Short-term assessment of the safety and efficacy of laparoscopic versus open abdominoperineal resection for treatment of low rectal cancer: a prospective randomized trial

Mohamad Elrefai, Ehab Elhanafy, Ehab Atef, Mohamed Elharoun, Helmy Ezzat

Gastrointestinal Surgical Center, Department of Surgery, Mansoura University, Egypt

Correspondence to Mohamad Elrefai, MD, Geehan Street, Gastrointestinal Surgery Center, Mansoura, Egypt. Tel: +201001977233; e-mail: mohelrefai@hotmail.com

Received: 12 November 2020
Revised: 20 December 2020
Accepted: 20 December 2020
Published: 11 January 2022

The Egyptian Journal of Surgery 2021, 40:755–759

Background
Laparoscopy has been widely applied for colorectal cancer surgery. Many studies have demonstrated that laparoscopy is safe and feasible for colon cancer. Recently, several studies compared laparoscopic abdominoperineal resection (LAPR) and open abdominoperineal resection for rectal cancer, but the results may differ from each other.
This study was conducted to evaluate the safety and oncological efficacy of LAPR compared with the conventional open procedure.
Setting
Gastro-Intestinal Surgical Center, Mansoura University, Egypt.
Patients and methods
This is a prospective randomized trial conducted in the period between January 2017 and March 2019. A total of 60 patients diagnosed with low rectal cancers were included in this study. Patients were randomly allocated into two groups: group A included 30 cases who underwent the open procedure, and group B included the other 30 cases who underwent the laparoscopic technique.
Both groups were compared in terms of operative time, blood loss, pain control, hospital stay, as well as early and late complications.
Results
Our data showed that LAPR resulted in early return to bowel functions expressed as early nasogastric tube removal, oral intake, flatus passage, and less postoperative pain.
Moreover, LAPR is associated with fewer postoperative complications, especially abdominal wound infections and paralytic ileus.
Conclusion
LAPR is a safe and feasible procedure that reduces postoperative complications and leads to faster postoperative recovery, lesser use of analgesia, and shorter hospital stay. In addition, LAPR is not inferior to open abdominoperineal resection in terms of oncological clearance as it offers better chance for harvesting more dissected lymph nodes.

Keywords:
abdominoperineal resection, laparoscopic, rectal cancer

Egyptian J Surgery 40:755–759

1110-1121

Background

Cancer of the rectum, defined as a malignant tumor within 15 cm from the anal verge, which accounts for ~30% of all colorectal malignancies [1].

It is now generally accepted that surgical resection with total mesorectal excision (TME) is the optimal therapeutic procedure for low or midrectal cancer. The key aspect is the extent of distal mesorectal spread, which has been recently reported to be up to 3 cm below the distal margin of the tumor [2].

Since 1982 when Heald *et al.* [3] and MacFarlane *et al.* (1993) [4] published their paper, TME has been implemented as the gold standard for rectal cancer surgery. In recent decades, abdominoperineal resection (APR) has been advocated as the standard surgical procedure for very low rectal cancer. Minimally invasive surgical techniques have been applied to abdominal surgery in the last few decades.

Multicenter studies and meta-analyses comparing laparoscopic with open surgical treatment of colonic cancer have demonstrated short-term advantages for the laparoscopic approach, including less postoperative pain, rapid recovery of intestinal function, and short length of hospital stay [5].

 DOI: 10.4103/ejs.ejs_332_20

Regarding the role of laparoscopy in rectal cancer surgery, outcomes are more inside of laparoscopic surgical techniques for several reasons. First, the anatomical position of the rectum makes access more difficult in the open technique; second, TME can be easier with laparoscopic approach, which is important for reducing local recurrence and improving survival. Last, laparoscopy enables better visualization and thus preservation of the autonomic nerves and sphincter apparatus is to maintain bladder, sexual function, and continence, which represent important aspects of quality of life after surgery [6].

This study is aimed to evaluate the outcomes of laparoscopic abdominoperineal resection (LAPR) compared with open procedure [open abdominoperineal resection (OAPR)] in multimodality management of low rectal cancer.

Patients and methods

This is a prospective randomized comparative study between LAPR and OAPR for lower rectal carcinoma in the period between January 2017 and March 2019 in Gastro-intestinal Surgical Center (GISC), Mansoura University, Egypt.

The medical records of patients were reviewed using computerized APR operation sheet, including all preoperative, intraoperative, and postoperative variables for each patient. The study was approved by the local ethical committee. An informed written consent was signed by all patients, after complete explanation of the idea of the study, along with the benefits and drawbacks of each procedure.

Sixty patients diagnosed with low rectal cancer (<5 cm from anal verge) were included in the study. Patients were randomly allocated into two groups: group A that included 30 cases who underwent OAPR (group A), and group B that included the other 30 cases who underwent LAPR (group B). No significant preoperative difference was noted between both groups. Demographic data are shown in Table 1.

