Few modifiable factors predict readmission following radical cystectomy

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Abstract

Introduction: We sought to determine the patient and provider-related factors associated with readmission after radical cystectomy (RC) for bladder cancer. In this era of healthcare reform, hospital performance measures, such as readmission, are beginning to affect provider reimbursement. Given its high readmission rate, RC could be a target for quality improvement.

Methods: We reviewed bladder cancer patients who underwent RC in California's State Inpatient Database (2005–2009) of the Healthcare Cost and Utilization Project. We examined patient- (e.g., race, discharge disposition) and provider-related factors (e.g., volume) and evaluated their association with 30-day readmission. Multivariable logistic regression was used to examine associations of interest.

Results: Overall, 22.8% (n = 833) of the 3649 patients who underwent RC were readmitted within 30 days. Regarding disposition, 34.8%, 50.8%, and 12.2% were discharged home, home with home healthcare, and to a post-acute care facility (PACF), respectively. Within 30 days, 20.3%, 20.9%, and 42.3% were discharged home, home with home healthcare, and to a PACF were readmitted, respectively. African Americans (odds ratio [OR] 1.64, 95% confidence interval [CI] 1.07–2.50), having ≥2 comorbidities (OR 1.42, 95% CI 1.06–1.91), receiving a neobladder (OR 1.45, 95% CI 1.09–1.93), and discharged to a PACF (OR 3.79, 95% CI 2.88–4.98) were independent factors associated with readmission. Hospital stays ≥15 days were associated with less readmission (OR 0.43, 95% CI 0.27–0.67, $p = 0.0002$). Procedure volume was not associated with complication, in-hospital mortality, or readmission.

Conclusions: About one-fifth of patients undergoing RC are readmitted. Patients who are discharged to a PACF, African American, and who have more extensive comorbidities tend to experience more readmissions. Increased efforts with care coordination among these patients may help reduce readmissions.

Introduction

Since passage of the Patient Protection and Affordable Care Act in 2010, hospital readmission has become an essential healthcare quality metric.[1,2] Centers for Medicare and Medicaid Services began penalizing hospitals with decreased Medicare payments for excessive readmissions in pneumonia, heart failure, and myocardial infarction. The policy will expand to include elective hip arthroplasty and knee arthroplasty,[2] while other elective procedures resulting in unplanned readmissions will be added.[3] Still, there is debate whether readmission reflects hospital quality and whether medical care readmission is comparable to surgical readmission.

Clinical leaders and hospital executives are concerned as reports show hospitals, such as teaching hospitals and safety-net hospitals (top quartile of hospitals providing uncompensated care), caring for sicker patients are more likely to have readmissions and thus incur disproportionate penalty.[4] Medical literature has shown 30-day readmission rates in heart failure and pneumonia are related to disease severity and socioeconomic status.[5] A large Medicare analysis from 479 471 discharges after 6 major surgeries (non-urologic) revealed a risk-adjusted readmission rate of 13.1% with higher-volume and lower mortality hospitals yielding slightly lower 30-day readmission.[6] Since readmission is variable and fairly high for many major surgeries, at which level should hospitals be penalized?

Across all surgical disciplines, including urology, the relationship between surgical care and readmission is underappreciated. Radical cystectomy (RC) may face scrutiny since it is associated with complication rates up to 68% and readmission rates as high as 26% even when performed at centres of excellence.[7-9] Given this data, RC could be a target quality improvement area. Therefore, our objective was to determine patient- and provider-related factors associated with 30-day readmission after RC.

Methods

Data sources

We used discharge data from California's State Inpatient Database of the Healthcare Cost and Utilization Project (HCUP), an Agency for Healthcare Research and Quality. The HCUP State Inpatient Database (SID) contains the largest collection of longitudinal, all-payer, encounter-level hospital care data in the United States. The national aggregate of SIDs encompasses 97% of hospital admissions. HCUP California databases allow tracking of patients across different times and practice settings using synthetic patient-level identifiers. SID data were merged with California's Office of Statewide Health Planning and Development hospital database to provide hospital characteristics. Case Western Reserve University's Institutional Review Board approved this study.

