

# Laparoscopy in Colorectal Malignancies: Current Concepts

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## Abstract

Laparoscopic surgery has widely spread in the treatment of colorectal cancer. For colorectal cancers, many randomized controlled trials regarding short-term outcome demonstrate that laparoscopic surgery is feasible, safe and has many benefits including reduction in a perioperative mortality. In terms of long-term outcome, four randomized controlled trials insist that there are no differences in both laparoscopic and open surgeries proving oncologic safety and that the long-term outcome is at least not inferior to open resection. However, there are still more important issues including long-term oncological outcome for advanced colon cancer, costeffectiveness and the impact on quality of life of patients.

**Keywords:** Colorectal malignancies, laparoscopy in colorectal malignancies, cancer sigmoid colon, rectal cancer.

## INTRODUCTION

After the acceptance of laparoscopy as the gold standard management for cholelithiasis, more and more thoughts are now being directed towards the use of laparoscopy in colorectal cancer surgery. Advantages of laparoscopic surgery like less postoperative pain, shorter hospital stay, decreased incidence of paralytic ileus, improved cosmesis, less intraoperative blood loss, decreased use of narcotics, and fewer postoperative wound complications have been the driving force of this consideration.<sup>1-3</sup> But concerns remain regarding potential violation of principles of oncologic surgery, technical aspects of performing the procedure, adequate staging capability, and existing learning curves.<sup>4,5</sup> Port-site recurrences were the major setback in the use of laparoscopy for colorectal malignancies. Hence investigators embarked on conducting multicentric randomized controlled trials to compare the effect of laparoscopic colorectal surgery and open surgery for colorectal malignancy in terms of recurrence and survival.

## MATERIALS AND METHODS

A literature search was performed using Medline and search engine Google. The following search terms were used “laparoscopy” and “colorectal malignancies”. More than 1500 citations were found. Selected papers were screened for further references. Criteria for selection was year of

study, number of cases, methods of analysis, and institutions where studies were conducted.

## VARIOUS OPERATIVE TECHNIQUES AVAILABLE

The learning curve for laparoscopic colorectal cancer surgery is estimated to be 35 to 50 procedures. As mentioned the 3 minimally invasive techniques used to resect the colon/rectum are:

- Laparoscopic colorectal surgery, in which the mesentery and the bowel are mobilized and transected laparoscopically. The anastomosis of the colon/rectum is done intracorporeally or extracorporeally. The specimen is removed from the abdomen via a small extraction incision, often the same incision through which the anastomosis may be performed or via the perineal wound created in perineal dissection of the rectal mobilization.
- Laparoscopic-assisted colorectal surgery is executed with full laparoscopic mobilization of the colon and rectum followed by externalization of the bowel through a small incision. The resection and the anastomosis is done extracorporeally.
- Hand-assisted laparoscopic colorectal surgery is a hybrid that shares techniques of laparoscopic and open surgery, a hand port is used to aid in the retraction, mobilization, and dissection of the bowel. The actual resection and anastomosis of the colon can be performed as in a

laparoscopic colectomy or laparoscopic assisted colectomy. Once the rectum is delivered through the perineal wound, one of the ports is used on left side to fashion an end colostomy.

Ideal extent of resection is defined by the removal of the blood supply and lymphatics at the level of origin of the primary feeding arterial vessel. Furthermore, the lesion should be excised *en bloc* with tumor-free radial margins (R0) to be considered curative.<sup>4,6</sup>

## ISSUES REGARDING LAPAROSCOPIC COLORECTAL SURGERY IN MALIGNANCY

- a. *Port-site tumor recurrence*: Several theories had been proposed for the possible increase in incidence of wound metastasis associated with laparoscopic surgery including mechanical, metabolic, immunologic and hematogenous routes of tumor implantation.<sup>7</sup> Direct, mechanical contamination from contact between the excised tumor mass and the wound site was initially believed to be a logical etiology; although wound metastasis have occurred at other port sites, suggesting the role of alternative mechanisms.<sup>8</sup> Despite the benefit in decreased systemic cell mediated immune suppression associated with laparoscopy, CO<sub>2</sub> has been shown to result in an acidotic intraperitoneal environment and impaired peritoneal macrophage function contributing to local tumor implantation.<sup>9-11</sup> But still use of wound protectors and specimen extraction bags to prevent direct contamination of incision sites and use of a general cytotoxic substance like povidone-iodine were excellent in preventing port-site incisional tumor implantation after laparoscopy.
- b. *Missing hepatic metastatic lesions*: Due to the loss of tactile sensation, concern regarding potential to miss hepatic metastatic lesions did arise. The use of intraoperative laparoscopic ultrasonography to effectively evaluate liver for lesions has eased this issue.
- c. Technical expertise in laparoscopic procedure.

