Nephron Sparing Surgery
Past, Present and Future

Hein Van Poppel
Professor and Chairman UZ Leuven
Adjunct Secretary General EAU

Pieter De Mulder Lecture

Tenth European International Kidney Cancer Symposium
Lyon, France — 24-25 April 2015
Kidney Cancer Treatment

Every solid mass….Radical Nephrectomy
Imperative Nephron Sparing Surgery
Elective Nephron Sparing Surgery
Laparoscopic Radical - Partial Nephrectomy
Ablative techniques - Robot
Observation – Watchful Waiting
Indications for Partial Nx

**ABSOLUTE = IMPERATIVE**
- solitary kidney, bilateral tumors, renal failure

**RELATIVE**
- contralateral diseases predisposing to renal failure
- known multifocality (VHL, papillary RCC…)

**ELECTIVE**
- tumors with normal contralateral kidney
Intergroup Study 30904

A Prospective Randomized Phase III Study

Radical Surgery to Kidney Sparing Surgery

in Solitary T1 T2 Renal Cell Carcinoma 5cm

To show equivalence.....
Is there a Place for Conservative Surgery in the Treatment of Renal Carcinoma?

H. VAN POPPEL, H. CLAES, P. WILLEMEN, R. OYEN and L. BAERT

Department of Urology, University Hospitals, Catholic University of Leuven, Leuven, Belgium

Summary—Since 1981, 31 patients have undergone conservative surgery for malignant renal tumours and have been followed up for at least 2 years. The techniques included enucleation or resection (wedge resection or partial nephrectomy).

In 10 patients the indications for kidney-sparing surgery were absolute, while in the remainder the conservative surgical approach was a deliberate choice. The tumours varied in diameter from 1.3 to 12 cm and no metastases were detected on pre-operative screening.

One patient died post-operatively from myocardial infarction. In the remaining 30 there were no local recurrences. Two patients died from skeletal metastases (1 with bilateral malignancy) and 2 underwent surgery in the post-operative period for haemorrhagic complications.

The efficacy of conservative surgery in the local control of renal cancer is an argument in favour of its wider use.


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# Elective Nephron-sparing Surgery

<table>
<thead>
<tr>
<th>Study</th>
<th>N° pts</th>
<th>Local recurr. %</th>
<th>Median FU mos</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van Poppel <em>et al.</em> (1998)</td>
<td>51</td>
<td>0</td>
<td>75</td>
</tr>
<tr>
<td>Herr (1999)</td>
<td>70</td>
<td>1.5</td>
<td>120</td>
</tr>
<tr>
<td>Hafez <em>et al.</em> (1999)</td>
<td>45</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td>Lee <em>et al.</em> (2000)</td>
<td>37</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Lau (2000)</td>
<td>189</td>
<td>1</td>
<td>44</td>
</tr>
<tr>
<td>Filipas <em>et al.</em> (2000)</td>
<td>180</td>
<td>1.6</td>
<td>56.4</td>
</tr>
<tr>
<td>McKiernan <em>et al.</em> (2002)</td>
<td>117</td>
<td>1.2</td>
<td>25</td>
</tr>
<tr>
<td>Kural <em>et al.</em> (2003)</td>
<td>50</td>
<td>0</td>
<td>33.1</td>
</tr>
<tr>
<td>Patard <em>et al.</em> (2004)</td>
<td>379</td>
<td>0.8</td>
<td>51</td>
</tr>
</tbody>
</table>

Why did we do NSS?
Partial Nephrectomy Is Associated with Improved Overall Survival Compared to Radical Nephrectomy in Patients with Unanticipated Benign Renal Tumours

Christopher J. Weight, Gregory Lischer, Benjamin T. Larson, Tianming Gao, Brian R. Lane, Steven C. Campbell, Inderbir S. Gill, Andrew C. Novick, Amr F. Fergany

Overall Survival

Eur.Urol. 2010
Partial Nephrectomy Is Associated with Improved Overall Survival Compared to Radical Nephrectomy in Patients with Unanticipated Benign Renal Tumours