Study design and patient characteristics

From California's SID, we retrospectively analyzed patients diagnosed with bladder cancer from January 2005 to December 2009 (n = 37 615) using the International Classification of Diseases, 9th Edition, Clinical Modification (ICD-9-CM) diagnosis codes. Inclusion criteria included the codes for malignant bladder neoplasm (188.0–188.9), carcinoma-in-situ code (237.7), and bladder neoplasm not-otherwise-specified code (239.4). We then used ICD-9-CM procedure codes to identify bladder cancer patients who underwent RC (n = 3711; code 57.71). We excluded all patients with missing synthetic patient identifiers needed to track subsequent hospitalizations (n = 62). Thus, the final surgical cohort included 3649 patients.

Objectives, hypothesis, and variables of interest

Our primary objective was to determine patient- and provider-related factors associated with readmission after RC for bladder cancer. We hypothesized that patients with lower socioeconomic status, advanced age, and increased medical comorbidities had more readmission after cystectomy. We also proposed that hospitals with an academic affiliation and higher surgical volume would have less readmission. We tested this hypothesis by reviewing a large population of RC cases.

We defined our dependent variable, readmission, as a subsequent hospitalization occurring within 30-days from the RC hospital stay. Our independent variables included diagnosis year, age, gender, race, primary insurance (Medicaid, Medicare, self-insured, private), comorbidity category (0, 1, 2, ≥3 comorbidities), complication category (0, 1, 2, ≥3 complications), length-of-stay category (0–5, 6–8, 9–11, 12–14, ≥15 days), hospital volume (<10, 10–49, ≥50 cystectomies/year), and procedure type. We classified the procedures as neobladder (code 57.87), standard incontinent diversion (codes 56.51, 56.52, 56.71), and other urinary diversion (code 56.79). Hospital characteristics were categorized into academic, profit or non-profit status, and government affiliation. Discharge disposition was classified as routine discharge home, home with home healthcare, and to a post-acute care facility [PACF] (e.g., nursing home or skilled-nursing-facility). Patient comorbidities were identified using ICD-9-CM diagnosis codes (e.g., congestive heart failure, code 428). Treatment-related complications were identified based on associated ICD-9-CM diagnosis and procedure codes obtained from inpatient secondary diagnoses and procedures (Appendix 1, Appendix 2).

Statistical analysis

We compared continuous variables using student t-test and categorical variables using chi-square test. We performed univariate analysis to assess independent variables associated with 30-day readmission. Next, to adjust for confounding factors, we used multivariable logistic regression to examine the associations of interest. After discovering patients discharged to a PACF had higher readmission, we performed a subanalysis using multinomial regression to identify factors associated with discharge to home, to home with home healthcare, or to PACFs. Comorbidity count was not included in the multinomial model because it caused model convergence and the data were insignificant.

Odds ratio (OR) estimates and 95% confidence intervals (CI) were obtained for all levels. Logistic model calibration and discrimination were assessed with c-statistic. Statistical significance was defined as p values less than 0.05. All analyses were done using SAS v9.3 (SAS Institute Inc. Cary, NC).

Results

Baseline descriptive data

We identified 3649 patients who underwent RC. The median age was 71 years (interquartile range [IQR] 62–77), with 83.3% male and 52.9% aged ≥70. Most patients (76.0%) were treated at academic centres. Most patients received surgery at hospitals performing <10 cystectomies/year (44.5%), with most receiving a standard incontinent diversion (79.6%) (Table 1).

