

Mortality and Morbidity after Laparoscopic Colectomy of Colonic Tumors

Dr. Ahmed Salih Ahmed¹, Dr. Ali Alalaq², Dr. Mohammed Abed Mohammed³

¹MBChB, CABS, FACS, EBSO, Consultant of Oncological Surgery, Baghdad Teaching Hospital, Baghdad, Iraq.

²MBChB, FICMS (General Surgery), Surgical Oncology Fellowship (Arab Board of Health Specialization), Al-Kadhimiyah Teaching Hospital, Baghdad, Iraq.

³MBChB, CABS, Specialist General Surgeon, Medical City, Baghdad, Iraq

Abstract: *Background:* Laparoscopic colectomy of colonic tumors is currently a common surgical procedure. Therefore, assessing its morbidity and mortality is essential for considering it as a standard approach for colonic tumor. *Patients & Methods:* A prospective randomized study included (35) patients who underwent laparoscopic colectomy, operated on from 1st of October 2020 to 30th of September 2022 in the third surgical unit at Baghdad teaching hospital in medical city in Iraq, all patients subjected to elective surgery for colorectal carcinoma. The current study assesses the different complications that may occur during or after laparoscopic procedure up to 30 days from time of surgery. *Results:* The number of patients that did not develop any post-operative complications within the first 30 days were 18 (51%) while those with complications were 17 (49%). The incidence of local complications distributed between the wound infection 9 (26%) which was the most common, wound dehiscence 5 (14%), bleeding 2 (6%), while the intra-abdominal collection, intestinal leak and injury to the urinary bladder all with one (3%) incidence for each one. The incidence of systemic complications was much lower than the local, were distributed as the following; pneumonia 8 (23%), cardiac ischemia 1(3%), death within 30 days post-op. was just 1 (3%), while no incidence of both pulmonary embolism and deep venous thrombosis. *Conclusion:* Laparoscopic colectomy of different types & sites of colonic tumor was a safe surgery with acceptable surgical and oncological results.

Keywords: laparoscopic colectomy, colorectal cancer, surgical complications, postoperative outcomes, minimally invasive surgery.

1. Introduction

Colorectal cancer is worldwide the most common malignant disease of the gastrointestinal tract and the second to third most common tumor disease with over one million new diagnoses and 500.000 deaths annually.¹

Surgery is the primary treatment for patients affected with potentially curable colorectal cancer. Adjuvant therapy is a systemic treatment administered with the intention of reducing the risk of relapse and death. The recurrence rate can be predicted by pathological staging. Adjuvant chemotherapy is a standard of care in stage III patients while its role is less well established in stage II.²

For oncologic concerns, laparoscopic colectomy was accepted as an alternative surgical approach for colon cancer after positive outcomes from several multi-center prospective randomized trials, since then, further evidence has accumulated to support the feasibility, safety, and benefits of the laparoscopic surgery for colorectal cancer.³

When compared with open surgery, laparoscopic colectomy have several advantages, including shorter hospital length of stay, shorter duration of narcotic use, decreased pain scores, quicker return of bowel function, decreased rates of ileus, improved rates of surgical site infection, lower incisional hernia incidence, and decreased incidence of adhesive small bowel obstruction.⁴

In general, complications can be divided into intraoperative and postoperative complications. Occurrence of intraoperative complications such as bleeding, bowel injury, ureteral lesions and bladder injuries are caused by

intraabdominal adhesions, anatomic problems, the experience of the surgeon and many other factors. Major postoperative complications include wound infection, anastomotic leakage, and ileus.⁵

2. Patients & Methods

A prospective randomized study included (35) patients who underwent laparoscopic colectomy, operated on from 1st of October 2020 to 30th of September 2022 in the third surgical unit at Baghdad teaching hospital in medical city in Iraq, all patients subjected to elective surgery for colorectal carcinoma that include laparoscopic right hemicolectomy, left hemicolectomy, anterior resection, abdominoperineal resection and panproctocolectomy.

The current study assesses the different complications that could occur during or after laparoscopic procedure up to 30 days from time of surgery.

The complications are divided into two categories, systemic and local complications, systemic complications include chest infection, deep venous thrombosis, pulmonary embolism, cardiac ischemia and death.

While local complications are divided into two types, intraoperative like bleeding, injury to adjacent structures while post-operative include wound seroma, infection, dehiscence, intestinal leak and intra-abdominal collection.