Christopher J. Weight, Gregory Lischer, Benjamin T. Larson, Tianming Gao, Brian R. Lane,
Steven C. Campbell, Inderbir S. Gill, Andrew C. Novick, Amr F. Fergany

Cardiac-specific Survival

Log-rank test, p < 0.0002
NSS for Small Renal Masses

D.C. Miller, 2006. SEER data

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KidneyCancer.com
Partial Nephrectomy: “An underutilized procedure”

Urologists fear the higher complication rate

Open radical nephrectomy for small lesions is easy, curative and not-complicated

Laparoscopic radical nephrectomy became popular and got standard for T1 tumors
Intergroup Study 30904


Median FU: 9.3 years

47 institutes

541 pts randomized

(1300 pts required)
Overall Survival RCC

Van Poppel et al., Eur. Urol. 2011

Tenth European International Kidney Cancer Symposium
Lyon, France — 24-25 April 2015
Re-analysis EORTC GU 30904

Randomized
$n = 541$

Radical nephrectomy
$n = 273$

Excluded:
No follow-up eGFR ($n = 14$)

Analyzed
$n = 259$

Nephron-sparing surgery
$n = 268$

Excluded:
No follow-up eGFR ($n = 13$)

Analyzed
$n = 255$

Re-analysis EORTC GU 30904

![Graph showing mean eGFR over time for RN and NSS groups with data points at various time intervals (yr). The graph includes error bars indicating variability.]

The beneficial effect of NSS on eGFR did not result in improved survival over a median FU of 9.3 y for all cause mortality.

Moderate renal dysfunction arising from surgery may not have the same negative implications for overall health as when arising from medical causes as diabetes or hypertension.

Partial Nephrectomy in Guidelines

Despite Randomized evidence...

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>LE</th>
<th>GR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with low-stage RCC (T1) should undergo nephron-sparing surgery rather</td>
<td>3</td>
<td>B</td>
</tr>
<tr>
<td>than radical nephrectomy whenever possible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For solitary renal tumours up to a diameter of 7 cm, nephron-sparing surgery is</td>
<td>3</td>
<td>C</td>
</tr>
<tr>
<td>the standard procedure <strong>whenever technically feasible.</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

selected patients. While PN was initially reserved for absolute indications such as patients with a solitary kidney, renal insufficiency whereby dialysis would likely ensue or in those with in inheritable forms of renal cancer, PN is now considered the treatment of choice for most clinical T1 renal masses, even in those with a normal contralateral kidney.
Partial Nx= Standard for T1a RCC

NSS for RCC > 7cm: CSS

91 pts
2 German centers
Equal outcome

NSS for T2-T3 RCC

Mayo Clinic
69 pts
pT2-T3a-b
Equal outcome

So, other extreme!

Single Institutional Experience with Nephron-sparing Surgery for Pathologic Stage T3bNxM0 Renal Cell Carcinoma Confined to the Renal Vein

Solomon L. Woldu, LaMont J. Barlow, Trushar Patel, Greg W. Hruby, Mitchell C. Benson, and James M. McKiernan

Outcome of Stage T2 or Greater Renal Cell Cancer Treated With Partial Nephrectomy

Rodney H. Breau, Paul L. Crispen, Rafael E. Jimenez, Christine M. Lohse, Michael L. Blute and Bradley C. Leibovich*

From the Department of Urology, Mayo Clinic, Rochester, Minnesota

Rationale?

Nephron-sparing surgery for pathological stage T3b renal cell carcinoma confined to the renal vein

Surendra B. Kolla, Cesar Ercole, Philippe E. Spiess, Julio M. Pow-Sang and Wade J. Sexton

Genitourinary Oncology Program, Moffitt Cancer Center, Tampa, FL, USA

Accepted for publication 4 January 2010

KidneyCancer.com
How to do NSS?
MANAGEMENT OF RENAL TUMORS
(JOHNS HOPKINS)

1621 PATIENTS

% by Year:
- ORN
- OPN
- LRN
- LPN
- LRA
- PRA

Lap.
Expert centers reproduce open surgery
Hilar clamping, cooling, intraoperative ultrasound...all have been developed
Hemostasis and warm ischemia are the most important issues
The complication rate is higher than that of open surgery, might get lower with Robot assistance

