

Clinical outcome of Laparoscopic and Robot-assisted Radical Cystectomy for Bladder Cancer in a Retrospective Study

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Research

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Abstract

Background: With the rapid development of surgical technics and instruments, more and more bladder cancer patients are being treated by laparoscopic radical cystectomy (LRC) and robot-assisted radical cystectomy (RARC) .The aim of this retrospective study was to compare the perioperative and long-term outcomes of patients who underwent cystectomy by these two surgical approaches.

Methods: We performed a retrospective review of the prospectively collected database of our hospital to identify patients with clinical stage Ta/T1/Tis to T3 who underwent RARC and LRC. Perioperative outcomes, recurrence, and overall survival (OS) were analyzed.

Results: From March 2010 to December 2019, there were total of 218 patients, which including 82(38%) patients with LRC and 136(62%) patients with RARC. No perioperative death was observed in both groups. Tumor recurrence, death from any causes, and cancer-specific death occurred in 77, 55, and 39 patients respectively. The 5-year DFS, OS, and CSS rates for all included patients were 55.4%, 62.4%, and 66.4%, respectively. There were no significantly statistically differences between the RARC group and the LRC group for number of lymph nodes harvested, positive lymph node rate, positive margin rate and postoperative pathological stage (all $P>0.05$). Patients undergoing RARC had lower median estimated blood loss (180mL vs. 250 mL; $P 0.015$) and 90-days postoperative complications (30.8% vs. 46.3%; $P 0.013$) than LRC.

Conclusions: For selected patients with RARC and LRC, both were safe and effective with a low complication rate and similar long-term outcome compared two groups. Moreover, the robotic approach resulted in lower median estimated blood loss and better outcome in postoperative complications.

Introduction

Bladder cancer is the most common urinary system malignant tumor in my china. According to the 2018 Global Cancer Statistics Report that bladder cancer has already became 8th in the rank of tumors. Among of them, 20%~30% of patients have muscular invasive bladder cancer. For patients with muscular invasive bladder cancer, radical cystectomy plus pelvic lymph node dissection is the gold standard of treatment. Currently, open radical cystectomy still are the most common used method of cystectomy in the world. However, the complication of surgical procedure has a high perioperative complication rate and significant mortality. In the past 20 years, the development of laparoscopic instruments and laparoscopic technology became mature that cause the laparoscopic became as new treatment for bladder cancer. At the same time, many advantages of the Da Vinci robot system has already showing up; Our department has carried out complete laparoscopic radical cystectomy plus orthotopic ileal neobladder since 2010, and robot-assisted radical cystectomy plus orthotopic ileal neobladder since 2014.

Materia And Methods

Patient selection

A retrospective review of the prospectively collected database of our institution between March 2010 and December 2019 has been performed. The study was approved by institutional ethics committee of Zhejiang provincial people's hospital. Eligible criteria were patients who underwent RARC or LRC for pathology stage T1 to T3. Patients with no metastasis and has relatively completed clinical data. In all, 218 patients were included, of whom 82(38%) had a LRC and 136(62%) had a RARC. All the patients underwent routine serum chemistry, cardiopulmonary function testing, abdomen or pelvic capacity computed tomography (CT). Disease features and comorbidities of individual patients even patients economic conditions and surgeon and patient preferences were all considered.

Surgical procedures

All patients were under general anesthesia. Operations were performed by three experienced surgeons for both laparoscopic and robotic-assisted operation. Both groups underwent radical cystectomy and systematic bilateral pelvic lymph node dissection with orthotopic ileal neobladder. The surgical procedures of the LRC and RARC were individually performed, as previously reported. [1,2]

Measurements and outcomes

Patients characteristics from clinical data included age, gender, body mass index (BMI), American Society of Anesthesiologists (ASA) score, previous medical history (smoker, hypertension, diabetes, cardiac disease, and operation history), and preoperative neoadjuvant chemotherapy. Perioperative outcomes were evaluated, including type of urinary diversion, operative time, estimated blood loss, rate of intraoperative transfusion and postoperative hospital stay. The intra-operative and postoperative complications were classified according to the modified Clavien-Dindo classification system. Pathologic outcomes included total number of lymph nodes removed, surgical margin, and pathologic stage. The identification of cancerous cells at the level of the inked parenchymal excision surface was regarded as a positive surgical margin.

