

Readmissions in the postoperative period following urinary diversion

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Abstract

Purpose Most analyses of complications after urinary diversion are restricted to the index admission. Given the complexity of these reconstructions, readmissions occur commonly. We sought to characterize the burden and impact of readmissions in the postoperative period following urinary diversion.

Methods Using 5% Medicare data for the years 1998–2005, we identified patients undergoing ileal conduit, continent, and other urinary diversions for benign and malignant indications. We examined the 90-day rates of readmission and evaluated factors associated with readmission after urinary diversion, either to the primary hospital or to a secondary facility. We assessed 90-day and 2-year mortality after urinary diversion and incorporated readmission status as a covariate in these multivariable models.

Results Our study sample included 1,565 patients, of whom 491 patients (31%) were readmitted within 90 days of their urinary diversion. Patients readmitted after urinary diversion had higher comorbidity count than those not readmitted (59% of those readmitted with comorbidity count at

least 1 versus 50% of those not readmitted, $P = 0.002$). Other clinical and demographic characteristics did not differ by readmission status ($P > 0.12$ for age, race, type of urinary diversion, and primary diagnosis). Complication rates were higher in readmitted patients than those not readmitted; 2-year mortality was associated with 90-day readmission status—18.8% of readmitted versus 12.8% of not readmitted patients died within 2 years of surgery ($P = 0.003$).

Conclusions Readmissions occur commonly after urinary diversion. Many readmitted patients have complications of complex surgery managed at secondary hospitals, which may portend a quality concern that merits further study.

Keywords Bladder cancer · Urinary diversion · Neobladder · Complications · Readmission · Quality of care

Introduction

Despite advances in reconstructive technique, urinary diversion remains a morbid procedure. Complication rates range from 18 to 37% [1–3] with quoted mortality rates ranging from 2 to 7% [4–6]. Most analyses are restricted to the immediate postoperative period, [3, 7–9] yet a large burden of the health care utilization after urinary diversion continues beyond the index admission. Patients often require multiple clinic visits for teaching, nursing care, and medical management of comorbid conditions [2]. Further, many of the complications of urinary diversion are severe enough to warrant readmission.

Readmissions are common after complex surgery [10–12]. As complex surgeries increasingly shift to large urban teaching hospitals, as has occurred for cystectomy and

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urinary diversion, [13] the site of readmission may impact patient outcomes. In gastrectomy patients, for example, readmission to secondary hospitals—hospitals other than the index surgical hospital—is associated with worse mortality outcomes [14]. Secondary hospitals may have fewer resources to manage complications associated with complex surgeries.

We sought to characterize the burden of readmissions in the postoperative period following urinary diversion. We further sought to understand the impact of the site of readmission on patient outcomes. Herein, we describe the incidence and associated factors for readmission after urinary diversion both to the hospital where surgery was performed as well as to secondary hospitals.

Methods

Study sample

We accessed a 5% sample of Medicare claims for the study years 1998–2005 to identify men and women undergoing urinary diversion. Medicare data are predominantly comprised of claims from beneficiaries enrolled on the basis of age greater than 65 years, but also include those with disabling conditions such as end stage renal disease. Medicare data include inpatient and outpatient claims submitted by health care providers and facilities. We derived our patient sample from the Medicare Provider Analysis and Review (MEDPAR) inpatient services file and the outpatient provider claims Carrier file and abstracted patient demographic characteristics from the Denominator file.

We identified men and women undergoing urinary diversion for benign and malignant indications from International Classification of Diseases, 9th Revision (ICD-9) and Common Procedural Treatment, 4th Revision (CPT) codes. Type of urinary diversion was identified with ICD-9 codes and CPT codes as well and categorized into ileal conduit and continent diversion groups. Other urinary diversions included ureterosigmoidostomy patients (ICD-9 code 56.71, CPT code 50810) and those undergoing enterocystoplasty (ICD-9 code 57.87, CPT code 50825, 51960). We did not restrict the sample by age, as many beneficiaries admitted younger than 65 years of age have conditions predisposing to a higher likelihood of urinary reconstruction, such as renal failure. We excluded patients without both Medicare Part A and Part B coverage and those enrolled in Medicare Health Maintenance Organization (HMO) programs. We further restricted our sample to those patients with at least 1 year of enrollment prior to their urinary diversion and 2 years of enrollment after surgery. This permitted comprehensive assessment of antecedent comorbid conditions and postsurgical complications.

We determined patient age, gender, race, US Census region of residence, and date of death, if applicable, from the Denominator files. We used the Klabunde modification of the Charlson comorbidity index to enumerate patient comorbidities [15].

