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Review Article

Current evidence for laparoscopic surgery in colorectal cancers

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ABSTRACT

The article lays an emphasis on the laparoscopic surgical method used to treat colorectal cancer. It reviews the current status of the laparoscopic colorectal surgeries and recommendation of evidences for short- and long-term outcome. The early results were against laparoscopic approach. There was a need of properly designed study to validate or invalidate these findings. Seven large-scale trials compared laparoscopic and open colectomy for colon carcinoma and examined short-term and long-term outcomes. These trials included the Clinical Outcomes of Surgical Therapies (COST) trial funded by the National Cancer Institute in the United States, the Conventional versus Laparoscopic-Assisted Surgery in Colorectal Cancer (CLASICC) trial in the United Kingdom, the Colon Cancer Laparoscopic or Open Resection (COLOR), a multicenter European trial.

For the validation of the argument that laparoscopy is safe, meta-analysis was performed. Certain conclusions of meta-analysis are also presented in this article. The individual merits and weaknesses of laparoscopic surgery as compared with open surgery as the primary treatment of colorectal cancer are being highlighted in this article.

1. Introduction

The incidence of colorectal cancer globally is around one million every year, and is the second most common cancer in women and third most common cancer in men.[1] About 80–90% of patients with cancer of colon and rectum are treated surgically. As with other cancers, minimally invasive techniques are increasingly being used for colorectal surgeries. The safety and benefits of these techniques in colorectal surgery have already been established, but there are still important issues including long-term oncological outcome for advanced colon cancer, cost effectiveness, and the impact on quality of life of patients. The aim of this paper is to review the current status of laparoscopic colorectal surgery, recommendation of technique, and evidences for short- and long-term outcomes.

2. Laparoscopic colorectal surgery

Since the first sigmoid resection by laparoscopic method by Jacobs in 1991, indications, technique, standardization, pre

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and postoperative management have been changing and constantly evolving.[2] Initial studies of laparoscopic colorectal surgery for benign colorectal disease had shown high rate of complications (18%), including inadvertent enterotomies, hemorrhage, anastomotic leaks, and pelvic abscesses. Similarly, in laparoscopic colorectal surgery for malignant indication, studies have shown trocar site recurrences, including one case series documenting a 21% rate[3] compared to 1% in open technique. Another study showed decreased survival at 2 years of 76% from 87% for all stages ($p = 0.02$) of colorectal cancer collected from a prospective database of 377 consecutive laparoscopic patients. Chan et al. showed an increased local recurrence rate at 3-year follow-up of 9.8% in the laparoscopically converted group as compared to 2.8% in open patients ($p = 0.03$).

As most of the early results were against laparoscopic approach, there was a need of properly designed study to validate or invalidate these findings. Seven large-scale trials compared laparoscopic and open colectomy for colon carcinoma and examined short-term and long-term outcomes. These trials included the Clinical Outcomes of Surgical Therapies (COST) trial funded by the National Cancer Institute in the United States, the Conventional versus Laparoscopic-Assisted Surgery in Colorectal Cancer (CLASICC) trial in the United Kingdom, the Colon Cancer Laparoscopic or Open Resection (COLOR), a multicenter European trial, the Barcelona trial, and several others.[4–6,15,34–39] The main focus of these trials was oncologic outcomes, but short-term outcomes, quality of life, and safety were also evaluated. The CLASICC trial was the only large trial that also evaluated MIS in rectal cancer.

3. Current status

3.1. *Evidence for colon cancer*

3.1.1. *COST study group*

This trial included 863 patients among 48 centers in the United States and Canada. Patients who underwent colorectal resection, excluding that of transverse colon and rectum, between 1994 and 2001 were included. The endpoint was tumor recurrence.[6] The first results were published in 2002 showing benefits of laparoscopy approach as improved quality of life, significantly shorter hospital stay, and requirement of less analgesia compared to the open group (5 versus 6 days, $p < 0.001$) in the early postoperative period. The conversion rate to open resection was 21%, and remained consistent throughout the study course.

Recently published 5-year outcomes data from the COST group trial, which followed 852 patients randomly assigned to either laparoscopic or open colorectal resections for cancer, showed an overall survival of 74.6% with laparoscopic resection versus 76.4% with open surgery ($p = 0.93$).[7] Disease-free survival was 68.4% and 69.2% ($p = 0.94$), respectively. Local recurrence rates were 2.6% and 2.3% ($p = 0.79$), and overall rates of recurrence were 21.8% and 19.4% ($p = 0.25$), respectively.[7] There was no significant difference in hepatic and pulmonary metastases between the groups in this study. The COST study's 5-year follow-up data also did not show a significantly higher wound-site or laparoscopic port-site recurrence when compared with open surgery.[7] The rate was 0.5% following laparoscopic surgery and 0.9% following open surgery ($p = 0.43$).

3.1.2. *COLOR*[9]

Around 1076 patients were included from 29 European centers between 1997 and 2003. Similar to COST, the exclusion criteria include tumor of transverse colon, extra-peritoneal rectal cancer, and patients with BMI more than 30%. The primary endpoint was cancer-free survival at 3 years. Surgeons who had performed at least 20 laparoscopic colostomies were included in the trial. The rate of conversion was 17% compared to 21% in COST. The reason behind the conversion was due to either bulky disease or fixity to pelvic wall but may be the result of inadequate preoperative imaging, and only 5% of patients underwent CT as preoperative imaging modality. If we analyze the short-term outcome that was published in 2005, although the duration (lap: 145 min, open: 115 min; $p < 0.0001$) for laparoscopic surgery was longer compared to open technique (may be because of learning curve), the blood loss was less (lap: 100 cc, open: 175 cc; $p < 0.0001$). There were no significant differences in oncologic outcomes, including the rate of positive margins ($p = 1.0$), in the number of lymph nodes harvested ($p = 0.35$). Postoperative morbidity, pulmonary or cardiac events, and anastomotic failures or wound infections were similar.[8] At 3 years, recurrences rates both local and distant were similar between both groups. Overall and cancer-free survival was not significantly different, regardless of disease stage. The 3-year cancer-free survival for all stages was 72.4% in the laparoscopic group and 76.4% in the open group ($p = 0.7$). Overall survival at 3 years for all stages was 81.8% in the laparoscopic group and 84.2% in the open group ($p = 0.45$).[9]

3.1.3. *CLASICC*

The study was performed in United Kingdom where 794 patients were included from 27 centers between 1996 and 2002. This was the first study, which included rectal cancer patients unlike COST or COLOR where they were excluded. Patients were randomized in a 2:1 basis, such that 526 were in the laparoscopic group and 268 in the open group. Of the 794 patients, 413 (52%) had colon cancer. The short-term primary endpoints were rates of positive circumferential and longitudinal resection margins, proportion of Dukes' C2 tumors, and in-hospital mortality. Long-term endpoints were survival, recurrence, and quality of life at 3 and 5 years, of which results are now available.

In 2005, the short-term results were published, showing no significant differences in the number of lymph nodes retrieval or the number of positive margins for colon cancer. The rate of conversion for colon cancer was 25% and for rectal cancer was 34%. The most common cause for conversion in both groups was fixation of the tumor or inaccessible laparoscopically as in 20% of low rectal cancers. Intraoperative complications, including intraoperative hemorrhage or arrhythmia ($p = 0.002$) and death rates (open versus laparoscopic 9% versus 5% and 1%, respectively; $p = 0.34$), were higher in converted groups. These in turn contributed to the low overall survival in converted groups. However, there was no significant difference in the rate of distant recurrence in converted cases.[10]