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## Comparison of Laparoscopic versus Open Surgery for Carcinoma Rectum in a Tertiary Care Cancer Centre

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**Introduction:** Rectal cancer surgery is traditionally performed by an open as well as laparoscopic surgical approach. Open approaches require laparotomy. Developments in instrumentation and optics have allowed the use of minimally invasive approaches to rectal cancer, which had been traditionally managed by open operation. Minimally Invasive Surgery avoids laparotomy and results in quicker return to normal functions and less morbidity. In this prospective study, we compared the immediate surgical and oncologic outcomes of patients who have undergone minimally invasive surgery with those who have had open surgery.

**Patients and Methods:** Between November 2003 and March 2006, 27 patients with cancer of rectum were recruited. Seventeen of them underwent minimally invasive surgery (MAS) (62.96%) and 10 patients (58.82%) were treated using open surgery (OS). Both operations were done by the same team of surgeons. The groups were compared in terms of perioperative outcomes, morbidity, mortality and adequacy of oncologic excision.

**Results:** The average duration of MIS was 216 minutes, varying from 150 to 399 minutes which was more than that of OS (180 minutes; range 120 – 300). The average blood loss was 190ml (120-310ml) in MIS compared to 270.45 ml (100-350ml) in open group. Average duration of hospitalization was 11.35 (7-35) days in MIS group compared to 12.5 (5-24) days in open group. Six (35.29%) patients in MIS group had developed morbidity. Similarly four (40%) patients in open group had morbidity. In the MIS average of 12.06 nodes (4 to 17 nodes) were excised during surgery. Average numbers of involved nodes were 2.82 (0-5). In Open Group, an average of 11.20 nodes (8 to 13 nodes) was excised during surgery. Average numbers of involved nodes were 20 (0 and 2).

**Discussion:** MIS is oncologically safe compared to open surgery. It has almost similar postoperative course, morbidity pattern and duration of hospital stay as open surgery. Increased duration of procedure compared to open surgery is a disadvantage of minimally invasive surgery, especially in the early part of learning curve.

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### Introduction

Traditionally rectal cancers were managed by open surgery. Open surgery usually constitutes abdominoperineal resection and anterior resection. During last decade minimally

invasive surgery became popular and accepted worldwide. It is thought to reduce the physiologic stress associated with open surgery and the morbidity associated with laparotomy. Even though some centers have started doing minimally invasive surgery routinely for carcinoma rectum, majority of rectal cancers in India are managed by open surgery and minimally invasive surgery has yet to set its foot in as one important method of surgical treatment. In the present study, we compared the immediate surgical results and pathological outcomes of minimally invasive surgery with that of open surgery.

### Patients and Methods

From November 2003 through March 2006, 27 patients with malignancies of rectum were included in the study, 18 patients (66.6%) were males and 9 of them (33.3%) were females. Out of 27 patients, 17 of them underwent MIS (62.96%) and 10 patients (58.82%) were treated using OS. Both operations were done by the same team of surgeons. In the MIS group, laparoscopic anterior resection (LAR) or laparoscopic abdominoperineal resection (LAPR) was done, depending upon the location of cancer.

Routine preoperative work-up included colonoscopy and computerized axial tomography (CT) scan of abdomen. Preanaesthetic evaluation included assessment of nutritional status, general medical condition, pulmonary function, and cardiac status. All intraoperative (duration of surgery, blood loss and blood transfusion), postoperative (day of oral intake, day of mobilization, day of bowel movement, day of discharge, morbidity and mortality) and pathologic parameters (number of lymph nodes removed, no of involved nodes, and adequacy of surgical margins) were recorded prospectively. The groups were compared in terms of perioperative outcomes, morbidity, mortality and adequacy of oncologic excision.

### Results

Among the 27 patients with malignancies of Rectum included in the study, 18 patients (66.66%) were males and 9 of them (33.33%) were females. Out of 27 patients, 17 of them underwent minimally invasive surgery (62.96%) and 10 patients (58.82%) were treated using open surgery. Table 1 gives details of site wise distribution among the patients. Table 2 deals with comprehensive picture of the procedure carried out.