On univariate analysis, age ($p = 0.04$), comorbidity count ($p = 0.003$), and discharge disposition ($p < 0.0001$) were the only variables associated with increased readmission (Table 2). There were 22.1% (638), 25.7% (79), and 25.5%

Table 1. Patient and hospital characteristics in BC patients who underwent RC

Variable	All RC patients n, %
Total patients	3649
30-day readmissions	833 (22.8)
Total complications	2014 (55.2)
In-hospital mortality	83 (2.3)
Median length-of-stay, days (IQR)	9 (7–13)
Median age, years (IQR)	71 (62–77)
Age categories	
<50	173 (4.7)
50–59	499 (13.7)
60–69	1046 (28.7)
70–79	1322 (36.2)
≥80	609 (16.7)
Gender	
Male	3042 (83.3)
Female	607 (16.7)
Race	
White	2825 (77.4)
Black	123 (3.4)
Other	701 (19.2)
Comorbidity	
0 comorbidity	487 (13.4)
1 comorbidity	910 (24.9)
2 comorbidities	849 (23.3)
≥3 comorbidities	1403 (38.5)
Complications	
No complications	1614 (44.2)
1 complication	1084 (29.7)
2 complications	519 (14.2)
≥3 complications	432 (11.8)
Diversion type	
Incontinent diversion	2887 (79.1)
Neobladder	307 (8.4)
Other	455 (12.5)
LOS category, days	
0–5	175 (4.8)
6–8	1325 (36.3)
9–11	1063 (29.1)
12–14	421 (11.5)
≥15	665 (18.2)
Hospital volume (no. cystectomies)	
<10	1625 (44.5)
10–49	1241 (34.0)
≥50	783 (21.5)
Hospital type	
Academic	2,790 (77.2)
Non-academic	822 (22.8)
Disposition	
Died	83 (2.3)
Post-acute care facility	444 (12.2)
Routine home	1270 (34.8)
Home healthcare	1852 (50.7)

BC: bladder cancer; RC: radical cystectomy; IQR: inter-quartile range; LOS: length of stay.

(116) readmissions in those who had an incontinent urinary diversion, neobladder, and other diversion, respectively. With respect to discharge, 34.8% (1270), 50.8% (1852), and 12.2% (444) were discharged home, home with home healthcare, and to a PACF, respectively. Within 30 days, 20.3% (258), 20.9% (387), and 42.3% (188) discharged home, home with home healthcare, and to a PACF were readmitted, respectively (Table 2).

Short-term outcomes

Thirty-day readmission, postoperative complication, and in-hospital mortality rates were 22.8% (833), 55.2% (2014), and 2.3% (83), respectively. Median length-of-stay was 9 days (IQR 7–13), with 18.2% (665) staying ≥15 days in hospital (Table 1).

Being African American (OR 1.64, 95% CI 1.07–2.50, $p = 0.02$), having ≥2 comorbidities (OR 1.42, 95% CI 1.06–1.91, $p = 0.02$), receiving a neobladder reconstruction (OR 1.45, 95% CI 1.09–1.93, $p = 0.01$), and discharge disposition to a PACF (OR 3.79, 95% CI 2.88–4.98, $p < 0.0001$) were independent factors associated with readmission. Patients discharged home with home healthcare were not associated with increased readmission (OR 1.04 95% CI 0.87–1.26, $p = 0.66$). Hospital stays ≥15 days were associated with less readmission and hospital procedure volume (>50 vs. <10 cystectomies/year) was not associated with improved readmission (Table 3).

Multinomial regression revealed that male patients ($p = 0.0002$) and patients with neobladder reconstruction ($p = 0.002$) were less likely to be discharged to a PACF. However, patients >80 years ($p \leq 0.0001$), increased complications count ($p \leq 0.0001$), and Medicare insurance ($p \leq 0.0001$) were associated with discharge to a PACF compared to home (Table 4).

