UROLOGYPRACTICE

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Utilization and Perioperative Outcomes of Partial Cystectomy for Urothelial Carcinoma of the Bladder: Lessons from the ACS NSQIP Database

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Abstract

Introduction: We identified predictors of partial cystectomy in the ACS NSQIP® database of more than 400 hospitals across North America. We also reviewed perioperative outcomes.

Methods: We reviewed the records of patients with an ICD-9 diagnosis of urothelial carcinoma of the bladder who were treated with partial or radical cystectomy from 2007 to 2012. The proportion of patients who underwent partial vs radical cystectomy and the proportion who received neoadjuvant chemotherapy were compared across time. We reviewed 30-day morbidity and mortality, and determined risk factors. Logistic regression was used to identify factors predictive of undergoing partial vs radical cystectomy.

Results: A total of 2,393 patients met study inclusion criteria. The ratio of partial to radical cystectomy was low and stable at 0% to 7% ($p = 0.36$). While patients undergoing radical cystectomy were more likely to receive neoadjuvant chemotherapy in later years ($p < 0.001$), neoadjuvant chemotherapy use before partial cystectomy was consistently low with time ($p = 0.68$). The 30-day morbidity rate after partial and radical cystectomy was 23.3% and 58.1% ($p = 0.001$), and the 30-day mortality rate was 1.6% and 2.1%, respectively ($p = 0.66$). On multivariate regression factors independently associated with partial vs radical cystectomy were cerebrovascular accident history (OR 4.4, $p = 0.005$), current nonsmoking (OR 0.43, $p = 0.032$) and lack of trainee participation in the operation (OR 0.28, $p < 0.001$).

Conclusions: The ratio of the number of partial to radical cystectomies performed was stable. Cerebrovascular accident history, nonsmoker status and lack of trainee participation were associated with partial cystectomy. Patients treated with radical cystectomy but not those who underwent partial cystectomy were more likely to receive neoadjuvant chemotherapy in later years. Large detailed registries such as ACS NSQIP have important potential use for evaluating trends in urological practice.

Key Words: urinary bladder neoplasms, cystectomy, physician's practice patterns, neoadjuvant therapy, drug therapy

Abbreviations and Acronyms

ACS = American College of Surgeons

ASA = American Society of Anesthesiologists®

BMI = body mass index

CVA = cerebrovascular accident

INR = international normalized ratio

NAC = neoadjuvant chemotherapy

NIS = Nationwide Inpatient Sample

PC = partial cystectomy

PCI = percutaneous coronary intervention

PRBC = packed red blood cells

RC = radical cystectomy

SEER = Surveillance, Epidemiology and End Results

SSI = surgical site infection

TIA = transient ischemic attack

UCB = urothelial carcinoma of bladder

Partial cystectomy is considered a definitive treatment option in select patients with UCB who satisfy certain pathological criteria, including a solitary tumor 5 cm or less located at the bladder dome or in a diverticulum, absent concomitant carcinoma in situ, ability to achieve a 1 to 2 cm surgical margin without ureteral reimplantation and adequate bladder capacity, or in patients who are deemed unsuitable candidates for RC.[1–4] These criteria exist independent of the status of NAC in the treatment regimen.

Submitted for publication September 11, 2014.

The ACS NSQIP and the hospitals participating in the ACS NSQIP are the source of the data used herein. They have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

No direct or indirect commercial incentive associated with publishing this article.

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2352-0779/15/23-109/0
UROLOGY PRACTICE

http://dx.doi.org/10.1016/j.urpr.2014.10.003
Vol. 2, 109-114, May 2015
Published by Elsevier

Recent reports also endorsed PC as an efficacious definitive therapy in patients with stage cT2N0 who achieve cT0 status after NAC and fit certain pathological criteria.[5−7] Thus, although RC remains the gold standard treatment for muscle invasive bladder cancer, indications for PC have expanded in the NAC era. However, the extent to which this bladder preserving approach has been adopted in the United States is unclear. Recent studies showed a decrease in PC use[8,9] or suggested that the procedure may be overused in certain circumstances.[8,10]

Several national registries track surgical procedures performed in the United States, allowing for examination of practice trends and outcomes with time. ACS NSQIP, a risk adjusted, case weighted complication tracking database that reports 30-day outcomes of various operations, is used extensively in quality improvement initiatives.[11−13] Initially developed at the VHA (Veterans Health Administration), the program was expanded after publication of the Patient Safety in Surgery Study and now includes more than 400 academic and community institutions.[11,12] Its comorbidity data makes this database ideal to identify clinical factors associated with procedure use and operative morbidity.

We elucidated PC and RC use trends with time, identified demographic and clinicopathological factors associated with PC use and assessed 30-day morbidity and mortality via analysis of ACS NSQIP.

