Management of VHL Renal Tumors

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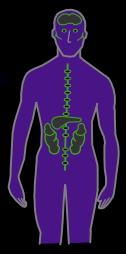
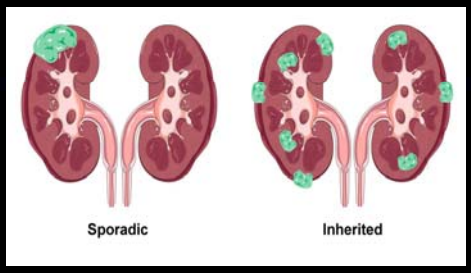
VHL Clinical Features

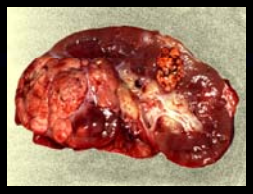
- Tumors develop in:
  - Both Kidneys
  - Adrenal Glands
  - Pancreas
  - Brain or Spine
  - Eyes
  - Inner Ears



Clear Cell Renal Carcinoma von Hippel Lindau (VHL)



VHL: Clear Cell RCC



Renal Cell Carcinoma

- **T1** **≤ 7 cm**
  - **T1a: ≤ 4 cm**
  - **T1b: 4-7 cm**
- **T2** **Tumor > 7 cm**
- **T3** **Tumor invades outside the kidney**
  - **T3a: peri-renal sinus, fat, adrenal**
  - **T3b: renal vein, vena cava**
- **T4** **Tumor invades beyond Gerota's Fascia**

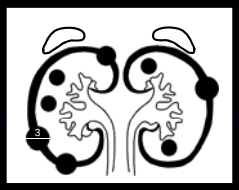
RCC Tumor Size and Survival

Tumor Size (cm)	5 Year Survival
≤ 2.5	100 %
2.5- 4.9	83 %
5.0- 7.4	61 %
7.5- 10.	51 %

J Urology 155: 1196, 1996
JSO 54: 163, 1993
J Urology 152: 1389, 1994

JOS 59: 186, 1995
J Urology 154: 901, 1995
JSO 64: 295, 1997

Management of Renal Carcinoma in VHL



"3 cm rule"
-Delay surgery until diameter of largest renal tumor = 3 cm
-Active surveillance

Surgery = nephron sparing enucleation

Inherited Forms of RCC

1. Von Hippel Lindau
   Clear Cell
2. Hereditary Papillary Renal Carcinoma
   Papillary Type 1
3. Birt Hogg Dubé:
   Chromophobe/Oncocytoma/Clear Cell
4. *Hereditary Leiomyomatosis RCC*
   Papillary Type 2

Partial Nephrectomy

- Established technique
- Tumors ≤ 4 cm
  - Compared to Radical Nx, No difference in:
    - Disease specific survival
    - Tumor recurrence

Licht MR, Novick AC. Nephron sparing surgery for renal cell carcinoma. J Urol 1993

Chronic Renal Insufficiency

- Compared to radical nephrectomy, nephron sparing surgery decreases risk of developing renal insufficiency

Hwang et al. Lancet Oncol 7: 735-40; 2006

Lau et al. Mayo Clin Proc 75: 1236-42; 2000

Chronic Renal Insufficiency

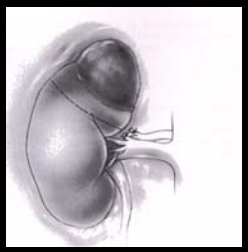
- Independent predictor of morbidity from cardiovascular and non-cardiovascular events

Go et al. NEJM 351: 1296-305; 2004

- 26% of patients with SRM's and normal serum Cr present with renal insufficiency (GFR < 60 ml/min)

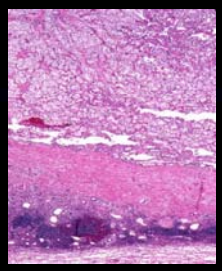
Hwang et al. Lancet Oncol 7: 735-40; 2006

T1a Treatment: Partial Nephrectomy Enucleation?

