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Postoperative complications, emergency department utilisation, and readmission after radical cystectomy

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Introduction There is minimal research on the types of complications patients experience after radical cystectomy (RC). Moreover, the impact of these complications is not well qualified. The primary purpose of this study is to qualify complications after RC and quantify rates of emergency department (ED) utilisation and readmissions to the hospital. The secondary purpose is to associate risk factors for ED visits and hospital readmission.

Material and methods Patients were retrospectively analysed, who underwent RC for bladder cancer. ED visits within 90 days of discharge from RC and readmission at both 30 and 31–90 days of discharge were collected. Complications were graded using the Clavien-Dindo system and classified using the Memorial Sloan-Kettering Cancer Center complication system.

Results Three hundred and eighty-six patients were included. The in-house complication rate before discharge was 36%, and the 90-day complication rate after discharge was 54.8%. 33.7% of patients had ≥1 ED visit postoperatively, 18.7% were readmitted within 30 days, and 17.3% within 31–90 days of discharge. The primary reason for ED presentation, readmission at 30 and 31–90 days was infection. Cutaneous ureterostomy (CU) was associated with greater likelihood of presentation to the ED and readmission 31–90 days postoperatively ($p < 0.01$). Overall survival (OS) was worse in patients who presented to the ED and/or were readmitted at both the 30- and 31–90-day marks ($p < 0.01$).

Conclusions ED utilisation and readmission rates after RC are high. The most common complication is infection. Patients with a CU are at higher risk for healthcare utilisation. OS is worse in patients with an ED visit or readmission to the hospital, and these patients may require closer monitoring.

Key Words: radical cystectomy ‹› emergency department ‹› readmission ‹› bladder cancer

INTRODUCTION

Radical cystectomy (RC) for bladder cancer is a procedure urologists perform with high morbidity and mortality. Outcomes for RC are well reported in the literature. Estimates are around 50% for postoperative complications within 3 months of surgery [1]. Further, oncologic outcomes have been extensively published, with disease-free survival at 5 years ranging from 53 to 74%, cancer-specific survival 66 to 80%, and overall survival (OS) 61 to 80% [2]. Most current research focuses on how to minimise immediate postoperative complications and/or maximise patient survival. This is critical information that warrants considerable time studying. However, there is a paucity of research on the types of complications patients experience after RC. Moreover, the impact of these complications is not well qualified, namely emergency department (ED) utilisation and readmission rates after RC.

Because RC has such high postoperative morbidity, it is surprising that more papers do not qualify the specific types of complications patients experience, but rather the grade of complication alone. Shabsigh et al. attempted to qualify complication type after RC into 11 categories, in what has become known as the Memorial Sloan-Kettering Cancer Center (MSKCC) complication system [3]. Using this framework, some have noted that either urinary tract infections (UTIs) or gastrointestinal (GI) complications are the most common postoperative complications, but there is no consensus on this [4, 5]. ED visits after RC are also difficult to quantify, with some estimates around 7–14% up to 90-days after surgery [4, 6]. Readmission rates are slightly better understood: around 23–28% at 30 days postoperatively and about 39% within 90 days of surgery, but additional study is still lacking [6–8]. Moreover, models that can predict risk factors for patients who are most likely to visit the ED after surgery and/or be readmitted are needed.

The primary purpose of this study is to qualify complications after RC and quantify rates of ED utilisation and readmissions to the hospital. The secondary purpose of this paper is to associate risk factors for ED visits and readmission to the hospital.

MATERIAL AND METHODS

After obtaining Atrium Health Wake Forest Baptist Medical Center institutional review board approval (IRB00100649), a retrospective analysis of all patients who underwent RC at our institution from 2012 to 2023 was conducted. All operations were performed for a diagnosis of bladder cancer, and any patients who had a cystectomy performed for non-oncologic purposes were excluded. A total of 8 operating surgeons were included, all of whom had either completed a urologic oncology fellowship and/or had been in practice as an attending urologist for at least 10 years,