**Table 1: Site distribution-all cases**

Site	No.	percent
Ca Lower Third	9	33.3
Ca Middle Third	11	40.7
Ca Rectosigmoid	1	3.7
Ca Upper Third	6	22.2
Total	27	100.0

**Table 2: Procedures performed**

Procedure	No.	Percent
Lap Assisted APR	10	37
Lap Assisted LAR	7	25.9
Open APR	5	18.5
Open LAR	5	18.5
Total	27	100.0

Out of total 17 patients, majority of the patients who had undergone laparoscopic surgery were males (12 patients) and remaining five patients were females. All patients had undergone surgery as primary modality of treatment. In site wise distribution of the laparoscopic group, six cases each were of low rectal cancers and mid rectal cancers; four patients were with upper rectal cancers and one patient with rectosigmoid lesion. Regarding the procedure done in MIS group, ten patients were subjected to LAPR and 7 cases to Lap Assisted LAR surgery procedures.

In the OS group of ten patients, six patients were males and four were females. In site wise distribution of the open group, three patients had low rectal, while 5 had mid rectal and two had with upper rectal cancers. Five patients each underwent abdominoperineal resection and anterior resection.

### **Immediate Results**

**Laparoscopic Group-** The average duration of MIS was 216 minutes, varying from 150 to 399 minutes. While average blood loss was 190 ml (range 120-310 ml), the average number of blood transfusion was .5 units (range 0-1). The time taken for postoperative oral intake ranged between 4 to 10 days, with an average duration of 5.41 days. While it took around 4 to 12 days (average 7.18 days) to remove drain, it took 3 to 10 days (average 5.35 days) for restoration of bowel movement. All the patients in the laparoscopic group were discharged between 7 and 35 days, with an average duration of discharge falling at 11.35 days.

**Open Group -** In open group, the time taken for carrying out the procedure was falling between 120 and 300 minutes, with an average duration of 180 minutes, while number of blood transfusions varied between 0 and 1 unit with an average of 0.6 units. The average blood loss reported among the patients was 270.45 ml (range 100-350 ml). The average day on which the patient started postoperative oral intake was observed to 6.6 days (range 4-8). While the average duration to stoppage of intravenous fluid took 11.4 days (range 7-20 days), average duration to restoration of bowel movement took 6.3 days (range 5 to 11 days). All drains were removed by an average duration of 8.4 days (range 5 to 13 days) and patient was discharged within an average duration of 12.5 days (range 9-18).

### **Complications**

In MIS group around 6(35.29%) of the patients developed minor morbidities which included perineal wound dehiscence in three patients (17.64%) and radiologic consolidation of lung , prolonged ileus and wound infection in one each (5.9%) of the patients. Similarly in OS

group, four patients among the open surgery group developed complications (40%), of which three of them had wound infection (30%) and prolonged ileus (10 %).

### **Oncologic Outcome**

In MIS group, about 88.2% of the patients (15 patients) had adenocarcinoma and 11.8% (2 patients) had malignant melanoma according to the final histopathological report. The margin status showed that all margins were negative after surgery. In the laparoscopic group average of 12.06 nodes (4 to 17 nodes) were excised during surgery and average number of involved nodes were 2.82 nodes (0-5). In open group, an average of 11.2 nodes (8 to 13 nodes) was excised during surgery and average numbers of involved nodes were 1.20 nodes (0 and 2).

A total of 13 patients (76.47%) received complete adjuvant treatment in the form of chemotherapy, while 2 patients took incomplete treatment (11.76%) and the remaining two patients (11.76%) did not receive neo adjuvant treatment in MIS group. In Open Group, 8 patients had received adjuvant treatment in the form of chemotherapy and two patients didn't receive any such treatment.

### **Discussion**

Carcinoma rectum is one area where laparoscopic resection can be put to maximum use because it does not need any incisions at all. The advantages of MIS is the better visibility offered by laparoscopic systems especially within the deep pelvis. Most of the earlier series the commonest procedure was APR as the case of OS [1-7]. But as times goes on more and LAR are being done laparoscopically [8-20].

