

*Research Article*

## Colectomy In Patients With Colonic Carcinoma: Laparoscopic Versus Open Methods

Yasser Baz\*, Ayman Kamal\*, Yasser Orban\*\* and Mohammed M. Ezzat\*

\* Department of Surgery, Helwan University

\*\* Department of Surgery, Zagazig University

### Abstract

**Background:** Colorectal cancer is one of the most common health threatening diseases around the globe as it is the third most frequent cancer worldwide and surgical resection is the mainstay of potentially curative treatment, Using of laparoscopy in colon surgery quickly diffuse in surgical practice since its introduction in the 1990's from an experimental infrequently performed approach to the current standard of care, as only few studies, nonrandomized and including small populations, have compared LCS to OCS, with no clear advantage of one approach over the other. **Aim of the study:** To compare efficacy between laparoscopic and open colectomy in patients with colonic carcinoma. **Subjects and methods:** A total of 134 patients attending Helwan and Zagazig University hospitals from January 2018 to January 2021 included in a prospective study. Participants were divided into two groups according to type of surgery. **Group 1:** included "66 patients" comprised those who had colonic with laparoscopic intervention. **Group 2:** included "68 patients" comprised those who had colonic carcinoma with open surgical intervention. **Results:** In LCS group, 54 patients had no post-operative complications while in OCS group, 36 patients had post-operative complications in the form of leakage, intra-abdominal infection, chest infection, wound infection & burst abdomen (P=0.000). There was a statistical significant difference between study groups in postoperative complications as only 12 patients of laparoscopic colectomy patients had postoperative complications. **Conclusion:** Laparoscopic colectomy is safe, valid and considered an effective surgical method for resection of colonic carcinoma. **Recommendation:** We recommend laparoscopic resection as a gold standard for patients with colonic carcinoma.

**Key Words:** colectomy, laparoscopic, open colectomy

### Introduction

Colorectal cancer is one of the most common health-threatening diseases around the globe as it is the third most frequent cancer worldwide and surgical resection is the mainstay of potentially curative treatment<sup>(1)</sup>, Using of laparoscopy in colon surgery has quickly diffused in surgical practice since its introduction in the 1990s from an experimental infrequently performed approach to the current standard of care<sup>(4)</sup>.

Conventional Open Colonic Surgery (OCS) is now constantly being replaced by Laparoscopic Colorectal Surgery (LCS) due to improvement of the technologies, great advances in equipment and development of standard techniques had shared the

widespread of LCS as it has a better short term outcomes<sup>(2)</sup>, equivalent pathological and long-term oncological outcomes to OCS<sup>(17)</sup>.

The non-inferiority of LCS to OCS in terms of pathologic outcomes, respect to tissue damage and other long-term outcomes remain to be proven<sup>(17,3)</sup>, as only few studies, nonrandomized and including small populations, have compared LCS to OCS, with no clear advantage of one approach over the other<sup>(6)</sup>.

This study focuses on comparison between laparoscopic and open conventional resection of colonic carcinoma in different parts of the colon. It is considered the first

study dealing with this subject at Helwan university hospitals.

### Objectives:

To compare efficacy between laparoscopic and open colectomy in patients with colonic carcinoma. Also, to evaluate short-term and postoperative outcome of both techniques. Finally, to evaluate the efficacy of either approach in radicality of resection on pathological bases.

### Patients and Methods

A total of 134 patients attending Helwan and Zagazig University hospitals from January 2018 to January 2021 included in a prospective study. Written informed consent was obtained from all patients and the study was approved by the research ethical committee. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Participants were divided into two groups according to type of surgery.

**Group 1:** included "66 patients" comprised those who had colonic and rectal carcinoma with laparoscopic intervention.

**Group 2:** included "68 patients" comprised those who had colonic and rectal carcinoma with open surgical intervention.

### Inclusion criteria:

Patients' age between 18 years and 80 years at both genders with a final diagnosis of colonic carcinoma. Operable patients of colonic carcinoma and fit for laparoscopy. Also, patients who will follow up constantly after operation and cooperative patients.

### Exclusion criteria:

Patients had inoperable, multicentric, recurrent colonic cancers, intraoperative mishap leading to conversion to open surgery, contraindication to laparoscopy and patients who were unavailable during the study.



**Surgical techniques (Fig. 1): Open colectomy specimens**



(Fig. 2): Laparoscopic right Hemicolectomy

#### **Preoperative preparation:**

Patients preoperative evaluation was done through laboratory investigations as (CBC-PT, PTT, INR – CEA Tumor marker – Liver & Kidney function tests – Random Blood glucose level – HCV & HBV viral markers). Also patients had colonoscopy with biopsy for histopathology and chest, abdomen and pelvis contrast enhanced Computed tomography.