A variety of preoperative and perioperative variables including patient age, gender, race, body mass index (BMI), Charlson Comorbidity Index (CCI), comorbidities (diabetes, hypertension, chronic obstructive pulmonary disease [COPD], and coronary artery disease [CAD]), urinary diversion type, operative approach, operative time (OT), length of stay (LOS), and tumour pathology were collected. Neoadjuvant and adjuvant chemotherapy was inconsistently documented in the medical record and so was not included. ED visits were tracked within the first 90 days of discharge from the hospital for RC, as well as the reason for ED visit based on MSKCC standardised complications [3]. All reasons for ED visits or readmission were counted for each patient such that some patients had multiple causes for an ED visit or readmission. Readmissions to the hospital were charted at both 30 and 31–90 days from discharge after RC along with the reason for readmission using MSKCC criteria. Most recent-follow up, OS, and cancer-specific survival were also collected on each patient. All patients received a phone call from clinic staff approximately 3 days after discharge from RC to assess how they were doing postoperatively and were seen in clinic within one month of RC by the operating surgeon. Postoperative follow-up after this was based on provider discretion.

The independent samples t-test was used to compare continuous variables for analysis involving 2 groups. The chi-squared test was used to compare categorical variables for analysis involving 2 or more groups. Because only 2 patients in the study received an Indiana pouch, they were excluded from any analysis on urinary diversion type. Based on univariable analysis showing a significant difference in ED visitation and readmission 31–90 days after discharge by diversion type, binary logistic regression was also run with 2 separate outcomes: ED visitation, and readmission 31–90 days after discharge from RC. Variables with $p < 0.01$ and/or clinical relevance were selected for inclusion in the binary logistic regression model ensuring no collinearity between variables. Kaplan-Meier survival curves with log-rank test were created to compare OS between patients who did and did not present to the ED after discharge as well as patients who were and were not readmitted 30 days and 31–90 days after discharge from RC. All statistical analysis was performed using SPSS Statistics Version 28 (Armonk, NY). Clinical significance was set at $p < 0.05$.

Bioethical standards

The study was approved by Atrium Health Wake Forest Baptist Medical Center institutional review board approval (approval No. IRB00100649).

RESULTS

A total of 386 patients met the inclusion criteria for analysis in the study. The full complement of patient demographics can be found in Table 1. Of these, 78 (20.2%) were women. The median age at surgery was 68 years, and the median CCI was 5. In total, 219 (56.7%) patients had an open RC and 167 (43.3) had robotic RC. Most patients had an ileal conduit diversion (n = 317, 82.3%), followed by cutaneous ureterostomy (CU; n = 50, 13%), percutaneous nephrostomy tube (PCN; n = 9, 2.3%), neobladder (n = 8, 2.1%), and Indiana pouch (n = 2, 0.52%). The median length of stay (LOS) was 5 days, and the median OT was 348 minutes. One hundred and thirty-seven (35.5%) patients had a complication before ever being discharged from the hospital during initial stay, of which 59 (43%) were Clavien grade I, 45 (32.8%) grade II, 8 (5.8%) grade IIIa, 6 (4.4%) grade IIIb, 3 (2.2%) grade IVa, 12 (8.8%) grade IVb, and 4 (3%) grade V. Mean follow-up was 35 months, and 171 (44.3%) patients had died by the end of the study window with a median OS of 12 months. One hundred and fifteen deaths (67.3%) were due to bladder cancer specifically. Postoperatively, 130 (33.7%) patients had at least one ED visit postoperatively. The primary reason for the first ED visit after RC was infectious aetiologies (n = 47), followed by GI (n = 26), and then GU reasons (n = 23). No significant differences were seen in OT, operative approach, LOS, age at surgery, gender, race, CCI, or medical comorbidities aside from hypertension between patients who did and did not present to the ED within 90 days after discharge from RC ($p > 0.05$). Diversion type differed based on ED visits, with a significantly greater proportion of CU patients visiting the ED after discharge ($p < 0.001$). Postoperative complications prior to discharge from RC, Clavien-Dindo grade, and tumour pathology were not significantly different ($p > 0.05$). OS was significantly longer in patients who did not present to the ED within 90 days of discharge from RC (Figure 1A; $p = 0.001$). On multivariable logistic regression, CU diversion patients were 3 times more likely to visit the ED relative to ileal conduit patients when controlling for gender, operative approach, tumour pathology, and race (Table 5; $p < 0.001$).