Open Partial Nx is still gold standard, certainly for solitary kidneys, and for complex, central and multifocal tumors
NSS and Renal Function Preservation

Risk factors for CKD

Kidney function loss by the resection-closure itself
- remove too much healthy parenchyma
  - Margin: cm, mm, no?
  - “enucleation / enucleoresection”

Warm ischemia time

Hilar clamping: every minute counts

M. Simmons et al. J. Urol., 187, 1667-73
Size of the Margin in NSS

1887  Czerny : margin?
1950  Vermooten : margin 1 cm
1975  Marberger : no reference margin
1992  Hohenfellner : enucleation + coagulation tumor bed
2006  Carini : simple enucleation
Enucleation / Enucleoresection
Enucleation is oncologically safe

Minervini et al., J.Urol. 185, 2011

982 standard NSS vs. 537 simple enucleation

(Local Recurrence was similar)
Positive Margins matter?

Higher rate of local tumor recurrence, but...
Cancer Specific Survival

26 centers

Bensalah et al. Eur Urol 2010; 57: 466-473

- Age
- Size
- Stage
- Grade
- FU

Log rank test - p=0.42

Follow-up (months)

Cancer Specific Survival

Margins

+ve

-ve

101 vs 102 matched analysis
“The majority of patients with PSMs after PN remain without disease recurrence and a surveillance strategy seems preferable to surgical reintervention”

NSS and Renal Function Preservation

Risk factors for CKD
Kidney function loss by the resection itself
- remove too much healthy parenchyma
  - Margin: cm, mm, no?
  - “enucleation / enucleoresection”

Warm ischemia time
Hilar clamping: every minute counts

M. Simmons et al. J. Urol., 187, 1667-73
Warm Ischemia Time

Laparoscopy for complex RCC?

Every Minute Counts When the Renal Hilum Is Clamped During Partial Nephrectomy

R. Houston Thompson a, j, Brian R. Lane b, j, Christine M. Lohse a, Bradley C. Leibovich a,
Amr Fergany b, Igor Frank a, Inderbir S. Gill c, Michael L. Blute a, Steven C. Campbell b

= risk of developing ESRD

p < 0.001

Years to Last Renal Follow-up

Survival Free of GFR < 30

0 1 2 3 4 5 6 7 8 9 10

<25 min

>25 min

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KidneyCancer.com
Ischemia Time and Complexity of Surgery

More challenging case, requires greater reconstruction

A. Longer ischemia time

B. Less parenchyma preserved during excision/reconstruction

Courtesy S. Campbell

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NSS and Renal Function Preservation

Resected And Ischemic Volume

RAIV

Warm and Cold Ischemia Time

- Comparison of warm (n=59) and cold (n= 64) ischemia
- $^{99}$m Tc-MAG3 renal scintigraphy
- WIT >25 min.: no recovery to baseline at 6 months
- CIT up to 58 min.: no ischemic injury to the renal remnant

Y. Funahashi et al., Urology 84: 1408-13, 2014
Urologic Dogma

- PNx is always better than RNx, because it avoids CKD and thus leads to better overall survival

- Ischemia is the most important factor affecting renal function after PNx, and must be avoided at all cost
Who really benefits from NSS?

1306 Pts

CKD I >90
II 60-89
III 30-59

Probability of developing significant renal function impairment

S.L. Woldu et al., Urology 84: 860-68, 2014
PN and RN cause equivalent harm

- Matched cohort study SEER-Medicare data set
  - 1471 PN and 4299 RN matched to controls
    - Renal events, secondary cancers and cardiovascular events were increased in both

- More research on active surveillance is needed

PNx versus RNx: Impact on Renal Function

- Renal functional recovery after PN is strongly associated with preoperative renal function and amount of healthy renal parenchyma preserved
  - Periods of warm ischemia > 25 min should be avoided
  - Cold ischemia when longer ischemia times are expected
- Surgical factors are less pertaining than Medically induced CKD

NSS Conclusion 1

- **Number of nephrons saved is the key determinant of renal function**
- **As long as warm ischemia is limited, most nephrons recover from the ischemic insult**
- **Even poorly functioning kidneys fully recover from ischemia**
Urologists should not resect kidneys if it is safe to do otherwise. SRM’s will often be amenable for an oncologically and technically safe NSS.