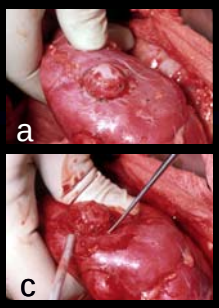


- SRM ≤ 4 cm
- Cancer Specific Survival
  - **90 – 95%**
- Local Recurrence
  - **4 – 6%**

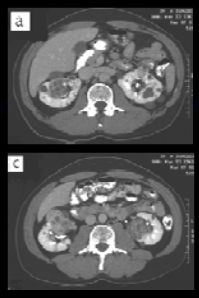
Tumor Enucleation



Tumor Enucleation



Pre-operative CT

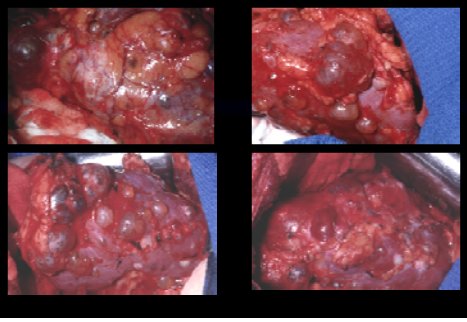


40 y.o. male

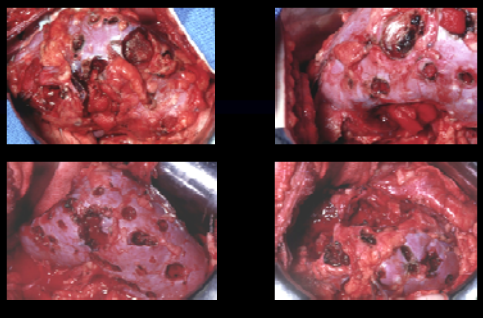
Cr Cl = 157 ml/min

S_{cr} = 0.9 mg/dl

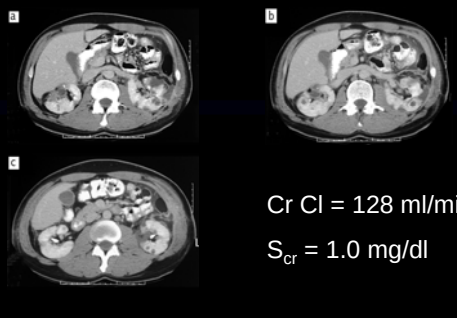
Intra-op before resection



Intra-op after resection



Post-operative CT



Cr Cl = 128 ml/min

S_{cr} = 1.0 mg/dl

3 cm Rule

- No one has developed RCC metastasis when following this rule

What happens when new tumors develop?

Feasibility and Outcomes of Repeat Partial Nephrectomy

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Salvage Partial Nephrectomy for Hereditary Renal Cancer: Feasibility and Outcomes

Gennady Bratslavsky,* Jack J. Liu, Aaron D. Johnson, Sunil Sudarshan, Peter L. Choyke, W. Marston Linehan and Peter A. Pinto

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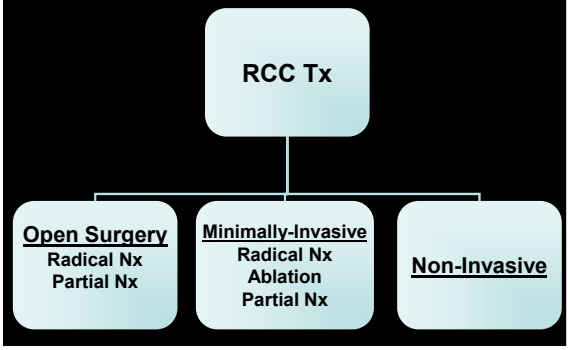
Evolving Surgical Therapies for RCC



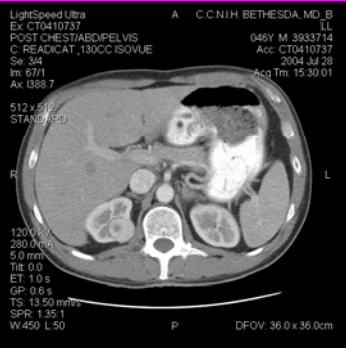
Surgical Techniques for NSS

- Comfort level and experience dictates partial nephrectomy approach

Minimally Invasive NSS

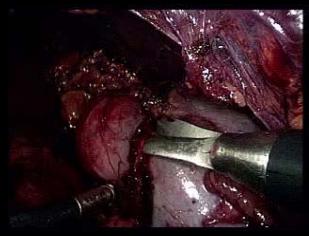
- Emulates open surgery
- Surgical tools are the same for open and minimally invasive NSS
  - Vascular clamps
  - Sutures and Hemostatic aids
  - Scissors, Penfield and right angle dissectors
  - Intra-operative Ultrasound

