



Surgical Techniques for Kidney Cancer: The Correct Approach for the Right Patient

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Objectives

- Brief Overview of Renal Cell Carcinoma
- Treatments Options
- Surgical Technique
- Tools to Aid in Making a Decision
- Outcomes

Renal Cell Carcinoma

- Approximately – 62,700 Americans Diagnosed in 2016
- Deaths – 14,240
- Renal Cell Carcinoma – 3.8% of all new malignancies
- Median age at diagnosis – 64 years
- Overwhelmingly, 90% of renal tumors are RCC
- Clear cell is the most predominant
 - Papillary
 - Chromophobe
 - Medullary/Collecting Duct
 - Oncocytoma/AML

Risk Factors

- Smoking and Obesity
- Hereditary Factors
 - Von Hippel-Lindau
 - Birt-Hogg Dube Syndrome
 - Tuberous Sclerosis
 - Hereditary Leiomyomatosis Fumarate Hydratase
 - MET/Hereditary Papillary
- Renal Cell Carcinoma – Incidence is rising → 1.1% per year
 - Death rates falling 0.7% per year (2004-2013)
- 5 year survival for localized renal cell – 92.5% (up from 88.4% in 1990s)

Renal Cell Carcinoma Staging

American Joint Committee on Cancer (AJCC) TNM Staging System for Kidney Cancer (7th ed., 2010)

Primary Tumor (T)

- TX Primary tumor cannot be assessed
- T0 No evidence of primary tumor
- T1 Tumor 7 cm or less in greatest dimension, limited to the kidney
 - T1a Tumor 4 cm or less in greatest dimension, limited to the kidney
 - T1b Tumor more than 4 cm but not more than 7 cm in greatest dimension, limited to the kidney
- T2 Tumor more than 7 cm in greatest dimension, limited to the kidney
 - T2a Tumor more than 7 cm but less than or equal to 10 cm in greatest dimension, limited to the kidney
 - T2b Tumor more than 10 cm, limited to the kidney
- T3 Tumor extends into major veins or perinephric tissues but not into the ipsilateral adrenal gland and not beyond Gerota's fascia
 - T3a Tumor grossly extends into the renal vein or its segmental (muscle containing) branches, or tumor invades perirenal and/or renal sinus fat but not beyond Gerota's fascia
 - T3b Tumor grossly extends into the vena cava below the diaphragm
 - T3c Tumor grossly extends into the vena cava above the diaphragm or invades the wall of the vena cava
- T4 Tumor invades beyond Gerota's fascia (including contiguous extension into the ipsilateral adrenal gland)

Regional Lymph Nodes (N)

- NX Regional lymph nodes cannot be assessed
- N0 No regional lymph node metastasis
- N1 Metastasis in regional lymph node(s)

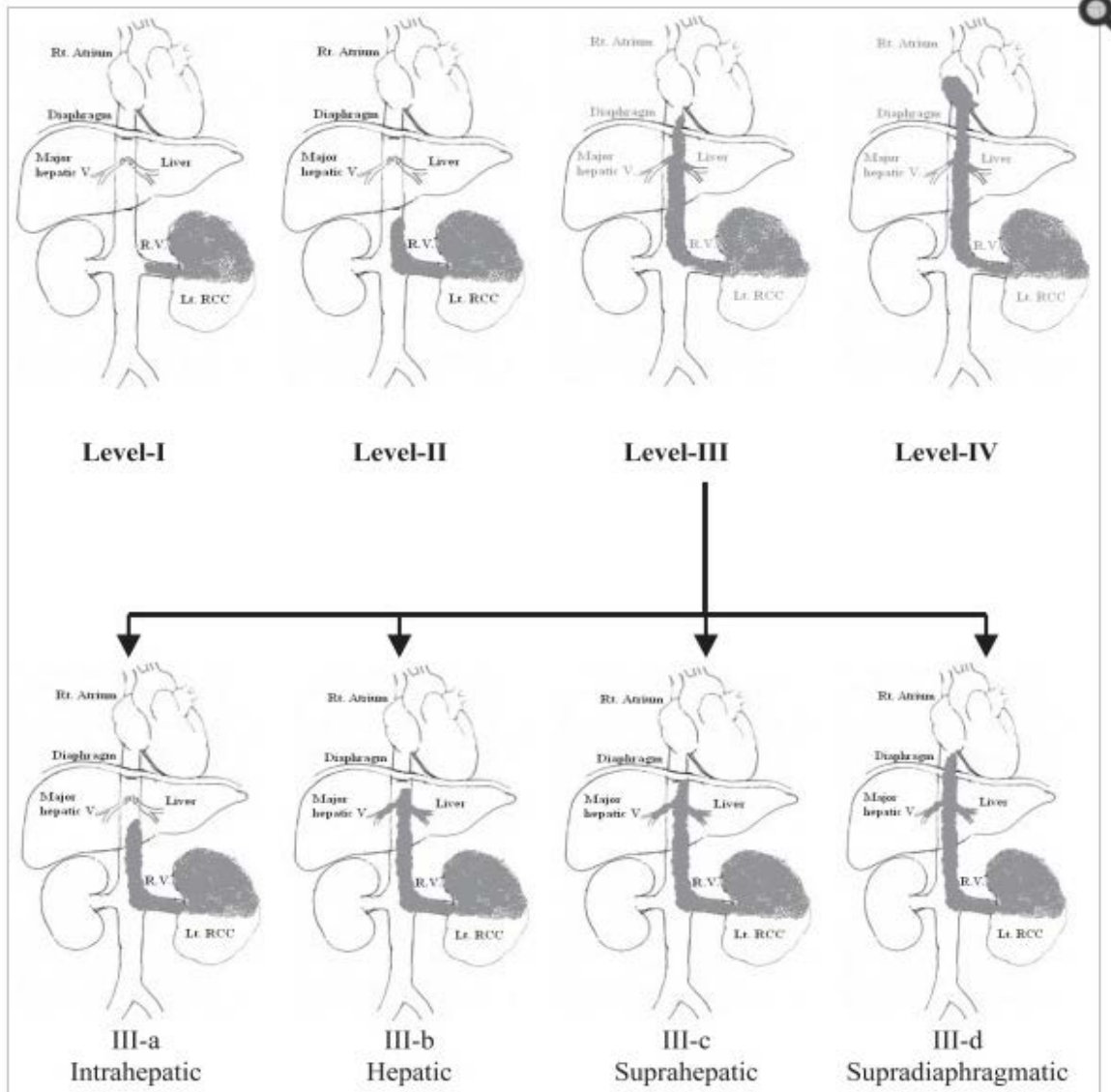
Distant Metastasis (M)

- M0 No distant metastasis
- M1 Distant metastasis

Anatomic Stage/Prognostic Groups

Stage I	T1	N0	M0
Stage II	T2	N0	M0
Stage III	T1 or T2 T3	N1 N0 or N1	M0 M0
Stage IV	T4 Any T	Any N Any N	M0 M1

Figure 1



Small Renal Masses

- Incidentally image-detected
- Contrast-enhancing renal tumors \leq 4 cm
- Up to 25% are benign cortical tumors
 - Oncocytoma
 - Metanephric Adenoma
 - Angiomyolipoma
- Another 25% are indolent
 - Chromophobe
 - Type I papillary renal cancer
- Cannot discriminate radiographically
- Twenty years ago \rightarrow Nephrectomy (regardless of size)

Renal Biopsy?

