

Risk of Readmission After Uncomplicated Hospitalization After Radical Cystectomy

C. Adam Lorentz,¹ Kirven Gilbert,¹ Mehrdad Alemozaffar,^{1,2} Dattatraya Patil,¹ Christopher P. Filson^{1,2,3}

Abstract

Mechanisms to shorten hospitalization after radical cystectomy might increase readmission risk. We examined length of stay and readmission risk after uncomplicated hospitalization for 4624 radical cystectomy patients, and found that shorter hospitalizations were not associated with an increased risk of readmission. In the absence of complications, enhanced recovery pathways are unlikely to increase risk of readmission for radical cystectomy patients.

Background: Enhanced recovery pathways after radical cystectomy attempt to decrease length of hospitalization, but might increase risk of readmission after discharge. We evaluated the relationship between length of stay and readmission after uncomplicated hospitalization for bladder cancer patients treated with radical cystectomy. **Patients and Methods:** Using the American College of Surgeons National Surgical Quality Improvement Program database, we identified bladder cancer patients who were treated with radical cystectomy from 2011 to 2015. We limited this cohort to those who did not have complications captured while in-hospital, and assessed the proportion readmitted within 30 days of surgery on the basis of length of stay (ie, < 7, 7-9, ≥ 10 days). We fit multivariable logistic regression models to estimate odds of readmission after adjusting for potential confounding factors. **Results:** Among 4624 patients treated with radical cystectomy, 1003 (21.7%) were readmitted within 30 days of surgery. Of 1,003 readmitted patients, 503 (50%) experienced a major complication after discharge. Factors associated with an increased risk of readmission included diversion with neobladder, diabetes, prolonged surgical time, and obesity (all $P < .01$). Patients with hospitalization < 7 days were not at increased risk of readmission compared with those with prolonged stays (354/1769, 20.0% < 7 days vs. 201/968, 20.8% ≥ 10 days, adjusted odds ratio, 1.04; 95% confidence interval, 0.90-1.21). **Conclusion:** In the absence of in-hospital complications after radical cystectomy, shorter hospitalizations were not associated with an increased risk of readmission. These findings emphasize the safety and potential cost savings of enhanced recovery pathways after these complex operations.

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Introduction

Bladder cancer patients treated with radical cystectomy are at considerable risk of major complications and readmission after discharge from the hospital. Enhanced recovery after surgery (ERAS) protocols can improve the quality of postoperative care by streamlining in-hospital processes for patients treated with major

surgeries.¹ By decreasing the length of hospitalization, these clinical pathways also have potential to decrease health care costs.

However, with more expeditious hospital stays, radical cystectomy patients might be at greater risk of major complications after discharge and subsequent readmission. Cost savings from shortened hospitalizations might be negated by increased post-discharge spending related to readmission. A recent population-based study—which did not evaluate radical cystectomy patients—showed that early hospital discharge did not result in increased postdischarge spending after major inpatient surgeries.² However, for radical cystectomy patients, an institutional study suggested that early hospital discharge was associated with a greater risk of major complications and subsequent readmission.³

To explore this issue further, we used data from a nationwide quality improvement registry to determine if a shorter length of stay

¹Department of Urology, Emory University School of Medicine, Atlanta, GA

²Winship Cancer Institute, Emory Healthcare, Atlanta, GA

³Atlanta Veterans Affairs Medical Center, Decatur, GA

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Address for correspondence: Christopher P. Filson, MD, MS, Department of Urology, Emory University, 1365 Clifton Rd NE, 1st Floor, Suite B1400, Atlanta, GA 30322
Fax: 678-843-6693; e-mail contact: cfilson@emory.edu

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was associated with a greater risk of readmission after an uncomplicated hospitalization for radical cystectomy patients. We hypothesized that shorter hospitalizations would not be associated with increased risk of readmission. If we do not observe a major difference, broader implementation of enhanced recovery pathways for radical cystectomy would be supported. In contrast, if an increased risk for readmission is seen for patients with shorter length of stay, this would merit an investigation into how to identify radical cystectomy patients at highest risk for readmission after an uncomplicated hospitalization.

Patients and Methods

Data Set

The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) is a large, multi-institutional database with cases representing a sample of surgeries within each institution.⁴ For each patient, data on > 150 variables are captured, including comorbidities, pre- and postoperative laboratory values, and length of stay, among others. These variables are prospectively gathered by trained nursing staff who follow patients via phone or mail for complete abstraction of the 30 days after surgery. Data are audited annually for accuracy and completeness.⁵

Patient Cohort

We identified bladder cancer patients (ie, International Classification of Diseases [ICD] Ninth Revision codes 188.0-188.9, ICD Tenth Revision codes C67.0-C67.9) from the ACS-NSQIP Participant Use Data File treated with radical cystectomy from 2011 to 2015 (ie, Common Procedural Terminology (CPT) codes 51570, 51575, 51580, 51585, 51590, 51595, 51596, and 51597). We excluded patients who had any postoperative minor or major complications before the date of discharge.

