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Complications After Robot-assisted Radical Cystectomy: Results from the International Robotic Cystectomy Consortium

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Abstract

Background: Complication reporting is highly variable and nonstandardized. Therefore, it is imperative to determine the surgical outcomes of major oncologic procedures.
Objective: To describe the complications after robot-assisted radical cystectomy (RARC) using a standardized and validated reporting methodology.
Design, setting, and participants: Using the International Robotic Cystectomy Consortium (IRCC) database, we identified 939 patients who underwent RARC, had available complication data, and had at least 90 d of follow-up.
Outcome measurements and statistical analysis: Complications were analyzed and graded according to the Memorial Sloan-Kettering Cancer Center (MSKCC) system and were defined and stratified by organ system. Secondary outcomes included identification of preoperative and intraoperative variables predicting complications. Logistic regression models were used to define predictors of complications and readmission.
Results and limitations: Forty-one percent ($n = 387$) and 48% ($n = 448$) of patients experienced a complication within 30 and 90 d of surgery, respectively. The highest grade of complication was grade 0 in 52%, grade 1–2 in 29%, and grade 3–5 in 19% patients. Gastrointestinal, infectious, and genitourinary complications were most common (27%, 23%, and 17%, respectively). On multivariable analysis, increasing age group, neoadjuvant chemotherapy, and receipt of blood transfusion were independent predictors of any and high-grade complications, respectively. Thirty and 90-d mortality was 1.3% and 4.2%, respectively. As a multi-institutional database, a disparity in patient selection, operating standards, postoperative management, and reporting of complications can be considered a major limitation of the study.
Conclusions: Surgical morbidity after RARC is significant when reported using a standardized reporting methodology. The majority of complications are low grade. Strict reporting of complications is necessary to advocate for radical cystectomy (RC) and helps in patient counseling.

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1. Introduction

Surgical management has a significant role in determining the final outcome of patients with muscle-invasive and recurrent non–muscle-invasive bladder cancer (BCa) [1]. Radical cystectomy (RC) is considered the gold-standard treatment, and despite undergoing various modifications to achieve the optimal outcome for patients in terms of cost-effectiveness, cancer control, and postoperative complications, it remains a morbid procedure with a variable complication rate [2–6]. Early oncologic outcomes of robot-assisted RC (RARC) reported by a limited number of specialized centers appear similar to RC, with an effort to reduce procedure-related complications. In 2003, Menon first reported his series of RARC as a minimally invasive approach toward attaining this goal, followed by various case series with limited complication details [7–9].

The reported complication rates following open RC vary from 24% to 64%, which likely results from a nonstandardized reporting method. More recently, however, most studies have adopted a uniform method of documenting complications [5,6] as a standardized approach toward postoperative complication reporting is essential to allow meaningful comparisons between minimally invasive and open techniques of RC and to appropriately counsel patients. This approach has been adopted in reporting RARC complications, and the rates vary between 34% and 52% [10–12]. These studies, however, represent a single institution or surgeon, where surgical volume and surgeon expertise may influence outcomes. For this reason, multi-institutional databases or population-based data are necessary to compare outcomes between surgical approaches. To this end, a recent observational cohort study using the US Nationwide Inpatient Sample found that the inpatient complication rate was lower with RARC, although costs were higher [13]. The purpose of this study was to characterize the incidence, type, and severity of postoperative complications after RARC using an international, multi-institutional database. In addition, we sought to identify risk factors for complications after RARC, readmission, and 90-d mortality.

2. Patients and methods

2.1. International Robotic Cystectomy Consortium database

A retrospectively reviewed, prospectively maintained institutional review board (I 97906)–approved database of the International Robotic Cystectomy Consortium (IRCC) is an effort of >20 institutions comprising >1200 patients treated with RARC for clinically localized BCa from 2003 to date. The IRCC collaborative effort enables all participating institutions to monitor their progress and share various aspects of evolving novel techniques.

2.2. Study design

Clinical, pathologic, and standardized complication data were available from 939 patients who underwent RARC at 16 participating institutions. Data were collected on clinical and pathologic characteristics. The technique used for RARC and pelvic lymph node dissection varied according to the individual surgeon and institution. Urinary diversion was performed via an extra- or intracorporeal approach.

All complications were retrospectively identified by review of inpatient and outpatient notes, imaging findings, and physician correspondence. Complications defined were graded according to the Memorial Sloan-Kettering Cancer Center (MSKCC) system [5], an established five-grade modification of the Clavien system [14]. The criteria that Martin et al. proposed for reporting complications related to surgery were used [15]. Complications were further grouped into 12 categories by organ system and categorized into low grade (grades 1–2) and high grade (grades 3–5). The secondary outcome of the study was to identify preoperative and intraoperative variables that predicted any and high-grade complications as well as predictors of hospital readmission and 90-d mortality.

2.3. Statistical analysis

Statistical analysis was performed using the Fisher exact test to summarize categoric variables and the Wilcoxon rank sum test or Kruskal-Wallis test for continuous variables. Logistic regression analysis was performed to evaluate predictors of at least one complication of any grade. Separate analyses were performed for high-grade (grade 3–5) complications. Models were fitted separately for preoperative and intraoperative variables. Variables analyzed included gender, age (10-yr age group), body mass index (BMI), neoadjuvant chemotherapy, case number, overall operative time, estimated blood loss (EBL), transfusion status (yes/no), type of urinary diversion (continent vs conduit), location of urinary diversion (extra- vs intracorporeally), and American Society of Anesthesiologists (ASA) score ($\leq$2 vs >2). Logistic regression analysis was also used to evaluate predictors of 90-d mortality and readmission within 90 d. Statistical analyses were performed using Stata v.11.0 (StataCorp, College Station, TX, USA).

3. Results

Data from 939 patients were available at the time of final analysis. Preoperative characteristics, pathologic and perioperative outcomes are detailed in Table 1. The median age was 68 yr of age (interquartile range [IQR]: 60–76), and median BMI was 27 kg/m^2 (IQR: 24–30). Fifty-three percent had ASA scores $\geq$3. Thirty-two percent had a continent diversion. The mean EBL was 580 ml (range: 20–3900), and 15% of the patients received an intraoperative blood transfusion. The median hospital stay was 8 d (IQR: 6–12).

Forty-eight percent (n = 448) of patients had a complication within 90 d of surgery. Twenty-nine percent (n = 273) of patients had grade 1–2 (low-grade) and 19% (n = 175) had grade 3–5 (high-grade) as their highest grade of complication. Twenty-seven percent, 23%, and 17% of patients most commonly developed gastrointestinal, infectious, and genitourinary complications based on the specific organ system, respectively (Table 2). Fifty-three patients required reoperation within 30 d of RARC. Data were available for 47 of the 53 patients who returned to the operating room. The indications for reoperation are listed in Table 3. The most common reasons for reoperation include fascial dehiscence (n = 12), small bowel obstruction (SBO) or partial SBO (n = 8), urine leak (n = 7), and bleeding (n = 5).

On multivariable analysis, 10-yr age group and receipt of neoadjuvant chemotherapy were independent predictors of any and high-grade complications, respectively, while