Disparities in long-term radiographic follow-up after cystectomy for bladder cancer: Analysis of the SEER-Medicare database

Shaheen Alanee, Sabha Ganai, Priyanka Gupta[1], Bradley Holland, Danuta Dynda, Joel Slaton[2]

Department of Surgery, Southern Illinois University School of Medicine, Springfield, IL, [1]Department of Urology, University of Minnesota, Minneapolis, Minnesota, [2]Department of Urology, University of Oklahoma, School of Medicine, Oklahoma City, Oklahoma, USA

Abstract

Introduction: It is uncertain whether there are disparities related to receiving long-term radiographic follow-up after cystectomy performed for bladder cancer, and whether intensive follow-up influences survival.

Materials and Methods: We analyzed 2080 patients treated with cystectomy between 1992 and 2004 isolated from the SEER-Medicare database. The number of abdominal computerized tomography scans performed in patients surviving 2 years after surgery was used as an indicator of long-term radiographic follow-up to exclude patients with early failures.

Results: Patients were mainly males (83.18%), had a mean age at diagnosis of 73.4 ± 6.6 (standard deviation) years, and mean survival of 4.6 ± 3.2 years. Multivariate analysis showed age >70 (odds ratio [OR]: 0.796, 95% confidence interval [CI]: 0.651–0.974), African American race (OR: 0.180, 95% CI: 0.081–0.279), and Charlson comorbidity score >2 (OR: 0.694, 95% CI: 0.505–0.954) to be associated with lower odds of long-term radiographic follow-up. Higher disease stage (Stage T4N1) (OR: 1.873, 95% CI: 1.491–2.353), higher quartile for education (OR: 5.203, 95% CI: 1.072–9.350) and higher quartile for income (OR: 6.940, 95% CI: 1.444–12.436) were associated with increased odds of long-term radiographic follow-up. Interestingly, more follow-up with imaging after cystectomy did not improve cancer-specific or overall survival in these patients.

Conclusion: There are significant age, race, and socioeconomic disparities in long-term radiographic follow-up after radical cystectomy. However, more radiographic follow-up may not be associated with better survival.

Key Words: Bladder cancer, cystectomy, imaging, surveillance

Address for correspondence:
Dr. Shaheen Alanee, 315 West Carpenter Street, P.O. Box: 19677, Springfield, Illinois, 62794-9677, USA. E-mail: salanee@siumed.edu
Received: 26.02.2015, **Accepted:** 06.07.2015

INTRODUCTION

Aging is associated with an increased incidence of certain tumors including bladder cancer.[1] In fact, bladder cancer is the fourth most common cause of death among octogenarians.[2] In such patients, radical cystectomy is the standard of care for aggressive bladder cancer and presents a challenge because of the physiologic changes associated with aging.[3] Recurrence rates after cystectomy are significant, and patients need

Access this article online	
Quick Response Code:	Website: www.urologyannals.com
	DOI: 10.4103/0974-7796.164852

How to cite this article: Alanee S, Ganai S, Gupta P, Bradley H, Dynda D, Slaton J. Disparities in long-term radiographic follow-up after cystectomy for bladder cancer: Analysis of the SEER-Medicare database. Urol Ann 2016;8:178-83.

long-term follow-up with imaging in the absence of clinically validated biomarkers for recurrence. The National Comprehensive Cancer Network (USA) developed uniform surveillance guidelines for patients after radical cystectomy that included recommendations for timing and frequency of imaging. These guidelines recommend that patients, in addition to laboratory testing, should receive abdominal imaging every 3–6 months for the first 2 years after surgery, and then as clinically indicated afterward. In theory, the frequency of imaging after the first 2 years should be based on the natural progression of the disease and the impact that early detection has on overall morbidity and mortality; however, studies have shown significant variation in imaging practice patterns among specialists.[4] This study aims to understand the effect of patient characteristics, a nondisease-related confounder, on long-term radiographic follow-up after cystectomy. As a secondary outcome, we sought to evaluate the effect of intensive radiographic follow-up on overall and cancer-specific survival.

