

# Association of Distance to Treatment Facility With Survival and Quality Outcomes After Radical Cystectomy: A Multi-Institutional Study

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## Abstract

**In a large multi-institutional cohort, patients distant to a tertiary care center had increased usage of neoadjuvant chemotherapy, a shorter time from diagnosis to surgery, and no difference in survival outcomes compared with patients who resided near to the facility. Thus, referring patients across the geographic distances observed in the present study did not appear to compromise patient care.**

**Background:** We sought to determine the effect of the travel distance on mortality and quality outcomes after radical cystectomy in a large multi-institutional cohort. **Patients and Methods:** A total of 3957 patients who had undergone radical cystectomy for urothelial carcinoma at 6 North American tertiary care institutions were included. The association of travel distance with quality-of-care endpoints, 90-day mortality, and long-term survival were evaluated.

**Results:** The median patient age was 69 years (interquartile range, 61-76 years), and most patients were men (80%). Most patients had clinical stage T2 (45.2%) and T1 (24.7%) tumors. The median distance to the treatment facility was 102.9 miles (interquartile range, 24-271 miles). Patients residing in the first quartile of travel distance to treatment facility (< 24 miles) had lower usage of neoadjuvant chemotherapy compared with patients in the fourth distance quartile (adjusted odds ratio, 1.58; 95% confidence interval, 1.22-2.05;  $P = .001$ ). Patients in the first distance quartile were also less likely to experience a delay in time to cystectomy (> 3 months) compared with patients with a greater travel distance (adjusted odds ratio, 0.673; 95% confidence interval, 0.532-0.851). Distance to the treatment facility was not associated with 90-day mortality or cancer-specific or all-cause mortality on multivariate analysis.

**Conclusion:** Despite the potential health care disparities for bladder cancer patients residing distant to a regional surgical oncology facility, the study results suggest that the travel distance is not a barrier to appropriate oncologic care at regional tertiary care centers.

*Clinical Genitourinary Cancer*, Vol. ■, No. ■, 1-7 © 2017 Elsevier Inc. All rights reserved.

**Keywords:** Bladder cancer, Morbidity, Neoadjuvant chemotherapy, Regionalization, Travel

Bladder cancer is the fifth most common noncutaneous malignancy, with an estimated 76,960 new cases in the United States in 2016.<sup>1</sup> Most patients (75%) will present with non-muscle-invasive disease; however, one third of those will eventually develop muscle-invasive bladder cancer. Radical cystectomy with bilateral pelvic

lymphadenectomy and neoadjuvant chemotherapy (NAC) are the current guideline-recommended treatments for muscle-invasive bladder cancer.<sup>2</sup> Radical cystectomy is associated with significant morbidity and mortality, with patient comorbidities an important factor, given the high median age at diagnosis (73 years) and the

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Submitted: Jan 31, 2017; Revised: Apr 17, 2017; Accepted: May 1, 2017

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## Travel Distance and Survival After Radical Cystectomy

high incidence of smoking in this population.<sup>3</sup> Cystectomy performed in high-volume facilities and by high-volume surgeons has been associated with improved outcomes compared with lower volume centers.<sup>4,5</sup> Indeed, radical cystectomy has been increasingly regionalized to higher volume facilities.<sup>6</sup>

Although regionalization has been associated with improved survival outcomes, many patients do not reside near a tertiary care center and face potential barriers to adequate care before and after surgery. Patients residing in rural communities, elderly patients, and those with limitations resulting from insurance, employment, or socioeconomic status might be particularly vulnerable. In a small single-institution study, the distance to a tertiary care center was an independent negative prognostic factor after radical cystectomy.<sup>7</sup> This suggests that potential disparities exist in access to postoperative care for patients who reside distant to the surgical treatment facility. In the present study, we used a large multi-institutional tertiary care cohort of patients who had undergone radical cystectomy for bladder cancer to evaluate the association of travel distance and survival outcomes after radical cystectomy.

