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Partial Nephrectomy for the Treatment of Renal Masses: Oncologically Sound and Functionally Prudent

Eric A. Singer[1], Gopal N. Gupta[2] and Gennady Bratslavsky[1,3]
[1]*Urologic Oncology Branch, Center for Cancer Research, National Cancer Institute, National Institutes of Health, Bethesda, MD,*
[2]*Department of Urology, Loyola University Medical Center, Maywood, IL,*
[3]*Department of Urology, SUNY Upstate Medical University, Syracuse, NY, USA*

1. Introduction

The global impact of renal cell carcinoma (RCC) cannot be overemphasized. Approximately 111,100 new cases and 43,000 deaths from the disease among men in developed countries occurred in 2008 alone (Jemal et al. 2011). In 2010, RCC ranked as the seventh and eighth most common malignancy in men and women in the United States, respectively, with 58,240 new cases and 13,040 deaths expected (Jemal et al. 2010). The incidence of renal cancer has been steadily increasing over the last two decades (Chow et al. 1999; Hock et al. 2002).

Surgical extirpation is considered the gold standard for the treatment of an enhancing renal mass. This has traditionally been performed via radical nephrectomy (RN), in which the entire kidney is removed along with the renal mass. While it is possible to maintain normal renal function after a radical nephrectomy, a growing body of evidence demonstrates that there is an increasing incidence of morbidity and mortality associated with decreasing renal function. This realization has refocused attention on the importance of partial nephrectomy in the management of renal masses.

Although most of the world literature reports on the utilization of and the outcomes of sporadic RCCs, the familial renal cancer patients managed at the National Cancer Institute (NCI) provide a robust data set allowing for examination of the oncologic and renal functional outcomes of numerous clinical scenarios and technical approaches, such as initial, repeat, and salvage partial nephrectomies, as well as renal interventions performed via open, laparoscopic, or robotic approaches. While performing serial interventions on the same renal unit results in greater morbidity with each subsequent surgery, metastasis-free survival and renal replacement therapy-free survival are high, making re-operative renal surgery a reasonable option for selected patients. We now advocate that the amount of preservable renal parenchyma, rather than tumor size, be the main determinant of the feasibility of partial nephrectomy (Lane, Fergany, Linehan and Bratslavsky, 2010).

In addition to discussing the importance of surgical preservation of renal function via partial nephrectomy and its role in avoiding the morbidity and costs of renal replacement therapy (RRT), data will also be provided about emerging approaches to nephron-sparing surgery

(NSS). While open partial nephrectomy (OPN), in which only the renal mass is removed sparing the unaffected renal parenchyma, had been the only viable treatment option, advances in laparoscopic and robotic surgery have allowed for a minimally invasive approach to renal surgery that speeds convalescence and decreases the pain associated with the procedure.

In summary, this chapter will provide the rationale and oncologic and functional outcomes that support an aggressive approach towards maximal renal preservation.

2. Oncologic outcomes

2.1 Open partial nephrectomy

Current treatment guidelines issued by both the American Urological Association (AUA) and the European Association of Urology (EAU) recognize NSS as the preferred treatment for renal masses up to 7cm in size (Campbell et al. 2009; Ljungberg et al. 2010). While minimally invasive options such as laparoscopic partial nephrectomy (LPN) and robotic assisted partial nephrectomy (RAPN) are gaining in popularity, OPN provides unique advantages that have not yet been replicated by other approaches, such as the ability to use cold ischemia and non-hilar clamping to maintain a bloodless operative field (Margreiter and Marberger 2010; Volpe et al. 2011). There is robust data describing the oncologic efficacy of open partial nephrectomy (Becker et al. 2006; Becker et al. 2006; Fergany et al. 2006; Pahernik et al. 2006). (Table 1)

Author (Year)	No. of patients	Mean tumor size (cm)	5-yr CSS (%)	10-yr CSS (%)	Local recurrence (%)	Mean Follow-up (mo)
Pahernik et al (2006)	715	3	98.5	96.7	3.3	79
Becker et al (2006)	241	3.7	97.8	95.8	1.4	66
Fergany et al (2006)	400	4.2	82	–	4	62
Becker et al (2006)	69	5.3	100	100	5.8	74

