Original Article

Laparoscopic Management Of Right Hemicolectomy For Ascending Colon Cancer

Emad Mohammed Salah , Walid Ahmed Abd Elhady , Mohammed Abd Elmoety Selim*, Tamer Mohammed El Shahidy

Department of General Surgery, Faculty of Medicine, Zagazig University, Egypt
*Corresponding author: Mohammed Abd Elmoety Selim,
E-mail: mohammedselim19@gmail.com
DOI: 10.47750/pnr.2022.13.S10.360

Abstract

The treatment of colon cancer presents numerous challenges for the surgeon who must aim to minimize the invasiveness of surgery, achieve curative resection, and prevent port-site recurrences.

Introduction:

Laparoscopic procedures have been performed for colonicmalignancy since 1991. Initial enthusiasm for the procedure wastempered by doubts about its safety. Reports of metastatic disease in the port sites and questions regarding the adequacy of the oncologic resection lead to several large randomized controlled trials to evaluatethe merits of laparoscopic versus open colectomy for cancer **(1).**

Standard oncologic principles: which include

1. proximal ligation of the primary arterial supply,
2. adequate proximal and distal margins,
3. appropriate lymphadenectomy.
4. en bloc resection of the primary tumor and any other structures involved locally
5. lymphadenectomy with a minimum of 12 lymph nodes harvested, and ligation of the named feeding vessel at itsorigin **(2).**

Colon resections are among the most technically challenging laparoscopic procedures being performed. These techniques encompass a wide variety of procedures and approaches for lesions located from the caecum to the anal canal. Each patient must have their operation tailored to the specific circumstances surrounding their disease process. A dedicated team of physician, nurses, and technicians working in concert preoperatively, intraoperatively and postoperatively is necessary for a successful outcome. A steep learning curve for mastering these techniques exists because of the complexity of skills needed for these operations. These hurdles are not insurmountable and can be built on basic skills already familiar to the laparoscopic surgeon. An important part of developing a safe and successful laparoscopic program is skill assessments with graded complexity scales **(3).**

-General oncological principles for laparoscopic Rt colectomy:

These include

1. avoidance of tumor spill,
2. Obtaining adequate resection margins and harvesting adequatelymph node basins.
3. No touch technique
4. En bloc resection of the primary tumor and any otherstructures involved locally **(3).**

Early problems during laparoscopic colectomy necessitating conversion were related to poor instrumentation; however, innovations by surgeons and industry have led to increased technical feasibility. Most colonic tumors are amenable to excision, unless theyare fixed due to local spread. The addition of hand-related deviceshas also led to increased accessibility for colorectal procedures. These make logical sense, because a larger incision is required to remove the specimen, which can be capitalized upon for the procedure itself **(4).**

As with open surgery, the patient undergoing laparoscopic surgery should, be counseled relative to the risks, benefits, potential complications, and available alternatives. An informed consent should include a clear statement explaining the potential conversion to an open procedure, preparing the patient in the event this occurs. The surgeon should not consider this a failure, but rather an exercise in good judgment **(5).**

Preoperative preparation is the same whether laparoscopy or laparotomy planned. The standard mechanical bowel preparation is undertaken. Oral and parentral broad-spectrum antibiotic are administrated. Patients are informed about and consented forpossibility of laparotomy, use of colonoscopy, and ileostomy**. (6)**

After induction of adequate general endotracheal anesthesia, a nasogastric tube and an indwelling bladder catheter are inserted to minimize, respectively, the risk of injury to the

stomach and bladder during trocar insertion and to enhance visualization during the procedure **(7).**

Right colectomy is performed with the patient supine on the operating table; all other colonic procedures are performed in modified synchronous position with the legs in stirrups. The patient's distal sacrum is positioned at the end of the table in order to gain access for stapled colorectal anastomosis or intraoperative colonoscopy, should they be necessary **(1).**

Trocar placement is another crucial and often discounted portion of the surgery. Trocars must be placed to allow adequate access to the operative field from a fixed position and a limited range of angles. Additionally, trocars should not be placed so that the instruments interfere with one another or other anatomic restrictions. Selection of trocars must be of the proper size to allow introduction of all necessary instrumentation into the operative field. For almost all colonic procedures the first port inserted is a supraumbilical 12-mm blunt port. The trocar is inserted by a cut- down method and secured to the fascia with two sutures. This acts as the camera port throughout the procedure, and is the site subsequently extended periumbilically and used for specimen extraction. Following insufflation to a pressure of 13 mmHg, the camera is introduced and the abdominal cavity inspected. Subsequent ports are then inserted under direct vision. **(8).**