All patients were tested with physical examinations, laboratory tests, chest radiography, and abdominal and pelvic ultrasonography or computed tomography during follow-up period. The follow-up arrangement was every 3 months for the initial 2 years, every 6 months for the next 2 years, and annually by thereafter. Oncologic outcomes included disease-free survival (DFS), overall survival (OS), and cancer-specific survival (CSS) were collected as well.

Statistical analysis

Categorical data were collected and analyzed as numbers and percentages. Standard deviations (SDs) was used to check summarized Continuous data. Distinguish between the LRC and RARC groups were explored with Pearson's chi-square test for categoric data and Student t test or Mann-Whitney U test for continuous variables. Since the distribution of age, sex, smoking status, American Society of Anesthesiologists(ASA) score, operation history, chronic disease were comparable between the two groups (Table 1). Overall survival (OS) was calculated from the day of surgery to the time of death.

Disease-free survival (DFS) was calculated from the day of surgery to the date of cancer recurrence or death from any cause. cancer-specific survival (CSS) was calculated from the date of diagnosis to the date of death caused by bladder cancer as well. OS, CSS and DFS were evaluated by Kaplan–Meier survival analysis. Log-rank tests were used to determine the statistical significance of survival between the two groups. A two-sided $P < 0.05$ was considered to indicate statistical significance. We used SPSS for Windows version 22 (IBM, Chicago, IL, USA) for statistical analysis.

Results

Patient population

In this study, among of 218 patients were included.136 patients were underwent RARC and 82 patients who underwent LRC. Patient characteristics are shown in table 1. The distribution of age, sex, smoking status, BMI, American Society of Anesthesiologists (ASA) score, operation history, chronic disease was comparable between the two groups. The median age was 62 years (IQR 52–70 years), and 166 patients (76.1%) were male. The median body mass index was 24.5 kg/m² (IQR 22.3–27.1 kg/m²) and low ASA score classification (score 1–2; 83.9%) were presented. The most common medical histories were smoking (36.7%) and hypertension (27.9%). Only one patient(1.2%) in the LRC group and two patients(1.4%)in the RARC group had received neoadjuvant chemotherapy. The age, proportion of male patients, BMI, ASA score classification, previous medical history, and rate of neoadjuvant chemotherapy were similar between the two groups.

Perioperative outcomes

The comparison of perioperative outcomes of the two groups can be seen in table 2. All patients were removed catheters and bilateral single J tubes by 13–15 days post-operation. The Median intraoperative estimated blood loss was 200 (100–480) ml and blood transfusion was carried out in 24 (11%) patients. Patients undergoing RARC had a significant less median estimated blood loss (250 vs. 180mL; $P = 0.015$) the hospitalization was 15 (13–22) days, and the intraoperative complication rate was presented in 11(5%) patients. the exhaust time was 2 (1–3) days, the feeding time of solid food was 4 (3–5) days, the total complication rate within 30 days was 28.0%, and the total complication rate within 90 days was 37.2%. The operative time of RARC group was slightly longer than that of the LRC group, but the difference was not statistically significant. Intraoperative blood loss was higher in the LRC group than in the RARC group, but there was no difference in blood transfusion rate between the two groups. There were no significant differences between the RARC group and the LRC group in terms of postoperative exhaust and feeding time, postoperative hospital stays, and the incidence of complications within 30 days after surgery (all $P > 0.05$). The incidence of total complications and grade I-II complications within 90 days after surgery was higher in the LRC group than in the RARC group, but there was no difference in grade III-IV complications (Table 2).

Pathologic outcomes

Pathologic outcomes for LRC and RARC are shown in Table 3. For all patients, positive nodes were identified in 9.6% and positive surgical margin was identified in 2.7%. Lymph node yields with median node counts of 19 for LRC and 20 for RARC ($P = 0.179$). Postoperative tumor pathological stages reveal that 48 cases in Ta/T1/Tis stage, 134 cases in T2 stage, and 36 cases in T3 stage. There was no statistical difference in the number of lymph node dissection, positive lymph node rate, positive rate of resection margin and postoperative pathological stage between RARC and LRC group (all $P > 0.05$)

Long-term outcomes

The median follow-up length was 33 months (IQR (20.6–48.2)). The patients with recurrence was 77 (35%). overall death and cancer-specific death occurred in 55(25%) and 39(18%) patients. The 5-year DFS, OS, and CSS rates were 55.4%, 62.4%, and 66.4% for all included patients. (Fig. 1,2,3)

