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The impact of readmission hospital on failure-to-rescue rates following major urologic cancer surgery

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Abstract

Purpose: Patients readmitted to secondary hospitals rather than the primary hospital where their surgery took place may be at risk for poorer outcomes. We sought to evaluate the effect of site of readmission on failure-to-rescue complication rates following urologic cancer surgery.

Materials and methods: Retrospective review of major urologic cancer surgeries in the Washington State Comprehensive Hospital Abstract Reporting System between 1998 and 2013. Failure-to-rescue (FTR) rates, defined as inpatient death after a complication requiring hospital readmission, were compared between patients readmitted to their primary hospital with those readmitted to a secondary hospital. Multivariable logistic regression (MVA) models evaluated the association between readmission site and FTR.

Results: Of 31,498 eligible patients, 3,113 patients were readmitted to hospital within 90 days of surgery, of whom 29.2% were readmitted to a secondary hospital. The highest FTR rates were following cardiac (11.6%), respiratory (11.2%), and sepsis-related complications (10.0%). When limiting to patients who underwent surgery in a high-volume center, the odds of FTR were 4-fold higher when complications were managed in a secondary hospital (OR = 4.06, 95% CI: 1.67–9.89).

Conclusions: The institution where patients present for postoperative complications is associated with differential mortality outcomes. Upon validation in a large cohort, these findings may inform quality improvement initiatives that target postoperative readmissions, algorithm-based approaches to post-surgical management of complications, and guide clinical decision-making around hospital transfers.

Keywords: Urology; Surgery; Readmissions; Failure to rescue; Quality; Health outcomes

1. Introduction

The centralization of complex urologic cancer surgeries has been proposed in an effort to reduce morbidity and mortality [1–5]. Although the relationship between hospital volume and immediate postoperative outcomes is established [6], morbidity extends beyond the index period, and hospital-specific outcomes may be further discriminated by the effectiveness of postoperative complication management. With nearly 1 in 7 surgical patients readmitted after discharge [7,8], some of these differential outcomes may be partly attributed to differences in the ability to successfully manage adverse events, a concept previously described as failure-to-rescue (FTR) [7,9–11].

High-volume centers have been found to have lower FTR rates than low-volume centers [12,13]. However, given that the delivery of urologic oncological surgery is subject to significant regional variation [5,14], the site of readmission may affect FTR rates. Patients may be required to travel large distances for surgery, yet present to local hospitals for management of postoperative issues, that may be less prepared to identify and effectively manage complications [15,16].

Understanding the impact that site of readmission has on health outcomes may inform policy and clinical behaviors around discharge disposition and patient transfers. Thus, we sought to evaluate FTR rates between patients readmitted

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back to their primary surgical hospital with those managed at alternate, secondary hospitals following urologic cancer surgery.

2. Patients and methods

2.1. Study population

We accessed the Washington State Comprehensive Hospital Abstract Reporting System (CHARS) between 1998 and 2013. CHARS transitioned formatting in 2008; thus, data from 2008 were incomplete and excluded. CHARS collects demographic and billing information from inpatient hospitalizations among all Washington-licensed non-Federal acute-care institutions. International Classification of Diseases, 9th Edition (ICD-9) codes were used to identify patients treated with radical prostatectomy (ICD-9 code 60.5), for prostate cancer (ICD-9 codes 185/185.0), radical cystectomy (RC, ICD-9 codes 57.7, 57.71, and 57.79), for bladder cancer (ICD-9 codes 188–188.9, 233.7, 233.9, 236.7, and 239.4), and radical (RN) or partial nephrectomy (PN) for renal cell carcinoma using a previously published algorithm [17]. We evaluated the first readmission within 90 days of surgery to exclude any survival bias among patients with multiple readmissions. We further limited our analysis to residents of Washington State to minimize the likelihood of missed out-of-state hospital readmissions.

Available demographic variables included age, sex, insurance type, and ZIP code. Comorbidities were evaluated by the Elixhauser method [18]. ZIP codes were linked to the Dartmouth Atlas to create demarcated areas of health care grouped into hospital service areas (HSAs) and hospital referral regions (HRRs) [19]. HSAs correspond to areas in which the majority of patients from that region are hospitalized (65 in Washington State) whereas HRRs are broader and represent areas in which the majority of patients within that region receive tertiary care (6 in Washington State). Geodesic distances between patient residence and hospital ZIP codes were examined.

Primary hospitals (PH) were designated as the same hospital where the index surgery took place. Secondary hospitals (SH) were hospitals other than the index surgical hospital, in which the patient was admitted >24 hours after a hospital discharge within 90 days of their surgery. Admissions >24 hours were used to reduce the effect of immediate hospital transfers and to reduce the bias from acute complications, which may have required urgent care at closer hospitals. Hospital volume was divided into tertiles, based on overall urologic surgery volume of evaluated cases, so that each tertile represented a third of all cases for a specific index surgery. In addition, for each surgery type, hospitals were ranked by number of surgeries performed annually to identify high-volume hospitals in the top 90%. High-volume centers averaged 139 RPs (range: 131–146), 21 RCs (9–25), 44 RNs (35–58), and 20 PNs (14–25) annually; moderate-volume centers averaged 54 RPs (37–75), 7 RCs (4–8), 18 RNs (13–26), and 5 PNs (3–7); and low-volume centers averaged 9 RPs (1–30), 1 RC (1–3), 4 RNs (1–13), and 1 PNs (1–3) annually. Prolonged length of stay (LOS) was defined as greater than the 75th percentile of LOS for each surgery (RP $=$ 3 days, RC $=$ 12 days, RN $=$ 6 days, and PN $=$ 5 days).

2.2. Study outcomes

The primary endpoint was the FTR rate on the first readmission within 90 days of surgery. Postoperative complications were determined by ICD-9 codes described previously [20–22] and supplemented with Agency for Healthcare Research and Quality Patient Safety Indicators [23]. Complications were grouped into cardiac, respiratory, sepsis, renal, venous thromboembolic events (VTE), and bleeding-related categories. Secondary outcomes included overall complication rates and all-cause mortality. All-cause mortality was defined as death among any readmitted patient irrespective of admission diagnosis.

2.3. Statistical analysis

Descriptive statistics are presented. The primary independent exposure variable was readmission site (PH vs. SH). Age, sex, year of surgery, comorbidity, prolonged LOS, hospital volume, distance travelled to index hospital, time to readmission, discharge to a skilled nursing facility (SNF), index surgery type, insurance, and readmission hospital volume were all considered as potential residual confounders through bivariate analysis and stepwise multivariable logistic regression models to identify factors associated with FTR.

We hypothesized that patients readmitted to secondary hospitals may have worse outcomes and that those outcomes may differ based on the procedural volume of the primary hospital. We used the dichotomous index hospital volume above or below the 90th percentile of hospitals ranked by volume for each specific procedure. Testing for effect modification of index hospital surgical volume on the relationship between PH/SH exposure and FTR outcomes was significant ($P = 0.006$), supporting our analysis stratification according to index surgical hospital volume. Multivariable model 1 was limited to patients who had surgery at high-volume hospitals; model 2 was limited to patients who had surgery at low-volume hospitals. Sensitivity among surgeries with higher FTR rates (RC and RN) and limited to FTRs for specific complications did not show substantively different risk estimates. Analyses were performed using SAS statistical software (version 9.3, SAS Institute Inc., Cary, NC). All P values are 2-sided.