Partial Nephrectomy
15 YEARS OF PROGRESS

ANDREW C. NOVICK LECTURE
KCA 2015

Paul Russo MD, FACS
Professor of Urology
Attending Surgeon
Memorial Sloan Kettering Cancer Center
Weill School of Medicine
Cornell University
New York, New York
Andrew Novick M.D. 1948-2008
Glickman Urological & Kidney Institute
Cleveland Clinic, Cleveland Ohio
Historical Perspective
Surgical Oncology/Kidney Surgery

• 1900-1970: Radical surgery (Halstead) for all tumors of all sizes, including kidney tumors.

• 1970-2000: Organ and limb sparing approaches introduced (breast and sarcoma) and accepted.

Robson Radical Nephrectomy
University of Toronto: 1960’s

• Partial nephrectomy only for essential indications such as tumor in solitary kidney, bilateral tumors, renal insufficiency

Robson, Churchill, Anderson J Urol
1969;101:297
Renal Cortical Tumors
Imaging Induced Size and Stage Migration (1990-2006)

• Development of modern ultrasound, CT and MRI.
• Tests ordered for non specific abdominal, musculoskeletal complaints or during unrelated cancer care.
• Era of the small renal mass begins (70% incidentally detected, median tumor size < 4cm)
• Movement from only essential to elective partial nephrectomy begins.
• Novick, Herr, Van Poppel: Early 1990’s reported “nephron sparing” or elective PN in the presence of healthy contra lateral kidney.
Contemporary Expanded Partial Nephrectomy 2006-2015

• Importance of avoiding Chronic Kidney Disease (CKD).
• Expanding indications for partial nephrectomy: bilateral tumors, >4, 4-7, >7cm, intra renal vein thrombus.
• Increasingly complex endophytic, peri hilar, post ablation, cytoreductive partial.
• MIS (lap/robotic assisted) partial nephrectomy.
• Complex open surgery plays critical role in performing advanced partial nephrectomy.
Kidney Tumor Surgery
Drivers of Paradigm Shift Toward PN

- 70% of tumors are incidentally detected with median tumor size of <4cm.
- Kidney cancer not a single disease. 54% of tumors are clear cell and account for 90% of metastases. 45% have indolent or benign histology.
- PN and RN: equivalent outcomes for T1 (<7) tumors.
- RN can cause or worsen chronic kidney disease (CKD) which is a risk factor for cardiovascular disease and worse survival.
- Kidney tumor patients are not the same as kidney donors.
Index Case: Incidentally discovered 4 cm renal mass in healthy 54 y.o. female.
MSKCC: DFS Partial and Radical Nephrectomy: Tumors 4cm or less across all histologies

A Prospective, Randomised EORTC Intergroup Phase 3 Study Comparing the Oncologic Outcome of Elective Nephron-Sparing Surgery and Radical Nephrectomy for Low-Stage Renal Cell Carcinoma

Hendrik Van Poppel a,*, Luigi Da Pozzo b,1, Walter Albrecht c, Vsevolod Matveev d, Aldo Bono e, Andrzej Borkowski f, Marc Colombel g, Laurence Klotz h, Eila Skinner i, Thomas Keane j, Sandrine Marreaud k, Sandra Collette k, Richard Sylvester k


• 1992-2003: 541 patients
• Overall survival
• Underpowered
• 45 centers, 17 countries
• Intention-to-treat

• FOR RCC patients with tumors 5 cm or less, PN not inferior to RN for O.S.
# Kidney donors are not Kidney tumor Patients

*JAMA* 503:959-266, 2010

<table>
<thead>
<tr>
<th>Type of Nephrectomy</th>
<th>Number of Patients</th>
<th>Median age (years)</th>
<th>Pre Op eGFR</th>
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<tbody>
<tr>
<td>Donor Nephrectomy</td>
<td>703</td>
<td>45</td>
<td>99 ml/min</td>
</tr>
<tr>
<td>Renal Cancer</td>
<td>662</td>
<td>58</td>
<td>69 ml/min</td>
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</table>
Chronic Kidney Disease (CKD)

*JAMA 313:837-846, 2015*

- Reduced glomerular filtration (eGFR < 60), structural kidney damage, proteinuria
- 30 million with CKD in USA.
- 30% of patients undergoing nephrectomy already have CKD.
- CKD: increased cardiovascular events and worse overall survival.
All Cause Mortality in 1,120,295 Outpatients (Age adjusted death rate as per eGFR)

Retrospective review of all patients (N=1479) from 1/1995-6/2005 who had definitive surgery for localized renal cortical tumors at MSKCC.

