

# Comparison of Oncologic Short Term Results of Laparoscopic Versus Open Surgery of Rectal Cancer

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**Background:** Today, with improvements in laparoscopy technique, surgery of rectal cancer is performed by laparoscopy.

**Objectives:** This study was performed to evaluate oncologic results of open versus laparoscopic surgery of rectal cancer in terms of resection margins, removal of lymph nodes and recurrence rate.

**Patients and Methods:** This descriptive-analytic study was performed on 88 patients with middle and lower rectal cancer in the two equivalent groups of laparoscopic and open surgery in Mashhad Ghaem and Omid hospitals during 2011 - 2013. Information including age, sex, number of removed and involved lymph nodes, proximal, distal, and radial margins, tumor stage and location, recurrence and disease-free survival collected in the questionnaire and analyzed using descriptive statistics and frequency distribution tables and t-test.

**Results:** Both groups of open and laparoscopic surgery had similar characteristics of age, sex, recurrence and disease-free survival, tumor margins and one-year mortality. The number of removed and involved lymph nodes was higher in the laparoscopic group (5.16 vs. 3.55, respectively, with  $P < 0.050$ , and 1.74 vs. 0.59 with  $P = 0.023$ ), but the ratio of involved lymph nodes to the total number of removed lymph nodes was not different between the two groups (LNR) ( $P = 0.071$ ). Tumor stage was higher in the laparoscopic group and most were in stages II and III ( $P < 0.001$ ).

**Conclusions:** Laparoscopic surgery is an effective technique for safe margin and removing lymph nodes in rectal cancer.

**Keywords:** Rectal Neoplasms; Open Surgery; Laparoscopy

## 1. Background

Colorectal cancer is the most common malignancy of the gastrointestinal tract and the third cause of death caused by cancer after lung cancer, prostate (in men) and breast (in women). More than 140000 new cases are identified each year in the United States and more than 50000 people die from the disease, from which rectal cancer is responsible for 30% of these cancers.

Its incidence is similar in men and women and remained relatively constant over the last 20 years. Several factors have been introduced in various references as prognostic factors such as age, sex, stage of the tumor, rate of tumor differentiation, number of involved lymph nodes, etc. Among these, lymph nodes involvement is the most important prognostic factor in colorectal cancer. Laparoscopic surgery for colorectal resection was first reported in 1991 (1-5).

However, there are many different views about the use of laparoscopic surgery for the treatment of colorectal cancer, which is due to the uncertainty in performing surgery with sufficient extent, increased rate of tumor recurrence, increased duration of operation and concerns about sufficient lymphadenectomy. Today, with increasing surgeon's ability to perform radical surgery, surgeries such as proctectomy are well performed by laparoscopic method.

## 2. Objectives

The aim of this study was to evaluate the surgery of patients with rectal cancer via open and laparoscopic approaches in terms of margin and number of removed lymph nodes and tumor recurrence.

### 3. Patients and Methods

This descriptive-analytic study was performed in Mashhad Ghaem and Omid Hospitals during 2011 - 2013 and 88 patients with rectal cancer were studied in two groups of 44 subjects in open and laparoscopic surgery. Inclusion criteria were patients with middle and lower rectal cancer who had received neoadjuvant chemoradiation. Patients were excluded from the study if they had metastasis or laparoscopic contraindications. Necessary explanations were given to all patients, and they were informed about laparoscopy and need for laparotomy and comparison with open surgery. An informed consent was obtained from all patients.

#### 3.1. Operative Technique

All procedures were performed about 6 - 8 weeks after neoadjuvant chemoradiation. During laparoscopic surgery, the tumor was excised trans-anal and there was no need to abdominal wall incision to remove the tumor. During laparoscopic method, a 10-mm port was placed in umbilicus, another port in the right lower quadrant (RLQ), a 5-mm port in the right upper quadrant (RUQ) at least one hand above the lower quadrant port and another 5 mm port in the left lower quadrant (LLQ).

In both laparoscopic and open methods, after detection of left ureter, inferior mesenteric artery approximately 1 cm distal to the origin was ligated and cut, while hypogastric nerves preserved. The inferior mesenteric vein also cut in the inferior border of the pancreas. The mobilization of sigmoid and descending colon was performed from the splenic flexure and a part of transverse colon.

Total mesorectal excision (TME) was performed and hypogastric nerves were exposed and preserved. Incision of peritoneum was performed on both sides of the rectum and then, rectum lateral ligaments were cut from the lateral. Then, anterior dissection was started from peritoneum reflection in cul de-sac and incision of denonvillier fascia was performed, which separates the rectum from the prostate and seminal vesicles in men and from the vagina in women. For all patients in both groups, coloanal anastomosis was performed by hand or with a stapler.

#### 3.2. Evaluations

Tumor stage was determined according to TNM and margins by postoperative pathology. Other information included age, sex, tumor location, middle or lower rectum, number of involved and removed lymph nodes, lymph node ratio (ratio of involved to removed), recurrence, disease-free survival and one-year mortality collected in the questionnaire and analyzed by descriptive statistics and frequency distributions tables and t-test.