Outcome measures

We examined 90-day outcomes to evaluate the management of perioperative complications. Urinary diversions are rarely performed as staged procedures, thus early postoperative readmissions are unlikely to be related to subsequent elective procedures. Surgical and medical complications selected a priori from prior retrospective reviews of complications after urinary diversion included stomal complications, wound complications, urinary obstruction, urolithiasis, urinary fistulae, infectious complications, and renal failure. These outcomes of interest were flagged using relevant ICD-9 codes in the MEDPAR and Carrier files. We examined inpatient readmissions in the 90 days following urinary diversion and used the providing hospitals unique identifier to attribute the initial readmission to the primary hospital (i.e., the hospital where the surgery was performed) or to a secondary hospital.

Statistical analysis

We compared patients undergoing urinary diversion by type of reconstruction and need for readmission with Chi-squared analysis for categorical variables and analysis of variance and independent samples t-tests for continuous variables. We further compared patients readmitted to their primary hospital to those readmitted to secondary facilities with Chi-squared analysis for categorical variables and independent samples t-tests for continuous variables. We compared 90-day complication rates by readmission hospital with Chi-squared analysis.

To understand whether readmission affects early and intermediate mortality outcomes after urinary diversion, we performed univariate survival analyses to examine 90-day and 2-year survival outcomes. We created multivariable Cox proportional hazards models to evaluate factors independently associated with 90-day and 2-year mortality. In addition to 90-day readmission status (categorized as not readmitted, readmitted to primary hospital, and readmitted to secondary hospital), we adjusted our survival analyses for patient age, gender, history of bladder cancer, and level of comorbidity.

The study was reviewed and approved by the University of California, Los Angeles (UCLA) and RAND corporation Institutional Review Board (IRB). All statistical analyses were performed with SAS 9.2 (SAS Corporation, Cary, NC).

Results

We identified 1,565 patients who underwent urinary diversion for benign and malignant indications between 1998 and 2005. Table 1 displays the characteristics of the study sample. Patients undergoing continent urinary diversion were younger and had fewer comorbidities than those undergoing ileal conduit or other reconstructions. A majority of patients receiving ileal conduit urinary diversions had bladder cancer as their primary diagnosis compared with continent and other reconstructions, where benign indications predominated.

Of our sample, 491 patients (31%) were readmitted within 90 days of their urinary diversion. Of those, 365 patients (74%) were readmitted once within 90 days of surgery, and the remaining 26% were readmitted two or more times. Age, gender, race, type of urinary diversion, and primary diagnosis did not differ between those readmitted and those not readmitted ($P = 0.54$, $P = 0.49$, $P = 0.11$, $P = 0.13$, and $P = 0.50$, respectively). Patients readmitted after urinary diversion had higher comorbidity count than those not readmitted (59% of those readmitted with comorbidity count at least 1 versus 50% of those not readmitted,

$P = 0.002$). Similarly, among those readmitted, age, race, type of urinary diversion, and primary diagnosis did not differ between those readmitted to the primary hospital compared with those readmitted to secondary facilities ($P = 0.12$, $P = 0.68$, $P = 0.40$, and $P = 0.57$, respectively). Comorbidity likewise did not differ by readmission hospital ($P = 0.87$). A trend was observed toward readmission to the primary hospital among men (67% of men vs. 59% of women, $P = 0.08$) and those in the Northeast and South, (73% of Northeastern, 67% of Southern, 60% of Midwestern, and 56% of Western diversion patients, $P = 0.07$).

Patients readmitted to secondary hospitals had higher lengths of stay for their initial readmission than patients readmitted to their primary hospital (lengths of stay 8.7 ± 11.0 days vs. 6.6 ± 8.6 days, $P = 0.02$, respectively). Table 2 displays complications rates stratified by readmission status. Sepsis and hernia were sufficiently rare in the postoperative period to prohibit inclusion in the analysis. Patients not requiring readmission beyond the index hospitalization had substantially lower rates of the complications analyzed than those readmitted. Those readmitted to secondary hospitals had higher rates of renal failure, urinary fistula, and stone disease than those readmitted to the primary hospital. Wound