Discussion

Healthcare policymakers are emphasizing improvements in hospital readmissions as a quality improvement initiative believing costs will decrease and overall care will improve with decreases in readmission. Across all surgical disciplines, including urology, the relationship between surgical care and readmission is underappreciated. In our RC analysis, we found two modifiable factors associated with 30-day readmission: being discharged to a PACF and receiving a neobladder reconstruction. We reported a 12.2% discharge rate to PACFs, which is close to the rate (16%) reported by the Agency for Healthcare Research and Quality in 2011.[10] Despite the low rate, those discharged to a PACF were almost 4 times more likely to be readmitted than those discharged to home after adjusting for confounders. The unexpectedly high 42% readmission rate from PACFs raises uncertainty in

Table 2. Univariate analysis of patients readmitted versus those not readmitted

Variable	Patients not readmitted within 30 days n (%)	Patients readmitted within 30 days n (%)	*p* value†
	2816 (77.2)	833 (22.8)	
Age categories			
<50	138 (4.9)	35 (4.2)	
50–59	409 (14.5)	90 (10.8)	
60–69	811 (28.8)	235 (28.2)	0.04
70–79	998 (35.4)	324 (38.9)	
≥80	460 (16.3)	149 (17.9)	
Gender			
Male	2341 (83.1)	701 (84.0)	0.47
Female	475 (16.8)	132 (15.7)	
Race			
White	2180 (77.4)	645 (77.4)	
Black	88 (3.1)	35 (4.2)	0.23
Other	548 (19.5)	153 (18.4)	
Insurance			
Medicaid/Medicare	1919 (68.1)	588 (70.5)	
Private	820 (29.1)	228 (27.4)	0.43
Other	77 (2.8)	17 (2.0)	
Comorbidity			
0 comorbidities	401 (14.2)	86 (10.3)	
1 comorbidity	719 (25.5)	191 (22.9)	0.003
2 comorbidities	647 (23.0)	202 (24.2)	
≥3 comorbidities	1049 (37.3)	354 (42.5)	
Complications			
No complications	1,246 (44.2)	368 (44.2)	
1 complication	832 (29.6)	252 (30.3)	0.48
2 complications	393 (14.0)	126 (15.1)	
≥3 complications	345 (12.3)	87 (10.4)	
LOS Category			
0–5	133 (4.7)	42 (5.0)	
6–8	1005 (35.7)	320 (38.4)	
9–11	816 (29.0)	247 (29.7)	0.062
12–14	320 (11.4)	101 (12.1)	
≥15	542 (19.3)	123 (14.8)	
Type of diversion			0.12
Incontinent diversion	2249 (79.9)	638 (76.6)	
Neobladder	228 (8.1)	79 (9.5)	
Other	339 (12.0)	116 (13.9)	
Hospital volume (no. cystectomies)			
<10	1244 (44.2)	381 (45.7)	
10–49	966 (34.3)	275 (33.0)	0.71
≥50	606 (21.5)	177 (21.2)	
Hospital type			
Academic	2163 (76.8)	627 (75.3)	0.41
Non-academic	626 (22.2)	196 (23.5)	
Disposition			
Died	83 (2.9)	0 (0.0)	
Post-acute care facility	256 (9.1)	188 (22.6)	<0.0001
Routine home	1012 (35.9)	258 (31.0)	
Home healthcare	1465 (52.0)	387 (46.5)	

LOS: length of stay. †Chi square test between those readmitted and not readmitted.

