

Laparoscopic Rectal Resection for Rectal Cancer

¹*Nidal Issa

¹Eden Shlomobitz

¹Department of Surgery Hashron Hospital Rabin Medical Center, and the Sackler School of Medicine Tel-Aviv University, Israel

Abstract

The introduction of laparoscopy in the last three decades has revolutionized the area of colorectal surgery. Laparoscopy is considered the technique of choice for colon cancer resection; however, despite improving early postoperative outcomes, the laparoscopic rectal resection has not established its superiority over the open technique in all the parameters.

Introduction

The incidence of colorectal cancer (CRC) in the United States has declined over the past decade. However, analysis of site of CRC reveals that, when compared to cancer of the proximal and distal colon, the reduction in the incidence of rectal cancer is relatively low. In fact, for individuals aged <50 years a 2% average annual percent increase has been observed. Moreover, rectal cancer, while being the second most common site of CRC overall, is the most common site for patients under 65 years of age.

While the role of neoadjuvant chemoradiation protocols have contributed to the improved prognosis of rectal cancer and reduced morbidity rates surgery remains the mainstay of treatment for rectal cancer.

Since Miles first described the abdominoperineal resection (APR) for treatment of rectal cancer in 1908 [1] much progress has been made. The first great step forward in modern surgery for rectal cancer has traditionally been attributed to the description of the total mesorectal excision (TME) by Heald in 1982 [2]. In this procedure en bloc clearance of the rectal mesentery, including its blood supply and lymphatic channels is carried out. TME lowered recurrence rates from approximately 30% with APR to around 6% [3]. Use of meticulous nerve-sparing techniques has lowered complication rates substantially. However dysfunction involving urinary and fecal continence as well as sexual dysfunction remain significant issues affecting up to 20% of patients [3].

The next step occurred with the proliferation of routine use of laparoscopic techniques. Ever since Jacobs' landmark study in 1991 [4] laparoscopic surgery for colon cancer has been extensively studied with near universal concurrence that, when compared to open surgery, short-term outcomes are improved with no difference in long-term morbidity or oncological outcomes. Short term benefits include reduced post-operative pain, decreased blood loss, faster recovery of bowel functions, reduced hospital stays and faster return to normal activities following discharge [5-7].

Rectal cancer, however, remains an outlier with fewer studies confirming the advantage of laparoscopy. Morbidity following rectal surgery can be substantial when compared to other colectomies as there is an ever present risk to urinary and fecal continence as well as to sexual function if dissection is not carried out in appropriate anatomical planes when performing operations within the pelvis. Additionally, the effects of neoadjuvant chemoradiation therapy as well as operating within the confines of the pelvis may increase the complexity of these operations.

Preoperative Preparation

As with all clinical scenarios, a thorough history and physical examination are the cornerstone for decision making. A history should include both cancer-specific questions as well as information regarding other comorbid conditions such as cardiac or respiratory diseases as these may have anesthesiological and surgical implications. An overall assessment of the patient's functional status should be performed to determine their fitness for surgery.

A detailed family history is imperative to rule out familial/hereditary syndromes. If a suspicion arises regarding the presence of a syndrome genetic counselling and testing should be carried out.

Routine blood tests, including complete blood cell counts, liver function tests, and a chemistry panel should be performed as indicated in preparation for general anesthesia.

Article Information

DOI: 10.31021/ijsp.20192125

Article Type: Review Article

Journal Type: Open Access

Volume: 2 **Issue:** 1

Manuscript ID: IJSP-2-125

Publisher: Boffin Access Limited

Received Date: 11 November 2019

Accepted Date: 20 November 2019

Published Date: 22 November 2019

*Corresponding author:

Nidal Issa,

Department of Surgery,
Hashron Hospital Rabin Medical Center, and the
Sackler School of Medicine,
Tel-Aviv University,
E-mail: nidalissa@clalit.org.il

Citation: Issa N, Shlomobitz E. Laparoscopic Rectal Resection for Rectal Cancer. Int J Surg Proced. 2019 Nov;2(1):125

Copyright: © 2019 Issa N, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 international License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Carcinoembryonic Antigen (CEA) levels should be obtained as a baseline to allow for future surveillance of disease recurrence.