MATERIALS AND METHODS

Study population

We used 1992–2007 SEER-Medicare linked data to identify a cohort of patients with any stage bladder cancer treated with radical cystectomy. This database provides information on Medicare patients included in SEER, a nationally representative collection of population-based registries that collect information about all incident cancer patients from diverse geographic areas in the United States. The SEER registries included approximately 26% of the US population (http://seer.cancer.gov/data/). For each Medicare patient in SEER, the SEER-Medicare linked files contain 100% of the Medicare claims from the inpatient, outpatient, and national claims history files.

We first identified all Medicare patients aged 65–99 years who had an incident bladder cancer detected before death between January 1, 1992, and December 31, 2004, as documented by bladder cancer codes 67.0–67.9 within the SEER-Medicare Patient Entitlement and Diagnosis Summary File. Next, we limited our study population to patients with any stage bladder cancer treated with radical cystectomy by using specific surgery codes International Classification of Diseases, 9th Revision (ICD-9) 57.71 and Common Procedure Terminology (CPT) codes 51570 and 51575. This produced a cohort of 4705 patients. We then excluded all patients who died within 2 years of cystectomy ($n = 950$), patients with incomplete data, or not covered by Medicare Part A and B, or were HMO members at any time during the study period ($n = 1045$). This process produced a cohort of 2080 patients.

Characterization of long-term radiographic follow-up

The number of abdominal computed tomographic (CT) scans was measured at the patient level and included scans performed in both inpatient and outpatient settings starting 2 years after treatment with cystectomy. We included only those CT scans that were associated with a primary diagnosis code for bladder cancer (i.e. ICD-9[5] codes 188.x [bladder cancer], 233.7 [carcinoma *in situ* of the bladder], and V105.4 [personal history of bladder cancer]). We characterized imaging by using the ICD-9 and Healthcare Common Procedure Coding System (HCPCS) codes in the Medicare files. The HCPCS codes are composed primarily of CPT codes (6) in addition to codes used exclusively by Medicare. Codes used included (74150, 74160, and 74170).

Outcomes

The primary outcome was the effect of patients' characteristics on long-term radiographic follow-up controlling for other confounders. Secondary outcome was the effect of long-term radiographic follow-up on patient's mortality after cystectomy, which included all-cause mortality to avoid potential problems with misclassification of the cause of death, and was measured from January 1, 1992, through December 31, 2007, by using explicit vital status fields in SEER and bladder cancer-specific mortality.[5-7]

Statistical analysis

We first characterized patients receiving surgery for bladder cancer by age, gender, and race and reported the mean number and standard deviation (SD) of CT scans performed 2 years after cystectomy by disease stage. We chose a threshold of 5 CT scans (slightly below the calculated mean of a number of CT scans performed starting 2 years after cystectomy) to represent long-term radiologic follow-up for the purpose of this analysis. We then used logistic regression analysis to determine the effect of patient characteristics on the long-term radiographic follow-up and used Cox proportional hazard model to determine the independent effect of such follow-up on overall and cancer-specific survival. In both analyses, we controlled for patient's age (in 5-year age groups), sex, race (white, black, Hispanic, or Asian), and the AJCC (https://cancerstaging.org/Pages/default.aspx) tumor stage (Stage I, Stage II and III, and Stage IV). In addition, we adjusted for educational and income status assessed at the level of the patient's ZIP code. Patient comorbidities were identified by using ICD-9 diagnosis codes[8] in Medicare inpatient and outpatient claims for health care encounters that had occurred during the 12-month period preceding the bladder cancer diagnosis. We then used the macro provided on the SEER-Medicare website to assess comorbidity characterized by the Charlson comorbidity index (http://healthservices.cancer.gov/

seermedicare/program/charlson.comorbidity.macro.txt). Patients were classified according to their comorbidity index score (0, 1, 2, or >2), which was treated as a categorical variable. We also controlled for the length of survival after cystectomy measured by months. All analyses were carried out with SAS software (version 9.3; Cary, NC, USA). The probability of a type I error was set at 0.05. All means are reported with their SD. Odds ratios (ORs) and Hazard ratios (HR) are reported with their 95% confidence intervals (CIs).

