Robotic Urologic Surgery: A New Era in Patient Care

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Laparoscopic Surgery
- Laparoscopic technique was introduced in urologic surgery in the 1990s
- Benefits: Improved recovery time, decreased morbidity

Limits of Laparoscopy
- Longer operative time
- Poor ergonomics
- Rigid instrumentation
- Limited ROM
- Steep learning curve
- Higher complication rates

The Da Vinci Robot
- Surgeon console
- Patient Cart (Robotic arms)
- Control tower

What Robotics Offers
- 360° Instrument range of motion
- Improved ergonomics
- Better instrument control
- Higher resolution of movement

Why is urologic surgery so well suited for robotics?
- Confined space (pelvis, renal fossa)
- Most operations are conducted within a small field
- Large difference in morbidity in traditional vs. robotic access (e.g., flank incisions)
- Pneumoperitoneum is highly effective at limiting blood loss (e.g., prostatectomy)
- Urologists really like neat toys
Prostatectomy
- Removal of the prostate, distal vas deferens and seminal vesicles
- Removal of pelvic lymph nodes in patients with Gleason score ≥7 or PSA ≥10
- Preservation of neurovascular bundles
- Reconstruction of the bladder neck

Indications for Prostatectomy
- Good performance status and 10y life expectancy
- Localized disease
- Ideally low and intermediate risk disease (Gleason 6-8)
- Atypical pathology (mucinous, small cell, signet ring)

History of Prostatectomy
- 1945 – First retropubic prostatectomy (RP) – Millin
- 1979 – First Nerve-sparing RP – Walsh
- 1986 – Introduction of PSA screening
- 1980s – Refinement of NS-RP and start of era of elective prostatectomy
- 1992 – First laparoscopic RP – Scheussler
- 2000 – First robotic RP – Abbou

Trends in Prostatectomy
- Steady decline in open cases
- Steady increase in robotic cases
- Increase in total cases
  - Stage migration
  - Practice patterns
  - Aging of population

Outcomes of Robotic RP
- PSM rates between 9-35%
- Continence at 3 months was between 47%-93%
- Continence at 18 months was between 75%-99%
- Technique of apex dissection is KEY to good outcome

ED Outcomes
- Rates are widely varied in the literature
- Potency rates at 12 months range from 54%-90%
- Risk factors: Age, baseline ED, comorbidities
Personal RALP Outcomes

Robotic Prostatectomy Outcomes
(Excenter 6-8; 2010-2012, n=65)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>62 (48-79)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>28 (21-34)</td>
</tr>
<tr>
<td>Gleason Score</td>
<td>7 (6-8)</td>
</tr>
<tr>
<td>PSA (ng/ml)</td>
<td>3.0 (1.0-9.0)</td>
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<tr>
<td>Pathologic Grade</td>
<td>3 (2-4)</td>
</tr>
<tr>
<td>Positive Margin Rate</td>
<td>32%</td>
</tr>
<tr>
<td>New Diastolic ED</td>
<td>18%</td>
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<tr>
<td>New Incontinence</td>
<td>37%</td>
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</tbody>
</table>

Robotic RP Complications
- Slightly lower overall complication rate than open RP
- Decreased blood loss, shorter length of stay


Partial Nephrectomy
- Historically (pre-1990’s) treatment for stage 1-3 renal tumors was radical nephrectomy
- Current standard of care is partial nephrectomy (when feasible)

History of Partial Nephrectomy
- First Partial Nephrectomy (PN) – 1950
- Modern PN technique developed – 1977 – Novick
- First laparoscopic PN – 1993 – Clayman
- First robotic PN – 2004 - Peschel

Indications for PN
- Contrast-enhancing mass on CT
- Anatomically amenable to resection
- Localized disease
- Solitary kidney
- Pre-existing kidney disease

Functional Outcomes after PN
- The amount of kidney volume spared dictates function after surgery
- More kidney equals higher GFR
- Risks for CKD include large/complex tumor, comorbidities, low starting GFR

Partial Nx confers better survival

- Oncologic efficacy (CSS) of PN and RN are equivalent
- Overall survival after PN is longer and is associated with higher GFR


Personal PN Outcomes

<table>
<thead>
<tr>
<th>Technique</th>
<th>Open (n=20)</th>
<th>Lap (n=26)</th>
<th>Robotic (n=24)</th>
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</thead>
<tbody>
<tr>
<td>Age</td>
<td>61.1 (16)</td>
<td>58.6 (11)</td>
<td>59.6 (14)</td>
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<tr>
<td>% Male</td>
<td>0.65</td>
<td>0.54</td>
<td>0.5</td>
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<tr>
<td>BMI</td>
<td>31.3 (7)</td>
<td>32.7 (9)</td>
<td>32 (9)</td>
</tr>
<tr>
<td>Tumor Size</td>
<td>4.5 (2.4)</td>
<td>3.1 (1.1)</td>
<td>2.3 (0.9)</td>
</tr>
<tr>
<td>Pre-op GFR</td>
<td>73 (23)</td>
<td>77.3 (27)</td>
<td>80 (32)</td>
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<tr>
<td>Total comp. Rate</td>
<td>15%</td>
<td>15%</td>
<td>8%</td>
</tr>
<tr>
<td>GU Comp rate</td>
<td>15%</td>
<td>6%</td>
<td>0%</td>
</tr>
<tr>
<td>Pos. Margin Rate</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Recurrence Rate</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Personal PN Outcomes

- Functional Outcomes

Robotic PN Complications

- Minor complications 20%-27%
- Major complications 6%-15%
- GU complications include renal hemorrhage (2%-4%) and urine leak (2%-4%)

Other Robotic Procedures

- Pyeloplasty
- Ureteral reimplant and reconstruction
- Radical Radical Cystectomy
- Pelvic lymph node dissection
- Abdominosacrocolpopexy
- Adrenalectomy
- Ureterolysis
- RPLND

Success and safety of all robotic procedures depend heavily on judicious patient selection

Under-utilization of PN

- Current standard of care per AUA guidelines is partial nephrectomy when technically feasible
- Despite significant advances, 70% of patients with pT1 tumors undergo radical nephrectomy

Robotic Dismembered Pyeloplasty
- Etiology: Congenital, stone-related, cancer
- 5y patency rate ranges from 75%-95%
- Can be done in both adult and pediatric patients

Robotic Ureteral Reimplant
- Etiology: Iatrogenic, stone-related, cancer
- 5y patency rate ranges from 85%-99%
- Can perform simple implant, psoas hitch and Boari flap robotically.

Future Directions
- Single port surgery
- Image-guided surgery
- Robotics innovations
- Natural orifice surgery