Table 3. Multivariate analysis for predictors of 30-day readmission

Variable	OR (95% CI)
Age, years	
50–59 vs. <50	0.88 (0.56–1.38)
60–69 vs. <50	1.12 (0.73–1.71)
70–79 vs. <50	1.25 (0.80–1.95)
≥80 vs. <50	1.06 (0.66–1.70)
Race	
African American vs. Caucasian	1.64 (1.07–2.50)
Other vs. Caucasian	1.22 (0.69–2.16)
Comorbidity	
1 comorbidity vs. 0	1.27 (0.95–1.70)
2 comorbidities vs. 0	1.42 (1.06–1.91)
3 comorbidities vs. 0	1.56 (1.17–2.07)
Complications	
1 complication vs. no complications	1.02 (0.84–1.23)
2 complications vs. no complications	1.11 (0.86–1.44)
≥3 complications vs. no complications	0.90 (0.65–1.24)
LOS category, days	
LOS 6–8 vs. LOS 0–5	0.92 (0.62–1.34)
LOS 9–11 vs. LOS 0–5	0.81 (0.55–1.21)
LOS 12–14 vs. LOS 0–5	0.71 (0.46–1.11)
LOS ≥15 vs. LOS 0–5	0.43 (0.27–0.67)
Neobladder	
Neobladder vs. no neobladder	1.45 (1.09–1.93)
Hospital volume (no. cystectomies)	
10–49 vs. <10	1.04 (0.83–1.30)
≥50 vs. <10	1.10 (0.81–1.51)
Hospital type	
Academic vs. non-academic	1.00 (0.78–1.28)
Disposition	
Home healthcare vs. routine home	1.04 (0.87–1.26)
Post-acute care facility vs. routine home	3.79 (2.88–4.98)

OR: odds ratio; CI: confidence interval; LOS: length of stay.

Table 4. Multinomial regression model examining the factors associated with discharge to post-acute care facility versus being discharged to home*

Variable	OR (95% CI)
Age, years	
50–59 vs. <50	0.91 (0.38–2.18)
60–69 vs. <50	1.18 (0.53–2.65)
70–79 vs. <50	1.95 (0.86–4.41)
≥80 vs. <50	5.31 (2.31–12.2)
Race	
African American vs. Caucasian	0.83 (0.44–1.60)
Other vs. Caucasian	0.64 (0.20–2.01)
Sex	
Male vs. female	0.57 (0.42–0.77)
Insurance	
Medicaid vs. private	1.26 (0.63–2.53)
Self vs. private	1.89 (0.49–7.25)
Medicare vs. private	2.70 (1.82–4.02)
Complications	
1 complication vs. no complications	1.77 (1.31–2.40)
2 complications vs. no complications	3.02 (2.12–4.29)
≥3 complications vs. no complications	7.63 (5.30–10.9)
Neobladder	
Neobladder vs. no neobladder	0.35 (0.18–0.67)
Hospital volume (no. cystectomies)	
10 to 49 vs. <10	1.17 (0.84–1.63)
≥50 vs. <10	1.17 (0.72–1.90)
Hospital type	
Academic vs. non academic	0.57 (0.41–0.80)

*Comorbidity count is not included in the in-hospital mortality model because it was causing model convergence. OR: odds ratio; CI: confidence interval.

the facilities ability to handle complex post-surgical patients. Potential reasons for readmission from PACFs include: lack of knowledge caring for urostomies, continent diversions, surgical drains or gastrointestinal/nutritional status in cystectomy patients. However, there may be selection bias since patients admitted to PACFs are likely older and sicker with a more complicated initial hospital stay. A smaller cystectomy series (n = 400) from 2004 to 2007 from Vanderbilt researchers revealed no difference in readmission based on discharge to a facility compared to home or home with home healthcare.[11] Yet, they reported readmission rates between 32% and 38% for all types of discharge. In general surgery literature, discharge disposition to skilled care facilities has been associated with frequent readmissions, increased mortality, delayed recovery, and diminished quality of life.[12]

Increased length-of-stay was associated with decreased readmission, except for patients discharged between 0 to 5 days, although less than 5% of patients were discharged by day 5. An increased length-of-stay is viewed as having significant postoperative events, poor outcomes, and higher costs, but our data showed the opposite regarding readmission. Determining whether a lengthy primary hospital stay, short primary stay along with an indeterminate readmission length, or short primary stay along with a PACF stay is the best patient-centered and cost-conscious approach could be studied further. Potential reasons for decreased readmission in these patients include: complete return of bowel function, improved mobility, better wound healing, and longer prophylaxis for venous thromboembolism prior to discharge.

