

Gadzinski, A.J., Roberts, W.W., Faerber, G.J., Wolf, J.S., Jr.: Long-term outcomes of nephroureterectomy versus endoscopic management for upper tract urothelial carcinoma. Journal of Urology, 2010.

**Table 1:** Demographics and Tumor Characteristics, by Treatment Group  
Data expressed as Mean  $\pm$  S.D. for continuous data (range), or No. in group (%) for nominal data

Variable (No. in group)	Endoscopic Management	Nephroureterectomy	P-Value
All Renal Units (96)	34	62	
Gender			
Male (68)	26 (76.5%)	42 (67.7%)	p = 0.4825
Female (28)	8 (23.5%)	20 (32.3%)	
Age, years	71.9 $\pm$ 10.3 (range, 33.5 – 85.0)	69.0 $\pm$ 10.6 (range, 43.5 – 93.2)	p = 0.1218
BMI	28.1 $\pm$ 5.2 (range, 19.8 – 43.1)	28.5 $\pm$ 5.5 (range, 19.4 – 47.1)	p = 0.8093
< 30, Non-obese (59)	20 (58.8%)	39 (62.9%)	p = 0.7876
30 – 40, Obese (33)	13 (38.3%)	20 (32.3%)	
> 40, Morbidly obese (4)	1 (2.9%)	3 (4.8%)	
ASA score	2.6 $\pm$ 0.6 (range, 1.0 – 4.0)	2.2 $\pm$ 0.6 (range, 1.0 – 3.0)	p = 0.0142
ASA 1 - 2 (57)	14 (41.2%)	43 (69.4%)	p = 0.0094
ASA 3 - 4 (39)	20 (58.8%)	19 (30.6%)	
Age-Adjusted CCI	4.1 $\pm$ 1.8 (range, 0.0 – 8.0)	3.4 $\pm$ 1.8 (range, 0.0 – 9.0)	p = 0.0320
0 - 3 (45)	11 (32.4%)	34 (54.8%)	p = 0.0347
$\geq$ 4 (51)	23 (67.6%)	28 (45.2%)	
Greatest Tumor Diameter ‡			
< 2 cm, Small (22)	14 (50.0%)	8 (13.3%)	p = 0.0004
$\geq$ 2 cm, Large (66)	14 (50.0%)	52 (86.7%)	
Grade ‡			
Low (52) *	24 (75.0%)	28 (45.2%)	p = 0.0083
High (42)	8 (25.0%)	34 (54.8%)	
Extent			
Solitary (51)	18 (52.9%)	33 (53.2%)	p > .9999
Multifocal (45)	16 (47.1%)	29 (46.8%)	
Location			
Renal Pelvis (82) †	28 (82.3%)	54*(87.1%)	p = 0.5557
Ureter (14)	6 (17.7%)	8 (12.9%)	
History of Bladder Tumors			
No Previous Bladder Tumors (67)	14 (41.2%)	53 (85.5%)	p < 0.0001
Previous Bladder Tumors (29)	20 (58.8%)	9 (14.5%)	
T stage			
T0	-	4 (6.5%)	
Ta	-	32 (51.6%)	
Tis	-	1 (1.6%)	
T1	-	6 (9.7%)	
T2	-	3 (4.8%)	
T3	-	16 (25.8%)	
N stage			
0	-	59 (95.2%)	
1	-	3 (4.8%)	
No. Nephron Sparing Indications (%):			
Bilateral Disease	4 (11.8%)	-	
Solitary kidney	9 (26.4%)	-	
Chronic renal insufficiency	3 (8.8%)	-	
Relative renal insufficiency	4 (11.8%)	-	
Elective	14 (41.2%)	-	

‡ Some data elements missing

\* 2 patients, one in each treatment group, had a pathological grade of LMP.

† 9 nephroureterectomy patients with renal pelvic tumors also had ureteral tumors.