Table 1. *Demographics of the study population. The following table lists baseline demographic, surgical, and postoperative characteristics of the study population. Numbers listed are either total with percentages for categorical variables in parentheses, or medians with interquartile ranges for continuous variables*

Variable	Total (%) or Median (IQR)
Patients	386
Age at surgery (years)	68 (60–74)
Female	78 (20.2)
Race	
Caucasian	337 (87.3)
Black	38 (9.8)
Hispanic	3 (0.78)
Asian	3 (0.78)
Other	5 (1.3)
Hypertension	203 (52.6)
Diabetes	94 (24)
Coronary artery disease	70 (18.1)
COPD	49 (12.7)
CCI	5 (4–6)
Approach	
Open	219 (56.7)
Robotic	167 (43.3)
Diversion	
Ileal conduit	317/386 (82.1)
Indiana pouch	2/386 (0.5)
Neobladder	8/386 (2.1)
Cutaneous ureterostomy	50/386 (13)
PCN	9/386 (2.3)
LOS	5 (4–7)
Operative time (minutes)	348 (296–402)
Complication before discharge	139 (36)
Reason for complication	
Infectious	16
Bleeding	10
Surgical	6
Genitourinary	23
Gastrointestinal	25
Wound	12
Thromboembolic	4
Cardiac	23
Pulmonary	6
Neurological	6
Miscellaneous	4
Clavien-Dindo grade	
I	59 (43.1)
II	45 (32.8)
IIIa	8 (5.8)
IIIb	6 (4.4)
IVa	3 (2.2)
IVb	12 (8.8)
V	4 (3)

Table 1. *Continued*

Variable	Total (%) or Median (IQR)
Tumour pathology	
T0	45/383 (11.7)
Ta	13/383 (3.4)
Tis	28/383 (7.3)
T1	30/383 (7.8)
T2a	63/383 (16.4)
T2b	55/383 (14.4)
T3a	50/383 (13.1)
T3b	32/388 (8.4)
T4a	59/383 (15.4)
T4b	8/383 (2.1)
Follow-up (months)	13 (4–33.8)
ED visit within 90 days of discharge	130 (33.7)
Number of ED visits	1 (1–2)
Readmission within 30 days of discharge	72 (18.7)
Readmission 31–90 days from discharge	67 (17.3)
≥1 readmission ≤90 days from discharge	115 (29.8)
Died	171 (44.4)
Cancer-specific death	115/160 (71.9)
Overall survival (months)	12 (4–25)

CCI – Charlson Comorbidity Index; COPD – chronic obstructive pulmonary disease; LOS – length of stay; PCN – percutaneous nephrostomy

For 30-day readmissions, 72 (18.7%) patients were readmitted (Table 2). The most common reason for readmission was infectious (n = 24), then GI (n = 20), and GU (n = 10) aetiologies. No significant differences were seen in OT, operative approach, urinary diversion type, LOS, age at surgery, gender, race, CCI, or medical comorbidities aside from hypertension between patients who were and were not readmitted within 30 days of discharge from RC (p >0.05). Postoperative complications during initial hospital stay were more common in patients who were not readmitted within 30 days of RC (p = 0.031). Clavien-Dindo grade and tumour pathology were not significantly different (p >0.05). OS was greater in patients not readmitted within 30 days of RC (Figure 1B; p <0.001).

Sixty-seven (17.3%) patients were readmitted between 31 and 90 days of discharge from RC. The most common reason for readmission was infectious (n = 27), then GU (n = 16), and GI (n = 13) aetiologies. No significant differences were seen in OT, operative approach, LOS, age at surgery, gender, race, CCI, or medical comorbidities aside from COPD between patients who were and were not readmitted within 90 days of discharge from RC (p >0.05). Diversion type differed based on 31–90-day readmis-