Surgeons generally select younger, healthier, more motivated patients for neobladder reconstruction. Yet, these patients had a 45% increased chance of readmission. Our data illustrate a need for greater perioperative counselling and attention to discharge planning in this cohort. Interestingly, neobladder cases were less likely to be discharged to PACFs possibly for the reasons mentioned above (facilities might not be comfortable managing reconstructive bladders). Alternatively, these patients may be younger, healthier, more educated with a stronger social support allowing discharge to home. Regardless, increased efforts with care coordination among neobladder patients may help reduce readmissions.

Although cystectomy cases are not subject to readmission penalties, hospitals may need to prepare for such inspection because there is high perioperative morbidity. We confirmed the morbidity revealing a 22.8% readmission, 55.2% complication, and 2.3% in-hospital mortality rate, which is similar to other published series.[7-9,13,14] We also revealed that treatment at higher-volume centres or academic centres was not protective or predictive of readmission. Academic centres were less likely to discharge patients to PACFs, which may be protective. Finally, since readmission is variable and fairly high for many major surgeries, at which level should hospitals be penalized? Adjustments for coexisting medical and social conditions may be needed to equalize hospital penalties.

The number of complications predicted early mortality but not hospital readmission, while the number of postoperative complications was associated with discharge to PACFs, which was associated with readmission. Other non-urologic studies have shown readmission increases as complications increase with up to a 4-fold increase in readmission with 1 or more complications.[15,16] The reasons for the differences may be due to the type of surgery, geographic location, or other unmeasured confounders. Previous reports have demonstrated worse outcomes based on race in bladder cancer. Possible explanations included delay in seeking care, presentation with advanced disease, and receiving surgery at lower-volume hospitals.[17,18] External data regarding readmission based on race are limited, but our data showed that the African American race was associated with an increased 30-day readmission.

Despite its strengths, there are limitations to our study. It is retrospective with inherent biases and the data reliability depends on how the variables were measured and recorded. Certain variables, such as patient performance status, surgeon volume, and case complexity, were not available. Although our study population included all patients in California, referral patterns may influence outcomes in certain circumstances. This could affect readmission interpretation related to hospital volume and academic affiliation. For example, academic hospitals likely do more complex cases that may result in a higher readmission rate. We reported similar readmission rates, which might actually indicate the academic centres are doing well. Also, this dataset does not have cancer staging or grade information or final pathology that could influence postoperative outcomes.

Conclusion

Cystectomy stands to face critical review in the "pay for performance" era, as about one-fifth of patients are readmitted within 30 days of surgery. Patients who are discharged to a PACF, African American, and with more extensive comorbidities had higher readmissions. Increased efforts with care coordination among these patients may help reduce readmissions.

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Appendix 1. Diagnosis codes used to calculate the comorbidity count

Diagnosis	ICD-9-CM Codes
Myocardial infarction	410,412
Congestive heart failure	428
Peripheral vascular disease	433.9, 441, 7854, V433
Cerebrovascular disease	430-438
Dementia	290
Pulmonary disease	490-496, 500-505
Connective tissue disorder	7100, 7101, 7104, 7140, 7141, 7142, 71481, 725
Peptic ulcer	531-534
Liver disease	5712, 5714, 5715, 5716
Diabetes	2500-2503, 2507
Diabetes complications	2504-2506
Paraplegia	342, 3441
Renal disease	582, 5830-5837, 585, 586, 588
Cancer†	140-172, 174-188, 190-195, 200-208
Metastatic cancer†	196-198, 1990, 1991
Severe liver disease	5722-5724, 5728
HIV	042-044

ICD-9-CM: International Classification of Diseases-Clinical Modification, 9th edition. †Bladder cancer is excluded from this condition.

