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Complications of Laparoscopic Restorative Rectal Carcinoma Resection

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ABSTRACT

Background: Laparoscopic restorative proctectomy (LRP) for rectal carcinoma (RC) is considered to be a technically demanding procedure with many risk factors known to be associated with occurrence of complications.

Objective: We aimed with this study to evaluate the various risk factors affecting perioperative and postoperative morbidity in LRP for RC.

Patients and Methods: This is a prospective observational study included patients suffering from middle and distal third RC admitted electively to Sohag University Hospital and Colorectal Unit in Ain Shams University between January 2017 and December 2019 with a mean follow-up of 20 months. Patients were evaluated and analysed regarding demographics, clinical picture, different investigations, efficacy of LRP, and different risk factors for perioperative and postoperative complications.

Results: A total of 35 patients underwent LRP for RC, perioperative complications happened in 8.5% and postoperative complications happened in 22.9%. Analysis of the variables affecting the occurrence of complications by univariate logistic regression showed that patients with co-morbidity were more likely to have complications than others (P=0.002), also patients with higher American Society of Anaesthesiologists' risk scoring grade were more likely to develop complications (P= 0.004), and in the same time the more advanced pathological stage had the same effect (P= 0.004).

Conclusion: We found that the significant influencing factors for the occurrence of surgical complications were co-morbidity, more advanced pathological staging and higher ASA grade.

Keywords: Laparoscopic restorative proctectomy, Laparoscopy, Rectal cancer.

INTRODUCTION

Colorectal cancer is recorded as the third most deadly and fourth most common cancer all over the world constituting a major burden over the health care system authorities[(1)]. Despite the great advantages of laparoscopic surgery, yet it is associated with higher complication rates when performed for RC than when performed for colon cancer because of technical difficulties and anatomical limitations in the pelvic cavity [(2)]. Despite important progress with the introduction of surgical staplers, techniques and perioperative management, patients who receive LRP for rectal cancer may still inevitably experience surgical complications [(3)]. Morbidity rates occur within 30 days of the LRP at a rate ranges from 25%-32% while surgical deaths during the same period reaches 6% to 8% [(4)].

Laparoscopic restorative proctectomy is technically demanding procedures, especially in male pelvis, due to the narrow space in the pelvic cavity, add to this familiarity with deep pelvic anatomy is a prerequisite, and mastery of laparoscopic techniques is needed to accomplish a safe and thorough dissection of the rectum out of the pelvis, which is often deep and limited. Although laparoscopy is a well-established technique yet cumulating results suggest that the learning curve is indispensable to avoid postoperative complications[(5)]. It is estimated that a learning curve of 60-80 resections are required to obtain expertise and mastery of the technique, which is only attainable in highly specialized tertiary centers in the hands of professional surgeons [(6)].

Avoiding injury to adjacent structures, besides autonomic nerve identification and preservation, are fundamental to avoid complications and achieve a good sexual and urinary functional outcome [(7)]. In the same time data suggest that postoperative complications may promote tumor recurrence and decrease long-term survival. So, efforts should be paid to avoid the occurrence of complications as far as possible [(8)].

The aim of this study was to evaluate factors affecting perioperative and postoperative complications after LRC for RC.

PATIENTS AND METHODS

This was a prospective single arm study, which included 35 patients which was conducted from January 2017 till December 2019 at General Surgery Department, Sohag University Hospital and Colorectal Unit in Ain Shams University.

Only patients presented with symptoms suggestive of RC, confirmed histologically to be adenocarcinoma (T_2-T_4, N_0 or N_1 tumors), without evidence of distant metastases, located in the distal or middle third and with a functioning, disease-free sphincter mechanism were included in the study.

Patients were excluded if they had distant metastases, locally advanced tumors (not responding to neo-adjuvant therapy), tumor invasion to adjacent organs, acute bowel obstruction or perforation from cancer, patients

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had ASA > II, past history of complicated laparotomy, those who were converted to conventional surgery, or if they had contraindications to laparoscopy.

