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Original Research Article

Comparative Outcomes of Laparoscopic Versus Open Surgery for Low Rectal Cancer: A Matched Case–Control Study

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Abstract:

Background: Low rectal cancer presents unique surgical challenges due to the confined pelvic anatomy and the need to balance oncologic clearance with sphincter and nerve preservation. Laparoscopic surgery has emerged as a minimally invasive alternative to open surgery, but concerns remain regarding oncological adequacy in low rectal tumors.

Objective: To compare perioperative, oncological, and functional outcomes between laparoscopic and open surgery for low rectal cancer.

Methods: This retrospective matched case–control study included 60 patients with histologically confirmed low rectal adenocarcinoma treated at Dr. Rajendra Gode Medical College. Thirty patients underwent laparoscopic low anterior resection (L-LAR) or laparoscopic abdominoperineal resection (L-APR), and 30 underwent open surgery (O-LAR or O-APR), matched for age, tumor stage, and comorbidities. Perioperative outcomes, oncological quality (R0 resection, circumferential resection margin [CRM], lymph node yield), and functional outcome using the Low Anterior Resection Syndrome (LARS) score at 6 months were compared.

Results: Laparoscopic surgery had a longer operative time (198 ± 35 vs 164 ± 28 min; $p<0.001$) but significantly lower blood loss (180 ± 40 vs 320 ± 60 mL; $p<0.01$), faster bowel recovery (1.8 vs 3.4 days; $p<0.001$), and shorter hospital stay (5.3 vs 8.1 days; $p<0.001$). Complications were fewer in the laparoscopic group (16.7% vs 30%). R0 resection rates (93.3% vs 90%), CRM positivity, and lymph node yields were comparable. LARS scores were significantly better following laparoscopic low anterior resection ($p<0.05$).

Conclusion: Laparoscopic surgery for low rectal cancer provides superior short-term recovery and functional outcomes while maintaining oncological safety compared with open surgery.

Keywords: rectal cancer, laparoscopy, total mesorectal excision, LARS, oncologic outcomes, minimally invasive surgery.

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Introduction

Low rectal cancer is characterized by tumors located at a distance of 5-6 cm to the anal verge, which is considered to be surgically difficult due to the lack of space in the pelvis and the necessity to attain oncological complete resection without loss of sphincter and autonomic nerves. Heald and colleagues introduced the concept of total mesorectal excision (TME) that has drastically decreased the local tumor recurrence and become the new gold standard in surgery of rectal cancer [1].

The historical method was the open operation. Laparoscopic surgery has become acceptable during the last 20 years because of fewer post-surgery pain and reduced hospitalization time and accelerated recovery rates [2,3]. Even so, apprehensions was raised early on the oncological suitability of laparoscopic surgery of low rectal tumors due to technicality, inadequate working space in the pelvis, and steep learning curve [4].

Colonial laparoscopic rectal cancer surgery has proven to be oncologically equal to open surgery when it comes to CRM positivity, lymph node harvest, and survival, notwithstanding large randomized controlled trials such as CLASICC, COLOR II and COREAN have demonstrated [5-9]. Meta-analyses also imply a better quality of life and efficacy of laparoscopic surgery [7, 10, 11].

There is paucity of data comparing these two methods of low rectal cancer in India and especially in the non-metropolitan tertiary care centers. Further, patient reported bowel functions like Low Anterior Resection Syndrome (LARS) have not received

extensive research. The study was thus aimed at comparing the perioperative, oncological, and functional outcomes of laparoscopic and open surgeries in the case of low rectal cancer.

Materials and Methods

Study Design: A matched case-control study was a retrospective study that was carried out following the approval of the Institutional Ethics Committee of Dr. Rajendra Gode Medical College and Hospital, Amravati.

Patient Selection: Sixty patients who have low rectal adenocarcinoma histologically proven ([?]6 cm of anal verge) were included.

Inclusion criteria: age 18- 75 years; clinical stage T1- T3, N0- N1; received LAR or APR.

Screening criteria: T4 tumor, metastasis, emergency surgery, previous radiotherapy to the pelvis.

Groups: Laparoscopic group (n=30): L-LAR or L-APR<|human|>Laparoscopic group (n=30): L-LAR or L-APR

Open group (n=30): O-LAR or O-APR

Age, tumor stage, comorbidities across the patients were matched.

Outcomes: Perioperative outcomes were operative time, blood loss, time to bowel function, time to stay in hospital and complications (Clavien-Dindo).

Outcomes Oncologic Oncologic outcomes comprised lymph node yield, CRM positivity, and R0 resection.