Discussion

RC + UD was treating muscular invasive bladder cancer as gold standard. [3] Since 1990s, ORC was the only surgical method for the treatment of MIBC or high-risk NMIBC. But perioperative complication rate and mortality rate have remained high Due to the complicated surgical procedure. With the rapid development of minimally invasive techniques, LRC and RARC have become important surgical procedures for the treatment of invasive bladder cancer [3] and have been performed by many medical centers. the advantages of LRC and RARC was reducing the rate of complications and quick recovery post-operation those advantages has already proved by multiple retrospective reports and randomized controlled studies [4–7], and the safety and tumor efficacy of LRC and RARC are similar to ORC[8,9]. Our department completed the first case of LRC and orthotopic neobladder reconstruction since 2010. In the pasted ten years, we gradually improved the details of the surgical procedure and began to perform RARC and orthotopic neobladder reconstruction since 2014. We found that there are few disadvantages presented as technical challenges and financial factor. Therefore, the decision of the two procedures is made by the patients. For example, tumor conditions, doctors' preferences and other factors. we summarize the characteristics of the perioperative period and oncology results of radical cystectomy and compare the differences between LRC and RARC based on the cancer database of the past ten years.

This study included patients with bladder cancer who underwent LRC or RARC in our center from March 2010 to December 2019. Excluding cases with incomplete data, a total of 218 patients were enrolled, 82 patients received LRC, and 136 patients received RARC. The median age and body mass index were 62 years old and 24.5 kg/m². Most patients were male (76.1%) with low ASA score(1–2 points; 83.9%). Comparison of two groups including the age, proportion of male patients, body mass index, ASA score, previous medical history, and neoadjuvant chemotherapy rate, result reveals that there was no statistical difference.

According to our results, the RARC group reveals longer operation time compared to LRC, but it does not reach statistical differences. There was a higher intraoperative blood loss in the LRC group. The other results including intraoperative blood transfusion rate and intraoperative complication rate were similar

between two groups. In general, the difference between LRC and RARC might due to the inside and outside of the learning curve, surgeon's experience, and the reasons for the renewal of surgical equipment. The difference in intraoperative blood loss seems related to different hemostatic methods and robotic instruments. The robotic surgery system has the characteristics of stable mechanical arm and lack of dead angle in the cavity. Whether it is separated or on the hemostatic clip, it could choose the best angle to cut into the desired level. In the narrow space condition, it is better than laparoscopic surgery, and the high-definition three-dimensional vision system of the robot system provide better anatomical structure and the direction of blood vessels it could supported the surgeon to avoid damages. In the past research reports has already proved those advantages as well[10–12]. For complications, the intraoperative, 30-day and 90-day postoperative complication rates are similar [13,14]. In the subgroup, there was no difference in the intraoperative complication rate and the 30-day postoperative complication rate between the LRC and RARC groups. However, there was significant difference between the two groups in the 90-day postoperative complication rate, especially for the 90-day minor complication rate, but there was no difference in the major complication rate. Then we analyzed details data of 90-days post-operative complications. Most of the complications that occurred within 90 days were urinary tract infection, pyelonephritis, lymphatic cysts, mild hydronephrosis, and small bladder stones. Most of them improved after conservative treatment or outpatient treatment. We found that the reason of difference in complications between the two groups might be the improvement of the bladder suture methods, because we were improved the suture methods and tried to find the better way of intraoperative anastomose during the past ten years. The surgery in the RARC group was mostly completed in the later period of the study. Most of the new bladders performed by the U-shaped method because it could reduce the length of the intestine and maximize the length of the bladder. Hence it released the anastomotic tension between new bladder and urethra. The incidence of urinary fistula or obstruction has been decreased. According to the previous experience, the new bladder is usually taken 30 to 35 cm ileum in the later period. The length-to-width ratio of the new bladder is about 4:3. During 3 months post-operation, The bladder volume will gradually expand after repeated expansion, then the bladder would be transforming to a new bladder with suitable volume and low pressure. Because of the new bladder has relatively enough volume to keep the urine, hence it could reduce the urinary tract infection and protect renal function.