Also the study discusses the time of the operation and the time of hospital stay for the patient.

All patient in current study are evaluated and staged completely by taking history and perform physical examination, colonoscopy with tissue biopsy, abdominal CT scan, chest CT scan, pelvic MRI, baseline chemical profile, serum CEA, neoadjuvant therapy if needed and MDT decision for surgery.

Locally advanced colonic carcinoma (T4) with invasion of adjacent organs and patient with distant metastasis were excluded from the study.

The details of operation include mechanical bowel preparation with intravenous antibiotics at induction of general anesthesia, CO₂ insufflation perform by Verus needle, assessment of peritoneal cavity to exclude any distant metastasis, medial to lateral approach perform for dissection of the mesentery with ligation of main mesenteric vessels, mobilization of colon then resection is done with appropriate oncological resection margin.

The anastomosis is usually done by stapler device with extraction of the specimen through small Pfannenstiel incision.

Post-operatively, the patients are placed on an enhanced recovery pathway, the nasogastric tube is removed in the operating room prior to awakening from anesthesia, following the operation, and the patient is given a clear liquid diet and intravenous fluids.

Patient usually discharge home at day 4 or 5 post op. then kept on follow up during the first 30 day post-op.

3. Results

A total of 35 patients who subjected to laparoscopic colectomy were enrolled in the current study, gender distribution as follow: the majorities of the respondents were male 20 (57%), while the female represents of 15 (43%) of the studied group.

The median age group were 51 year while the median BMI were 32 of the studied group.

Table 1: Patient Baseline Demographic and Clinical Characteristics

Characteristic	No.	Percentage%
Gender	Male	20
	Female	15
total	35	100%
Age (median) year	51	
BMI (median)	32	

The tumor site varied among the patients in the current study, the majority were at the rectum 23 (66 %) patient while the second common site was the sigmoid colon 6 (17 %) then the descending colon with 3 (8%), cecum had 2 (6%) and finally the transverse colon only 1 (3%) patient.

While the type of operations were divided between the laparoscopic anterior resection 16 (46%), sigmoid colectomy 6 (17%), panproctocolectomy 5 (14%), left hemi-colectomy 3 (8%), abdomino-perineal resection 2 (6%), right hemi-

colectomy 2 (6%), and the last one was the transverse colectomy just 1(3%) operation.

The median time of operation was 360 min. while the median time for patient hospital stay were 6 days.

Table 2: Surgical details

	No.	Percentage %
Site of tumor	Cecum	2 6 %
	Transverse colon	1 3 %
	Descending colon	3 8 %
	Sigmoid colon	6 17 %
	rectum	23 66 %
Type of operation	Right hemicolectomy	2 6 %
	Transverse colectomy	1 3 %
	Left hemicolectomy	3 8 %
	Sigmoid colectomy	6 17 %
	Anterior resection	16 46 %
	AP resection	2 6 %
Panproctocolectomy		5 14 %
Time of operation(median) (min.)		360
Time of hospital stay (median) (day)		6

The number of patients that not develop any post-operative complications within the first 30 day were 18 (51%) while those with complications were 17 (49%).

The incidence of local complications distributed between the wound infection 9 (26%) which was the most common, wound dehiscence 5 (14%), bleeding 2 (6%), while the intra-abdominal collection, intestinal leak and injury to the urinary bladder all with one (3%) incidence for each one.

Table 3: Total complications

	No.	Percentage %
Patient with No complications	18	51 %
Patient with complications	17	49 %
Total	35	100%

Table 4: Local complications

Local complications	No.	Percentage %
Bleeding	2	6 %
Injury to adjacent organ	1	3 %
Wound infection	9	26 %
Wound dehiscence	5	14 %
Collection	1	3 %
leak	1	3 %

The incidence of systemic complications was much lower than the local, were distributed as the following; pneumonia 8 (23%), cardiac ischemia 1(3%), death within 30 days post-op. was just 1 (3%), while no incidence of both pulmonary embolism and deep venous thrombosis.

