Robotic Partial Nephrectomy

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No Disclosures

Milestones to Robotic Partial Nephrectomy

• Long-term safety of open partial nephrectomy
• Introduction of laparoscopic radical nephrectomy and laparoscopic partial nephrectomy (LPN)
• Ongoing refinement of LPN
Laparoscopic Partial Nephrectomy

- Experienced open surgeons can not easily transfer skills to LPN

- Technical challenges:
  - Intracorporeal suturing
  - Hemostasis
  - Warm ischemia

Open vs. Laparoscopic PN
Johns Hopkins / Mayo / CCF

<table>
<thead>
<tr>
<th></th>
<th>Lap (n=771)</th>
<th>Open (n=1028)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OR time *</td>
<td>3.3 hours</td>
<td>4.3 hours</td>
</tr>
<tr>
<td>Warm ischemia</td>
<td>31 min</td>
<td>20 min</td>
</tr>
<tr>
<td>EBL</td>
<td>300 cc</td>
<td>370 cc</td>
</tr>
<tr>
<td>Intra op comp</td>
<td>1.8%</td>
<td>1.0%</td>
</tr>
<tr>
<td>PO comp</td>
<td>25%</td>
<td>19%</td>
</tr>
<tr>
<td>PO bleed</td>
<td>4.2%</td>
<td>1.6%</td>
</tr>
<tr>
<td>LOS *</td>
<td>3.3 days</td>
<td>5.8 days</td>
</tr>
<tr>
<td>Renal function</td>
<td>98%</td>
<td>99%</td>
</tr>
</tbody>
</table>

* significant

Other Reasons For Partial Nephrectomy

- When looking at patients with T1a lesions:
  - Most are amenable to PN
  - 26% have GRF < 60 (stage III CKD)
  - Decreasing GFR independent predictor of cardiovascular events & death

Nguyen et al, J Urol, 2006
Go et al, NEJM, 2004

Robotic Partial Nephrectomy

- Will this technique simplify suturing?
- Will this increase applicability?
- Will this be the next blockbuster application?

Objectives

- Describe evolving technique of robotic partial nephrectomy
- Review initial outcomes
Robotic Partial Nephrectomy: Initial Report

• N = 13, mostly exophytic, mean tumor diameter = 3.5 cm
• Mean operative time: 215 minutes
• Mean warm ischemia time: 22 min
• Complications:
  • Intraoperative: none
  • Postoperative: 8% (1/13, ileus)

Gettman et al Urology 64: 914, 2004

Robotic Partial Nephrectomy: Initial Report

• Undertaken when paucity of robotics experience in general
• Conclusions
  • Procedure ideally performed transperitoneally
  • More difficult (port placement) than prostatectomy
  • Experience of assistant is critical
  • Few advantages
Key Events Since 2004

- Urologists experienced with upper and lower urinary tract robotic procedures
- Newer robotic technologies introduced
- Competing minimally invasive techniques gaining momentum

Better Robots

Benefits
- Setup
- Instrument Exchanges
- Movements
- Monitoring
- Learning
da Vinci S System

- Telestrator
- TilePro allows real-time imaging input
- More instruments selections
- HD camera
- Camera zoom function

Ablative Technologies

- RFA
- Cryo
- HIFU
Transitioning to Robotic Partial Nephrectomy

- Experience with RARP & dedicated team a must
- Setup & port placement is critical
- Procedure is higher stakes
  - Serious bleeding potential
  - Time constraints (warm ischemia)
  - Need goal of negative margins
  - Risk of renal unit loss

Decisions Before Starting

- Who will first assist
- Initial patient selection
- Transperitoneal vs. retroperitoneal
- Which robot
  - 3 arms vs. 4 arms
- Lateral vs. medial port placement
Robotic Partial Nephrectomy

- Indications (initially): exophytic (<4 cm) tumors:
  - Anterolateral
  - Lower pole
  - Female

Patient Position: Left (full flank)
Robotic Pyeloplasty: Medial Port Placement

• Standard laparoscopic and open pan
• Laparoscopic ultrasound probe
• Laparoscopic vascular clamp
• Laparoscopic stapler with reloads (in room)
• Robotic: Cadiere, hot shears, needle drivers, dual blade retractor
Robotic Partial Nephrectomy: Suture and Accessories

- Suture
- Weck clips
- Nu-knit
- Surgicel + gelfoam bolsters
- FloSeal
- Lapraty clips
Operative Steps

- Colon mobilization
- Hilar dissection
- Excision of tumor
- Renorrhaphy
- Restore anatomy
- Remove specimen
OUTCOMES
Exophytic Renal Lesions

