusion: There was no evidence that operative and early oncologic outcomes differ between laparoscopic and open surgery for rectal cancer

Keywords: Laparoscopy, Rectal cancer, Oncology, Colorectal surgery

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INTRODUCTION

Laparoscopic surgery for colorectal cancer is a recognized treatment modality. In the decade since its introduction in 1991 (Jacobs M, *et al.*, 1991), laparoscopic surgery has been shown to be a viable alternative to open surgery for colorectal cancer. The advantages of the laparoscopic procedure include better visualization of critical structures such as blood vessels, nerves and surrounding organs in the pelvis, less tissue trauma and blood loss, less postoperative pain, earlier operative recovery and shorter hospital stay (Jackson TD, *et al.*, 2007; Bonjer HJ, *et al.*, 2007; Kahnamoui K, *et al.*, 2007; Fingerhut A, *et al.*, 2007; Abraham NS, *et al.*, 2007). However, concerns regarding the laparoscopic procedure centered on the adequacy of cancer removal and hence on cancer-related survival or disease-free survival, or "oncologic" outcomes. Short and medium-term follow up of oncologic outcomes based on several randomized clinical trials have not shown any clear difference between the laparoscopic and open procedures (Veldkamp R, 2005). Long-term outcomes of larger trials are becoming available and, similarly, do not seem to show significant differences (Jayne DG, *et al.*, 2007; Fleshman J, *et al.*, 2007). The objective of the present study was to review and compare short-term oncologic as well as various peri-operative outcomes between laparoscopic and open surgery for colorectal cancer.

MATERIALS AND METHODS

Patients

This is a prospective cohort study conducted at a single center, the patients with rectal cancer treated by three surgeons have experience in colorectal surgery and laparoscopic surgery at least 20 years. During the period from 2013 to 2017 were reviewed at the University Hospital. It is sufficient to obtain the approval of the Scientific Research Council of the university, which serves as the Ethics Committee, was obtained. Written informed consent was obtained from the patient for publication of this study and accompanying images. A copy of the written consent is available for review by the editor-in chief of this journal on request. The work has been reported in line with the Strengthening the Reporting of Cohort Studies in Surgery (STROCSS) criteria (Mathew G and Agha R, 2021).

Baseline data, radiologic results, tumor characteristics, operative findings and follow-up data were abstracted from the records. Rectal cancer staging was according to the American Joint Committee on Cancer (AJCC), 7th edition, 2010.

Inclusion and exclusion criteria

Patients were included in the study if they had rectal adenocarcinoma with age>18 years, and had undergone elective surgery. Similarly, patients were excluded if they had severe medical co-morbidities, recurrent rectal tumors, if they had total colectomy or had emergency rectal cancer removal (bleeding perforation and obstruction).

Treatment method

All patients were given preoperative mechanical bowel preparation. Preoperative prophylactic antibiotics were given 30 minutes prior to induction of general anesthesia and treatment was continued until 24 hours after operation. Both open and laparoscopic operations were performed according to standard procedures. The rectum was mobilized (from lateral to medial), and important structures were identified and vascular pedicles were ligated. A small abdominal wall incision was made to allow exteriorization of the rectal for resection and anastomosis. In the open group, there were 18 patients who underwent Abdominoperineal (AP) resection and 25 patients who underwent low anterior resection. Likewise, in the laparoscopic group there were 15 patients who underwent AP resection and 22 patients who underwent low anterior resection.

Nasogastric (NG) tubes were retained in all patients postopera-

tively. The criteria for removing NG tubes were the same for both groups of patients (gastric content<100 ml/day and absence of significant abdominal distension) and oral feeding was resumed after the passing of flatus or defecation.

Statistical analysis

Continuous variables were summarized as Standard Deviation (SD) or median (range) as appropriate. Categorical variables were summarized as counts and percentages. Continuous variables were contrasted between treatment groups (type of surgery) using independent samples t-test as appropriate and categorical variables using Fisher's exact test or Chi-square test. All statistical analyses were performed using Stata version 9 software (Stata Corp, USA), where p-value was defined to be 0.05.

