

Outcome of Laparoscopic Resection for Left Sided Colon and Rectal Cancer

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Abstract

Background: For many years, traditional surgery for left colon and rectal cancers had developed with variable degrees of morbidity. With the evolution of laparoscopy and by the aid of better visualization and magnification, laparoscopic colorectal surgery had appeared, but technically challenging as it involves almost all advanced laparoscopic techniques, with the benefits of minimal morbidity, less pain, earlier recovery, shorter hospital stay, without compromising oncological results. **Aim:** The aim of this work was to evaluate laparoscopic resection for left sided colon and rectal cancer as regard feasibility, safety and outcomes. **Patients and Methods:** This prospective study was conducted on 40 patients having left sided colon and rectal cancer, including 29 patients with rectal cancer and 11 patients with left sided colon cancer within the inclusion criteria are evaluated by clinical examination, radiological and colonoscopic study and biopsy and treated by laparoscopic resection and followed ranged from 6 months to 2 years with mean of 20 months. **Results:** Twenty seven patients (67.5%) underwent laparoscopic anterior resection, 11 patients (27.5%) underwent laparoscopic left hemicolectomy and only 2 patients (5%) underwent laparoscopic abdominoperineal resection, minimal morbidity, no cancer related mortality and no recurrence during the period of follow up either local or systemic. **Conclusion:** Laparoscopic resection for left sided colon and rectal cancer is technically feasible, oncologically safe and has more benefits on postoperative recovery.

Keywords

Laparoscopic Colorectal Surgery

1. Introduction

Colorectal cancer ranks as one of the most significant leading causes of death from malignancies, and actually the gold standard treatment option is surgery [1]. Traditional open techniques were for many years the only hope for such poor patients with variable

degrees of morbidity [2]. Laparoscopic colorectal surgery is technically demanding as it involves almost all advanced laparoscopic skills [3]. Colorectal surgeon needs a long time in mastering the advanced laparoscopic skills required in this type of surgery, but the great advantages of laparoscopic colorectal surgery than open surgery overweight this effort [4]. The radicality of resection and the oncological results were initially a matter of debate limiting the spread of laparoscopic colorectal surgery [5] [6]. A series of studies showed that, in experienced hands, laparoscopic colorectal surgery has a valuable effect on post-operative recovery, compared to open surgery, without compromising the oncological results [7].

The aim of this work was to evaluate laparoscopic resection for left sided colon and rectal cancer as regard feasibility, safety and outcomes.

2. Patients and Methods

This study was conducted at Gastrointestinal, Liver and Laparoscopic surgery unit, General Surgery Department, Tanta University Hospitals over a period from 1st April 2013 to 31 January 2016 on 40 patients having left sided colon and rectal cancer.

Patients with locally advanced or metastatic lesion, emergency presentation, and patients with history of prior major abdominal surgery causing dense scar tissue, high risk patients for general anesthesia and those with coagulation disorders or hepatic dysfunction (Child-Pugh C) are excluded from this study.

Approval from the ethical committee of our institution was taken, and informed written consent was obtained from all patients after full explanation of the benefits and risks of the procedures and for recording the procedure and inclusion within the study.

Patients were examined thoroughly, laboratory and radiological investigations were done to confirm diagnosis and for proper staging of the disease and also tumor markers screening followed by colonoscopy and biopsy and then undergo standard bowel preparation.

Operative details: Under general anesthesia with endotracheal intubation, a nasogastric tube and a urinary catheter were inserted and digital rectal examination is performed to assess the rectal tumors and to confirm the level and relation to the sphincters, then the abdomen and perineum are prepped and draped. Pneumoperitoneum was initiated as usual and careful exploration of the abdominal cavity including the liver and peritoneal surfaces to exclude tumor dissemination.

Splenic flexure mobilization: With the patient in Trendelenburg position starting to the left third of the transverse colon, by the aid of ultrasonic dissector or ligasure the omentum is dissected from the transverse colon and the lesser sac is opened.

Dissection (medial to lateral approach): We prefer this approach as it has the advantage of “no-touch” technique and also the persistence off the lateral embryological attachments to the end of the dissection made it easy.

Identification of the Inferior Mesenteric Vein (IMV): The IMV is identified at the ligament of Trietz lateral to the fourth part of the duodenum.

