

Root Causes and Modifiability of 30-Day Hospital Readmissions after Radical Cystectomy for Bladder Cancer

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Abbreviations and Acronyms

CCI = Charlson comorbidity index
LOS = length of stay
RC = radical cystectomy
SNF = skilled nursing facility
VTE = venous thromboembolic event

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Purpose: Radical cystectomy is associated with high complication and rehospitalization rates. An understanding of the root causes of hospital readmissions and the modifiability of factors contributing to readmissions may decrease the morbidity associated with radical cystectomy. We characterize the indications for rehospitalization following radical cystectomy, and determine whether these indications represent immutable patient disease and procedure factors or whether they are modifiable.

Materials and Methods: From MarketScan® databases we identified patients younger than 65 years with a diagnosis of bladder cancer who underwent radical cystectomy between 2008 and 2011 and were readmitted to the hospital within 30 days of radical cystectomy. All associated ICD-9 codes in the index admission, subsequent outpatient claims and readmission claims were independently reviewed by 3 surgeons to determine a root cause of rehospitalization. Causes were broadly categorized as medical, surgical or infectious, and reviewers determined whether the readmission was modifiable. Multivariate logistical regression models were used to identify factors associated with rehospitalization.

Results: A total of 1,163 patients were included in the study and 242 (21%) were readmitted to the hospital within 30 days. Of these readmissions 26% were considered modifiable ($\kappa=0.71$). Of the nonmodifiable readmissions an infectious cause accounted for 52% and a medical cause accounted for 48%, whereas of the modifiable readmissions 62% were due to surgical causes, 30% to medical and 8% to infectious causes. On multivariate analysis only discharge to a skilled nursing facility was associated with modifiable (OR 6.12, 95% CI 2.32–16.14) or nonmodifiable (OR 3.27, 95% CI 1.63–6.53) hospital readmissions.

Conclusions: The majority of rehospitalizations after radical cystectomy are attributable its inherent morbidity. However, optimization of aspects of pericystectomy care could minimize the morbidity of radical cystectomy.

Key Words: patient readmission, urinary bladder neoplasms, cystectomy, complications, treatment outcomes

HOSPITAL readmissions are a major contributor to health care expenditures in the United States. Almost 20% of Medicare beneficiaries were

rehospitalized within 30 days of discharge at a cost of \$17.4 billion in the years 2003 to 2004.¹ Although estimates of the proportion of

readmissions that are modifiable vary considerably based on the patient population and methodology, a 2011 review of 34 studies found a median of 27% of readmissions were potentially modifiable.² In an attempt to decrease the health and financial burden of the treatment of disease, hospital readmissions have been increasingly targeted by policy makers as demonstrated by recent penalties for readmissions for certain diagnoses and procedures.³

Despite improvements in mortality associated with radical cystectomy for bladder cancer, this operation is still associated with considerable morbidity. For patients with muscle invasive bladder cancer RC remains the gold standard of treatment, providing excellent local control and conferring long-term survival.⁴ Nevertheless, RC is associated with a 35% to 64% complication rate and a 26% to 35% rehospitalization rate.⁵⁻⁷ This may contribute to the finding that bladder cancer is the costliest cancer in terms of lifetime expenditures.⁸

We hypothesize that although many indications for rehospitalization after RC are inherent due to the extensive extirpative and reconstructive components of the surgery, a substantial proportion of these complications is modifiable. In this study we characterize reasons for rehospitalization after RC and determine whether these rehospitalizations could have been prevented. Understanding the mechanisms by which perioperative patient risk factors and treatment algorithms may be optimized could decrease the occurrence of these potentially modifiable complications.

METHODS

Using MarketScan commercial databases we identified patients who underwent RC for a primary diagnosis of bladder cancer between 2008 and 2011. MarketScan comprises the inpatient and outpatient health insurance claims of more than 34 million enrollees annually from 150 employers and 13 commercial health plans across the United States. Patients older than 65 years may have dual coverage with Medicare with claims data not captured by MarketScan. Thus, we restricted our analysis to enrollees younger than 65. Procedure type and primary diagnosis were identified by CPT and ICD-9 procedure and diagnosis codes. Demographic information including age, gender, diversion type, CCI,⁹ length of index hospitalization, discharge disposition and receipt of neoadjuvant chemotherapy was collected.

Rehospitalizations occurring within 30 days of RC were captured by MarketScan and the observed ICD-9 diagnosis and procedure codes for each readmission were analyzed to determine the primary reason for readmission. Readmission diagnoses were broadly categorized as medical, surgical or infectious. Medical causes included nonsurgical conditions such as failure to thrive, cardiac events, ileus and venous thromboembolic events. Surgical causes of readmission included any event incited by a

technical issue related to RC and/or the urinary diversion. Examples included readmissions with diagnosis and procedure codes suggesting anastomotic bowel leak, small bowel obstruction requiring re-exploration, ureteroenteric anastomotic stricture, fistulas associated with the bowel and/or urinary tract, and wound dehiscence requiring closure. The rehospitalization cause was categorized as infectious if the patient had a diagnosis code for any infection and did not have ICD-9 or procedure codes suggesting that a surgical factor contributed to the infection. Examples included patients with codes for urinary tract infection without the need for nephrostomy tubes, unspecified septicemia, intra-abdominal abscesses without a code for bowel leak, colitis and pneumonia.

The identified inciting event and not the resulting sequelae served as the basis for categorization. For example, although a patient may have a code for pyelonephritis on hospital readmission, if a code for percutaneous nephrostomy tube placement was present, the root cause of rehospitalization was presumed to be surgical (ie ureteroenteric anastomotic stricture). In addition, readmission diagnoses were categorized by system type to better describe the root causes of these readmissions. Rehospitalizations associated with stoma complications were categorized as a genitourinary complication due to continuity with the urinary tract whereas anastomotic bowel leaks and bowel obstruction were categorized as gastrointestinal complications.

To determine whether the primary diagnosis underlying each readmission was modifiable, 2 urologists independently reviewed the diagnosis and procedure codes for each rehospitalization. The reviewers then judged whether the rehospitalization could conceivably have been prevented from a provider perspective. Factors considered modifiable included readmissions attributable to surgical technique, or those that could have been avoided through optimal perioperative care such as judicious antibiotic administration, and VTEs which were presumed to be preventable through chemoprophylaxis. Modifiability was only considered from the perspective of the actions of providers. Factors potentially modifiable by the patient were not considered. A senior urologist reconciled cases in which the primary reviewers disagreed about modifiability.

Multivariable logistical regression models were created to identify patient factors that were associated with modifiable or nonmodifiable readmission. We examined patient demographic and clinical characteristics. Patient demographic information included age, race/ethnicity and gender. Clinical covariates evaluated included LOS, burden of comorbid conditions, type of urinary diversion (ie continent orthotopic neobladder vs ileal conduit) and discharge disposition. Comorbidity indices were calculated using the Klabunde modification of the CCI.¹⁰ To ensure ascertainment of patient comorbidities we only included patients who were enrolled in MarketScan for 12 months before RC. We further excluded patients who underwent RC without a primary diagnosis of bladder cancer. A Cohen's kappa score was calculated to determine the degree of inter-rater agreement between the 2 surgeons examining the modifiability of readmissions. This study qualified for a waiver of institutional review

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