Renal Cell Cancer
Past, Present and the Future

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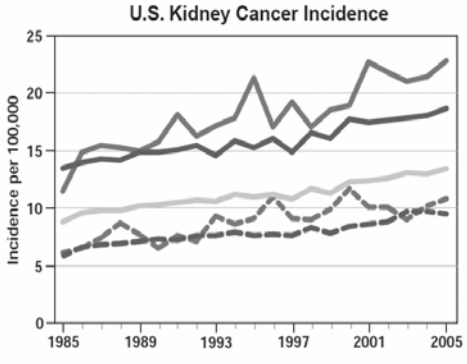
Presentation By Stage

- 58% localized to kidney
- 18% locally advanced or to regional LNs
- 19% with metastatic disease

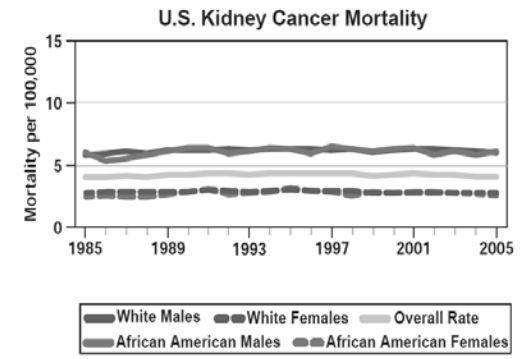
Renal Cell Carcinoma
Epidemiology

- Incidence (2009)
  - ✓ Estimated >49,000 new cases
  - ✓ >11,000 deaths
  - ✓ 2% of all cancers in US each year
  - ✓ Almost 300,000 alive with a history of disease
- Median age of diagnosis is 64 years, median age at death is 71 years

Kidney Cancer Incidence

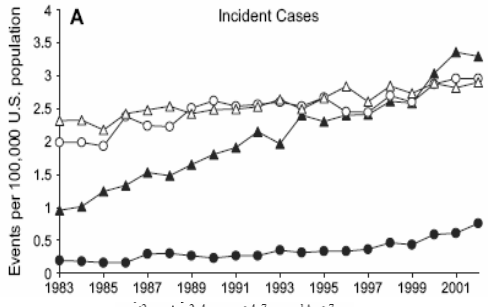


Kidney Cancer Mortality



NCI

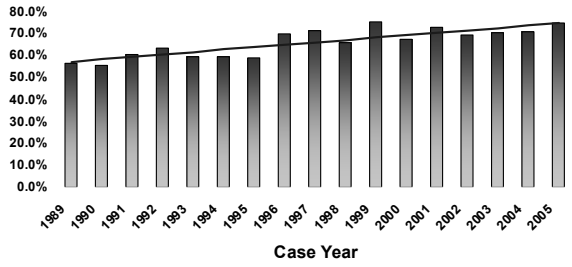
Incidence of Small Renal Masses



Hollingsworth, JM et al, 2006

Renal Cortical Tumors

Incidental Detection (70% in 2005)



Russo, et al

Etiology

- More than 100 chemicals were investigated in animal models such as aromatic hydrocarbons, no specific agent has been definitively established as causative in human RCC
- Smoking
- Slightly increased relative risks for workers in the metal, chemical, rubber, and printing industries
- Obesity, low socioeconomic status, and urban background
- Thorotrast (which was used as a contrast agent in the past), radiation therapy, and antihypertensive medications

Sporadic and Hereditary RCC

Sporadic Renal-Cell Carcinomas			Renal-Cell Carcinomas in an Inherited Syndrome	
Histologic Appearance	Incidence	Gene and Frequency	Rare Syndrome†	Gene
		percent		
Conventional	75	*VHL*, 60	VHL disease FCRC Hereditary paraganglioma	*VHL* Chromosome 3p translocation *SDHB*
Papillary	12	*MET*, 13 *TFE3*, <1	HPRC HLRCC	*MET* *FH*
Chromophobe	4		Birt–Hogg–Dubé syndrome	*BHD*
Oncocytoma	4		Birt–Hogg–Dubé syndrome	*BHD*
Collecting duct	<1			
Unclassified	3–5			