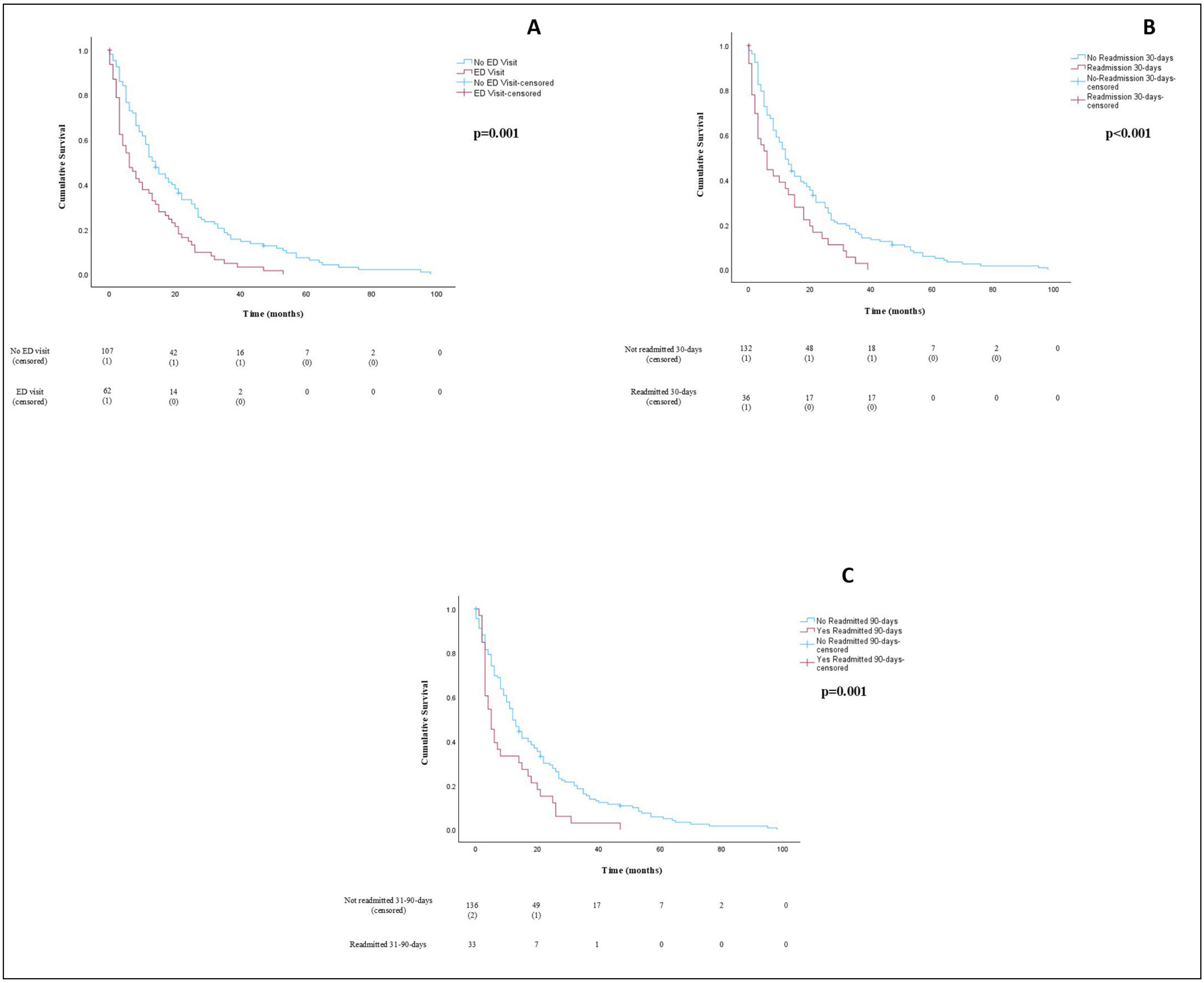

Figure 1. *Kaplan-Meier survival curve. The following figure compares overall survival based on:* **A)** *ED visit versus no ED visit after discharge;* **B)** *Readmission versus no readmission 30 days after discharge;* **C)** *Readmission 31–90 days after discharge. Overall survival is in months on the x-axis, and cumulative survival is displayed on the y-axis. Each death during the study window was recorded as an event for the survival curve. Censored patients are displayed with a hash mark on the graphs. Log-rank values are displayed on each graph. Number at risk table is also provided under each graph.*

sion status, with a significantly greater proportion of CU patients readmitted (p <0.001). Postoperative complications during initial hospital stay and Clavien-Dindo grade were not significantly different (p >0.05). Tumour pathology differed between those who were and were not readmitted between 31 and 90 days of discharge from RC, with a greater proportion of higher-stage tumours in patients readmitted (p = 0.042). OS was greater in patients not readmitted within 31–90 days of RC (Figure 1C; p = 0.001).