Found association between year of surgery and baseline GFR even after controlling for comorbidity, tumor size, and BMI.

“Dose-Dependent” survival based upon baseline GFR independent of the tumor stage.

Findings of this study underscore the importance of preserving renal parenchyma and beg the question of whether treatment of small tumors may be worse than the malignancy itself.

**Effect of Baseline Glomerular Filtration Rate on Survival in Patients Undergoing Partial or Radical Nephrectomy for Renal Cortical Tumors**

Joseph A. Pettus, MD; Thomas L. Jang, MD; Robert H. Thompson, MD; Ofer Yossepowitch, MD; Meagan Kagiwada, BS; and Paul Russo, MD

**MSKCC: Mayo Clinic Proceedings. 2008; 83: 1101-1106.**
Chronic kidney disease after nephrectomy in patients with renal cortical tumours: a retrospective cohort study

William C Huang, Andrew S Levey, Angel M Serio, Mark Snyder, Andrew J Vickers, Ganesh V Raj, Peter T Scardino, Paul Russo

<table>
<thead>
<tr>
<th>Total (n=662)</th>
<th>Preoperative serum creatinine concentration (μmol/L)</th>
<th>&lt;80 (n=228)</th>
<th>80-105 (n=239)</th>
<th>106-124 (n=195)</th>
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<tr>
<td>&lt;30</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30-44</td>
<td>15 (2%)</td>
<td>0</td>
<td>0</td>
<td>15 (100%)</td>
</tr>
<tr>
<td>45-59</td>
<td>156 (24%)</td>
<td>69 (44%)</td>
<td>87 (56%)</td>
<td></td>
</tr>
<tr>
<td>60-89</td>
<td>406 (61%)</td>
<td>146 (36%)</td>
<td>167 (41%)</td>
<td>93 (23%)</td>
</tr>
<tr>
<td>≥90</td>
<td>85 (13%)</td>
<td>82 (96%)</td>
<td>3 (4%)</td>
<td>0</td>
</tr>
</tbody>
</table>

Data are number of patients (% of those with preoperative GFRs).

Table 1: Distribution of preoperative estimated GFRs (mL/min per 1.73 m²) of original cohort

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26% of patients undergoing elective PN had eGFR <60 c/w CKD despite “normal” Serum creatinine

Lancet Oncol 2006; 7: 735–40

Figure 3: Probability of freedom from new onset of GFR lower than 45 mL/min per 1.72 m², by operation type
Partial Nephrectomy Versus Radical Nephrectomy in Patients With Small Renal Tumors—Is There a Difference in Mortality and Cardiovascular Outcomes?

William C. Huang,* Elena B. Elkin, Andrew S. Levey, Thomas L. Jang and Paul Russo

From the Department of Urology, New York University Medical Center (WCH) and Departments of Epidemiology and Biostatistics (EBE) and Division of Urology, Department of Surgery (TJ, PR), Memorial Sloan-Kettering Cancer Center, New York, New York, and Division of Nephrology, Department of Medicine, Tufts-New England Medical Center (ASL), Boston, Massachusetts

RN 1.4x > PN

RN 1.38x > PN

SEER/Medicare Database
Pooled Analysis of Worlds Literature Supports Partial Nephrectomy


- 51 studies involving 31,728 patients comparing partial and radical nephrectomy for localized renal tumors.
- Partial nephrectomy: 19% reduction in all cause mortality.
- Partial nephrectomy: 29% reduction in cancer specific mortality.
- Partial nephrectomy: 61% reduction in CKD.
Figure 1. Partial nephrectomy by year in patient subset with tumors 4 cm or less treated electively.
Figure 1. Treatment Trends of Small Kidney Cancers (2001-2009)