Cohen HT et al, 2005

Renal Masses Classified by Pathologic Features

Malignant	Benign	Inflammatory
Renal cell carcinoma	Simple cyst	Abscess
Conventional	Angiomyolipoma	Focal pyelonephritis Xanthogranulomatous pyelonephritis
Chromophilic	Oncocytoma	Infected renal cyst Tuberculosis
Chromophobic	Renal adenoma	Rheumatic granuloma
Collecting duct	Metanephric adenoma	
Urothelium based	Cystic nephroma	
Transitional cell carcinoma	Mixed epithelial-stromal tumor	
Squamous cell carcinoma	Reninoma (JG cell tumor)	
Adenocarcinoma	Leiomyoma	
Sarcoma:	Fibroma	
Leiomyosarcoma, Liposarcoma, Angiosarcoma, Hemangiopericytoma	Hemangioma	
Malignant fibrous histiocytoma,Synovial sarcoma, Osteogenic sarcoma, Clear cell sarcoma, Rhabdomyosarcoma	Vascular	
	Renal artery aneurysm	
	Arteriovenous malformation	
	Pseudotumor	
Wilms' tumor		
Primitive neuroectodermal tumor		
Carcinoid		
Lymphoma		
Leukemia		
Metastases		
Invasion by adjacent neoplasm		

Clinical Presentations

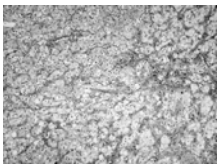
- 80% incidental
- Flank pain
- Gross hematuria
- Palpable mass
- Microhematuria
- Paraneoplastic syndromes (10-20%)

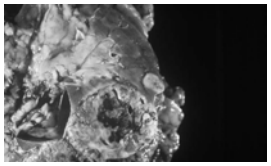
1997 Heidelberg Classification *Renal Cortical Tumors*

- Benign Parenchymal Neoplasms
  - ✓ Metanephric Adenoma
  - ✓ Metanephric adenofibroma
  - ✓ Papillary renal cell adenoma
  - ✓ Renal Oncocytoma
- Malignant Parenchymal Neoplasms
  - ✓ Conventional renal cell carcinoma (Clear Cell)
  - ✓ Papillary renal cell carcinoma
  - ✓ Chromophobe renal cell carcinoma
  - ✓ Collecting duct carcinoma
    - Medullary carcinoma of the kidney
  - ✓ Unclassified

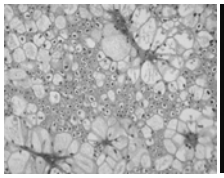
Kovacs, G., Akhtar, M., and Beckwith, B. J. J Pathol, ***183:*** *131, 1997*

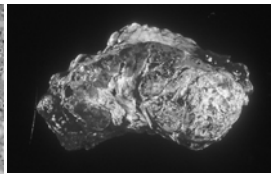
Conventional Clear Cell 64.5%





Chromophobe Ca 8.7%

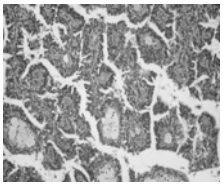


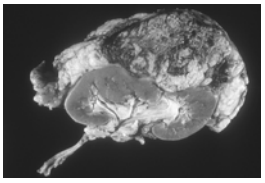


Imaging: IVP

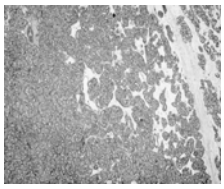
- Intravenous pyelography is rarely used
- Features suggestive of malignancy include
  - ✓ Calcification
  - ✓ Irregular margin
  - ✓ Increased tissue density
  - ✓ Distortion of the collecting system

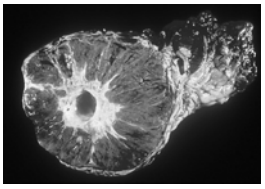
Papillary Ca 13.6%





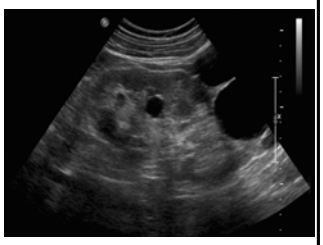
Oncocytoma 9.3%





Renal Ultrasound

- Reliable for differentiation of solid mass from fluid and can establish the diagnosis of a simple renal cyst and complex renal cysts
- Helpful in suggesting the fat content of an angio-myolipoma (increased echogenicity)