Participants were consented for surgery. Bowel preparation was done. Also, Foley's urinary catheter and nasogastric tube were inserted. Intravenous antibiotics at induction of anesthesia. Sequential compression stockings and administration of subcutaneous low molecular Weight heparin anticoagulant for venous thrombosis prophylaxis

#### **Open colectomy:**

General anesthesia with endotracheal intubation was induced with the participants in the supine position and then midline exploratory incision was done till peritoneum. Liver and peritoneum assessment was done for exclusion of any metastasis or signs of inoperability, then detection of tumor Site with resection according to the site as follow: right hemi colectomy for cancer caecum and ascending colon, extended right hemi colectomy for hepatic flexure carcinomas. Transverse

colectomy for malignancies at transverse colon, left hemi colectomy for left sided tumors and extended left hemi colectomy for splenic flexure carcinomas. Finally, Sigmoidectomy for sigmoid carcinoma. Resection anastomosis was done, abdominal lavage and closure of the abdominal incisions in layers with intra-abdominal tube drains. Intra operative and post-operative complications were recorded

#### **Laparoscopic colectomy:**

After induction of general anesthesia and endotracheal intubation, the participant was properly positioned according to the operated site of the tumor.

Pneumoperitoneum creation via 10 mm sub umbilical safety trocar. Trocars are placed according to the site of the tumor. Evaluation of the whole abdomen was done at first to exclude liver metastasis or intraperitoneal Mets of the tumor then we started the procedure. We used the medial-tolateral technique that requires ligation of the lymphovascular bundle first then free the colon from its peritoneal attachments. After that hemostasis was done and intracorporeal or extracorporeal anastomosis was done. Extraction of the tumor through widening one of the ports or via pfannestiel incision. Irrigation and suction of the peritoneal space and port site, intra peritoneal tube drains were inserted,

removing trocars with deflation of CO<sub>2</sub>. Closure of the port sites, intra operative and postoperative complications were recorded.

#### **Postoperative care:**

Intravenous antibiotics and fluids are post-operatively continued. Oral fluid intake is started three days after surgery then advanced to a regular diet as the patient tolerates feeding. Early ambulation is instructed to avoid DVT.

## **Results**

### **Demography of the patients:**

This prospective study was conducted on 134 patients presented with colonic carcinoma (68 patients had operated by open colectomy and 66 patients had operated by laparoscopic colectomy) came to the outpatient clinic of Helwan and Zagazig University hospitals between January 2018 to January 2021.

Patients undergoing LCS were marginally younger (mean 51 vs. 55 years,  $p=0.063$ ). There was no significant difference in gender distribution between the two groups, while there was a statistical significant difference between the study groups in age as open colectomy patients had older age than laparoscopic colectomy patients.

### **Site of operation**

All sites of the colon were operated e.g. caecum, right colon, hepatic flexure, transverse colon, left colon and sigmoid colon. There was no statistical significant difference between the study groups regarding the site of operation.

### **Number of affected lymph nodes:**

There was no statistical significant difference between the study groups regarding number of affected lymph nodes.

### **Intraoperative complications:**

In laparoscopic colectomy group, 62 patients had no complications intraoperative, no patients had bleeding and patients only

4 patients had left ureteric injury during laparoscopic Sigmoidectomy. While in open colectomy, 53 patients had no intra-operative complications and 5 patients had bleeding during operation and 10 patients had injuries. There was no statistical significant difference between the study groups regarding intraoperative complications ( $P=0.16$ ).

### **Postoperative complications:**

In Laparoscopic colectomy group, 54 patients had no post-operative complications while in open colectomy group, 36 patients had post-operative complications in the form of leakage, intra-abdominal infection, chest infection, wound infection & burst abdomen ( $P=0.000$ ). There was a statistical significant difference between study groups in postoperative complications as only 12 patients of laparoscopic colectomy patients had postoperative complications.

### **Operation time:**

In LCS group, the mean operation time minutes ( $163 \pm 25$  min) was while in open colectomy group was ( $122.6 \pm 24$  min), There was statistical significant difference between study groups regarding operation time ( $P=0.00$ ).