Laparoscopic Partial Nephrectomy

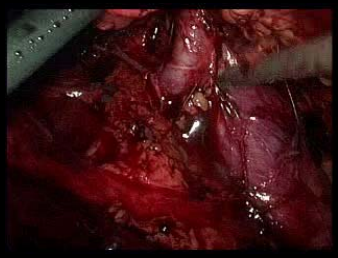


Retroperitoneal Approach

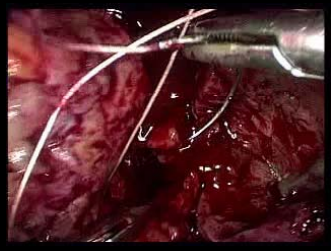
Laparoscopic Partial Nephrectomy



Laparoscopic Partial Nephrectomy



Laparoscopic Partial Nephrectomy



Minimally Invasive Partial Nephrectomy: Can Robotics Help?

- Improvement in technology and skill level for laparoscopic surgeons
- Role of laparoscopy in extirpative and reconstructive urologic surgery is expanding
- Lap NSS can be difficult to teach and reproduce
- Difficult for open trained surgeons to perform
  - **Similar to: open → laparoscopic → robotic prostatectomy**

Evolution of Surgery

- **Open** Surgery
  - Full Range of Motion; Full 3-D Visualization
  - Large Incision; Long Recovery due to surgical morbidity

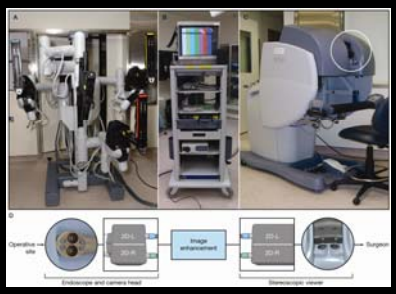
Evolution of Surgery

- **Laparoscopic** Surgery
  - Minimally Invasive; Reduced LOS & morbidity
  - Vision: 2-D; 4-5x Magnification
  - Instruments: 4 Degrees of Motion; Rigid Instruments; Opposite Movement
  - Result: Long Learning Curve; Difficult for Complex / Reconstructive Surgery

Evolution of Surgery

- **Robotic** Surgery
  - Vision: 3-D; 10x Magnification
  - Instruments: 7 Degrees of Motion; Replicated Movement – "Mimics Open Surgical Technique"
  - Instruments: Full Control of Camera and Arms
  - Result: Shorter Learning Curve; More Complex Surgery; Benefits of MIS to Broader Base of Patient

daVinci Surgical System



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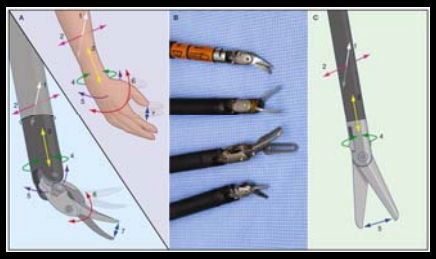
daVinci Surgical System



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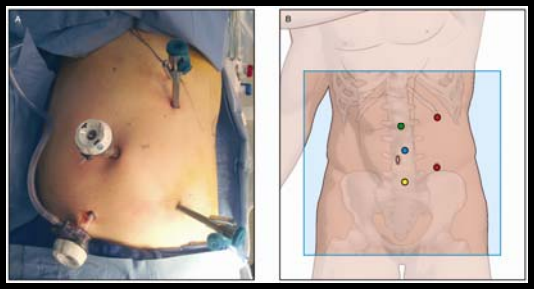
Port Access for the Robotic Arms