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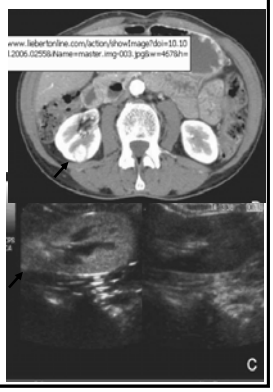
- Increased vascularity with doppler may indicate malignancy.
- Using microbubble contrast may be helpful (Wink et al2007)



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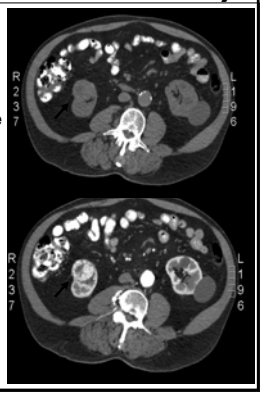
CT scan (Renal Protocol)

- Renal CT scan is the single most important radiographic test for defining the nature of a renal mass.
- Thin-slice CT scanning, with and without IV contrast
- Any renal mass that enhances by more than 15 Hounsfield units (HU) should be considered a renal cell carcinoma until proved otherwise
- Solid masses with areas of negative CT attenuation numbers (below -20 HU) indicative of fat are diagnostic of AMLs
- In approximately 10% of solid renal masses, CT findings are indeterminate, and additional testing or surgical exploration is needed

Zagoria, 2000, Hartman et al, 2004,Nelson, 2002

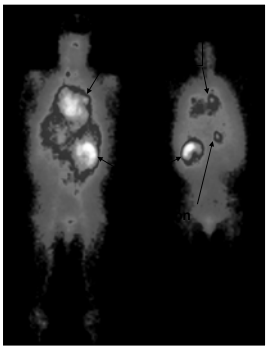


Magnetic Resonance Imaging

- Should not be used routinely for evaluation of renal masses
- On T1 image Enhancement of renal mass with intravenous gadolinium-labeled diethylenetriamine-pentaacetic acid.
- This technique is most helpful in patients for whom iodinated contrast medium is contraindicated because of severe allergy.

Cg250 Antibody For Pre-op Imaging

- Reacts only to clear cell renal carcinomas
- Antigen: Carbonic anhydrase-IX
- Normal tissue cross-reactivity – bile duct – saturable

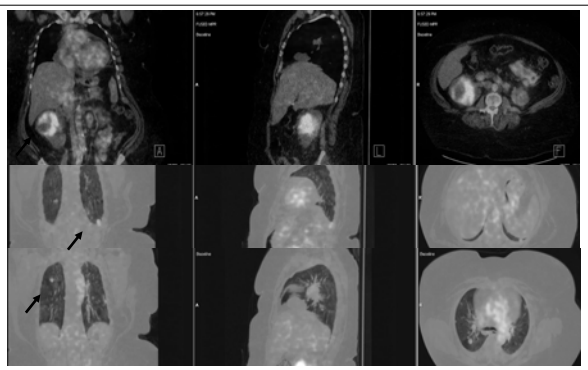


Ludwig Institute for Cancer Research

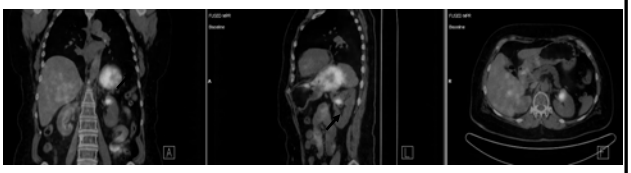
CT PET Scan

- There is no role for CT PET-FDG in diagnosing primary lesion in the kidney
- Limited role for metastatic disease and local recurrence

cG250 PET CT Scan



cG250 PET CT Scan



Renal Mass Biopsy

- Fine needle aspiration
- Core biopsy
- Complications:
  - ✓ 44% subcapsular hematoma on post biopsy CT scan.
  - ✓ Clinically significant bleeding is unusual and almost always self-limiting
  - ✓ Infections and pneumothorax are rare
  - ✓ Tumor Seeding