Digital rectal exam (DRE) and rectoscopy should be performed by the operating surgeon to precisely determine tumor size, distance from anal verge and the possibility of a sphincter sparing procedure. Full colonoscopy should be performed in all patients to rule out synchronous tumors and polyps which can exist in up to 3% and 30% of patients, respectively [8]. Additionally, in cases where the tumor is poorly palpable it should be tattooed during colonoscopy.

Imaging modalities should be used for both local and distant staging. Trans-Rectal Ultrasound (TRUS) and Magnetic Resonance Imaging (MRI) are both options for local disease staging. As there are advantages and disadvantages for each modality neither is the clear cut gold standard and indeed some physicians use both for improved accuracy [8-11]. For distant metastases a CT of the chest and abdomen should be obtained as the liver and lungs are the most common sites of distant disease spread. The role of FDG-PET is still evolving due to high levels of false-positive results.

Neoadjuvant

The indications for neoadjuvant chemoradiotherapy remains an ongoing debate. In general, disease stages T3-4N0M0 as well as T1-4N1-2M0 will benefit from neoadjuvant therapy.

Two main treatment strategies exist, Short-Course Radiotherapy (SCRT) for 5 days without chemotherapy followed by surgery within 1 week and "long-course" preoperative chemoradiotherapy (LCRT) for 5 to 6 weeks with concurrent administration of 5-fluorouracil-based chemotherapy followed by surgery 8 to 12 weeks later. A meta-analysis showed that the addition of chemotherapy to preoperative radiation significantly increased acute toxicity while no differences were observed in postoperative morbidity or mortality. It increased the rate of complete pathological response without a higher sphincter preservation rate. Local recurrence at five years was significantly lower in the chemotherapy group compared to radiation alone although no statistically significant differences were observed in DFS or OS [12]. Lacking clear cut data and with many trials ongoing, decisions regarding treatment protocols should be made based on local experience and expertise.

Surgical treatment

Planning the curative surgical resection of a malignant rectal tumor should include two main, albeit occasionally contradictory, goals. First, complete removal of the tumor and regional lymph nodes with adequate negative margins in order to increase the chance of achieving cure. Second, preservation of sphincter function, fecal and urinary continence and sexual function. In order to maximize both of these goals a multi-disciplinary team consisting of specialized surgeons, oncologists and radiologists should be involved in planning the operation and neoadjuvant therapy when indicated while ensuring the patient is well aware of the risks involved in rectal resection.

Successful resection is defined by adequate free margins including proximal, distal and circumferential margins. This principle should be preserved even in cases where sphincter preservation is not possible as the chance at achieving cure takes precedent. Careful dissection within the plane between the fascia propria and the presacral fascia follows the principles of surgical oncology and minimizes the risk for vascular or neural injuries. It is imperative to preserve the hypogastric nerves and the pelvic plexus and its subdivisions to prevent neurogenic bladder and sexual dysfunction.

Surgical technique

The patient is placed in the Lloyd-Davies position with slightly rotated to the right and in Trendelenburg position. Port positioning varies according to surgeon's preference, we usually use four ports.

Three 5-mm ports and one or one 10-12 mm ports are used. The optical port is placed on the right of the umbilical area.

After exploration of the abdominal cavity, the first step is ligation of the mesenteric vessels, then mobilization of the left and sigmoid colon by medial to lateral approach technique, with careful identification and preservation of left ureter. The procedure proceeds to the dissection of the rectum and excision of the mesorectum through the Holly plane between the presacral fascia and the posterior mesorectal fascia. After completion of the mesorectal excision laterally and anteriorly, the rectum can be divided with a stapling device, leaving enough distal margin from the tumor (2 cm). Special attention for preservation of the mesorectum, nerves and vessels is required during the mesorectal excision. A left Mc Burney incision is our preference for extraction of the specimen. With the help of wound protector the sigmoid colon is transected and an envil is placed in the remaining proximal segment. The anastomosis is then performed under laparoscopic guidance with the circular stapler. Anastomotic leak testing was performed by water leak testing (using water down iodine solution) or air leak testing.