Table 1. Oncologic Outcomes of Contemporary OPN Series

OPN for renal masses less than 4cm in size has been shown to be oncologically equivalent to radical nephrectomy. Belldegrun and colleagues compared 146 subjects who underwent OPN to 125 matched subjects treated with total nephrectomy and found that there was no difference in cancer-specific survival at nearly five years of follow-up (Belldegrun et al. 2008). Similarly, when comparing the cancer-specific mortality for OPN vs. radical nephrectomy in 1454 subjects treated for tumors up to 4cm at seven international academic centers, there was no statistically significant difference between the two approaches at an average follow-up of slightly more than five years (2.2% for OPN vs. 2.6% for radical nephrectomy; $p = 0.8$) (Patard et al. 2004).

Most recently, the results of the prospective, randomized EORTC phase III trial comparing the oncologic outcomes of elective NSS vs. radical nephrectomy for renal tumors up to 5cm

were reported (Van Poppel et al. 2011). From 1992-2003, 541 subjects with normal contralateral renal units were enrolled and followed for a median of 9.3 years after surgery (RN = 273, NSS = 268). While this trial was closed early because of poor accrual, the overall survival rates of 81.1% for RN and 75.7% for NSS were observed. This difference was not statistically significant when analysis was limited to clinically and pathologically eligible subjects (P=0.175). Similarly, there was no significant difference in time to progression between RN and NSS (P=0.48). Cancer-specific survival was not a study endpoint and only 12 of 117 subject deaths were attributable to RCC (4 in the RN group and 8 in the NSS group).

Urologic oncologists continued to expand the "classic" non-essential indications for OPN to routinely include tumors up to 7cm in size (Russo et al. 2002; Russo 2007; Lane et al. 2010). Leibovich and colleagues retrospectively compared 91 subjects who underwent PN for tumors ranging from 4-7cm to 841 subjects treated with radical nephrectomy at the Mayo Clinic from 1970-2000 (Leibovich et al. 2004). At 5 years of follow-up, there were no statistically significant differences in cancer-specific survival and metastasis-free survival between these two groups. Dash and colleagues from Memorial Sloan-Kettering Cancer Center compared elective OPN compared elective OPN (n=45) to radical nephrectomy (n=151) in subjects with clear cell RCC tumors ranging between 4-7cm (Dash et al. 2006). They reported identical disease-free survival at 21 months of follow-up, however, the 5% recurrence rate seen in the OPN cohort prompted the authors to recommend that patients with T1b lesions managed with NSS be surveilled for an extended period of time.

2.1.1 Open partial nephrectomy for local recurrence

Obtaining a negative surgical margin is a critical objective in NSS. The size of the negative margin needed to maintain oncologic efficacy is small and the attainment of wide margins comes directly at the cost of preserved renal parenchyma (Sutherland et al. 2002). Enucleative surgery for well encapsulated tumors, in which no margin of normal parenchyma is excised, may also be a reasonable approach, especially in patients with significant pre-operative renal insufficiency or multifocal disease. This surgical approach does not appear to hamper survival outcomes compared to PNs in which a margin is taken (Carini et al. 2006; Carini et al. 2006; Minervini et al. 2011).

While surgical site recurrence rates are low and typically associated with grossly positive surgical margins at the time of NSS, the management of locally recurrent disease, or metachronous multifocal disease in the ipsilateral renal unit, is challenging and often well suited to OPN (Russo 2007). The NCI experience of managing familial renal cancer syndromes such as von Hippel-Lindau (VHL), hereditary papillary renal carcinoma (HPRC), and Birt-Hogg-Dube' (BHD) provides unique insight into the management of locally recurrent RCC (Singer and Bratslavsky 2010).

In order to preserve renal function, maximize the time interval between repeat partial nephrectomies, and minimize the risk of metastasis, the NCI employs the "3cm rule" as a size threshold for surgical decision making. When the largest solid tumor in a given kidney measures 3cm in diameter NSS is recommended via enucleation of all detectable lesions within that renal unit (Walther et al. 1999; Duffey et al. 2004). It should be noted, however, that the 3cm rule was initially developed in patients with VHL and then applied to patients with HPRC and BHD. Patients with hereditary leiomyomatosis and renal cell carcinoma (HLRCC), which is associated with papillary type 2 tumors that are known for their

virulence and early metastatic potential, are never observed if solid renal tumor is detected. These patients are offered surgical extirpation that includes a margin of normal parenchyma as soon as a solid solid lesion is detected.