Methods

We queried the ACS NSQIP database for patients with UCB (ICD-9 codes 188.0 to 188.9, 223.3 and 233.7) who underwent RC (CPT codes 51570 to 51597) or PC (51550 to 51565) between 2007 and 2012. CPT code 51598, representing RC in the setting of total pelvic exenteration for gynecologic malignancy, was excluded from analysis. Patients with bladder cancer of nonurothelial histology were also excluded.

The trend in the proportion of PC vs RC performed from 2007 to 2012 was assessed using the chi-square test. This was repeated to determine the trends of NAC and neoadjuvant radiotherapy, defined as radiotherapy within 90 days preoperatively, in all patients and for each modality (PC vs RC). Although the NSQIP data dictionary specifies that chemotherapy was noted within 30 days preoperatively, a study citing personal communication with NSQIP administrators confirmed that chemotherapy received before 30 days was recorded if there was intent to perform cystectomy as in NAC.[13]

Clinical and demographic features associated with PC vs RC were assessed by the chi-square test for categorical variables and the Student t-test for continuous variables. Predictors of PC use were further examined by logistic regression analysis with variables significant on univariate analysis included in the multivariate model. Evaluated predictors included baseline laboratory values, demographics, perioperative data and an extensive list of medical comorbidities. The multivariate model was adjusted for operative year to avoid confounding due to the changing composition of ACS NSQIP.

We investigated 30-day morbidity and mortality outcomes with a Cox proportional hazards model to determine predictive clinical and demographic features, including surgery type (PC vs RC), collapsed during the entire study period. The Kaplan-Meier method was used to compare 30-day mortality and 30-day morbidity-free survival for PC vs RC using the log rank test. For patients with multiple postoperative morbidity events analysis was based on time to the first event. Complications were not assigned a Clavien classification due to the lack of data in ACS NSQIP on the interventions prompted by each complication. Statistical analysis was done with SPSS®, version 21.0. The 2-sided test was used with statistical significance considered at $p \leq 0.05$.

Results

The proportion of PC vs RC cases remained low but stable at 4.3% to 7.4% from 2007 to 2012 ($p = 0.36$). NAC use increased from 5.3% in 2007 to 20.8% in 2012 ($p < 0.001$). Substratification by surgical modality revealed that NAC trended upward for RC but not for PC ($p < 0.001$ vs 0.68). Neoadjuvant radiotherapy use remained stable with time in the RC cohort at 0% to 1.2% ($p = 0.42$). No patient who underwent PC received neoadjuvant radiotherapy.

Table 1 lists clinical and demographic characteristics. Mean ± SD age was similar in the PC and RC groups (67.9 ± 15 vs 68.6 ± 10.4 years, $p = 0.48$). Of the patients 75.6% were male, 83.1% were white, 73% had an ASA® score of greater than 2 and about 70% had a BMI of greater than 25 kg/m^2. BMI distribution differed significantly between the groups. More patients treated with PC had a BMI of 35 to 40 kg/m^2 (14.7% vs 7.5%) but fewer had a BMI of greater than 40 kg/m^2 (2.3% vs 4.2%) (entire distribution $p = 0.03$).

Table 1.
Demographic characteristics of patients with UCB who met study inclusion criteria

	No. PC (%)	No. RC (%)	Total No. (%)	p Value
Gender:				0.74
Male	96 (74.4)	1,712 (75.7)	1,808 (75.6)	
Female	33 (25.6)	549 (24.3)	582 (24.4)	
Unknown			3 (0.1)	
Race:				0.44
White	110 (94.0)	1,880 (94.4)	1,990 (83.2)	
Black	4 (3.4)	86 (4.3)	90 (3.8)	
Other	3 (2.6)	25 (1.3)	28 (1.2)	
Unknown	−	−	285 (11.9)	
ASA score:				0.35
1	1 (0.8)	15 (0.7)	16 (0.7)	
2	42 (32.6)	596 (26.3)	638 (26.7)	
3	77 (59.7)	1,531 (67.7)	1,608 (67.2)	
4	9 (7.0)	122 (5.3)	131 (5.5)	
BMI (kg/m^2):				0.03
18.5 and Less	3 (2.3)	50 (2.2)	53 (2.2)	
Greater than 18.5−25	28 (21.7)	636 (28.2)	664 (27.7)	
Greater than 25−30	53 (41.1)	826 (36.6)	879 (36.7)	
Greater than 30−35	23 (17.8)	480 (21.3)	503 (21.0)	
Greater than 35−40	19 (14.7)	169 (7.5)	188 (7.9)	
Greater than 40	3 (2.3)	94 (4.2)	97 (4.1)	
Unknown	−	−	9 (0.3)	−