Appendix 2. Treatment related complications based on the associated diagnosis and procedure codes	
Complication/Condition	**Diagnosis and Procedure Codes (ICD-9-CM)**
Cardiac	
AMI	Dx: 410, 410.0, 410.1, 410.2
CHF	Dx: 402.0, 402.1, 402.9, 428, 428.0, 428.1, 428.2, 428.3, 428.4, 428.9
Cardiac arrest	Dx: 427.5
Cardiac complications from procedure	Dx: 997.1
Respiratory	
Collapsed lung	Dx: 512, 512.1, 518.0 Sx: 46.04, 46.94
Pulmonary edema	Dx: 514, 518.4
Pneumonia/respiratory infection	Dx: 466, 466.0, 466.1, 480, 480.0, 480.1, 480.2, 480.3, 480.8, 480.9, 481, 482, 482.0, 482.1, 482.2, 482.3, 482.4, 482.8, 482.9, 483, 483.0, 483.1, 483.8, 485, 486
Respiratory failure	Dx: 518.5
Respiratory arrest	Dx: 799.1
Respiratory complications from procedure	Dx: 997.3
Pleural effusion	Dx: 511.9
Vascular	
Injury of abdominal blood vessels	Dx: 902, 902.0, 902.1, 902.2, 902.3, 902.4, 902.5, 902.8, 902.9
Pulmonary embolism/infarction	Dx: 415.1
Thrombophlebitis of deep vessels of lower extremities (DVT)	Dx: 451.1, 451.11, 451.19, 453.4, 453.40, 453.41, 453.42
Arterial embolism/thrombosis	Dx: 444.2, 444.8
Stroke	Dx: 433, 433.0, 433.1, 433.2, 433.3, 433.8, 433.9, 434, 434.0, 434.1, 434.9, 436, 435, 435.0, 435.1, 435.3, 435.8, 435.9
Vascular complication not specified	Dx: 451.2, 451.8, 451.9, 453.8, 453.9, 997.2, 999.2
Wound/bleeding	
Peritonitis	Dx: 567, 567.0, 567.1, 567.2, 567.3, 567.8, 567.9
Dehiscence/rupture of operative wound	Dx: 998.3
Postoperative infection	Dx: 998.5, 998.6
Hematoma/hemorrhage	Dx: 568.8, 596.7, 998.1 Sx: 51.98
Genitourinary	
Kidney infection	Dx: 590.1, 590.2, 590.8, 590.9
Kidney disorders NOS	Dx: 591, 593.3, 593.4, 593.5, 593.8, 593.9
Bladder infection	Dx: 595, 595.0, 595.3, 595.8, 595.9, 599, 599.0
Miscellaneous-medical	
Renal failure	Dx: 584, 584.5, 584.6, 584.7, 584.8, 584.9, 586
Shock	Dx:785.5, 995.0, 995.4, 998.0
Complications of blood transfusion	Dx: 999.1, 999.2, 999.3, 999.4, 999.5, 999.6, 999.7, 999.8
Lymphedema and disorders	Dx: 457.1, 457.8
Gastrointestinal complications/Bowel obstruction	Dx: 560, 560.1, 560.8, 560.9, 997.4
Fever	Dx: 780.6
Miscellaneous-surgical	
Intestinal repair resection	Sx: 58, 58.71, 58.73, 58.75, 58.79, 58.99
Colostomy/ileostomy	Sx: 58.1, 58.2
Liver repair/resection	Sx: 62.12, 62.5, 62.99
Repair bile duct	Sx: 63.6, 63.69
Repair/distal pancreatectomy	Sx: 64.42, 64.49
Splenic repair/splenectomy	Sx: 53.3, 53.53, 53.59
Surgical complications	Dx: 998.8, 998.9
Accidental laceration	Dx: 998.2
Foreign body/substance	Dx: 998.4, 998.7
Other	Dx: E870.0, E876.2, E876.5

ICD-9-CM: International Classification of Diseases-Clinical Modification, 9th edition; AMI: acute myocardial infarction; CHF: congestive heart failure; DVT: deep vein thrombosis; NOS: no evidence of disease.