Re-operative NSS requires a careful balance between oncologic efficacy and renal preservation. Although there have been significant advances in the use of systemic targeted therapies to treat locally advanced and metastatic RCC, these agents are not considered curative and are associated with significant toxicities, which highlights the importance of timely and effective surgical management for local recurrences (Rini 2009).

Due to the added surgical challenges and morbidity that re-operative renal surgery entails, there are few publications available to guide patients and their oncologists (Novick and Streem 1992; Steinbach et al. 1995; Ansari et al. 2003). Johnson and colleagues at the NCI reviewed 51 planned repeat partial nephrectomies in 47 subjects with locally recurrent disease (Johnson et al. 2008). A total of 40 perioperative complications occurred. Although the majority of these complications did not result in long-term disability, one subject suffered an intraoperative myocardial infarction and died postoperatively, and three subjects lost a renal unit. Despite the increased degree of perioperative morbidity associated with repeat NSS, only 3 subjects (5.8%) in Johnson's series required RRT; a number that would have been considerably higher if radical nephrectomy had been performed, considering that one-third of the surgeries in their cohort were performed on a solitary kidney.

Bratslavsky and colleagues studied a small cohort of subjects who underwent three or more surgical interventions on the same renal unit, which they described as "salvage" PN (Bratslavsky et al. 2008). Not surprisingly, major perioperative complications occurred in 46%. However, more than 75% of the renal units were saved with minimal changes in postoperative serum creatinine, creatinine clearance, and differential renal function. The authors demonstrated that salvage PN was a viable option for select patients with recurrent, mulitifocal localized kidney cancer, and for the first time demonstrated the feasibility of such procedures, as well as resilience of the kidneys in their ability to survive repeat surgical interventions. (Table 2)

Most recently, Singer and colleagues described the renal functional and oncologic outcomes of patients with bilateral renal masses managed surgically at the NCI who had at least 10 years of post-operative follow-up (Singer et al. 2011). They identified a cohort of 128 subjects who had undergone bilateral renal surgery with a median of 3 operations per person. Sixty-eight percent of the cohort had repeat surgery on the same renal unit, with a median time between interventions of 6.2 years. At a median follow-up of 16 years, overall survival was 88%, RCC-specific survival was 97%, and metastasis-free survival was 88%. Despite bilateral, and infrequently repeat interventions, the most recent calculated median eGFR was 57 mL/min/1.73m^2 for the entire cohort. Greater than 95% of subjects were able to avoid RRT. This work has demonstrated that at a minimum of 10 years after initial surgery and despite the need for repeat surgical interventions on the same kidney, NSS allows for excellent oncologic and functional outcomes in selected patients.

2.2 Laparoscopic partial nephrectomy

LPN has gained acceptance as the *de facto* standard treatment for renal cortical tumors less than 4cm in size, when technically feasible by this approach (Lane and Gill 2007; Gong et al. 2008; Lane and Gill 2010). Initially employed to resect small, exophytic renal masses, the indications have expanded to include completely endophytic tumors, hilar tumors and

tumors that measure 4–7cm in size (Gill et al. 2006; Permpongkosol et al. 2006; Lattouf et al. 2008; Simmons et al. 2009; Shikanov et al. 2010). The challenges of LPN, when compared to OPN, include completely resecting the tumor in a bloodless field and performing the necessary renorrhaphy while simultaneously minimizing warm ischemic time.
Several of these challenges have been overcome with technical modifications to the surgery including magnified visualization, improved tools for intracorporal suturing and cold ischemia, as well as improved laparoscopic equipment.