Table 2. *Risk factors for emergency department visits after discharge from radical cystectomy. The following compares patient variables between those who did and did not present to the ED after RC to identify risk factors for ED utilisation. The first row shows the MSKCC reasons for ED visitation. Numbers listed are either totals with percentages for categorical variables in parentheses or means with standard deviations for continuous variables. Indiana pouch patients are not listed because they were excluded from analysis. Associated p-values are also listed for each comparison*

Variable	ED visit (n = 130)	No ED visit (n = 256)	p-value
Reason for first ED visit			
Infectious	47	–	–
Bleeding	4		
Surgical	3		
Genitourinary	23		
Gastrointestinal	26		
Wound	13		
Thromboembolic	4		
Cardiac	4		
Pulmonary	6		
Neurological	0		
Miscellaneous	0		
Operative time (minutes)	355.2 (101.8)	346 (89.2)	0.389
LOS (days)	7.2 (8.8)	17.2 (139)	0.410
Age (years)	67 (9)	66.4 (11.1)	0.588
CCI	5.1 (2)	5.4 (2)	0.147
Female	33 (25.4)	45 (17.6)	0.071
Race	–	–	0.295
Approach			
Open	81 (62.3)	138 (53.9)	0.115
Robotic	49 (37.7)	118 (46.1)	
Diversion			
Ileal conduit	95 (73)	222 (88)	<0.001
Neobladder	5 (3.8)	3 (1.2)	
Cutaneous ureterostomy	29 (22.3)	21 (8.3)	
PCN	1 (0.8)	8 (3.1)	
Postoperative complication prior to discharge	52 (40)	85 (33.2)	0.392
Clavien-Dindo grade	–	–	0.527
Tumour pathology	–	–	0.138
Diabetes	38 (29.2)	54 (21)	0.076
Hypertension	80 (61.5)	123 (48)	0.012
Coronary artery disease	26 (20)	44 (17.1)	0.498
COPD	12 (9.2)	37 (14.5)	0.145
Overall survival (months)	11.3 (12.2)	20.8 (20.4)	0.001

CCI – Charlson Comorbidity Index; COPD – chronic obstructive pulmonary disease; LOS – length of stay; PCN – percutaneous nephrostomy

Table 3. *Risk factors for 30-day readmission after discharge from radical cystectomy. The following compares patient variables between those who were and were not readmitted to the hospital after RC within 30 days of discharge to identify risk factors for 30-day readmission. The first row shows the MSKCC reasons for readmission. Numbers listed are either totals with percentages for categorical variables in parentheses or means with standard deviations for continuous variables. Indiana pouch patients are not listed because they were excluded from analysis. Associated p-values are also listed for each comparison*

Variable	Readmission 30-days (n = 72)	No readmission 30-days (n = 314)	p-value
Reason for readmission			
Infectious	24	–	–
Bleeding	2		
Surgical	2		
Genitourinary	10		
Gastrointestinal	20		
Wound	8		
Thromboembolic	4		
Cardiac	3		
Pulmonary	3		
Neurological	0		
Miscellaneous	2		
Operative time (minutes)	359.6 (97.2)	346.7 (92.6)	0.297
Length of stay (days)	7.4 (10.3)	15.3 (125.4)	0.594
Age (years)	66.4 (11)	66.9 (9.4)	0.749
CCI	4.9 (1.8)	5.4 (2)	0.064
Female	17 (23.6)	61 (19.4)	0.425
Race	–	–	0.347
Approach			
Open	81 (62.3)	138 (53.9)	0.115
Robotic	49 (37.7)	118 (46.1)	
Diversion			
Ileal conduit	55 (76.4)	262 (84.5)	0.288
Neobladder	2 (2.8)	6 (1.9)	
Cutaneous ureterostomy	14 (19.4)	36 (17.1)	
PCN	1 (1.4)	8 (2.6)	
Postoperative complication prior to discharge	18 (25)	121 (38.5)	0.031
Clavien-Dindo grade	–	–	0.104
Tumour pathology	–	–	0.138
Diabetes	38 (29.2)	54 (21)	0.076
Hypertension	80 (61.5)	123 (48)	0.012
Overall survival (months)	10.5 (11.2)	19.3 (19.5)	<0.001

CCI – Charlson Comorbidity Index; COPD – chronic obstructive pulmonary disease; PCN – percutaneous nephrostomy

On multivariable logistic regression, CU diversion patients were 3.47 times more likely to be readmitted 31–90 days after discharge from RC relative to ileal conduit patients when controlling for gender, operative approach, tumour pathology, and race (Table 6; p <0.001).

