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Original Research

Safety of laparoscopic resection for colorectal cancer in patients with liver cirrhosis: A retrospective cohort study

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ABSTRACT

Background: Patients with liver cirrhosis represent a high risk group for colorectal surgery. The safety and effectiveness of laparoscopy in colorectal surgery for cirrhotic patients is not clear. The aim of this study was to compare the outcomes of laparoscopic colorectal surgery with those of open procedure for colorectal cancer in patients with liver cirrhosis.

Materials and Methods: A total of 62 patients with cirrhosis who underwent radical resections for colorectal cancer from 2005 to 2014 were identified retrospectively from a prospective database according to the technique adopted (laparoscopic or open). Short- and long-term outcomes were compared between the two groups.

Results: Comparison of laparoscopic group and open group revealed no significant differences at baseline. In the laparoscopic group, the laparoscopic surgery was associated with reduced estimated blood loss (136 vs. 266 ml, $p = 0.015$), faster first flatus (3 vs. 4 days, $p = 0.002$) and shorter days to first oral intake (4 vs. 5 days, $p = 0.033$), but similar operative times ($p = 0.856$), number of retrieved lymph nodes ($p = 0.400$) or postoperative hospital stays ($p = 0.170$). Despite the similar incidence of overall complications between the two groups (50.0% vs. 68.8%, $p = 0.133$), we observed lower morbidities in laparoscopic group in terms of the rate of Grade II complication (20.0% vs. 50.0%, $p = 0.014$). Long-term of overall and Disease-free survival rates did not differ between the two groups.

Conclusion: Laparoscopic colorectal surgery appears to be a safe and less invasive alternative to open surgery in some elective cirrhotic patients in terms of less blood loss or early recovery and does not result in additional harm in terms of the postoperative complications or long-term oncological outcomes.

1. Introduction

Patients with liver cirrhosis represent a special group for whom surgery implies a high risk [1,2]. This high surgical risk occurs because of the pathophysiology of liver disease itself and to the presence of contributing factors, such as coagulopathy, malnutrition, adaptive immune dysfunction, cardiomyopathy, and renal dysfunction, which all lead to poor outcomes [2]. The surgical condition of soft tissue edema or easy touch bleeding increases the risk of infection, ascites, coma, hemorrhage, and eventually mortality [1–4]. Though hepatic surgery has long been the most common surgical procedures performed in cirrhotic patients, the improvement in perioperative management has allowed an increase in surgical procedures for extrahepatic indications [3–7]. However, the mortality rate after nonhepatic surgeries ranges from 8.3% to 29% in comparison to 1.1% in non-cirrhotic patients [2,8]. For elective colorectal surgery, patients with cirrhosis had significantly higher in-hospital mortality than patients with no cirrhosis [2,4,9–11].

Nowadays, minimal-access techniques play a key role in the management of numerous gastrointestinal problems, offering several well-established advantages over conventional open techniques [3,12–16]. Moreover, the indications for laparoscopic procedure gradually expand into many formerly high-risk patients groups, such as the elder, obese individuals and cirrhotic patients [3,5–7,17,18]. Recent studies analyzing the feasibility, safety and efficacy support the use of laparoscopy in patients with liver cirrhosis. This procedure presents a great advantage in terms of less blood loss, shorter hospital stay, and fewer surgery-related complications [3,5–7]. For colorectal surgery, despite the risk of coagulopathy and hemorrhage intraoperatively, one study initially reported the laparoscopic approach for colorectal disease in

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some selected cirrhotic patients [19], with low morbidity and mortality, and further research was limited.

Although several large-scale randomized controlled trials have confirmed laparoscopic surgery for colorectal cancer [12,13,16], studies regarding the use of laparoscopic colorectal cancer surgery in liver cirrhosis patients are rare. Some previous studies only referred with low proportion of laparoscopic procedure in the cohort [20,21]. Comparisons of benefits between laparoscopic and conventional open colorectal surgery for patients with liver cirrhosis have yet to be sufficiently compiled. Thus, our study comprised much more laparoscopic cases to evaluate the safety of laparoscopic surgery for the colorectal cancer with liver cirrhosis.

2. Materials and methods

This study was registered a priori with http://www.ResearchResgistry.com/. The work has been reported in line with the STROCSS criteria [22].

2.1. Patients

We conducted a retrospective analysis of colorectal cancer surgery prospectively collected at Shaoxing hospital of Zhejiang University and Sir Run Run Shaw hospital affiliated to Zhejiang University between January 2005 and December 2014. Among 7526 patients undergoing surgical resection for colorectal cancer, 95 patients (1.3%) also had a diagnosis of liver cirrhosis. After excluding patients with Child-Pugh class C or a MELD score over 15, recurrent cancer, synchronous cancers or distance metastases (Stage IV), an emergency surgery, *trans*-anal excision for rectal cancer, and converted surgery, 62 patients were enrolled in this study. Patients selected were divided into the open surgery and the laparoscopy surgery based on surgeon's initial preference. Liver cirrhosis was diagnosed by patients histories, compatible imaging findings (computed tomography, ultrasound, or magnetic resonance imaging) preoperatively or macroscopic appearance of liver surface intraoperatively. The causes of liver cirrhosis were differentiated according to HBV/HBC virus, Schistosomiasis, alcohol-related, biliary and other factors (Autoimmune, non-alcohol related fatty liver disease, etc.). Liver cirrhosis grading was measured by two popular measurement systems—Child-Pugh classification and Model for Endstage Liver Disease (MELD) scores [23]. This study was approved by the research ethics committee of the two hospitals.

