

Original Research Article

Comparison of short-term outcomes following open and laparoscopic resections for colorectal malignancies

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ABSTRACT

Background: The laparoscopic approach for colorectal cancers are still a matter of controversy. In the present study, we tried to compare the laparoscopy with open methods of colorectal resections.

Methods: Retrospective study where patients diagnosed with colorectal cancer in our hospital from year 2014 January to December 2016 were taken. Total number of cases were 69 of which, the total number of right colon cases were 26. Out of twenty-six, 12 underwent open procedure and 14 underwent laparoscopic resections. Total number of left colon cancers were 09. Of these, 2 underwent open and 7 underwent laparoscopic procedure. Thirty-four (34) rectal cancers were included in the study. Of these, 12 underwent open rectal procedures and 22 underwent laparoscopic resections. Multiple parameters like duration of surgery, post-operative complications, postoperative stay, pathological T staging, lymph node yield, positive nodes, distal resection margins, circumferential radial margins were compared.

Results: Operating time was significantly shorter in open procedure than laparoscopic surgery in both rectal resection and right hemicolectomies. The postoperative stay was significantly shorter in laparoscopic right hemicolectomy compared to open procedure. All other parameters like post-operative complications, T stage, lymph node yield, positive nodes, distal resection margins and CRMs were comparable in both groups. The lymph node yield was similar in upfront and post neoadjuvant carcinoma rectum cases.

Conclusions: Laparoscopic colorectal resections have similar rates of complication, with shorter hospital stays with no compromise on oncological clearance with respect to lymph node yield, CRMs, distal resection margins compared to open procedures.

Keywords: Colorectal malignancies, Lymph node yield, Open and laparoscopic resection, Short term outcomes

INTRODUCTION

Radical resection of the tumor bearing segment of the bowel with wide tumour free resection margins and a systematic lymphadenectomy is the mainstem of curative therapy of colorectal cancer. The evolution of video-endoscopic surgery led to the idea of laparoscopic colorectal resection, which was first described in 1991 (Franklin 1993; Jacobs 1991).¹ In the 1980s, Heald and

Ryall introduced total mesorectal excision where precise, sharp dissection is undertaken around the integral mesentery of the hindgut, which envelopes the entire mid rectum. This procedure adds to operative time and complications but has been claimed to eliminate virtually all locally recurrent disease after "curative" surgery.² Over the past 2 decades, numerous prospective randomized studies have clearly reported the feasibility, safety, and advantages of laparoscopic colorectal surgery.

In addition to low morbidity, shorter hospital stays, and faster return of bowel function, prospective trials have demonstrated oncologic adequacy in the management of colon cancer. Despite these encouraging results, the adoption of laparoscopy in colorectal surgery has been slow.³ The right laparoscopic hemicolectomy procedures have produced conflicting reports. The reasons could be because of variable and complex anatomy on right side with different procedures like right, extended right hemicolectomy and transverse colectomy.⁴ The number of harvested lymph nodes (LNs) required to allow accurate staging after resective surgery for colorectal cancer remains a matter of controversy.⁵ Lymph node resection carries with it prognostic and therapeutic implications. An appropriate lymphnode resection should extend to the level of the origin of the primary feeding vessel. In all cases for cure, the lymph node resection should be radical and the lymph nodes should be removed enbloc. The NCI recommends minimum of 12 lymph nodes for proper staging.⁶ In the present study we have compared the variables like duration of surgery, lymph node yield, number of positive nodes, postoperative complications and postoperative stay in the hospital in open and laparoscopic procedures in colorectal malignancies.

METHODS

A retrospective analysis of medical records of patients with colorectal malignancies who underwent various resections (open/laparoscopic) in our institute from 2014 January to 2016 December was done. There were 69 colorectal malignancies diagnosed and treated during this period. There were 26 right colon cancers of which, 12 underwent open procedure and 14 underwent laparoscopic resections. There were 9 left colon cancers. Of these, 2 underwent open and 7 underwent laparoscopic procedure. Because of low sample size the left colon cancers were not put into analysis. Thirty-four (34) rectal cancers were there in the study. Of these, 12 underwent open rectal procedures and 22 underwent laparoscopic resections. Out of 34, 13 received neoadjuvant chemoradiotherapy as they were >T2 and node positive on MRI.