- Will this alter treatment/management?
- Core biopsy > Fine needle aspiration
- Diagnostic rate – 92%
 - Sensitivity - 99.7%
 - Specificity – 93.2%
- Agreement between histological subtype and grade
 - Good ($k = 0.683$) and Fair ($k = 0.34$)
- Low risk of Clavien ≥ 2 complications
- Nondiagnostic in 10-20% cases
- Oncocytic Neoplasm?

To Treat or Not to Treat

- My Priorities
- 1st – Cancer Control
- 2nd – Partial or Radical Nephrectomy
- 3rd – Size of the incision (robotic?)

- Overlying factor – Quality of Life

Active Surveillance

- Small Renal Masses (SRM)
 - ≤ 4 cm, enhancing, incidentally found
 - Significant medical comorbidities
 - Charleston Comorbidity Index
 - Limited life expectancy
- Absolute
 - High anesthetic risk, <5 year life expectancy
 - Significant risk of ESRD
 - Life Expectancy < 10 years
- Risk of Malignancy
 - SRMs ≤ 1 cm, benign 50%
 - SRMs – 1- 2.9 cm, - 75% malignant risk

Active Surveillance

- Small Renal Masses (SRM)
 - Risk of metastatic disease
 - Within the first 3 years - <5%
- Growth
 - Slowly – 2-3 mm/year
 - $\leq 40\%$ will demonstrate no growth > 3 years (even if + biopsy)
 - Benign and malignant lesions can grow similarly or show no growth
- When to intervene?
 - Rapid growth
 - >0.5 cm/year or >4 cm in size

Cryotherapy

- Provocative trial from Mayo Clinic – compared partial nephrectomy, radiofrequency ablation (RFA), and cryoablation (CA) for cT1 tumors of 1,424 patients
- RFA had inferior outcomes in metastases free rates
- For cT1b, similar local and metastases control between PN and CA
 - 326 patient for PN and 53 for cryoablation
 - Side note, Cleveland Clinic's 3 year local recurrence free rate is only 60% versus 97% of Mayo Clinic
- Overall survival best for PN but due to selection bias?

R.E.N.A.L. Nephrometry Score

FOX CHASE
CANCER CENTER

What is Nephrometry?

$$\begin{matrix} \text{R.} & \text{E.} & \text{N.} & \text{A.} & \text{L.} \\ \boxed{1} & + & \boxed{1} & + & \boxed{1} & + & \boxed{a} & + & \boxed{1} & = & \mathbf{4a} \end{matrix}$$

(R)adius (maximal diameter in cm)

≤ 4 > 4 but < 7 ≥ 7

(E)xophytic/endophytic properties

$\geq 50\%$ $< 50\%$ Entirely endophytic

(N)earness of tumor to the collecting system or sinus (mm)

≥ 7 > 4 but < 7 ≤ 4

(A)nterior/Posterior

(A) Anterior (P) Posterior (X) Neither

Suffix "h" (Click box if hilar tumor touches the main renal artery or vein)

(L)ocation relative to polar lines

(Click on image below that best shows location of tumor relative to polar lines. Your selection will be bordered by red and described in the bar above the images.)



R.E.N.A.L. Nephrometry Score

R.E.N.A.L. Nephrometry Scoring System

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What is Nephrometry?

Nephrometry is a novel scoring system that quantifies the salient anatomy of renal masses in order to provide a useful clinical tool for: (1) guiding management decisions and (2) more meaningful comparisons of reports in the urological literature.

Nephrometry score of 4 to 6 = low complexity
Nephrometry score of 7 to 9 = moderate complexity
Nephrometry score of 10 to 12 = high complexity

R.E.N.A.L. Nephrometry Score

Oncology

Utility of the R.E.N.A.L. Nephrometry Scoring System in Objectifying Treatment Decision-making of the Enhancing Renal Mass

Daniel Canter, Alexander Kutikov, Brandon Manley, Brian Egleston, Jay Simhan, Marc Smaldone, Ervin Teper, Rosalia Viterbo, David Y. T. Chen, Richard E. Greenberg, and Robert G. Uzzo

Table 2. Surgical approach stratified by nephrometry score

Variable	Complexity (n = 615)		
	Low (Score 4-6)	Moderate (Score 7-9)	High (Score 10-12)
Radical nephrectomy			
MIS (n = 153)	7 (5)	55 (20)	91 (44)
Open (n = 55)	1 (1)	8 (3)	46 (22)
Partial nephrectomy			
MIS (n = 183)	89 (70)	82 (29)	12 (6)
Open (n = 224)	31 (24)	136 (48)	57 (28)
Total (n = 615)	128 (100)	281 (100)	206 (100)

$P < .001$ (ie, as tumor complexity increases, open NSS or radical nephrectomy more likely).

Suffix "A" and "P" associated with PN ($P < .001$).

MIS indicates both robotic and laparoscopic approaches.

