

Laparoscopic Colonic Resection for Rectosigmoid Colonic Tumours: A Retrospective Analysis and Comparison with Open Resection

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Abstract Laparoscopic approach for treatment of colorectal malignancy is gaining acceptance gradually; however the benefits of laparoscopic surgery in colonic and rectal tumours is still open to debate. This study aims at a retrospective analysis of operative and short term outcome of patients with rectosigmoid tumours. A retrospective analysis of operative, postoperative and short-term outcome of 62 patients who underwent laparoscopic colorectal resection for cancer of rectosigmoid region were compared with a same number of parameters-matched patients who underwent open colorectal resection. Blood transfusion requirement was significantly more in the open group compared to the laparoscopy group (38.7% versus 6.4%, $p=0.001$). ICU stay was less in the laparoscopy group ($p<0.05$) and they were started on oral liquid diet earlier ($p=0.013$). The number of the lymph nodes retrieved, positive distal margin and radial involvement were similar in both groups. The hospital stay was significantly shorter in laparoscopy group (8.4 versus 13.8 days, $p<0.05$). Radical operation for rectosigmoid tumors is technically feasible with laparoscopic surgery. Laparoscopic approach is associated with less blood loss, transfusion and significantly less ICU stay. Laparoscopic group recovers early and needs less hospital stay

Keywords Laparoscopic surgery · Rectosigmoid · Colonic resection · Colorectal malignancy

Introduction

Laparoscopic approach for the treatment of malignant colorectal lesions is still evolving. The first successful laparoscopic sigmoidectomy for cancer was reported in 1991 by Jacob's et al. [1]. However, the laparoscopic technique was not adopted by surgeons worldwide because of concerns about the adequacy of intra-abdominal exploration and the initial reports of high incidence of port-site metastases [2, 3]. As a consequence, laparoscopic surgery for colon cancer was not adopted widely until initial reports of few randomized trials were published in 2002–2005 period [4–6]. These reports have demonstrated the benefits of laparoscopic approach over open surgery in terms of diminished postoperative pain, early return of bowel functions, better immunological function, less hospital stay and more rapid convalescence. Recently long term survival data of these trials and multicenter randomized trials have shown comparable disease free and overall survival of laparoscopic group compared to open surgery group.

In India, laparoscopic colorectal surgery is still evolving. To extend the potential benefits of laparoscopic approach to the patients with colorectal malignancy, our unit began practising laparoscopic colorectal surgery in 2005. The aim of this study is to assess the feasibility of laparoscopic surgery for colorectal tumours in our set up and to audit the short term outcome of laparoscopic approach to that with patients undergoing open colorectal resection.

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Methods

Between February 2006 to April 2008, 102 patients underwent laparoscopic colorectal surgery in the unit. Of this, 62 patients with cancers involving sigmoid colon and rectum who underwent laparoscopic colorectal surgery (LAC) formed the study group. This group of 62 patients were compared retrospectively with same number of parameters-matched patients who underwent open colorectal resections (OR) during 2003–2005 period. The clinical parameters, operative parameters and short-term outcome details were collected from the prospective database of LAC patients and from the case records of OR patients.

Inclusion Criteria and Selection of Patients

All the procedures were performed by trained consultant surgeons (PK and DV) assisted by residents. These surgeons had sufficient experience in open colorectal surgery and had undergone overseas training in laparoscopic colorectal surgery. All patients, apart from routine evaluation underwent colonoscopic biopsy, contrast-enhanced multi-slice CT scan to localise the lesion preoperatively. In case of patients with small/early lesions; preoperative colonoscopic tattooing with India ink dye was performed to facilitate localisation of tumours during laparoscopy. Patients with previous colonic resection, multiple previous surgeries, severe co-morbid conditions, coagulopathy and metastatic disease were excluded. All other patients were offered laparoscopic approach during the study period.

Surgical Procedure

Patients were given preoperative bowel preparation with polyethylene glycol a day prior to surgery and allowed liquid diet on the preoperative day. All procedures were done under general anaesthesia. Patients were placed in a Lloyd Davies position and adequate shoulder support was ensured to prevent the patient from slipping off the operating table in a steep Trendelenberg position. Patients arms are kept on the sides and anti-embolism stockings were applied to the lower limbs.