Volpe, et al 2006

Renal Mass Biopsy

- Routine renal mass biopsy is not indicated.
- US or CT scan guidance
  - ✓ Advantages of US: portability, multiplanar and real-time imaging, and lower cost
  - ✓ Advantages of CT:
    - Gas and other structures do not obscure visibility
    - Excellent spatial resolution
    - Better needle visualization
    - Easier to avoid necrotic areas
    - Rapid skill acquisition

Renal Mass Biopsy

TABLE 2. *Accuracy of renal mass needle core biopsies in recent series*

References	No. Tumors Biopsied	Imaging Guidance	Needle Size (gauge)	% Nondiagnostic Biopsies	No. Malignant Biopsies/No. Pathologically Confirmed	% Outcomes
Wood et al[8]	79*	CT/US	22 (FNA), 17–20 (cores)	6.3	49/41	Sensitivity 93, accuracy 95
Lechevallier et al[15]	73	CT	18	21	48/26	Concordance biopsy + surgical diagnosis 89
Hara et al[13]	33	CT/US	18	0	21/15	Concordance biopsy + surgical diagnosis 86.7
Caoili et al[24]	26	US	18	0	19/4	Sensitivity + specificity 100
Harisinghani et al[39]	28*,†	CT	22 (FNA), 18 (cores)	0	17/16	Concordance biopsy + surgical diagnosis 100
Neuzillet et al[9]	88	CT	18	9.1	66/62	Accuracy 92
Eshed et al[14]	22	CT	18	4.5	15/14	Sensitivity 93, specificity 100
Shah et al[29]	66	CT/US	18	21	37/15	Accuracy 98

* Combined FNA and needle core biopsies were obtained in most patients.
† Includes only biopsies of Bosniak III complex cystic renal masses.

Volpe, et al 2006

Renal Mass Biopsy

TABLE 3. *Accuracy of renal mass FNA in recent series*

References	No. Biopsies	Imaging Guidance	Needle Size (gauge)	% Nondiagnostic Biopsies	No. Malignant Biopsies/No. Pathologically Confirmed	% Accuracy
Cristallini et al[31]	72	CT/US	21–22	7.1	34/22	Sensitivity 89.2, specificity 97.1
Niceforo and Coughlin[32]	23	CT	22	0	12/6	Sensitivity 80, specificity 100, accuracy 87
Campbell et al[34]	25	CT	22	24	19/19	Sensitivity 76
Truong et al[7]	108	CT/US	23–25	16	46/46	Sensitivity 97, specificity 100

Volpe, et al 2006

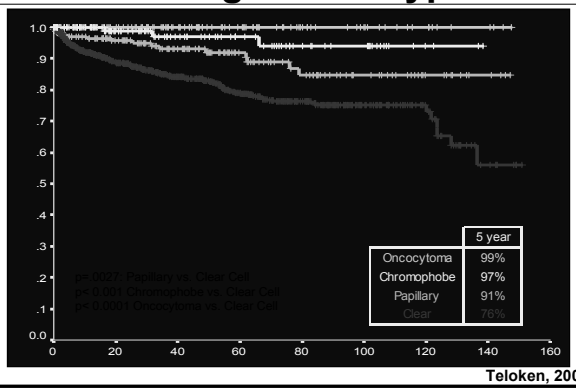
Prognostic Factors

- **Stage TNM**
- **Histological type**
- **Fuhrman grade**
- **Performance status**
- **MSKCC Criteria**
- **Molecular markers**

Indications for Renal Mass Biopsy

- **Rule out nonrenal cell primary tumors (mets or lymphoma)**
- **Rule out benign lesions**
- **Confirm the diagnosis and the histological subtype of a renal primary lesion in patients with metastases or unresectable masses**
- **Confirm diagnosis prior to ablations**
- **Confirm diagnosis for patient considering observation or when surgery is high risk**