Table 1 Characteristics of the study sample

	Ileal conduit	Continent	Other	Total	<i>P</i> value
Total, no.	1,248 (80)	105 (7)	212 (13)	1,565	
Age, no. (%)					
Mean \pm SD					
<65 years	129 (10)	45 (43)	29 (14)	203 (13)	<0.001
65–69	183 (15)	17 (16)	13 (18)	239 (15)	
70–74	360 (29)	27 (26)	64 (30)	451 (29)	
75–79	346 (28)	14 (12)	38 (23)	407 (26)	
≥ 80	230 (18)	3 (3)	32 (15)	265 (17)	
Gender, no. (%)					
Men	850 (68)	65 (62)	137 (65)	1,052 (67)	0.29
Women	398 (32)	40 (38)	75 (35)	513 (33)	
Race/ethnicity, no. (%)					
White	1,130 (91)	91 (87)	187 (88)	1,408 (90)	0.29
Nonwhite	118 (9)	14 (13)	25 (12)	157 (10)	
Charlson comorbidity index, no. (%)					
0	563 (45)	66 (63)	105 (50)	734 (47)	0.03
1	376 (30)	25 (24)	60 (28)	461 (30)	
≥ 2	304 (25)	14 (13)	46 (22)	364 (23)	
Primary diagnosis, no. (%)					
Bladder cancer	885 (71)	37 (35)	104 (49)	1,026 (66)	<0.001
Other	363 (29)	68 (65)	108 (51)	539 (34)	
US Census region, no. (%)					
Midwest	364 (29)	33 (31)	62 (29)	459 (29)	0.14
Northeast	246 (20)	9 (9)	38 (18)	293 (19)	
South	463 (37)	42 (40)	78 (37)	583 (37)	
West	175 (14)	21 (20)	34 (16)	230 (15)	

Table 2 Readmission facility and 90-day complications after urinary diversion

	Not readmitted	Readmitted		<i>P</i> value
		Primary hospital ^a	Secondary hospital	
Total, no.	1,074 (69)	303 (20)	165 (11)	
Wound infection, no. (%)	23 (2.1)	29 (9.6)	7 (4.2)	<0.001
Renal failure, no. (%)	13 (1.2)	14 (4.6)	16 (9.7)	<0.001
Stoma complications, no. (%)	2 (0.2)	2 (0.7)	2 (1.2)	0.10
Urinary fistula, no. (%)	4 (0.4)	9 (3.0)	9 (5.5)	<0.001
Urinary obstruction, no. (%)	15 (1.4)	25 (8.3)	14 (8.5)	<0.001
Urolithiasis, no. (%)	1 (0.1)	2 (0.7)	2 (1.2)	0.03

^a Primary hospital refers to the facility where the urinary diversion was performed

Table 3 Intermediate 90-day and short-term 2-year mortality after urinary diversion

Hazard ratio (95% CI)	90-day mortality	2-year mortality
90-day readmission status (vs. not readmitted)		
Readmitted to primary hospital ^a	1.10 (0.46–2.63)	1.52 (1.11–2.09)
Readmitted to secondary hospital	0.81 (0.23–2.77)	1.46 (0.98–2.16)
Comorbidity index (vs. 0)		
1	2.09 (0.76–5.74)	1.37 (1.00–1.87)
≥2	4.77 (1.91–11.9)	1.54 (1.11–2.15)

^a Primary hospital refers to the facility where the urinary diversion was performed. Also adjusted for age, gender, race

infections were significantly more common among those readmitted to the primary hospital than those not readmitted and those readmitted elsewhere. Urinary obstruction was more common among readmitted patients but did not differ by readmission hospital. Stomal complications did not differ by readmission status but were also infrequent.

In the 90-day postoperative period, 31 patients (2.0%) died of any cause; 90-day mortality was not associated with readmission status (90-day mortality 2.0% in those not readmitted, 2.3% in those readmitted to the primary facility, and 1.8% in those readmitted to a secondary hospital, $P = 0.91$). Within 2 years of diversion, 225 patients (14.6%) died of all causes. Two-year mortality was more common among patients readmitted in the perioperative period (18.8% of readmitted patients vs. 12.8% of those not readmitted, $P = 0.003$). Table 3 displays hazard ratios from Cox multivariable models of 90-day and 2-year mortality after urinary diversion. Increasing comorbidity was associated with 90-day and 2-year mortality after urinary diversion.

Discussion

Our study has several important findings. First, a large proportion of Medicare beneficiaries undergo urinary diversion

for benign indications. Urinary diversion is intimately associated with bladder cancer: a common indication for lower urinary tract reconstruction is to follow surgical removal of the bladder and associated organs for cancer. However, in our sample, which included those with Medicare younger than 65 for disabling conditions, roughly a third of our patients underwent urinary reconstruction for benign disease. This may have implications for the identification of data sources to investigate long-term outcomes after urinary diversion as cancer-specific datasets may fail to capture a substantial number of reconstructed patients. Those with benign conditions were also more likely to undergo continent urinary diversions. Analysis of national datasets has revealed underutilization of continent reconstructions among bladder cancer patients undergoing radical cystectomy [16]. Understanding the processes which facilitate prioritization of continent diversions among patients with benign lower urinary tract pathology may aid dissemination of continent techniques among cancer patients.