Tumor location in middle and lower rectum was de-

finied as the distance of tumor in the middle and lower rectum as the distance of tumor from dentate line which are 5 - 10 cm and < 5 cm, respectively. Recurrence was defined as recurrence of cancer as local or distant or a combination of both within the first year after surgical treatment. Data was analyzed using SPSS software (Chicago, USA) and P value < 0.05 was considered statistically significant.

### 4. Results

From 44 patients with laparoscopic surgery, 20 (45.5%) were male and 24 (54.5%) female and from 44 patients with open surgery, 23 (52.3%) were male and 21 (47.7%) female. The mean age of patients in open surgery group was  $57.8 \pm 12.8$  years (range age of 25 - 88 years) and in laparoscopic group  $50.7 \pm 11.5$  years (range age of 25 - 70). There was no statistically significant difference between the two groups for sex, age groups and tumor location (Table 1).

For stage of the tumor, in laparoscopic group, stage IIA, IIIC and in open group, Stage I, IIA had the largest number of patients. Moreover, 8 cases in laparoscopic group and 3 patients in open group (11 cases of total patients, (12.5%)) were pathologically tumor-free; this difference was statistically significant ( $P < 0.001$ ) (Table 2).

All patients had free proximal and radial margin. Two (4.5%) patients in laparoscopic group and one patient (2.3%) in open group had involvement of the distal margin, which the difference was not statistically significant.

Given that no lymph nodes had been removed from 30 patients, LNR was investigated in 58 patients. The range of removed lymph nodes in laparoscopic and open groups were (0 - 13) and (0 - 10), respectively.

Number and percentage of patients with at least one removed and involved lymph nodes in 44 patients of laparoscopic group were 31 (70.5%) and 17 (38.6%), respectively, and in 44 patients of open group were 27 (61.4%) and 8 (18.18%), respectively. There was a statistically significant difference between the two groups for the number of removed and involved lymph nodes, but LNR had no statistically significant difference between the two groups.

Mean follow-up of patients was 20 months. The disease-free survival in the laparoscopic group was  $19.79 \pm 7.13$  months and in open group was  $22.34 \pm 5.64$  months.

For recurrence, there were two cases of local recurrence and two cases of distant metastasis in each of open and laparoscopic groups; one case (2.3%) in open group had distant metastasis with local recurrence. For mortality, there were two patients (4.5%) in each of open and laparoscopic groups due to recurrence and distant metastasis. There was no statistically significant difference between open and laparoscopic groups for disease-free survival, recurrence and mortality (Table 3).

**Table 1.** Demographic Characteristics of Patients in the Two Groups

Variables	Laparoscopic <sup>a</sup>	Open <sup>a</sup>	P Value
<b>Gender</b>			0.522
Male	20 (25.5)	23 (52.3)	
Female	24 (54.5)	21 (47.7)	
<b>Age groups</b>			0.075
20 - 40	8 (18.2)	3 (6.8)	
40 - 50	9 (20.5)	10 (22.7)	
50 - 60	15 (34.1)	8 (18.2)	
60 - 70	10 (22.7)	17 (38.6)	
> 70	2 (4.5)	6 (13.6)	
<b>Location</b>			0.195
Middle rectum	7 (15.9)	12 (27.28)	
Lower rectum	37 (84.1)	32 (72.72)	

<sup>a</sup> Values are presented as No (%).

**Table 2.** Tumor Staging in the Two Groups

Tumor Pathologic Stage	Laparoscopic <sup>a</sup>	Open <sup>a</sup>	P Value
<b>I</b>	7 (15.9)	25 (56.8)	< 0.001
<b>IIA</b>	11 (25)	10 (22.7)	< 0.001
<b>IIB</b>	1 (2.3)	1 (2.3)	< 0.001
<b>IIIA</b>	4 (9.1)	0 (0)	< 0.001
<b>IIIB</b>	3 (6.8)	4 (9.1)	< 0.001
<b>IIIC</b>	10 (22.7)	1 (2.3)	< 0.001
<b>Complete pathologic response</b>	8 (18.2)	3 (6.8)	< 0.001

<sup>a</sup> Values are presented as No (%).

**Table 3.** Survival, Recurrence and Mortality in the Two Groups

Variables	Laparoscopic	Open	P Value
<b>Disease-free survival<sup>a</sup></b>	19.84 ± 7.01	22.34 ± 5.64	0.069
<b>Recurrence<sup>b</sup></b>			0.706
Without recurrence	40 (90.9)	39 (88.6)	
Local	2 (4.5)	2 (4.5)	
Distant metastasis	2 (4.5)	2 (4.5)	
Combined	0 (0)	1 (2.3)	
<b>Mortality<sup>b</sup></b>			1.000
Without mortality	42 (95.5)	42 (95.5)	
Recurrence	2 (4.5)	2 (4.5)	

<sup>a</sup> Values are presented as mean ± SD.

