

Comparative study of totally laparoscopic right hemicolectomy versus laparoscopic-assisted right hemicolectomy for the treatment of right-sided colonic cancer

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Received: 25 November 2020

Revised: 8 December 2020

Accepted: 13 December 2020

Published: 18 May 2021

The Egyptian Journal of Surgery 2021, 40:316–321

Introduction

Colorectal carcinoma is one of the leading reasons of cancer-related deaths all over the world. Our study was designed for comparing the surgical outcomes of totally laparoscopic resection of colon (TLRC) with intracorporeal anastomosis and laparoscopic-assisted colectomies (LARC) with extracorporeal anastomosis for cases of colonic cancer.

Patients and methods

A total of 42 patients had been selected and were subjected to elective surgery for colonic cancer and were prospectively evaluated. A total of 21 patients had been treated by TLRC and the other 21 patients had been treated by LARC.

Results

Reported data for both techniques showed significant superiority in TLRC when compared with LARC regarding the incidence of postoperative pain, timing of first defecation, hospital stay, and incidence of wound-related complications.

Conclusion

TLRC is a safe and feasible technique, which had been resulted in an encouraging short-term outcome, low incidence of major complications, and preservation of oncological principles, without affection of operative times.

Keywords:

cancer colon, laparoscopic colectomy, surgical outcomes

Egyptian J Surgery 40:316–321

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1110-1121

Introduction

Colorectal carcinoma (CRC) is the third leading cause of cancer deaths in the world, and its incidence is rising in developing countries [1]. The global burden of CRC is expected to increase by 60%, thereby reaching almost 2.2 million new cases and 1.1 million annual deaths by the year 2030 [2]. Surgical resection has shown to increase survival and decrease mortality among patients with CRC [3,4].

Since the first laparoscopic colectomy was described by Jacobs *et al.* [5], it has been an evolving technique. Many studies have demonstrated the safety and benefits of laparoscopic colonic surgery, making it the preferred approach in the surgical management when compared with conventional technique [6,7].

Laparoscopic colonic surgery includes two main variants: totally laparoscopic resection of colon (TLRC) and laparoscopic-assisted resection of the colon (LARC). All operative steps were performed intracorporeally with mini-incision to deliver the already resected specimen in TLRC or to perform extracorporeal resection and re-anastomosis in LARC [8–10].

The current study was conducted to compare TLRC and LARC regarding the standards of morbidity, mortality, oncological radicality, 1-year disease-free survival, and quality of life.

Patients and methods

Our study was carried on 42 patients with colonic cancer admitted to Medical Research Institute during the period between November 2016 and December 2019. A total of 21 patients were subjected to TLRC and the other 21 patients were subjected to LARC. Approval was obtained from the local ethics committee, and all patients have signed an informed consent form. Patients with cancer colon at or distal to splenic flexure, obstruction, emergency conditions, uncontrolled ischemic heart disease, American Society of Anesthesiologists score III or IV [11], previous abdominal surgery with expected abdominal extensive adhesions, or advanced stages of

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the disease (stages III and IV) were excluded from the study.

All included patients had been subjected to routine laboratory investigations, computed tomography (CT) chest, abdomen and pelvis ultrasound examination, CT enterocolonography, colonoscopy, and histopathological examination of colonoscopic biopsy.

Operative techniques

Pneumoperitoneum was created via open technique. Four to five ports were used: a 12-mm umbilical camera port, a 12-mm working port for stapler in the left lower abdomen, and two to three 5-mm working ports located in the left upper abdomen and suprapubic region.

A 30-degree laparoscope was used. The mobilization of the right colon and mesentery was performed in a medial to lateral manner in most cases. The ileocolic pedicle and the right branch of the middle colic artery were divided close to their origin intracorporeally with endo-GIA vascular stapler or hemoclips. In the LARC group, exteriorization of the colon was achieved through extension of the umbilical port in the midline in some cases or through right paramedian incision or right transverse incision. After sufficient mobilization of the right colon and hepatic flexure, side-to-side stapled ileocolic anastomosis was performed with hand sewen closure of the enterotomy. The anastomosis was laparoscopically reevaluated after closure of the incision in all cases.

In the TLRC group, the terminal ileum and transverse colon were divided intracorporeally with a 60-mm endo-GIA stapler, blue load, and the specimen was then retrieved through a Pfannenstiel incision. Reinsufflation was done after closure of the incision, and a side-to-side isoperistaltic intracorporeal ileocolonic anastomosis was done using 60-mm endo-GIA.

The enterotomy was then closed laparoscopically with a two-layer, running suture with 3.0 vicryl. The mesenteric gap was closed using interrupted 3.0 stitches [12–16].

Postoperative management

Postoperative assessment was performed in the immediate postoperative period. Third-generation cephalosporins regimen was given for the patients for 7 days, together with postoperative medications such as anticoagulant and analgesics (NSAIDs and opioids, which were available for all patients when

needed according to the severity of pain). Intraoperative assessment was performed regarding resection margins and blood loss. Follow-up for the patients was carried on at 1, 3, 6, and 12 months regarding patient satisfaction in relation to the type of skin incision using scoring system of the short assessment of patient satisfaction [17], morbidity (early and late complications according to Clavien-Dindo classification) [18], mortality, disease-free survival period, detection of recurrence which was based on CT enterocolonography at 6 and 12 months postoperatively, and readmission and its cause.