All patients underwent CT/MRI imaging, colonoscopy and biopsy before surgery. No selection criteria were applied to allocate the patients for open or laparoscopic procedures. Procedures were done after discussing the pros and cons of the procedures with patients. All procedures were done by the single experienced surgical oncology team.

Surgical procedures/principles

In both open and laparoscopic colectomies same oncological principles were followed that is, enbloc resection consisting of clear resection margins, ligation of vascular pedicles with lymphadenectomy. After

laparoscopic mobilization, through a small incision the specimen was resected and hand-sewn end to side ileocolic anastomoses was done in all right colic cancers.

In cases of carcinoma rectum, sharp TME with adequate distal and circumferential radial margins and high ligation of inferior mesenteric artery and vein was done for tension free anastomoses. Autonomic nerve plexus was preserved. All colorectal/coloanal anastomoses were done with a circular stapler. Diversion was done in post neoadjuvant chemoradiotherapy cases.

Assessment of parameters

Multiple parameters like duration of surgery, lymph node yield, number of positive nodes, lymph node yield between upfront and neoadjuvant therapy rectal cases, distal margin (rectal cases), circumferential radial margin (CRM in rectal cases), post-operative complications and duration of post-operative stay were assessed.

Statistical analysis

Mann-Whitney U test, fisher's exact test and chi-square test were done to find out the significance. The test was found to be significant if the values were less than 0.05.

RESULTS

Rectal carcinoma

Total number of carcinoma rectum cases were 34. Of these, 22 underwent laparoscopy and 12 underwent open surgery. The mean age (years) in laparoscopy was 49.45 versus 46.33 in open cases with a P value of 0.557 (not significant). The mean duration of surgery was 224 minutes (lap) versus 197 minutes (open) with a P value of 0.008 which was significant. The mean lymph node yield was 9.27 (lap) versus 6.17 (open) with a P value of 0.148 (not significant). The mean number of positive nodes were 2.77 (lap) versus 1.83 (open) with a P value of 0.784 (not significant). The mean distal margin was 2.29 cm (lap) versus 1.72 cm (open) with a P value of 0.204 (not significant). The mean Circumferential radial margin (CRM) was 8.45 mm (lap) versus 9.08 mm (open) with a P value of 0.557 (not significant) (Table 1). One patient who underwent laparoscopic resection had both positive distal margin and CRM with all dissected 17 lymph nodes showing metastases. Totally there were 13 rectal cancers who received neoadjuvant chemoradiotherapy. Out of 13, six underwent laparoscopic resections and seven underwent open resections. The mean lymph node yield was better in upfront procedures (9.19) than in post neoadjuvant cases (6.54), but the p value was not statistically significant (Table 2). Six (27.3%) out of 22 laparoscopy cases had postoperative complications (table 3). Four had wound infection, 1 had parastomal hernia and 1 had rectovaginal fistula (RVF).

Table 1: Mean comparison between laparoscopy and open surgery variables in carcinoma rectum.

Variables	Laparoscopy	Open surgery	Difference Mean±SD	P value
	Mean±SD	Mean±SD		
Age	49.45±14.05	46.33±18.36	3.12±4.31	0.557
Duration (mins) surgery	224.09±26.80	197.50±22.21	26.59±4.59	0.008 *
In yield	9.27±5.94	6.17±2.72	3.10±3.22	0.148
Post node	2.77±4.42	1.83±2.72	0.94±1.70	0.784
Po stay(days)	12.68±6.70	15.00±7.69	2.32±0.99	0.301
Distal margins (cm)	2.29±1.36	1.72±0.66	0.57±0.70	0.204
CRM (mm)	8.45±3.00	9.08±1.93	0.63±1.07	0.557

Statistical Analysis: Mann-Whitney U test. Statistically significant if P<0.05

Table 2: Lymphnode yield between upfront and post neoadjuvant therapy cases in carcinoma rectum.