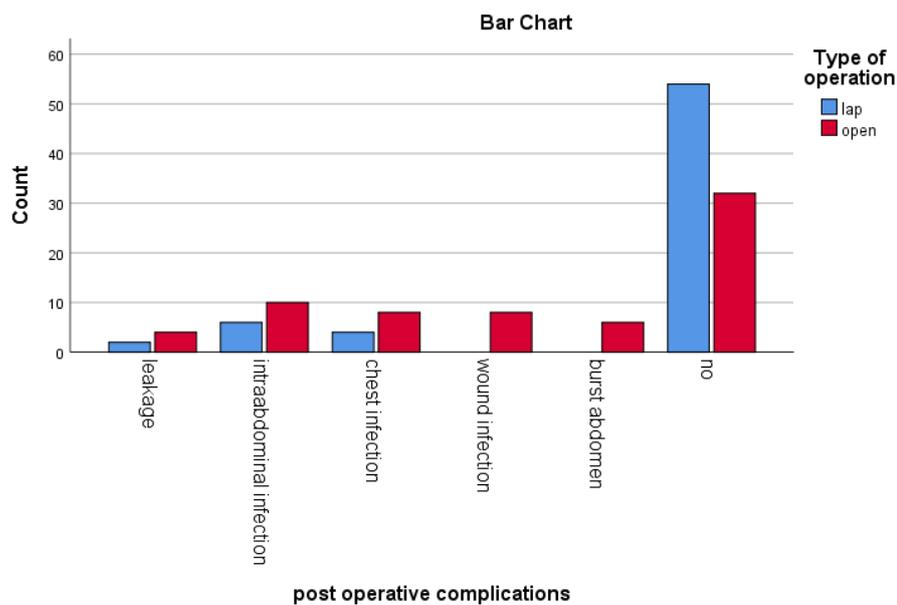
### **Length of hospital stay:**

In laparoscopic colectomy the mean length of hospital stay was 4.7 days in comparison to that of open colectomy that was 11.7 days. There was a statistical significant difference between studied groups in Length of hospital stay as Open colectomy patients had more hospital days than Laparoscopic colectomy patients ( $P=0.000$ ).

### **Amount of blood loss**

In laparoscopic colectomy group, the amount of blood loss mean was 260 ml. in comparison to that open colectomy that was 423 ml. There was statistical significant difference between study groups regarding amount of blood loss ( $p=0.000$ ).

		Type of operation		X <sup>2</sup>	P-value
		lap	open		
Sex	Male	29	36	1.087	.297
	Female	37	32		
intra operative complications	Bleeding	0	5	8.248	.016
	Injuries	4	10		
lymph nodes affected	< 10	12	18	1.324	0.250
	>10	54	50		
postoperative complications	Leakage	2	4	22.603	.000
	intraabdominal infection	6	10		
	chest infection	4	8		
	wound infection	0	8		
	burst abdomen	0	6		



	Type of operation	Mean	Std. Deviation	P-value
	Age	Lap	51.4697	10.85034
Open		54.7353	9.26495	
operative time minutes	Lap	163.4118	24.80385	0.000
	Open	122.6364	24.39082	
amount of blood loss per mil.	Lap	259.8485	127.16425	0.000
	Open	423.0882	145.83017	
hospital stay post operative days	Lap	4.7121	2.44172	0.000
	Open	11.7353	5.20223	

## Discussion

Surgical resection of colonic carcinoma is considered the backbone of curative treatment. Since the first laparoscopic colon resection in 1990, a great surgical progress has been the era of colorectal cancer therapy by minimally invasive surgical techniques with its associated patient-related benefits<sup>(5)</sup>. This study highlights usage of laparoscopic techniques in resection of cancer colon and the difference between it and conventional open technique in patients with cancer colon at Helwan and Zagazig university hospitals.

In our study, we evaluated the efficacy of laparoscopic colectomy in achievement of proper resection of affected lymph nodes at vascular pedicle of the colon; we noticed that there is no statistical significant difference between study groups regarding number of affected lymph nodes. This was matched to Baladucci G et al.,<sup>(7)</sup> as the analysis of their data highlights that there was no significant difference for what concerns excised lymph nodes between the two groups however Anania G et al.,<sup>(1)</sup> published that LCS may allow more lymph nodes to be harvested than in open surgery, Puckett Y et al.,<sup>(8)</sup> concluded that the retrieval of greater than 12 LNs in colonic carcinoma colectomies is associated with better staging and better prognosis.

In our study, the amount of blood loss was less in LCS in comparison to OCS and there was statistical significant difference between the study groups regarding amount of blood loss, this was matched to Anania G et al.,<sup>(1)</sup> as they published that LCS offered better short-term outcomes including overall complications, lower estimated blood loss.