Laparoscopic vs open rectal surgery

In laparoscopic surgery, when compared to open surgery, optic instruments provide a clear and magnified view of pelvic structures including the parietal and visceral fascia of the meso rectum and allow the surgeon to complete a meticulous dissection along the correct anatomical plane [13]. Due to the utmost importance of complete TME for survival following surgery for rectal cancer [2,3,14], any technique that allows the surgeon an improved chance at achieving this goal should be used. However, laparoscopic TME (l-TME) remains a challenging technique and requires an extensive learning curve with 50-150 procedures needed to gain proficiency [15].

Short-Term Outcomes

While short-term outcomes are generally superior in laparoscopic surgery when compared to open the complexity and challenge of rectal operations require us to examine these results in the specific context.

The COREAN trial is a multi-center RCT performed in Korea, which randomized 340 patients with cT3N0-2 mid or low rectal cancer without distant metastasis after preoperative chemoradiotherapy to open or laparotomy arms with a 1:1 ratio. Surgery time was significantly shorter in the open group (197 vs. 245 min.) and there was less estimated blood loss during open surgery. These data, however, did not translate into worse clinical outcomes as there was no difference in need for blood transfusions or perioperative complications. Moreover, return of normal bowel function was significantly faster in the laparoscopic group while postoperative hospital stay was non-significantly reduced. Three months after surgery quality of life questionnaires revealed improved physical function and less fatigue following laparoscopy compared to open. Likewise there were significantly fewer micturition, GI and defecation problems in the laparoscopic group [16]. Likewise the COLOR II trial showed superior short-term results for the laparoscopic group. While laparoscopic procedures took longer in this trial there was less blood loss during laparoscopic procedures. Return of bowel function and return to oral intake were quicker and hospital stay was shorter in the laparoscopic group. There were no significant differences in operative complications, readmission or postoperative morbidity and mortality [17].

A recent meta-analysis, which included 38 studies (13 RCTs) with a total of 13408 patients, was conducted to compare outcomes between laparoscopic and open rectal resection. While operative times were significantly longer for laparoscopy, estimated blood loss was significantly reduced. They found no significant difference in intraoperative complications. Postoperatively, time to first bowel movement, length of hospital stay, postoperative complications and mortality were all reduced in the laparoscopic group [18].

Oncological Outcomes

While the short-term benefits of laparoscopic surgery are well established, the main detriment to implementing laparoscopic techniques as the first-line option for curative rectal surgery was a concern over long-term oncological outcomes. Many RCTs have since been conducted in order to examine this issue.

The MRC CLASICC trial compared laparoscopic to open procedures for all colorectal cancer surgeries. While early results were slightly discouraging, with regard to rectal cancer, due to non-significantly elevated circumferential resection margin (CRM) positivity in the laparoscopic group compared to open leading to concern that disease free survival (DFS) and overall survival (OS) might be affected. However, their 10 year analysis (median follow-up of 63 months) revealed no difference in DFS or OS between open and lap groups. Additionally, no differences were observed in distant recurrence rates [13].

A large RCT dedicated to comparing lap to open resection for stage II/III rectal cancer, the ACOSOG-Z6051 trial, showed similar results. Early data failed to show non-inferiority of lap resection with regard to pathological outcomes, i.e. increased positive CRM. However, after a median follow up of 48 months both DFS and local recurrence were not statistically different between lap and open resection [19].

A similarly designed trial, the ALaCaRT Randomized Clinical Trial, showed nearly identical results with a failure to demonstrate non-inferiority regarding pathological outcomes. Here too, however, no difference between laparoscopy and open were noted in local recurrence, DFS or OS [20,21].

Contrary to these studies the COREAN trial reported no difference in pathological outcomes. CRM positivity, macroscopic quality of the TME specimen and the number of harvested lymph nodes were all similar between the lap and open groups [16]. Two year follow-up then confirmed that DFS was also similar [22].

Another large trial including over 1000 patients, the COLOR II trial, showed results similar to the COREAN trial. There was no statistically significant difference between lap and open groups when assessing completeness of resection, CRM positivity, number of lymph nodes harvested or median tumor distance to distal resection margin. After 3-year follow-up DFS, OS, local recurrence and distant metastases were similar for both open and lap groups [17,23].