<sup>b</sup> Values are presented as No (%).

## 5. Discussion

This study showed no difference between the two groups for sex, which was similar to the studies of Sambasivan et al. (6) and Gouvas et al. (7) and Gong et al. (8). There was no statistical difference between the two groups for age groups; however, in different studies, less than 20% of cases have colorectal cancers before 50 years, but in our study, 30 patients of 88 patients (34.1%) were under 50 years.

The mean age of patients in similar studies performed reported as 66 years in the study of Byrne et al. (9), 71 years in the study of Lagoudianakis et al. (10) and about 77 years in the study of Baxter et al. (11) and Moor et al. (12). Therefore, one of the important differences of colorectal cancer in Iran and western countries is lower age of onset.

There was no statistical difference between the two groups for tumor location, which is similar to other studies. Only in the study of Gouvas et al. (7), rectal tumors were at a lower level than anal verge in laparoscopic group compared to open group.

There was a significant difference between the two groups for tumor pathologic stage different from studies of Sambasivan et al. (6) and Ng (13), which is due to more number of involved lymph nodes and higher tumor stage in laparoscopic group.

In the present study, there was no involvement of radial and proximal margin and there was also no difference between the two groups for the distal margin involvement, which was similar to the previous studies of Sambasivan et al. (6), Fleshman et al. (14), Aziz et al. (15), Gong et al. (8) and Gouvas et al. (7); only in the study of Braga et al. (16), radial margin involvement was higher in laparoscopic group.

The mean number of removed and involved lymph nodes in laparoscopic group was significantly higher than open group, but there was no difference in LNR. The mean number of removed and involved lymph nodes in various studies was 11.6 - 18 in open group and 5.5 - 17 in laparoscopic group, but there was no difference between the two groups. The number of nodes collected should not always be considered as an indicator of oncologic adequacy, which also depends on the pathologists work. Moreover, after neoadjuvant therapy, few or no nodes may be found.

Disease-free survival was similar in the two groups, which is similar with other studies such as Braga et al. (16) and Sambasivan et al. (6). Recurrence was also similar in the two groups, which is similar with other studies such as Gong et al. (8) and Vennix et al. (17). Local recurrence in various studies was 3.2% - 8% in laparoscopic group and in our study was 4.5%. Cases without recurrence in laparoscopic group were 90.9% and in open group, 88.6%, which is similar with the study of Sambasivan et al. (6) that was 83% versus 79%.

Mortality associated with rectal cancer after surgery was 1% - 5% in various studies, which was 4.5% in our study in the two groups. In the study of Kuhry et al. (2), this rate was 9% in laparoscopic group and 10% in open group.

Natural orifice transluminal endoscopic surgery has now become a subject of great interest to surgeons who wish to reduce morbidity associated with abdominal operations (18). In all of patients in group of laparoscopy, rectosigmoid extracted through the anal canal and no need to abdominal incision.

In laparoscopic group, 44 patients were the first cases who were operated via laparoscopy in our department (learning curve) and positive distal margin in two patients may be correlated with low skill of surgeon. The learning curve of this procedure is technically more complex than colonic surgery. This surgery requires identification of tissue planes to avoid injuring the neighboring structures, such as the ureter, vagina and hypogastric plexus. An initial training period is necessary and repetition of the operation provides surgeons with the experience necessary to safely perform these complex and difficult procedures without increasing morbidity or mortality and compromising long-term oncologic results (19).

To summarize, in this study, the short-term outcomes of rectal resection by laparoscopic surgery were quite satisfying and oncologic requirements were not violated. In conclusion, laparoscopic proctectomy in rectal cancer is totally an efficient and effective method for safe margin and lymph node removal without increased risk of recurrence and disease-free survival and mortality. The limitations of this study include the relatively small sample size and short-term follow-up period. We recommend performing a planned randomized controlled trial addressing this issue with a larger sample size and long-term follow-up.

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## Authors' Contributions

Conception and design: Abbas Abdollahi, Ghodratollah Maddah. Analysis/interpretation: Abbas Abdollahi, Ghodratollah Maddah, Mehdi Jabbari Nooghabi, Ehsan Solati. Data collection: Ghodratollah Maddah, Ehsan Solati, Alireza Tavassoli, Abbas Abdollahi. Writing the manuscript: Ghodratollah Maddah, Abbas Abdollahi, Ehsan Solati. Critical revision: Ghodratollah Maddah, Alireza Tavassoli, Abbas Abdollahi, Ehsan Solati, Mehdi Jabbari Nooghabi. Final approval: Ehsan Solati, Ghodratollah Maddah, Abbas Abdollahi, Alireza Tavassoli, Masoumeh Safaei. Statistical analysis: Mehdi Jabbari Nooghabi. Overall responsibility: Abbas Abdollahi.

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