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 20 software (SPSS Inc., Chicago, Illinois, USA). Significance was set at a *P* value less than 0.05. Qualitative data were described using number and percent, whereas normally quantitative data were expressed in mean±SD. Continuous variables were compared using independent sample *t* test for parametric variables. Categorical ones were expressed as percent value and analyzed with Fisher test or χ^2 test, where appropriate.

Results

In our study, the reported data revealed that there was an insignificant difference regarding the age, sex, anatomical site, and tumor staging (Table 1).

It was found that two cases had been converted to open technique, one in each group, with insignificant difference; the reasons for reported conversion were owing to bleeding and adhesions (Table 2).

There was an insignificant difference regarding proximal and distal resection margins and number of lymph nodes harvested, whereas in LARC, significant increase was found concerning estimated blood loss and skin incision length (Table 2).

Concerning the immediate postoperative assessment in LARC group, regarding the postoperative pain, it was significantly increased in LARC group, which was noticed through the increased number of patients who required use of opioids for pain control; the timing of first defecation was assessed, which was significantly later in LARC; days of hospital stay, which were longer in LARC; incidence of nausea and vomiting, which had higher incidence in LARC; and finally, the incidence of wound infection at the site of skin incision used for

Table 1 Comparison between the two studied groups regarding demographic data and tumor characteristics

	TLCR (N=21)	LACR (N=21)	P value
Age			
Range	40–67	50–74	$t=0.002$
Mean±SD	52.95±8.56	60.67±7.27	
Sex [n (%)]			$\chi^2=2.592$
Male	11 (52.38)	16 (76.19)	0.1073
Female	10 (47.62)	5 (23.81)	
Anatomical site [n (%)]			$\chi^2=0.71$
Cecum	7 (33.33)	7 (33.33)	0.8708
Ascending colon	8 (38.10)	6 (28.57)	
Hepatic flexure	5 (23.81)	6 (28.57)	
Transverse colon	1 (4.76)	2 (9.52)	
	21 (100.0)	21 (100.0)	
Stage [n (%)]			$\chi^2=0.096$
Stage I	9 (42.9)	10 (47.6)	0.0756
Stage II	12 (57.1)	11 (52.4)	

Table 2 Comparison between the two studied groups regarding operative data

	TLCR (N=21) [n (%)]	LACR (N=21) [n (%)]	P value
Conversion			–
Open technique (adhesions in TLRC and bleeding in LARC)	1 (4.0)	1 (4.0)	
Site skin incision			$\chi^2=15.075$
Pfannenstiel	21 (100.0)	0	0.0005*
Right paramedian	0	12 (57.14)	
Upper midline	0	1 (4.76)	
Right transverse	0	8 (38.10)	
Proximal resection margin (cm)	5.85±1.97	7.57±2.45	0.008
distal resection margin (cm)	13.46±3.38	12.90±2.71	0.280
Number of lymph nodes harvested	23±3.08	21.65±2.55	0.241
Operative time (min)	188.10±26.08	176.81±30.82	0.104
Blood loss (ml)	50.48±14.59	89.05±22.98	0.0001†
Length of skin incision (mm)	49.00±6.31	71.57±10.36	0.0001†

LARC, laparoscopic-assisted resection of the colon; TLRC, totally laparoscopic resection of colon. *Refers to the presence of significant statistical value.

specimen extraction, which was reported to have higher incidence in LARC, and it was mild and healed by conservative measures (Table 3).

Regarding the late postoperative outcome such as readmission owing to obstruction and leakage, an insignificant difference was found (Table 3).

At 1-year follow-up, there were no reported cases of recurrence for the two techniques (Table 3).

Patient satisfaction scoring was performed using the scoring system of short assessment of patient satisfaction, and the results showed better satisfaction in TLRC group (Table 4).

Data revealed that patients were satisfied mostly from Pfannenstiel type of skin incision with around 90% satisfaction followed by the right transverse incision with around 60% satisfaction, whereas the least

satisfying incision noticed was the right paramedian incision (Table 5).

Discussion

In our study, it was found that there was better patient satisfaction subjected to Pfannenstiel incision when compared with other types of incisions. This was attributed to better cosmetic results and less incidence of wound complications. This was in concordance with other studies published by DeSouza *et al.* [19], Sonoda *et al.* [20], Jayne *et al.* [21], Shapiro *et al.* [22], and Biondi *et al.* [23].

