Oncologic outcomes and prognostic impact of urothelial recurrences in patients undergoing segmental and total ureterectomy for upper tract urothelial carcinoma

Jose A. Pedrosa, MD; Timothy A. Masterson, MD; Kevin R. Rice, MD; Hristos Z. Kaimakliotis, MD; M. Francesca Monn, MD; Richard Bihrle, MD; Michael O. Koch, MD; Ronald S. Boris, MD

Department of Urology, Indiana University School of Medicine, Indianapolis, IN

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Abstract

Introduction: We evaluated the impact of urothelial recurrences in a cohort of patients undergoing segmental (SU) and total ureterectomy (TU) as an alternative to nephroureterectomy (NU) for upper tract urothelial carcinoma.

Methods: Between 1999 and 2012, patients who underwent SU, TU and NU for treatment of upper tract urothelial carcinoma were evaluated. Demographic, surgical, pathologic and oncologic data were collected. Recurrence-free (RFS) and disease-specific survival (DSS) were analyzed using Kaplan-Meier and multivariable Cox methods.

Results: A total 141 patients were evaluated, 35 underwent SU, 10 TU and 96 NU. Patients who underwent TU were more likely to have bilateral disease ($p < 0.01$), solitary kidney ($p < 0.01$), and multifocal disease ($p = 0.01$). Organ-confined ($p < 0.01$) and low-grade disease ($p < 0.01$) were more common in the TU and SU groups compared with NU. At a median follow-up of 56.9 months (range: 0.2–181.1) disease relapse occurred in 88 (55.3%) patients. Localized recurrence occurred in 31.1% of SU/TU group compared to 27.1% ($p = 0.62$) of the NU group. Neither total nor segmental ureterectomy demonstrated significantly worse RFS ($p = 0.26$ and $p = 0.81$), CSS ($p = 0.96$ and $p = 0.52$) or overall survival ($p = 0.59$ and $p = 0.55$) compared with complete NU. Localized urothelial recurrence did not confer increased risk of cancer-specific ($p = 0.73$) or overall mortality ($p = 0.39$). The paper's most important limitations include its retrospective nature and its relatively small number of patients.

Conclusion: No significant survival differences were demonstrated between surgical approaches for upper tract urothelial cancer. Localized urothelial recurrence after surgical treatment for upper tract urothelial cancer does not affect mortality in this population. TU with ileal-substitution may provide an alternative option for patients with extensive ureteral disease and poor renal function.

Introduction

Isolated urothelial tumours of the ureter account for 30% of upper tract urothelial carcinoma, representing a small fraction of this already rare disease.[1,2] Traditionally, surgery for upper tract urothelial carcinoma consists of nephroureterectomy (NU), including resection of bladder cuff, with or without regional retroperitoneal and/or pelvic lymphadenectomy. The removal of the entire ipsilateral urinary tract for upper tract urothelial carcinoma was supported by data demonstrating a high incidence of multifocal tumours and rates of ipsilateral recurrence in this disease population.[3]

Encouraged by the non-cancer related survival benefits of nephron-sparing surgery,[4] a conservative surgical approach for upper tract urothelial carcinoma has been evaluated. Potential benefits of ureteral resection for the upper tract urothelial carcinoma population may be even more critical due to the inherent incidence of chronic kidney disease following surgery and the potential need for postoperative chemotherapy.[5] Alternatives to NU include endoscopic tumour resections/ablations, segmental ureterectomy (SU), or total ureterectomy (TU) with urinary tract reconstruction. The potential benefits of renal preservation must be weighed against the potential impact of localized urothelial recurrences, which may or may not affect the overall course of the disease. We compared the recurrence patterns of patients undergoing NU and SU/TU for upper tract urothelial carcinoma and evaluated survival in these groups.

Methods

We evaluated patients who underwent surgical treatment for upper tract urothelial carcinoma, including NU, SU and TU, between January 1999 and August 2012. Resection was performed that included the ureter distal to the tumour and bladder cuff in all cases. Patients with metastatic disease at

presentation or history of muscle invasive bladder cancer were excluded from the study. TU was performed as previously described by Armatys and colleagues[6] and indicated for patients with multifocal ureteral disease and solitary kidney or extensive bilateral disease where segmental resection would not be feasible. Patients with locally advanced disease, defined by disease extending outside the ureter, were not considered amenable to TU. Regional retroperitoneal and/or pelvic lymph node dissection was performed based on clinical suspicion for lymph node involvement and/or surgeon's preference.

