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Short-term outcomes of laparoscopically assisted surgery for rectal cancer following neoadjuvant chemoradiotherapy: a single-center experience

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ABSTRACT

Objective: The efficacy of laparoscopic treatment of rectal cancer remains unclear, and little is known about its effect on sphincter preservation. We compared short-term outcomes of laparoscopically assisted and open surgeries following neoadjuvant chemoradiotherapy (CRT) for mid and low rectal cancer.

Methods: This study enrolled 137 patients with mid-low rectal cancer who underwent curative resection, 51 by laparoscopically assisted (Lap group) and 86 by conventional open (Open group) surgeries, following neoadjuvant CRT from July 2007 to July 2012. The clinical and surgical findings of the two groups of patients were prospectively collected and analyzed.

Results: Three patients (5.9%) in the Lap group were converted to an open procedure. The mean operating times were similar in both groups. The Lap group had a significantly higher rate of sphincter preservation (62.7% *versus* 41.9%, $P = 0.018$) and significantly lower mean blood loss than the Open group. Mean times to first flatus, start of a normal diet, and overall postoperative hospitalization were longer for open surgery. The complication rate (11.8% *versus* 31.4%, $P = 0.009$) was significantly lower in the Lap group. Mean distal resection margin, involvement of the circumferential resection margin (2.0% *versus* 3.5%, $P = 1.000$), and mean lymph nodes harvested (12 *versus* 11; $P = 0.242$) were equivalent in the two groups.

Conclusions: Laparoscopically assisted surgery following neoadjuvant CRT is safe for patients with rectal cancer and provides favorable short-term benefits but without compromising oncologic outcomes. This sphincter-preserving procedure may be a treatment of choice for patients with lower rectal cancer.

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1. Introduction

Significant advances in the treatment of rectal cancer over the past 30 years have been attributed to the increased use of neoadjuvant treatment, the widespread adoption of total mesorectal excision (TME) and marked improvements in minimally invasive techniques. Laparoscopic surgery for rectal cancer, when performed by experienced surgeons at specialized centers, has been shown effective and feasible [1–10]. Those trials, however, did not assess the short-term efficacy of laparoscopic surgery after neoadjuvant chemoradiotherapy (CRT), a treatment associated with increased bleeding tendency and delayed wound healing [11,12]. In addition, tissue edema and fibrosis induced by CRT may blur anatomic landmarks and dissection planes, making laparoscopic surgery difficult in these patients [13].

Sphincter preservation is critical to the quality of life of rectal cancer patients. Distance of the tumor from the anal verge and numbers of operations performed by the surgeon are considered the most significant factors for sphincter-sparing surgery, whereas little is known about the effects of laparoscopic techniques on sphincter preservation. Laparoscopic resection may result in a high rate of sphincter preservation in patients with lower rectal cancer because of the ability of laparoscopic methods to provide a magnified, high-definition view of the narrow pelvis [14–16]. To evaluate the feasibility and safety of laparoscopically assisted surgery following neoadjuvant CRT in patients with mid and low rectal cancer, we compared the short-term outcomes, including perioperative outcomes, sphincter preservation, and oncological results, in patients who underwent laparoscopically assisted and conventional open surgeries after neoadjuvant CRT.

2. Methods

2.1. Patients

This study involved 137 consecutive patients with prospectively maintained medical records who underwent laparoscopically assisted (Lap group) or conventional open (Open group) curative resection for mid and low rectal cancer following neoadjuvant CRT at Cancer Hospital, Chinese Academy of Medical Science, Beijing, China, between July 2007 and July 2012. All patients had histologically confirmed stage II or III rectal adenocarcinoma, according to the International Union Against Cancer/American Joint Committee on Cancer colorectal cancer staging system, with all tumors located $\leq$10 cm from the anal verge. Patients were excluded if they had (1) synchronous distant metastasis; (2) emergency situations, such as obstruction, perforation, or hemorrhage; or (3) familial adenomatous polyposis or a second malignancy. In our study, all operations were performed by two surgeons experienced in both laparoscopic and open colorectal surgeries and the operative approach (laparoscopically assisted or open resection) was decided by the surgeons' discretion, the patient's preference, and our operating theater availability. This study was approved by the institutional review board of our hospital, with all patients providing written informed consent after being told the risks and benefits of the two procedures.

Each included patient underwent a digital rectal examination to evaluate sphincter function and tumor distance from the anal verge, with the results determining the possibility of performing sphincter-preserving surgery. All patients underwent total colonoscopy with biopsy, with a barium enema performed when patients did not complete the colonoscopy. Clinical tumor-node-metastasis stage was based on contrast-enhanced computed tomographic scans of the abdomen and pelvis, magnetic resonance imaging, and endoscopic ultrasound. Chest X-rays or chest computed tomographic scans and liver ultrasound were performed to exclude distant metastases.

2.2. Preoperative CRT protocol

All patients in both groups received preoperative long-course radiotherapy, consisting of a total of 50 Gy delivered in 25 fractions of 2 Gy each, five times per week for 5 wk. During the period of radiotherapy, patients received oral capecitabine 1650 mg/m^2/d for 35 d, plus intravenous oxaliplatin 50 mg/m^2 once weekly for 5 wk.

2.3. Surgical technique

The mean interval to surgery was 53 (range 28–105) d for all patients. Patients started fasting 1 d before surgery and received bowel preparation with 3 L of polyethylene glycol 14–18 h before surgery and 200 mL Glycerin Enema the evening before. Patients underwent laparoscopically assisted or open surgeries with TME and autonomic-nerve preservation, with both types of procedures performed by senior surgeons with extensive experience in colorectal cancer surgery. Patients undergoing laparoscopically assisted surgery were placed in the 30° Trendelenburg position with legs apart, and the abdominal and pelvic cavities were accessed via four trocars. The inferior mesenteric artery was ligated close to its origin. The left mesocolon and the sigmoid mesocolon were dissected in the medial to lateral direction, and the rectum and its mesentery were sharply mobilized down to the pelvic floor along the anatomic space between the parietal and visceral fascia with a harmonic scalpel, maintaining the integrity of the mesorectum. The ureters and underlying hypogastric nerve plexus were carefully safeguarded. The splenic flexure was mobilized when necessary to ensure a tension-free anastomosis or if left colonic ischemia was observed intraoperatively. In patients who underwent low anterior resection, a lower midline vertical incision about 6–8 cm long was made, through which the rectum was transected 1.5–5 cm below the tumor using a mechanical stapler. A circular stapler was then introduced to complete bowel anastomoses. A temporary ileostomy or colostomy was performed depending on the surgeon's technical evaluation of the quality of the anastomosis. In patients who underwent abdominoperineal resection, the sigmoid colon was transected with endoscopic linear staplers. The rectum, together with the entire mesorectum, was fully mobilized, and the specimen was retrieved through the perineal wound after the