Larger and more complex RCC’s can be subjected to NSS, if oncologically and technically safe.

If not, a Radical Nephrectomy will only rarely induce CKD and impact on overall survival.

Surgical skills are needed in solitary kidneys and in CKD patients.
## The Future?

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Rad Nx</th>
<th>Open Part. Nx</th>
<th>Lap Part. Nx</th>
<th>Ablation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity</td>
<td>15%</td>
<td>16%</td>
<td>20%</td>
<td>2-6%</td>
</tr>
<tr>
<td>Recovery</td>
<td>35 days</td>
<td>33 days</td>
<td>12 days</td>
<td>1 day</td>
</tr>
<tr>
<td>Mortality</td>
<td>2%</td>
<td>1.6%</td>
<td>&lt;1%</td>
<td>&lt;0.5%</td>
</tr>
<tr>
<td>Hospital Stay</td>
<td>5 days</td>
<td>3 days</td>
<td>1.9 days</td>
<td>0.5-1 day</td>
</tr>
<tr>
<td>Cost</td>
<td>$31,000-35,000</td>
<td>$26,000-32,000</td>
<td>$26,000-32,000</td>
<td>$5,000-10,000</td>
</tr>
</tbody>
</table>

Kim, J Urol ‘03  McDougall, J Urol ‘96  Corman, Br J Urol ‘00  Lotan, Br J Urol ‘05  Kercher, Surg End ‘03
Thank you
CV Events and RN or NSS

CVe= onset of coronary artery disease, cardiomyopathy, hypertension, heart failure, dysrhythm...

Multi-institutional 1987-2013

1331 T1a-b renal mass

Normal initial renal function

Meta-analysis of PNx vs. Rad Nx

N= 36 studies, > 40,000 patients analyzed

• All but one retrospective, almost all subject to selection bias

• Advantages of PNx based on pooled estimates:
  - 61% risk reduction for severe CKD $p<0.0001$
  - 19% risk reduction all cause mortality $p<0.0001$
  - 29% risk reduction in cancer specific mortality $p=0.0002$