A clinical audit was held in a multidisciplinary approach including colorectal surgeon, hepatobiliary surgeon, medical oncologist, gastroenterologist, radiation oncologists and pathologist to discuss and choose the proper management plan before decision making for every patient.

The studied patients had preoperative investigations including biochemical evaluation; coagulation profile, complete blood count, serum blood sugar, liver function tests, renal function tests, total proteins, serum albumin, also colonoscopy, endorectal ultrasound (ERUS), an abdominal CT scan and a chest radiograph. MRI pelvis was performed to rule out tumor invasion into adjacent organs and positron emission tomography (PET) scan was done in selected cases to exclude distant metastases for tumor staging.

Neoadjuvant chemoradiotherapy were prescribed if patients had locally advanced tumors (cT_{3-4} and/or cN_{1-2}); (50.4 Gy in 28 fractions together with systemic 5-fluorouracil) to get down-staging with a reassessment CT at 4 weeks after completion of radiation. Operation was done 6 weeks after completion of radiotherapy.

Patients who fulfilled the inclusion criteria underwent LRP after informed consent. Patients got preoperative preparation; mechanical bowel preparation and prophylactic antibiotics, which continued for five days more postoperatively.

Surgical technique:

All patients were operated on under general anesthesia. Patient was placed in a modified lithotomy position, with the head and right side tilting down. Insufflation with CO_2 through supra-umbilical incision and pressure maintained at 12-14 mmHg. A 5-port technique was employed; ports were placed under direct vision of a flexible 30º videoscope.

Firstly a careful exploration to exclude the presence of metastases was employed, then a medial to lateral dissection from sacral promontory upward reaching the inferior mesenteric vessels, which was then dissected at its origin followed by ligation of both artery and vein near their origins with clips, being careful to protect the pre-aortic sympathetic neural plexus. Then an incision was made at the right leaf of the sigmoid mesocolon, and the avascular plane between the visceral and parietal pelvic fascia was entered taking care preserving the left gonadal vessels and ureter, which were safely explored and protected.

The rectum with its mesentery was sharply dissected along the anatomical space between the visceral and parietal endopelvic fascia, until the anal hiatus of levator ani was reached. The superior hypogastric nerves and pelvic autonomic nerve plexus were identified and preserved. When the pelvic dissection was complete, PR examination was done by assistant to confirm adequacy of distal margin (1 cm for T_2 and 2 cm for T_{3-4a} tumors), which was cut using endoscopic linear staplers (Ethicon™ endo-GIA-type) mechanical suturing device followed by specimen extraction via a plastic wound protector through a small Pfannenstiel incision in lower abdomen. Restoration of the continuity was done using Ethicon™ Circular surgical stapler and the integrity of anastomosis was assessed by saline irrigation test.

The resected tumors were histologically examined for T-stage and distance from proximal and distal surgical resection margins. The perirectal lymph nodes (LN) deposits were carefully dissected, counted, and sampled for assessment of metastasis and pathologic staging (N-stage). Circumferential resection margins (CRMs) (closest distance between the radial resection margin and the tumor tissue) were considered positive if malignant cells were found at microscopy at a distance of < 1 mm between the outermost part of the tumor and the CRM or between LN harbouring tumor cells and the CRM.

Postoperatively patient run through Enhanced recovery after surgery protocol (ERAS) and the inserted drain was removed on the third postoperative day. All patients were discharged after drain removal. Gastrografin® enema was done prior to stoma closure, usually 8 weeks postoperative or after completion of adjuvant therapy if indicated.

Adjuvant chemotherapy in the form of 5-fluorouracil was used for all fit patients where there was doubt of local clearance. Patients were exempted from this line if they received preoperative chemoradiotherapy and radical surgery was adopted, also unfit elderly.