Exclusion criteria included patients with distant metastasis, extracolonic invasion, and emergency-operation cases (bowel obstruction or intestinal perforation).

Both groups were compared in terms of operative time, blood loss, blood transfusion, hospital stay, as well as early and late postoperative complications.

Table 1 Demographic data of the cases in the two study groups

	Group A *N*=30	Group B *N*=30	*P*
Age	58.5 (35–77)	46(29–63)	0.009
BMI	31.06 (25–40)	28.5 (19.4–40)	0.073
Sex [*n* (%)]			
Male	12 (40)	15 (50)	0.096
Female	18 (60)	15 (50)	
Smoking [*n* (%)]	2 (6.7)	3 (10)	0.661
DM [*n* (%)]	4 (13.3)	3 (10)	0.661
HTN [*n* (%)]	4 (13.3)	3 (10)	

DM, diabetes mellitus; HTN, hypertension.

Routine preoperative laboratory, radiological, and endoscopic assessment were done for all patients.

Randomization was done by drawing a numbered card by a nursing staff who is not involved in the study. Card drawl was done after anesthesia had been induced.

Before surgery, all patients were referred to an oncologist and they received neoadjuvant chemoradiation aiming at downstaging of tumor and improvement of postoperative survival.

Operative technique of LAPR: the preferred position for performing the abdominal phase is the supine one that is converted into lithotomy position for the perineal phase. After insufflation of the abdomen, the abdominal cavity is explored for any signs of metastatic disease. If not, the procedure is carried on. We used four ports: two working ports 5 mm are inserted in the right iliac fossa, the operator may extend one of them for entrance of cannula 12 mm for endostapler for cutting the proximal end of the colon, the other port may be used as the site for drain at the end of operation. The camera port is placed supraumbilical, while the assistant port is placed in the left iliac region.

With gentle traction of the sigmoid colon to visualize its pedicle more easily, the peritoneal covering at the base of sigmoid mesocolon is dissected with harmonic scalpel. Afterward, the inferior mesenteric vessels are clipped and divided (the artery and then the vein) with identification of the ureter whenever possible. The peritoneal attachments of the upper rectum are exposed and dissected with harmonic scalpel. Freeing of the rectum posteriorly and then anteriorly from the other pelvic organs is carried out. Afterward, its lateral attachments are divided also with harmonic scalpel. After the pelvic floor is reached, the left colon is divided at the descending-sigmoid junction using a surgical linear endostapler before going to the perineal phase. The perineal phase starts by creating a purse-string suture

around the anal verge. An elliptical skin incision is done with continued posterior dissection till reaching the abdominal cavity. After adequate posterior dissection, the specimen end is extracted through the perineal wound allowing proper traction for the rest of lateral and anterior dissections till complete specimen extraction. Afterward, the pelvic floor muscles are closed in layers with insertion of a drain through the perineal area reaching inside the pelvic cavity for draining any postoperative fluids. After completion of the perineal phase, the abdominal cavity is inspected to ensure hemostasis before creation of left-sided end colostomy (ensuring that the exteriorized stoma is not twisted or under tension).

Intraoperative data such as operative time, blood loss, complications as well as postoperative variables such as removal of nasogastric tube, day to start oral intake, passage of flatus, hospital stay, and postoperative pain and pathology were recorded and compared for both groups.

Statistical analysis

Comparison between the groups of LAPR and OAPR was done using Fisher exact test for categorical variables and Mann–Whitney test for continuous variables. Bivariate correlation for univariate analysis and binary logistic regression for multivariate analysis.

Data management was done by SPSS v-24 program for Windows. Data analysis was performed by Statistical Package for the Social Sciences (SPSS 24.0, IBM/SPSS Inc., Chicago, IL) software. A *P* value less than 0.05 was considered significant.

Results

Intraoperatively, no difference between both groups in terms of blood loss, operative time, or intraoperative complications was observed (Table 2).

However, there was a significant difference between both groups in favor of patients who underwent LAPR in terms of early removal of nasogastric tube, day to start oral intake, passage of flatus, shorter hospital stay, and less postoperative pain ($P<0.0001$) (Table 3).

Regarding early postoperative complications according to Clavien Dindo classification, patients who underwent OAPR (group A) experienced more significant complications than those who underwent LAPR (group B). The bleeding cases (one patient in group A and two patients in group B) were treated conservatively with fluid and blood transfusion, while paralytic ileus (six patients) in group A was treated by bowel rest intravenous fluids that are rich in potassium. Abdominal wound infection and perineal wound infection were higher in group A ($P=0.003$ and 0.111, respectively). These data are illustrated in Table 4.