We retrospectively reviewed data from medical records. For purpose of the analysis, patients evaluated before 2004 were assigned as low grade if they were grade 1 (1973 WHO classification) and as high grade if they were grade 2 or 3. The study endpoints were recurrence-free survival (RFS), cancer-specific survival (CSS), and overall survival (OS). For survival analysis, patients currently alive were censored at the data of last follow-up. Recurrence was defined by radiographic, endoscopic, or histologic documentation of local failure or distant metastasis. Localized urothelial recurrence was used for patients who presented with recurrent disease arising from the urothelium, including bladder, ipsilateral upper urinary tract, and contralateral urinary tract.

Pearson's chi-squared and Mann Whitney tests were used to compare categorical and continuous variables, respectively. The Kaplan-Meier method with log rank tests was used to compare survival between groups. Cox proportional hazards regression was used to evaluate variables associated with overall and cancer-specific mortality. Any variables found in univariable analysis with $p < 0.05$ were included in a multivariable cox proportional hazards model. All statistical analyses were performed using SPSS (SPSS Inc., Chicago, IL) and a priori p values less than 0.05 were considered significant for statistical tests and analysis. Institutional Review Board approval was granted for the conduct of the study.

Results

A total of 141 patients were identified, including 96 who underwent NU and 45 patients who underwent ureteral resection (35 SU and 10 TU with ileal ureter creation) (Table 1). Patients who underwent TU were more likely to have bilateral disease ($p < 0.01$), solitary kidney ($p < 0.01$), and multifocal disease ($p = 0.01$). Organ-confined disease ($p < 0.01$) and low-grade disease ($p < 0.01$) were more common in the TU and SU groups than NU.

Table 1. Clinicopathologic characteristic of patients according to the type of surgery

Variables			Type of surgery		*p* value
Median age (range)		72 (41–88)	69 (43–84)	71 (43–95)	0.52
Gender	Male	8 (80.0)	23(65.7)	58 (60.4)	0.44
	Female	2 (20.0)	12 (34.3)	38 (39.6)	
Race	Caucasian	8 (80.0)	34 (97.1)	91 (94.8)	0.11
	Non-caucasian	2 (20.0)	1 (2.9)	5 (5.2)	
Median CCI (range)		3 (2–7)	3 (2–7)	3 (3-8)	0.56
Median creatinine mg/dL		1.3 (0.5–3.4)	1.2 (0.5–3.4)	1.4 (0.7–2.8)	0.47
History of NMIBC		6 (60.0)	38 (39.9)	11 (31.4)	0.25
Side	Right	6 (60.0)	14 (40.0)	54 (56.2)	<0.01
	Left	2 (20.0)	21 (60.0)	42 (43.8)	
	Bilateral	2 (20.0)	0 (0)	0 (0)	
Solitary kidney		6 (60.0)	2 (5.7)	2 (2.1)	<0.01
pT stage	pTis/pTa/pT0	6(60.0)	18 (51.4)	24 (25)	<0.01
	pT1	3 (30.0)	2 (5.7)	24 (25)	
	pT2	1(10.0)	7 (20.0)	13 (13.5)	
	pT3	0 (0.0)	7 (20.0)	25 (26.0)	
pN stage	pNx/pN0	9(90.0)	33 (94.3)	79 (82.3)	0.2
	pN+	1 (10.0)	2 (5.7)	17 (17.7)	
Grade	Low	2 (20.0)	16 (45.7)	15 (15.6)	<0.01
	High	8 (80.0)	19 (54.3)	81 (84.4)	
Multifocal		4 (40.0)	2 (5.7)	10 (10.4)	0.01
LVI		1 (10)	5 (14.3)	24 (25.0)	0.27
CIS		3 (30.0)	8 (22.9)	26 (27.1)	0.85

CCI: Charlson Comorbidity Index; NMIBC: non-muscle invasive bladder cancer; LVI: lymphovascular invasion; CIS, carcinoma in situ; SU, segmental ureterectomy; TU: total ureterectomy; SU: segmental ureterectomy; NU: nephroureterectomy.

Recurrence analysis

At a median follow-up of 56.9 months (range: 0.2–181.1), 68 (42.8%) patients were alive without disease, 4 (2.5%) were alive with disease, 41 (25.8%) were dead of disease and 28 (17.6%) were dead from other causes. A total of 71 (50.3%) patients relapsed during the follow-up period. Initial recurrence sites included bladder in 33 (23.4%) patients, contralateral upper tract in 2 (1.4%), ipsilateral upper tract in 5 (3.5%), and distant metastasis in 31 (22.0%). Ipsilateral recurrences represented 11.1% of the recurrences in the SU/TU group (Fig. 1).