Conversion to open technique was performed in two cases, one case in each group, owing to adhesions with improper safe visualization of the operative field in TLRC, whereas in LARC group, conversion was owing to uncontrollable bleeding. Studies by Scatizzi

Table 3 Comparison of the postoperative data among the two studied groups

Postoperative data	TLRC (N=21)	LARC (N=21)	P value
Timing of first defecation (days)	2.90±1.04	3.48±1.08	0.044*
Hospital stay (days)	6.05±1.20	7.24±1.55	0.004*
Severity of Pain (number of patients required opioid usage) [n (%)]	2 (9.25)	8 (38.10)	0.029*
Nausea, vomiting	1 (4.76)	6 (28.57)	0.038*
Wound infection	1 (4.76)	6 (28.57)	0.038*
Incisional hernia	1 (4.76)	2 (9.52)	0.549
Leakage	0	1 (4.76)	0.162
Obstruction	0	1 (4.76)	0.162
1-year disease-free survival	21 (100.0)	21 (100.0)	–
Recurrence	0	0	–
Readmission	0	2 (9.52)	0.521

*Refers to the presence of significant statistical value.

Table 4 Comparison of patient satisfaction correlated with skin incision

	TLRC (N=21) [n (%)]	LARC (N=21) [n (%)]	P value
Patient satisfaction correlated with skin incision			$\chi^2=10.235$
Very satisfied	7 (35.0)	7 (35.0)	0.0366*
Satisfied	9 (45.0)	1 (5.0)	
Neutral	5 (25.0)	5 (25.0)	
Dissatisfied	0	6 (30.0)	
Very dissatisfied	0	2 (10.0)	

*Refers to the presence of significant statistical value.

Table 5 Relation between patient satisfaction and type of skin incision

Patient satisfaction	Site of incision [n (%)]				Total
	Pfannenstiel	Right paramedian	Right transverse	Upper midline	
Very dissatisfied	0	2 (100.0)	0	0	2
Dissatisfied	0	6 (100.0)	0	0	6
Neutral	5 (50.0)	4 (40.0)	0	1 (10)	10
Satisfied	9 (90.0)	0	1 (10)	0	10
Very satisfied	7 (50.0)	0	7 (50)	0	14
Total	21	12	8	1	42
χ^2			15.85		
P			0.006*		

*Refers to the presence of significant statistical value.

et al. [13] and Fabozzi *et al.* [14] showed a conversion rate of 5–20%; conversion to open was owing to intraabdominal adhesions, or high American Society of Anesthesiologists scores III and IV, with critical comorbidities that could not withstand longer operative period.

In the studies reported by Senagore *et al.* [24] and Cirocchi *et al.* [25], it was found that blood loss was significantly increased in LARC, which was attributed to that the entire operative field was not totally visualized during extracorporeal anastomosis with subsequent traction on the mesentery, which might have resulted in minor vascular injury with more blood loss; this might have occurred also in our patients, and in our study, blood loss was measured through weighing operative towels preoperatively and postoperatively [24,25].

Patients in LARC had significantly higher incidence of wound infection; this might be owing to longer skin incision, more soiling of the wound, and the type of skin incision used for specimen extraction, which was affected by the site of anastomosis.

This was published by Jayne *et al.* [21] and Shapiro *et al.* [22] which might be an explanation of our patients' similar results.

Comparing TLRC and LARC regarding timing of first defecation, it was found that timing in TLRC was significantly earlier than LARC. Moreover, the length of hospital stay was significantly longer in LARC.

Regarding, the severity of postoperative pain and nausea and vomiting, it was reported that their incidence was significantly less in TLRC.

The better postoperative state in patients of TLRC group might be owing to less bowel mobilization, manipulation and traction, in addition to lower incidence of wound infection and shorter skin incision.

This was reported by Milsom *et al.* [6], Scatizzi *et al.* [13], Fabozzi *et al.* [14], Hellan *et al.* [15], Senagore *et al.* [24], Grams *et al.* [26], Wu *et al.* [27], Singh *et al.* [28], and Nakamura *et al.* [29], which might be correlated with the similar outcome in our patients.

In studies reported by Jayne *et al.* [21], Shapiro *et al.* [22], and Nakamura *et al.* [29], it was noticed that there was less incidence of intestinal leakage in TLRC group, which might be attributed to less bowel manipulation, mobilization and traction, in addition to lower incidence of wound infection and soiling, which could be an explanation for our patients' similar data.

Moreover, it was reported in articles published by Singh *et al.* [28] and Law *et al.* [30] that there was less incidence of intestinal obstruction in TLRC compared with LARC, which was correlated with less bowel manipulation and less incidence of incisional hernia; this might be the reason for similar reported data between theirs and ours. In our study, two patients were readmitted. The first patient was presented with manifestations of intestinal leakage in the form fever, abdominal pain, and wound leaking discharge 2–3 days after hospital discharge and treated by conservative measures. The second case was readmitted 2 months later after discharge who presented with manifestations of bowel obstruction in the form of abdominal distension, pain, and vomiting owing to incisional hernia with adhesions, which was managed by surgical repair.

Regarding the oncological outcome, it was found that no significant value was reported regarding the recurrence rate and the 1-year disease-free survival, which was in agreement with the studies reported by Kuhry *et al.* [31], Jayne *et al.* [32], and Transatlantic Laparoscopically Assisted vs Open Colectomy Trials Study Group [33].

Conclusion

TLRC seems to be superior to LARC regarding operative and postoperative data and complications; however, further studies over longer period including larger volume of patients may show more statistically significant difference in between both surgical techniques.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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