LAPR quite consistently took an average of 3 to 4 hours among different reports [1-5, 7, 11-14]. The average operating time for Laparoscopic sphincter-preserving TME was more variable, and ranged from 2 to 7 hours in different reports [8, 9, 14, 16- 18]. Laparoscopic techniques may be associated with less operative blood loss and reduced perioperative transfusions [20, 21, 25], although there are data that indicate no difference [23]. There is also a marginal benefit in the length of hospital stay,

with studies showing either similar [11, 20, 21, 23] or shorter hospital stay [1-5, 15, 25, 26]. The absolute reduction in the average hospital stay was quite dramatic in the latter case, ranging from 4.5 to 7 days [27-32].

In non randomized comparative studies, laparoscopic and open resection of rectal cancer were found to be equivalent in achieving distal and radial margins [1-5, 11, 15, 20, 21, 26, 33]. In four separate series, the reported distal margin in laparoscopic sphincter preserving TME for mid and low rectal cancer ranged from 3 to 4.3cm, with microscopic involvement in 1% (range 0-2) of cases [14, 16, 17, 20]. Finally although lymph node harvest in the resected specimens varied considerably from 5 to 27 [1-5, 11, 12, 14-17, 19, 20, 22, 24, 25, 31, 33], this was found to be similar to that of OS in most studies [1-5, 11, 20, 21, 26, 33].

In the vast majority of reports, postoperative mortality rates following laparoscopic rectal cancer excision were similar [13, 23, 27, 28, 31, 34, 35] so was morbidity [13, 23, 21, 28, 29, 30, 32] when compared with OS in most comparative studies. The clinical leak rate was comparable to that of open TME and remained significant at 11% to 17%. Conversion during laparoscopic procedures rectal cancer excision varies greatly, from 5 to 33 %. Common reasons for conversion were intraoperatively bleeding, bulky or locally advanced tumours, technical difficulties and adhesions.

In a large series by Kockerling and coauthors on low rectal cancer [24], the incidence of abdominal wound and chest infection were 5.1% and 4.3% respectively, converted cases being included. These figures are certainly noteworthy and suggest that as with laparoscopic colectomy, reduction in the size of the abdominal incision helps to decrease postoperative wound and pulmonary complications. Postoperative bowel obstruction is yet another common morbidity following abdominal surgery.

Local recurrence is the single most important measure of success in rectal cancer surgery. The majority of the comparative studies found similar local recurrence rates for MIS and open rectal cancer excision [15, 19, 21, 27, 31] and most were able to achieve a local recurrence

rate below 10%. Local recurrence rates after LAPR varied considerably, from 0% to 25% [9, 10, 18, 33, 38, 40], whereas those of laparoscopic sphincter-saving TME were in the respectable range of 0% to 6 % [19, 22, 25, 33, 39, 40]. Similarly, current evidence proves port site metastasis to be a rare event in laparoscopic rectal cancer surgery. The overall incidence in the literature is 0.1% a figure comparable to that of wound recurrence in open surgery [41, 42]. Thus, port-site metastasis is not an inherent detriment of laparoscopic surgery for rectal cancer.

Scheidbach *et al.*, [28] reported 4-year overall survival rates of 86.6% and 71.7% after curative LAPR and anterior resection respectively. Leroy and coworkers [19] reported a slightly lower 5-year figure of 65%. Several small comparative studies of laparoscopic versus open rectal cancer excision demonstrated no survival difference, but follow-up time was short in all these reports [13, 19, 24, 27, 31, 35].

## Conclusions

Although curative laparoscopic rectal cancer excision does not appear to confer any disadvantages in terms of early local disease recurrence and survival figures. The available evidence demonstrates its safety in experienced hands and an ontological clearance comparable to that of the open counterpart.

## Authors' Contribution

**KC** Prepared literature search and prepared the draft manuscript

**KCK**- Designed the study.

**PSG** Done statistical analysis

**MHP** Helped in designing the study

**GCG** helped in writing manuscript

all authors read and approved the final manuscript for submission.