- **Radical nephrectomy**
- **Nephron-sparing surgery**
- **Nonsurgical management**

Data on partial nephrectomy and ablation when combined as nephron-sparing surgery. See the eFigure in the Supplement for partial nephrectomy and ablation listed separately.
Recommendation: For renal cortical tumors of 4 cm or less partial nephrectomy should be done whenever technically feasible.
95,711 patients from National Inpatient Sample

*Guidelines led to only 6.4% increase in PN
Extending Partial Nephrectomy
Technical Feasibility/Selection Factors

- **Patient factors**: Age, life expectancy, baseline eGFR, medical co morbidities.

- **Tumor factors**: Size, location, proximity to hilar vessels, anticipated vascular and collecting system resection and repair.

- **Surgeon factors**: Experience with complex kidney surgery, surgical volume, commitment to kidney preservation, reconstructive surgical experience.
OPEN PARTIAL NEPHRECTOMY
Further Expanding of Indications

- Massive bilateral sporadic renal tumors.
- Bilateral tumors for familial and hereditary syndromes.
- Tumor in solitary or functionally solitary kidney
- Cytoreductive PN with intra renal vein tumor thrombus.
- Enhancing renal masses after failed thermal ablation.
- Repeat PN for recurrent tumor.
- PN for renal sinus tumors.
7 cm exophytic renal mass in 59 yo male incidentally detected. PN done: renal oncocytoma
A, overall survival in 873 patients treated with RN (dotted curve) and 286 treated with PN (solid curve) (p = 0.8). B, cancer specific survival in 704 patients treated with RN and 239 treated with PN (p = 0.039).

Mayo Clinic PN (n=69) vs RN (n=207) for T2, T3a, T3b

69 patients with PN (red curve) vs 207 patients with RN (black curve).

J. Urology 183:903-908, 2010
Color Doppler reveals hypovascular tumor later found to be a Chromophobe RCC.
Anatrophic kidney split
Endophytic and renal sinus based tumors can be accessed through a horizontal cortical incision in the avascular plane (Brödel’s line) using anatrophic techniques.
37 yo female with 19 cm r and 6 cm left endophytic renal tumors
Underwent sequential PN for Clear cell RCC
S/p bilateral PN for clear cell RCC: now 10 yrs NED
43 yo male with VHL: 9 cm right and multiple left renal masses underwent sequential PN
43 yo male with VHL: 9 cm right and multiple left renal masses underwent sequential PN
4 years post op currently NED in kidney but now with cerebellar hemangioblastoma and adrenal pheo.
61 y.o female 16 m s/p cryoablation of left renal mass now with persistent, enhancing mass.
Laparoscopic/Robotic Partial Nephrectomy

All Procedures

Tumors ≤4cm

Tumors >4cm to ≤7cm

Tumors >7cm
MSKCC: Rapid recovery clinical pathway for open and MIS partial nephrectomy

*J. Urol. 191:1225-1230, 2014*

- Pre op counseling describes pathway and post op expectations (for both MIS and OPEN surgeons).
- Early ambulation stressed (night of operation allowed) with 14 laps (1 mile) around the hospital ward on day 1 and 2.
- Rapid advancement of diet to regular.
- At home, 3 protein rich meals/day and at least 30 min of walking bid, no heavy lifting for 3 months.
Rapid Recovery Pathway

Partial Nephrectomy 2015
Open Questions and Unresolved Issues

• At what age and in which patients should active surveillance not partial nephrectomy be recommended?
• For eligible patients, how can partial nephrectomy utilization be enhanced?
• How can troublesome complications of post operative bleeding, urinary fistula, and infection be reduced?
• What is the optimum reno protective approach?
• How can ischemic injury be minimized?
Contemporary Partial Nephrectomy
Conclusions

• Oncologically effective operation for tumors 7cm or less.
• Preserves renal function and prevents CKD and its associated cardiovascular morbidity.
• Can effectively be performed by open and MIS approaches.
• Currently remains under utilized for small renal masses.
• Further research needed to optimize case selection, reduce kidney injury, and post op complications.