	Johnson et al. (2008)	Bratslavsky et al. (2008)
Partial Nephrectomy Type	Repeat	Salvage
Patients, *n*	47	11
Partial nephrectomy, *n*	51	13
Median tumors removed (range)	7 (1-55)	5 (1-27)
Median EBL, *mL* (range)	1,800 (50-21,500)	2,100 (200-12,000)
Transfusion Requirement (%)	38 (75)	10 (77)
Median Units Transfused (Range)	2 (0-31)	4.5 (0-18)
Intraoperative Complications		
Visceral or vascular injury (%)	2 (4)	6 (46)
Ureteral Injury (%)	1	0
Postoperative complications		
Prolonged Urine Leak (%)	8 (15)	2 (15)
Permanent Hemodialysis (%)	3 (6)	2 (15)
Renal Unit Loss (%)	3 (6)	3 (23)
Rhabdomyolysis (%)	0	1 (8)
Reoperation (%)	2 (4)	4 (36)
Cardiovascular events (%)	1 (2)	0

Table 2. Repeat and Salvage PN Outcomes

As urologists gained more experience with LPN, more centers have employed LPN for technically challenging scenarios where OPN was historically utilized. Tumors that are centrally located and close to the hilum mean the surgeon will encounter larger blood vessles and must perform a more extensive renorrhaphy, often with pelvicaliceal repair. Nadu and colleagues found that LPN for peripheral (n=159) vs. central (n=53) tumors had similar estimated blood loss (EBL) and operative times, whereas WIT was longer for central masses (37 vs. 28 min) (Nadu et al. 2009). Richstone and colleagues evaluated their results with LPN for hilar tumors in 18 patients and reported a mean operative time of 173 min, WIT of 29.4 min and median EBL of 394 ml (Richstone et al. 2008). In addition to tumors in difficult locations, PN in the obese patient population have been shown to have a higher rate of postoperative complications, such as cardiovascular events, wound infections, DVT and wound dehiscence. Romero and colleagues compared LPN (n=56) and OPN (n=28) in an obese cohort and demonstrated that the LPN group had shorter operative time, decreased EBL and fewer intraoperative and postoperative complications compared to those treated by OPN (Romero et al. 2008).

With regards to oncologic outcomes when compared with OPN, LPN has proven to have equivalent 5 year outcomes for T1a lesions in numerous single institution and multi-institutional studies (Porpiglia et al. 2005; Permpongkosol et al. 2006; Bollens et al. 2007; Gill et al. 2007; Lane and Gill 2007; Marszalek et al. 2009; Simmons et al. 2009). Rassweiler and colleagues reported a local recurrence rate of 1.41% among all the urologic malignancies treated in 1098 patients who underwent mixed urologic laparoscopic procedures over a ten year period with a median follow-up of 5 years (Rassweiler et al. 2003). More recently, the Cleveland Clinic reported 5 year survival data after LPN (n=58) with a mean follow-up of 5.7 years (Lane and Gill 2007). Overall survival was 86% and cancer specific survival was 100%. They did not report development of metastatic disease and documented a single local recurrence (2.7%). These findings were consistent with other reported cancer specific survival in reported LPN series which range from 91.4% to 100%.

The overall local recurrence rate in reported LPN series range from 0% to 2.4% with positive surgical margins ranging from 0% to 2.9% (Porpiglia et al. 2005; Lane and Gill 2007; Lane and Gill 2010). Simmons and colleagues reported on the eqiuivalence of oncologic outomes in select patients with clinical stage T1b–T3 tumors treated with LPN compared to a matched cohort of patients who underwent laparoscopic radical nephrectomy (Simmons et al. 2009). The cancer specific survival rate in both groups was 97% and the recurrence free survival was 97% and 94% in the laparoscopic radical nephrectomy and LPN groups, respectively. In a multi-institutional study, Porpiglia and colleagues described LPN for T1b masses in 63 patients and reported intraoperative hemorrhage in 7.3% of cases and postoperative complications in 14.6% of cases (Porpiglia et al. 2010). (Table 3)