Laparoscopy is limited by the loss of tactile feedback of the involved specimen and mesentery. In addition, palpation of solidorgans to evaluate for contiguous or metastatic disease is also limited. Nevertheless, these disadvantages are offset by the benefits of laparoscopy such as providing excellent magnification and visualization with decreased tissue trauma and less blood loss. Newertechnology such as intraoperative ultrasonography may be helpful in determining the local and distant extent of disease **(9).**

-Laparoscopic Right Hemicolectomy

After the first port has been placed in either the supra or infraumbilical location, the additional 2 to 3 ports are placed on the left side, one in the left iliac fossa, one on the left paraumbilical region and the third (optional) port is used in obese or who have extensive antecedent adhesion. The surgeon stands on the patient’s left side and the assistant between the legs or next to the surgeon. The actual dissection commences by surgeon gently grasping the right colon with an atraumatic clamp inserted in the left iliac fossa, port. The surgeon right hand then uses the ultrasonic scissors (harmonic scalpel; ethiconendosurgery) to incise the line of Toldt from the right iliac fossa up tothe and around the hepatic flexure **(7).**

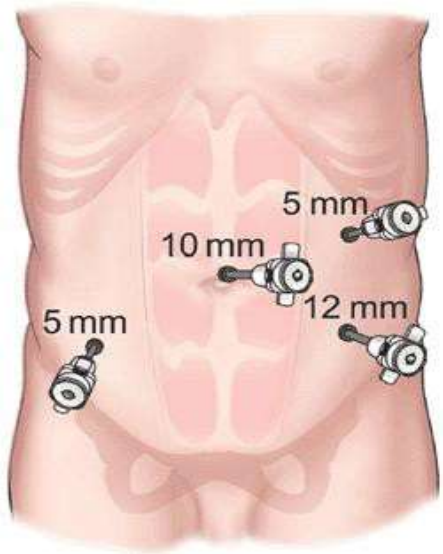

Figure (1): Port setup for right side procedures **(8).**

The gastrocolic ligament can either be taken down from the transverse colon along its avascular plane using the harmonic scalpel or by dividing it using the harmonic scalpel. The end points for this mobilization including the right ureter, the iliac vessels, the duodenum**,** head of the pancreas and the middle colic vessels **(10).**

The ileocolic artery can be divided with staples, ligation, clips, or a coagulator device such as the harmonic scalpel or the LigaSure device. Immediately superior to the duodenum is the right colic vessel either as a solitary branch or as a branch of the middle colic artery; this should be divided if a wide resection is needed **(11).**

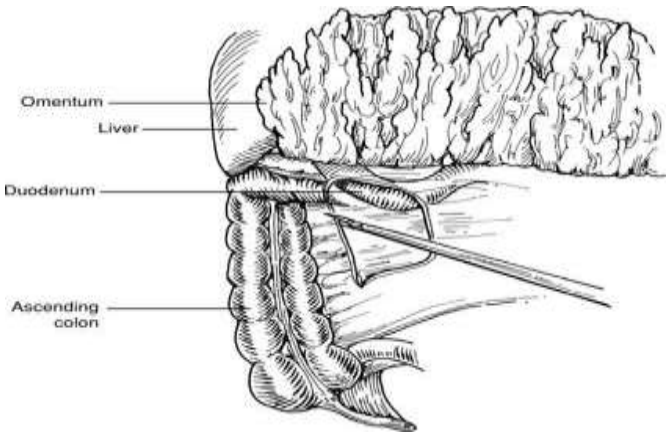

Figure (2): Medial to lateral dissection, with identification of the duodenum **(11).**

The mobilized right colon is brought up to the anterior abdominal wall. A 3- to 5-cm transverse Incision is made in the right mid-abdomen to allow the right colon to be brought up as a loop. Alternatively, the terminal ileum and transverse colon can be divided intracorporeally. This facilitates extraction of the specimen.