Table 5: Systemic complications

Systemic complications	No.	Percentage %
Pneumonia	8	23%
PE	0	0%
DVT	0	0%
Cardiac ischemia	1	3%
death	1	3%

4. Discussion

Laparoscopy is being widely used in the treatment of both malignant and benign colorectal diseases in many surgical centers where were advanced in laparoscopic procedures, Previous research has demonstrated its advantages when compared with open surgery, such as short hospital stay, greater satisfaction with incision cosmetic, oncological equivalence, postoperative recovery time, and cost effectiveness.⁶

Fleshman J. & et al⁷, van der Pas MH & et al⁸ have found that; the overall complications rate of laparoscopic colectomy were 57% and 40% respectively, while Jiang W. & et al.⁹ found the complications rate was only 13%, our study reveal a complications rate about 49%, so the results was comparable with the other studies although a small sample size in our study.

The most common complication that we face it in the current study was the wound infection with 26% of cases, although we applied all strategies to prevent such complication including perioperative antibiotics, such complication was reported in many previous studies, Zarnescu E. & et al¹⁰ Marta C. & et al¹¹ have reported the wound infection with 35% and 10% respectively, while Osman C. & et al¹² found only 5% of his cases, A multivariate analysis showed that wound infection was related to tumor stage, a converted laparoscopic procedure and open surgery¹³, some article report that extraction of the specimen by using the special extraction bag may lower the rate of wound infection.¹⁴

Wound dehiscence was the second most common complication observed in this study, 14% of cases, most of them are accompanied with wound infection and one of them was associated with an intestinal leak.

The bleeding is one of the most devastating complications that a surgeon may face in any type of surgery and especially the laparoscopic one, in the current study the rate of bleeding was 6% (2 patient), one of them was intra-abdominal that need re-exploration to control the bleeding while the other patient had intraluminal bleeding which treated endoscopically.

Romain B. & et al¹⁵ found that the rate of bleeding in laparoscopic colectomy was 6% while Osman C.⁹ found the rate only 3% and Zarnescu E. & et al¹⁰ show 5% bleeding rate among his patients.

Intraoperative hemorrhage is a common complication in colorectal surgery that needed to be identified and managed as soon as possible. It requires the surgeon to have a sound comprehension of the anatomy of colon and rectum, qualified laparoscopic operation skills, a calm mind and good teamwork.

For surgeons, while surgical complications cannot be completely avoided, there are still chances for reducing the incidence.

Intraoperative hemorrhage can be caused by a variety of factors, among which anatomy, operations, and teamwork are

most important, laparoscopic colorectal surgeons must have solid knowledge on the key laparoscopic anatomic landmarks of colon and rectum and the natural anatomic layers under laparoscope and meanwhile grasp the basic operational skills required in a laparoscopic colorectal surgery.¹⁶

The current study shows a rate of anastomotic leakage (3%) similar with that previously reported in literature, which ranged from 1.2 to 6.4%.¹⁰

Wei-Zhong J. & et al⁹ found that the rate of leakage was 2.5%, while Emily F. & et al¹⁷ report that the rate of intestinal leak in laparoscopic colectomy was 3%, also report that the risk factors include male sex, preoperative smoking, chronic steroid use, and preoperative chemotherapy administration within 90 days of surgery.¹⁷

Injury to the ureter was found in one patient (3%) of current study in the laparoscopic anterior resection surgery, Zafar SN. et al¹⁸ found that the rate of injury about 0.56% while Wissam J. & et al¹⁹ show the rate was 0.3%, but the incidence of such complication is usually associated with some specific type of surgery like low anterior resection of abdomino-perineal resection of rectal tumor.

In rectal cancer surgery, strong evidence in favor of preoperative chemoradiotherapy for the management of locally advanced disease started appearing in 2004, Operating on an irradiated pelvis is challenging, which, along with the proximity of the ureters to the dissection plane, may lead to higher rates of iatrogenic ureteric injury.¹⁹

The systemic complication such as respiratory pneumonia, cardiac ischemia and deep venous thrombosis had lower incidence rate than the local complication.

The most common systemic complication was the respiratory pneumonia that found in 8 (23%) of patients, most of the literature like Jonas J. & et al²⁰ and Sarath S. & et al²¹ found that the rate of respiratory pneumonia after laparoscopic colectomy were 6%, 4.5 % respectively.

Pulmonary infection is one of the most common clinical complications of laparoscopic surgery. Therefore, it is necessary to give scientific nursing measures to patients during the perioperative period, which will be helpful to the prognosis and recovery of patients.²²

The overall mortality rate in the current study with 30 days post-operative was 3% (only one patient) and it was due to cardiac ischemia, this rate was comparable with mortality rate of many other studies like Elmer E. & et al²³ that report a mortality rate of 2.2% while Henry J. & et al²⁴ found the rate within 1%, A Munasinghe & et al²⁵ report 0.5% mortality among the laparoscopic colectomy patients.