Demographic data included patient age, sex, body mass index (BMI), Charlson comorbidity index [24], American Society of Anesthesiologists score (ASA score), preoperative laboratory results (total bilirubin, albumin, prothrombin time [PT], creatinine, platelet, and carcinoembryonic antigen). Cancer stage was classified according to the 7th edition of the American Joint Committee on Cancer (AJCC) staging system [25]. Perioperative outcomes included operation time (min), blood loss (mL), stoma creation, combined resections, intraoperative transfusion, time to first flatus and oral intake, postoperative lengths of hospital stay, postoperative morbidity. Postoperative morbidity was classified according to the revised version of the Clavien-Dindo classification system [26], and a comprehensive complication index (CCI) was further computed [27].

2.2. Surgery, peri-operative management and chemoradiotherapy

Conventional and laparoscopic surgery was done according to standard protocol as described previously [16,28,29,31]. The surgical procedure achieved an *en bloc* excision of the primary colorectal cancer combined with resection of the invaded organ(s). Gentle dissection was conducted according to the rules of the no-touch technique. Colorectal resection routinely involved proximal ligation of vessels (inferior mesenteric artery for left colon and rectum, ileocolic artery for right colon), complete mobilization of the splenic flexure for left colon, and partial or total mesorectal excision according to rectal cancer localization. Anterior resection of rectal cancer was carried out 5 cm below the lower edge of the tumor for the upper third of the rectum or 2 cm for low rectal cancer. Hartmann's procedure was done by open or converted approach. The colorectal specimen was extracted through a mini laparotomy or transanaly in case of low rectal tumors. For colon cancer, reconstruction was conventional stapled or handsewn anastomosis. For rectosigmoid cancer, reconstruction was stapled anastomosis, and temporary loop ileostomy was necessary for low rectal cancer. Permanent stoma was created for abdominoperineal resection or Hartmann's procedure. Combined resection was performed smoothly for minor or partial lesions, such as gallstones with chronic cholecystitis, tumor partial invasion to small intestine, bladder or ovary, and none of them had hindered the process of colorectal resection or caused any harmful consequences.

All of the patients were subjected to liquid diet and PEG intestinal preparation 1 day before surgery. Closed drains were placed for all patients after surgery, and removed after semisolid diet. In case of ascites, prolonged or percutaneous drainage was needed. Nasogastric tubes were used 1 h before surgery and removed on the first postoperative day, except for 3–4 days for anterior resection of rectal cancer without temporary loop ileostomy. Patients were asked for gum chewing and ward ambulation on first postoperative day. Urinary bladder catheter was removed on the second postoperative day, except for 5–7 days for middle and low rectal cancer surgery. Patients were given a liquid diet after resumption of bowel function (passage of flatus). Discharge criteria included adequate pain control, removal of urinary bladder catheter and tolerance of a semisolid diet.

Adjuvant therapy before and after surgery was depended on physician's discretion, patients's tolerance and compliance. For T3, T4, and/or N+ rectal cancer, a neoadjuvant long-course radiochemotherapy was recommended, and operation was proceeded 6–8 weeks thereafter. Adjuvant chemotherapy was based on 5-Fluorocuacil (5-Fu) alone or combined with oxaliplatin-based chemotherapy. 5-Fu based chemotherapy was refered to Xeloda (Capecitabine) alone 21-day cycle for 6 months. Oxaliplatin-based chemotherapy was refered to FOLFOX4, mFOLFOX 6 14-day cycle or XELOX (CAPOX) 21-day cycle for 6 months.

2.3. Follow-up

Patients were followed at 3-month intervals for 2 years, 6-month intervals for the subsequent 3 years, and annually thereafter. The last follow-up was updated on August 31, 2017. Follow-up examinations, including serum CEA level, computed tomography (CT) of the chest, abdomen, and pelvis, colonoscopy, were conducted semiannually or when recurrence was suspected. Overall survival (OS) was determined from the date of surgery to the date of death from any cause. Disease-free survival (DFS) was measured from the date of surgery to the date of recurrence or death. Recurrence was determined by clinical and radiological examinations, with or without histological confirmation.

2.4. Statistical analysis

Quantitative data were reported as mean (range). Normally distributed quantitative data were analyzed with the Student *t*-test. Qualitative data were reported as number of patients (percentage of patients) and were compared with either the Pearson chi-square test or the Fisher exact test, depending on the sample size. Survival curves were estimated using the Kaplan–Meier method and compared with the log-rank test. A two-sided p value < 0.05 was considered statistically significant. All analyses were conducted using SPSS PASW Statistics 18.0 software (SPSS, Inc., Chicago, IL).