The functional outcome was measured by LARS score at 6 months among LAR patients.

Statistical Analysis: The t-test and Chi-square of the student were applied and the p was taken to be statistically significant which is less than 0.05.

Results

Baseline-matched groups were comparable for age, stage, and comorbidities.

Table 1: Perioperative outcomes

Parameter	Laparoscopic	Open	p-value
Operative time (min)	198 ± 35	164 ± 28	<0.001
Blood loss (mL)	180 ± 40	320 ± 60	<0.01
Hospital stay (days)	5.3 ± 1.2	8.1 ± 2.4	<0.001
Time to bowel function (days)	1.8 ± 0.6	3.4 ± 1.1	<0.001
Complications (%)	16.7	30.0	0.18

Laparoscopic surgery resulted in significantly reduced blood loss, faster bowel recovery, and shorter hospitalization despite longer operative time.

Table 2: Oncological and functional outcomes

Parameter	Laparoscopic	Open	p-value
R0 resection (%)	93.3	90.0	0.64
Lymph nodes	15.6 ± 3.1	14.9 ± 2.9	0.42
CRM positivity (%)	6.7	10.0	0.64
LARS score	17.3 ± 6.5	23.9 ± 7.1	<0.05

Oncological quality was equivalent, while functional outcome was superior in the laparoscopic group.

Discussion

This is a matched case-control study, which was done in Dr. Rajendra Gode Medical College and hospital, and it has shown that laparoscopic surgery in low rectal cancer offers considerable perioperative and functional benefits compared to open surgery with oncological safety. Laparoscopy was also accompanied by less blood loss, quicker bowel movements, less hospitalization and a significant improvement in the LARS scores with no encroachment on R0 resection or lymph node retrieval [12].

The observed longer duration of operation in the laparoscopic group is due to the technical difficulty associated with minimally invasive dissection of the pelvis and the learning curve that was reported in the CLASICC and COLOR II trials [5,6]. Nevertheless, laparoscopy makes the process of visualization and magnification easier, which can help to obtain accurate TME in the narrow pelvis and can be the reason behind the similar or even lower levels of CRM positivity [13].

Minimally invasive surgery has a biological advantage that is supported by our study, which shows reduced blood loss and recovery and is in line with the COREAN trial and several meta-analyses [7,9]. The enhancement in bowel activity after laparoscopic LAR is possibly a marker of better quality of pelvic autonomic nervous system preservation, which is again confirmed with long-term quality-of-life outcome research [11,14, 15].

These findings are significant in the case of a tertiary care Indian center. In the non-metropolitan

situations, laparoscopic surgery on the rectal cancer can provide the same results as international trials with the proper expertise. Less time in the hospital and quicker healing are also translated into decreased healthcare use.

The weaknesses are retrospective design and absence of long-term survival data, however, long term consistencyo with the global randomized trials evidence makes our findings valid.

Conclusion

The laparoscopic operation of low rectal cancer can be seen as a rare intersection of increased postoperative recovery and oncological safety. Therefore, patients who underwent laparoscopic resection had greatly decreased blood loss, quicker bowel activity, short stay in the hospital, and better LARS, indicating better retention of pelvic autonomic nerves and less trauma during surgery. Such functional advantages are especially significant in low rectal cancer, where bowel dysfunction after surgery can have serious implications on the quality of life.

More importantly, all of these advantages were not obtained at the cost of oncological rigor. The rates of R0 resection, circumferential resection margin positivity and lymph node harvest were similar between laparoscopic and open surgery and they confirmed that high-quality total mesorectal excision was available even in the limited space of the pelvis using minimal invasive surgeries. This is in line with the findings of large randomised trials and meta-analyses that have also shown oncological non-inferiority of laparoscopy in treating rectal cancer.

Laparoscopic surgery has better visualization, magnification and fine dissection that is very beneficial in low tumours of the rectum as compared to experienced centres. Laparoscopy does not only maintain the rate of cure when done by trained colorectal surgeons but, in addition, improves patient-related well-being and functional recovery, when carried out according to the established oncological principles. Such advantages are converted into accelerated recovery, decreased medical use, and enhanced life quality in the long-term.

Collectively, our results indicate the perception that laparoscopic surgery is no longer an option but it is the choice of surgery in low rectal cancer patients who have been properly chosen and operated in a facility with sufficient experience and facilities.

Ethics Statement: Institutional Ethics Committee, Dr. Rajendra Gode Medical College & Hospital, Amravati approved. Informed consent taking.

Conflict of Interest: None.

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