DISCUSSION

The complication frequency in our cohort after RC was in line with previous publications. Thirty-six per cent of patients had some form of complication after RC before discharge from the hospital, and 75.9% of these were low grade (≤ grade II). Other literature has reported in-house complication rates around 35% [9]. When also including complications after discharge requiring readmission within 90 days of discharge, the complication rate was 54.8%. Current meta-analysis estimates are that ~60% of patients will experience a complication within 90 days of RC, concurring with our findings [1, 9, 10].

We saw that prior to discharge from RC, GI and GU causes were the most likely type of complication, with infectious aetiologies a distant third. However, for both 30- and 90-day readmissions, infection was the most common complication. In their 90-day analysis of morbidity and mortality from RC, Hirobe et al. [4] noted that UTI was the most frequent complication patients experienced, followed by wound infections and then paralytic ileus. Yuh et al. [11] found an overall greater rate of complications in their RC analysis (80%) than our study, but in terms of classifications, infectious was most common after RC. Katsimperis et al. [10] elected to separate UTI and infectious complications in their classification system, but again found that 25% of all postoperative complications could be attributed to either of these issues. A unique strength of our study is the additional inclusion of complications prior to discharge, which appears to differ in classification from those seen after discharge based on our results. Maibom et al. [9] attempted to identify risk factors for specific RC complications in their meta-analysis. They saw mixed results but noted that continent reservoirs over ileal conduits may be a risk factor for postoperative UTI, as is a higher CCI [9]. Looking at GI complications, it appears that increasing age is most likely to contribute to an increased risk of these issues [9]. Further study is needed to properly identify risk factors of each MSKCC complication type after RC.

We found that 33.7% of our RC cohort presented to the ED at least once postoperatively within 90 days of discharge. The most common reason for an ED visit was an infectious aetiology, followed by GI and GU reasons. Baack Kukreja et al. [12] reported an over-

Table 4. *Risk factors for 90-day readmission after discharge from radical cystectomy. The following compares patient variables between those who were and were not readmitted to the hospital after RC within 30 days of discharge to identify risk factors for 90-day readmission. The first row shows the MSKCC reasons for readmission. Numbers listed are either totals with percentages for categorical variables in parentheses or means with standard deviations for continuous variables. Indiana pouch patients are not listed because they were excluded from analysis. Associated p-values are also listed for each comparison*

Variable	Readmission 90-days (n = 67)	No readmission 90-days (n = 319)	p-value
Reason for readmission			
Infectious	27	–	
Bleeding	1		
Surgical	2		
Genitourinary	16		
Gastrointestinal	13		
Wound	5		
Thromboembolic	3		
Cardiac	4		
Pulmonary	4		
Neurological	0		
Miscellaneous	1		
Operative time (minutes)	344.1 (93.3)	350 (93.8)	0.641
Length of stay (days)	7.9 (10.9)	6.4 (5.5)	0.255
Age (years)	65.9 (12.8)	66.8 (8.8)	0.575
CCI	5.3 (2.1)	5.3 (1.9)	0.937
Female	15 (22.4)	63 (19.7)	0.625
Race	–	–	0.208
Approach			0.418
Open	41 (61.2)	178 (55.8)	
Robotic	26 (38.8)	141 (44.2)	
Diversion			<0.001
Ileal conduit	45 (67)	272 (86.3)	
Neobladder	0	8 (2.5)	
Cutaneous ureterostomy	20 (30)	30 (9.5)	
PCN	2 (3)	7 (2.2)	
Postoperative complication prior to discharge	20 (29.8)	119 (37.3)	0.248
Clavien-Dindo grade	–	–	0.590
Tumour pathology			0.042
T0	8/66 (12.1)	37/317 (11.7)	
Ta	1/66 (1.5)	12/317 (3.8)	
Tis	2/66 (3)	26/317 (8.2)	
T1	1/66 (1.5)	29/317 (9.2)	
T2a	6/66 (9.1)	57/317 (9.1)	
T2b	12/66 (18.2)	43/317 (13.6)	
T3a	12/66 (18.2)	38/317 (12)	
T3b	10/66 (15.2)	22/317 (6.9)	
T4a	13/66 (19.7)	46/317 (14.5)	
T4b	1/66 (1.5)	7/317 (2.2)	
Diabetes	19 (28.4)	73 (22.9)	0.339
Hypertension	40 (59.7)	163 (51.1)	0.200
Coronary artery disease	12 (17.9)	58 (18.2)	0.624
COPD	2 (3)	47 (14.7)	0.009
Overall survival (months)	10.4 (11)	19.6 (19.4)	0.001