Division of inferior mesenteric artery (IMA): To ensure an adequate lymphadenectomy, the first 2 cm of the IMA are skeletonized with aid of the right angled dissector before it is divided.

Mobilization of the Sigmoid and Descending Colon: The mobilization of the sigmoid colon follows the division of the vessels. This step includes the freeing of posterior and lateral attachments of sigmoid mesenteries.

Dissection of the Rectum: The “holly plane” around the rectum and its mesentery is entered ensuring total mesorectal dissection and preserving the hypogastric nerve is a must.

Restoration of the intestinal continuity is prepared extracorporeal ly after extraction of the specimen from a small pfannnestiel incision and done under laparoscopic guidance.

Follow up: All patients were followed up monthly for six months, then every 3 months for the first year and yearly thereafter. Chest and abdominopelvic CT scan were done every 6 months for the detection of local or systemic recurrences A colonoscopy was being obtained at the 1-year visit. (ranged from 6 months to 2 years with a mean of 20 months) (**Figures 1-9**).



Figure 1. Division of gastrocolic omentum and opening of lesser sac.

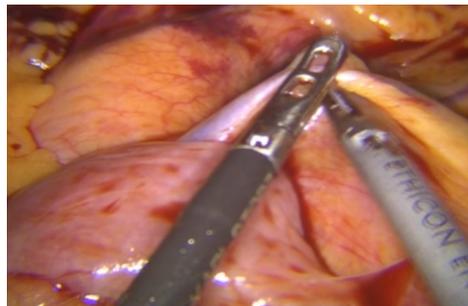


Figure 2. Identification of IMV lateral to the fourth part of the duodenum.

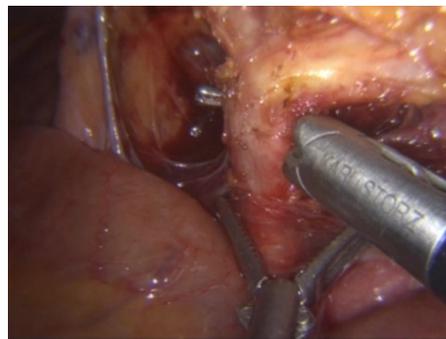


Figure 3. Skeletonization of inferior mesenteric artery using right angle dissector.

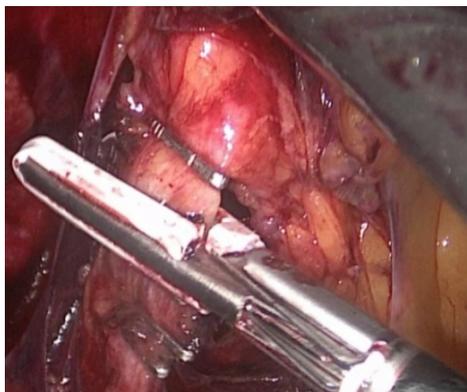


Figure 4. Division of the IMA using ligasure after proximal and distal clipping.



Figure 5. The inferior mesenteric vein is divided after proximal clipping.



Figure 6. Lateral mobilization of the colon.



Figure 7. Dissection of the rectum.

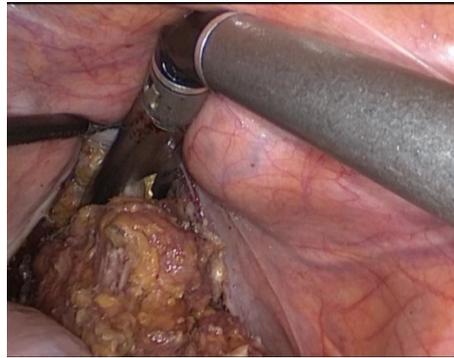


Figure 8. Division of distal rectum using articulated endo GIA.

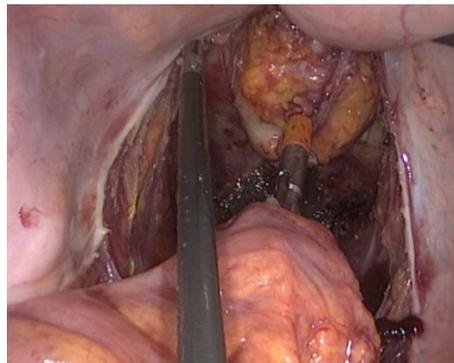


Figure 9. The anastomosis is then done under laparoscopic guidance.