Use of Partial Nephrectomy

- SEER Data
 - 1999 to 2006
 - 18,000 SRM
 - Increased from 20% → 40%
- Too low?
 - Risk of ESRD
 - Cardiac risks later in life

Positive Surgical Margins Increase Risk of Recurrence after Partial Nephrectomy for High Risk Renal Tumors



Paras H. Shah,* Daniel M. Moreira, Zhamshid Okhunov, Vinay R. Patel, Sameer Chopra, Aria A. Razmaria, Manaf Alom, Arvin K. George, Oksana Yaskiv, Michael J. Schwartz, Mihir Desai, Manish A. Vira, Lee Richstone, Jaime Landman, Arie L. Shalhav, Inderbir Gill and Louis R. Kavoussi

- Specifically looked at positive surgical margins (PSM) and disease recurrence
- Several previous studies fail to determine prognostic information
- In 1,240 patients from 2006 – 2013
 - PSM in 97 patients (7.8%) – Pathologic not Gross
 - Risk of relapse appears associated with distant rather than local recurrence
 - Median time to recurrence – 19 months (33 median follow up)
 - Higher in pT2-3a or Furhman Grade III/IV



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Adult Urology

Positive Surgical Margins Increase Risk of Recurrence after Partial Nephrectomy for High Risk Renal Tumors