Neoadjuvant therapy	Mean±SD	Difference	P value
No (N=21)	9.19±5.71	2.65±1.74	0.188
Yes (N=13)	6.54±3.97		

Statistical analysis: Mann-Whitney U test. Statically significant if P<0.05

Table 3: Post Op complications comparison between Laparoscopy and Open Surgery methods in carcinoma rectum.

Post op comp	Laparoscopy	Open surgery	P value
	N (%)	N (%)	
Present	6 (27.3)	4 (33.3)	0.714
Absent	16 (72.7)	8 (66.7)	
Total	22 (100.0)	12 (100.0)	

Statistical Analysis: Fisher's Exact test. Statistically significant if P<0.05

Rectovaginal fistula had developed in the same case which had positive distal margin and positive CRM with all dissected 17 nodes positive.in open cases, 4 (33.3%)

developed complications. Two had burst abdomen, 1 had wound infection and 1 had rectovaginal fistula. The rvf complication happened in a t4b, node positive and the distal margin positive case. The p value was not statistically significant between the groups. The mean duration (days) post-operative stay in the hospital in laparoscopy cases was 12.68 versus 15.00 in open cases with a p value of 0.204 which was not significant.

Right colon cancer

Total number of right colon cancers were 26. Of which, 14 underwent laparoscopic right hemicolectomy and 12 underwent open right hemicolectomy. The mean age in years was 55.08 in open versus 50.43 in laparoscopy cases with a P value of 0.203 (not significant). The mean duration of surgery (minutes) in open surgery was 151.25 versus 183.57 in laparoscopy with a P value of 0.003 which was statistically significant. The mean number of lymph node yield was 13.50 in open versus 14.57 in laparoscopy with a P value of 0.661 (not significant). Mean number of positive nodes in open cases were 0.67 versus 0.86 in laparoscopy with P value of 0.390 (not significant). The mean distal margin (cm) was 10.33 in open versus 9.93 in laparoscopy cases with a P value of 0.400 (not significant) (Table 4).

Table 4: Mean comparison between Laparoscopy and Open surgery variables in carcinoma colon.

Variables	Laparoscopy	Open surgery	Difference	P value
	Mean±SD	Mean±SD	Mean±SD	
Age	55.08±10.80	50.43±12.26	4.65±1.46	0.203
Duration (minutes) surgery	151.25±19.08	183.57±27.42	32.32±8.33	0.003 *
In yield	13.50±6.75	14.57±8.59	1.07±1.84	0.661
Post node	0.67±2.31	0.86±2.41	0.19±0.10	0.390
PO stay (days)	10.08±2.47	8.50±4.69	1.58±2.22	0.004 *
Distal margins (cm)	10.33±2.57	9.93±3.25	0.40±0.68	0.400

Statistical Analysis: Mann-Whitney U test. Statistically significant if P<0.05

One patient in laparoscopy had a distal margin positive.

Two (16.7%) out of 12 cases in open right hemicolectomy developed complications. One patient developed anastomotic leak and 1 had recurrent vomiting. Three (21.4%) out of 14 laparoscopic right hemicolectomies developed complications. One had an anastomotic leak, 1 had wound infection and 1 had recurrent vomiting. The P value was 1.000 which was not statistically significant (Table 5).

Table 5: Post OP complications comparison between Laparoscopy and Open surgery methods in carcinoma colon.

Post OP comp	Laparoscopy	Open surgery	P value
	N (%)	N (%)	
Present	2 (16.7)	3 (21.4)	1.000
Absent	10 (83.3)	11 (78.6)	
Total	12 (100.0)	14 (100.0)	

Statistical Analysis: Fisher's Exact test. Statistically significant if P<0.05

Mean duration (days) of Post-operative stay in open surgery was 10.08 versus 8.50 in laparoscopy cases with a P value of 0.004 which was statistically significant.