A recent meta-analysis which included 14 RCTs found a significantly higher rate of incomplete TME in the laparoscopic group compared to open. Other variables, including, CRM positivity, number of lymph nodes harvested, involvement of distal margins and distance to margins were not significantly different [24].

Taken together these data show that although surgical quality may be slightly compromised this does not translate to adverse clinical outcomes. As surgeons become more adept at L-TME and the procedure becomes further standardized it stands to reason that pathological results will continue to improve. However, it still remains to be seen whether this will be evident in future studies. Moreover, many of the RCTs were not standardized regarding neoadjuvant therapy and tumor location. As these variables inevitably effect surgical quality it is imperative to specifically design studies for to analyze their effects.

In summary, while there is some evidence that pathological outcomes following laparoscopic surgery may be compromised, long-term follow-up does not show adverse clinical results.

Other Laparoendoscopic Techniques

More recent advances in laparoscopic technique have been developed, including the adaptation of single-incision laparoscopic surgery (SILS) to rectal surgery. This technique offers reduced pain and hospitalization times as well as superior aesthetic results. First described for use in colorectal surgery in 2008 [25], this technique has been studied in a number of papers. While showing promising

results in experienced hands widespread use has been limited due to extended learning curves as well as technical and ergonomic challenge [26,27]

Another technological advancement being applied to rectal surgery is the use of robotics. The first reports of robotic TME (r-TME) for rectal cancer in 2006 showed no difference in outcomes while providing technical advantages such as very precise dissection in the confined pelvic space, and three-dimensional imaging [28]. Robotic systems include instruments with much greater range of motion, multi-articulated instruments allow for a large range of angles to be achieved during dissection. The camera system provides a three dimensional magnified view controlled by the surgeon allowing greater visualization. These inherent features are extremely important when operating within the confines of the pelvis where precise dissection is required. Moreover, surgeons experience less physical strain and assume a more ergonomic position when operating robotically as opposed to laparoscopically [29-33].

The main limitations of robotic surgery include the lack of tactile sensation and tensile feedback. This requires the surgeon to rely on visual cues alone in order to assess the correct amount of force needed for traction thereby increasing the risk of inadvertent tissue damage. Additionally the docking and separation of the robotic cart may be time consuming resulting in longer operative times. Finally, high costs limit the availability of these systems in many centers.

A further attempt to improve short-term outcomes is utilization of natural orifice transluminal endoscopic surgery (NOTES) techniques. A trans-anal total mesorectal excision (TaTME) procedure has been developed. Sylla *et al.* [34] first reported the use of this procedure on a living human in 2010 [34]. While this procedure is still in its early stages and high-quality RCTs are still ongoing, preliminary results show promise. A recent meta-analysis showed significant advantage of TaTME vs. laparoscopy regarding circumferential resection margin involvement, operative time, blood loss, conversion, hospital stay, overall postoperative complications, and readmission. However, it is important to note that the published data is retrospective and the studies were performed by expert surgeons at high-volume centers [35-37]. Further study is still needed to assess whether this promising technique should be widely adopted.

References

1. Miles WE. A method of performing abdomino-perineal excision for carcinoma of the rectum and of the terminal portion of the pelvic colon (1908). *CA Cancer J Clin.* 1971 Nov-Dec;21(6):361-364.
2. Heald RJ, Husband EM, Ryall RD. The mesorectum in rectal cancer surgery--the clue to pelvic recurrence. *Br J Surg.* 1982 Oct;69(10):613-616.
3. Ridgway PF, Darzi AW. The role of total mesorectal excision in the management of rectal cancer. *Cancer Control.* 2003 May-June;10(3):205-211.
4. Jacobs M, Verdeja JC, Goldstein HS. Minimally invasive colon resection (laparoscopic colectomy). *Surg Laparosc Endosc.* 1991 Sep;1(3):144-150.
5. Strohlein MA, Gruzner KU, Jauch KW, Heiss MM. Comparison of laparoscopic vs. open access surgery in patients with rectal cancer: a prospective analysis. *Dis Colon Rectum.* 2008 Apr;51(4):385-391.
6. Zaharie F, Ciorogar G, Zahari R, Mocan T, Zdrehus C, et al. Laparoscopic rectal resection versus conventional open approach for rectal cancer - a 4-year experience of a single center. *J BUON.* 2015 Nov-Dec;20(6):1447-1455.
7. Chan DK, Chong CS, Lieske B, Tan KK. Laparoscopic resection for rectal cancer: what is the evidence? *Biomed Res Int.* 2014 Mar;347810.
8. Monson JR, Weiser MR, Buie WD, Chang GJ, Rafferty JF. Practice Parameters for the Management of Rectal Cancer (Revised). *Diseases of the Colon & Rectum.* 2013 May;56(5):535-550.