RESULTS

After satisfying inclusion and exclusion criteria for analysis, there were 2080 patients, who were mainly males (83.18%), with a mean age of 73.4 ± 6.6 years and mean survival after cystectomy of 4.6 ± 3.2 years. The distribution of patient characteristics is illustrated in Figure 1. Figure 2 demonstrates the mean number of CT scans by disease stage. The calculated mean number of CT scans done starting 2 years after surgery was 6.2 ± 4.6 scans for Stage I (T1, Ta, Tis), 5.7 ± 3.1 scans for Stage II and III (T2, T3), and 6.8 ± 3.1 scans for Stage IV disease (T4, N1, M1).

Table 1 shows the results of the logistic regression analysis for the effect of patient and disease characteristics on the likelihood of receiving long-term radiologic follow-up after cystectomy for bladder cancer. Age above 70 years (odds ratio [OR]: 0.796, 95% CI: 0.651–0.974), African American race (compared to white; OR: 0.180, 95% CI: 0.081–0.279), and Charlson comorbidity score >2 (OR: 0.694, 95% CI: 0.505–0.954) were associated with lower odds of long-term follow-up. Higher disease stage (OR: 1.873, 95% CI: 1.491–2.353), higher quartile for education (OR: 5.203, 95% CI: 1.072–9.350) and higher quartile for income (>75,000 vs. <25,000; OR: 6.940, 95% CI: 1.444–12.436) were associated with higher odds of receiving more than 5 additional CT scans in patients who survived 2 years after surgery. Gender, other races (Asian vs. white, Hispanic vs. white), and lower disease stage (Stage T2, T3 vs. T1 and Tis) were not significant predictors if increased likelihood of having more than 5 CT scans after surviving 2 years after cystectomy.

Table 1: Results of the logistic regression analysis for the likelihood of having more than 5 CT scans done after cystectomy

Variable	OR	95% CI
Age >70 versus ≤70	0.796	0.651-0.974
Female versus male	0.989	0.769-1.272
African American versus white	0.180	0.081-0.398
Asian versus white	1.145	0.588-1.702
Hispanic versus white	1.625	0.599-2.651
T2, T3 versus stage Ta, T1 and CIS	0.965	0.783-1.188
T4 and N1 versus Ta, T1 and CIS	1.873	1.491-2.353
Charlson score >2 versus ≤2	0.694	0.505-0.954
Higher quartile of education versus lower quartile by zip code	5.203	1.072-9.350
Higher quartile of income (>75,000) versus lower quartile of income (<25,000)	6.940	1.444-12.436

OR: Odds ratio, CI: Confidence interval, CIS: Carcinoma *in situ*, CT: Computerized tomography