Pathological examination of the resected specimen showed no statistically significant difference between both groups, except for a higher number of dissected lymph nodes for group B ($P=0.004$). These data are illustrated in Table 5.

After discharge, patients were followed up in the outpatient clinic at the following time points: 2

Table 2 Operative data of the cases in the two study groups

	Group A *N*=30		Group B *N*=30		*P*
Duration of operation (min)	240 (180–300)		270		0.225
Blood loss (ml)	350		300		0.399
Drain [*n* (%)]	30	(100)	30	(100)	
Pelvic peritoneal closure [*n* (%)]	30	(100)	18	(60)	0.003
Liver metastasis [*n* (%)]	3	10	0	0	0.437

Table 3 Early postoperative period of the cases in the two study groups

	Group A *N*=30	Group B *N*=30	*P*
NGT amount (ml)	30 (100–450)	200 (150–300)	0.542
NGT removal (days)	230 (100–450)	0 (0–1)	<0.0001
Start oral feeding (days)	2.5 (2–3)	1 (1–2)	<0.0001
Time to 1st pass flatus (days)	2.5 (1–3)	1 (1–2)	<0.0001
Hospital stay (days)	10.5 (6–26)	6 (3–18)	0.001
Pain (numerical score)	6.5 (4–8)	3(2–6)	<0.0001
Urine retention [*n* (%)]	3 (14)	2 (9)	0.0954

NGT, Nasogasrtic tube.

Table 4 Postoperative complications of the cases in the two study groups

	Group A *N*=30	Group B *N*=30	*P*
Clavien Dindo class			
I	20	6	0.019
Abdominal wound infection [*n* (%)]	8 (26.6)	0	–0.003
Perineal wound infection [*n* (%)]	12 (40)	6 (20)	–0.111
II	7	2	0.001
Bleeding [*n* (%)]	1 (3.3)	2 (6.6)	–0.195
Paralytic ileus [*n* (%)]	6 (20)	0	–0.02
Parastomal hernia [*n* (%)]	0	0	
Incisional hernia [*n* (%)]	3 (10)	0	0.437

Table 5 Postoperative pathology of the cases in the two study groups

	Group A *N*=30	Group B *N*=30	*P*
Pathology [*n* (%)]			
Adenocarcinoma	30 (100)	30 (100)	
I	0	0	
Grade			
II	24(80)	18 (60)	0.716
III	6 (20)	22 (40)	
Cut margin infiltration	0	0	
Dissected LNs	9.5 (2–17)	15 (5–23)	0.004
Positive LNs	4 (0–12)	3 (0–21)	0.436

LN, lymph node.

weeks, 1 month, 3 months postoperative, and then every 3 months afterward.

Discussion

The technique of laparoscopic colorectal surgery has been introduced for the first time in 1991, and, since then, many developments have been introduced into this technology. The use of laparoscopy for rectal cancer surgery has been a matter of debate between surgeons, but recently many studies have revealed its advantages and recommended its wide application [7,8].

In 1995, the first LAPR was described with results encouraging its use in treatment of low rectal cancer. However, many surgeons recommended waiting for the long-term results and oncologic outcomes before implementing LAPR as a standard technique [9].

The Clinical Outcomes of Surgical Therapy Study Group as well as other studies supporting laparoscopic colectomy excluded rectal resections, specifically LAPRs, because of the complexity of this surgery [9].

For this reason, additional clinical trials were done to evaluate the role of laparoscopic rectal resection [7]. These trials revealed many advantages associated with the application of the laparoscopic approach, such as reduction in postoperative ileus, shorter duration of postoperative hospital stay, lower risk of a nonroutine discharge, and the lower costs [8].

We decided to perform this RCT to compare the results of both techniques among our patients.

Regarding operative data between both groups, the median amount of blood loss was 350 and 300 ml for groups A and B, respectively. There was no significant difference between both groups regarding blood loss (P=0.399). According to the study conducted by Wang *et al.* [10], the median amount of blood loss was 93.87 and 88.44 ml for laparoscopic and open groups in order (P=0.49) and the reported operative time for both groups was 180.83 and 172.07 min, respectively, and it was nonsignificant between both groups (P=0.1).

In our study, the median operative time was 4 h for both groups (P=0.225). The operative time was also found insignificant in the study conducted by Stewart *et al.* [11] (4.21 h for the open cases vs. 4.36 h for laparoscopy; P=0.36).