R.E.N.A.L. Nephrometry – 4a

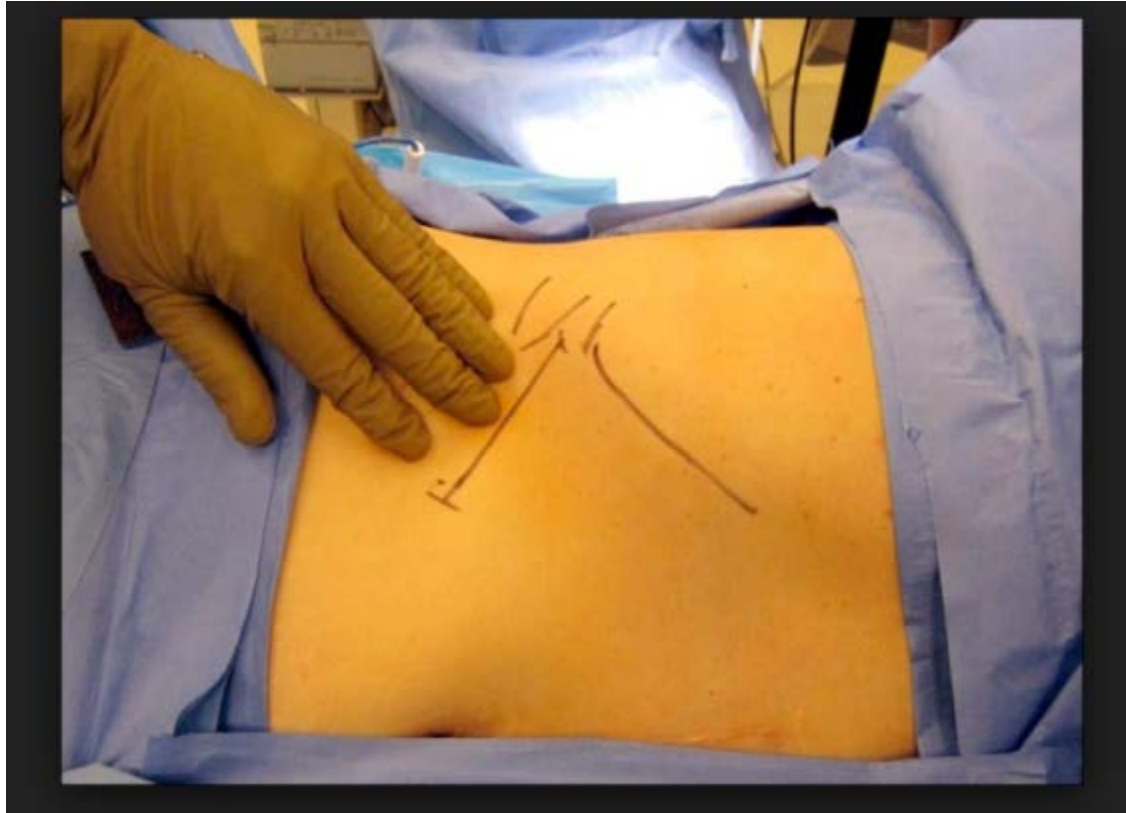


R.E.N.A.L. Nephrometry – 10x



R.E.N.A.L. Nephrometry – 10ph

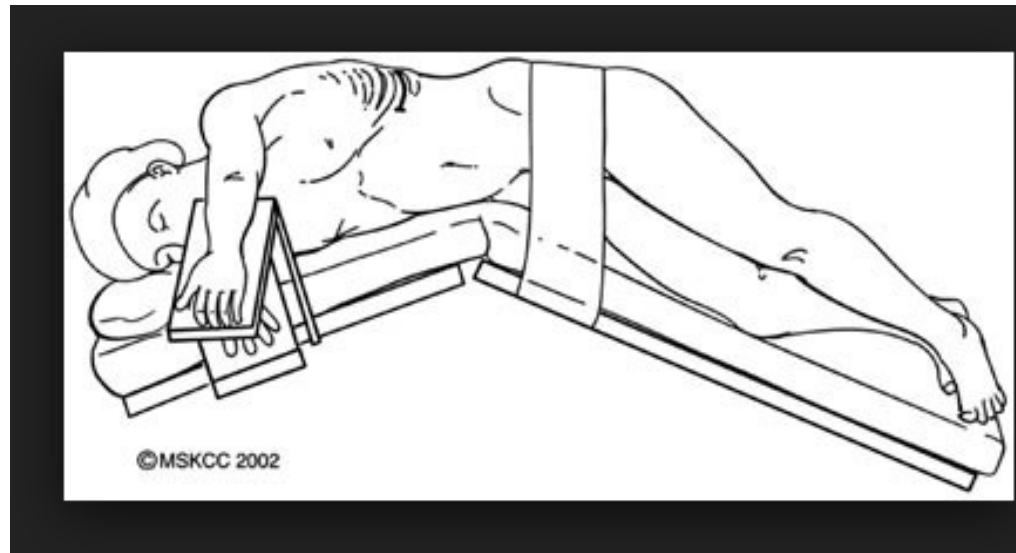
Flank Incision



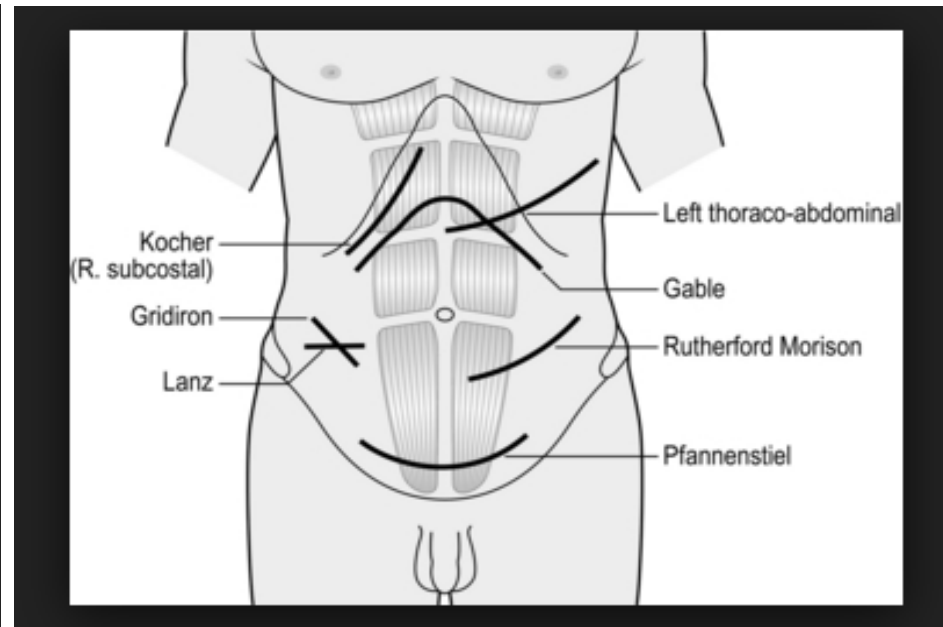
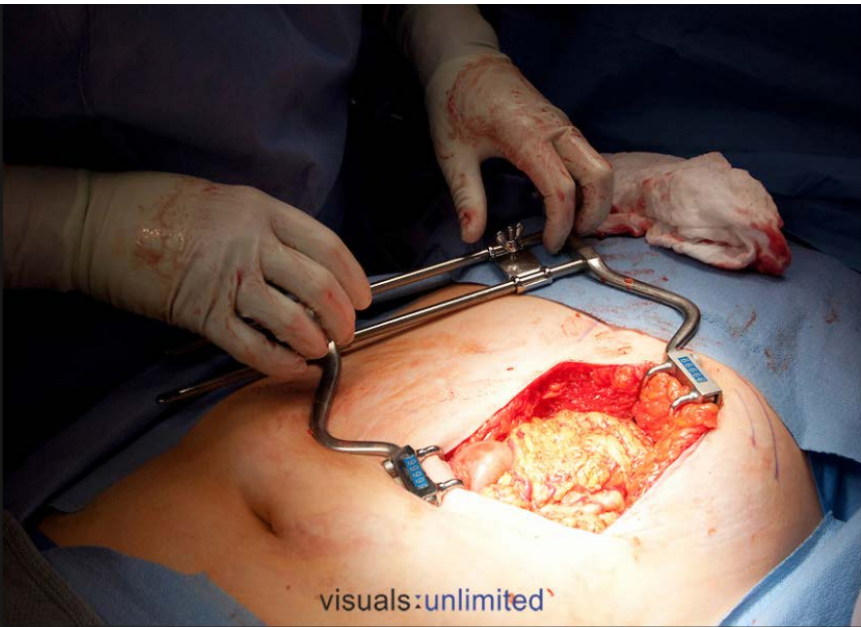
Flank Incision