Second, readmission in the postoperative period is a common occurrence and large source of health care utilization after urinary diversion. Greater than 30% of the patients in our study were readmitted within 90 days of surgery. This rate is comparable with patients undergoing other complex surgical procedures such as colorectal surgery and pancreaticoduodenectomy [10, 11]. Approximately a quarter of those had multiple readmissions. Urinary diversion is a morbid procedure, but studies that focus on the index admission fail to capture a significant proportion of the morbidity that occurs. Readmissions disproportionately affect the sickest patients, as comorbidity was the only clinical or demographic factor significantly associated with readmission status. This raises concern that many of these readmissions were for medical complications. Yet, comorbidity is also associated with surgical complications [7, 17]. Rigorous attention to preoperative optimization of specific comorbidities with high associations with the sequelae of urinary diversion, such as chronic pulmonary disease and poor nutritional status, may lower readmission rates in more comorbid patients.

Third, readmission to secondary facilities as opposed to readmission to the hospital where surgery was performed was not associated with patient demographic characteristics. We anticipated, given the natural regionalization of cystectomy that occurred during the 1990s, [13] that urinary diversion patients readmitted to secondary facilities represent regionalized patients: patients referred to tertiary hospitals by urologists that do not perform radical cystectomy. As such, there may be demographic differences in the constituencies of readmitted patients stratified by the readmission hospital. We identified a trend toward gender and regional differences. Gender differences may reflect the stronger support offered to male cancer patients by their partners than female cancer patients by their partners, [18] while regional differences may reflect the geographic concentration of urban areas in the Northeast and South compared with the Midwest and especially the West. Most cystectomies—and by proxy most urinary diversions—are performed in urban teaching hospitals; the expanse of the West may explain fewer readmissions to the primary hospital in this region. Strategies for organized regionalization of cystectomy care for bladder cancer should consider geographic differences in the concentration of tertiary referral centers.

Lastly, complication rates, as expected, were more common among readmitted patients. The complications likely drove the readmissions, as few of the complications analyzed may be managed in an ambulatory setting. The hospital at which patients were readmitted may be a proxy for patient access to care. Primary hospitals may be more difficult to access among regionalized patients following surgery as secondary hospitals may be the closest medical facilities to patients requiring urgent medical attention. Although certain complications were more common at primary hospitals, severe complications such as renal failure and urinary fistula were more common at secondary hospitals. The sequelae of these more substantial complications may explain the higher 2-year mortality rates among patients readmitted to secondary facilities. Secondary facilities may have a lower comfort level managing the complications of complex cancer surgery, or reduced ancillary resources such as interventional radiology to aid with managing those complications. Further studies should investigate the outcomes of diversion-related complications stratified by the facility at which they are treated. Secondary hospitals may be low volume hospitals and, thus, regionalization of the complications of urinary diversion may be required to optimize 90-day outcomes. Our data show, at least, that 90-day survival is not compromised regardless of the readmission hospital.

Our study has numerous limitations. As the study of readmissions after urinary diversion has been limited, we chose to focus our analysis on simple description of the

magnitude of the problem. However, we had limited cancer-specific information in this Medicare dataset and could not account for the severity of the cancer in our analyses. Patients with higher stage cancers often receive chemotherapy after surgery which may explain some of the readmissions. Our focus on Medicare beneficiaries may limit the generalizability of our results. Although the majority of bladder cancer patients are of Medicare age, [19] patients with benign lower urinary tract pathology that requires urinary diversion comprise a diverse age range. Our results may be specific to older and disabled patients undergoing urinary diversion and may not extrapolate to younger healthier patients. Also, in using readmission status as a primary regressor in our survival analyses, we may be biased toward better survival in readmitted patients. Those readmitted had to survive long enough to require readmission. Lastly, we restricted our sample to those with complete claims data for a 2-year postoperative period. This strict inclusion criteria may have reduced our sample to a select cohort that under or overestimates the incidence of complications following urinary diversion.

Despite these limitations, we characterized the incidence of readmissions after urinary diversion and identified a possible quality of care concern with regard to readmissions to secondary facilities. Readmissions within 90 days of urinary diversion confound the care of a third of patients undergoing these reconstructions, evidence of the immense burden of these reconstructions on the patients. Of those, over half get readmitted to secondary hospitals, rather than the hospital at which surgery was performed. Those readmitted to secondary institutions may have worse downstream outcomes, as their secondary hospital readmission may evince reduced access to care. Strategies to regionalize complex surgical care must balance the benefit of having surgery at a high volume institution with the consequences of that regionalization. The potential for quality concerns related to readmissions specifically to secondary hospitals merits further study.

Conflict of interest The authors have no conflicts of interest to disclose.

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