An open 10 mm trocar insertion through umbilicus was used in all cases. Pneumoperitoneum was created by open access through umbilicus in all cases and intrabdominal pressure was maintained at 12–14 mmHg. Subsequent port placements included two 5 mm ports in right and left anterior axillary line, with an additional 12 mm port in the right iliac fossa. For low rectal lesions an optional suprapubic port was added. A 30° telescope was used. The procedure started with mobilisation of the mesorectal pedicle and ligation of inferior mesenteric artery and lymphadenectomy at the level of origin of the artery.

Dissection was facilitated by use of ultrasonic shears (Harmonic Scalpel, Ethicon Endo-Surgery). Following this, retroperitoneal mobilisation of left colon up to splenic flexure was performed. Lateral peritoneal reflection was divided and splenic flexure fully mobilised. Finally, mesorectal peritoneal reflection was divided bilaterally and mesorectal mobilisation performed. Mesorectum was divided at an appropriate level according to the level of the tumour to get a tumour free mesorectum/total mesorectal excision and an adequate distal margin. Rectum was then transected with endoscopic staplers and a 5–7 cm mini-laparotomy was performed to bring out the mobilized and divided tumour-bearing segment. The specimen, including the lympho-vascular pedicle was resected and the anvil of the circular stapler introduced in to the proximal colon and secured using 2.0 polypropylene purse-string sutures. Proximal colon with anvil was returned back to the abdominal cavity and the mini-laparotomy was closed. End-to-end colorectal anastomosis was performed under laparoscopic vision using the circular stapler introduced per rectally by the assistant. A pelvic drain and a 24 F Foley's catheter was placed per rectally beyond the anastomosis. The need for a diverting colostomy was left to the discretion of the operating surgeon.

The patients who underwent open colorectal surgery also had undergone surgery using the same principles through a midline laparotomy: Vessel ligation first followed by colonic mobilisation, mesorectal excision and colorectal anastomosis.

Outcome Measures and End Points

Demographic features of both LAC group and OR group were noted as were intraoperative parameters like operating time, blood loss, blood transfusion, conversion to open surgery (in LAC group) and use of temporary colostomy. The number of lymph nodes retrieved, the distal margin, radial margin and pathological staging were compared. Postoperative outcome measures like duration of stay in intensive care unit (ICU), passage of flatus/stools, and resumption of oral liquids were noted. Postoperative complications in both groups and hospital stay were also compared. The statistical analysis was performed using Chi square test and Student's *t*-test using SPSS software.

Results

A total of 62 patients underwent laparoscopic colorectal resections during the study period. The demographic features of this group were compared with a retrospective cohort of patients who underwent open resections and are given in Table 1. The age, sex, and site of the lesion, and the procedure undertaken were similar in both groups. Four

Table 1 Demographic features of laparoscopic and open resection groups

Parameter	Laparoscopic (LAC)	Open (OR)	P value
Male:Female ratio	36:36	41:31	Ns
Age (years)	58.8±11.7	60.4±13.1	Ns
Systemic illness	31 (50%)	26 (42%)	Ns
Site of lesion			
Sigmoid	4 (6.4%)	2 (3.2%)	Ns
Rectosigmoid	11 (17.7%)	10 (16.1%)	Ns
Upper rectum	14 (22.5%)	11 (17.7%)	Ns
Mid rectum	16 (25.8%)	18 (29%)	Ns
Low rectum	10 (16.1%)	13 (20.9%)	Ns
Anal canal	7 (11.2%)	8 (12.9%)	Ns
Surgical Procedure			
Low anterior resection	26 (41.9%)	29 (46.7%)	Ns
High anterior resection	25 (40.3%)	21 (33.3%)	Ns
Sigmoid colectomy	4 (6.4%)	2 (3.2%)	Ns
APER	7 (11.2%)	8 (12.9%)	Ns

patients (6.4%) required conversion to open surgery. Two patients were converted due to bulky lesions making dissection below the tumour difficult, one required conversion due to inadequate distal margin noticed after stapler transection of the distal rectum and another required conversion due to extensive adhesions from a previous laparotomy. In 51 patients surgery was completed laparoscopically and in 11 (18%) was done as a laparoscopically assisted procedure. This was for hand-sewn anastomosis in 9 patients and in 2 patients for facilitating dissection in bulky tumours. Diverting stomas were made in 9 patients (14.5%) in the LAC group and 13 (20.9%) patients in the OR group ($p=ns$).