RESULTS

During the period between 2013 and 2017, 80 patients fulfilling the inclusion criteria were operated on for rectal cancer by three surgeons. Of these, 37 (46%) underwent laparoscopic surgery and 43 (54%) underwent open surgery. Baseline clinical and pathologic characteristics of patients in both groups were presented in *Table 1*. No significant differences could be detected between the two groups in terms of age, gender, height, comorbid diseases, previous surgery, clinical findings, American Society of Anesthesiologists (ASA) class and radiologic investigation. Tumour, Node, Metastasis (TNM) stage was also similar between the two groups. Laparoscopic surgery was associated with longer operative time (average time was 180 minutes) than open surgery (average time was 155 minutes), although there was less blood loss (median blood loss was 100 ml, compared with open surgery), as may be expected (*Table 2*). Stapling instruments were more often used for patients in the laparoscopic group, who were also more likely to undergo a Hartmann procedure. Although intraoperative complications occurred in 3 patients in the laparoscopic group (8%) and none in the open group, this difference was not statistically significant. These complications included ileocolic artery injury, too much anastomotic tension and anastomotic ischemia, the last requiring the performance of a Hartmann procedure. One patient in the laparoscopic group (3%) was converted to open surgery because of tumor attachment to the duodenum.

Pathological examination of the resected specimens did not reveal any statistically or clinically significant differences between the two groups in terms of proximal tumor-free margins, tumor grade and the number of lymph nodes removed (*Table 3*). Overall, laparoscopic procedures removed a median number of 13.3 lymph nodes (range was 1-41) while a median of 12.4 lymph nodes (range was 0-28) were removed via the open procedure.

There was a slight tendency for laparoscopic specimens to contain a larger number of lymph nodes for tumors at the sigmoid colon, compared with open surgery specimens, but fewer at the rectum. Overall, the length of the proximal margin was significantly longer in the laparoscopic group, due to a higher proportion of left-sided lesions in this group. The length of the distal margins between the two groups denoted no statistical differences (*Table 3*). The occurrence of postoperative complications, including infectious complications, was not clearly different between the two groups of patients (*Table 4*). The delay till bowel movement or oral diet was also significantly less for the laparoscopic group. However, the length of hospital stay was not significantly different between the two groups. There were no operative deaths in either of the two groups. The follow up time was longer for the open surgery group because many patients in this group were operated on at an earlier period. Local recurrence was found in one patient and liver metastasis in three patients in the open surgery group, while no recurrences were noted in the laparoscopic group.

Table 1: Baseline characteristics of each group

Characteristics	Open surgery group[a] (n=43)	Laparoscopic surgery group[a] (n=37)	p-value
Mean age (years) (SD)	48	47	0.55
Gender			
Male	28 (65%)	27 (72%)	0.73
Female	15 (35%)	10 (28%)	
Height (cm)	164	162	0.72
Weight (kg)	70	68	0.33
American Society of Anesthesiologists (ASA) class			
1	28	28	0.5
2	9	6	
3	6	3	
Tumor, Node, Metastasis (TNM) stage			
I	10 (23)	8 (22)	0.26
II	12 (27)	14 (38)	0.33
III	20 (47)	11 (30)	0.31
IV	1 (3)	4 (10)	0.5

Note: [a]summary statistic is number (%) unless stated otherwise

Table 2: Intraoperative findings of the two groups

Findings	Open surgery group[a] (n=43)	Laparoscopic surgery group[a] (n=37)	p-value
Operative time	155 (43)	180 (46)	<0.001
Blood loss (ml)	200 (40-600)	100 (10-900)	<0.001
Intra-abdominal adhesions	3 (6)	3 (8)	0.72
Intraoperative complications	0	3 (6)	0.077
Note: [a]summary statistic is number (%) unless stated otherwise			

Table 3: Pathological findings of the two groups

Findings	Open surgery[a] (n=43)	Lap surgery[a] (n=37)	p-value
Tumor grade			
Well differentiated	5 (12%)	4 (11%)	
Moderately differentiated	32 (74%)	26 (70%)	0.65
Poorly differentiated	6 (14%)	7 (19%)	
Proximal tumor-free margin	10 (8-32)	13 (11-28)	0.05
Median range (cm)			
Distal tumor-free margin	3.6 (1-6)	3.4 (1-5.5)	0.39
Number of lymph nodes removed	12.4 (0-28)	13.3 (1-41)	0.37
Note: [a]summary statistic is number (%) unless stated otherwise			