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**Table 2:** Demographics and Tumor Characteristics, by Indication for Endoscopy  
Data expressed as Mean  $\pm$  S.D. for continuous data (range), or No. in group (%) for nominal data

Variable (No. in group)	Non-Imperative	Imperative	P-Value
All Renal Units (34)	18	16	
Gender			p = 0.4290
Male (26)	15 (83.3%)	11 (68.8%)	
Female (8)	3 (16.7%)	5 (31.2%)	
Age, years	69.9 $\pm$ 12.5 (range, 33.5 – 85.0)	74.2 $\pm$ 6.5 (range, 64.7 – 84.6)	p = 0.4076
BMI	28.7 $\pm$ 5.2 (range, 21.5 – 43.1)	27.3 $\pm$ 5.2 (range, 19.8 – 36.5)	p = 0.4175
< 30, Non-obese (20)	10 (55.5%)	10 (62.5%)	p = 0.6180
30 – 40, Obese (13)	7 (38.9%)	6 (37.5%)	
> 40, Morbidly obese (1)	1 (5.6%)	0 (0%)	
ASA score	2.4 $\pm$ 0.7 (range, 1 – 4)	2.8 $\pm$ 0.4 (range, 2 – 3)	p = 0.1675
ASA 1 - 2 (14)	10 (55.6%)	4 (25.0%)	p = 0.0921
ASA 3 - 4 (20)	8 (44.4%)	12 (75.0%)	
Age-Adjusted CCI	3.4 $\pm$ 1.8 (range, 0 – 6)	4.9 $\pm$ 1.4 (range, 0 – 8)	p = 0.0261
0 - 3 (11)	10 (55.6%)	1 (6.3%)	p = 0.0031
$\geq$ 4 (23)	8 (44.4%)	15 (93.7%)	
Greatest Tumor Diameter ‡			
< 2 cm, Small (14)	10 (62.5%)	4 (33.3%)	p = 0.2519
$\geq$ 2 cm, Large (14)	6 (37.5%)	8 (66.7%)	
Grade ‡			
Low (24)*	14 (82.4%)	10 (66.7%)	p = 0.4235
High (8)	3 (17.6%)	5 (33.3%)	
Extent			
Solitary (18)	13 (72.2%)	5 (31.3%)	p = 0.0374
Multifocal (16)	5 (27.8%)	11 (68.7%)	
Location			
Renal Pelvis (28)	13 (72.2%)	15 (93.8%)	p = 0.1801
Ureter (6)	5 (27.8%)	1 (6.2%)	
History of Bladder Tumors			
No Previous Bladder Tumors (14)	9 (50.0%)	5 (31.3%)	p = 0.3151
Previous Bladder Tumors (20)	9 (50.0%)	11 (68.8%)	
No. Nephron Sparing Indications (%):			
Bilateral Disease	-	4 (25.0%)	
Solitary kidney	-	9 (56.3%)	
Chronic renal insufficiency	-	3 (18.7%)	
Relative renal insufficiency	4 (22.2%)	-	
Elective	14 (77.8%)	-	

‡ Some data elements missing

\* 1 Non-Imperative patient had a pathological grade of LMP.

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**Table 3: Endoscopic Operative Data**

	All Renal Units	Non-Imperative Indication	Imperative Indication	p-value
Total Surgical Procedures	226	79	147	
URS Procedures	199	72	127	
PCN Procedures	27	7	20	
Initial procedures				0.5510
URS	28 (60.8%)	14 (66.7%)	14 (56.0%)	
Successful initial URS	17	9	8	
URS Inspection only, then PCN	6	2	4	
Failed URS resection, then PCN	3	1	2	
2 URS resections required in 1 patient	2	2	0	
PCN	18 (39.1%)	7 (33.3%)	11 (44.0%)	
Successful initial PCN resection	6	4	2	
Successful PCN resection after URS Inspection	6	2	4	
Successful PCN resection after failed URS resection	3	1	2	
3 PCN resections required in 1 patient	3	0	3	
Subsequent URS	----			0.0007
Without tumor recurrence	78 (45.6%)	37 (63.8%)	41 (36.3%)	
With tumor recurrence	93 (54.4%)	21 (36.2%)	72 (63.7%)	
Subsequent PCN resection	9	0	9	----
Kidneys with Ipsilateral Upper Tract Recurrences	27 (84.4%) <sup>1</sup>	12 (70.6%) <sup>2</sup>	15 (100%) <sup>3</sup>	0.0456
Number of Procedures per year	2.6	2.2	2.8	
Number of Recurrences per year	1.2	0.6	1.6	
Complications of All procedures <sup>4</sup>	21 (9.3%)	8 (10.1%)	13 (8.8%)	0.8116
URS Procedures	15 (7.5%)	5 (6.9%)	10 (7.9%)	>0.9999
PCN Procedures	6 (22.2%)	3 (42.9%)	3 (15.0%)	0.2896
Complications of Initial procedures	----			
URS Resection	5 (17.9%)	2 (14.2%)	3 (21.4%)	>0.9999
PCN Resection	5 (27.8%)	3 (42.9%)	2 (18.2%)	0.3260
Complications of Subsequent procedures	----			
URS without recurrence	3 (3.8%)	2 (5.4%)	1 (2.4%)	0.6012
URS with tumor recurrence	7 (7.5%)	1 (4.8%)	6 (8.3%)	>0.9999
PCN resection	1 (11.1%)	0	1 (11.1%)	----