In this study there were about 5.9% of cases (4/68) had post-operative fistula in OCS group while there were 3% of cases (2/66) postoperative fistula after LCS and this agreed with Mousa BR et al.,<sup>(5)</sup> in their study there were about 13.3% of cases (2/15) had post-operative fistula in OCS group while there were no postoperative fistula after LCS as laparoscopic surgery

has consistently been shown to have comparable or improved short-term and oncological long-term outcomes when compared to conventional OCS. However, literature evaluating the effect of LCS on anastomotic leak rate is inconsistent and inconclusive; there has been some concern that laparoscopy is associated with increased rates of anastomotic failure as most series, however, show no significant difference, and a minority report benefit.

In our study, intra-abdominal infection and chest infection were significantly lower in laparoscopic colectomy group than open colectomy group and this was matched with Caroff DA et al.,<sup>(9)</sup> that LCS is associated with a lower surgical site infection rate than OCS in both relatively healthy patients and those with multiple comorbidities, Tateno Y et al., 2021<sup>(13)</sup> published that LCS for sigmoid colon cancer can be successful and safe in an elderly patient who was infected with COVID-19 and passed 3 weeks asymptomatic before the surgery and in addition, none of the surgical staff was infected with COVID-19 after the surgery

In our study, in laparoscopic colectomy we didn't detect wound infection or burst abdomen, Also, Lerass et al.,<sup>(10)</sup> noticed that LCS was associated with a lower rate of overall complications, specifically wound complications, urinary tract infection, venous thromboembolic complications, respiratory complications, anastomotic leakage, postoperative ileus, need for blood transfusion and septic complications.

In 2018, Gavriilidis et al.,<sup>(3)</sup> reported that LCS mean operative time was longer by 38 min, and surgery involving Middle Colic Artery dissection at its origin necessarily requires surgeons with advanced laparoscopic expertise and specialized skills as this kind of surgery is surgeon and learning curve dependent and can extend the operative time and that was matched with our study as LCS mean operative time was longer by 40.8min, Feo CF 2021 et al.,<sup>(16)</sup> their data confirmed that laparoscopic right colectomy has a longer operative time than open surgery, and no significant short-term

benefits were observed for the studied parameters. And Huang Y et al., 2021<sup>(15)</sup> in their study, laparoscopic surgery for left-sided colon cancer was associated with higher likelihood of prolonged operation time.

According to our results there was shorter hospital stay in laparoscopic colectomy patients in comparison to OCS and this was agreed with Schootman M et al., 2021<sup>(11)</sup> published that LC patients had shorter hospital stay and better overall outcomes compared with OCS patients.

Abu El-Hagga AA et al., 2021<sup>(12)</sup> published that LCS with central vascular ligation procedure is a safe, valid, and feasible surgical method as it is associated with smaller incisions, less operative blood loss, earlier recovery after operation and shorter hospital stay compared with open technique.

Ringressi MN 2021 et al.,<sup>(14)</sup> published that in a confirmed general picture of good long term results in the treatment of carcinoma of the colon, their study highlights the oncologic effectiveness of LCS when compared with OCS as testified to by the same number of retrieved/ examined nodes in the two groups, moreover and most importantly, their study produces evidence of better results of LCS in terms of DFS and OS. Therefore, our data support minimally invasive surgery as the gold standard for the surgical treatment of patients with non-advanced colonic carcinoma.

Huang Y et al., 2021<sup>(15)</sup> found that LCS for left-sided colon cancer resection was associated with improved perioperative outcomes and reduced risk of adverse events and the long-term survival was equivalent to that achieved by conventional open procedures, Moreover

Yamauchi S et al., 2021<sup>(17)</sup> the non-inferiority of LCS to OCS has been demonstrated, moreover, it is verified that there was no difference in technical and oncological safety.

## Conclusion

Laparoscopic colectomy is safe, valid and considered an effective surgical method for resection of colonic carcinoma as it has many benefits as less blood loss, short hospital stay, early return to work and good oncological outcomes. We recommend laparoscopic resection as a gold standard for patients with colonic carcinoma.

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## Conflicts of interest

Yasser Baz, Ayman Kamal, Yasser Orban and Mohammed Ezzat have no conflicts of interest or financial ties to disclose.

## Authors' contribution

YB, AK, ME and YO carried out the clinical procedures and have been involved in drafting the manuscript or revising it critically for important content. YB & ME were involved in the recruitment of patients and contributed to acquisition of the data. YB & YO was involved in analysis and interpretation of the data. All authors read and approved the final manuscript.

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