## SYSTEMIC AND METABOLIC EFFECTS OF MINIMALLY INVASIVE SURGERY

The systemic immune system's physiological response to surgical trauma affects several metabolic pathways, producing a state of immunosuppression that varies according to the extent of operative trauma.<sup>12</sup> This was suggested by smaller elevations in serum interleukin (IL-6), tumor necrosis factor and C-reactive protein (CRP) after

laparoscopic surgery.<sup>13</sup> Such short-term alterations and their long-term implications on tumor recurrence and patient survival though unknown, yet some effects of open surgery may be more deleterious than when the operation is performed laparoscopically. Wu et al found that in patients with colonic carcinoma, postoperative leukocyte counts and leukocyte subpopulations normalized earlier after laparoscopic colectomy than after open surgery.

## PROSPECTIVE RANDOMIZED CONTROLLED TRIALS: LONG-TERM RESULTS AND OUTCOMES

A review of conducted prospective randomized controlled trials revealed the efficacy of laparoscopic colorectal surgery for malignancy. The United Kingdom Medical Research Council Conventional vs Laparoscopic Assisted Surgery in Colorectal Cancer (UK MRC CLASICC; clinical trial no ISRCTN 74883561) trial is a randomized clinical study of laparoscopic- assisted vs conventional open surgery in patients with colorectal cancer. Approximately 794 patients were randomized (268 open and 526 laparoscopic) between July, 96 and June, 2002.<sup>14</sup>

The 3-year overall survival (OS) for all patients was 67.8 % with 87 deaths in the open arm and 161 deaths in the laparoscopic arm. Overall cause of death was similar in both arms. There was no difference in 3-year OS for patients with either colon or rectal cancer. Overall, there was no evidence of a difference between the two techniques for any stage of disease, though a nonsignificant trend was observed for improved 3-year OS after laparoscopic surgery in patients with Dukes' A rectal cancers. The 3-year disease free survival (DFS) for all patients was 66.8%. There was no difference between the two surgical techniques in 3-year DFS.

The overall local recurrence rate at 3 years was 8.4%. The overall distant recurrence rate at 3 years was 14.9%. Overall there were 10 wound/port-site recurrences within 3 years of randomization. There was one wound/port-site recurrence in the open arm and nine wound/port-site recurrences in the laparoscopic arm. The open wound/port-site recurrence was 0.6% and laparoscopic wound/port-site recurrence was 2.5%. Patients developing wound/port-site recurrences tended to have larger tumors (median diameter 45 mm) compared to patients without wound/port-site recurrence (median diameter 35 mm), more advanced disease (7 of 10 had Dukes' C1 or C2 cancers), or evidence of intra-abdominal recurrence (7 of 10).

The trial confirms and extends previous studies reporting that for any stage 3-year survival and disease free intervals are no worse than in patients undergoing laparoscopic colorectal surgery as compared to open surgery. The DFS, OS, and local recurrences in patients undergoing laparoscopic resection of colorectal cancer are as good with laparoscopic surgery as with open surgery.

Overall, 10 wound or port-site recurrences occurred in 639 patients randomly assigned who had curative colorectal cancer surgery (1.9%). Of these, only one (0.2%) was reported as a true port-site recurrence, with the remainder being retrieval site recurrences. The majority of retrieval site recurrences occurred in patients with larger tumors or more advanced disease, emphasizing the need for adequate wound protection during specimen extraction. Port-site recurrences in the Barcelona and Clinical Outcomes of Surgery Therapy (COST) trials were 0.94% and 0.5% respectively.<sup>15</sup> Previous studies investigating immune dysfunction after laparoscopic surgery have failed to demonstrate any difference in comparison to open surgery.<sup>16</sup>

In long-term observations, the Quality of Life (QOL) after laparoscopic surgery is no worse than conventional open surgery. In a previous subgroup analysis of rectal cancer surgery, a nonsignificant trend for worse sexual function in males was reported after laparoscopic resection.<sup>17</sup> The long-term QOL analysis presented here emphasizes the decline in male sexual function after rectal resection was present in both arms.