After resection of the colon with adequate margins, a hand- sewn or stapled anastomosis is performed. The mesenteric defect can then be closed, and the bowel is placed back into the peritoneal cavity. A total intracorporeal stapled anastomosis is possible with the instrumentation currently available, but it is somewhat time consuming **(9).**

-Laparoscopic Total Colectomy:

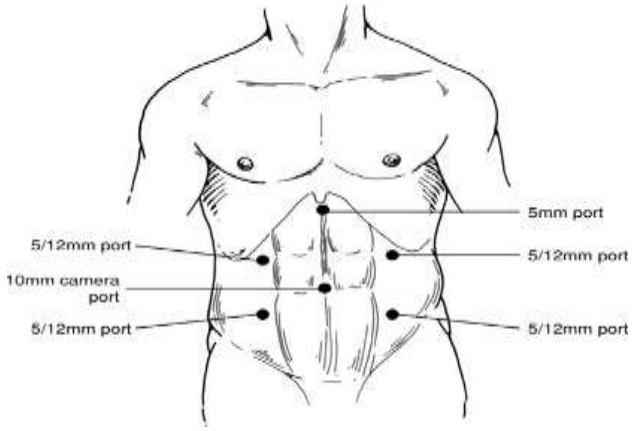

Figure (3): Trocar positioning for total colectomy **(11).**

Laparoscopic total or subtotal colectomy is probably one of the most difficult, complex and technically demanding procedures in laparoscopic colorectal surgery. This surgery requires mobilization ofthe entire colon and division of its mesentery, with management of allthe major vessels of the colon, while exposing vital structures to be wounded and working in all four quadrants of the abdomen. Several technical factors are involved in the slow acceptance of this technique, which include the necessity of a complex bowel anastomosis (often deep in the pelvis), identification and division of large blood vessels, and the need for extraction of a bulky specimen **(11).**

The abdominal colon can be divided into four segments for mobilization and resection, and in patients requiring total proctocolectomy; the rectum can be considered the fifth segment. Themost logical point at which to begin is the cecum. Therefore, the first segment to be mobilized is the cecum and the ascending colon. The second segment is the hepatic flexure and the transverse colon. The third is the splenic flexure and the descending colon, and the sigmoid colon is the fourth segment. The mesentry of the right colon shouldbe divivided

from the terminal ileum towrd the hepatic flexure**(3).**

The omentum is elevated over the top of the transverse colon to gain access to the transverse resection. The transverse colon is thenelevated and sharp dissection is carried out in the area of the mesotransverse colon until the middle colic artery is identified and isolated from surrounding tissue. Elevating the transverse colon could frequently allow staging of the vessels and facilitate the identification. This artery is then controlled and coagulated. **(3).**

The lesser sac is then entered above the superior margin of thepancreas, and dissection is carried out primarily to the left side of the transverse colon in a stepwise fashion, with care taken to identify andcontrol all vessels in the mesentery including the left colic artery **(11).**

The specimen is removed through minilaparotomy, throughan extension of the umbilical wound. The anastomosis can be created with the circular stapler or laparoscopic **(3).**

Contraindications and exclusion criteria

Absolute contraindication include intolerance of pneumoperitoneum or acutely obstructed cancer with bowel distension. Hypovolemic shock, massive acute bleeding and critical hemodynamic instability **(7).**

The main relative contraindications to laparoscopic colonic resection include intestinal obstruction, bulky tumors, cancer invasiveinto adjacent organs, and pregnancy,diffuse fecal peritonitis , a patientwith history of previous pelvic or abdominal surgery andmorbid obesity, especially in males **(Table 1) (7).**

Table (1): Contraindications to laparoscopy **(7).**

Absolute	Hypovolemic shock, massive bleeding, hemodynamicinstability. Sever cardiac disease.
Relative	Peritonitis of uncertain origin.Abdominal wall hernias. Diaphragmatic hernias. Uncorrected coagulopathies.Portal hypertension. Multiple previous surgical procedures.Late pregnancy.

Targarona et al. **(12)** measured the bony pelvis and the organs contained by means of 3-D reconstruction of the CT scan. Theyhypothesized that the volume and diameter of the prostate and tumor could limit laparoscopic dissection maneuvers, but did not influence outcome. The shape of the tumor was critical, nevertheless, because the independent factor that predicted

conversion in the overall group and in the male subgroup was the craniocaudal length of the tumor.

They also demonstrate that the anatomy of the pelvis and the pathologic characteristics play a key role in the feasibility of laparoscopic surgery for low rectal tumors and in the immediate outcome **(12).**

Patients with a body mass index of more than 30 kg/m2 wereexcluded from the Colon cancer Laparoscopic or Open Resection trial(COLOR) because at the time of trial design obesity was regarded asa technical challenge to laparoscopic colectomy **(13).**

On the other hand, **Delaney** and co-workers studied patients with a body mass index of more than 30 kg/m2 who had eitherlaparoscopic colectomy or open colectomy. The researchers found that operating times and morbidity did not differ between groups and that hospital stay was 2 days shorter after laparoscopic surgery than after open surgery. However, the conversion rate from laparoscopic surgery to open surgery was 30% **(8).**