## Conflict of Interests

The authors declare that there are no competing interests



## Ethical Considerations

Ethical Committee approval was obtained prior to commencement of study and written informed consent was obtained from all participants.

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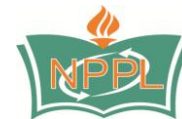
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## References

- Fleshman JW, Wexner SD, Anvari M, LaTulippe JF, Birnbaum EH, Kodner IJ, Read TE, Noguerras JJ, Weiss EG. Laparoscopic vs. open abdominoperineal resection for cancer. *Dis Colon Rectum*. 1999; 42(7): 930-9. [PMID: 10411441].
- Ramos JR, Petrosemolo RH, Valory EA, Polania FC, Pecanha R. abdominoperineal resection: Laparoscopic versus conventional surgery. *Surg Laparosc Endosc*. 1997; 7(2): 148-52. [PMID: 9109247]
- Iroatulam AJ, Agachan F, Alabaz O, Weiss EG, Noguerras JJ, Wexner SD. Laparoscopic abdominoperineal resection for anorectal cancer. *Am Surg*. 1998; 64(1):12-8. [PMID: 9457031]
- Darzi A, Lewis C, Menzies-Gow N, Guillou PJ, Monson JR. Laparoscopic abdominoperineal excision of the rectum. *Surg Endosc*. 1995 Apr;9(4):414-7. [PMID: 7660266].
- Chindasub S, Charntaracharnong C, Nimitvanit C, Akkaranurukul P, Santitarmanon B. Laparoscopic abdominoperineal resection. *J Laparoendosc Surg*. 1994 Feb;4(1):17-21. [PMID: 8173107].
- Larach SW, Salomon MC, Williamson PR, Goldstein E. Laparoscopic assisted abdominoperineal resection. *Surg Laparosc Endosc* 1993; 392:115-8. [PMID: 8269230]
- Glatfeli A, Birrer S, Buchman P, Christen D, Frei E, Kraiber C, Krähenbühl L, Lange J, Metzger U. Techniques and results of Laparoscopic rectum resection. *Schweiz Med Wochenschr Suppl*. 1996;79:85S-88S. [PMID: 8701269] (German).
- Weiser MR, Milsom JW. Laparoscopic total mesorectal excision with autonomic nerve preservation. *Semin Surg Oncol* 2000; 19:396-403. [PMID: 11241922]
- Watanabe M, Teramoto T, Hasegawa H, Kitajima M. Laparoscopic ultralow anterior resection combined with per anum intersphincteric rectal dissection for lower rectal cancer. *Dis Colon Rectum*. 2000 Oct;43(10 Suppl):S94-7. [PMID: 11052484].
- Chung CC, Ha JP, Tsang WW, Li MK. Laparoscopic-assisted total mesorectal excision and colonic J pouch reconstruction in the treatment of rectal cancer. *Surg Endosc* 2001; 15: 1098-1101. [PMID: 11727078]
- Hartley JE, Mehigan BJ, Quershi AE, Duthie GS, Lee PW, Monson JR. Total mesorectal excision: assessment of the Laparoscopic approach. *Dis Colon Rectum* 2001; 44:315-21. [PMID: 11289275]
- Yamamoto S, Watanabe M, Hasegawa H, Kitajima M. Prospective evaluation of Laparoscopic surgery for rectosigmoidal and rectal carcinoma. *Dis Colon Rectum* 2002; 45: 1648-1654. [PMID: 12473889]
- Pikarsky AJ, Rosenthal R, Weiss EG, Wexner SD. Laparoscopic total mesorectal excision. *Surg Endosc* 2002; 16(4):558-62. [PMID: 11972187]
- Morino M, Parini U, Giraudo G, Salval M, Brachet Contul R, Garrone C. Laparoscopic total mesorectal excision: a consecutive series of 100 patients. *Ann Surg* 2003; 237: 335-342. [PMID: 12616116]