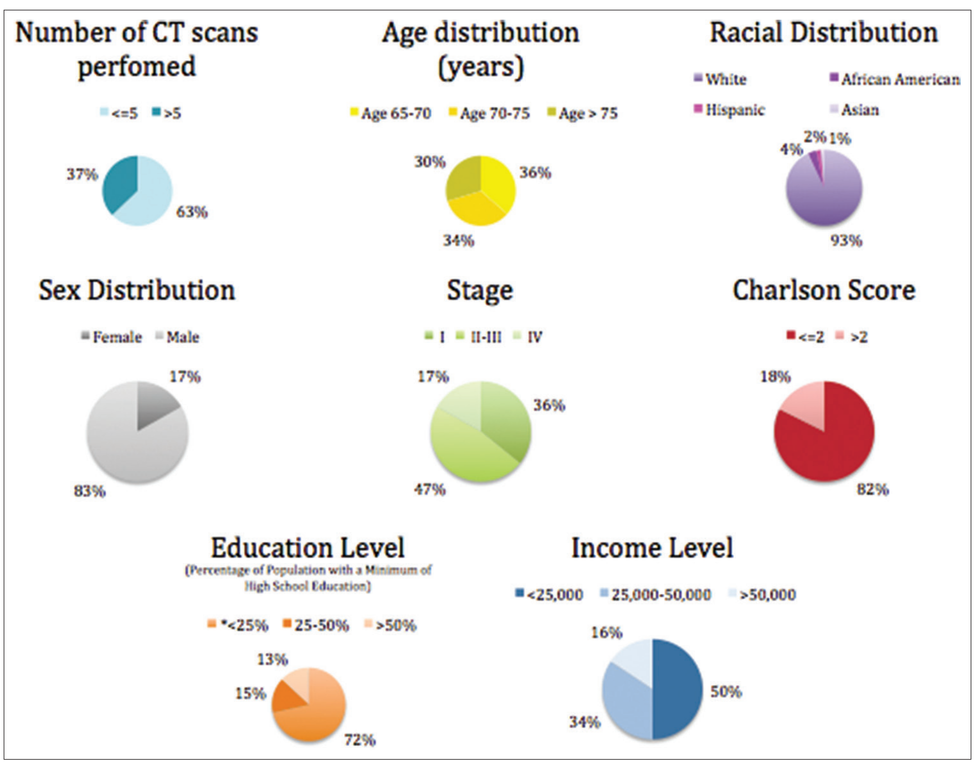

Figure 1: Patient and disease characteristics

Table 2 presents the results of Cox proportional hazard analysis for the effect of long-term radiologic follow-up on overall survival and cancer-specific survival. While the number of CT scans done in long-term survivors did not affect overall (HR: 1.50, 95% CI: 0.89–2.29) or cancer-specific survival (HR: 1.12, 95% CI: 0.76–1.56), we observed the expected effect of disease severity, as well as patient's age and comorbidities on overall survival. Specifically, there was a 90% increased mortality in patients with Stage IV compared to Stage I, with patients with higher age having lower survival than those at a lower age (40% increased mortality in ages 70–75 compared to ages 65–70 years), and patients with higher Charlson index with a higher mortality compared to those with lower index (280% increase in mortality for patients with Charlson index ≥3 compared to lower scores). Patient's sex, income, and education did not significantly affect the overall mortality after cystectomy.

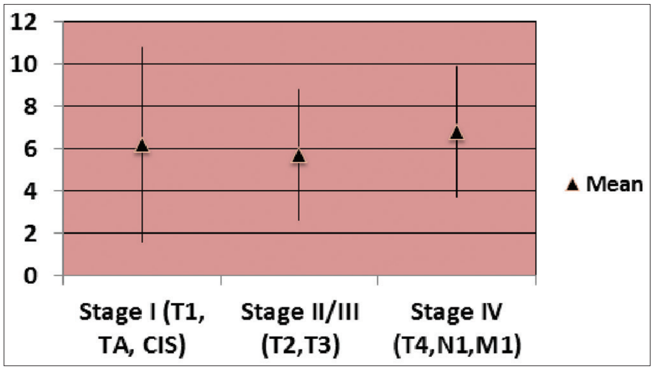

Figure 2: Mean number of computerized tomography scans performed on patients surviving 2 years after cystectomy by disease stage

Table 2: Population characteristics, all-cause mortality, and bladder cancer-specific mortality for patients surviving 2 years after cystectomy and included in the study (*n*=2080)

Patient stratification	All-cause mortality			Bladder cancer-specific mortality		
	HR	95% CI		HR	95% CI	
Number of CT scans						
≤5	1			1		
>5	1.50	0.89	2.29	1.12	0.76	1.56
Age						
65-70	1			1		
70-75	1.476	1.21	1.802	0.836	0.581	1.203
>75	1.824	1.482	2.245	1.196	0.8	1.787
Race						
White	1			1		
African American	0.807	0.458	1.422	0.445	0.133	1.486
Hispanic	0.522	0.266	1.025	0.38	0.05	2.899
Asian	0.888	0.52	1.516	1.243	0.476	3.246
Sex						
Female	1			1		
Male	0.847	0.673	1.067	0.826	0.528	1.292
Stage						
I	1			1		
II-III	1.171	0.968	1.416	2.248	1.513	3.34
IV	1.947	1.556	2.437	2.952	1.913	4.556
Charlson score						
≤2	1			1		
>2	2.862	1.416	5.785	0.551	0.127	2.39
Education						
<25%*	1			1		
25-50%	1.117	0.897	1.392	0.935	0.593	1.473
>50%	1.281	0.869	1.89	1.112	0.539	2.295
Income						
<25,000	1			1		
25,000-50,000	1.076	0.849	1.363	0.767	0.498	1.182
>50,000	1.085	0.744	1.584	1.308	0.647	2.644