The operation time, blood loss and blood transfusion rate, ICU stay and parameters related to short term recovery of the patients in LAC group and OR are presented in Table 2. Operating time and blood loss were not statistically different though the LAC group required more time and less blood loss. However, blood transfusion requirement was significantly more in the OR group compared to the LAC group (38.7% versus 6.4%, $p=0.001$). ICU stay was less in LAC group ($p<0.05$) and they were started on oral

liquid diet earlier ($p=0.013$). The mean duration to pass flatus/faeces in LAC group was 3.6 ± 0.4 days. The same information in OR group could not be fully retrieved owing to the retrospective nature of this study. The patients could tolerate semisolid diet in LAC group on a mean of 6.4 days and this was not statistically different to that of 8.9 days in the OR group. The hospital stay was significantly shorter ($p<0.05$) in LAC group (8.4 days) compared with OR group (13.8 days).

All patients had adenocarcinoma on histopathology. The number of the lymph nodes retrieved, the mean number of patients with positive distal margin and radial involvement were similar in both groups (14.4 versus 13.6 nodes). Similarly, the stages of the disease according to the Duke's staging were also comparable in both LAC and OR groups (Table 3).

The postoperative complications after surgery were widely different in the two groups Table 4. The numbers of complications were less in LAC group; sub-acute intestinal obstruction in 4, anastomotic leaks in two and cardiac problems in two patients. One patient with cardiac failure

Table 2 Comparison of Intraoperative parameters and short-term recovery of laparoscopic and open resection groups

Parameter	LAC	OR	P value
Operation time (minutes)	296.7±57.5	180±58.3	Ns
Blood loss (ml)	116±108	380±108	0.23
Blood transfusion (units)	4 (6.4%)	24 (38.7%)	<0.001
ICU stay (hours)	24.2±11.8	79±37.1	<0.05
Oral liquids (days)	4.11±0.85	6.41±1.04	0.013
Semisolid diet (days)	6.4±0.9	8.9±1.03	Ns
Hospital stay (days)	8.4±1.04	13.8±5.3	<0.05

Table 3 Pathological characteristics of laparoscopic and open groups

Parameter	LAC	OR	P value
Lymph nodes (number)	14.4±2.02	13.6±1.9	Ns
Distal margin involvement	1	3	Ns
Radial margin	2	3	Ns
Tumour stage			
Dukes A	12	8	Ns
Dukes B	33	31	Ns
Dukes C	17	23	Ns

Table 4 Postoperative complications, morbidity and short term outcome of the LAC and open groups

Parameter	LAC Group	Open group
Postoperative complications		
Intestinal obstruction	4 (6.4%)	7 (11.2%)
Anastomotic leak	2 (3.2%)	7 (11.2%)
Intra abdominal abscess	0	2 (3.2%)
Secondary haemorrhage	0	2 (3.2%)
Re-exploration	3 (4.8%)	8 (12.9%)
Wound infection	0	16 (25.8%)
Pulmonary complications	0	5 (8%)
Cardiac events	2 (3.2%)	2 (3.2%)
Deep vein thrombosis	0	2 (3.2%)
Morbidity	5 (8%)	11 (17.7%)
Mortality	1(1.6%)	4 (6.4%)
Short term outcome		
Intestinal obstruction	4 (6.4%)	8 (12.9%)
Incisional hernia	1 (1.6%)	5 (8%)

and pulmonary oedema died (1.6%) on 8th postoperative day. In the OR group, complications were wound infection (predominantly), pulmonary complications, sub-acute intestinal obstruction, deep vein thrombosis, anastomotic leaks and secondary haemorrhage. Noticeably, no patient in the LAC group developed pulmonary complications or wound related problems. The morbidity rate in LAC versus OR was 5 (8%) versus 11 (17.7%) ($p=ns$). Four patients (6.4%) died in OR group, 3 due to sepsis and one due to myocardial infarction.