Recurrence in the remaining urothelium occurred in 31.1% of the patients in the SU/TU groups compared to 27.1% in the NU group, however this was not significant ($p = 0.62$). Pathologic information was available for 35 (87.5%) patients. Stage distribution of urothelial recurrences was as follows: 28 (80%) patients had pT1/pTa/pTis disease and 7 (20.0%) patients relapsed with pT2 or higher. Low- and high-grade disease recurrence was demonstrated in 7 (20%) and 28 (80%), respectively. Additionally, when looking at ipsilateral upper tract recurrences identified in the SU group, we found that 3 out of a total of 5 recurrences occurred at the renal pelvis away from the initial resection site.

Survival analysis

When compared to the NU group, neither TU nor SU significantly affected RFS ($p = 0.26$ and $p = 0.81$), CSS ($p = 0.96$ and $p = 0.52$) or OS ($p = 0.59$ and $p = 0.55$). Actuarial 3-year RFS was 48.6% for NU, 35.0% for the SU and 23.6% for the TU group, while 3-year CSS was 69.2%, 67.6% and 61.0%, and 3-year OS was 55.3%, 57.5% and 55.0%, respectively (Fig. 2). The presence of an urothelial recurrence did not confer increased risk of cancer-specific ($p = 0.73$) or overall mortality ($p = 0.39$) (Fig. 3). This was further confirmed in the multivariable model ($p = 0.27$ and $p = 0.62$ for CSS and OS, respectively).

Univariable analysis for overall mortality demonstrated prognostic association with age ($p = 0.01$), T stage ($p < 0.04$), N stage ($p < 0.01$), grade ($p = 0.02$), and lymphovascular invasion ($p < 0.01$). The same factors, except for age, were also prognostic indicators for cancer-specific mortality (Table 2). In the multivariate model evaluating the relationship between urothelial recurrence and mortality, only age ($p < 0.01$) and N stage ($p < 0.01$) remained significantly associated with overall mortality, while T stage ($p = 0.02$) and N stage ($p = 0.01$) continued to be associated with cancer-specific mortality.