HR: Hazard ratio, CI: Confidence interval, CT: Computerized tomography. *Variable is significant when 95% confidence interval does not contain the value of 1

DISCUSSION

Our study shows patient demographics to be significant predictors of long-term radiologic follow-up independent of disease characteristics. Age above 70 years, African American race, and higher Charlson comorbidity scores put patients at a disadvantage when it comes to long-term radiographic imaging after surgery for bladder cancer. Patients in the higher quartile for education and income were more likely to receive more imaging. We, however, also show that long-term CT imaging was not associated with improved cancer-specific or overall survival in bladder cancer.

These results bring to light the effect of patients and disease characteristics on adherence to general guidelines for imaging after cystectomy. Dalbagni *et al.* surveyed 330 members of the Society of Urologic Oncology regarding their patients' follow-up after cystectomy. Of the respondents to their survey, they found that only 60% of practitioners tailored their follow-up based on disease characteristics.[4] Our data further illustrates factors, other than disease stage, that affects decisions made on follow-up course after treatment, and highlights the bias against older patients and patients at disadvantage because of race, income, and education when it comes to receiving adequate care even when it comes to a serious disease like bladder cancer.

In our study, race and socioeconomic status were the most important factors influencing surveillance. Of interest, similar trends can be found in other types of cancer. Rulyak *et al.* found that lower socioeconomic status, age greater than 80, and African American race were associated with decreased colorectal surveillance in patients with a history of colorectal cancer.[9] A review study by Salz *et al.*, showed similar results of a small disparity in the use of colonoscopy in colorectal cancer survivors based on race.[10] Similar results have been shown for breast cancer. Multiple studies have shown Spanish-speaking Latina breast cancer survivors receive less follow-up than both English-speaking Latina and white breast cancer survivors.[11,12] It is apparent through the study of bladder cancer and other malignancies that significant disparity exists in treatment and surveillance between people of different socioeconomic status. As a result, minorities that fall within a lower socioeconomic group may suffer decreased follow-up possibly contributing to worse outcomes.

A fundamental debate in the literature centers on whether more intense follow-up has any impact on overall survival.[13] While intensive colorectal cancer surveillance may be considered based on Level I evidence, it differs in that is a disease with a biology that allows for surgical resection of recurrences and metastases, favoring a benefit from early detection.[14] Slaton *et al*. proposed a balanced stage-specific surveillance protocol for bladder cancer that they believed would help detect recurrences and complications, and reduce the number of imaging studies by only recommending use of CT in patients with pT3 disease.[15] Volkmer *et al*. concluded that there is no survival benefit for detecting tumor recurrence early at an asymptomatic stage by regular follow-up examinations after surgery for bladder cancer.[16] Our study showed long-term radiologic follow-up was not necessarily associated with improved survival in bladder cancer patients controlling for confounders. However, this should not distract us from the fact that nondisease characteristics affected long-term care in patients affected by cancer. If we were to believe that long-term radiographic care is of no clinical benefit in bladder cancer, then we should spare all patients the unnecessary exposure to radiation, and should not treat patients differently because of their age, race, or socioeconomic level.

The study makes use of two large population databases (SEER-Medicare) that offer a broad representation of patients across the nation. Limitations of this study include the difficulty with interpreting coding in the database as these changes over the years and despite meticulous study of the coding practices and changes it is possible that some data was missed due to changes in coding and billing. In addition we were unable to analyze if a regional differences or practitioner specific disparities exist, this may be an interesting issue to investigate in the future. We focused on CT scan because it is the modality commonly used for imaging after cystectomy and the one urologists are most familiar with, but we acknowledge that a complete study would also examine follow-up with ultrasound and magnetic resonance imaging. Another limitation is our inability to control for factors like a renal failure that would affect the frequency of CT imaging. We are hoping that controlling for patient's age and comorbidities indirectly control for such factors. Finally, the representation of African Americans in SEER-Medicare is low, and our conclusions about the effect of race may change if a different database that has a higher percentage of African Americans was utilized.