Wang *et al.* [10] reported that the laparoscopic group showed shorter time to pass flatus (57.31 vs. 63.51 h for the open group; P<0.001). Moreover, the minimally invasive group needed less postoperative analgesia (P<0.001). Our study cases experienced the same results. The laparoscopic group showed earlier time to pass flatus (1 day) when compared with the open group (2.5 days; P<0.001), and consequently, the laparoscopic group experienced early Nasogasrtic tube (NGT) removal and oral feeding (P<0.001). Comparing postoperative pain of both groups via numerical scale (0–10), it was found that the median level of group B was 3 while being 6.5 for the open group and thus, less need for postoperative analgesia for the LAPR patients (P<0.001).The study reported by Schlussel *et al.* [12] found that the open approach was associated with a significantly longer hospital stay (7 days for open vs. 5.3 days for laparoscopy; P<0.01). These results also were supported by the results of Wang *et al.* [10] who published that the median hospital stay for the laparoscopic group was 11.15 days while being 12.63 days for the open cases. There was a significant difference confirming the superiority of the laparoscopic approach regarding early recovery and returning home (P=0.01). These previous findings matched the results of our study that showed a significant difference between the two groups in hospital stay. The median stay for the open group was 10.5 days versus 6 days for the laparoscopic patients (P=0.001).

Postoperative complications were classified according to Clavien Dindo classification in our study. Group B showed significantly lower complication rates than group A, especially in class-I and class-II complications (P=0.019 and 0.001, respectively). Abdominal wound infection was significantly higher in group A (eight cases), while no patient experienced postoperative port-site infection in the laparoscopic group (P=0.003). Twelve cases of the open group

experienced perineal wound infection while being six cases in group B (P=0.111). These results are nearly similar to those reported by previous studies.

Regarding postoperative pathology in our study, it was evident that the laparoscopic group was more efficient than the open approach in harvesting more lymph nodes (15 vs. 9.5 nodes; P=0.004). This result is considered by the authors to be very important to negate the misconception adapted by the community and even by some general surgeons that LAPR does not achieve the same oncological nodal clearance as the open procedure.

The limitations of this study are the small sample size and lack of long-term follow-up.

Conclusion

LAPR is a safe and feasible procedure that reduces postoperative complications and leads to faster postoperative recovery, lesser use of analgesia, and shorter hospital stay. In addition, LAPR is not inferior to OAPR in terms of oncological clearance as it offers a better chance for harvesting more dissected lymph nodes.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Al-Sukhni E, Milot L, Fruitman M, Beyene J, Victor JC, Schmocker S, *et al.* Diagnostic accuracy of MRI for assessment of T category, lymph node metastases, and circumferential resection margin involvement in patients with rectal cancer: a systematic review and meta-analysis. Ann Surg Oncol 2012; 19:2212–2223.

2 Piso P, Dahlke MH, Mirena P, Schmidt U, Aselmann H, Schlitt HJ, *et al.* Total mesorectal excision for middle and lower rectal cancer: a single institution experience with 337 consecutive patients. J Surg Oncol 2004; 86:115–121.

3 Heald RJ, Moran BJ, Ryall RD. Rectal cancer: the Basingstoke experience of total mesorectal excision, 1978-1997. Arch Surg 1998; 133:894–898.

4 MacFarlane JK, Ryall RDH, Heald RJ, *et al.* Mesorectal excision for rectal cancer. The Lancet 1993; 341:457–460.

5 Zhang X, Wu Q, Hu T, Gu C, Bi L, Wang Z. Laparoscopic versus conventional open abdominoperineal resection for rectal cancer: an updated systematic review and meta-analysis. J Laparoendosc Adv Surg Tech 2018; 28:526–539.

6 Jefferies MT, Evans MD, Hilton J, Chandrasekaran TV, Beynon J, Khot U. Oncological outcome after laparoscopic abdominoperineal excision of the rectum. Colorect Dis 2012; 14:967–971.

7 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. (2013). Laparoscopic versus open surgery for rectal cancer (COLOR II): short-term outcomes of a randomised, phase 3 trial. Lancet Oncol 2013; 14:210–218.

8 Keller DS, Champagne BJ, Reynolds Jr HL, Stein SL, Delaney CP. Cost-effectiveness of laparoscopy in rectal cancer. Dis Colon Rectum 2014; 57:564–569.

9 Mbadiwe T, Obirieze AC, Cornwell E 3rd, Turner P, Fullum TM. Surgical management of complicated diverticulitis: a comparison of the laparoscopic and open approaches. J Am Coll Surg 2013; 216:782–788.

10 Wang YW, Huang LY, Song CL, Zhuo CH, Shi DB, Cai GX, *et al.* Laparoscopic vs open abdominoperineal resection in the multimodality management of low rectal cancers. World J Gastroenterol 2015; 21:10174.

11 Stewart DB, Hollenbeak C, Boltz M. Laparoscopic and open abdominoperineal resection for cancer: how patient selection and complications differ by approach. J Gastrointest Surg 2011; 15:1928.

12 Schlussel AT, Lustik MB, Johnson EK, Maykel JA, Champagne BJ, *et al.* A population-based comparison of open versus minimally invasive abdominoperineal resection. Am J Surg 2015; 209:815–823.