DISCUSSION

In rectal cancer, many parameters or variables have been studied. Lymph node harvest is one of the most important parameter. Boutrous M et al, studied in 234 patients of whom 118 underwent laparoscopy and 116 underwent open rectal resections. Patients who underwent laparoscopic proctectomy had significantly more lymph nodes harvested (mean, 25.9; range, 3-69) compared with patients who underwent open resections (mean, 20.9; range, 3-61; p = 0.016). However, the number of positive lymph nodes was not significantly different between the laparoscopic (mean, 1.9; range, 0-21) and open (mean, 2.1; range, 0-15) resection groups. Involvement of circumferential margins (5.6% versus 3.4%, p = 0.49) and the mean measured free circumferential margins (11.0±6.2 versus 11.4±6.3 mm; p = 0.69) were similar after laparoscopic and open TME. Last, there were no positive distal margins in either group, and the proportion of distal margins ≤1 cm (16.1% versus 10.3%, p = 0.19) was similar in laparoscopic and open TME specimens. Laparoscopic proctectomies required longer operative time in comparison with open proctectomies (245 versus 213 minutes, p = 0.002). The 30-day postoperative morbidity was significantly greater for open resections (43.1% versus 25.4%, p =0.04), largely because of a significantly higher incidence of wound infections (19.8% versus 9.3%, p = 0.02). In addition, mean hospital stay was significantly shorter by 1 day (p = 0.05) for laparoscopic proctectomies.

Lujan et al, in their randomized control study, 103 patients were randomized to open surgery and 101 to a

laparoscopic procedure.⁷ Mean operating time was 21 minutes longer for laparoscopic than open surgery. Return to oral diet and length of hospital stay were longer by a mean of 1 day in the open group, but these differences were not significant. Anatomical and pathological examination of the specimen showed similar involvement of the circumferential and radial margins in the two groups, but the number of lymph nodes isolated was greater in laparoscopic group (mean 13.63 versus 11.57; P = 0.026).

In COLOR II, randomized control trial, a total of 1044 patients were included (699 in the laparoscopic-surgery group and 345 in the open surgery group).⁸ In the laparoscopic-surgery group, the operating time was 52 minutes longer, bowel function returned 1 day earlier, and the hospital stay was 1 day shorter than in the open-surgery group. There were no significant differences in the rates of anastomotic leaking, complication, or death. There was no significant difference with respect to lymph node yield, circumferential resected margin and distal margins.

Xiong et al, in his meta-analysis compared laparoscopic total mesorectal excision (LTME) and open total mesorectal excision (OTME) as the primary treatment for patients with middle and low rectal cancer with regard to short-term outcomes.⁹ Four RCTs enrolling 624 participants (LTME group, 308 cases; OTME group, 316 cases) were included in the meta-analysis. LTME for rectal cancer was associated with a significantly longer operative time. In the present study, we found no significant differences in the number of lymph nodes, overall morbidity and perioperative mortality rates between the two groups. Time to resume liquid diet, time to resume normal diet, and length of hospital stay, although not significantly different between the two groups, did suggest a positive trend toward LTME.

Regarding the lymph node yield comparing upfront procedures with post neoadjuvant chemoradiotherapy cases, there have been studies showing decreased number of lymph nodes in the latter setting.

In the study by Morcos B et al, a total of 116 patients were included.¹⁰ Fifty-nine patients (51%) received neoadjuvant therapy before resection. The mean number of lymph nodes removed was 18 (range 4e67) per specimen. There was less lymph node yield in patients who received neoadjuvant therapy (16 versus 19, p 1/4 0.008). Only 64% of patients who had preoperative therapy had 12 lymph nodes or more in the specimen as opposed to 88% of those who had surgery upfront (p 1/4 0.003).

Elsheikh et al, in his retrospective study of a cohort of 409 consecutive cases, the management included surgical excision alone 126 (29%), or a preoperative short or long term chemo-radiotherapy 75 (17.2%), and 260 (59.8%) respectively prior to surgery.¹¹ Total lymph node (TLN)

count ranged from (2-50, mean 12.38). Patient treated with surgery only have a significant high total LN yield (mean is 15.53, 12.99, and 10.25 in surgery, short chemo radiotherapy and long course chemo radiotherapy respectively, P value<0.005).

In the present study, the laparoscopic rectal resections had a significantly longer operating time than open resections. This could be assigned to the learning curve of the operating team. The lymph node yield was better in laparoscopic group than open group, although not significant. Reasons could be because of improved visualization, improved retraction, and easier access to the most proximal portion inferior mesenteric vessels which facilitated a more proximal high ligation of the inferior mesenteric vessels and a wider, more complete mesenteric resection, resulting in greater lymph node harvest in the laparoscopic group. The other parameters like complication rates, CRM, distal margins were not statistically significant between the groups which was similar to other studies.