Statistical analysis: The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 16, SPSS Inc. Chicago, IL, USA). For quantitative data, the range, mean and standard deviation were calculated. Significance was adopted at $p < 0.05$ for interpretation of results of tests of significance (**Table 1** & **Table 2**).

3. Results

The results were tabulated as follow.

Twenty seven patients (67.5%) underwent laparoscopic anterior resection, 11 patients (27.5%) underwent laparoscopic left hemicolectomy and only 2 patients (5%) underwent laparoscopic abdominoperineal resection (**Tables 3-7**).

Sixty percent of our cases were of Stage III, 22.5% of Stage II and 17.5 were of stage I according to AJCC staging system (**Tables 8-11**).

4. Discussion

For many years laparoscopic surgery have been developed with it known advantages, and widely used as an alternative to open surgery for benign and malignant colorectal diseases [8]. Laparoscopic colon resection have established better short-term results, and equivalent oncological outcomes [9]. Laparoscopic rectal surgery is developing with promising short-term outcome, but requires more technical skills [10].

In our work the operations performed were 27 laparoscopic anterior resections, 11 laparoscopic left hemicolectomies and only 2 laparoscopic abdominoperineal resections.

Table 1. Basic data.

Variables	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
Sex:		
Male	16	40.0
Female	24	60.0
Age years:		
Range	25 - 71	
Mean ± SD	51.22 ± 11.96	
Body mass index (BMI):		
Range	22 - 35	
Mean ± SD	28.02 ± 3.39	
ASA score		
1	15	37.5
2	17	42.5
3	8	20.0

Table 2. Anatomical distribution of the tumors.

Site of the tumor	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
Colon:		
-Descending colon	3	7.5
-Sigmoid colon	8	20.0
Rectum:		
-Upper rectum	8	20.0
-Mid-rectum	8	20.0
-Lower rectum	13	32.5

Table 3. Mean values of operative time and blood loss.

Variables	The studied patients with left sided colon or rectal cancer (n = 40)		
	Colon cancer patients (n = 11)	Rectum cancer patients (n = 29)	Total (n = 40)
• Operative time in minutes:			
Range	140 - 220	165 - 300	140 - 300
Mean±SD	159.54 ± 23.92	206.03 ± 33.09	193.25 ± 37.08
t-test	4.242		
P	0.001*		
•Operative blood loss (cc):			
Range	25 - 250	30 - 200	25 - 250
Mean ± SD	73.64 ± 63.90	91.90 ± 46.80	86.87 ± 51.81
Z value	0.995		
P	0.326		

*Significant (P < 0.05)

Table 4. Intra-operative complications.

Intraoperative complications	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
Intraoperative complications:		
No	33	82.5
Yes:	7	17.5
-Bleeding	3	7.5
-Injury of colonic wall close to tumor site	1	2.5
-Injury of gonadal vessel	2	5.0
-Ureteric injury	1	2.5

Table 5. Postoperative complications.

Postoperative complications	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
No	30	75.0
Yes:	10	25.0
-Wound Infection	4	10.0
-Trocar site hemorrhage	1	2.5
-Subacute Intestinal obstruction "treated conservatively"	1	2.5
-Ileus	1	2.5
-Anastomotic leakage, BPR abdominal hemorrhage	1	2.5
-Pulmonary embolism	1	2.5
-Urinary fistula	1	2.5

Table 6. Histological differentiation of the tumors.

Differentiation of the tumor	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
-Well differentiated	9	22.5
-Moderate differentiated	21	52.5
-Poor differentiated	4	10.0
-Mucinous	6	15.0

Table 7. Tumor size and resection margins

Variables	The studied patients with left sided colon or rectal cancer (n = 40)
Tumor size (cm):	
Range	1 - 7
Mean ± SD	3.57 ± 1.41
Margins (cm):	
colon:	
-proximal	
Range	7 - 15
Mean ± SD	10.54 ± 2.84

Continued

-distal		
Range		6.5 - 10.7
Mean \pm SD		8.32 \pm 2.3
Rectum:		
-proximal		
Range		6.5 - 14
Mean \pm SD		9.32 \pm 3.23
-distal		
Range		0.50 - 6
Mean \pm SD		3.22 \pm 1.64
-Circumferential	1 (involved)	3.45%

Table 8. Postoperative recovery data.

