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TOPIC PAPER

Quality of care in bladder cancer: trends in urinary diversion following radical cystectomy

**John L. Gore · Mark S. Litwin ·
The Urologic Diseases in America Project**

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Abstract
Objective Quality-of-care indicators have not yet been defined for patients with bladder cancer. Nonetheless, certain aspects of bladder cancer care can be evaluated to quantify the quality of care delivered. We sought to determine trends in continent urinary diversion to evaluate the adoption of this more optimal reconstruction.
Methods Subjects who underwent radical cystectomy for a primary diagnosis of bladder cancer were identified from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample. We identified covariates independently associated with utilization of continent urinary diversion after radical cystectomy using multivariate logistic regression modeling. We then examined trends in diversion type based on patient and hospital characteristics and examined the impact of hospital volume on use of continent reconstruction.
Results Our weighted sample included 5,075 subjects (14.3%) who underwent continent urinary diversion and 30,295 subjects (85.7%) who underwent an ileal conduit. Independent correlates of continent diversion included younger age, male gender, having private insurance, and undergoing surgery at an urban teaching hospital. Hospitals performing continent diversions on more than 40% of their cystectomies had a yearly cystectomy volume of 0.8 surgeries. Subjects treated at high-volume hospitals trended toward lower rates of comorbid conditions.
Conclusions We identified substantial disparities in continent diversion which, based on yearly trends, are unlikely to improve in the near future. Continent reconstructions are not the exclusive domain of high-volume cystectomy centers. Yet efforts to increase rates of this complex reconstruction must concentrate on technique dissemination and better definition of the quality-of-life detriments incurred by cystectomy patients.

Keywords Bladder cancer · Quality of care · Urinary diversion

J. L. Gore
VA Greater Los Angeles Healthcare System,
Los Angeles, CA, USA

J. L. Gore
Robert Wood Johnson Clinical Scholars Program,
University of California-Los Angeles, Los Angeles, CA, USA

J. L. Gore (✉) · M. S. Litwin
Department of Urology,
David Geffen School of Medicine at UCLA,
Box 951738, Los Angeles, CA 90095-1738, USA
e-mail: jgore@mednet.ucla.edu

M. S. Litwin
Department of Health Services, School of Public Health,
University of California-Los Angeles, Los Angeles, CA, USA

M. S. Litwin
Johnson Comprehensive Cancer Center,
David Geffen School of Medicine at UCLA,
Los Angeles, CA, USA

M. S. Litwin
RAND Corporation, Santa Monica, CA, USA

Introduction

The formal study of quality of care in bladder cancer remains in its infancy. Unlike prostate cancer, with defined quality indicators that may be applied to various clinical settings [1], no quality measures have been described for bladder cancer. Clinical guidelines have defined appropriate management strategies for initially diagnosed non-invasive

transitional cell carcinoma of the bladder, recurrent cancers, and invasive and metastatic bladder cancer [2–5]. These guidelines are based on expert opinion of how bladder cancer patients should be managed, and thus represent current standards for quality of care in bladder cancer.

Yet quality of care may be as simple as ensuring that patients undergoing transurethral resections of bladder tumors receive a postoperative intravesical instillation of mitomycin, that those with significant comorbidity receive medical clearance prior to radical cystectomy, or that those without specific clinical contraindications are offered continent urinary diversion. Thus, rates of utilization of continent reconstruction serve as a measure of one aspect of quality of care for bladder cancer patients undergoing radical cystectomy.

The past decade has witnessed a marked expansion in acceptable criteria for continent urinary diversion. Formerly reserved for men with invasive cancers localized to the bladder, continent reconstruction has proven feasible among women, the elderly, and those with more locally advanced cancers, including patients with prostate invasion and lymph node metastases [6–9]. Despite equivocal health-related quality of life results comparing continent reconstructions to incontinent ileal conduit diversions [10–16], most experts consider continent urinary diversion to be the optimal reconstructive modality [7, 17]. Limitations of the quality-of-life instruments, rather than equivalent outcomes, likely mediate the published results [18]. Thus, continent urinary diversion is considered the reconstruction of choice in the absence of clinical contraindications. We sought to characterize national trends in continent urinary diversion and to examine correlates of its utilization.