Leroy and colleagues assessed outcome of laparoscopic colectomy in obese and non- obese patients who had colon cancer, and found that groups did not differ in operating times, radicality of resection, and morbidity. Moreover, none of the patients with a body mass index of more than 30 kg/m2 needed conversion to open surgery (**14**). Moreover, **Targarona et al.,** suggest that rectal laparoscopic surgery in the obese can be performed successfully without increasing the conversion rate or operative time **(12).**

So, patients who are obese can thus benefit from laparoscopic surgery, and obesity should no longer be regarded as a contraindication to laparoscopic colectomy **(13).**

Elderly patients were not excluded from the Colon cancer Laparoscopic or Open Resection (COLOR) trial. **Yamamoto et al.,** showed that surgical outcome after laparoscopic colectomy for patients 80–90 years old was much the same as for those 60 years or younger **(15).** Furthermore, Sklow and co- workers, reported faster recovery after laparoscopic colectomy than after open colectomy in patients older than 75 years despite a longer operating time compared with open surgery **(16).**

An additional interesting finding noted by **Targarona et al.** is the lack of relation between previous chemo-radiotherapy and conversion or longer operative time secondary to local anatomic changes induced by radiotherapy. Their findings seem to supportother studies in the open era that showed the safety of rectal surgery after radiotherapy **(12)**

Intraoperative Complications:

1) Operation time:

From the analysis of 3738 resections (1680 laparoscopic resection and 2058 conventional

open resection**), Abraham et al**. **(17)** noted that laparoscopic resection took on average 27.6% (41 min) longer to carry out than conventional open resection respectively.

Although, laparoscopic resection took longer to carry out but had an associated morbidity rate that was lower than that of conventional open resection. There was no significant difference between the two groups in perioperative mortality rates or the incidence of re-operation **(17).**

Operating time varies with surgical experience, and gaining experience with laparoscopic colectomy can reduce the operatingtime to that with open colectomy. Although in this trial, laparoscopic colectomies lasted longer than did open procedures, operating time varied substantially between cent res **(13).**

2) Mechanical Complications

These complications may occur during induction of pneumo- peritoneum, trocars introduction, and/or manipulation by traumatic graspers.

I. Extra-Peritoneal Gas Insufflation

Failure to introduce the Veress' needle into the peritonealcavity may produce extra-peritoneal emphysema. If this is recognizedearly, the gas may be allowed to escape and the needle reintroduced through the same or another site. Alternatively the trocar and cannula may be introduced by 'open laparoscopy' **(18).**

II. intraabdominal organ injury

The ove rall incidence of access-related injuries is relatively small. Large series from general surgery reported incidences below 1% **(**19**).**

Postoperative complications

1) Surgical site infection

Colorectal operations are, at best, clean-contaminated procedures, and at times there is contamination of both the peritoneal cavity and the surfaces of the surgical wound. **(20).**

2) Anastomotic leakage

Anastomotic leakage is the most serious complication specificto intestinal surgery and ranges from 2.9% to as high as 15.3%. At least one third of the mortality after colorectal surgery is attributed to leaks **(21)**.

3) Postoperative bleeding

In general postoperative bleeding after colorectal proceduresis a rare complication. The risk depends on the performed surgical procedure, the co-morbidities of the patient and in individual cases onan impaired clotting system. **(20).**

4) Ileus

Postoperative ileus has long been considered an inevitableconsequence of gastrointestinal surgery. It prolongs hospital stay,increases morbidity, and adds to treatment costs. **(21)**.

References:

