Rural Medicare patients less likely to undergo penile prosthesis implantation following radical cystectomy

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Introduction: *Erectile dysfunction is common after radical cystectomy; however, research on sexual dysfunction after this procedure is relatively scarce. Our goal was to evaluate the incidence of penile prosthesis implantation after radical cystectomy, with a focus on rural/urban disparity.*

Materials and methods: *We used the SEER-Medicare database to identify patients with bladder cancer diagnosed between 1991-2009 who had a radical cystectomy (ICD-9 codes 57.7, 57.71, 57.79). The outcome was placement of a penile implant (ICD-9 codes 64.95 and 64.97). Covariates extracted included rural county status, age, race, ethnicity, marital status, geographic region, socioeconomic status, Charlson comorbidity, pathologic cancer stage, and type of urinary diversion.*

Results: *A total of 95 penile implants were performed in the 11,477 cystectomy patients (0.83%). Patients who had a penile implant were mostly from urban counties (85.1%) and in the Western region of the United States (83.9%). After controlling for covariates, rural patients who underwent an ileal conduit for urinary diversion were less likely to have a penile prosthesis procedure after radical cystectomy.*

Conclusions: *Penile prosthetic procedures are uncommon in bladder cancer patients who have undergone radical cystectomy; therefore, sexual health should be considered and discussed with patients after radical cystectomy.*

Key Words: *urinary bladder neoplasms, cystectomy, penile prosthesis, rural health, healthcare disparities*

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Introduction

Radical cystectomy (RC) is the gold standard management for muscle invasive bladder cancer. As with many pelvic surgeries, it is associated with significant changes in sexual function and over 80% of men experience erectile dysfunction (ED) after RC.[1] Sexual dysfunction may arise from the surgery itself, psychosocial issues with body image following urinary diversion, or a combination of both.[2] Medical options for treating ED include oral medications,

vacuum erection devices, intraurethral suppositories, and intracavernosal injections. Surgical management includes implantation of malleable or inflatable penile prosthesis (PP). An analysis of 15,811 radical prostatectomy patients showed that only 2.3% utilized PP.[3] However, investigation into the use of PP in the RC population has yet to be done.

The vast majority of RCs are performed in tertiary referral centers, usually in more metropolitan settings. Rural patients face decreased access to urologic care for many reasons, including decreasing urologists per capita, younger provider preferences for establishing practice in urban settings, and increasing sub-specialization.[4] Similarly, following recovery from extirpative surgery, access to specialists for PP placement may also be difficult as the majority of high volume implanters are located in urban areas. Given these disparities, rural RC patients may be at a disadvantage in terms of their sexual health should surgical management for ED be necessary.

Material and methods

The SEER-Medicare database links two large population-based sources to collect clinical, demographic, and cause of death information about Medicare beneficiaries with cancer.[5] We used this database to identify all male Medicare beneficiaries who underwent RC based on ICD-9 codes 57.7, 57.71, and 57.79 from 1991-2009.[6] The primary outcome was receipt of PP, which was identified using ICD-9 codes 64.95 and 64.97.[3]

United States Department of Agriculture 2003 Rural Urban Continuum Codes (RUCC) were used to categorize county-level rural/urban status based on patient residence, not where treatment was received.[7] RUCC designates counties on a continuum of 1 to 9 by county population size and adjacency to a metropolitan area; counties coded as 1 to 3 are urban and counties coded 4 to 9 are rural.[8] RUCC definitions are described in Table 1.

We used Deyo's coding algorithm to calculate the Charlson comorbidity index.[9] Following an algorithm developed by Ananthakrishnan and colleagues, we calculated a county-level socioeconomic deprivation score incorporating median income, percent living in poverty, percent uninsured, and percent over the age of 25 who graduated high school from the 2010 US census. Scores ranged from 0-8, with higher scores related to greater deprivation.[10]

Demographic variables analyzed were rurality, age, race, ethnicity, marital status, SEER region, and socioeconomic deprivation score. Clinical variables included Charlson comorbidity index, pathological staging, and type of urinary diversion. Descriptive statistics were performed using PROC FREQ in SAS 9.4.