Those operations have been completed by our department which got excellent outcomes in complications. The reasons we consider as follow: ☐The enlarged field of view under the endoscopic could provide satisfactorily view of neurovascular bundle and the urethra ,which could reduce the damage of the ureter, keep better blood supply, and preserved Appropriate ureteral length; ☐The robot-assist RARC could performed better quality anastomosed between urethra, ureter and new bladder. Complete operation inside the human body could minimize the anastomotic tension and prevented the twisting of the ureter or intestine. And more which could reduce the anastomotic stenosis or the incidence of postoperative urinary fistula as well; ☐ The single J tube inserted during the operation cause the new bladder under low pressure, which could prevent urinary leakage, reduce the probability of infection, ureteral stricture and reflux; ☐ we performed the new bladder with endovascular gastrointestinal

anastomosis stapler, (Endo-GIA) which could provide cutting and anastomosis been completed at same time. That was easy performed for surgeons and got significantly shorter time than manual suture. The outcomes we found that could relatively decreased Incidence of postoperative abdominal infection and incision infection as well. The operation was completed performed in the abdominal cavity, those avoiding the exposure of abdominal organs in the air which reducing the invisible water loss during the operation, the post-operation fasting time was shorter than before and the digestive function recovers quickly.

The patient's postoperative pathology were mostly \leq T2 stage (87.5%). The positive rates of lymph nodes in overall, LRC and RARC were 9.6%, 9.8% and 8.8%, respectively. The positive rate of surgical margin was 2.7%, 2.4%, 2.9%. Compared with some studies, the overall pathological results showed lower positive rates of lymph nodes and positive surgical margins [15,16]. Those difference might due to patients who included in this study were all undergoing orthotopic neobladder reconstruction. Which mostly patients diagnosed with lower pathological stage before surgery. LRC and RARC found no difference in pathological T stage, positive lymph nodes or positive surgical margins, which is consistent with other studies [17].

The disadvantage of this study was the single-center retrospective non-randomized study. Moreover, although the three surgeons are all experienced in endoscopic surgery, but there were also many factors could influence the surgical outcomes. In addition, RARC may get benefited from the late joined of the study which could affects the comparison results. Because of these potential confounding factors and uncontrolled selection bias, the results were affected. In addition, more RARC in the recent years to be performed which shorter follow-up period may also become one of the limitations. Therefore, whether cystectomy under minimally invasive techniques and ileal orthotopic cystectomy can instead of open surgery still could a question.[18–20] Hence, more long-term, randomized, and multicenter studies are still needed to evaluate. In summary, both LRC and RARC can be well performed to treated muscular invasive or high-risk non-muscular invasive bladder cancer. It is a safe and repeatable surgical method, which has the potential advantages of lower complications and faster recovery post-surgery. And more, RARC has better performance than LRC in reducing intraoperative bleeding and postoperative complications. Hence, RARC was worth to performed if the patient does not have financial issue.

Declarations

Availability of data and materials

While the patient data are confidential, they are available.

Statement of Ethics:

All study participants were informed about the planned procedure and signed informed consent. The study was approved by the ethics committee of Zhejiang Provincial People's Hospital, HangZhou city, China.

Competing interests:

The authors declare that they have no competing interests.

Consent for publication:

Not applicable.

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Author's Contribution

DaHong Zhang and Shuai Wang: Project development

YuChen Bai and Jing Quan: Manuscript writing

WeiZheng and QiZhang, Fei Wei : Data collection

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Tables

Due to technical limitations, table 1 to 3 is only available as a download in the Supplemental Files section.

Figures

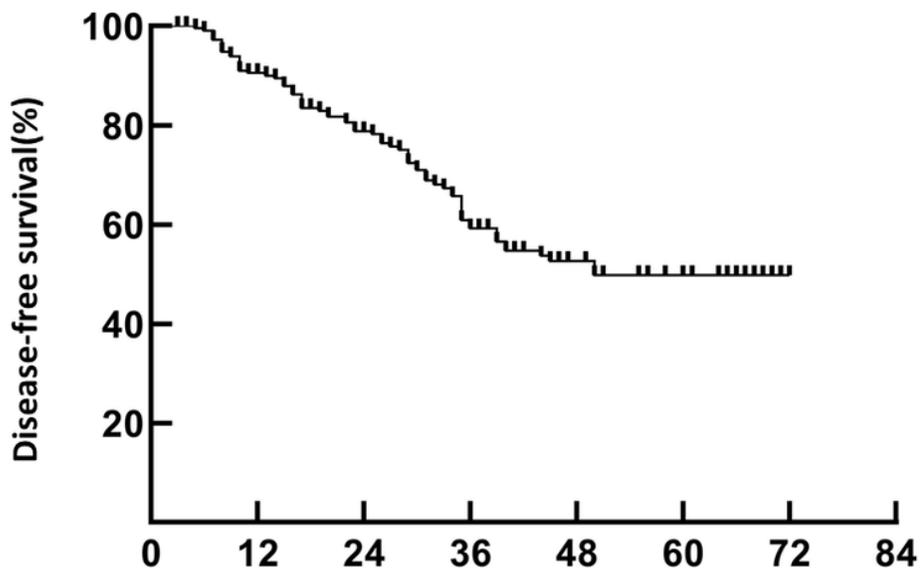


Figure 1: Follow-up period (months)