**Metanalysis**

Cochrane, Medline, Embase, Scopus, Web of science

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**All cause mortality**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>log(Hazard Ratio)</th>
<th>SE</th>
<th>Weight</th>
<th>Hazard Ratio (IV, Fixed, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breaux (18)</td>
<td>-0.0099303</td>
<td>0.2408135</td>
<td>2.3%</td>
<td>1.01 (0.63, 1.62)</td>
</tr>
<tr>
<td>Butler (19)</td>
<td>0.01325071</td>
<td>0.5704314</td>
<td>4.4%</td>
<td>1.04 (0.34, 3.14)</td>
</tr>
<tr>
<td>Cormier (20)</td>
<td>-0.2613667</td>
<td>0.4028156</td>
<td>0.8%</td>
<td>0.77 (0.35, 1.71)</td>
</tr>
<tr>
<td>Donat (21)</td>
<td>-0.82088053</td>
<td>0.2491645</td>
<td>2.1%</td>
<td>0.44 (0.27, 0.72)</td>
</tr>
<tr>
<td>Hellenhalel (22)</td>
<td>-0.27448645</td>
<td>0.0957354</td>
<td>14.5%</td>
<td>0.76 (0.63, 0.92)</td>
</tr>
<tr>
<td>Huang (18)</td>
<td>-0.12854047</td>
<td>0.1035183</td>
<td>12.8%</td>
<td>0.72 (0.59, 0.88)</td>
</tr>
<tr>
<td>Indikula (23)</td>
<td>0.00995033</td>
<td>0.6799903</td>
<td>0.2%</td>
<td>1.01 (0.18, 5.67)</td>
</tr>
<tr>
<td>Kim (24)</td>
<td>-1.42711630</td>
<td>1.0609500</td>
<td>0.1%</td>
<td>2.43 (0.03, 1.92)</td>
</tr>
<tr>
<td>Lau (25)</td>
<td>-0.04823929</td>
<td>0.3128145</td>
<td>1.4%</td>
<td>0.96 (0.52, 1.77)</td>
</tr>
<tr>
<td>Lee (26)</td>
<td>0.18526244</td>
<td>0.4226775</td>
<td>0.7%</td>
<td>1.47 (0.84, 2.28)</td>
</tr>
<tr>
<td>Lamer (27)</td>
<td>0.12237636</td>
<td>0.2093565</td>
<td>3.0%</td>
<td>1.13 (0.75, 1.70)</td>
</tr>
<tr>
<td>Miller (10)</td>
<td>-0.32850707</td>
<td>0.128224</td>
<td>3.1%</td>
<td>0.72 (0.56, 0.93)</td>
</tr>
<tr>
<td>Ritzko (28)</td>
<td>-0.15082829</td>
<td>0.2208721</td>
<td>2.5%</td>
<td>0.86 (0.85, 1.54)</td>
</tr>
<tr>
<td>Simmons (29)</td>
<td>0.37136356</td>
<td>0.0448209</td>
<td>0.3%</td>
<td>1.45 (0.41, 5.13)</td>
</tr>
<tr>
<td>Thomson (11)</td>
<td>0.11332678</td>
<td>0.2647126</td>
<td>4.5%</td>
<td>1.12 (0.80, 1.57)</td>
</tr>
<tr>
<td>Thomson (12)</td>
<td>0.05826901</td>
<td>0.1566479</td>
<td>5.4%</td>
<td>1.06 (0.78, 1.44)</td>
</tr>
<tr>
<td>Van Poppel (33)</td>
<td>0.31481074</td>
<td>0.2137703</td>
<td>2.9%</td>
<td>1.37 (0.90, 2.09)</td>
</tr>
<tr>
<td>Weight (34)</td>
<td>-0.47803586</td>
<td>0.2393056</td>
<td>2.7%</td>
<td>0.62 (0.40, 0.90)</td>
</tr>
<tr>
<td>Weight (35)</td>
<td>-1.2039278</td>
<td>0.422665</td>
<td>0.6%</td>
<td>0.73 (0.30, 1.26)</td>
</tr>
<tr>
<td>Zim (33)</td>
<td>-0.09169073</td>
<td>0.4060837</td>
<td>0.8%</td>
<td>0.40 (0.18, 0.98)</td>
</tr>
<tr>
<td>Zim (33)</td>
<td>-0.20702417</td>
<td>0.0626898</td>
<td>13.7%</td>
<td>0.78 (0.51, 1.20)</td>
</tr>
</tbody>
</table>

Total (95% CD): 100.0% 0.83 (0.76, 0.87)