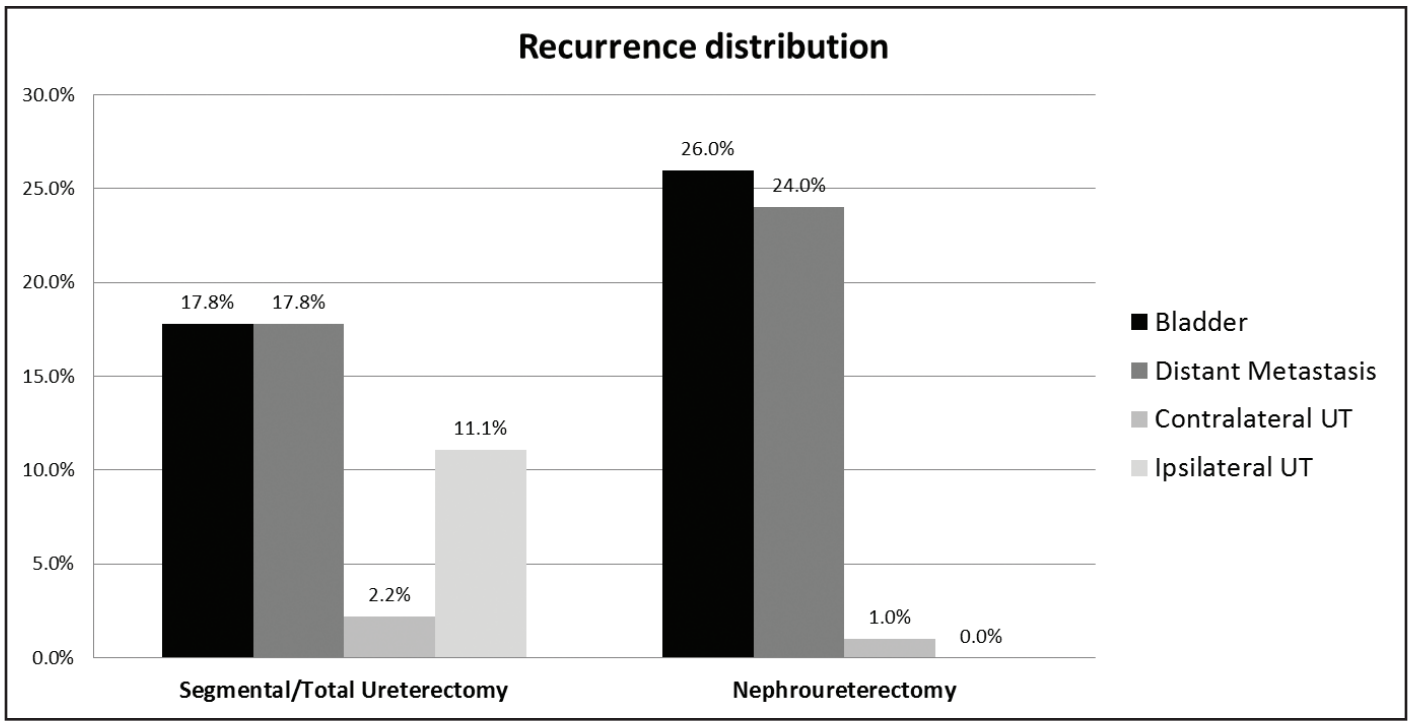
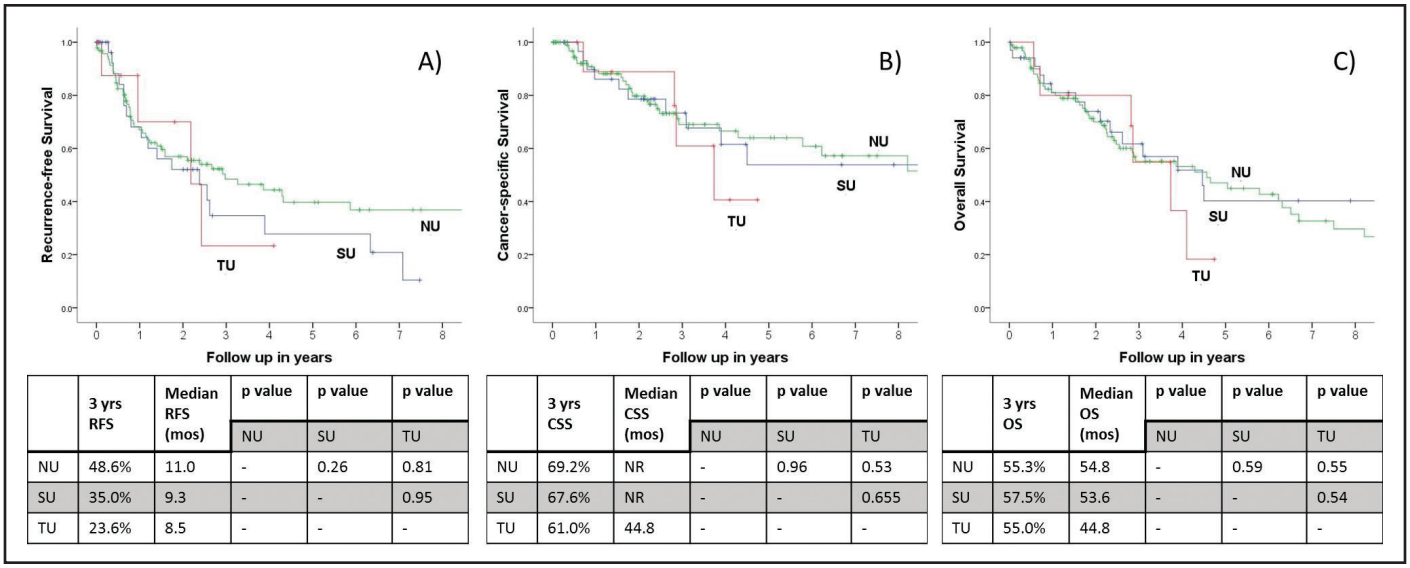


Fig. 1. Distribution of recurrences sites between ureteral resection (segmental ureterectomy and total ureterectomy) and nephroureterectomy.