Methods

Patient population

We identified individuals undergoing radical cystectomy for bladder cancer from the nationally representative Nationwide Inpatient Sample (NIS) in order to comprehensively characterize trends in urinary diversion following radical cystectomy. The NIS, managed by the Healthcare Cost and Utilization Project, is a stratified random sample of admissions to hospitals in 38 states. The NIS captures over 8 million patient discharges with a sampling algorithm designed to generalize admissions data to the US population. The NIS carries no longitudinal information; thus, the unit of analysis is an individual patient admission. Further, the NIS only contains claims and cost information, with no cancer-specific data such as histology, stage, or grade. Diagnoses, procedures performed, and comorbid conditions are tabulated through discharge and procedure International Classification of Diseases [9th revision (ICD-9)] codes.

Our cohort comprised subjects with a primary diagnosis of bladder cancer who underwent radical cystectomy (ICD-9 code 57.71). We restricted our sample to those for whom codes for the mode of urinary diversion were available. We categorized subjects as recipients of either a continent reconstruction (orthotopic neobladder or continent cutaneous reservoir, ICD-9 code 57.87) or incontinent urinary diversion (ileal or colonic conduit, ICD-9 code 56.51) based on secondary procedure codes concomitant with a code for radical cystectomy. Subjects were identified from NIS for the years 1998–2005.

Independent variables

We abstracted subject- and hospital-specific variables thought to be associated with the type of reconstruction utilized. Demographic variables analyzed included age, sex, and race/ethnicity. Due to the paucity of non-whites who underwent radical cystectomy for bladder cancer in NIS, we dichotomized race/ethnicity into whites and non-whites. We categorized primary payer as those with private insurance, Medicare, and Medicaid or other insurance or payer coverage. Individual socioeconomic status variables are not available in either data source; thus, income was ascribed to subjects based on linkage of their ZIP code to US Census Bureau data. We assessed comorbidity of our subjects with the Elixhauser method, where we identified individual comorbid conditions [19]. Cancer-specific data are not available in NIS; however, NIS permits analysis of subjects in all age groups, compared with restriction to subjects 65 years and older in the more commonly used Surveillance, Epidemiology, and End Results registry linked to Medicare claims data.

Hospital characteristics abstracted included hospital location and teaching status, hospital region, and cystectomy volume. We dichotomized hospital volume according to its 90th percentile for the sample. This corresponded to three or more cystectomies per year. To determine whether trends in continent diversion reflected trends across provider or trends only at tertiary referral or high volume centers, we also examined the 95th and 99th percentile of hospital volume. This corresponded to five or more and ten or more cystectomies annually, respectively. Region refers to US Census Region.

Statistical analysis

We present descriptive statistics for patient and provider data, compared by reconstructive modality with Chi-squared analysis for categorical variables and independent sample t-tests for continuous variables. Multivariable logistic

regression determined variables independently associated with continent urinary diversion, incorporating covariates *a priori* selected as hypothesized correlates of diversion type. Factors incorporated into these models included patient demographic (age, gender, ethnicity, primary payer) and clinical covariates (comorbid conditions) as well as hospital characteristics (hospital type, hospital cystectomy volume).

We then examined trends in utilization of continent diversion in order to determine the current state of adoption of continent reconstruction following radical cystectomy for bladder cancer. We stratified rates of continent urinary diversion by patients and provider characteristics. All statistical analyses were performed with SAS 9.02 (SAS Institute, Cary, NC).

Results

Our survey-weighted sample yielded 35,370 bladder cancer subjects from the NIS who underwent radical cystectomy with urinary diversion in the years 1998–2005. Of those, 5,075 (14.3%) received a continent urinary diversion and 30,295 (85.7%) were reconstructed with an incontinent conduit. Table 1 displays the characteristics of the study sample stratified by modality of urinary diversion. Subjects who received a continent reconstruction were younger than those who received a conduit. Continent diversion was more prevalent among males and less common among subjects with Medicare as the primary payer. Hospital characteristics associated with continent urinary diversion on univariate analysis included higher cystectomy volume, and urban teaching hospitals.