1. **Lawes DA and Young-Fadok TM.** Laparoscopic Resection for Carcinoma of the Colon. In: Mastery of Endoscopic and Laparoscopic Surgery: Indications and Techniques. Soper N.J., Swanstrom L.L., Eubanks S. et al. (Eds), 3rd edn, Lippincott Williams & Wilkins, 2019; pp. 480-489.
2. **Young-Fadok, T. M., Fanelli, R. D., Price, R. R., & Earle, D. B.** Laparoscopic resection of curable colon and rectal cancer: an evidence-based review. Surgical endoscopy, 2007,21, 1063-1068.
3. **Richard L. Drake and Jennifer M. McBride :**surgery of the colon. In: (editor) Josef E. Fischer: fischer‟s mastery of surgery.6th edition. Lippincott Williams&Wilkins, 2012.ch7:P1594-1848.
4. **Paraskeva PA, Aziz O and Darzi A**. Laparoscopic surgery for colon cancer. Surg Clin N Am, 2015; 85(6): 49-60.
5. **Potenti FM and Wexner SD.** Laparoscopy for benign colonic disease in Surgical Laparoscopy by Zucker K A. Lippincott Williams & Wilkins 2001; p 255-272.
6. **Ambe PC1,2, Zarras K3, Stodolski M4, Wirjawan I4, Zirngibl H4.** Routine preoperative mechanical bowel preparation .World J Surg Oncol. 2019 ; 16:17-20.
7. **Waxner SD and Oikonomakis IN.** Basic principles of laparoscopic colonic surgery. In: Laparoscopic Surgical Oncology. Pappas T.N. Leandros E.A., Bramis J.P. (Eds), Paschalidis Medical Publications, 2016; pp. 47-52.
8. **Delaney CP, Neary PC, Alexander G.** instrumentatoin and setup, operative procedures. In: operative techniques inlaparoscopic colorectal surgery, 1st edition, LippincottWilliams and Wilkins, 2017, (3)5-11, (5)67-70**.**
9. **Ing RD, Jacobs M and Plasencia G.** Laparoscopic colectomy for colon cancer. In: Surgical Laparoscopy. Zucker K.A. (Ed), 6th edition, Lippincott Williams & Wilkins, 2014; ch. 21, pp. 245-254.
10. **Fujita J, Uyama I and Sugioka A.** Laparoscopic right hemicolictomy with radical lymph node dissection using the non-touch isolation tichnique for advanced colon cancer.Surg Today, 2001; 31: 93-96.
11. **Franklin ME, Treviño JM and Whelan RL.** Laparoscopic Right, Left, Low Anterior, Abdominoperineal, and Total Colon Resections. In: Mastery of Surgery, Fischer, Josef E. (Eds), 5th edn. Lippincott Williams & Wilkins, 2017; pp. 1490- 1509.
12. **Targarona EM, Balague C and Pernas JC.** Can We Predict Immediate Outcome After Laparoscopic Rectal Surgery? Multivariate Analysis of Clinical, Anatomic, and Pathologic Features after 3-Dimensional Reconstruction of the Pelvic Anatomy. Lippincott Williams & Wilkins, 2018; 247: 642- 649.
13. **Bonjer HJ, Deijen CL, Abis GA, Cuesta MA, van der Pas MH, de Lange-de Klerk ES, Lacy AM, Bemelman WA, Andersson J, Angenete E, Rosenberg J, Fuerst A and Haglind E. COLOR II Study**

Group. A randomized trial of laparoscopic versus open surgery for rectal cancer. N Engl J Med 2015; 372: 1324-1332.

14. **Leroy, J., Ananian, P., Rubino, F., Claudon, B., Mutter, D., & Marescaux, J.** The impact of obesity on technical feasibility and postoperative outcomes of laparoscopic left colectomy. Annals of surgery, 2005, 241(1), 69.
15. **Yamamoto, S., Fujita, S., Akasu, T., Ishiguro, S., Kobayashi, Y., & Moriya, Y.** Wound infection after elective laparoscopic surgery for colorectal carcinoma. Surgical endoscopy,2007. 21, 2248-2252.
16. **Sklow B, Read T and Birnbaum E.** Age and type of procedure influence the choice of patients for laparoscopic colectomy. Surg Endosc, 2013; 17: 923–29.
17. **Abraham N, Byrne CM and Young JM.** Clinical review: Meta- analysis of non-randomized comparative studies of the short-term outcomes of laparoscopic resection for colorectal cancer. ANZ J. Surg, 2007; 77: 508–516.
18. **Winslow ER, Menzies D and Birnbaum EH.** Woundcomplications of laparoscopic vs open colectomy. Surg Endosc, 16, 2012: 1420–1425.
19. **Sasmal PK, Tantia O, Jain M, Khanna S, Sen B.** Primary access- related complications in laparoscopic cholecystectomy via the closed technique: experience of a single surgical team over more than 15 years. Surg Endosc. 2019 ;23(11):2407- 15.
20. **Vahagn C. Nikolian, MD, Neil S. Kamdar, MA, Scott E.Regenbogen, MD, MPH, Arden M. Morris, MD,MPH, John C. Byrn, MD, Pasithorn A. Suwanabol,MD, Darrell A. Campbell, Jr, MD,and Samantha Hendren, MD, MPH**. Anastomotic Leak after Colorectal Resection: A Population-Based Study of Risk Factors and Hospital Variation**.** Surgery. 2017 Jun; 161(6): 1619–1627.
21. **Agha A, Benseler V, Hornung M, et al.** Long-term oncologic outcome after laparoscopic surgery for rectal cancer. Surg Endos 2014; 28:1119–1125.