9. Yahya JB, Farrell MJ, Herzig DO, Degnin CR, Chen Y, et al. Preferential use of imaging modalities in staging newly diagnosed rectal cancer: a survey of US radiation oncologists. *J Gastrointest Oncol*. 2018 Jun;9(3):435-440.
10. Muthusamy VR, Chang KJ. Optimal methods for staging rectal cancer. *Clin Cancer Res*. 2007 Nov;13(22):6877s-6884s.
11. Bipat S, Glas AS, Slors FJ, Zwinderman AH, Bossuyt PJ, et al. Rectal cancer: local staging and assessment of lymph node involvement with endoluminal US, CT, and MR imaging--a meta-analysis. *Radiology*. 2004 Sep;232(3):773-783.
12. Ceelen WP, Van Nieuwenhove Y, Fierens K. Preoperative chemoradiation versus radiation alone for stage II and III resectable rectal cancer. *Cochrane Database Syst Rev*. 2013 Feb;28(2):Cd006041.
13. Green BL, Marshall HC, Collinson F, Quirke P, Guillou P, et al. Long-term follow-up of the Medical Research Council CLASICC trial of conventional versus laparoscopically assisted resection in colorectal cancer. *Br J Surg*. 2013 Jan;100(1):75-82.
14. Nagtegaal ID, van Krieken JH. The role of pathologists in the quality control of diagnosis and treatment of rectal cancer--an overview. *Eur J Cancer*. 2002 May;38(7):964-972.
15. Kayano H, Okuda J, Tanaka K, Kondo K, Tanigawa N. Evaluation of the learning curve in laparoscopic low anterior resection for rectal cancer. *SurgEndosc*. 2011 Sep;25(9):2972-2979.
16. Kang SB, Park JW, Jeong SY, Nam BH, Choi HS, et al. Open versus laparoscopic surgery for mid or low rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): short-term outcomes of an open-label randomised controlled trial. *Lancet Oncol*. 2010 Jun;15(7):767-774.
17. vander Pas MH, Haglind E, Cuesta MA, Furst A, Lacy AM, et al. Laparoscopic versus open surgery for rectal cancer (COLOR II): short-term outcomes of a randomized, phase 3 trial. *Lancet Oncol*. 2013 Mar;14(3):210-218.
18. Zheng J, Feng X, Yang Z, Hu W, Luo Y, Li Y. The comprehensive therapeutic effects of rectal surgery are better in laparoscopy: a systematic review and meta-analysis. In *Oncotarget*. 2017 Feb;8(8):12717-12729.
19. Fleshman J, Branda ME, Sargent DJ, Boller A, George VV, et al. Disease-free Survival and Local Recurrence for Laparoscopic Resection Compared With Open Resection of Stage II to III Rectal Cancer: Follow-up Results of the ACOSOG Z6051 Randomized Controlled Trial. *Ann Surg*. 2019 Apr;269(4):589-595.
20. Stevenson ARL, Solomon MJ, Brown CSB, Lumley JW, Hewett P, et al. Disease-free Survival and Local Recurrence After Laparoscopic-assisted Resection or Open Resection for Rectal Cancer: The Australasian Laparoscopic Cancer of the Rectum Randomized Clinical Trial. *Ann Surg*. 2019 Apr;269(4):596-602.
21. Stevenson AR, Solomon MJ, Lumley JW, Hewett P, Clouston AD, Gebiski VJ, et al. Effect of Laparoscopic-Assisted Resection vs Open Resection on Pathological Outcomes in Rectal Cancer: The ALaCaRT Randomized Clinical Trial. *JAMA*. 2015 Oct;314(13):1356-1363.