Variables	The studied patients with left sided colon or rectal cancer (n = 40)		
	Colon cancer patients (n = 11)	Rectum cancer patients (n = 29)	Total (n = 40)
Analgesics usage (days):			
Range	2 - 5	2 - 6	2 - 6
Mean \pm SD	2.64 \pm 1.03	3.41 \pm 1.12	3.20 \pm 1.14
t-test		2.005	
P		0.052	
First time of bowel motion days:			
Range	2 - 5	1 - 6	1 - 6
Mean \pm SD	3.18 \pm 0.87	2.96 \pm 1.12	3.02 \pm 1.05
t-test		0.577	
P		0.567	
First time of oral intake days:			
Range	3 - 5	2 - 6	2 - 6
Mean \pm SD	3.54 \pm 0.69	3.45 \pm 1.21	3.47 \pm 1.08
t-test		0.250	
P		0.804	
Hospital stay (days):			
Range	5 - 9	5 - 14	5 - 14
Mean \pm SD	6.18 \pm 1.25	7.55 \pm 2.06	7.17 \pm 1.96
t-test		0.117	
P		0.047*	

Table 9. Number of lymph nodes retrieved and lymph node metastasis.

Variables	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
Number of removed lymph nodes:		
Range		2 - 27
Mean \pm SD		11.25 \pm 4.91
Number of patients with lymph nodes metastasis:		
No	16	40.0
Yes	24	60.0

Table 10. Conversion among the studied patients with left sided colon or rectal cancer (n = 40).

Variables	The studied patients with left sided colon or rectal cancer (n = 40)	
	n	%
•Conversion to open surgery:		
No	31	77.5
Yes (causes):	9	22.5
-Extensive adhesion to the uterus	3	7.5
-Bleeding from posterior meso-rectum and IMA)	2	5
-Colostomy was obstacle for dissection	1	2.5
-Bladder invasion	1	2.5
-Bulky tumor and intimate adherence to the ureter	1	2.5
-Ureteric injury	1	2.5

Table 11. Anatomical distribution of the tumor among the studied patients with left sided colon or rectal cancer (n = 40).

Variables	The studied patients with left sided colon or rectal cancer (n = 40)						χ^2 P
	No conversion (n = 31)		Intra-operative conversion (n = 9)		Total (n = 40)		
	n	%	n	%	n	%	
•Colon:							
-Descending colon	2	6.5	1	11.1	3	7.5	1.151
-Sigmoid colon	6	19.4	2	22.2	8	20.0	0.950
•Rectum:							
-Upper rectum	7	12.9	1	11.1	8	20.0	
-Mid-rectum	6	19.4	2	22.2	8	20.0	
-Lower rectum	10	32.3	3	33.3	13	32.5	

The mean operative time was 193.25 ± 37 minutes. There was significance difference in the operative time between laparoscopic colon and rectal procedures; the mean operative time in laparoscopic left hemicolectomies was 159.54 ± 23.92 minutes while it was 206.03 ± 33.09 minutes for laparoscopic rectal resections.

Laparoscopic rectal surgery takes longer duration than its corresponding open surgery in all randomized and comparative trials. The mean surgical time was reported to be between 180 - 260 minutes [11]. But *Araujo et al.*, 2003 reported significantly shorter operative time with laparoscopic compared to open colorectal surgery (228 min vs 284 min respectively, $P = 0.04$). Due to cumulative laparoscopic experience and there was no abdominal incision to close [12].

In our study, blood loss ranged from 25 - 250 cc with mean 86.87 ± 51.8 , with no significant difference in the blood loss between laparoscopic colon and rectal procedures. While *Arezzo et al.*, 2012 reported in their systematic review and meta-analysis that

intraoperative blood loss was significantly less for the laparoscopic group compared to the open group and ranged from 20 ml to 321.7 ml and from 92 ml to 555.6 ml in the laparoscopic and open groups respectively [13].

In our work adverse intraoperative events occurred in 7 cases (17.5%), there was bleeding in 3 cases (7.5%), injury of the gonadal vessels in 2 cases (5%), Injury of colonic wall occurred in one case close to the tumor site(2.5%) and left ureteric injury occurred in one case due to extensive adhesions (2.5%).