Discussion

Laparoscopic surgery for colorectal diseases has gained popularity over the last decade. It is being increasingly applied for the treatment of colorectal carcinoma as well. Recent published literature including multicentre trials have demonstrated comparable short and long term results with that of open surgery. There are no published reports of large series of laparoscopic surgery for colorectal cancer from India. This is probably because of the initial technical difficulties in advanced laparoscopic skills in bowel mobilisation and resection given the fact that laparoscopic surgery is still evolving in India. This procedure has a definitive learning curve [7, 8] and it is said that it takes 30 number of surgeries to plateau the curve. We feel that a good experience in open colorectal surgeries is a prerequisite to master laparoscopic colorectal surgery.

There are many controversies regarding application of laparoscopic technique for treatment of rectal cancer. The adequacy of resection, lymph node harvest, cost, local

recurrence and survival rates being the concerns regarding laparoscopic resection. This is reflected by the fact that many large multicenter trials except MRC-CLASSIC have not included patients with rectal cancer [9]. However, there are 5 randomized trials published till date and that have demonstrated comparable short term outcome of laparoscopic and open surgery [4, 6, 9–15]. Our study also shows comparable short term outcome of the LAC group with relatively early recovery following surgery. Analysis of these results serves as an audit of this relatively new technique.

The demographic features of both groups were comparable with respect to the location of the tumour, type of surgery etc., making the analysis meaningful. We feel that the conversion rate of 6.4% in this series is quite acceptable. The operating time for LAC group was more, though statistically not significant, compared to the OR group (297 versus 180 minutes). This has been observed in other series as well [4, 6, 13, 14]. A meta-analysis of the large randomized trials has shown a conversion rate of 19% [16]. However, when the patients who underwent a conversion to an open surgery were excluded, the difference was not marked. We feel that the operating time is getting shorter as we gain more experience. The significant difference was noticed in patient's short term recovery in terms of less ICU stay, early recovery of gut function and ability to tolerate oral liquids earlier. ICU stay and early oral feeding was significantly better in the LAC group. This could be probably due to less tissue trauma in laparoscopic surgery [5]. Dissection through small incisions, precise dissection aided by magnification, lack of manual handling of viscera and forceful retraction in laparoscopy helps in early recovery of gut function [10, 11, 16]. However the ability to tolerate semisolid diet was not different between the LAC and OR group. This was due to the fact that 4 patients in LAC group developed sub acute intestinal obstruction and when these patients were excluded, ability to tolerate semisolid diet was significantly different. We could not compare passage of flatus/faeces and the analgesic requirement between both groups due to the retrospective nature of the study, as this information was not recorded fully in the OR group. Despite this, the better short term recovery of the LAC group could be demonstrated by the fewer days spent in the ICU and shorter hospital stay. This has been demonstrated in most of the other series as well [5, 10–14, 16].

Complications observed in this study between the LAC and OR group were widely different. There were no pulmonary complications or incidence of deep vein thrombosis in the LAC group. This is mainly due to early ambulation and lesser postoperative pain after laparoscopic resection. All these factors contributed to the short ICU stay as well. Open group showed varied

complications including pulmonary, wound related and septic complications.

Perhaps the most important aspect of surgery for malignant disease is the ability to remove the disease radically without compromising on oncologic principles. This was compared in the current study as well. The number of lymph nodes cleared, the number of patients with positive resection margins etc were similar in both the groups. This has been the experience in most large trials as well [4, 6, 13, 14]. Moreover, the long term results of multicentre randomised trials like COST, CLASSIC and COLOR have demonstrated equal disease free and overall survival for colorectal cancer treated by laparoscopy compared to open surgery [14, 15, 17]. These observations imply that laparoscopic approach for resection of colorectal is oncologically safe in treating this disease. In India, laparoscopic surgery for colonic carcinoma is still evolving and we are yet to see long term results of this treatment modality, which is likely to be comparable to open surgery. We presume that it shall not be different considering that an equally radical resection could be achieved laparoscopically in terms of lymph node harvesting, completeness of resection, TME etc. as observed in this study. A larger number of patients and long term follow up data from Indian patients are required to substantiate this fact.

To conclude, this first report of a series of patients from India demonstrates that radical surgery for rectosigmoid colorectal tumours can be performed laparoscopically in our set of patients. Laparoscopic approach is associated with lesser blood loss, shorter ICU stay, early resumption of oral feeds and shorter hospital stay. This study demonstrates good short term outcome with laparoscopic surgery compared with open surgical approach.

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