Patients were followed-up monthly for 6 months then every six months for one year by history, physical examination, and serum CEA. Rectal electromyography in some selected patients. If recurrence was in doubt, lower endoscopy and CT were done, mean follow-up 20 months.

Data recorded were patients' demographics, co-morbidities, operative complications, days to pass flatus and first bowel movement, time to resume a liquid diet,

postoperative complications both early and late; all were subjected to analysis.

Ethical consent:

An approval of the study was obtained from Sohag University Academic and Ethical Committee. Every patient signed an informed written consent for acceptance of participation in the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The collected data were evaluated using the SPSS® software package (SPSS® 21, Chicago, IL, USA). Quantitative data were expressed as mean, standard deviation (SD), and range. Qualitative data were expressed as frequency and percentage. Univariate and multivariate logistic regression analyses were done to determine factors affecting occurrence of complications, two-sided P-value <0.05 with 95% confidence interval (CI) was considered as statistically significant.

RESULTS

Regarding patients' demographics, there were 22 men and 13 women with a sex ratio of 1.7:1**.** The mean age of the studied group was 54.4 years. The mean body mass index was 23.89 (kg/m^2). Fourteen patients (40%) were smokers. Associated comorbidities were documented in thirteen patients (37.1%). There were five patients (14.3%) with previous abdominal operations (Table 1).

Table (1): Patients' demographics

Parameter	Number of patients	Percentage
Age (years)		
• 20-30	2	5.7%
• 30-40	4	11.4%
• 40-50	5	14.3%
• 50-60	11	31.4%
• 60-70	13	37.1%
Mean±SD (Range)	54.4 ±20.3 (28-77)	
Gender		
• Male	22	63%
• Female	13	37%
Smoking		
• Smokers'	14	40 %
• Non-Smokers'	21	60 %
Preoperative co-morbidities		
• Cardiac	9	25.7%
• Diabetic	13	37.1%
• Hepatic	2	5.7%
• Renal	1	2.9%
Total number of patients who had co-morbidities	13 patients (37.1%)	
Body mass index (kg/m^2)		
• 18-25	19	54.3%
• 25-30	13	37.1%
• ≥30	3	8.6%
Mean	23.89±5.4 (18-30 kg/m^2)	
Previous abdominal surgery		
• Cholecystectomy	2	5.7%
• Splenectomy	1	2.9%
• Total abdominal hysterectomy	1	2.9%
• Repair of perforated peptic ulcer	1	2.9 %

The commonest clinical presentation was frank bleeding per rectum, which occurred in thirty patients. Lower third tumors were represented in twenty patients. According to ASA stratification twenty two patients came in ASA class I. Among all patients, twenty three were defined as UICC stage II and 18 patients had moderately differentiated tumors (Table 2).

Table (2): Demonstration of clinical and tumor characteristics

Parameter	Number of patients	Percentage
Clinical presentation		
• Bleeding per rectum	30	85.7%
• Change in bowel habits	21	60%
• Abdominal pain	9	25.7%
• Systemic symptoms (decreased appetite and weight loss)	5	14.2%
ASA classification		
• Class I	22	62.9%
• Class II	13	37.1%
Tumor location in rectum		
• Middle third	15	42.9%
• Lower third	20	57.1%
UICC stage		
• Stage II (T_3-T_4,N_0)	22	62.9%
• Stage III(T_2-T_4,N_1)	13	37.1%
Grade of differentiation		
• Well differentiated	11	31.4%
• Moderately differentiated	18	51.4%
• Poorly differentiated	6	17.2%

Intraoperative complications were encountered in three patients and they were recovered by treatment (Table 3).

Table (3): Management and outcome of intraoperative complications

Intraoperative complications	N (%)	Management	Outcome
Ureteric injury	1 (2.9%)	Repair over double J stent, removed after 2 months	Recovered
Bladder perforation	1 (2.9%)	Laparoscopic suturing with absorbable sutures	Recovered
Bleeding	1 (2.9%)	Hemostat with titanium clips	Recovered
Total	3 (8.5 %)		

Regarding postoperative course; eight patients developed postoperative complications, which were recovered by treatment (Table 4).