Logistic regression was used to generate odds ratios for the multivariable regression model using the PROC LOGISTIC procedure in SAS 9.4, constructed with demographic and clinical variables as covariates and receipt of PP as the dependent variable. Significance was determined at the 0.05 level. Normality assumptions were checked for all analyses. The Southern Illinois University Institutional Review Board reviewed this project and determined it did not meet criteria for research involving human subjects.

Results

Sample population characteristics

The study cohort included 11,477 men with bladder cancer treated with RC between 1991-2009, with 95 patients (0.8%) undergoing PP placement, Table 2.

TABLE 1. **Definitions of rural-urban continuum codes**

Code	Description
	Metropolitan counties
1	Counties in metro areas of 1 million population or more
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
	Nonmetropolitan counties
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

TABLE 2. **Characteristics of the patient population by penile prosthetic implant status**

Variable	Implant status				
	No implant (n = 11,382)		Implant (n = 95)		p value
	n	%	n	%	
Rural residence status					< 0.01
Rural	4725	41.6	14	14.9	
Urban	6647	58.5	80	85.1	
Age at time of surgery (years)					< 0.01
< 65	1085	9.5	13	13.7	
65-69	2914	25.6	43	45.3	
70-74	3100	27.2	28	29.5	
75+	4283	37.6	11	11.6	
Race					0.01
White	10331	92.5	83	86.5	
African American	437	3.9	< 11	*	
Other	410	3.6	< 11	*	
Hispanic	474	4.2	<11	*	0.01
Married	8502	77.1	71	75.5	0.72
Region					< 0.01
Northeast	1165	11.3	< 11	*	
Midwest	1925	18.6	< 11	*	
South	1958	18.9	< 11	*	
West	5299	51.2	78	83.9	
Socioeconomic deprivation score					< 0.01
0-3 (higher socioeconomic status)	6629	58.3	29	30.5	
4-5	3371	29.7	*	*	
6-8 (lower socioeconomic status)	1368	12.0	< 11	*	
Charlson comorbidity index (mean, SD)	3.44	1.67	3.22	1.78	0.21
Pathologic staging group					0.04
pTa / pTis / pT1	4278	38.9	44	49.4	
pT2-4	6716	61.1	45	50.6	
Urinary diversion with ileal conduit	8927	78.4	51	53.7	< 0.01

*data suppressed to protect patient confidentiality

Overall, 4,739 rural patients and 6,727 urban patients were identified. Fourteen rural patients (0.3%) and 80 urban patients (1.2%) underwent PP placement. While rural patients represented 41.3% of the RC population, the proportion of rural patients receiving PP was only 14.9% (14/94). Amongst patients under 65 years old, 1.2% (13/1,098) had a PP placed, compared to 1.5% (43/2,957) of men 65-69 years old, 0.9% (28/3,128) aged 70-74, and 0.3% (11/4,294) over 74 years old. A higher proportion of African Americans (< 11/443, data suppressed to protect patient confidentiality) and Other race (< 11/416) received a PP compared to White men (0.8%, 83/10,414). While the West region represented 51.5% of the total sample, there was a higher proportion of PP in the West compared to the other regions (83.9%, p < 0.01). The majority of RC patients underwent ileal conduit urinary diversion (78.2%), yet represented approximately half of the PP implanted (53.7%).

Logistic regression model

On logistic regression, Urban patients had a 3.1 higher odds of receiving a PP following RC compared with rural patients (CI 1.5-6.3), Table 3. The odds of a patient from the West region receiving a PP was 10.8 higher compared with patients from the South (CI 3.3-36.0). Declining socioeconomic status had decreased odds of receiving a PP of 0.6 (CI 0.4-0.8). PP placement in

TABLE 3. **Multivariable logistic regression model for penile prosthesis implantation after radical cystectomy**