Table 2 displays the multivariate model of covariates independently associated with continent reconstruction. Older age, female gender, having Medicaid or other insurance coverage, and select comorbid conditions were independently associated with decreased odds of continent diversion. Surprisingly, non-whites had higher odds of continent diversion than whites. Compared with subjects treated at urban teaching hospitals, those treated at urban non-teaching hospitals had lower odds of continent reconstruction following radical cystectomy for bladder cancer.

Figure 1 displays trends in the proportion of continent diversions performed over time stratified by patient (panel a) and hospital (panel b) characteristics. The proportion of diversions that were continent rose sharply between 1998 and 2001. The highest increase was among subjects treated at hospitals in the 99th percentile of cystectomy volume. Thereafter, the proportion of continent diversions among all cystectomies performed plateaued, regardless of patient or hospital characteristics.

To evaluate whether the trends identified reflected saturation of the highest volume centers, we examined rates of continent reconstruction at individual hospitals. Unweighted, our sample included 906 centers. Of these, no continent reconstructions were performed at 535 hospitals (59.1%) accounting for 1,500 of the 5,602 cystectomies in the unweighted sample (26.8%). At 218 hospitals (24.1%), greater than 25% of cystectomies were followed by continent urinary diversions, with surgical volume at these institutions ranging from one case over the study period to greater than 21 cystectomies annually. Over 40% of reconstructions were continent at 119 centers (13.1%), with hospital cystectomy volume ranging from one surgery over the study period to 10.2 cystectomies per year, on average. Mean cystectomy volume for centers performing more than 40% of diversions in a continent manner was 0.8, implying that the majority of centers performing a high proportion of continent reconstructions were low volume hospitals.

To determine whether differential utilization of continent diversion at high and low volume hospitals reflected

Table 1 Characteristics of the study sample (weighted)

No. (%)	Urinary diversion		*P*-value
	Continent	Ileal conduit	
Total	5,075 (14.3)	30,295 (85.7)	
Age (years), mean	65.3	68.8	<0.01
<55	906 (23.0)	3,028 (77.0)	<0.01
55–64	1,368 (18.0)	6,224 (82.0)	
65–74	1,672 (12.9)	11,270 (87.1)	
≥75	1,130 (10.4)	9,770 (89.6)	
Gender			
Male	4,426 (15.0)	25,147 (85.0)	0.01
Female	650 (11.2)	5,138 (88.8)	
Race/ethnicity			
White	3,087 (13.5)	19,746 (86.5)	0.17
Non-white	444 (16.8)	2,191 (83.2)	
Primary payer			
Private	2,280 (18.7)	9,911 (81.3)	<0.01
Medicare	2,535 (11.8)	19,021 (88.2)	
Medicaid/Other	260 (13.7)	1,632 (86.3)	
Hospital type			
Urban teaching	3,502 (15.8)	18,599 (84.2)	0.04
Urban non-teaching	1,257 (11.5)	9,684 (88.5)	
Rural	311 (13.5)	2,001 (86.5)	
Hospital volume, mean	27.4	21.4	0.04
High volume hospital[a]	2,529 (49.8)	13,451 (44.4)	<0.01
Hospital region			
Northeast	1,016 (12.3)	7,223 (87.7)	0.22
Midwest	1,263 (14.1)	7,723 (85.9)	
South	1,922 (15.5)	10,503 (84.5)	
West	874 (15.2)	4,855 (84.8)	

[a] Based on 90th percentile hospital volume, or greater than three cystectomies annually

Table 2 Multivariate logistic regression analysis of factors associated with continent urinary diversion