### Patients and Methods

#### Patient Population

After institutional review board approval at all participating centers, we identified 4001 patients who had undergone radical cystectomy for urothelial carcinoma of the bladder at 6 high-volume North American tertiary care centers: Mayo Clinic Rochester, MD Anderson Cancer Center, University of Southern California, University of Texas Southwestern, University of British Columbia, and the University of Texas at San Antonio. The institutions were labeled A to F to avoid linking data to the individual institutions. A total of 44 patients were excluded because their primary residential address ZIP (zone improvement plan) code/postal code could not be determined. The inclusion dates ranged from January 2000 to June 2014. A retrospective review of the medical records was performed to retrieve the following clinical variables: patient demographic data, age-adjusted Charlson comorbidity index, clinical and pathologic tumor characteristics (stage, nodal status, lymphovascular invasion, and soft tissue margins), use of NAC, type of urinary diversion, and interval from transurethral diagnosis to cystectomy. The tumor stage was reported according to the seventh edition of the American Joint Committee on Cancer guidelines, and the World Health Organization/International Society of Urological Pathology classification was used for tumor grade. The treatment, such as the use of NAC, extent of lymphadenectomy, and type of urinary diversion, was not standardized and was based on individual clinical judgment. The use of NAC at the primary institution or an outside facility was recorded. The postoperative follow-up schedule varied between the institutions but generally consisted of physical examination and routine laboratory testing at 3 to 6 weeks after surgery and then every 3 to 4 months, with abdominal imaging studies for the first year and semiannually thereafter.

The study endpoints were the use of NAC, the interval from diagnosis to cystectomy (defined as the interval from the most recent transurethral resection to cystectomy), mortality at 90 days, cancer-specific mortality, and all-cause mortality. Analysis of NAC usage was restricted to patients eligible for NAC, specifically patients with clinical stage cT2-cT4 tumors. Cancer-specific mortality was

defined as death from metastatic bladder cancer, as determined by a review of the medical records. Overall mortality was determined by a review of the medical records and by a search of the publically searchable death records.

#### Statistical Analysis

The travel distance was determined by measuring the straight line distance (in miles) between the patient's residence ZIP code/postal code and the treatment institution's ZIP code/postal code (ZIPDISTANCE FUNCTION; SAS software, version 9.2; SAS Institute Inc, Cary, NC). The patients were stratified into 4 distance categories according to the distance quartiles for the overall cohort. Because the median travel distance varied by institution, we also evaluated each institution individually to determine the local trends in distance in association with the study outcomes.

To further account for heterogeneity in the local geography and median travel distances at each institution, we categorized institutions into 2 groups according to the median travel distance for patients at each institution: group 1, hospitals with a median travel distance  $\geq 100$  mile (institutions A and B); and group 2, hospitals with a median travel distance  $< 100$  miles (institutions C-F).

The association of distance with 90-day mortality, use of NAC, and interval to cystectomy was determined by multivariate binary logistic regression. Because NAC directly affects the time from transurethral resection to cystectomy, patients who had received NAC were excluded from the time to cystectomy analysis. The median survival estimates were determined using the Kaplan-Meier method. The prognostic association of variables with cancer-specific survival (CSS) and overall survival (OS) was assessed by univariate and multivariate Cox proportional hazards regression. List-wise deletion was used in regression analyses for cases with missing data. Statistical analyses were conducted using SPSS, version 19 (IBM, Armonk, NY).

### Results

The clinical and pathologic characteristics of 3957 patients who had undergone radical cystectomy for treatment of urothelial carcinoma at 6 North American tertiary care centers are listed in [Table 1](#). Most patients were men (79.8%) and white (87.3%), with a median age of 69 years (interquartile range [IQR], 61-76 years). Of the patients, 80.9% had organ-confined disease and 20.8% had regional nodal metastases on pathologic staging. NAC was used in 22.1% of patients overall and ranged from 6.9% to 44.7% for individual institutions. The median time from transurethral resection to cystectomy was 1.7 months (IQR, 1.0-3.1 months). The median distance traveled to the health care facility for cystectomy was 102.9 miles (IQR, 21-266 miles). The median travel distance ranged from 30.3 to 198 miles for individual institutions.

#### Association of Travel Distance With Use of NAC and Interval to Cystectomy

Patients were stratified into quartiles according to the distance from treatment facility ( $< 24$ , 24.1-103, 103.1-271, and  $> 271$  miles). Patients with a greater travel distance were more likely to receive NAC than were patients who were near to the tertiary treatment facility ([Table 2](#)). This association was strongest for patients in the fourth distance quartile ( $> 266$  miles) compared

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