Another randomized trial conducted by the clinical outcomes of surgical therapy study group (COST) between August, 1994 and August, 2001 of 872 patients was carried out where a total of 428 patients underwent open colectomy and 435 were treated laparoscopically. Operative times were significantly longer in the laparoscopic surgery group than in the open colectomy group (150 vs 95 minutes). The extent of resection was similar in both groups; bowel margins were less than 5 cm in 6% of patients in the open colectomy group and 5% in laparoscopic group. Perioperative recovery was faster in the laparoscopic surgery group than in the open colectomy group, reflected by shorter hospital stay and briefer use of parenteral narcotics and oral analgesics. There were no statistical differences between the groups in the rates of intraoperative complications (2% in the open colectomy group and 4% in the laparoscopic group), 30 day postoperative mortality rates and severity of postoperative complications at discharge at 60 days and rates of readmission or reoperation (< 2% in each group).

After a median follow-up of 4.4 years, 160 patients had a recurrence of tumor (84 in the open colectomy group and 76 in the laparoscopic surgery group) and 186 had died (95 and 91 respectively). The cumulative incidence of recurrence among patients treated with the laparoscopic procedure did not differ significantly from the open group. The overall survival was also very similar in the two groups as was the disease free survival rate. These findings held true for any stage of cancer; there were no significant differences between treatment groups in the time to recurrence, disease free survival or overall survival. Tumor recurred in surgical wounds in 3 patients-2 in laparoscopy and 1 in open group.

Other multi-institutional randomized controlled trials like the Barcelona trial, COST trial, and COLOR trial have level 1 evidence to support the advantages of and refute the disadvantages of laparoscopic curable colon cancer surgery.<sup>18,19</sup>

Although clinical trials establish the safety and feasibility of laparoscopic colectomy in colon cancer, less evidence exists for the same in rectal cancer. Laparotomy and meticulous total mesorectal excision as advocated by Herald et al is currently the accepted standard of care for carcinoma rectum; a technique associated with low recurrence and optimal survival.<sup>20</sup> Laparoscopic surgery in rectal cancers requires to duplicate these oncologic results. Many authors have published significant case-series studies establishing the safety of laparoscopic rectal cancer surgery with >1200 patients. Feliciotti et al prospectively studied laparoscopic assisted and open resections and found both methods to respect oncologic principles with similar long-term outcomes.<sup>21</sup> Prospective studies have revealed that laparoscopic resection compared with open surgery did not worsen survival or disease control in patients with rectosigmoid cancer. 2 recent meta-analysis reviewed the current literature on the laparoscopic resection of rectal cancer.<sup>22,23</sup> Gao et al analyzed 11 studies (1995-2005), which included 285 patients who had undergone laparoscopic resection for rectal cancer. The authors found that laparoscopic surgery was associated with lower morbidity but longer operating time. Wound infection, anastomotic leakage, and mortality were similar in the open and laparoscopic groups. Aziz et al analyzed 20 studies (1993-2004) including 909 patients who had undergone laparoscopic rectal cancer resection and 1162 who had undergone open surgery. Reduction in length of stay and time to first bowel movement and stomal function in patients who underwent laparoscopic surgery was revealed. In the set of abdominoperineal resection, laparoscopic patients

required fewer parenteral analgesics and had reduced rates of postoperative wound infections.

## CONCLUSION

Serious concerns about the potential inadequacy of resection, possible staging inaccuracies, tumor cell dissemination demanded prospective randomized comparisons between the open and laparoscopic procedures for colorectal malignancies. Multi-institutional studies provide data in support of safety of laparoscopy with respect to complications, time to recurrence, disease free survival, overall survival, and quality of life. Operative factors like extent of resection—specifically nos of lymph nodes sampled, length of bowel and mesentery resected and bowel margins—did not vary in both the groups. Hence, it may be suggested that it is safe to proceed with laparoscopic colorectal cancer surgery and that plans to conduct comprehensive analysis of the quality of life, cost and cost-effectiveness of laparoscopic surgery for colorectal malignancies may be undertaken.<sup>24</sup>

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