Figure 1

Disease-free survival(%)

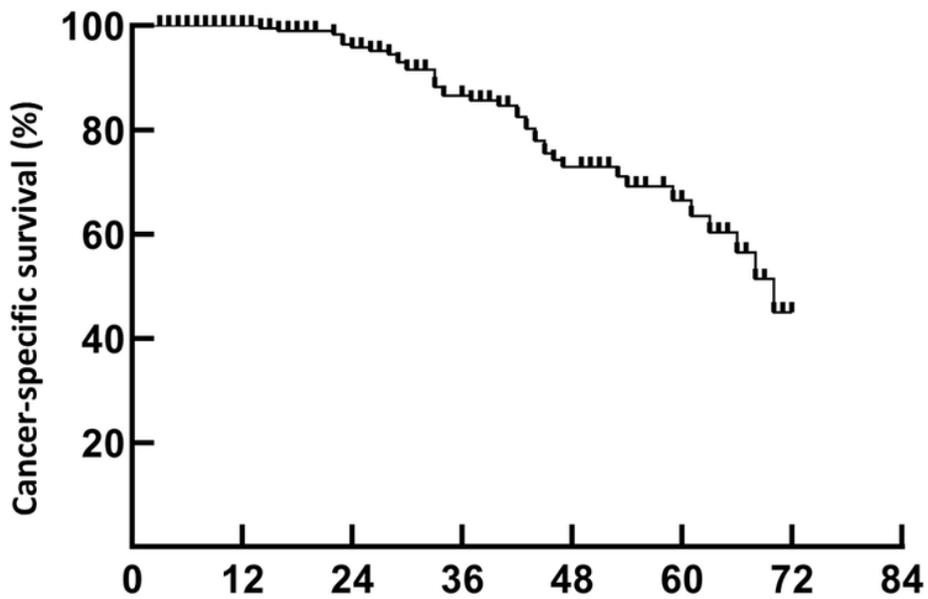


Figure 2: Follow-up period (months)

Figure 2

Cancer-specific survival (%)

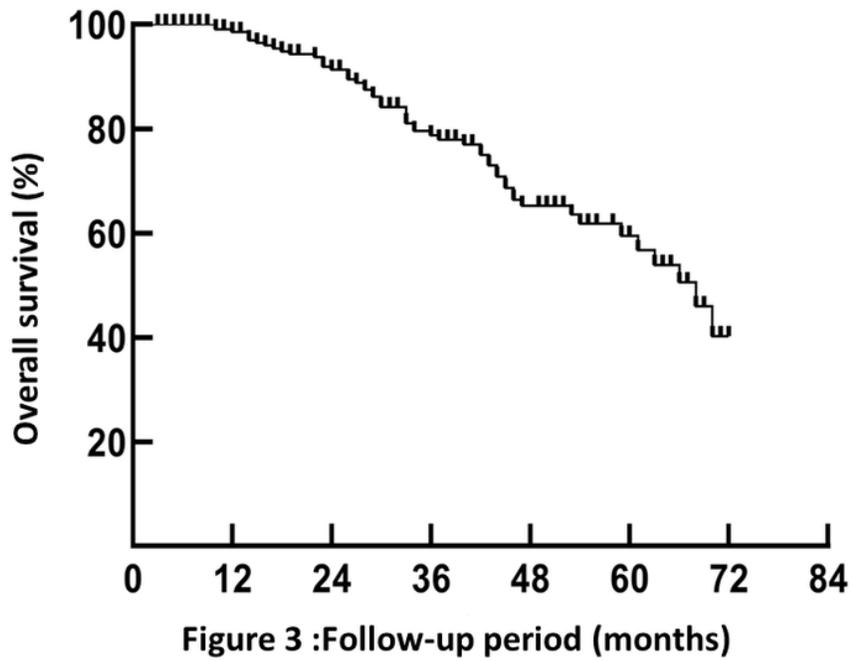


Figure 3

Overall survival (%)

Supplementary Files

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