Key: URS = ureteroscopy, PCN = percutaneous nephroscopy

<sup>1</sup>Percentage is of 32 renal units for which follow-up data was complete.

<sup>2</sup>Percentage is of 17 renal units for which follow-up data was complete.

<sup>3</sup>Percentage is of 15 renal units for which follow-up data was complete.

<sup>4</sup>There were 6 major complications in each of the non-imperative and imperative groups.

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**Table 4:** Five year Kaplan-Meier Survival Estimates

	ENDO, all n =34	NUx, all n = 62	p- value	ENDO , Low grade n =24	NUx, Low grade n = 28	p- value	ENDO, High grade n =8	NUx, High grade n = 34	p- value	All Low Grade n = 52	All High Grade n = 42	p- value
Bladder recurrence [No. renal units with data]	[31]	[56]		[22]	[27]		[7]	[29]		[49]	[36]	
Survival	32.5% (16.1-50.1)	37.8% (23.2-52.3)	0.52	39.7% (18.5-60.2)	28.4% (11.4-48.2)	0.61	21.4%* (1.2-58.6%)	49.9%* 49.9% (28.5-68.1)	0.05	33.4% (19.4-48.0)	44.0% (25.7-60.9)	0.72
Median time to Bladder recurrence [No.]	11.4 [20]	10.1 [31]		16.3 [13]	10.1 [17]		4.1 [5]	9.7 [14]		13.5 [30]	5.5 [19]	
Median Follow-up in patients without Bladder recurrence	51.4	33.4		60.4	53.1		28.3	30.5		60.4	30.5	
Ipsilateral recurrence [No. renal units with data]	[31]	-		[22]	-		[7]	-		[22]	[7]	
Survival	13.3% (3.8-28.8)	-	-	18.7% (5.2-38.7)	-	-	0.0%	-	-	36.4%* (17.4-55.7)	0.0%* 18.7% (5.1-38.7)	0.03
Median time to Ipsilateral recurrence [No.]	4.1 [26]	-		5.6 [17]	-		4.1 [7]	-		5.6 [17]	4.1 [7]	
Median Follow-up in patients without Ipsilateral recurrence	61.2	-		61.2	-		-	-		61.2	-	
Contralateral recurrence [No. renal units with data]	[21]	[52]		[17]	[26]		[3]	[26]		[43]	[29]	
Survival	100%	87.3% (71.7-94.6)	0.12	100%	81.6% (57.7-92.7)	0.07	100%*	95.7%* 95.7% (72.9-99.4)	0.72	88.5% (72.0-95.6)	96.2% (75.7-99.4)	0.38
Median time to Contralateral recurrence [No.]	-	34.7 [6]		-	43.2 [5]		-	4.9 [1]		43.2 [5]	4.9 [1]	
Median Follow-up in patients without Contralateral recurrence	47.9	53.0		65.6	64.7		45.1	50.1		65.2	41.4	
Metastasis-Free [No. renal units with data]	[32]	[60]		[23]	[26]		[7]	[34]		[49]	[41]	
Survival	88.8% (68.7-96.3)	73.4% (58.6-83.7)	0.24	94.4% (66.6-99.1)	87.8% (59.5-96.8)	0.25	85.7% (33.4-97.8)	63.5% (44.6-77.4)	0.79	91.1% (74.9-97.1)	66.7% (49.4-79.2)	<0.01
Median time to Metastasis [No.]	39.6 [5]	10.0 [16]		84.3 [2]	65.9 [4]		37.9 [2]	7.2 [12]		65.9 [6]	7.2 [14]	
Median Follow-up in patients without Metastases	60.4	55.5		61.2	62.5		21.8	48.3		62.4	43.6	
Cancer-Specific [No. renal units with data]	[34]	[62]		[24]	[28]		[8]	[34]		[52]	[42]	
Survival	93.5% (76.6-98.3)	79.7% (65.7-90.2)	0.39	100%	89.2% (63.1-97.1)	0.63	85.7% (33.4-97.9)	72.4% (53.4-84.7)	0.95	94.4% (79.3-98.6)	74.8% (57.9-85.7)	<0.01
Median time to Death from Cancer [No.]	43.5 [4]	14.5 [12]		102.0 [1]	53.5 [2]		41.2 [2]	14.2 [10]		56.4 [3]	14.2 [12]	
Median Follow-up in patients without Death from Cancer	59.9	65.6		66.9	72.8		38.0	55.7		69.3	51.6	
Overall [No. renal units with data]	[34]	[62]		[24]	[28]		[8]	[34]		[52]	[42]	
Survival	61.4% (42.9-75.5)	58.5% (44.5-70.1)	0.45	74.8% (52.2-87.8)	71.8% (49.6-85.5)	0.30	25.0% (3.7-55.8)	47.8% (29.6-63.9)	0.12	73.4% (58.6-83.7)	42.9% (27.0-57.7)	<0.01
Median time to Death any cause [No.]	44.7 [21]	28.0 [31]		55.8 [12]	41.1 [9]		31.2 [7]	25.5 [22]		45.9 [21]	25.8 [29]	
Median Follow-up in patients without Death any cause	75.6	79.4		76.1	79.4		51.4	71.4		77.1	59.8	