The difference in the mortality between these literatures may explained by presence of variable type of comorbidity, age and the post-operative complications among the patients.

So, the benefit of our study is to show that, the laparoscopic colectomy surgery of variable types of colonic tumor was safe with acceptable post-operative rate of morbidity and mortality

although there are some limitations like the small sample size of patients.

5. Conclusion

Laparoscopic colectomy of different types & sites of colonic tumor was a safe surgery with acceptable surgical and oncological outcome.

References

- [1] Jurowich C, Lichhardt S, Kastner C, Haubitzl, Prock A, Filser J, et al. (2019) Laparoscopic versus open right hemicolectomy in colon carcinoma: A propensity score analysis of the DGAV StuDoQ|ColonCancer registry. *PLoS ONE* 14(6): e0218829. <https://doi.org/10.1371/journal.pone.0218829>.
- [2] Roberto Labianca a, Giordano D. Beretta b, Basem Kildani b, Colon cancer, Critical Reviews in Oncology/Hematology, Volume 74, Issue 2, May 2010, Pages 106-133.
- [3] Huang, YM. , Lee, YW. , Huang, YJ. Et al. Comparison of clinical outcomes between laparoscopic and open surgery for left-sided colon cancer: a nationwide population-based study. *Sci Rep* 10, 75 (2020).
- [4] Parker JM, Feldmann TF, Cologne KG. Advances in Laparoscopic Colorectal Surgery. *Surg Clin North Am.* 2017 Jun; 97(3):547-560. doi: 10.1016/j.suc.2017.01.005. PMID: 28501246.
- [5] Kirchhoff P., Clavien, PA. & Hahnloser, D. Complications in colorectal surgery: risk factors and preventive strategies. *Patient Saf Surg* 4, 5 (2010). <https://doi.org/10.1186/1754-9493-4-5>.
- [6] Osman Civil, Murat Burç Yazıcıoğlu, Abdullah Güneş, Short-term outcomes of a single center: Laparoscopic resection of colorectal disease, *Laparoscopic Endoscopic Surgical Science*, Cilt 26 , Sayı 2 , 2019 , Sayfalar 49-54.
- [7] Fleshman J, Branda M, Sargent DJ, et al. Effect of Laparoscopic-Assisted Resection vs Open Resection of Stage II or III Rectal Cancer on Pathologic Outcomes: The ACOSOG Z6051 Randomized Clinical Trial. *JAMA.* 2015; 314(13):1346–1355. doi:10.1001/jama.2015.10529.
- [8] van der Pas MH, Haglind E, Cuesta MA, Fürst A, Lacy AM, Hop WC, Bonjer HJ; COlorectal cancer Laparoscopic or Open Resection II (COLOR II) Study Group. Laparoscopic versus open surgery for rectal cancer (COLOR II): short-term outcomes of a randomised, phase 3 trial. *Lancet Oncol.* 2013 Mar; 14(3):210-8. doi: 10.1016/S1470-2045(13)70016-0.
- [9] Wei-Zhong Jiang, MD; Jian-Min Xu, MD; Jia-Di Xing, MD, Short-term Outcomes of Laparoscopy-Assisted vs Open Surgery for Patients With Low Rectal Cancer The LASRE Randomized Clinical Trial, *JAMA Oncol.* 2022; 8(11):1607-1615. doi:10.1001/jamaoncol.2022.4079.
- [10] Zarnescu, E.C.; Zarnescu, N.O.; Sanda, N.; Costea, R. Risk Factors for Severe Postoperative Complications after Oncologic Right Colectomy: Unicenter Analysis. *Medicina* 2022, 58, 1598. <https://doi.org/10.3390/medicina58111598>.
- [11] Climent M, Martin ST. Complications of laparoscopic rectal cancer surgery. *Mini-invasive Surg* 2018; 2:45. <http://dx.doi.org/10.20517/2574-1225.2018.62>.
- [12] Osman Civil, Murat Burç Yazıcıoğlu, Abdullah Güneş, Short-term outcomes of a single center: Laparoscopic resection of colorectal disease, *Laparosc Endosc Surg Sci* 2019; 26(2):49-54 DOI: 10.14744/less.2019.45822.