Table (4): Postoperative complications and their management

Postoperative complications	N (%)	Management	Outcome
Ileus	2 (5.7%)	Conservative measures	Recovered
Anastomotic Leakage	1 (2.9%)	Was managed successfully with drainage and diverting stoma	Recovered
Pelvic abscess	1 (2.9%)	By percutaneous drainage under cover of antibiotics	Recovered
Wound infection	2 (5.7%)	Open wound care	Recovered
Anastomotic stenosis	2 (5.7%)	Dilatation	Recovered
Total	8 (22.9%)		

The most common functional outcome, which was assessed at 12 months postoperatively, was frequent bowel movements (Table 5).

Table (5): Functional outcomes at 12 months postoperatively

Characteristics	Value n (%)
Sexual dysfunction	4 (11.4%)
Frequent bowel motions	15 (42.8%)
Liquid stool incontinence	2 (5.7%)
Flatus incontinence	3 (8.6%)

Patients with co-morbidity, with ASA II, and with pathological stage III were more likely to develop complications (Table 6).

Table (6): Univariate logistic regression analysis of factors affecting occurrence of postoperative complications

Factor	Odds ratio	(95% CI)	P value
Co-morbidity • No • Yes	1 15	(2.78-80.86)	0.002
ASA grade • ASA I • ASA II	1 10.63	(2.16-52.15)	0.004
Pathological staging • Stage II • Stage III	1 10.8	(9.04-2.10)	0.004

According to multivariate logistic regression of predictors for postoperative complications, including significant factors identified in univariate analyses, ASA II patients and pathological stage III appeared to be independent risk factors (Table 7).

Table (7): Multivariate logistic regression analysis of factors affecting occurrence of postoperative complications in patients treated with LRP (including significant factors in univariate analysis)

Factor	Odds ratio	(95% CI)	P value
American Society of Anesthesiologists Grade • ASA I • ASA II	1 14.00	(2.06-94.84)	0.007
Pathological staging • Stage II • Stage III	1 26.93	(2.41-30.83)	0.001

On follow-up, 2 patients (5.7%) had anastomotic stenosis, which responded well to dilatation at the time of ileostomy closure. Low anterior resection syndrome occurred in 20 patients (57.1%); fifteen patients (42.8%) experienced six or fewer bowel movements per day.

DISCUSSION

Rectal cancer surgery is a technique with a relatively high morbidity, about 39% in large trials [(9)]. There is no need to emphasize that the incidence of perioperative complications gives an idea about the safety of the surgical procedure. Meanwhile postoperative complications had a negative impact on 5-year disease-free survival after LRP for RC [(2)].

The avoidance of intraoperative complications mainly depends on the strict adherence to the guidelines of the technique and the understanding and definition of the anatomy especially the left ureter and the presacral veins[(10)]. Data suggest that the learning curve is an important risk factor for postoperative complications requiring higher number of cases[(5)]. The learning curve was not a reliable factor for explanation of our complication results (8.5%) because the operating surgeons have good experience in laparoscopic colorectal surgery.

The incidence and gravity of complications associated with laparoscopic rectal cancer surgery remain more or less equal to open surgery, which makes it a safe procedure [(11)]. Moreover some complications have been reduced, including respiratory sequelae, venous thromboembolism, and surgical site infection, other problems such as anastomotic leakage and bleeding still persist [(12)]. One of the most dangerous complications is the intraoperative hemorrhage, which is very dangerous and may be difficult to control with imminent fatality if not promptly controlled [(13)]. We got intraoperative bleeding incidence of (2.9%) which was managed successfully in the same secession by clipping.

