Minimally Invasive Management of Kidney Tumors in the VHL Patient

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An "explosion" of new information and strategies !!

Does this Patient have VHL?

- VHL suspected when a person has:
  - Multiple hemangioblastomas (brain, spinal cord, eye), or
  - 1 hemangioblastoma and at least one of the following:
    - Clear cell kidney cancer
    - Pancreatic cysts
    - Pheochromocytoma
    - Endolymphatic sac tumor
    - Epididymal cyst

- In young patients, VHL is also suspected when there are multiple bilateral clear cell kidney cancers

Kidney Manifestations of VHL

- VHL – associated renal cell carcinoma comprises about
  - 4% of the total kidney cancer incidence
  - Kidney cancer in 25-45% of patients with VHL
  - Kidney cysts in up to 63% of patients with VHL
  - Average age at presentation ~ 39 years
  - Equal in both males and females

- 20% VHL patients have new mutation in the VHL gene (no prior family history)

- Sporadic kidney cancer diagnosed at average of 60–64 years of age
  - 75-85% VHL mutation

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Three Important Questions

• Why treat renal tumors?
• When do we treat renal tumors?
• How do we treat renal tumors?

Why Treat VHL Related Kidney Tumors

• Leading causes of VHL related mortality:
  1. Clear cell renal cell carcinoma (kidney cancer)
  2. Central nervous system hemangioblastomas

When to Treat VHL Related Kidney Tumors

• Similar treatment for kidney cancer regardless of whether a patient has VHL, However…
• Specific VHL considerations
  – Surgery generally considered when a tumor reaches 3 cm
  – Preservation of functional kidney tissue is imperative
  – Enucleation is acceptable
• Average growth rate of solid kidney tumors in VHL disease is 4.4 mm/year
  – similar to the growth rate of sporadic RCC

Jilg et al (2012)

VHL Kidney Tumor Growth Characteristics

• 96 tumors
• Average F/U 56 months
• Average growth 4.4 mm/yr
• Slow growing = 35%
  (1–3 mm/year)
• Moderate growing = 50%
  (3.1–7 mm/year)
• Rapid growing = 15%
  (7.1–17.5 mm/year)
• Growth rate different based on type of mutation?
  - splice mutations (5.6 mm/year) > nonsense mutation (2.5 mm/year)

Jilg et al (2012)
VHL Kidney Tumor Growth Characteristics

- Faster growing tumors
  - Higher probability of metastatic progression
  - Likely reflects more aggressive tumor behavior
  - Consider more frequent imaging
  - Adjust surgical excision threshold to smaller size?

VHL and Renal Cysts

- Majority of cysts in VHL disease grow slowly
- Kidney tumors occur alone or in combination with complex cysts
- Simple kidney cysts and atypical cysts can develop into cancer

How to Treat VHL Tumors

- Active Surveillance
- Partial Nephrectomy
- Ablative Technologies
- Radical Nephrectomy

Avoid if at all possible
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Success

Open

Lap

Robotic

Partial Nephrectomy

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Partial Nephrectomies

- Open Multifocal Partial Nephrectomies
- Robotic-Assisted Multifocal Partial Nephrectomies
- Salvage Partial Nephrectomy

Young healthy female
Discovery of right renal tumor during workup of abdominal pain
Managed with robotic right retroperitoneal partial nephrectomy

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Robotic Assisted Retroperitoneal Right Partial Nephrectomy
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- Middle aged male with history polio virus and lower extremity dysfunction
- S/P Right open partial nephrectomy in 2011 – clear cell kidney cancer
- Enlarging left renal mass
- Managed with robotic transperitoneal left partial nephrectomy

Robotic Assisted Transperitoneal Left Partial Nephrectomy

Partial Nephrectomy Complications

• Bleeding (immediate vs. delayed)
• Urinary fistula / urine leak
• Progression to kidney insufficiency / failure
• Injury to adjacent structures
• Death
• Positive margins
• Recurrence

Repeat Partial Nephrectomies for VHL

Minor and Major Complications

- % of VHL Patients With Complications

Jilg et al, 2012
Partial Nephrectomy - Bleeding

- Incidence reported ~ 2% (1.5% to 12%)
- Higher for central tumors (up to 8%)
- Collecting system repair common
- Onset – average 12 days post-op
- Needle placement causes pseudoaneurysm
- 3rd or 4th order Renal Artery Branch
- Selective renal embolization > 90% effective


Partial Nephrectomy Complication
Delayed Hemorrhage

Transcatheter arterial selective embolization

4th order branch renal artery
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Urinary Fistula / Leak

- Incidence: 2-6%
- Reported Risk Factors:
  - Larger tumors
  - Endophytic tumors
  - (+/-) Higher EBL
  - (+/-) Longer ischemic time
  - (+/-) Collecting system entry

Probe-Based Ablative Therapies

Kidney Tumor Ablation

- Ablation reserved for tumors between 2-3 cm
- Usually a secondary procedure
- Ablation - lower incidence of acute morbidity
- Radiofrequency (RFA) - 12-21% failure
- Cryoablation (Cryo) – 8-10% failure rate
- Contraindications to ablation
  - cystic tumors
  - tumors adjacent to ureter, bowel, major kidney vessels
  - extensive multifocal tumors

Kidney Tumor Ablation

- Proactive treatment approach
  - Usually percutaneous
  - Waning indications for lap assisted cryo or RFA
- Minimally invasive recovery profile
- Concerns:
  - Increased local recurrence compared to excision
  - Controversy regarding radiographic parameters of success
  - Often difficult surgical salvage

Park et al, 2010
Yang et al, 2013
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Laparoscopic Renal Cryotherapy

Percutaneous Renal Cryotherapy

Radiofrequency Ablation

Percutaneous Radiofrequency Ablation

- Tumor coagulation
  - High frequency current applied to target tissue results in ionic agitation and heat
    - Protein denaturation
    - Cell membrane disintegration
    - Occurs immediately above 60°C
- Vascular parenchyma may act as a heat sink
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Probe-Based Ablative Complications

- Incomplete ablation
  - Percutaneous vs lap/open
- Hemorrhage (due to fracture) most common complication with Cryo
  - Tumor is too large
  - Multiple probes
- Visceral injury (pancreas, bowel)
- Ureteral / kidney obstruction

Goals for Managing Kidney Tumors in the VHL Patient

1. Minimize risk of kidney cancer metastasis while simultaneously preserving renal function
2. Minimize the total number of surgical procedures a patient will require over their lifetime
3. Monitor microscopic tumors in otherwise healthy kidneys until they become clinically relevant
4. Purpose of kidney sparing procedures in VHL disease is not to “eradicate” tumors, but to “reset the clock” by removing clinically significant tumors

Thank you

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