Variable	Odds ratio	Lower CI	Upper CI
Rural vs. urban residence	3.12	1.53	6.34
Age group	1.36	1.18	1.56
Race – African American vs. White	0.60	0.24	1.54
Race – Other vs. White	1.99	0.27	14.62
Hispanic	0.88	0.34	2.23
Married	0.86	0.50	1.46
Region			
Northeast vs. West	1.62	0.45	5.80
Midwest vs. West	1.99	0.78	5.05
South vs. West	10.82	3.25	36.03
Socioeconomic deprivation score	0.55	0.39	0.78
Charlson comorbidity index	1.08	0.95	1.24
Stage (pTa/is/1 vs. pT2-4)	1.44	0.92	2.25
Urinary diversion (ileal conduit vs. other)	2.64	1.70	4.11

R^2 value = 0.012; CI = confidence interval

those with continent urinary diversion was 2.6 times more likely than those with an ileal conduit (CI 1.7-4.1). Race, ethnicity, marital status, Charlson score, and pathologic cancer stage were not statistically significant in patients receiving PP following RC in the regression model.

Discussion

There is a dearth of content on rural sexual health disparities in the literature. Our population of interest in this study (rural patients after RC) may be doubly underserved, first by their rural status and second by the limited counseling on sexual health after RC in general. In order to explain why rural RC patients are less likely to receive PP, we must draw from previous work on rural health inequities and general barriers to ED treatment.

Access to healthcare for rural Americans is difficult for many reasons including geography and travel distance. Gore and colleagues concluded that patients with stage II bladder cancer having to travel > 50 miles for an available surgeon had decreased odds of receiving a RC as compared to patients who must travel 0-4 miles (OR 0.60, 95% CI 0.37-0.98).[11] The regionalization of bladder cancer treatment exacerbates this issue, with 90%-92% of all RCs performed in urban areas.[12] Economic issues exist as well, as literature shows that rural patients are more likely to have out-of-pocket medical costs exceeding 5% of their income and have unmet or delayed care because of cost.[13] Barriers to ED treatment include the belief of spontaneous recovery (younger men) and that it is part of the natural course of aging (older men).[14]

RC is a high risk procedure with a 90-day mortality rate of 10.6% and 5-year overall survival rate of 50%.[15,16] The high mortality and presence of competing medical comorbidities in this patient population may contribute to the limited number of PP implanted. Patients also may not desire a PP after RC due to loss of sexual desire. Work by Allareddy and colleagues have shown that a higher proportion of bladder cancer patients treated with RC are less interested in sex as compared to those with an intact bladder.[17] It is reasonable to have the discussion of erectile function and treatment options early within the first postoperative year following recovery from surgery as functional status at that time is strongly predictive of longterm outcomes.[18]

The lower proportion of men under 65 years old receiving a PP (1.2%) compared to men 65-69 (1.5%) was an unexpected finding. Eligibility for Medicare includes age 65 or older, disability, end stage renal disease, or amyotrophic lateral sclerosis (Lou Gehrig's disease).[19] These competing comorbidities in men under 65 with Medicare may explain the lower utilization of PP. The high proportion of PP implants in the West region may be explained in part by outlier data from two California counties--Los Angeles and Orange--which represented over half of all the PP implants in the sample.

Our study is limited by the use of claims-based data with coding at the source, where the data being analyzed may have mistakes related to human input error. We did not include preoperative erectile function nor do we have a standardized ED score available. This study only evaluated implantation of PP. It did not encompass other ED treatments such as medications or vacuum erection devices. The SEER-Medicare database only includes patients with Medicare insurance. Younger and healthier patients with private payer insurance, Medicaid, or VA health care were excluded and may represent a population more likely to desire a PP.

Future research should aim to expand this introductory work concerning sexual health needs of bladder cancer patients after RC. A survey of urologists' current clinical practice and perceptions on the topic may provide a better understanding of why so few PP implants are performed after RC and identify targets for improvement.

Conclusion

It is uncommon for men with Medicare to undergo PP placement following RC for bladder cancer, despite the high probability of erectile dysfunction following surgery. Further, rural patients are less likely to undergo PP placement following RC compared to their urban counterparts. RC patients should be counseled on the options available for them to address these sexual health needs following recovery. □

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