22. Jeong SY, Park JW, Nam BH, Kim S, Kang SB, et al. Open versus laparoscopic surgery for mid-rectal or low-rectal cancer after neoadjuvant chemoradiotherapy (COREAN trial): survival outcomes of an open-label, non-inferiority, randomized controlled trial. *Lancet Oncol*. 2014 Jun;15(7):767-774.
23. Bonjer HJ, Deijen CL, Haglind E, Group CIS. A Randomized Trial of Laparoscopic versus Open Surgery for Rectal Cancer. *N Engl J Med*. 2015 Apr;372(14):1324-1332.
24. Martinez-Pere A, Carra MC, Brunetti F, deAngelis N. Pathologic Outcomes of Laparoscopic vs Open Mesorectal Excision for Rectal Cancer: A Systematic Review and Meta-analysis. *JAMA Surg*. 2017 Apr;152(4):e165665.
25. Remzi FH, Kirat HT, Kaouk JH, Geisler DP. Single-port laparoscopy in colorectal surgery. *Colorectal Dis*. 2008 Oct;10(8):823-826.
26. Keller DS, Haas EM. Single-Incision Laparoscopic Colon and Rectal Surgery. *Clin Colon Rectal Surg*. 2015 Sep;28(3):135-139.
27. Madhoun N, Keller DS, Haas EM. Review of single incision laparoscopic surgery in colorectal surgery. *World J Gastroenterol*. 2015 Oct 14;21(38):10824-10829.
28. Pigazzi A, Ellenhorn JD, Ballantyne GH, Paz IB. Robotic-assisted laparoscopic low anterior resection with total mesorectal excision for rectal cancer. *SurgEndosc*. 2006 Oct;20(10):1521-1525.
29. Lim DR, Bae SU, Hur H, Min BS, Baik SH, Lee KY, Kim NK. Long-term Oncological outcomes of robotic versus laparoscopic total mesorectal excision of mid-low rectal cancer following neoadjuvant chemoradiation therapy. *SurgEndosc*. 2017 Apr;31(4):1728-1737.
30. Baek SJ, Kim CH, Cho MS, Bae SU, Hur H, et al. Robotic surgery for rectal cancer can overcome difficulties associated with pelvic anatomy. *SurgEndosc*. 2015 Jun;29(6):1419-1424.
31. Hellan M, Ouellette J, Lagares-Garcia JA, Rauh SM, Kennedy HL, et al. Robotic Rectal Cancer Resection: A Retrospective Multicenter Analysis. *Ann Surg Oncol*. 2015 Jul;22(7):2151-2158.
32. Park S, Kim NK. The Role of Robotic Surgery for Rectal Cancer: Overcoming Technical Challenges in Laparoscopic Surgery by Advanced Techniques. *J Korean Med Sci*. 2015 Jul;30(7):837-846.
33. Kim NK, Kang J. Optimal Total Mesorectal Excision for Rectal Cancer: the Role of Robotic Surgery from an Expert's View. *J Korean Soc Coloproctol*. 2010 Dec;26(6):377-387.
34. Sylla P, Rattner DW, Delgado S, Lacy AM. NOTES transanal rectal cancer resection using transanal endoscopic microsurgery and laparoscopic assistance. *SurgEndosc*. 2010 May;24(5):1205-1210.
35. Wu Z, Zhou W, Chen F, Wang W, and Feng Y. Short-term Outcomes of Transanal versus Laparoscopic Total Mesorectal Excision: A Systematic Review and Meta-Analysis of Cohort Studies. *J Cancer*. 2019 Jan;10(2):341-354.
36. Piatkowski J, Jackowski M, Nowak M, Szeliga J. (2019) TaTME: 2 Years of Experience of a Single Center. *Surg Laparosc Endosc Percutan Tech*. 2019 Feb;29(1):64-68.
37. Vignali A, Elmore U, Milone M, Rosati R. Transanal total mesorectal excision (TaTME): current status and future perspectives. *Updates Surg*. 2019 Mar;71(1):29-37.