\*Estimated Survival points shorter than 60 months: Bladder Recurrence 51.4 months, Ipsilateral Recurrence 12.6 months, Contralateral Recurrence 45.1 months.

Key: ENDO = Endoscopic management, NUx = Nephroureterectomy

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Table 5: Multivariable Proportional Hazards Analysis of Survivals

Variable	Hazard Ratio	95% Confidence Interval	P-value
<b>Overall Survival</b>			
Treatment Group			
Nephroureterectomy	1.0 (referent)	-	-
Endoscopic Management	1.351	0.723, 2.524	0.3458
Age adjusted CCI			
0 - 3	1.0 (referent)	-	-
≥ 4	2.585	1.372, 4.872	0.0033
Tumor Extent			
Solitary	1.0 (referent)	-	-
Multiple	1.289	0.723, 2.299	0.3892
Tumor Grade			
Low	1.0 (referent)	-	-
High	2.933	1.609, 5.349	0.0004
<b>Cancer-Specific Survival</b>			
Treatment Group			
Nephroureterectomy	1.0 (referent)	-	-
Endoscopic Management	0.868	0.226, 3.329	0.8365
BMI	0.872	0.768, 0.990	0.0346
Tumor Grade			
Low	1.0 (referent)	-	-
High	7.223	1.841, 28.336	0.0046
<b>Metastasis Free Survival</b>			
Treatment Group			
Nephroureterectomy	1.0 (referent)	-	-
Endoscopic Management	0.760	0.235, 2.455	0.6466
Tumor Grade			
Low	1.0 (referent)	-	-
High	3.449	1.233, 9.644	0.0183
<b>Bladder Recurrence</b>			
Treatment Group			
Nephroureterectomy	1.0 (referent)	-	-
Endoscopic Management	0.962	0.531, 1.744	0.8997
Age-adjusted CCI			
0 - 3	1.0 (referent)	-	-
≥ 4	1.796	0.965, 3.340	0.0645
Tumor Extent			
Solitary	1.0 (referent)	-	-
Multiple	1.881	1.055, 3.351	0.0322
<b>Ipsilateral Recurrence‡</b>			
Tumor Extent			
Solitary	1.0 (referent)	-	-
Multiple	1.369	0.559, 3.352	0.4924
Tumor Location			
Ureter	1.0 (referent)	-	-
Renal Pelvis	5.109	1.045, 24.988	0.0440
Tumor Grade			
Low	1.0 (referent)	-	-
High	1.815	0.706, 4.670	0.2162

‡ Age Adjusted CCI was excluded because the number of events limited multivariate analysis to three variables.