	OR (95% CI)
Age (years) vs. < 55	
55–64	0.80 (0.72, 0.88)
65–74	0.61 (0.54, 0.70)
≥ 75	0.51 (0.45, 0.59)
Female gender	0.83 (0.75, 0.91)
Non-white ethnicity	1.15 (1.02, 1.30)
Comorbid conditions	
Congestive heart failure	0.94 (0.80, 1.11)
Complicated diabetes	0.60 (0.41, 0.89)
Obesity	0.45 (0.36, 0.58)
Preoperative weight loss	0.83 (0.68, 1.01)
Primary payer vs. private	
Medicare	0.91 (0.82, 1.01)
Medicaid/other	0.86 (0.74, 0.99)
Hospital type vs. urban teaching	
Urban non-teaching	0.79 (0.72, 0.85)
Rural	1.00 (0.87, 1.15)
High volume hospital[a]	0.95 (0.88, 1.03)

[a] Based on 90th percentile hospital volume, or greater than three cystectomies annually

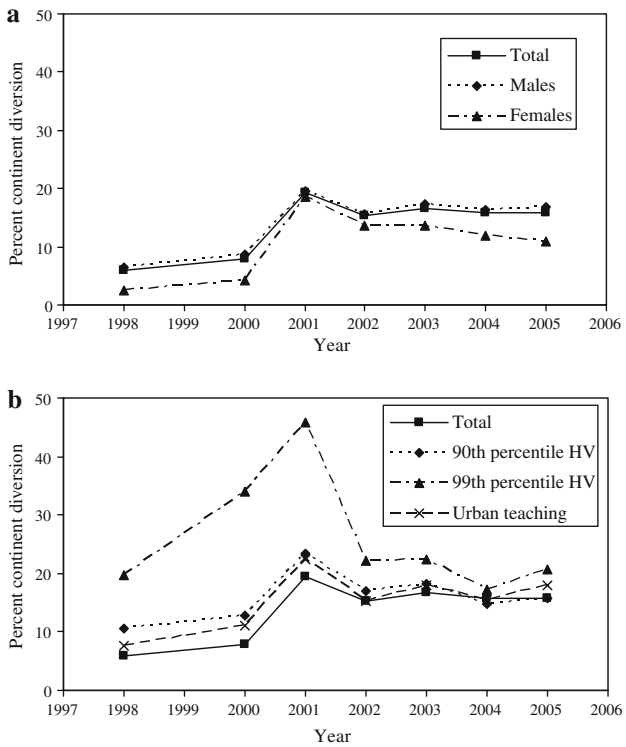

Fig. 1 Time trend in the proportion of subjects undergoing continent diversion stratified by **a** gender and **b** hospital location and volume (*HV* hospital volume)

Table 3 Prevalence of comorbid conditions stratified by hospital cystectomy volume

Comorbid condition	Hospital volume		*P*-value
	Low	High[a]	
Congestive heart failure	889 (6.0)	536 (4.2)	0.01
Valve disease	553 (3.7)	387 (3.1)	0.19
Pulmonary circulatory disease	86 (0.6)	75 (0.6)	0.94
Peripheral vascular disease	708 (4.8)	448 (3.5)	0.03
Hypertension	6,486 (43.8)	5,553 (43.8)	0.99
Paralysis	199 (1.3)	116 (0.9)	0.14
Other neurological disorder	271 (1.8)	203 (1.6)	0.53
Chronic lung disease	3,434 (23.2)	2,090 (16.5)	<0.01
Uncomplicated diabetes	2,156 (14.6)	1,731 (13.7)	0.34
Complicated diabetes	140 (0.9)	142 (1.1)	0.52
Hypothyroidism	630 (4.3)	566 (4.5)	0.74
Arthritis/collagen vascular disease	171 (1.2)	142 (0.5)	0.89
Coagulopathy	330 (2.2)	230 (1.8)	0.38
Obesity	425 (2.9)	380 (3.0)	0.80
Preoperative weight loss	581 (3.9)	357 (2.8)	0.11
Iron-deficiency anemia	1,696 (11.4)	1,107 (8.7)	0.01
Alcohol dependence	260 (1.8)	214 (1.7)	0.86
Psychotic disorder	194 (1.3)	128 (1.0)	0.28
Depression	412 (2.8)	384 (3.0)	0.61

[a] Based on 90th percentile hospital volume, or greater than three cystectomies annually

differential case mix, i.e., identification of few high volume hospitals with high proportions of continent reconstructions implies that patients at these centers have a greater burden of comorbid illness, we examined rates of comorbid illness stratified by hospital volume (Table 3). We observed a trend toward increased comorbidity among subjects treated at low volume centers, which was significant for comorbid congestive heart failure, peripheral vascular disease, chronic lung disease, and iron deficiency anemia.