Author (Year)	No. of patients	Mean tumor size (cm)	CSS (%)	Positive Surgical Margin (%)	Local recurrence (%)	Mean Follow-up (mo)
Bollens et al (2007)	39	2.3	100	2.6	0	15
Permpongkosol et al (2006)	85	2.4	97.6	2.4	1.7	40
Gill et al (2007)	771	2.7	99.3	1.6	1.4	14
Marszalek et al (2009)	100	2.8	96.3	4	3	44
Lane et al (2007)	58	2.9	100	1.7	1.7	68
Simmons et al (2009)	35	4.9	97	0	6	44
Porpiglia et al (2010)	63	4.7	N/A	6.5	0	N/A

Table 3. Oncologic Outcomes of Contemporary LPN Series

Although comparisons of open and laparoscopic PN have been performed, all studies are retrospective, and no randomized studies have been done so far. Nevertheless, the available literature suggests the equivalence of LPN to OPN for renal cortical tumors. Gill and colleagues in a multi-institutional study compared LPN (n=1029) and OPN (n=771) in 1800 patients with a renal cortical tumor measuring less than 7cm (Gill et al. 2007). In that study, patients undergoing OPN were a higher risk group with decreased performance status,

renal functional impairment and more tumors greater than 4cm. The authors reported a positive surgical margin rate of 2.85% for LPN versus 1.26% for OPN and three year cancer specific survival of 99.3% for LPN and 99.2% for OPN. Marszalek and colleagues performed a matched-pair comparison of 200 patients matched for age, sex, and tumor size who underwent OPN (n=100) and LPN (n=100) with median 3.6 year follow-up (Marszalek et al. 2009). The stage of renal cell cancer was pT1 in all cases and the average tumor size was 2.8cm in the LPN cohort and 2.9cm in the OPN cohort. They reported a positive surgical margin rate of 4% and 2% in the LPN and OPN cohorts, respectively. Estimated 5 year local recurrence free survival using Kaplan-Meier method was 97% and 98%, and distant recurrence free survival was 99% and 96% in the LPN and OPN cohorts, respectively.
In summary, use of LPN has expanded from its initial use for the extirpation of smaller exophytic lesions to larger T1b tumors, endophytic and hilar lesions. It appears that for tumors less than 4cm in size, LPN provides equivalent oncologic control to OPN at intermediate follow-up. Oncologic outcomes are encouraging for tumors in the 4-7cm range although intermediate term oncologic data has yet to be reported.

2.3 Robotic assisted partial nephrectomy

With the establishment of LPN as an alternative to OPN in the treatment of renal cortical masses, RAPN has been increasingly adopted by urologic surgeons with the goal of broadening the utilization of NSS while still providing the advantages of minimally invasive surgery. Established advantages of minimally invasive techniques for PN include decreased postoperative pain, decreased hospital stay and shorter convalescence compared with standard open technique. This alternative to LPN may aid in the learning curve and facilitate in the reconstructive aspects of what is a technically demanding operation. Features of the robotic platform include stereoscopic vision, articulating instruments, and motion scaling to reduce tremor. These amenities may allow the surgeon to replicate established maneuvers employed during OPN, allow for extirpation of complex, centrally located tumors, and reconstruction of the pelvicaliceal system.
The feasibility and safety of RAPN has been demonstrated in several small, single institution studies (Gettman et al. 2004; Phillips et al. 2005; Caruso et al. 2006; Kaul et al. 2007; Aron et al. 2008; Deane et al. 2008; Benway et al. 2009; Ho et al. 2009; Michli and Parra 2009; Benway et al. 2010). Recent studies have demonstrated the feasibility of RAPN for larger, deeper tumors that are hilar in their location as well as for multiple tumors in the hereditary renal cancer population (Rogers et al. 2008; Boris et al. 2009; Gupta et al. 2011). (Table 4)
In a recent review of the RAPN literature, Shapiro and colleagues analyzed the results of the largest series of RAPN and reported an overall positive surgical margin rate of 3.3% (7/211) and that at up to 54 months of follow-up, there were no local or distant recurrences (Shapiro et al. 2009). With the expansion of LPN to T1b tumors, RAPN has also been employed for these challenging tumors. Patel and colleagues retrospectively analyzed a cohort of 71 patients who underwent RAPN for tumors greater than 4cm (n=15) compared to those with tumors less than 4cm (N=56) (Patel et al. 2010). There were no positive surgical margins in the greater than 4cm group and 3 reported in the less than 4 cm group for an overall rate of 5.4% but the authors noted that on final pathology only 1 of the positive surgical margins was for a malignancy with no sequelae at one year. Gupta and colleagues reported on 19 surgeries for multiple tumors (average 2.3 tumors/kidney) with the largest tumor greater than 4cm (Gupta et al. 2010). Remarkably, in this population, no patient required a blood transfusion and mean WIT was 36 min. There are currently no intermediate or long term