Flank Incision



Subcostal Incision



Chevron/Mercedes



Robotic – Trans/Retroperitoneal



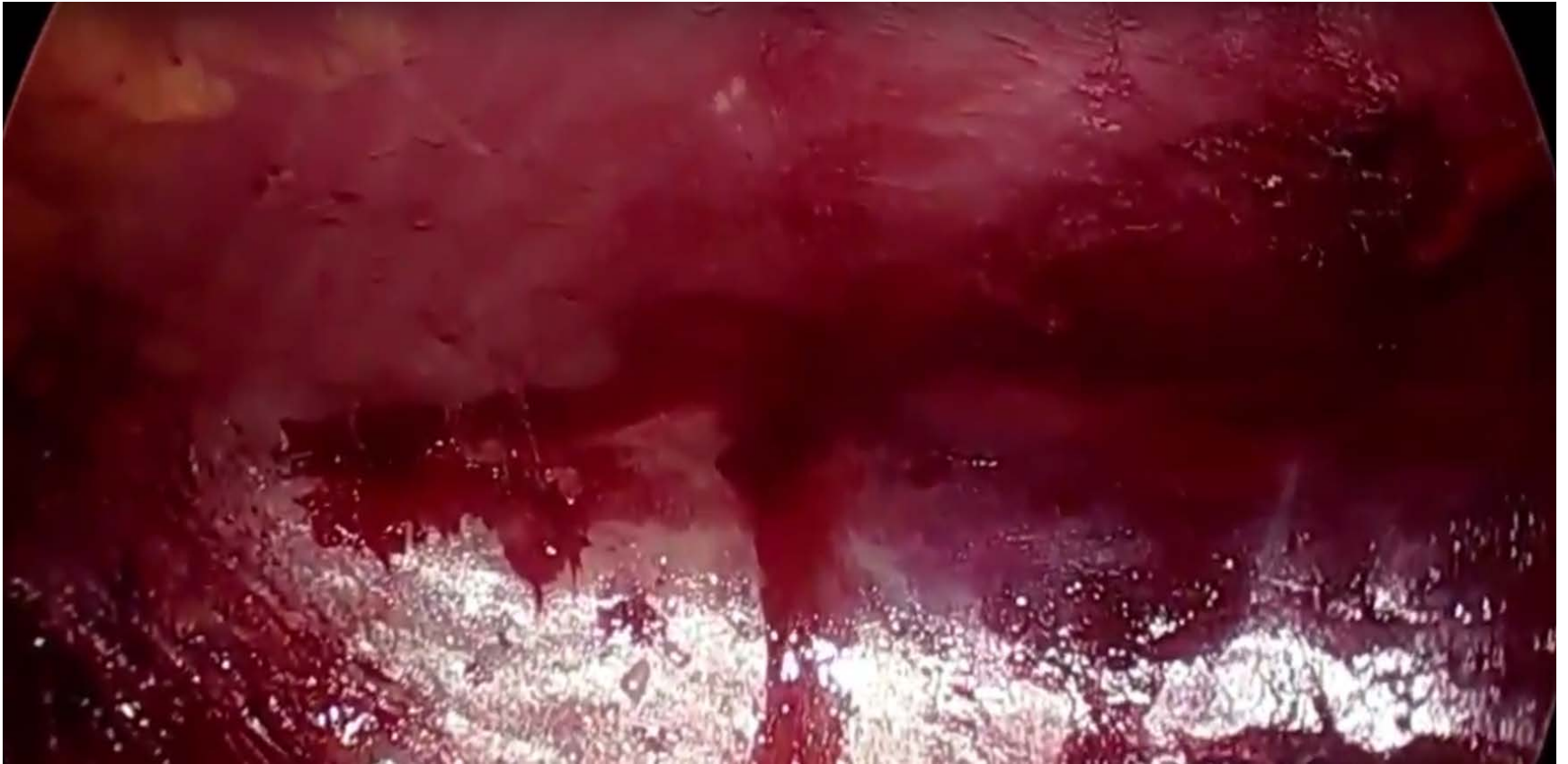
Robotic – Trans/Retroperitoneal



Robotic – Trans/Retroperitoneal



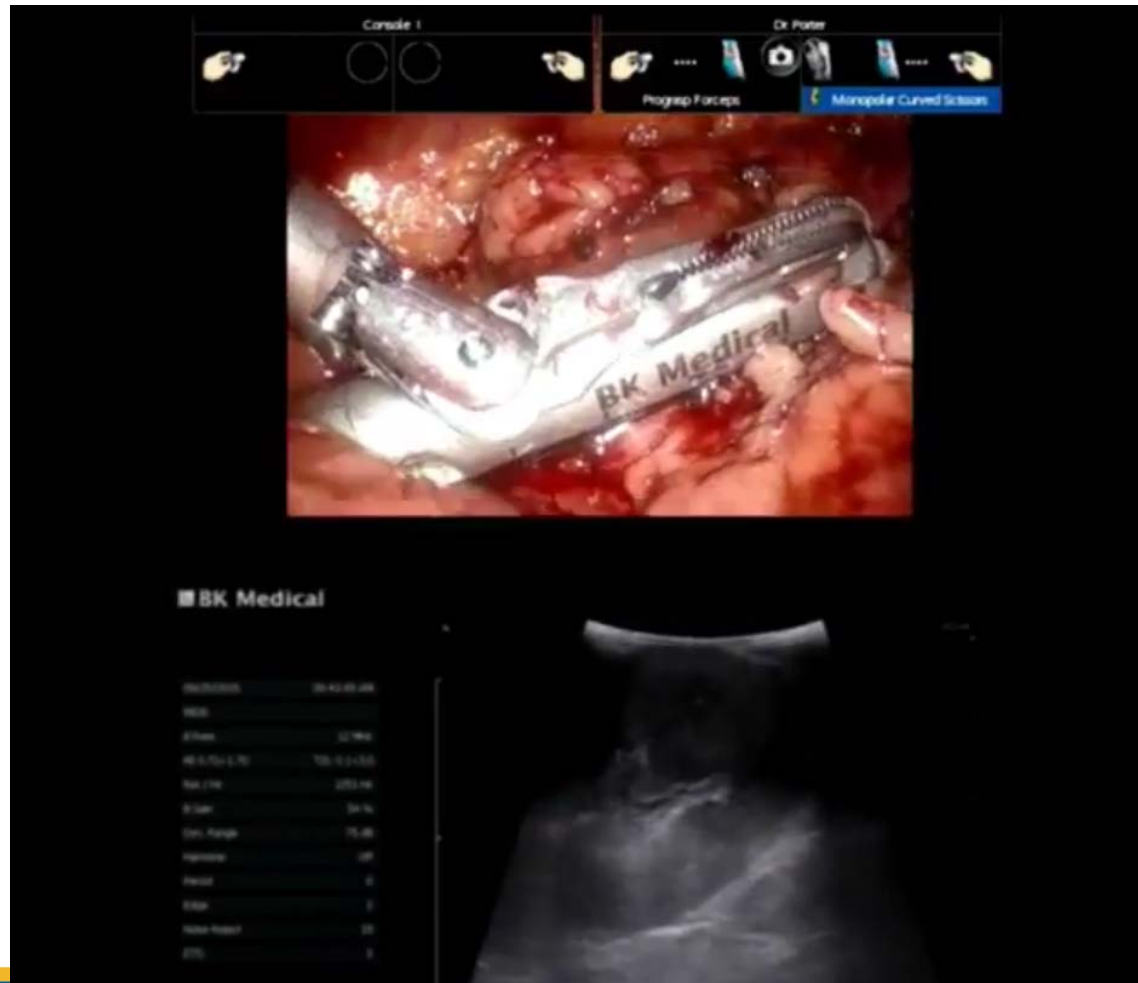
Robotic – Trans/Retroperitoneal



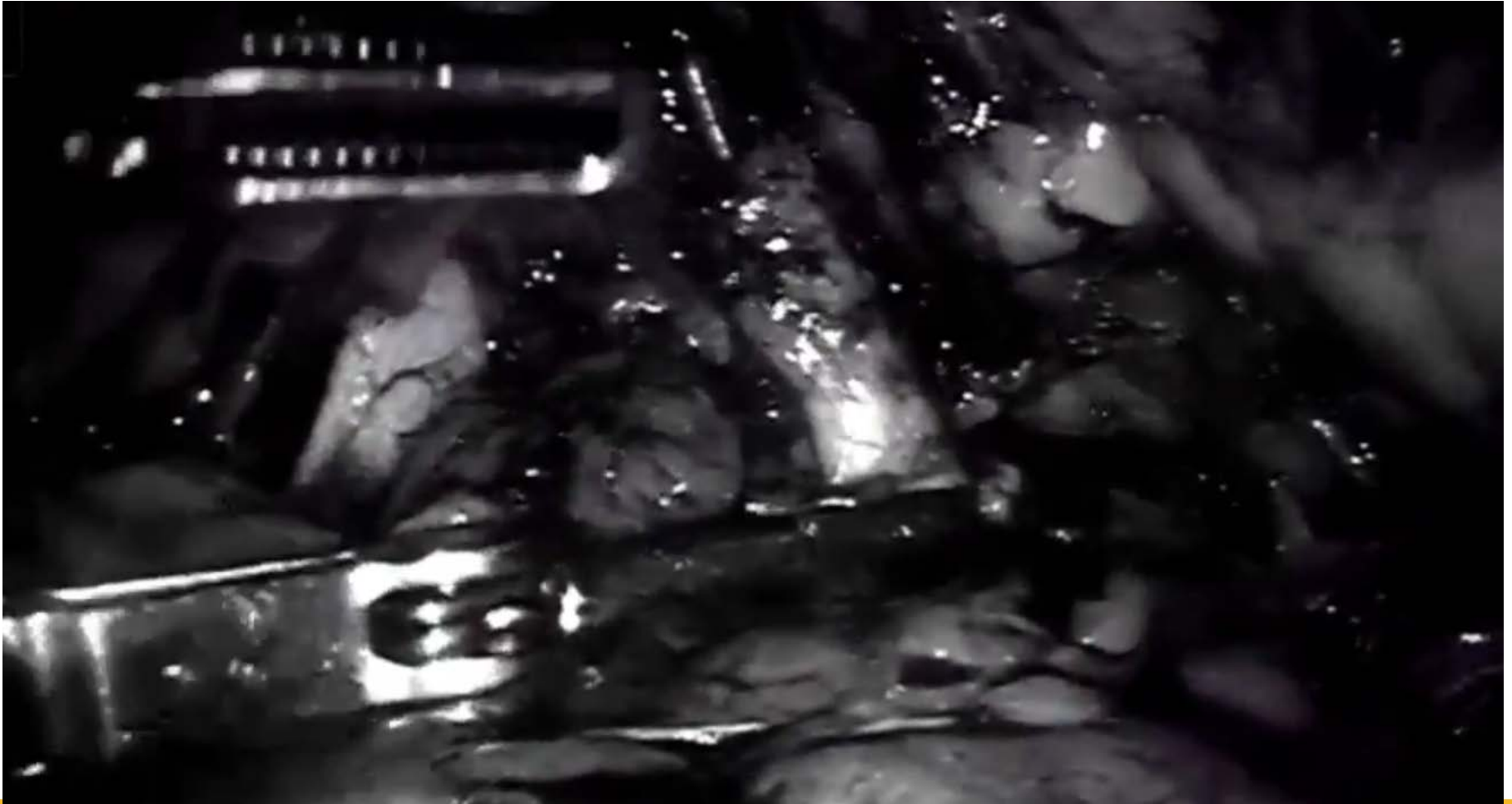
Robotic – Trans/Retroperitoneal



Robotic – Trans/Retroperitoneal



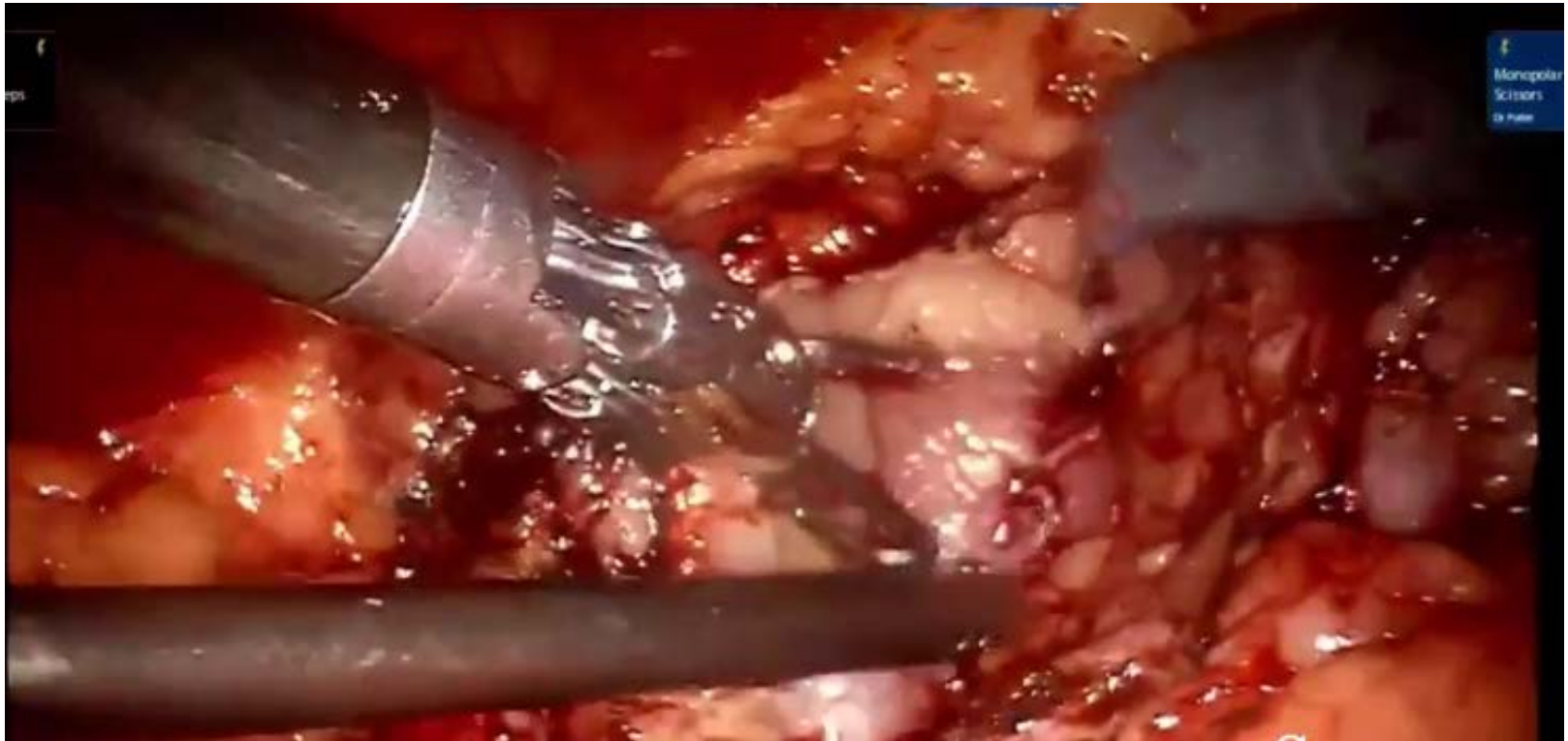
Robotic – Trans/Retroperitoneal



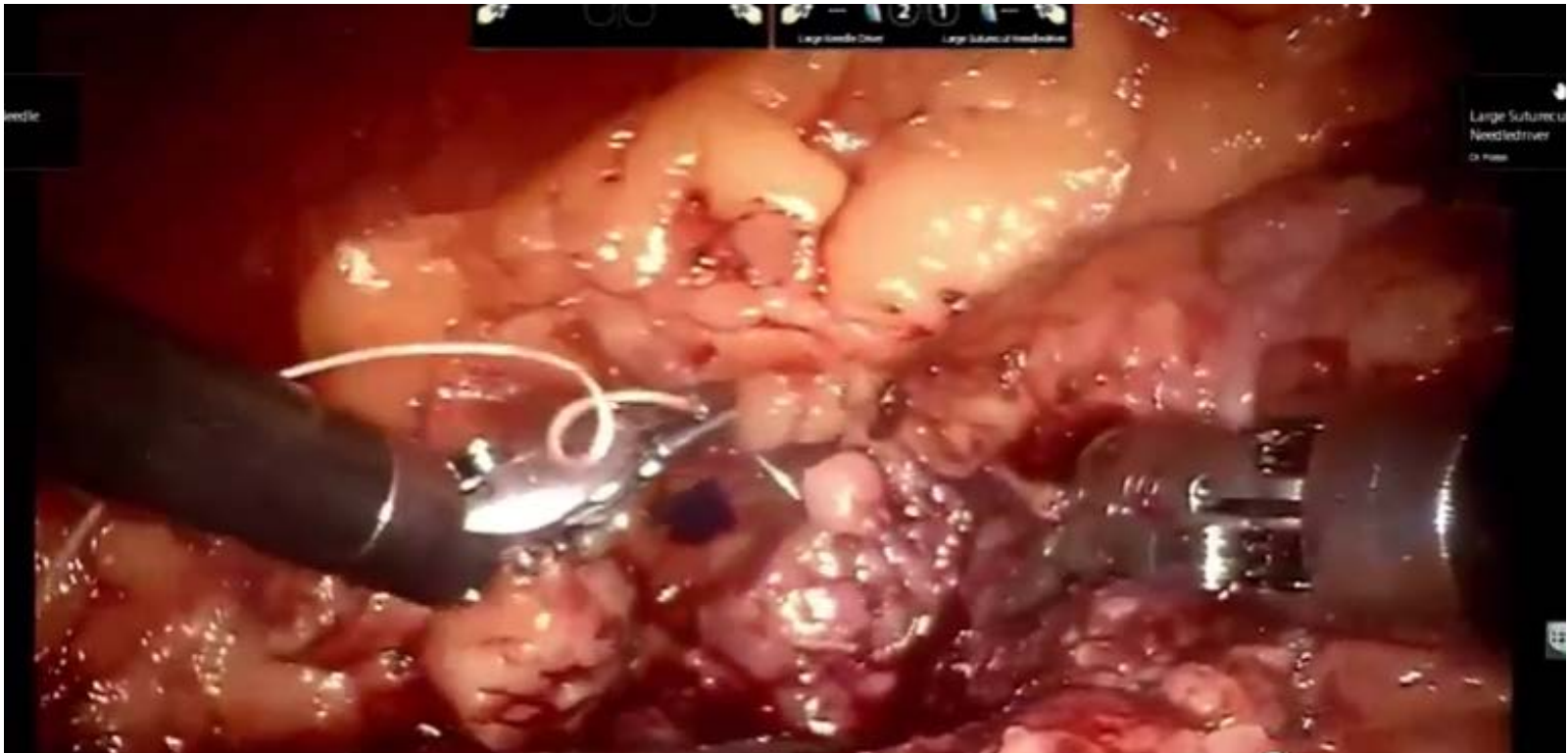
Robotic – Trans/Retroperitoneal



Robotic – Trans/Retroperitoneal



Robotic – Trans/Retroperitoneal



Robotic Partial Nephrectomy for Posterior Tumors Through a Retroperitoneal Approach Offers Decreased Length of Stay Compared with the Transperitoneal Approach: A Propensity-Matched Analysis.

[Maurice MJ](#)¹, [Kaouk JH](#)¹, [Ramirez D](#)¹, [Bhavani SB](#)², [Allaf ME](#)³, [Rogers CG](#)⁴, [Stifelman MD](#)⁵.