	3 yrs RFS	Median RFS (mos)	p value	p value	p value
			NU	SU	TU
NU	48.6%	11.0	-	0.26	0.81
SU	35.0%	9.3	-	-	0.95
TU	23.6%	8.5	-	-	-

	3 yrs CSS	Median CSS (mos)	p value	p value	p value
			NU	SU	TU
NU	69.2%	NR	-	0.96	0.53
SU	67.6%	NR	-	-	0.655
TU	61.0%	44.8	-	-	-

	3 yrs OS	Median OS (mos)	p value	p value	p value
			NU	SU	TU
NU	55.3%	54.8	-	0.59	0.55
SU	57.5%	53.6	-	-	0.54
TU	55.0%	44.8	-	-	-

Fig. 2. A: Recurrence-free survival; B: cancer-specific survival; and C: overall survival curves according to type of resection.

Discussion

Although NU with removal of bladder cuff remains the standard of care to treat ureteral upper tract urothelial carcinoma, recent evidence regarding the survival impact of renal preservation and the role of renal-dependent chemotherapy agents for urothelial cancer have restored interest in urothelial-sparing approaches to manage this disease. The endoscopic approach relies on the use of laser techniques to ablate and/or resect the tumour, which may compromise adequate pathologic evaluation, thus subjecting patients to higher instances of under-treatment.[7-9] By comparison, segmental or complete ureteral resection allows for full thickness excision of the involved ureter and peri-ureteral tissue, as well as allows us to perform lymph node dissection to complete pathologic staging. In our 45 patients undergoing SU or TU for upper tract urothelial carcinoma, all had adequate pathologic specimen for analysis, and pT3 disease was identified in 7 (15.5%) patients and positive lymph nodes in 3 (6.7%).

Nephrectomy is associated with an average 25% reduction of global renal function; this diminished postoperative eGFR has been independently associated with cardiovascular death and decreased OS.[4,10] Additionally, the potential candidacy of urothelial carcinoma patients for adjuvant chemotherapy and/or clinical trials should be considered prior to surgical planning. According to several reports, an estimated 88% to 93% of patients in the post-NU setting have an eGFR <60 and would be ineligible to receive cisplatin-based therapy.[5,11] Although increasing utilization of neoadjuvant chemotherapy for upper tract urothelial carcinoma may partially obviate the importance of ureteral resection in this disease population, these findings retain oncologic importance for several reasons: (1) eligibility for clinical trials; (2) risk for the development of muscle-invasive bladder cancer where chemotherapy is well-established; and (3) lower efficacy of non-cisplatin based palliative chemotherapy.[12-14]

Segmental resections for upper tract urothelial carcinoma have traditionally been associated with high recurrence rates.[15] Although this is concerning in this patient population, this data were often confounded by publications that combined NU patients with and without complete ureterectomy and bladder cuff.[16] These inadequately treated patients, many of whom would never have been ureteral resection candidates, were subjected to unfortunate "stump recurrences," skewing the interpretation of results.[17] When analyzing patients exclusively with SU, published series have shown much more encouraging outcomes.[18,19] Colin and colleagues, in the largest published study, evaluated 52 distal SU patients and 416 NU patients, demonstrating similar 5-year DSS (87.9% vs. 86.3%, $p = 0.99$).[20] Jedres and colleagues performed a Surveillance, Epidemiology, and End Results (SEER)-database review of 569 SU and 1222 NU patients and described similar oncologic outcomes between groups (5-year DSS 86.6% vs. 82.2%, $p = 0.05$).[21] Our 3-year DSS and OS for the ureterectomy group (SU and TU) was 69.7% and 54.9% compared to 69.2% and 56.3% for the NU group ($p = 0.78$ and $p = 0.80$, respectively).

Despite not reaching statistical significance, we found higher a incidence of recurrence in the segmental resection population, with a 3-year RFS of 33.7% in the ureterectomy group versus 48.7% in the NU group ($p = 0.27$). Differences are consistent with the presence of ipsilateral upper tract recurrences in the ureterectomy group that is completely negated in the nephroureterectomy arm. Recent publications have reported a 9% to 11% ipsilateral recurrence rate