oncologic outcomes reported in the literature for RAPN, but short term outcomes from several robotic series seem to be equivalent to those reported for LPN series. However, these data are immature at best and long term data is needed regarding oncologic outcomes.

Author (Year)	No. of RAPN	Mean tumor size (cm)	Mean WIT (min)	Mean operative time (min)	Mean blood-loss (ml)	Positive surgical margin	Mean Follow-up (mo)
Boris et al (2009)	10	2.3 (multiple)	29.6	257	360	not assessed	9
Scoll et al (2010)	98	2.8	25.5	203	127	5	13
Rogers et al (2008)	148	2.8	27.8	197	183	6	7
Benway et al (2010)	183	2.9	23.9	210	131.5	4	16
Rogers et al 2008)	8	3.6	31	192	230	0	3
Patel et al (2010)	15	5	25	275	100	0	7
Gupta et al (2010)	19	5 (multiple)	36	390	500	not assessed	22

Table 4. Selected RAPN Series

3. Renal functional outcomes

While it is intuitive that sparing normal renal parenchyma will impart better overall kidney function, the misconception long held is that the sacrifice of normal functioning nephrons via radical nephrectomy will not cause serious long term side effects. However, one of the most important recent concepts to be recognized is the adverse effects of renal insufficiency on compounding medical comorbidities. Although no randomized prospective studies exist at this time, retrospective analysis revealed that incremental increases in renal insufficiency are associated with incremental increases in all-cause hospitalization, cardiovascular morbidity and all-cause mortality (Go et al. 2004). Additionally, several other studies demonstrated a close association of renal insufficiency with cardiovascular disease, while others have suggested that patients treated with radical nephrectomy had shorter overall survival when compared to those treated with PN (Russo and Huang 2008; Huang et al. 2009). Two studies comparing late renal functional outcomes in over 450 patients undergoing radical nephrectomy and PN demonstrated that patients undergoing radical nephrectomy were more likely to have serum creatinine levels elevated to more than 2.0 mg/dL and proteinuria (Lau et al. 2000). A more recent study from the Mayo Clinic identified 648 patients treated with radical nephrectomy or PN for tumors less than or equal to 4 cm and a normal contralateral kidney (Thompson et al. 2008). Overall survival calculated in 327 patients under the age of 65 after controlling for year of surgery, diabetes at presentation, Charlson comorbidity score and tumor histology found that radical

nephrectomy was significantly associated with an increased risk of death. These results strongly indicate that the use of radical nephrectomy for small renal masses is unjustified oncologically and that NSS should be selected whenever possible.

Duration and type of "safe" ischemia has been actively evaluated in recent years. A large multi-institutional study evaluated the effects of ischemic time on renal function in patients undergoing OPN without ischemia, with warm ischemia, and with cold ischemia. This study included patients with solitary kidneys and defined chronic renal insufficiency on the basis of serum creatinine. The conclusion of this study was that WIT should be limited to 20 minutes and cold ischemia time to less than 35 minutes to avoid an increased risk of chronic renal insufficiency and acute renal failure (Simmons et al. 2008; Becker et al. 2009). As the urologic community has gained experience with LPN and RAPN, WIT has been reduced and in several studies it was found comparable to that of OPN. (Table 4) Regardless, until prospective data can determine the true safe maximum WIT in regards to renal function, every attempt to minimize WIT should be made.