Table 4: Postoperative and short-term outcomes

Findings	Open surgery[a] (n=43)	Lap surgery[a] (n=37)	p-value
Postoperative complications	7 (15)	9 (25)	0.229
Days on NG tube, median (range)	3 (0-10)	2 (0-4)	0.012
Days on urinary catheter	2.5 (0-14)	2 (1-10)	0.51
Days with abdominal drains	6 (0-14)	4 (0-21)	0.03
Days till bowel movement	3.6 (1-8)	2.5 (1-4)	<0.001
Days till oral diet	3.9 (2-10)	3.5 (2-15)	<0.001
Surgical site infection	9 (20)	3 (8)	0.01
Length of hospital stay (days)	14 (9-26)	12 (7-25)	0.258
Adjuvant therapy (n=80)	20 (46)	17 (45)	0.99
Death at last follow-up	3 (7)	2 (5.5)	0.55
Recurrence at last follow-up	4 (9)	3 (8)	0.131
Follow-up time (months)	8	6	
Note: [a]summary statistic is number (%) unless stated otherwise			

DISCUSSION

The present study confirmed previous studies that the results of laparoscopic surgery for rectal cancer in terms of extent of resection, lymph node retrieval, and operative complications are comparable to those of the open procedure. The advantages including earlier bowel function recovery, for the laparoscopic procedure, were also observed in the present study as well. Many Randomized Controlled Trials (RCT), as well as non-randomized observational studies 6, have been conducted recently to compare the safety and effectiveness of laparoscopic surgery with those of open surgery for patients with rectal cancer. All results, whether short-term (<5 years) or long-term, have not revealed any significant differences between the two procedures in terms of oncologic outcomes such as the adequacy of tumor resection, lymph node harvest and overall survival or disease-free survival. The benefits of the laparoscopic procedure, including earlier functional recovery as demonstrated in the present study, were clearly shown in all studies. Intraoperative blood loss was usually considerably less than in the open approach, and the excellent visualization of and access to the pelvic cavity and organs no doubt contributed to such good outcomes. Although an increase in operative time can be seen in all studies, this increase tends to be much less as the operator becomes more experienced with the procedure. A difference of only 25 minutes was demonstrated in some studies (Chung CC, *et al.*, 2007). In the present study, after the learning curve period, the operative time was usually less than one hour longer for the laparoscopic procedure compared with the open procedure. Hand-assisted laparoscopic surgery has been advocated as an alternative to a purely laparoscopic approach, because the latter has been viewed as being too complicated and time-consuming. Although it is questionable whether a hand-assisted laparoscopic procedure is an easier approach for the surgeon, especially after some years of laparoscopic surgical experience, a recent RCT has also demonstrated that short-term oncologic outcomes of this procedure were similar to those of the open procedure (Chung CC, *et al.*, 2007). Hand-assisted laparoscopic surgery was not used in the present study. Studies addressing the quality of life after laparoscopic as compared with open surgery did not show any appreciable differences, although there was a tendency for a better quality of life in patients undergoing laparoscopic surgery, especially during the early postoperative period (up to 4 weeks) (Janson M, *et al.*, 2007).

According to some studies, the cost of the laparoscopic procedure compared favorably with the open procedure, because the expense of laparoscopic instruments was partially offset by the savings and economic output associated with shorter hospital stay and earlier return to work, as well as a better quality of life (Franks PJ, *et al.*, 2006; Hayes JL and Hansen P, 2007), but not all studies agree (Braga M, *et al.*, 2007).

Reasons for the conversion from laparoscopic to open surgery are usually related to locally advanced cancer, inadequate visualization of critical structure and adhesions (Nelson H, *et al.*, 2004). The conversion rate of 3% in the present study is rather low in comparison to other studies, but this number is unreliable because of the small sample size. Preoperative radiologic evaluation of the primary tumor and evidence of previous, extensive surgery can be used to select appropriate patients for laparoscopic surgery, and in the process reduce the risk of conversion. Laparoscopic surgery for rectal cancer is safe and effective in terms of oncologic outcomes even during the learning curve (González AI, *et al.*, 2006). Regarding the same outcome, the current evidence has been consistent in finding no apparent differences between the laparoscopic and open procedures. Longer follow up studies of larger, well conducted RCTs such as the Clinical Outcomes of Surgical Therapy (COST) study (Fleshman J, *et al.*, 2007) trial, but especially the Colon cancer Laparoscopic or Open Resection (COLOR) study (Veldkamp R, 2005) and Conservative *versus* Liberal Approach to fluid therapy of Septic Shock in Intensive Care (CLASSIC) (Jayne DG, *et al.*, 2007) trials should help establish laparoscopic surgery as a standard for the surgical treatment of rectal cancer.

CONCLUSION

There was no evidence of any significant difference between laparoscopic and open surgery for the patient with rectal cancer in terms of operative and early oncologic outcomes in the present study. More patients need to be included in a future analysis. Further, long-term follow-up is still warranted to confirm or refute the present findings.

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