Discussion

Our study has several important findings. First, consistent with prior analyses [20], we identified disparities in the utilization of continent reconstruction on the basis of patient and provider characteristics. Older patients, females, those of lower socioeconomic status, those with greater comorbidity, and those treated at urban non-teaching hospitals compared with those treated at urban teaching institutions had lower odds, all other covariates held constant, of undergoing continent urinary diversion. These results validate

prior work from the nationally representative SEER-Medicare dataset and corroborate sociodemographic disparities and a pronounced provider influence on utilization of continent diversion after radical cystectomy for bladder cancer [20].

Second, our examination of trends in continent reconstruction suggests limited adoption of this more optimal diversion. Although there appeared to be an increase from the 90s to the early part of the new century, the proportion of patients undergoing continent reconstructions appears to have plateaued, regardless of patient gender or hospital type. Despite expansion of accepted criteria for consideration of continent diversions to include women and those with locally advanced cancers, less than 20% of patients in 2005 received a neobladder. The technical complexity and increased demand of the nursing required to care for patients with orthotopic and cutaneous neobladders may mediate their limited dissemination. The rise in rates may have represented increased utilization of continent reconstruction among providers equipped to provide this diversion. The subsequent plateau, however, demonstrates that the number of those available providers is limited.

Third, the majority of hospitals sampled do not perform continent urinary diversions at all. This led us to believe that whatever expansion in continent reconstruction that has occurred has been at tertiary referral centers, with limited adoption at lower volume, non-teaching institutions. Stein reported the experience of possibly the highest volume cystectomy center in the US and noted that greater than 90% of patients undergoing radical cystectomy for bladder cancer receive either an orthotopic or cutaneous neobladder [7]. Contrary to our expectations, however, many of these low-volume institutions perform a substantial proportion of continent reconstructions. At 38 institutions with annual average cystectomy volumes of less than 1, 100% of the diversions performed were continent. The average cystectomy volume of hospitals that performed continent diversions on at least one-quarter of their cystectomy patients was just over one surgery per year.

We had previously thought that, similar to the urbanization of radical cystectomy care in general [21], continent reconstructions had become the domain of urban teaching hospitals. We thus considered the possibility of case-mix differences between high and low-volume institutions. If high-volume centers manage bladder cancer patients with a greater burden of comorbid illness, low rates of continent diversion may be justified. To the contrary, we found that patients treated at high volume centers tended toward a lower prevalence of comorbid illness.

So how may we increase the proportion of patients offered continent urinary diversion? When just over half of hospitals performing radical cystectomies offer continent urinary diversions, better dissemination of technique and alignment of hospitals ill-equipped to manage these complex reconstructions with high volume centers is mandatory. We must also understand the processes that facilitate utilization of continent diversion at low-volume centers. We need to understand whether continent diversions increase morbidity and mortality outcomes after radical cystectomy: disproving this commonly held belief may decrease provider reluctance to offer more complex reconstructions. Finally, we must develop better quality-of-life measures after cystectomy and diversion. Although current instruments show no discernible difference in quality of life between those reconstructed with continent or incontinent diversions, this may be an indictment of the ability of current questionnaires to capture concerns of neobladder and conduit patients, male and female, in a way that permits valid comparison.

We identified disparities in utilization of continent diversion, alarming trends in the uptake of this complex reconstruction, and hospital characteristics that confound our ability to understand processes to increase rates of continent reconstruction that may be disseminated. These findings underscore the need for further work in this arena to maximize the population of patients to whom this more optimal reconstruction is available. As Dr. Stein stated, "orthotopic diversion has had a tremendously positive impact on patients requiring cystectomy. It is imperative that we improve upon our existing ideas and techniques so that we may provide patients an even more improved quality of life following cystectomy in the future"[7].

Conflict of interest statement None.

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