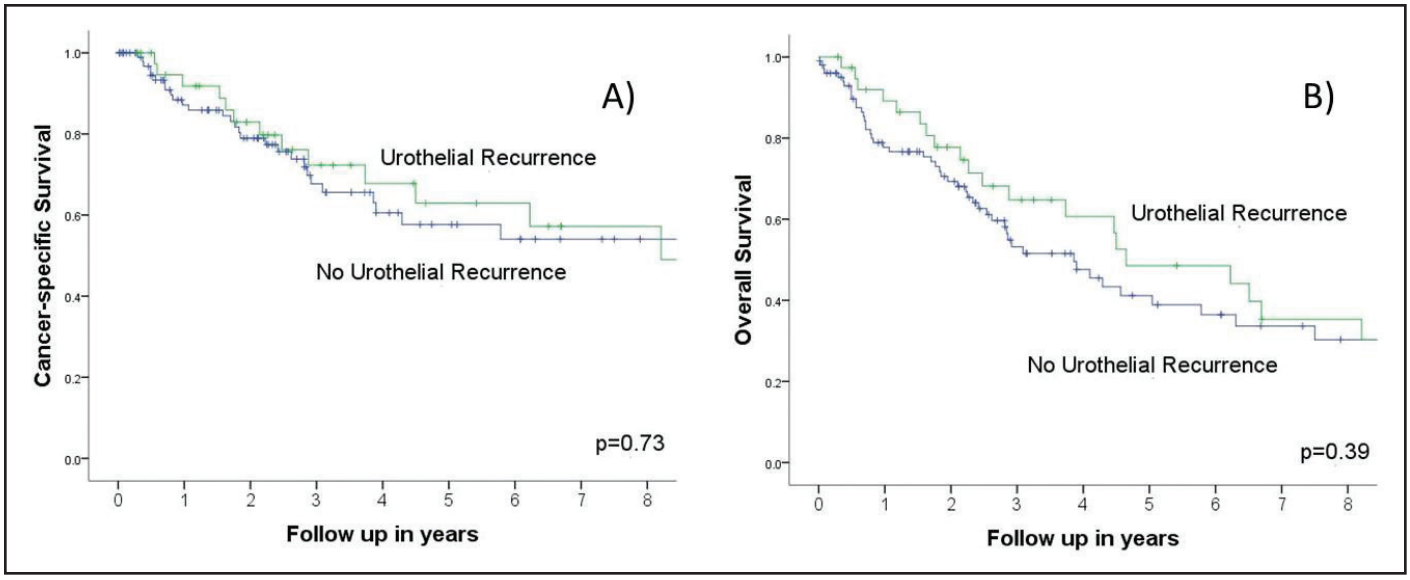


Fig. 3. A: Cancer-specific survival; B: overall survival curves according to the presence of urothelial recurrence.

in patients undergoing segmental resection.[13,20,21] Our series of patients (SU and TU) demonstrated an 11.1% ipsilateral upper tract recurrence rate, commensurate with prior literature (Fig. 1).

Estimating the impact of SU on oncologic outcomes is challenging due to the inability to determine whether recurrences are caused by disease persistence from incomplete local resection versus de novo disease in the affected urinary tract. Raman and colleagues[13] demonstrated that over 60% of bladder recurrences after NU had different pathologic characteristics, favouring de novo disease as an explanation for these failures. These findings suggest that the increased surface of urothelium may harbor genetic alterations, predisposing patients to urothelial recurrences. In our series the most common recurrence site was bladder (23.4% of patients), in which 73% of these recurrences were pT1 or less. Aside from distant metastases, the next most common recurrence site was the ipsilateral upper tract seen in 5 (3.5%) cases. Among these patients, 3 were localized in the ipsilateral renal pelvis, away from the initial resection site. Again, these findings reinforce our hypothesis that de novo disease may be the primary contributor to disease relapse in this setting.

Do localized disease recurrences actually affect survival in patients with upper tract urothelial carcinoma? In our series we found no association between this type of recurrence and CSS (3-year CSS 72.2% vs. 65.3%, $p = 0.73$) or OS (3-year OS 65.6% vs. 50.9%, $p = 0.34$) (Fig. 3). Additionally, our findings were again supported using a multivariable model demonstrating that age and initial tumour stage (pT and pN) were the major predictors of survival, irrespective of the presence of urothelial recurrence. This data were again concordant with the current literature that fails to show clear differences in survival between segmental resection and nephroureterectomy for upper tract urothelial carcinoma. Despite similarities in DSS, patients experiencing ipsilateral recurrence after local resection are prone to physical morbidity from a higher burden of treatment, as well as emotional stressors related to disease failure, which should be considered during preoperative planning at the time of initial diagnosis.

The limitations of our study include its retrospective nature and relatively small number of patients. Pathologic analysis and surgical technique, including the performance and technique of lymph node dissection, were not standardized and may have affected our results. As previously described, the technique for confection of ileal ureter during TU followed the same principles as described in a previous publication.[6] Additionally, longer follow-up will be needed to better assess the oncologic legitimacy of ureteral resections for upper tract urothelial carcinoma. Due to the rarity of the disease, multi-institutional collaboration is imperative. Despite these limitations, our study represents one of the largest contemporary series evaluating the role of ureteral resections for both limited and extensive localized upper tract urothelial carcinoma.

