Published in final edited form as:

Urology. 2016 December ; 98: 70–74. doi:10.1016/j.urology.2016.06.035.

Temporal trends in conduit urinary diversion with concomitant cystectomy for benign indications: a population-based analysis

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Abstract

Objectives—To describe national trends in cystectomy at the time of urinary diversion for benign indications. Multiple practice patterns exist regarding the necessity of concomitant cystectomy with urinary diversion for benign end-stage lower urinary tract dysfunction. Beyond single institution reports, limited data is available to describe how concurrent cystectomy is employed on a national level.

Methods—A representative sample of patients undergoing urinary diversion for benign indications with or without concurrent cystectomy was identified from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample from 1998–2011. Using multivariate logistic regression models, we identified hospital and patient-level characteristics associated with concomitant cystectomy with urinary diversion.

Results—There was an increase in the proportion of concomitant cystectomy at the time of urinary diversion from 20% to 35% ($p < 0.001$) between 1998 and 2011. The increase in simultaneous cystectomy over time occurred at teaching hospitals (vs. community hospitals), in older patients, in male patients, in the Medicare population (vs. private insurance and Medicaid), and in those with certain diagnoses.

Conclusions—There has been an overall increase in the use of cystectomy at the time of urinary diversion for benign indications on a national level, though the indications driving this clinical decision appear inconsistent.

Keywords

cystectomy; urinary diversion; ileal conduit; national trends; neurogenic bladder

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Financial disclosures:

The remaining authors have no relevant financial interests.

Introduction

Urinary diversion for benign indications is relatively rare, and can be performed with or without a concomitant cystectomy. Diversion is typically offered as a last resort for refractory lower urinary tract symptoms (LUTS) secondary to neurogenic bladder (e.g. spinal cord injury, spina bifida, and multiple sclerosis, most commonly), radiation cystitis, interstitial cystitis, or recurrent fistula formation.¹ There is some debate about how to manage the bladder at the time of urinary diversion, specifically whether to perform a cystectomy concurrently. Urinary diversion without a cystectomy may result in pyocystitis, secondary carcinoma, or pain.² Some physicians advocate for a concomitant cystectomy, which essentially eliminates sequelae of the retained bladder. However, cystectomy can increase the operative time and morbidity of the procedure.¹ Recent reports from single institution case series suggest that the complication rates range from 39–73%.^{1–3} Nevertheless, there is an overall paucity of data for benign cystectomy nationwide.

As a result, this study aimed to describe temporal trends in concurrent cystectomy for benign indications in the United States. We additionally sought to identify patient and hospital-level factors associated with these national trends.

Materials and Methods

Our Institutional Review Board determined that this project met criteria for exemption.

Data source

Data from the Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) from 1998–2011 was examined. The NIS is a 20% stratified sample of all-payer hospital discharges in the United States, containing information from approximately 7 million discharges each year in 44 states.⁴ Each record is a summary report of a person's hospital stay (i.e. discharge summary), indicating associated diagnoses and procedures performed during that hospitalization. The unit of analysis is the record (hospital discharge), which is unique for the patient; however, patients cannot be identified or matched across separate hospital discharges, thus individual patients cannot be followed over time or over multiple discharges.

Inclusion/Exclusion criteria

Using International Classification of Diseases, version 9 (ICD-9) diagnosis codes, abstracted, de-identified data from hospital discharge summaries was collected. First, we limited the sample of records to those with a procedure code for urinary diversion, specifically ileal conduit (ICD-9: 56.51-formation of a cutaneous uretero-ileostomy). Based on iterative examinations of the records and previously published studies on diversion in the NIS data,⁵ we determined that this code was the most specific for urinary diversion that would exclude non-diversion procedures, such as bladder augmentation. This is also consistent with previous studies that report non-conduit diversions comprised only 12.9% of the urinary diversions performed.^{1–3} Next, we excluded records with a primary diagnosis of any malignancy (ICD-9: 140-239) and those for patients under the age of 18 (Supplementary Figure 1). Lastly, we divided the sample into two cohorts: those who underwent ileal conduit

urinary diversion without concomitant cystectomy (ICD-9: 56.51) and those who underwent ileal conduit urinary diversion with concomitant cystectomy (ICD-9: 56.51 and either ICD-9: 57.71-radical cystectomy or ICD-9: 57.79-other total cystectomy).

Variables

From the available records, we abstracted patient-level data on age, gender, insurance payer status (private, Medicare, Medicaid, and other), and indicators for individual comorbidities (congestive heart failure, neurological disorders, valvular disease, pulmonary circulation disease, peripheral vascular disorders, chronic pulmonary disease, diabetes, diabetes with chronic complications, hypothyroidism, renal failure, liver disease, lymphoma, metastatic cancer, solid tumor without metastasis, rheumatoid arthritis, coagulopathy, obesity, weight loss, fluid and electrolyte disorders, chronic blood loss anemia, deficiency anemia, alcohol abuse, drug abuse, psychoses, and depression). From this data, the Elixhauser Comorbidity Index⁶ was calculated. We additionally captured NIS hospital-level characteristics: census geographic region (northeast, south, west, and midwest), urban-rural status, teaching status, and hospital size (small, medium, large).