CCI – Charlson Comorbidity Index; COPD – chronic obstructive pulmonary disease; PCN – percutaneous nephrostomy

Table 5. *Regression model for emergency department visitation after radical cystectomy. The following table is a binary logistic regression model with emergency department visit after radical cystectomy as the outcome. For urinary diversion, ileal conduit is the referent group. Indiana pouch patients are not listed because they were excluded from analysis*

Variable	B	SE	Significance	Exp(B)	95% CI	
					Upper	Lower
Gender	0.48	0.27	0.078	1.6	0.95	2.75
Approach	–0.28	0.23	0.23	0.76	0.48	1.19
Diversion	–	–	0.003	–	–	–
Ileal conduit	Referent	–	–	–	–	–
Neobladder	1.39	0.77	0.070	4.0	0.89	18.0
CU	1.10	0.32	<0.001	3.0	1.59	5.66
PCN	–1.22	1.07	0.25	0.29	0.036	2.41
Tumour pathology	0.015	0.045	0.73	1.02	0.93	1.11
Race	–0.012	0.18	0.95	0.99	0.70	1.40

B – unadjusted odds ratio; CI – confidence intervals; CU – cutaneous ureterostomy; Exp(B) – adjusted odds ratio; PCN – percutaneous nephrostomy; SE – standard error

Table 6. *Regression model readmission 31–90 days after radical cystectomy. The following table is a binary logistic regression model with emergency visit after radical cystectomy as the outcome. For urinary diversion, ileal conduit is the referent group. Indiana pouch patients are not listed because they were excluded from analysis*

Variable	B	SE	Significance	Exp(B)	95% CI	
					Upper	Lower
Gender	0.17	0.34	0.61	1.19	0.61	2.31
Approach	–0.14	0.28	0.63	0.87	0.50	1.53
Diversion	–	–	0.01	–	–	–
Ileal conduit	Referent	–	–	–	–	–
Neobladder	–19.20	14156.22	0.99	0.001	0.001	–
CU	1.24	0.35	<0.001	3.47	1.76	6.83
PCN	0.60	0.83	0.47	1.82	0.36	9.17
Tumour pathology	0.11	0.06	0.063	1.11	0.99	1.25
Race	–0.017	0.23	0.94	0.99	0.62	1.56

B – unadjusted odds ratio; CI – confidence intervals; CU – cutaneous ureterostomy; Exp(B) – adjusted odds ratio; PCN – percutaneous nephrostomy; SE – standard error

all ED visit rate of 38.5% after RC and found that differences in management recovery pathways had no effect on likelihood of an ED visit. Spencer et al. [6] found that 14% of their RC cohort who were not readmitted still required an ED visit after surgery. Hirobe et al. [4] found that 7% of their RC cohort required an ED visit despite not being readmitted to the hospital. Our overall ED visit rate is similar to much of the current body of literature, although studies are too limited to compare. On univariable analysis, history of hypertension was significantly associated with an ED visit after RC. There is almost no current information on risk factors for ED department utilisation after RC, but it has been well established that cardiopulmonary comorbidities are a risk factor for increased ED utilisation after major surgeries in other fields [13]. CU diversions also were a risk factor for ED visitation after RC, and they remained significant on logistic regression. While there is literature on the relationship between diversion and readmission status, little exists on ED utilisation, and more work is needed in this area. OS was also worse in those who presented to the ED. It is not unexpected that patients who required an ED visit fared worse postoperatively, and these may be patients who providers need to follow closer. We also feel our results highlight the need for standard protocol development in patient management after RC to reduce ED utilisation overall.