Robotic PN: Initial Reports

<table>
<thead>
<tr>
<th>Author</th>
<th>Yr</th>
<th>N</th>
<th>Size (cm)</th>
<th>OR (min)</th>
<th>WIT (min)</th>
<th>OR comp (%)</th>
<th>PO comp (%)</th>
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</thead>
<tbody>
<tr>
<td>Gettman</td>
<td>04</td>
<td>13</td>
<td>3.5</td>
<td>215</td>
<td>22</td>
<td>0</td>
<td>8 (1/13)</td>
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<tr>
<td>Phillips</td>
<td>05</td>
<td>12</td>
<td>1.4</td>
<td>265</td>
<td>26</td>
<td>25 (3/12)</td>
<td>8 (1/12)</td>
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<td>Caruso</td>
<td>06</td>
<td>10</td>
<td>2.0</td>
<td>279</td>
<td>26</td>
<td>20 (2/10)</td>
<td>10 (1/10)</td>
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<tr>
<td>Kaul</td>
<td>07</td>
<td>10</td>
<td>2.3</td>
<td>155</td>
<td>21</td>
<td>0</td>
<td>20 (2/10)</td>
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<tr>
<td>Bhayani</td>
<td>08</td>
<td>35</td>
<td>2.8</td>
<td>142</td>
<td>20</td>
<td>0</td>
<td>11 (4/35)</td>
</tr>
<tr>
<td>Ho</td>
<td>08</td>
<td>20</td>
<td>3.0</td>
<td>83</td>
<td>22</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Deane</td>
<td>08</td>
<td>11</td>
<td>3.1</td>
<td>228</td>
<td>32</td>
<td>0</td>
<td>9 (1/11)</td>
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<td>Aron</td>
<td>08</td>
<td>12</td>
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<td>242</td>
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<td>25 (3/12)</td>
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<tr>
<td>Benway</td>
<td>09</td>
<td>50</td>
<td>2.5</td>
<td>145</td>
<td>18</td>
<td>0</td>
<td>10 (5/50)</td>
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<tr>
<td>Michli</td>
<td>09</td>
<td>20</td>
<td>2.7</td>
<td>142</td>
<td>28</td>
<td>5 (1/20)</td>
<td>10 (2/20)</td>
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<tr>
<td>Totals</td>
<td>04-09</td>
<td>193</td>
<td>Wt Mean 2.6 cm</td>
<td>Wt Mean 171</td>
<td>Wt Mean 22</td>
<td>4% (7/193)</td>
<td>10% (20/193)</td>
</tr>
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Robotic PN: Initial Reports (N=193)

• Intraoperative complications: 4%
  • Hemorrhagic (n=3)
  • Robot malfunction (n=3)
  • Lost needle (n=1)

• Early postop. complication: 10%
  • Cardiovascular (n=5)
  • Hemorrhagic (n=3)
  • DVT/PE (n=3)
  • Ileus (n=3)
  • Urine leak (n=2)
  • Other (n=4)

• Other notables....
  • Conversions 5%
  • Transfusions 6%
  • Margin pos. 2%
  • Renal loss None
### Robotic PN vs. Lap PN: Initial Experiences

<table>
<thead>
<tr>
<th></th>
<th>Robotic Literature (N=193)</th>
<th>Cleveland Clinic* (N=200)</th>
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<tbody>
<tr>
<td>OR time</td>
<td>171 min</td>
<td>198 min</td>
</tr>
<tr>
<td>WIT</td>
<td>22 min</td>
<td>29 min</td>
</tr>
<tr>
<td>Tumor diam</td>
<td>2.6 cm</td>
<td>2.9 cm</td>
</tr>
<tr>
<td>Transfusion</td>
<td>6%</td>
<td>9%</td>
</tr>
<tr>
<td>Conversion</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>OR comp</td>
<td>4%</td>
<td>5.5%</td>
</tr>
<tr>
<td>PO comp</td>
<td>10%</td>
<td>12%</td>
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*Ramani et al. JUrol 173:42, 2005

### UCI: Robotic PN vs. Lap PN

<table>
<thead>
<tr>
<th>Mean values</th>
<th>RPN (n=11)</th>
<th>LPN (n=11)</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Tumor size (cm)</td>
<td>3.1</td>
<td>2.3</td>
<td>--</td>
</tr>
<tr>
<td>Operative time (min)</td>
<td>229</td>
<td>290</td>
<td>0.10</td>
</tr>
<tr>
<td>WIT (min)</td>
<td>32</td>
<td>35</td>
<td>0.50</td>
</tr>
<tr>
<td>Complication</td>
<td>9%</td>
<td>9%</td>
<td>NS</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper</td>
<td>8</td>
<td>3</td>
<td>--</td>
</tr>
<tr>
<td>Middle</td>
<td>--</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Lower</td>
<td>3</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Washington Univ: Single Surgeon (Dr. Bhayani)**

<table>
<thead>
<tr>
<th>Mean values</th>
<th>RPN (n=40)</th>
<th>LPN (n=62)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative time (min)</td>
<td>140</td>
<td>156</td>
<td>0.04</td>
</tr>
<tr>
<td>WIT (min)</td>
<td>19</td>
<td>25</td>
<td>0.03</td>
</tr>
<tr>
<td>EBL</td>
<td>136</td>
<td>173</td>
<td>NS</td>
</tr>
<tr>
<td>LOS</td>
<td>2.5</td>
<td>2.9</td>
<td>0.03</td>
</tr>
<tr>
<td>Complications</td>
<td>20</td>
<td>15</td>
<td>NA</td>
</tr>
</tbody>
</table>

NA = not analyzed, NS = non-significant


**Robotic PN: Evolving Role**

- Complex tumors (Rogers et al.)\(^1\)
  - N = 14, mean diam. = 3.6 cm
  - No complications

- Hilar tumors (Rogers et al.)\(^2\)
  - N = 11, mean diam. = 3.8 cm
  - No OR complications, 2 PO urine leaks

Robotic PN: Evolving Indications

• Summary:
  • Encouraging initial results
  • Need larger cohorts/ longer followup
  • ? Opportunity to expand limits

Unanswered Questions

• Less morbid?
• Can robot significantly reduce warm ischemia time?
• Will partial nephrectomy become the next robotics revolution?
• Optimal methods of access, tumor excision & hemostasis
Conclusions

- Low incidence of complications associated with robotic PN
- Rate of complications at least equivalent to same era of lap PN
- Ongoing evaluation required

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The End!