Conclusion

Ureteral resection for localized upper tract urothelial cancer offers preservation of renal function in a population where chronic kidney failure is highly prevalent. Even though local urothelial recurrences remain high, the impact of segmental resection on overall disease survival appears minimal. Although feasible, outcomes of total ureteral removal with ileal reconstruction remain preliminary and TU should cur-

Table 2. Univariable and multivariable Cox proportional hazard models for CSS and RFS including the presence of urothelial recurrence

	Multivariable Cox proportional hazards							
Variables	**Overall mortality**				**Cancer specific mortality**			
	Univariable		**Multivariable**		**Univariable**		**Multivariable**	
	HR (95% CI)	*p* value	HR (95% CI)	*p* value	HR (95% CI)	*p* value	HR (95% CI)	*p* value
Age (cont.)	1.03 (1.01–1.06)	0.01	1.04 (1.02–1.07)	<0.01	1.01 (0.98–1.04)	0.63	-	-
Sex (male)	0.43 (0.50–1.34)	0.43	-	-	0.81 (042–1.54)	0.52	-	-
Race (Caucasian)	1.17 (0.50–2.70)	0.71	-	-	0.97 (0.30–3.14)	0.95	-	-
CCI (cont.)	1.16 (0.98–1.36)	0.08	-	-	0.97 (0.75–1.24)	0.79	-	-
T stage (T3 and T4)	2.73 (1.69–4.42)	<0.01	1.34 (0.67-2.69)	0.41	5.05 (270–9.45)	<0.01	2.88 (1.17–7.11)	0.02
N stage (N positive)	4.76 (2.73–8.30)	<0.01	3.16 (1.47–6.79)	<0.01	7.30 (3.75–14.21)	<0.01	3.05 (1.23–7.57)	0.01
Grade (high grade)	2.11 (1.08–4.14)	0.02	1.23 (0.59–2.56)	0.58	2.58 (1.01–6.58)	0.04	1.30 (0.45–3.71)	0.60
LVI (presence)	3.78 (2.25–6.33)	<0.01	1.87 (0.93–3.77)	0.08	4.93 (2.59–9.38)	<0.01	1.31 (0.51–3.34)	0.56
CIS (presence)	1.02 (0.59–1.77)	0.93	-	-	1.48 (0.77–2.86)	0.24	-	-
Type of resection (SU and TU)	0.93 (0.56–1.56)	0.80	-	-	1.10 (0.57–2.10)	0.78	-	-
Urothelial rec. (presence)	0.78 (0.46–1.31)	0.34	1.15 (0.66–1.97)	0.62	0.89 (0.46–1.73)	0.74	1.48 (0.73–2.98)	0.27

CSS: cancer-specific survival; RFS: recurrence-free survival; HR: hazard ratio; CI: confidence interval; HR: hazard ratio; CCI: Charlson Comorbidity Index; LVI: lymphovascular invasion; CIS: carcinoma in situ; SU: segmental ureterectomy; TU: total ureterectomy; SU: segmental ureterectomy; NU: nephroureterectomy.

rently be reserved as an alternative to segemental ureterectomy or nephroureterectomy for patients with extensive ureteral disease and poor renal function.

Competing interests: Authors declare no competing financial or personal interests.

This paper has been peer-reviewed.