**Cancer specific mortality**

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>log(Hazard Ratio)</th>
<th>SE</th>
<th>Weight</th>
<th>Hazard Ratio (IV, Fixed, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barbillas (34)</td>
<td>0.15700375</td>
<td>1.4368958</td>
<td>0.6%</td>
<td>1.17 (0.07, 19.56)</td>
</tr>
<tr>
<td>Becker (35)</td>
<td>-1.6073121</td>
<td>0.3218429</td>
<td>7.8%</td>
<td>0.19 (0.10, 0.36)</td>
</tr>
<tr>
<td>Bedev (18)</td>
<td>-0.69147178</td>
<td>0.7281359</td>
<td>1.0%</td>
<td>0.50 (0.12, 2.08)</td>
</tr>
<tr>
<td>Breaux (18)</td>
<td>-0.04081499</td>
<td>0.3528259</td>
<td>7.8%</td>
<td>0.96 (0.50, 1.84)</td>
</tr>
<tr>
<td>Butler (19)</td>
<td>0.31481074</td>
<td>0.5141237</td>
<td>3.2%</td>
<td>1.37 (0.50, 3.72)</td>
</tr>
<tr>
<td>Crepel (37)</td>
<td>0.67294447</td>
<td>0.5109523</td>
<td>3.2%</td>
<td>1.96 (0.72, 5.34)</td>
</tr>
<tr>
<td>D’Amormo (38)</td>
<td>0.10436002</td>
<td>1.4086859</td>
<td>0.4%</td>
<td>1.11 (0.06, 20.54)</td>
</tr>
<tr>
<td>Hellenthal (29)</td>
<td>-0.94105641</td>
<td>0.2087375</td>
<td>19.8%</td>
<td>0.39 (0.26, 0.58)</td>
</tr>
<tr>
<td>Jodrel (39)</td>
<td>0.77924848</td>
<td>0.4327957</td>
<td>4.7%</td>
<td>2.18 (0.99, 5.00)</td>
</tr>
<tr>
<td>Kim (24)</td>
<td>-0.04081499</td>
<td>1.2077382</td>
<td>6.6%</td>
<td>0.96 (0.09, 10.24)</td>
</tr>
<tr>
<td>Lau (25)</td>
<td>0.28517994</td>
<td>0.795782</td>
<td>3.5%</td>
<td>1.33 (0.30, 5.50)</td>
</tr>
<tr>
<td>Lee (26)</td>
<td>0.25448222</td>
<td>0.4167252</td>
<td>4.0%</td>
<td>1.29 (0.57, 2.92)</td>
</tr>
<tr>
<td>Leibovich (40)</td>
<td>-0.47000363</td>
<td>0.6075253</td>
<td>2.3%</td>
<td>0.63 (0.19, 2.06)</td>
</tr>
<tr>
<td>Lester (41)</td>
<td>0.27902714</td>
<td>0.2516232</td>
<td>13.4%</td>
<td>1.31 (0.80, 2.15)</td>
</tr>
<tr>
<td>Margulis (42)</td>
<td>-0.90350821</td>
<td>0.5205681</td>
<td>3.1%</td>
<td>0.41 (0.15, 1.12)</td>
</tr>
<tr>
<td>Pankar (42)</td>
<td>-0.5794185</td>
<td>0.3357496</td>
<td>7.5%</td>
<td>0.65 (0.29, 1.08)</td>
</tr>
<tr>
<td>Simmons (29)</td>
<td>0.37156356</td>
<td>1.2352845</td>
<td>6.0%</td>
<td>1.45 (0.13, 16.17)</td>
</tr>
<tr>
<td>Thompson (13)</td>
<td>-0.67344355</td>
<td>0.3808413</td>
<td>5.0%</td>
<td>0.51 (0.14, 1.95)</td>
</tr>
<tr>
<td>Thompson (13)</td>
<td>0.72270998</td>
<td>0.0291644</td>
<td>2.1%</td>
<td>2.06 (0.60, 7.07)</td>
</tr>
<tr>
<td>Weight (30)</td>
<td>-0.26166476</td>
<td>0.3415584</td>
<td>8.2%</td>
<td>0.77 (0.41, 1.45)</td>
</tr>
<tr>
<td>Weight (31)</td>
<td>-0.01629073</td>
<td>0.7106225</td>
<td>1.5%</td>
<td>0.74 (0.09, 1.78)</td>
</tr>
</tbody>
</table>

Total (95% CD): 100.0% 0.71 (0.59, 0.85)

Test for overall effect: Z = 5.69 (P = 0.00001)

Heterogeneity: Ch2 = 39.11, df = 20 (P = 0.0006): I2 = 49%

---

**PN confers a survival benefit and a lower risk of CKD**

But: low quality of the existing evidence

Open Surgery
Enucleation

Easy and quick...
Classical Partial Nephrectomy for SRM
NSS in Larger RCC
T2 : Wedge to Enucleation
NSS in T3a  Upper Pole
Partial is as good as Radical Nephrectomy for 4-7 cm RCC

- 873 RN vs 286 PN in Mayo and MSKCC
  - OS and CSS is not compromised

cT1b Partial Nephrectomy

- 71 patients mean tumor size 4 - 7 cm
- mean follow-up 74 months
- PURE ENUCLEATION
- margin size: 0,0 mm
- 3 local recurrences:
  - 1 kidney recurrence: second partial Nx
  - 2 local recurrence with M+
- 5 and 8 y CSS = 85.1 and 81.6%