In the present study also the mean of lymph node yield was better in upfront cases than post chemotherapy cases, but the P value was not significant (Table 2). Preoperative radiotherapy is thought to decrease the lymph node yield after surgical excision. This is probably caused by the immune response and fibrosis in lymph nodes exposed to radiotherapy, which results in diminution in their size, making their identification in the pathology specimen difficult.¹⁰

Carcinoma colon

Zheng M et al, compared laparoscopy versus open right hemicolectomies.¹² 30 patients with colon cancer who underwent laparoscopic right hemicolectomy (LRH) were compared with 34 controls treated by open right hemicolectomy (ORH) in the same period.

Mean operation time of LRH and ORH groups was 152.65±28.29 and 147.25±27.50 minutes respectively, with no significant difference. Five patients in LRH group experienced postoperative complications: two with pulmonary infections, two with wound infections and one with incomplete intestinal obstruction, while 10 patients of postoperative complications were found in ORH group. The morbidity in ORH group was slightly higher than that in LRH group, but the difference was not statistically significant. The number of total lymph node yield, including epicolic and paracolic lymph nodes, intermediate lymph nodes and principal lymph nodes in LRH group was 11.24±8.02, 6.82±4.72, 2.59±2.43 and 1.82±2.53 respectively, and had no significant difference compared to those in ORH group.

Times for flatus passage, hospital stay, and time to resume early activity in LRH group were 2.24±0.56 d, 13.94±6.5 d, and 3.94±1.64 d respectively, which were significantly shorter than those in ORH group (P<0.05).

Khan JS et al, in his prospective study compared laparoscopy with open right hemicolectomy.⁴ One sixty-four patients (78 male) underwent an elective right-sided colonic resection. Eighty-nine patients (54%) were in the LRH and seventy-five in the ORH group.

The median lymph node yield was 13 in the ORH and 15 in the LRH group. This difference was not statistically significant. The R0 resection margins were achieved in 97% of ORH and 99% of LRH patients. The median length of hospital stays (LOS) was 4 days (range: 2-21 days) in the LRH group and 8 days (range: 3-38 days) for ORH cases (p<0.0001).

Eleven patients were readmitted within 30 days of surgery (2 ORH, 9 LRH), the median total length of post-operative stay (including readmission) remained at 4 days in the LRH and 8 days in the ORH group. The median operating time for LRH was 120 minutes (range: 70-230 minutes).

COST trial, randomly assigned 872 patients with adenocarcinoma of the colon to undergo open or laparoscopically assisted colectomy.¹³ Operating times were significantly longer in the laparoscopic-surgery group than the open colectomy group (150 minutes versus 95 minutes, P<0.001).

Perioperative recovery was faster in the laparoscopic-surgery group than in the open-colectomy group, as reflected by a shorter hospital stay. There were no significant differences between the groups in the rates of intraoperative complications (2 percent in the open-colectomy group and 4 percent in the laparoscopic surgery group, P=0.10), 30-day postoperative mortality (P=0.40), rates and severity of post-operative complications at discharge (P = 0.98) and at 60 days (P = 0.73), and rates of readmission (10 percent and 12 percent, respectively; P=0.27), or the rates of reoperation (less than 2 percent in each group, P=1.0).

In our experience, the duration of surgery was significantly lesser in open than in laparoscopic surgery (151.25 versus 183.57- P value of 0.003). This again can be attributed to the learning curve of our surgical team. The other variable which was significant was the post-operative stay, which was significantly less in laparoscopy. The reason could be that, the lower immune and stress response instigated with a laparoscopic technique could have contributed to reduced leak rates and fewer major complications. This has been hypothesized previously in a randomized controlled trial.

CONCLUSION

Even though it was a retrospective study, we had some results which was comparable to many other studies. Apart from the longer operating time with laparoscopy, other pathological parameters and postoperative complications were similar in both open and laparoscopic

group. Hence, laparoscopic resection can be considered on par to open resection in colorectal cancer. For better results, we need to do randomized control trials.

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