- Maurice et al. evaluated transperitoneal (TP) versus retroperitoneal (RP) approach for posterior tumors
- 610 consecutive cases
- Balanced ASA, R.E.N.A.L., BMI, tumor laterality
- RP has shorter LOS (2.2 vs 2.6 days) but longer warm ischemia time (21 vs 19 min)
- No difference between margins, eGFR, complications

Complications of Partial Nephrectomy

153.e4

H.B. Zaid et al. / Urologic Oncology: Seminars and Original Investigations 35 (2017) 153.e1–153.e6

Table 2

Comparison of blood loss, complications, and positive surgical margins by year of surgery. Sample sizes for features with missing data are indicated in italics in parentheses

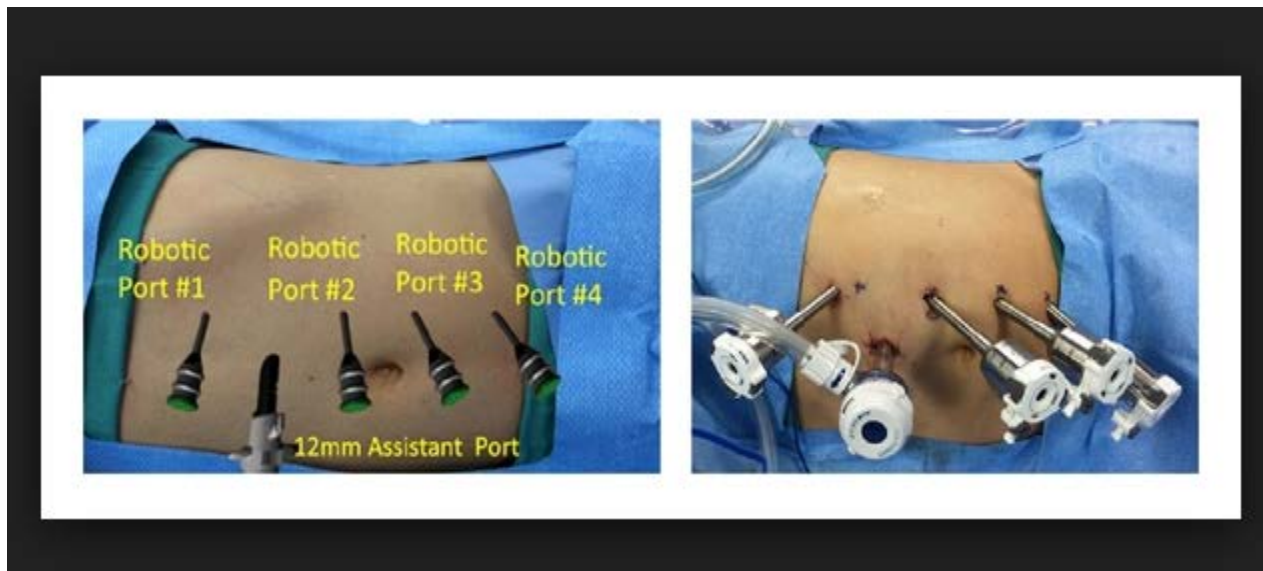
Feature	All <i>N</i> = 1,773	2001–2006 <i>N</i> = 766 Median (IQR)	2007–2012 <i>N</i> = 1,007	<i>P</i> Value
Blood loss, cc (<i>N</i> = 1,707)	200 (100–450)	250 (100–500)	200 (100–400)	<0.001
Received blood transfusion	258 (15)	122 (16)	136 (14)	0.15
Early complications (<i>N</i> = 1,759)				
