Complications of Robotic Partial Nephrectomy: Expect the Unexpected

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Objectives:

• Discuss the indications, operative set up, and surgical technique of robotic partial nephrectomy
• Interpret the published literature regarding methods to reduce warm ischemia during partial nephrectomy
• Describe surgical techniques to reduce warm ischemia during robotic partial nephrectomy
• Describe new technologies that may aid in assessing and reducing warm ischemia
Complications of Robot-Assisted Partial Nephrectomy: *Expect the Unexpected*

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Complications of Robot-Assisted Partial Nephrectomy: 
*Shock and Awe*

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Accidents do happen...
Despite good intentions or planning…
Risks exists...
Outline

• Published Complication Rates of RAPN
• Intraoperative Complications
  – Intraoperative Bleeding
  – Tumor Violation
• Postoperative Complications
  – Urine Leak
  – Pseudoaneurysm
• Examples of Miscellaneous Complications
• Practical Tips on Avoiding Complications
Published Complication Rates

- Multi-institutional review of complications

<table>
<thead>
<tr>
<th></th>
<th>RAPN</th>
<th>UF</th>
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<tbody>
<tr>
<td>Transfusion rate</td>
<td>4.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Positive margins</td>
<td>1.6%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Angioembolization</td>
<td>0.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Urine leak</td>
<td>1.6%</td>
<td>1.0%</td>
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</tbody>
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WARNING!

DUE TO THE GRAPHIC CONTENT OF THIS VIDEO PRESENTATION

VIEWER DISCRETION IS ADVISED

(NOTE: No kidney was lost in any of the following cases)
Intraoperative Bleeding
Venous Back Bleeding #1
Venous Back Bleeding #1
Venous Back Bleeding #1
Venous Back Bleeding #2
Arterial Bleeding #1
Arterial Bleeding #2
Arterial Bleeding #2
Parenchymal Bleeding: Management

1. Apply pressure with instrument or gauze
2. Increase insufflation pressure
3. Skillful use of experienced assistant
4. If arterial: consider missed artery and/or additional bulldog clamps
5. If venous: clamp or unclamp vein
6. Have sutures (rescue) and clips available
7. Test function of needle drivers BEFORE clamping renal artery
8. Be prepared to suture efficiently
Critical Role of the Assistant
Intraoperative Bleeding: Prevention

1. Study **all phases** of preop CT/MRI
   - Multiphase CT best (arterial, venous, delayed)
   - Review all views (axial and coronal)
   - Pay special attention to vascular anatomy

2. Dissect and skeletonize **all** arteries and veins

3. Consider vessel loops for quick intraop identification of artery(ies) and vein(s)

4. Consider multiple bulldog clamps on arteries

5. Avoid areas of vascular calcification
Vascular Bleeding
Vascular Bleeding: Management

1. Don’t panic
2. All hands on deck
3. Think and work quickly
4. Blood available in the room
5. Apply pressure
6. Increase insufflation
7. Have needle drivers, suture, endo GIA
8. Consider open conversion (rare)
9. Last resort is radical nephrectomy (almost never necessary)
Tumor Violation
Tumor Violation #1
Tumor Violation #2
Tumor Violation: Management

1. Optimize hemostasis of operative field
2. Attempt to re-excise deeper margin
3. Consider frozen section
4. Consider open conversion
5. Last resort is radical nephrectomy
Tumor Violation: Root Causes

1. Poor preoperative planning
   – Review of CT for size, location, depth of tumor

2. Poor intraoperative localization
   – Use and interpretation of lap ultrasound findings

3. Poor vascular control and hemostasis

4. Insufficient margin of excision
   – Secondary to enhanced magnification
Tumor Violation: Prevention

1. Study all phases of preop CT/MRI (both preop and intraop)

2. Measure depth of endophytic portion of tumor

3. Familiarity with intraoperative ultrasound
   – Laparoscopic or drop-in probe

4. Consider having ultrasonographer in OR

5. Use of Tile Pro feature on daVinci Si

6. Expose wide region of parenchyma around tumor
Drop-In Ultrasound Probe
Urine Leak
Urine Leak: Presentation

- Postop ileus
- High JP output (elevated drain creatinine level)
- Acute rise in serum creatinine
Urine Leak: Management

1. Retrograde
2. Ureteral Stent
Leak resolved with:

1) Ureteral stent (2-4 weeks)

2) JP pulled back and placed to gravity (until output minimal)

3) Foley (until JP minimal)
Urine Leak: Prevention

1. Anticipate entry
2. Selective closure
Pseudoaneurysm
Presentation: Delayed Gross Hematuria

Arterial blush

Pseudoaneurysm
Pseudoaneurysm: Management

• Have high index of suspicion if any sign of postop gross hematuria

• Trial of bedrest and transfusion if patient stable

• Have a low threshold to perform renal angiogram
Management: Selective Angioembolization

Pre-embolization

Post-embolization

post coiling
Pseudoaneurysm: Prevention

1. Have good vascular control and hemostasis
2. Cauterize cortical edge
3. Running suture along base of renal defect
4. Sliding clip renorrhaphy (Benway and Bhayani, 2010)
   • Superior closing tension vs. other methods
   • 32.7 Newtons (Hem-o-lok) vs. 16.7 (Lapra-Ty) vs. 11.3 (Sutures only)

Benway BM and Bhayani SJ Endourol 24: 605, 2010
Miscellaneous Complications
Paralyzed Assistant
Satinsky Clamp
Satinsky Clamp
4th Arm Misadventure
How to Minimize Complications

• Build your robotics team (esp. bedside assistant and surgical tech)

• Gain experience with other robotic procedures first (e.g. RALP, pyeloplasty, nephrectomy)

• Begin with low complexity renal tumors (i.e. small < 4 cm, exophytic, anterior)

• Study your CT/MRI thoroughly (all phases, axial, coronal, arterial, delayed)

• Avoid selective arterial or no ischemia technique in the beginning of your experience
How to Minimize Complications

• Develop a checklist of equipment and sutures and review preop and intraop

• Perform a ‘time out’ - rehearse each step and develop a backup plan for adverse events

• Educate and inform your patient about risks

• Be prepared and expect the unexpected
Poor preparation = BAD outcome
An Ounce of Prevention…
Thank You