CONCLUSIONS

Our analysis of the SEER-Medicare database is an attempt to understand the effect of patient demographics on the intensity of long-term follow-up in patients with cancer. Older age, African American race, and lower socioeconomic status were associated with decreased long-term radiographic follow-up after surgery in bladder cancer patients. In our study, long-term radiographic follow-up was not associated with survival benefit after treating bladder cancer, but until such finding is validated and reflected in practice guidelines, all patients with cancer should receive equal care regardless of their age, race, and socioeconomic status.

Acknowledgments

We acknowledge the efforts of the Applied Research Program, National Cancer Institute (NCI); the Office of Research, Development and Information, Centers for Medicare and Medicaid Services (CMS); Information Management Services (IMS), Inc.; and the SEER Program tumor registries in the creation of the SEER-Medicare database.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Siegel R, Ma J, Zou Z, Jemal A. Cancer statistics, 2014. CA Cancer J Clin 2014;64:9-29.
2. Stroumbakis N, Herr HW, Cookson MS, Fair WR. Radical cystectomy in the octogenarian. J Urol 1997;158:2113-7.
3. Peyromaure M, Guerin F, Debre B, Zerbib M. Surgical management of infiltrating bladder cancer in elderly patients. Eur Urol 2004;45:147-53.
4. Dalbagni G, Bochner BH, Cronin A, Herr HW, Donat SM. A plea for a uniform surveillance schedule after radical cystectomy. J Urol 2011;185:2091-6.
5. Feuer EJ, Merrill RM, Hankey BF. Cancer surveillance series: Interpreting trends in prostate cancer – Part II: Cause of death misclassification and the recent rise and fall in prostate cancer mortality. J Natl Cancer Inst 1999;91:1025-32.
6. Penson DF, Albertsen PC, Nelson PS, Barry M, Stanford JL. Determining cause of death in prostate cancer: Are death certificates valid? J Natl Cancer Inst 2001;93:1822-3.
7. Weinstock MA, Reynes JF. Validation of cause-of-death certification for outpatient cancers: The contrasting cases of melanoma and mycosis fungoides. Am J Epidemiol 1998;148:1184-6.
8. Bach PB, Guadagnoli E, Schrag D, Schussler N, Warren JL. Patient demographic and socioeconomic characteristics in the SEER-Medicare database applications and limitations. Med Care 2002;40 8 Suppl:IV-19-25.
9. Rulyak SJ, Mandelson MT, Brentnall TA, Rutter CM, Wagner EH. Clinical and sociodemographic factors associated with colon surveillance among patients with a history of colorectal cancer. Gastrointest Endosc 2004;59:239-47.
10. Salz T, Woo H, Starr TD, Jandorf LH, DuHamel KN. Ethnic disparities in colonoscopy use among colorectal cancer survivors: A systematic review. J Cancer Surviv 2012;6:372-8.
11. López ME, Kaplan CP, Nápoles AM, Livaudais JC, Hwang ES, Stewart SL, *et al.* Ductal carcinoma *in situ* (DCIS): Posttreatment follow-up care among Latina and non-Latina white women. J Cancer Surviv 2013;7:219-26.
12. Rosales M, Ashing K, Napoles A. Quality of cancer follow-up care: A focus on Latina breast cancer survivors. J Cancer Surviv 2014;8:364-71.

13. Fernández MI, Parikh S, Grossman HB, Katz R, Matin SF, Dinney CP, *et al.* The role of FISH and cytology in upper urinary tract surveillance after radical cystectomy for bladder cancer. Urol Oncol 2012;30:821-4.
14. Primrose JN, Perera R, Gray A, Rose P, Fuller A, Corkhill A, *et al.* Effect of 3 to 5 years of scheduled CEA and CT follow-up to detect recurrence of colorectal cancer: The FACS randomized clinical trial. JAMA 2014;311:263-70.
15. Slaton JW, Swanson DA, Grossman HB, Dinney CP. A stage specific approach to tumor surveillance after radical cystectomy for transitional cell carcinoma of the bladder. J Urol 1999;162 (3 Pt 1):710-4.
16. Volkmer BG, Kuefer R, Bartsch GC Jr, Gust K, Hautmann RE. Oncological followup after radical cystectomy for bladder cancer-is there any benefit? J Urol 2009;181:1587-93.