- Rullier E, Sa Cunha A, Couderc P, Rullier A, Gontier R, Saric J. Laparoscopic intersphincteric resection with coloanal anastomosis for mid and low rectal cancer. *Br J Surg*. 2003; 90(4):445-51. [PMID: 12673746]
- Bretagnol F, Rullier E, Laurent C, Zerbib F, Gontier R, Saric J. Comparison of functional results and quality of life between intersphincteric resection and conventional coloanal anastomosis for low rectal cancer. *Dis Colon Rectum*. 2004 47(6):832-8. [PMID: 15108027]
- Tsang WW, Chung CC, Li MK. Prospective evaluation of Laparoscopic mesorectal excision with colonic J pouch reconstruction for mid and low rectal cancers. *Br J Surg* 2003; 90:867-71. [PMID: 12854115]
- Zhou ZG, Wang Z, Yu YY, Shu Y, Cheng Z, Li L, Lei WZ, Wang TC. Laparoscopic total mesorectal excision of low rectal cancer with perseveration of the anal sphincter report of 82 cases. *World J Gastroenterol* 2003; 9:1477-81. [PMID: 12854145]
- Leroy J, Jamali FR, Forbes L, Smith M, Marescaux J. Laparoscopic Total Mesorectal Excision for Rectal Cancer Surgery: Long term outcomes. *Surg Endosc* 2004; 18: 281-289. [PMID: 14691716]
- WU WX, Sun YM, Hua YB, Shen LZ. Laparoscopic versus conventional open resection of rectal carcinoma: a clinical comparative study. *World Gastroenterol* 2004; 10 (80):1167-70. [PMID: 15069719]
- Schwandner O, Schiedeck TH, Killaitis C, Bruch HP. A case control study comparing Laparoscopic and open surgery for rectosigmoid and rectal cancer. *Int J Colorectal Dis* 1999; 14:158-63. [PMID: 10460907].
- Scheidbach H, Schneider C, Konradt J, Barlehner E, Kohler L, Wittekind CH, Kockerling F. Laparoscopic abdominoperineal resection and anterior resection with curative intent for carcinoma of the rectum. *Surg Endosc* 2002; 16: 7-13. [PMID: 11961595]
- Araujo SE, da Silva eSousa AH Jr, de Campos FG, Habr-Gama A, Dumarco RB, Caravatto PP, Nahas SC, da Silva J, Kiss DR, Gama-Rodrigues JJ. Conventional approach x laparoscopic abdominoperineal resection for rectal cancer treatment after neoadjuvant chemoradiation: results of a prospective randomized trial. *Rev Hosp Clin Fac Med Sao Paulo*. 2003 May-Jun;58(3):133-40. Epub 2003 Jul 22. [PMID: 12894309].
- Köckerling F, Scheidbach H, Schneider C, Barlehner E, Köhler L, Bruch HP, Konradt J, Wittekind C, Hohenberger W. Laparoscopic abdominoperineal resection: early postoperative results of a prospective study involving 116 patients. The Laparoscopic Colorectal Surgery Study Group. *Dis Colon Rectum*. 2000 Nov; 43(11):1503-11. [PMID: 11089583].
- Anthuber M, Fuerst A, Elser F, Berger R, Jauch KW. Outcome of Laparoscopic surgery for rectal cancer in 101 patients. *Dis Colon Rectum* 2003 Aug; 46(8):1047-53. [PMID: 12907898]
- Baker RP, White EE, Tutu L, Duthie GS, Lee PW, Monson JR. Does Laparoscopic abdominoperineal resection of the rectum compromise long-term survival? *Dis Colon Rectum* 2002; 45: 1481-1485. [PMID: 12432295]