Carini et al., J.Urol., 2006
Radical or Partial Nephrectomy

**Experience from living donors:**

Renal function is no problem after unilateral Nx

Live Donor $\neq$ RCC patient

- No AHT
- No Diabetes
- No Coronary disease
- BMI lower
- ECOG better
- ASA better
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).
Partial Nephrectomy vs. Radical

Complication rate of partial Nx is higher  
Length of stay, hospital cost comparable  
Creatinine failure and dialysis need much lower


Quality of life significantly better


Still an underutilized procedure

- Miller J.Urol 2006
Laparoscopic nephrectomy today is standard!
Recurrence-free Survival

Margins

$p = 0.113$

Bensalah et al. Eur Urol 2010; 57: 466-473
Chronic kidney disease after nephrectomy in patients with renal cortical tumours: a retrospective cohort study

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

Figure 2: Probability of freedom from new onset of GFR lower than 60 mL/min per 1.72 m², by operation type

Figure 3: Probability of freedom from new onset of GFR lower than 45 mL/min per 1.72 m², by operation type
Rationale of NSS
Risk Factors for CKD

- Age > 60
- DM
- HTN
- CV disease
- Metabolic syndrome
- Nephrotoxins, OTCs
- Family hx of CKD
- Hx of ARF
- Obesity
- Tobacco use
- HIV, Hepatitis C
- Occupational exposures
- Most minorities
- Stones-obstruction
- Low income/education
- Reduced kidney mass

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>GFR (mL/min/1.73 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kidney damage with normal or ↑ GFR</td>
<td>≥90</td>
</tr>
<tr>
<td>2</td>
<td>Kidney damage with mild ↓ GFR</td>
<td>60–89</td>
</tr>
<tr>
<td>3</td>
<td>Moderate ↓ GFR</td>
<td>30–59</td>
</tr>
<tr>
<td>4</td>
<td>Severe ↓ GFR</td>
<td>15–29</td>
</tr>
<tr>
<td>5</td>
<td>Kidney failure</td>
<td>&lt;15 (or dialysis)</td>
</tr>
</tbody>
</table>
Few patients progressed (9 RNx-12 PNx)

117 deaths: - 12 due to RCC : 4 in RNx and 8 in PNx
   - 3 due to surgery : 1 in RNx and 2 in PNx
   - CV deaths: 20 in RNx and 25 in PNx

- Overall survival is shorter with PNx for all randomized pts (p=0.03)
- OS of RCC patients is not different (p=0.07)
- OS of Clin. and Pathol. eligible patients is not different (p=0.17)

Partial Nx for RCC not inferior to Radical Nx
Comments on result 30904

Open studies definitely /repeatedly favour NSS

The only RCT doesn’t confirm this superiority
  - Only 12 deaths, many cross-over
  - Inability to complete accrual
  - Lack of evaluation of renal function
  - What was conservative surgery?
RCT 30904: What have we learned?

- RCT on surgery are difficult
- Design/execution takes too long
- Intergroup collaboration is not easy

RCT’s might not give the answer to questions on onco-surgical techniques
And larger/more complex tumors?

**CS Survival vs Tumor Diameter**

- ≤ 4 cm 310 PATS.
- > 4 cm 175 PATS.

Enucleation = oncologically safe?

Nonrandomized, retrospective, comparative study by SATURN Project-LUNA Foundation

982 standard NSS vs. 537 simple enucleation

Cancer-specific survival at 5 and 10 y is similar
But, in the mean time...
Nephron Sparing Surgery

I. Polar resection
II. Wedge resection
III. Enucleoresection/excavation
IV. Pure enucleation
Increasing Incidence of RCC

Events per 100,000 U.S. population

- < 2cm
- 2-4cm
- 4-7cm
- > 7cm

1963 1985 1987 1989 1991 1993 1995 1997 1999 2001

n=34.503

SEER Data, HOLLINGSWORTH, JCI 98:1333, 2006