Regarding urinary injury, namely ureteric or vesical; it occurs collectively in 2%-2.8% of LRP. Ureteric injury occurs during inadvertent mobilisation of sigmoid colon, or along the lateral pelvic sidewall on entry into the pelvis [(3)]. We got ureteric injury without gap in 2.9% which was managed by end-to-end anastomosis over a JJ-ureteral stent with absorbable sutures during the same secession. Bladder injury is commonly associated with injudicious use of electrocautery during anterior anterior rectal wall dissection. Interrupted suturing with absorbable sutures and insertion of indwelling urethral catheter, which is left in situ for 7-10 days, is needed [(14)]. In our study we had 2.9% bladder injury, which was controlled without conversion of the procedure.

Anastomotic leak is a serious postoperative complication after LRP for RC

with a reported incidence of 4.2% to 26% and mortality rate reaching 40% [15]. Male gender and low anastomosis are risk factors for leak after low anterior resection; probably because of narrower pelvis in the male and suboptimal blood supply for distal anastomoses [16]. Also, neoadjuvant chemoradiation, more advanced tumor stage, longer operative time, intraoperative hemorrhage and multiple firings of the stapler increase the risk of this leak following LRP for RC. A surgeon is obliged to do a diverting stoma which may be mandatory in patients with ≥2 of the aforementioned risk factors [17,18]. In our study, anastomotic leak developed in 2.9% with low RC who developed leak on the fifth postoperative day and managed successfully with drainage and protective stoma.

There is a matter of debate regarding the role of diverting stoma in prevention of anastomotic leak, some claim that diverting stoma does not reduce anastomotic leak but increases the risk of postoperative intestinal obstruction in LRP [19], while others recommend the use of diverting stoma for such high-risk patients [20], also **Cong *et al.***, concluded that the rate of leak was higher in open group than in LRP, which could be attributed to the higher rate of protective defunctioning stoma in LRP compared with that in open low anterior resection[21]. In our study, diverting ileostomy was constructed in 71.4% of patients who had lower rectal cancer, those with comorbidities and elderly patients' ≥ 50 years and we got a leak incidence of 2.9% which responded well to drainage under sonographic guide in the presence of stoma.

The incidence of anastomotic stricture after anterior resection has been reported to range from 0-30% with most series in the range of 6-10%. Although stricture can occur irrespective of the anastomotic technique, the incidence has apparently increased with the use of staplers [15]. In the present study, we had only 5.7% anastomotic stenosis that responded well to dilatation at the time of ileostomy closure.

Low anterior resection syndrome (LARS) is present in 55.2%-58% of patients who underwent LRP being more frequent after low anastomosis and in young patients who received neoadjuvant chemoradiotherapy, total mesorectal excision (TME), anastomotic leak, and diverting stoma [22]. In our study, LARS occurred in 57.1%; 42.8% experienced six or fewer bowel movements per day, and most of them could tolerate anal continence status well.

Despite all efforts to identify and preserve nerves during open TME, there is an incidence of sexual dysfunction ranges from 10 to 35% of patients [23]. The sexual dysfunction after LRP has significant lower rates than those experienced after open surgery [24]. In our study erectile impotence happened in 11.4% which is in line with previous study [25].

As determination of the incidence and risk factors of postoperative complications following LRP especially avoidable ones like poor physical status is essential to prevent it [26]. We analysed the different risk factors that may be responsible for the occurrence of surgical complications and we concluded that co-morbidity, more advanced pathological staging and higher ASA grade were significantly correlated with occurrence of these complications which is correlated with previous study [27].

Thus, LRP can be done safely with strict adherence to the surgical guidelines and good understanding of the anatomy of the area in the hands of well experienced surgeons. No doubt that training of the surgeon, learning curves and optimization of postoperative care are becoming paramount to maximize patient safety and minimize postoperative complications [28].

Still more multicenter, prospective studies are needed to assess the feasibility and reproducibility of the technique safely.

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