27. Rhodes M, Rudd M, Nathanson L, Fielding G, Siu S, Hewett P, Stitz R. Laparoscopic anterior resection: a consecutive series of 84 patients. *Surg Laparosc Endosc* 1996 6(3):213-7. [PMID: 8743366]
28. Scheidbach H, Schneider C, Baerlehner E, Konradt J, Koeckerling F; Laparoscopic Colorectal Surgery Study Group. Laparoscopic anterior resection for rectal carcinoma. Results of a registry. *Surg Oncol Clin N Am* 2001; 10(3):599-609.
30. Leung KL, Kwok SP, Lam SC, Lee JF, Yiu RY, Ng SS, Lai PB, Lau WY. Laparoscopic resection of rectosigmoid carcinoma: prospective randomised trial. *Lancet*. 2004 Apr 10;363(9416):1187-92. [PMID: 15081650].
31. Wibe A, Syse A, Andersen E, Tretli S, Myrvold HE, Søreide O; Norwegian Rectal Cancer Group. Oncological outcomes after total mesorectal excision for cure for cancer of the lower rectum. *Disc Colon Rectum* 2004;47(1):48-58. [PMID: 14719151]
32. Barlehner E, Decker T, Anders S, Heukrodt B. Laparoscopic surgery of rectal carcinoma. Radical oncology and late results. *Zentralbl Chir*. 2001; 126(4):302-6(German) [PMID: 11370393].
33. Braga M, Vignali A, Gianotti L, Zuliani W, Radaelli G, Guarini P, Dellabona P, Di Carlo V. Laparoscopic versus open colorectal surgery: a randomized trial on short-term outcome. *Ann Surg*. 2002 Dec;236(6):759-66; discussion 767. [PMID: 12454514].
34. Feliciotti F, Guerrieri M, Paganini AM, De Sanctis A, Campagnacci R, Perretta S, D'Ambrosio G, Lezoche E. Long-term results of Laparoscopic versus open resection for rectal cancer for 125 unselected patients. *Surg Endosc* 2003; 17(10):1530-5. [PMID: 12874687]
35. Chapman AE, Levitt MD, Hewett P, Woods R, Sheiner H, Maddern GJ. Laparoscopic-assisted resection of colorectal malignancies: A systematic review. *Ann Surg* 2002; 23(6):759-67. [PMID: 11685021]
36. Reissman P, Teoh TA, Skinner K, Burns JW, Wexner SD. Adhesion formation after Laparoscopic anterior resection in a porcine model: a pilot study. *Surg Laparosc Endosc* 1996; 6:136-139. [PMID: 8680636]
37. Karanjia ND, Corder AP, H Bearn P, Heald RJ. Leakage from stapled low anastomosis after total mesorectal excision for carcinoma of the Rectum. *Br J Surg* 1994, 81, 1224-1226. [PMID: 7953369]
38. Carlsen E, Schlichting E, Guldvog I, Johnson E, Heald RJ. Effect of the introduction of total mesorectal excision for the treatment of rectal cancer. *Br J Surg* 1998; 85(4):526-9. [PMID: 9607540]
39. Larach SW, Patankar SK, Ferrara A, Williamson PR, Perozo SE, Lord AS. Complications of Laparoscopic colorectal surgery. Analysis and comparison of early Vs latter experience. *Dis Colon Rectum* 1997; 40(5):592-6. [PMID: 9152190]
40. Adam IJ, Mohamdee MO, Martin IG, Scott N, Finan PJ, Johnston D, Dixon MF, Quirke P. Role of circumferential margin involvement in the local recurrence of rectal cancer. *Lancet* 1994 Sep 10; 344(8924):707-711 [PMID: 7915774]
41. Heald RJ, Husband EM, Ryall RD. The mesorectum in rectal cancer surgery- the clue to pelvic recurrence? *Br J Surg* 1982; 69: 613-616. [PMID: 6751457]
42. Bonnel C, Parc YR, Pocard M, Dehni N, Caplin S, Parc R, Tiret E. Effects of preoperative radiotherapy for primary resectable rectal adenocarcinoma on male sexual and urinary function. *Dis Colon Rectum*. 2002 Jul;45(7):934-9. [PMID: 12130883].
43. Pocard M, Zinzindohoue F, Haab F, Caplin S, Parc R, Tiret E. A prospective study of sexual and urinary function before and after total mesorectal excision with autonomic nerve preservation. *Surgery* 2002; 131(4):368-72. [PMID: 11935125]



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