References

1. Abouassaly R, Alibhai SM, Shah N, et al. Troubling outcomes from population-level analysis of surgery for upper tract urothelial carcinoma. *Urology* 2010;76:895-901. http://dx.doi.org/10.1016/j.urology.2010.04.020
2. Jeldres C, Sun M, Isbarn H, et al. A population-based assessment of perioperative mortality after nephroureterectomy for upper-tract urothelial carcinoma. *Urology* 2010;75:315-20. http://dx.doi.org/10.1016/j.urology.2009.10.004
3. Anderstrom C, Johansson SL, Pettersson S, et al. Carcinoma of the ureter: A clinicopathologic study of 49 cases. *J Urol* 1989;142(2Pt1):280-3.
4. Weight CJ, Larson BT, Fergany AF, et al. Nephrectomy induced chronic renal insufficiency is associated with increased risk of cardiovascular death and death from any cause in patients with localized cT1b renal masses. *J Urol* 2010;183:1317-23. http://dx.doi.org/10.1016/j.juro.2009.12.030
5. Lane BR, Smith AK, Larson BT, et al. Chronic kidney disease after nephroureterectomy for upper tract urothelial carcinoma and implications for the administration of perioperative chemotherapy. *Cancer* 2010;116:2967-73. http://dx.doi.org/10.1002/cncr.25043
6. Armatys SA, Mellon MJ, Beck SD, et al. Use of ileum as ureteral replacement in urological reconstruction. *J Urol* 2009;181:177-81. http://dx.doi.org/10.1016/j.juro.2008.09.019
7. Wang JK, Tollefson MK, Krambeck AE, et al. High rate of pathologic upgrading at nephroureterectomy for upper tract urothelial carcinoma. *Urology* 2012;79:615-9. http://dx.doi.org/10.1016/j.urology.2011.11.049
8. Elliott DS, Segura JW, Lightner D, et al. Is nephroureterectomy necessary in all cases of upper tract transitional cell carcinoma? Long-term results of conservative endourologic management of upper tract transitional cell carcinoma in individuals with a normal contralateral kidney. *Urology* 2001;58:174-8. http://dx.doi.org/10.1016/S0090-4295(01)01109-8
9. Daneshmand S, Quek ML, Huffman JL. Endoscopic management of upper urinary tract transitional cell carcinoma: Long-term experience. *Cancer* 2003;98:55-60. http://dx.doi.org/10.1002/cncr.11446
10. Huang WC, Levey AS, Serio AM, et al. Chronic kidney disease after nephrectomy in patients with renal cortical tumours: A retrospective cohort study. *Lancet Oncol* 2006;7:735-40. http://dx.doi.org/10.1016/S1470-2045(06)70803-8
11. Silberstein JL, Power NE, Savage C, et al. Renal function and oncologic outcomes of parenchymal sparing ureteral resection versus radical nephroureterectomy for upper tract urothelial carcinoma. *J Urol* 2012;187:429-34. http://dx.doi.org/10.1016/j.juro.2011.09.150
12. Liu Y, Lu J, Hong K, et al. Independent prognostic factors for initial intravesical recurrence after laparoscopic nephroureterectomy for upper urinary tract urothelial carcinoma. *Urol Oncol* 2014;32:146-52. http://dx.doi.org/10.1016/j.urolonc.2013.02.018. Epub 2013 Apr 28.
13. Raman JD, Sosa RE, Vaughan ED Jr, et al. Pathologic features of bladder tumors after nephroureterectomy or segmental ureterectomy for upper urinary tract transitional cell carcinoma. *Urology* 2007;69:251-4.
14. Galsky MD, Chen GJ, Oh WK, et al. Comparative effectiveness of cisplatin-based and carboplatin-based chemotherapy for treatment of advanced urothelial carcinoma. *Ann Oncol* 2012;23:406-10.
15. Hall MC, Womack S, Sagalowsky AI, et al. Prognostic factors, recurrence, and survival in transitional cell carcinoma of the upper urinary tract: A 30-year experience in 252 patients. *Urology* 1998;52:594-601.
16. Strong DW, Pearse HD. Recurrent urothelial tumors following surgery for transitional cell carcinoma of the upper urinary tract. *Cancer* 1976;38:2173-83.
17. Mazeman E. Tumours of the upper urinary tract calyces, renal pelvis and ureter. *Eur Urol* 1976;2:120-6.
18. Giannarini G, Schumacher MC, Thalmann GN, et al. Elective management of transitional cell carcinoma of the distal ureter: Can kidney-sparing surgery be advised? *BJU Int* 2007;100:264-8.
19. Dragicevic D, Djokic M, Pekmezovic T, et al. Comparison of open nephroureterectomy and open conservative management of upper urinary tract transitional cell carcinoma. *Urol Int* 2009;82:335-40.
20. Colin P, Ouzzane A, Pignot G, et al. Comparison of oncological outcomes after segmental ureterectomy or radical nephroureterectomy in urothelial carcinomas of the upper urinary tract: results from a large French multicentre study. *BJU Int* 2012;110:1134-41.
21. Jeldres C, Lughezzani G, Sun M, et al. Segmental ureterectomy can safely be performed in patients with transitional cell carcinoma of the ureter. *J Urol* 2010;183:1324-9.

Correspondence: Dr. Jose A. P. Pedrosa, Department of Urology, Indiana University School of Medicine, 535 Barnhill Drive, RT 420, Indianapolis, IN, 46202; jappedrosa@gmail.com