Death within 30 d	2 (<1)	2 (<1)	0	0.19
Hemorrhage	65 (4)	18 (2)	47 (5)	0.009
DVT	6 (<1)	3 (<1)	3 (<1)	1.0
PE	4 (<1)	0	4 (<1)	0.14
MI	14 (1)	7 (1)	7 (1)	0.62
Wound infection or dehiscence	33 (2)	20 (3)	13 (1)	0.044
Abscess	17 (1)	10 (1)	7 (1)	0.20
Urine leak	77 (4)	31 (4)	46 (5)	0.57
Sepsis	11 (1)	6 (1)	5 (1)	0.55
Acute renal failure	65 (4)	34 (4)	31 (3)	0.14
Loss of kidney	1 (<1)	1 (<1)	0	0.43
Additional surgical procedure	2 (<1)	2 (<1)	0	0.19
Pneumothorax	16 (1)	4 (1)	12 (1)	0.14
Any of the above	241 (14)	104 (14)	137 (14)	0.94
Clavien grade(s) of complication (<i>N</i> = 1,759)				
1	102 (6)	42 (6)	60 (6)	0.64
2	59 (3)	34 (4)	25 (3)	0.025
3	86 (5)	29 (4)	57 (6)	0.064
4	41 (2)	22 (3)	19 (2)	0.18
5	2 (<1)	2 (<1)	0	0.19
3, 4, or 5	119 (7)	47 (6)	72 (7)	0.38
		Median (IQR)		
Length of hospital stay, d	4 (3–5)	4 (3–5)	3 (2–5)	<0.001
		<i>N</i> (%)		
Positive surgical margins (<i>N</i> = 1,766)	51 (3)	16 (2)	35 (3)	0.082