Kirchhoff et al., 2010 reported damage to the spleen (incidence of 0.006%), or intestinal perforation and ureteric injuries (incidence < 0.01%) [14].

In this study postoperative complications occurred in 10 cases (25%), most of them occurred during our early experience. *Arezzo et al.*, 2012 registered surgical complication rate was 16.6% in the laparoscopic group and 19.0 % in the open group. [12]. *Breukink et al.*, 2006 found no difference in morbidity between the laparoscopic and open groups [15].

In our study we have low incidence of anastomotic leakage (2.5%) as defunctioning ileostomy was done routinely in all cases of low rectal resections. While *Morino et al.*, 2003 reported a leak rate of 17% in 100 rectal cancers below 12 cm but as high as 25% in those who were not defunctioned [16].

In our study minor wound infections are faced in 10%. *Aziz et al.*, 2006 reported that there are 8.9% of wound infections after laparoscopic versus 10 % after open resection and there is marked reduction of wound infection after laparoscopic abdominoperineal resection than open resection [17].

In our study recovery of intestinal function was assessed by first time of bowel motion, it ranged from 1 - 6 days with mean 3.02 ± 1.05 days. First time of oral intake ranged from 2 - 6 days with mean 3.47 ± 1.08 days. While *Sun et al.*, 2011 showed that the mean time of first bowel motion was 3.2 ± 1.6 in the laparoscopic group while it was 4.3 ± 2.9 for open group [2].

In our study, the duration of hospital stay for all procedures ranged from 5 - 14 with mean 7.17 ± 1.96 days. This agrees with the *KOREAN* trial, the mean hospital stay for laparoscopic rectal resections was shown to be 8 days ranging from 7 to 16 days [18].

In our study the duration of analgesia usage ranged from 2 - 6 days with mean 3.20 ± 1.14 . *Sun et al.*, 2011 showed that laparoscopic colorectal surgery obviously caused significantly less pain for patients [2].

Adequate resection margin and lymphadenectomy is essential for good oncological results [19].

In our study, the tumor size was ranged from 1 - 7 cm with median 3.57 ± 1.41 cm and this coincide with the study carried out on the same issue by Veldkamp R, *et al* (2005): in which the mean size of lesions for the LAP group was 4.4 ± 3.1 cm, and that of the open group was 5.7 ± 2.5 cm. The mean distal margin was 8.32 ± 2.3 cm for colonic lesions while it was 3.22 ± 1.64 cm for rectal lesions. In only two cases of rectal cancers the distal resection margin was less than 2 cm and the histological examination showed free proximal and distal resection margins in all surgical specimens in all patients [20].

In our study, circumferential margin (CRM) was free in all cases of rectal cancer ex-

cept one case (3.45%) showed involved or positive CRM which is similar to that concluded by *Rostirolla et al.*, 2016 who found a rate of 5.66% of circumferential margins committed [7].

In our study, the numbers of lymph nodes retrieved ranged from 2 - 27 lymph nodes with mean $11.25.00 \pm 4.91$. lymph node metastases were present in 24 cases (60%). Twelve lymph nodes should be removed in the surgical specimen for a proper oncological staging [21].

In our work, there was (22.5%) rate of conversion (9 out of 40) and, was associated with prolonged operative time, prolonged duration of analgesia usage, delayed bowel movement, delayed starting of oral intake and prolonged duration of hospital stay in comparison with the non converted cases. It also was common in patients with high BMI. Out of the nine cases of conversion, only two cases were converted to open in the second year of the study due to improvement in the learning curve and stabilization of the operative technique.

Anton et al., 2014 stated that, conversion was required because of local tumor invasion or difficult dissection in a narrow pelvis, bulky tumor, dilated small bowel and dense adhesions [22].

Breukink et al., 2006 reported a highly variable rate of conversion ranging from 0% to 33% [15].

Ng et al., 2014 had a conversion rate of 30.3% most of them were done early after routine diagnostic laparoscopy [23].

5. Conclusion

Laparoscopic resection for left sided colon and rectal cancer is technically feasible, oncologically safe and has more benefits on postoperative recovery.

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