Primary Exposure and Outcome of Interest

We evaluated length of stay as the primary exposure, examined as a categorical variable: <7, 7 to 9, and ≥ 10 days. The cutoffs for each category were determined on the basis of recently described cystectomy length of stay indices^{3,6,7} with the goal of establishing a range for the expected middle tertile (ie, 7-9 days) then a “short” and “prolonged” length of stay range. We then assessed the outcome of readmission for any diagnosis within 30 days of surgery. The 30-day window is supported by previous data that show nearly 80% of readmissions after cystectomy occur within this period.⁸

Other Covariates and Potential Confounders

Other examined variables included patient demographic characteristics (age, sex, body mass index, race, and ethnicity), comorbidities (frailty, smoking history, diabetes mellitus treated with oral agents or insulin, functional status, American Society of Anesthesiology [ASA] classification, cerebrovascular disease), and treatment factors (neoadjuvant chemotherapy, previous radiation, type of diversion, surgery time). We also examined development of major complications after discharge, whether readmission was related to surgery specifically, and discharge destination (home vs. not home).

Complications abstracted included wound (superficial/deep/organ space surgical site infections, wound dehiscence), pulmonary (pneumonia, reintubation, ventilator support >48 hours), renal

(acute renal failure, progressive renal insufficiency), neurologic (cerebrovascular accident/stroke with neurologic deficit), cardiac (cardiac arrest, myocardial infarction), thromboembolic (deep venous thrombosis and pulmonary embolism), septic (sepsis, septic shock), urinary tract infection, and any postoperative transfusion. Major complications were defined using an algorithm described elsewhere.⁹

Statistical Analysis

In an initial step, we used appropriate parametric and nonparametric testing to evaluate the association between exposure, other covariates, and outcomes of interest. Next, we constructed multivariable logistic regression models including all observed covariates. Patients with missing data for outcome and primary exposure variables were excluded from the analysis; this represented 19 of 4624 patients in analytic cohort (0.4%). Model covariates were selected on the basis of a priori hypotheses of effect plus any covariates with $P < .15$ on bivariate testing. The final model contained the following covariates: age (categorical), length of stay (categorical), year (categorical), frailty status (frail vs. pre-frail vs. robust), presence of major complications after discharge (dichotomous), surgical time (ordinal in quartiles), diversion type, diabetes diagnosis (yes/no), history of cardio- or cerebrovascular disease (yes/no), and body mass index (continuous on 1-unit scale). We excluded neoadjuvant chemotherapy as a covariate because of a significant proportion of patients missing these data. We considered $\alpha = 0.05$ as a cutoff for statistical significance, and all testing was 2-sided. This study was deemed exempt from institutional review board oversight, because it used deidentified data without protected health information.

Results

Among 4624 patients treated with radical cystectomy for bladder cancer, the median age range was 61 to 70 years, 3609 (78.1%) were male, 1533 (33.2%) obese, 1105 (23.9%) smokers within the previous year, 728 (15.7%) underwent a continent diversion. Among 513 patients with non-missing data for the variable, 95 (18.5%) were treated with chemotherapy within 30 days before surgery. Further cohort demographic characteristics and clinical variables are given in Table 1.

Patients with a length of stay of < 7, 7 to 9, and ≥ 10 days comprised 38.3% ($n = 1769$), 40.8% ($n = 1887$), and 20.9% ($n = 968$) of the cohort, respectively. The median length of stay was 7 days; 1003 patients (21.7%) were readmitted within 30 days of surgery. Readmission occurred at a median number of 7 days after discharge. Factors associated with an increased risk of readmission on bivariate analysis included continent diversion, diabetes requiring oral medication or insulin, prolonged surgical time, and obesity (all $P < .001$; Table 1). Of readmitted patients, 503 (50%) experienced a major complication after discharge. Covariates significantly associated with differences in length of stay included age, sex, obesity, race/ethnicity, year of admission, use of neoadjuvant chemotherapy, ASA classification, non-home discharge disposition, diversion type, and surgical time (all $P < .05$; Table 1).

Estimates from our multivariable models showed that, after adjustment, the presence of diabetes and increasing body mass index were independently associated with risk of readmission (Table 2). Major complications after discharge were also important, with an adjusted odds ratio (OR) of 6.68 (vs. no complications, 95%

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