Statistical Analysis

We described patient and hospital characteristics in our population by concomitant cystectomy and compared characteristics using Wilcoxon tests for continuous variables and Pearson Chi-square tests for categorical variables. Multivariate logistic regression was performed to assess the association between time and concomitant cystectomy while adjusting for other important covariates including sex, age, Elixhauser comorbidity index⁶, hospital location, hospital size, hospital region, payer, and individual comorbidities. Finally, we performed a multivariate logistic regression model with four interaction terms to assess the variation in the relationship between concomitant cystectomy and time by payer, hospital teaching status, hospital region, and hospital urban/rural location.

All analyses incorporated NIS survey weights to generate nationally representative estimates, and p-values below 0.05 were considered to be statistically significant. Analyses were conducted using R version 3.2.1 (www.r-project.org).

Results

Between 1998 and 2011, 15,717 urinary diversions were performed for benign indications at U.S. hospitals. Of these, 11,470 (73%) patients underwent a urinary diversion without a concurrent cystectomy and 4,247 (27%) patients underwent a urinary diversion with concomitant cystectomy. Demographic, clinical, and hospital characteristics are presented in Table 1. The proportion of patients undergoing urinary diversion with concomitant cystectomy was significantly older (median age 64 vs. 59; $p<0.001$). Male patients were more likely to undergo a concomitant cystectomy compared to females (55.8% vs. 37.4%, $p<0.001$). Patients with Medicare insurance were also more likely to undergo a concurrent cystectomy compared to those with Medicaid, private, or other insurances ($p=0.006$).

Urinary diversion was performed most commonly for neurogenic bladder (all cause), irradiation cystitis, interstitial cystitis, and fistula (Table 1). Surgical indications differed

between groups ($p < 0.001$). The proportion of patients undergoing urinary diversion with concomitant cystectomy was higher for diagnoses of irradiation cystitis (14.5% vs. 7.7%) and interstitial cystitis (13.2% vs. 2.2%), and less for neurogenic bladder (22.1% vs. 27.8%) and fistula (9.3% vs. 17.8%).

Between 1998 and 2011, there was an increase (20% to 35%) in the proportion of patients undergoing urinary diversion with concomitant cystectomy (Figure 1). Multivariate analyses revealed an association between year and concomitant cystectomy (Adjusted Odds Ratio [AOR] 1.05; 95% CI 1.02, 1.08; $p < 0.001$).

The relationship between concomitant cystectomy and time varied by payer (Figure 2; $p = 0.01$); the proportion of concomitant cystectomy increased the greatest for those insured by Medicare, from below 20% to 40% over the time period. This relationship also varied by hospital teaching status (Figure 3; $p = 0.04$): the proportion of concurrent cystectomy performed at teaching hospitals increased from 15% to more than 35%. The association between concomitant cystectomy and time did not vary by hospital region ($p = 0.10$) or by hospital urban/rural location ($p = 0.39$).

Comment

Our results demonstrate that for the majority of cases in the United States, cystectomy at the time of urinary diversion is not performed for benign indications. Over the time period examined, the proportion of cases with concomitant cystectomy did increase, although the individual factors driving these clinical decisions are not clear. It appears that a concomitant cystectomy was performed more often in older patients, in men in those with Medicare insurance, and in those with certain diagnoses. While the proportion of cases with concomitant cystectomy did not vary across hospital settings (urban vs. rural and geographic region), the proportion of cases with a concurrent cystectomy was higher at teaching hospitals vs. non-teaching hospitals. Possible explanations for this may be that patients referred to teaching institutions are often more complex with more comorbid conditions, and that surgeons at teaching institutions may be more willing to accept additional risks that may be perceived to occur with concomitant cystectomy. Further analyses will be needed to assess whether complications do, in fact, vary by whether concomitant cystectomy is performed at the time of urinary diversion.

Sparse published data exists regarding patient demographics and surgical indications and outcomes for patients undergoing benign cystectomy. In 2000, Neulander et. al. published a series of 19 patients (12 women, 7 men) with a mean age of 63 years who underwent a urinary diversion for benign indications, including: severe urinary incontinence, gross hematuria, or refractory LUTS secondary to neurogenic bladder or pelvic radiation. Thirteen of these patients underwent a concomitant cystectomy, while the remaining 6 patients required a delayed cystectomy due to complications of the retained bladder. This study reported no morbidity attributable to the concurrent simple cystectomy and concluded that a cystectomy should be performed at the time of urinary diversion to avoid sequelae of a retained bladder.⁷