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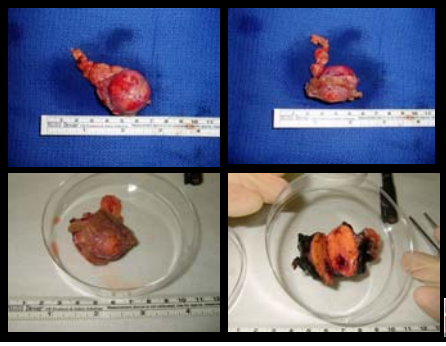
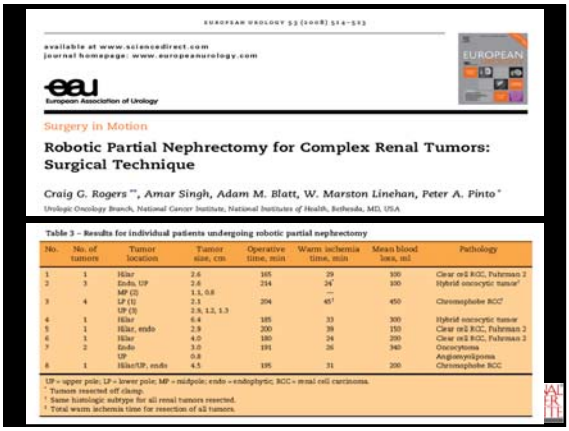
Robotic Assisted Partial Nephrectomy

Robotic Assisted Partial Nephrectomy

Robotic Partial Nephrectomy





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Surgery in Motion

Robotic Partial Nephrectomy for Complex Renal Tumors: Surgical Technique

*Craig G. Rogers *, Amar Singh, Adam M. Blatt, W. Marston Linehan, Peter A. Pinto*

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Table 3 – Results for individual patients undergoing robotic partial nephrectomy

No.	No. of tumors	Tumor location	Tumor size, cm	Operative time, min	Warm ischemia time, min	Mean blood loss, ml	Pathology
1	1	Hilar	2.6	165	29	100	Clear cell RCC, Fuhrman 2
2	3	Endo, UP	2.6	214	24[†]	100	Hybrid oncocytic tumor[‡]
		MP (2)	1.3, 0.8		—		
3	4	LP (1)	2.1	204	45[†]	450	Chromophobe RCC[‡]
		UP (3)	2.9, 1.2, 1.3				
4	1	Hilar	6.4	185	33	300	Hybrid oncocytic tumor
5	1	Hilar, endo	2.9	200	39	150	Clear cell RCC, Fuhrman 2
6	1	Hilar	4.0	180	24	200	Clear cell RCC, Fuhrman 2
7	2	Endo	3.0	191	26	340	Oncocytoma
		UP	0.8				Angiomyolipoma
8	1	Hilar/UP, endo	4.5	195	31	200	Chromophobe RCC

UP = upper pole; LP = lower pole; MP = midpole; endo = endophytic; RCC = renal cell carcinoma.
[†] Tumors resected off clamp.
[‡] Same histologic subtype for all renal tumors resected.
[†] Total warm ischemia time for resection of all tumors.

Surgical Techniques for NSS

- Open
- Laparoscopic
  - Pure lap

Regardless of technique, goal is to spare nephrons

- Robotic assisted
  - da Vinci surgical system

Evolving Surgical Therapies for RCC

RCC Tx

- **Open Surgery**
  - Radical Nx
  - Partial Nx
- **Minimally-Invasive**
  - Radical Nx
  - Ablation
  - Partial Nx
- **Non-Invasive**

RFA Treatment of RCC

- Percutaneous, outpatient procedure
- Conscious sedation and local anesthesia
- U/S or CT imaging to place needle
- 15- 18 gauge needle with insulated shaft
- Two 10 minute treatments per tumor
- Monitor impedance or temperature
- Cauterize needle tract, avoid bleeding and prevent tumor seeding

NCI Phase II Trial

- Hereditary kidney cancer
  - Solid tumors, <3 cm
  - Tumor growth over 1 year
  - Creatinine ≤ 1.7 or clearance > 60 ml/ min
- Radio frequency ablation technique
  - 200 watt device
  - Percutaneous or laparoscopic approach
  - CT or US guidance
  - 2 to 4 heating cycles at 12 minutes each
- Outcomes
  - Radiographic assessment (size and enhancement)
  - Renal function

CONCLUSION

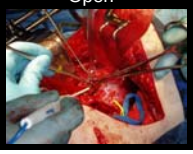
- VHL Renal Tumors are clear cell RCC
- "3 cm rule" balances need for dialysis and tumor spread
- Partial nephrectomy / ablation but avoid radical nephrectomy when possible, even after prior renal surgery

CONCLUSION

Laparoscopic

Robotic

Open



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