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The relationship of travel distance with cystectomy access and outcomes

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Abstract

Purpose: Regionalization of care and travel distance may result in unintended consequences for complex surgery such as cystectomy. Our objective was to evaluate effect of differential distance on cystectomy receipt among patients with muscle-invasive bladder cancer (MIBC) and investigate the association between travel distance and cystectomy outcomes such as readmission.

Methods: Using a linked data resource combining the NC Central Cancer Registry with claims data from Medicare, Medicaid, and private insurance plans, we included 736 patients with MIBC and 1,082 who underwent cystectomy. To evaluate access, differential distance was calculated as the difference between the nearest urologist and nearest cystectomy provider. To assess outcomes, logistic regression was used to evaluate rehospitalization and major complications, and Cox proportional hazards model for survival analysis.

Results: To evaluate access and outcomes, 736 patients with MIBC and 1,082 patients undergoing cystectomy were evaluated, respectively. Overall, 29% (211 of 736) with MIBC underwent cystectomy. Differential distance was not a predictor of cystectomy receipt (odds ratio = 1.0; 95% CI: 1.00, 1.01). Among patients undergoing cystectomy, travel distance from cystectomy provider was not a significant predictor of 30- or 31 to 90 day readmissions (odds ratio = 1.0; 95% CI: 1.00, 1.00) although patients who lived further from their cystectomy provider were more likely to be readmitted to a nonindex hospital ($P < 0.001$) when controlling for other factors. Although travel distance did not have a significant effect on overall survival, patients readmitted between 31 to 90 days had worse overall survival ($P < 0.0001$).

Conclusions: The additional distance needed to reach a cystectomy provider did not predict receipt of surgery for MIBC. Furthermore, travel distance from cystectomy provider was not a significant predictor for subsequent readmission after cystectomy and did not affect overall survival.

Keywords: Bladder cancer; Radical cystectomy; Treatment; Travel distance; Access to care; Readmissions; Urinary bladder neoplasms

1. Introduction

Cystectomy is considered to be standard treatment for muscle-invasive bladder cancer (MIBC) [1]. Guideline-concordant treatment for MIBC is markedly underused despite better survival associated with cystectomy compared to less aggressive therapy [2,3]. Moreover, cystectomy can be highly morbid as treated patients have the highest rates of readmissions and complications among major cancer surgeries [4].

Accordingly, some have advocated for volume-based referral practices in an attempt to improve surgical outcomes. High-volume centers have been linked to a decrease in mortality for major surgery, including cystectomy for bladder cancer [5]. However, regionalization of care raises

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concerns about the increase in distances some patients might travel. Increased travel distance may result in unintended consequences, such as reduced access and care fragmentation [4,6], particularly for a surgery that wrestles with both underutilization and excessive readmissions [7]. Previous studies have indicated decreased odds of receiving cystectomy [3], decreased short-term (but not overall) survival [4], and increased readmission following surgery with increasing distance [8]. However, the potential interplay between distance, access, and outcomes has not been evaluated concurrently nor has it included patients younger than age 65 years.

To enable a more comprehensive evaluation of the effect of distance on access and outcomes of cystectomy treatment, our objective was 2-fold: to evaluate the effect of distance on cystectomy receipt among patients with MIBC and to investigate the association between distance and cystectomy outcomes. We hypothesized that patients who lived relatively close to a cystectomy provider would be more likely to receive cystectomy and those traveling a longer distance to undergo cystectomy would have a more complicated outcome.

2. Materials and methods

2.1. Data source

An analytic dataset was created from the Cancer Information & Population Health Resource, a unique linked data resource created by the University of North Carolina Lineberger Comprehensive Cancer Center [9]. North Carolina, a state historically fueled by the tobacco industry, provides a keen population to investigate bladder cancer care. Patient demographic and tumor information were obtained from the North Carolina Central Cancer Registry (NCCCR), which is linked to administrative claims data from fee-for-service (non-HMO) Medicare, Medicaid, and privately administered health plans through deterministic and probabilistic methods [10]. Linked administrative claims data include enrollment files and insurance claims records from inpatient, outpatient, physician, and equipment files. In total, this dataset captures 85% of the cancer population in North Carolina.

2.2. Study population and measures for distance

We constructed separate, distinct cohorts for the 2 primary objectives (consort diagrams, Supplemental Figs. 1 and 2). First, to evaluate the effect of distance on access, we identified adult patients (ages 18 y and older) with a primary diagnosis of clinical stage II (T2N0M0), MIBC from 2003 to 2011 in the NCCCR and linked to claims ($n = 1{,}540$). Patients without continuous enrollment for 12 months before and after diagnosis were excluded, leaving 736 patients. For each patient, we ascertained the *differential distance*, which has demonstrated a strong relationship with treatment in other conditions and may reflect the added distance that may come from regionalization [11,12]. Differential distance was calculated as the distance from the patient to the nearest cystectomy provider (defined as a urologist performing at least 4 cystectomies in the year of diagnosis) minus the distance from the patient to the nearest urologist. For example, a patient located 10 miles from the nearest urologist and then 25 miles from the nearest cystectomy provider would have a differential distance of 15 miles. Distance was calculated as a straight line from the center of the patient and urologist ZIP code, and analyzed as a continuous variable. The threshold of 4 cystectomies in a year was used to define a cystectomy provider as most urologists who did not meet this threshold performed cystectomy infrequently from year to year (e.g., many years performing 0 cystectomies). To assess the effect of altering definitions of high volume providers and distance, we performed several sensitivity analyses. First, we allowed for time-varying providers (since number of surgeries could fluctuate across years). Second, using the patient as the center of a 30-mile radius, we calculated the number of high volume providers in their area. Third, we conducted an analysis that included "top performing" centers (centers with the top 3 and 5 highest number of cystectomies performed each year).

Second, to evaluate the effect of distance on outcomes following cystectomy, all disease stages were included from 2003 to 2012. Among patients diagnosed with bladder cancer, we identified 1,345 patients who underwent cystectomy during the study interval (see codes in Supplemental Table 1). We excluded patients without continuous enrollment for at least 6 months before and 3 months after cystectomy resulting in a final sample size of 1,082. For this cohort, we calculated the *travel distance* from the patient to the hospital where the cystectomy was performed again using the straight-line distance between the associated ZIP codes. Travel distance was analyzed as a continuous variable.

2.3. Covariates

Patient demographic variables at the time of diagnosis were obtained and included patient age, race, year of diagnosis, indicator of urothelial tumor type defined by the morphology code, and type of insurance. Comorbidity was calculated based on the Charlson index and measured in the 12 months before diagnosis for the first cohort, and 6 months before cystectomy for the second cohort [13]. Census tract variables such as percentage of high school graduates and percentage of white population in tertiles were also included as proxies for socioeconomic status.

2.4. Outcome measures

To evaluate the effect of differential distance on receipt of treatment for stage II MIBC, we used a validated