While complication rates for urinary diversion are known to be significant, recent single institution reports have suggested that the additional morbidity of a concomitant cystectomy may actually be higher than previously reported.^{1–3} In 2011, Rowley et. al. published a series of 23 patients who underwent urinary diversion with concomitant supratrigonal cystectomy for benign indications with a perioperative complication rate of 39.1%.² In 2014, Osborn et. al. published a series of 139 patients who underwent simple cystectomy also for benign indications with a reported overall complication rate of 67%.¹ Furthermore, in 2015, Al Hussein Al Awamlh et. al. published a study of 29 patients undergoing simple cystectomy for radiation-induced refractory LUTS with a 65.5% 30-day postoperative complication rate.⁸ These findings clearly suggest that the complication rate is higher than originally reported and represent important information for patient counseling. Even though the rise in concomitant cystectomy was significant, this may be an explanation as to why there was only a modest increase (20–35%) during the 14-year study period.

To our knowledge, this is the first study to examine the use of cystectomy for benign indications on a national level and we demonstrated significant temporal trends in the proportion of cases that employed a concomitant cystectomy. However, there are a number of limitations in this study. First, we were only able to analyze variables available in the dataset and important patient and clinical characteristics influencing the likelihood of concomitant cystectomy were not available. Second, we restricted the sample to those undergoing ileal conduit diversion specifically, because this was the most specific code for urinary diversion. Therefore the results under-report the overall prevalence of urinary diversions and the generalizability of the findings is limited. Nevertheless, previous reports have shown that non-conduit diversions are uncommon¹ in this patient population, and previous studies examining the use of urinary diversion for malignant cystectomy employed similar methods for coding.⁵

Furthermore, while the use of administrative data reveals associations between concomitant cystectomy and patient and hospital characteristics, causality cannot be ascertained. Analyzing records in the NIS is cross-sectional by design, and there is no longitudinal data beyond the initial hospitalization. Finally, any study using administrative data are subject to misclassification bias because of inconsistent or incorrect coding of procedures or diagnoses. We presumed that this bias would be equal for our comparison groups. Several studies have demonstrated reliability between professional ICD-9 coding and clinical records, suggesting coding errors are likely minimal.^{9,10}

Conclusions

Nationwide, there has been a general increase in the use of concurrent cystectomy with urinary diversion for benign indications over the last 14 years. Overall, concomitant cystectomy seems to have increased at teaching institutions, in male patients, in the Medicare patient population, and in those with certain diagnoses. This national trend to perform a concurrent cystectomy at the time of urinary diversion is consistent with single institution reports.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Funding:

This study was supported by CTSA award No. UL1TR000445 from the National Center for Advancing Translational Sciences, the National Institute of Diabetes and Digestive and Kidney Diseases of the National Institutes of Health under award number K23DK103910, and by the Vanderbilt Office of Clinical and Translational Scientist Development. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of Vanderbilt University, the National Center for Advancing Translational Sciences or the National Institutes of Health.

Roger R. Dmochowski is a paid consultant for Allergan and Medtronic. Melissa R. Kaufman is a paid consultant for Cook Myosite and Boston Scientific. Douglas Milam is a paid consultant for Boston Scientific.

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Figure 1.
Proportion of concomitant cystectomy with urinary diversion over time.

Figure 2.

Proportion with concomitant cystectomy performed by payer over time.

Figure 3.
Proportion with concomitant cystectomy performed by hospital teaching status over time.

Table 1

Descriptive characteristics of 15,717 NIS discharges for urinary diversion with and without concomitant cystectomy from 1998–2011.

	Diversion + Cystectomy n=4,247	Diversion n=11,470	p-value
Age (median, range)	64 (19–90)	59 (18–94)	<0.001
Elixhauser Comorbidity Index (median, SE)	2.1 (0.1)	2.0 (0.0)	0.266
% Diagnosis			<0.001
Neurogenic bladder	22.1	27.8	
Irradiation cystitis	14.5	7.7	
Interstitial cystitis	13.2	2.2	
Fistula	9.3	17.8	
Complication-GU graft	0.4	0.8	
Complication-urinary	1.7	3.5	
Bladder dysfunction	5.0	2.1	
Urinary incontinence	1.9	4.6	
Obstruction	2.5	3.3	
Cystitis NOS	5.0	2.6	
Other	24.3	27.5	
% Female	37.4	55.8	<0.001
% Hospital Location			0.993
Rural	5.7	5.7	
Urban	94.3	94.3	
% Hospital Teaching Status			0.575
Non-teaching	26.2	27.5	
Teaching	73.8	72.5	
% Hospital Size			0.313
Small	6.8	7.3	
Medium	16.0	19.3	
Large	77.1	73.5	
% Hospital Region			0.026
Northeast	12.3	18.5	
Midwest	28.8	27.2	
South	37.1	35.8	
West	21.7	18.5	
% Payer			0.006
Medicare	61.3	58.3	
Medicaid	9.0	13.4	
Private insurance	25.2	24.9	
Other	4.5	3.3	

Key: GU=genitourinary, NOS=not otherwise specified, SE=standard error

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