DVT = deep vein thrombosis; IQR = interquartile range; MI = myocardial infarction; PE = pulmonary embolism.

Complications of Partial Nephrectomy

- Increased risk of complications
 - Male (OR = 1.4)
 - Solitary Kidney (OR = 1.71)
 - eGFR (OR = 2.89, for eGFR <30)
 - Charlson Score (OR = 1.97)
 - Tumor Size (OR = 1.12 for 1 cm increase)
- Lap and Robotic had lower risk (OR = 0.016)
 - Tumor Size and Complexity?

Robotic – Trans/Retroperitoneal



Oncologic Control

- Between radical and partial nephrectomy is there a difference?
- Gu et al, systemic review and meta-analysis
- Evaluated for overall survival, recurrence-free survival, and cancer-specific survival

Table 1
Baseline characteristics of the included studies.

Studies	Study design	Study period	Patient population	Country	Surgical approach		No. of patients		Age, yr		Gender (male/female)		Tumor size, cm		Clinical stage
					PN	RN	PN	RN	PN	RN	PN	RN	PN	RN	
Nayak_2016	Pro	2009–2015	Population-based	Canada	Open or lap or rob	Open or lap or rob	1058	390							T1
Shim_2015	Retro	1997–2011	Single institution	Korea			775	1043	54(12)						T1
O'Malley_2015	Retro	1988–2007	Population-based	USA			1893	10,864	61.7(12.4)	64.1(12.5)	1347/546	7200/3664	3.2(1.4)	4.7(1.5)	T1
Mashni_2015	Retro	1989–2012	Single institution	USA			1707	403	60(52–69)	65(56–71)	1050/657	237/166	2.5(1.8–3.1)	3.0(2.5–3.5)	T1a
Lai_2015	Retro	2005–2010	Single institution	China	Open or lap or rob	Lap	48	38	63(14)	61(14)	32/16	27/11	2.5(1.1)	4.8(1.2)	T1
Roos_2014	Retro	1980–2010	Multi-institution	Germany			1108	2955	59.7(11.6)	61.6(11.1)	748/360	1769/1186	3.4(1.8)	5.6(2.7)	T1-2
Oh_2014	Retro	2000–2010	Multi-institution	Korea	Open or lap or rob	Open or lap or rob	30	33	57.4(13.0)	60.2(11.8)			2.8(0.9)	3.4(0.7)	T1a
Milonas_2013	Retro	1998–2009	Single institution	Lithuania	Open	Open	34	317	62.2(10.3)	63.4(10.6)	19/15	164/153	4.67(0.72)	5.25(0.95)	T1b
Ha_2013	Retro	1999–2011	Multi-institution	Korea	Open or lap or rob	Open or lap or rob	54	369	53(20–79)				3.4(median)		T1
Hansen_2012	Retro	1988–2008	Population-based	USA			245	245	63(53–73)	62(53–71)	167/78	169/76	8.8(8.0–10.5)	9.0(8.0–11.0)	T2
Antonelli_2012	Retro	1995–2007	Multi-institution	Italy			1068	919	60.5(12.7)	62.7(11.3)	747/321	603/316	2.8(1.1)	3.4(1.1)	T1a
	Retro	1995–2007	Multi-institution	Italy			198	1426	58.2(14.8)	62.4(11.6)	134/64	902/524	5(0.9)	5.7(1.1)	T1b
Weight_2011	Retro	1999–2006	Single institution	USA			96	117	63(56–71)	67(58–76)	73/23	75/42	4(2.6–5.2)	6(5.0–6.7)	T1
Weight_2010	Retro	1999–2006	Single institution	USA	Open or lap	Open or lap	438	429	63(53–71)	65(56–73)	302/136	262/167	5.0(4.5–5.6)	5.6(5.0–6.4)	T1b
Bedke_2008	Pro	1990–2006	Single institution	Germany			66	398	59.3(13.4)	60.0(11.9)	49/17	237/161			T1-2

Oncologic Control

- In their review consisting of 27,764 patients
- Partial nephrectomy has superior OS (HR: 0.81)
- No difference between CSS or RFS
- Attributed to morbidity of Chronic Kidney Disease
- Limitations – Non-randomized observational studies, heterogeneity of subjects, did not evaluate surgical and QOL outcomes, renal function

Oncologic Control

- In 2011, EORTC (European Organization for Research and Treatment), prospective, randomized, trial
- Partial or Radical for tumors < 5 cm
- Median follow up – 9.3 years
- Closed due to poor accrual
- 12/117 death from RCC (4/RN – 8/PN), 21 patients progressed (9/RN, 12/PN)
- QOL and eGFR not measures
- The number of progression/death too small and cannot explain differences

Coffee and Renal Cell Carcinoma?

- Case control study of 669 patients vs 1,001 frequency-matched controls
- Categorized into non-coffee, decaffeinated, coffee, or both
- Compared to no coffee, inverse associated with caffeinated coffee and RCC (OR 0.74)
- Decaffeinated? Trended towards an increase risk of RCC

Thank You