4. Future directions for partial nephrectomy

With the establishment that PN for renal tumors up to 7cm is oncologically equivalent to radical nephrectomy, urologic oncologists have been expanding the indications for PN to include tumors greater than 7cm (T2) and even lesions that penetrate the renal capsule (T3a) or have tumor thrombus involving the main renal vein (T3b). Breau and colleagues from the Mayo Clinic recently reported their experience treating 69 subjects with advanced renal tumors (T2=32, T3a=28, T3b=9) who were compared to a matched cohort from their kidney tumor registry (Breau et al. 2010). Cancer-specific and overall death rates were similar between the two groups ($p=0.489$ and $p=0.642$, respectively), and differences in metastatic disease and local recurrence at an average follow-up of 3.2 years were not statistically significant ($p=0.92$ and 0.234, respectively). Renal function, however, as measured by serum creatinine, was better preserved in the PN group (9.5% increase vs. 33% increase; $p<0.001$).

Similarly, several small series have been reported in which NSS was used in the cytoreductive setting for patients with metastatic disease (Krambeck et al. 2006; Hutterer et al. 2007). The majority of these cases were performed on solitary kidneys or in the presence of renal insufficiency. Survival was not negatively impacted when compared to historic controls who received radical nephrectomy, and renal function was preserved adequately to avoid RRT, which will help facilitate access to targeted systemic treatments (Singer et al. 2010; Singer et al. 2011). Targeted systemic therapy has also been used in the neoadjuvant setting to downsize the primary tumor in a solitary kidney so that PN would be technically feasible (Shuch et al. 2008).

In the years ahead, it is unlikely that tumor diameter will be a major determinant for the type of renal surgery offered to a patient with a renal mass. Instead of size, the surgeon will base his or her recommendation for or against NSS on objective measures of the feasibility of a safe and complete resection (Lane et al. 2010). Most recently, Bratslavsky has raised the concept of the metastatic potential of renal tumors, in which the development of metastatic disease is not prevented by removal of the normal renal parenchyma. He argues against arbitrary size cut-offs traditionally used for selection of patients for partial nephrectomy, and suggests that maximal preservation of normal parenchyma in patients with largest tumors may be even more important, as these patients would be at a higher risk for

metastatic disease and could benefit for future adjuvant trials or treatment (Bratslavsky, 2011). Finally, as urologists continue to report and compare their NSS outcomes, they will need to use a new metric, such as the RENAL nephrometry score or the PADUA classification, which objectively quantifies the anatomic complexity of a renal mass (Kutikov and Uzzo 2009; Ficarra et al. 2009).

5. Conclusions

NSS should be considered the preferred therapy for renal tumors whenever it is technically feasible via any surgical approach. Patients and their referring physicians should seek out high-volume centers and experienced surgeons who have a special interest in NSS. The method of PN selected, whether OPN, LPN, or RAPN, matters far less than ensuring that the correct operation is performed for the appropriate indications. Since the loss of renal function can increase the risk of post-operative morbidity and mortality in numerous ways, PN must continue to be the treatment of choice for kidney tumors. PN is the oncologically sound and functionally prudent way to manage an increasing number of renal tumors.

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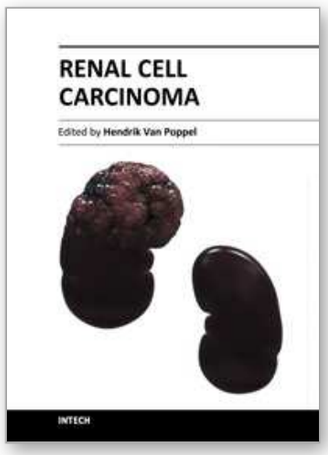

Renal Cell Carcinoma

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Surgical and medical oncologists have been unable to decrease renal cell carcinoma mortality for uncertain reasons, although a lot of progress has been made in diagnosis and imaging, recognition of different genetic and pathological entities, management of localized disease and in the research on new drug treatments for advanced stages of the disease, potentially combined with surgery. The purpose of this book, which tackles a number of separate interesting topics, is to provide further insight into the disease and the management of early and advanced renal cell carcinoma. The volume is divided into different parts; the first part covers the characterization of renal masses and the second part covers rare distinct pathological entity. In the management section, active surveillance, partial nephrectomy and radiofrequency ablation are presented. A separate chapter reviews the management of Von Hippel Lindau disease, and finally, conventional and aberrant signaling pathways are explored.

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51000 Rijeka, Croatia
Phone: +385 (51) 770 447
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中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
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