- [13] S Biondo, E Kreisler, D Fraccalvieri, E E Basany, A Codina-Cazador, H Ortiz, Risk factors for surgical site infection after elective resection for rectal cancer. A multivariate analysis on 2131 patients, *PMID*, 2012 Mar; 14(3): e95-e102.doi: 10.1111/j.1463-1318.2011.02798.x.
- [14] Mohamed H, Albendary M, Wuheb A, et al. (February 26, 2023) A Systematic Review and Meta-Analysis of Bag Extraction Versus Direct Extraction for Retrieval of Gallbladder After Laparoscopic Cholecystectomy. *Cureus* 15(2): e35493. doi:10.7759/cureus.35493.
- [15] Romain Besson, Christos Christidis, Christine Denet, Management of postoperative bleeding after laparoscopic left colectomy, *PMID*: 27270479, 2016 Aug;31(8):1431-6. doi: 10.1007/s00384-016-2612-8. *Epib* 2016 Jun 6.
- [16] Luyang Zhang*, Junjun Ma*, Lu Zang, Prevention and management of hemorrhage during a laparoscopic colorectal surgery, *Ann Laparosc Endosc Surg* 2016; 1:40, doi: 10.21037/ales.2016.11.22.
- [17] Emily F. Midura, M.D., Dennis Hanseman, Ph.D., Bradley R. Davis, M.D, Risk Factors and Consequences of Anastomotic Leak After Colectomy: A National Analysis, *Dis Colon Rectum* 2015; 58: 333–338 DOI: 10.1097/DCR.0000000000000249 © The ASCRS 2015.
- [18] Syed Nabeel Zafar, MD, MPH, Chiledum A. Ahaghotu, MD, MBA, Laura Libuit, BS, Ureteral Injury After Laparoscopic Versus Open Colectomy, *JSLS.* 2014 Jul-Sep; 18(3): e2014.00158. doi: 10.4293/JSLS.2014.00158.
- [19] Wissam J. Halabi, M.D.1 • Mehran D. Jafari, M.D.1 • Vinh Q. Nguyen, Ph.D.2, Ureteral Injuries in Colorectal Surgery: An Analysis of Trends, Outcomes, and Risk Factors over a 10-Year Period in the United States.
- [20] Jurt, J., Hübner, M., Pache, B. et al. Respiratory Complications after Colorectal Surgery: Avoidable or Fate. *World J Surg* 42, 2708–2714 (2018). <https://doi.org/10.1007/s00268-018-4699-2>.
- [21] Sujatha-Bhaskar S, Alizadeh RF, Inaba CS, Koh CY, Jafari MD, Mills SD, Carmichael JC, Stamos MJ, Pigazzi A. Respiratory complications after colonic procedures in chronic obstructive pulmonary disease: does laparoscopy offer a benefit? *Surg Endosc.* 2018 Mar; 32(3):1280-1285. doi: 10.1007/s00464-017-5805-5. *Epib* 2017 Aug 15. *PMID*: 28812150; *PMCID*: PMC6281393.
- [22] Zhai T, Zhang L, Sun J, Li Y, Hou J, Du F. Study on the Risk Factors of Pulmonary Infection after Laparoscopic Surgery and Analysis of the Detection Results of Drug-Resistant Bacteria. *J Healthc Eng.* 2022 Mar 18; 2022:6510068. doi: 10.1155/2022/6510068. *PMID*: 35340242; *PMCID*: PMC8956428.
- [23] van Eeghen, Elmer E., den Boer, Frank C., Loffeld, Ruud J. L. F., Thirty days post-operative mortality after surgery for colorectal cancer: a descriptive study.

Journal of Gastrointestinal Oncology; Vol 6, No 6
(December 01, 2015).

- [24] Henry J Lujan, Gustavo Plasencia, Moises Jacobs, Long-term survival after laparoscopic colon resection for cancer: complete five-year follow-up. PMID: 12006931, 2002 Apr; 4(4):491-501. doi: 10.1007/s10350-004-6227-8.
- [25] A Munasinghe, B Singh, N Mahmoud, Reduced perioperative death following laparoscopic colorectal resection: results of an international observational study. PMID: 25761553, 2015 Dec; 29(12):3628-39. doi: 10.1007/s00464-015-4119-8.