Readmissions to the hospital were within established ranges in our patient population, but few modifiable risk factors were seen on analysis. Some researchers have identified neobladder as a risk factor for readmission after RC [14–17]. Others have not found an association between readmission to the hospital and any urinary diversion [18]. CU is not included in many current papers and is a unique risk factor for readmission in the 31–90-day window after discharge we identified in our patient population, which remained significant on logistic regression. While Kim et al. [15] did not study CU, they did find urinary diversion only played a role in the likelihood of readmission in the late period after RC (31–90 days), which we similarly discovered. This finding could be explained in 2 ways: 1) CU is usually done in patients with multiple co-morbidities and who are more fragile. These patients usually require a shorter OT, and for this reason, a CU is selected as the urinary diversion of choice; 2) stents for CU are typically removed during the first month, and the risk of stricture requiring re-stenting and readmission is thus increased. It is due to this second point that some urologists recommend prolonged stenting for CU [19]. Postoperative complications prior to discharge were also associated with a lower rate of readmission in the 30-day window after discharge. Minillo et al. [20] found that LOS ≥15 days predicted lower likelihood of readmission after RC. LOS was not associated with readmission in our study, but patients with postoperative complications may have closer follow-up and monitoring secondary to complex hospital stays leading to less need for readmission long-term after RC. As seen with ED visits, OS was worse in those who were readmitted after RC; providers need to follow these patients closer postoperatively.

We acknowledge that our study is inherently limited by its retrospective nature, most notably due to selection bias in our cohort. Furthermore, we cannot fully account for ED visits and readmissions outside of our healthcare system. Moreover, we elected to limit our analysis to 90 days of discharge from RC and so cannot comment on complications outside of this window. While we did have standardised follow-up criteria in the first month after surgery for the study cohort, it was up to provider discretion after this, which limits the strength of our conclusions. Though the MSKCC criteria for complication after RC are widely employed, other urologists may elect to categorise complications in a different way than we did for our analysis. Lastly, we did not have a full complement of neoadjuvant or adjuvant chemotherapy regimens on all patients, and so no analysis was performed on these potentially confounding variables. Strengths of our study include a large sample size and capturing ED visits, which many studies lack. Furthermore, we identified risk factors for ED visitation and readmission, which can guide practitioners in appropriate management after RC.

CONCLUSIONS

The complication rate after RC is high both during initial hospital stay and within the first 90 days after discharge. Nevertheless, most complications are low grade. ED utilisation after RC remains poorly understood, but our results indicate that around one-third of patients will have at least one ED visit within the first 90 days of discharge from RC. Readmission rates are also high, 30 and 31–90 days after discharge. The most likely reason for ED presentation and readmission is infection, with GI and GU as the next most common. CU diversion appears to be a risk factor for ED visits and readmission 90 days after discharge from RC, which is a novel finding. Postoperative complications may also be associated with lower readmission rates to the hospital within 30 days of discharge, but further research is needed. OS is worse for patients who presented to the ED and who were readmitted at the 30- and 31–90-day intervals, which is not unexpected given that these patients often had more complex postoperative issues.

We feel that our findings have multiple implications for physicians' practice. Preoperatively, patients should be counselled appropriately in terms of both the likelihood and type of complications to expect after RC. Urologists should also fully consider all diversion options for patients in preoperative planning for RC, making note of our analysis showing increased ED use and readmission with CU. Furthermore, ED providers can be better educated on RC patients, specifically the most likely reasons for patient presentation to the ED and how to appropriately triage and manage them. Patient management protocols after RC also remain an area open to further research to better improve care for RC. Ultimately, healthcare utilisation after RC is high, and measures to identify these patients most at risk early on after RC can help prevent excess strain on the system and lead to cost savings in the future.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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ETHICS APPROVAL STATEMENT

The study was approved by Atrium Health Wake Forest Baptist institutional review board approval (approval No. IRB00100649).

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