Progression Free Probability by Histological Subtype



Teloken, 2009

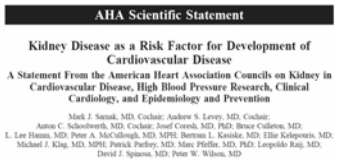
Therapeutic Modalities

David Sharp, MD

Chronic Kidney Disease

(2000-present)

Independent Risk Factor for CVD



AHA Scientific Statement

Kidney Disease as a Risk Factor for Development of Cardiovascular Disease

A Statement From the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention

Mark J. Sarnak, MD, Cochair; Andrew S. Levey, MD, Cochair; Anton C. Schoolwerth, MD, Cochair; Josef Coresh, MD, PhD; Bruce Culleton, MD; L. Lee Hamm, MD; Peter A. McCullough, MD, MPH; Bertram L. Kasiske, MD; Ellie Kelepouris, MD; Michael J. Klag, MD, MPH; Patrick Parfrey, MD; Marc Pfeffer, MD, PhD; Leopoldo Raij, MD; David J. Spinosa, MD; Peter W. Wilson, MD

Treatment of Small Renal Tumors

- **A plethora of options**
  - ✓ **Surveillance**
  - ✓ **Radical nephrectomy (open/ lap/ robotic)**
  - ✓ **Partial nephrectomy (open/ lap/ robotic)**
  - ✓ **Ablative**
    - **Cryoablation**
    - **Radiofrequency ablation**

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(2000-present)

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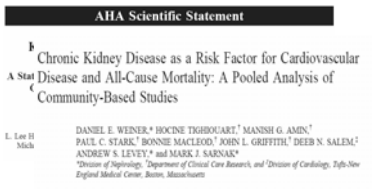

AHA Scientific Statement

Chronic Kidney Disease as a Risk Factor for Cardiovascular Disease and All-Cause Mortality: A Pooled Analysis of Community-Based Studies

DANIEL E. WEINER,* HOCINE TIGHIOUART,† MANISH G. AMIN,† PAUL C. STARK,† BONNIE MACLEOD,† JOHN L. GRIFFITH,† DEEB N. SALEM,‡ ANDREW S. LEVEY,* and MARK J. SARNAK*

*Division of Nephrology, †Department of Clinical Care Research, and ‡Division of Cardiology, Tufts-New England Medical Center, Boston, Massachusetts

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(2000-present)
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AHA Scientific Statement

Chronic Kidney Disease as a Risk Factor for Cardiovascular

Evidence for increased cardiovascular disease risk in patients with chronic kidney disease

Josef Coresh[a], Brad Astor[a] and Mark J. Sarnak[b]

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Independent Risk Factor for CVD

AHA Scientific Statement

Chronic Kidney Disease as a Risk Factor for Cardiovascular

Evidence for increased cardiovascular disease risk in patients with chronic kidney disease

Kidney Function as a Predictor of Noncardiovascular Mortality

ORIGINAL ARTICLE

Chronic Kidney Disease and the Risks of Death, Cardiovascular Events, and Hospitalization

Alan S. Go, M.D., Glenn M. Chertow, M.D., M.P.H., Dongjie Fan, M.S.P.H., Charles E. McCulloch, Ph.D., and Chi-yuan Hsu, M.D.

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Analysis of 1,129,295 ambulatory adults According to Estimated GFR

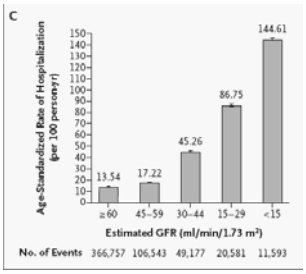

Table 2. Adjusted Hazard Ratio for Death from Any Cause, Cardiovascular Events, and Hospitalization among 1,120,295 Ambulatory Adults, According to the Estimated GFR.*

Estimated GFR	Death from Any Cause	Any Cardiovascular Event	Any Hospitalization
	adjusted hazard ratio (95 percent confidence interval)		
≥60 ml/min/1.73 m²†	1.00	1.00	1.00
45–59 ml/min/1.73 m²	1.2 (1.1–1.2)	1.4 (1.4–1.5)	1.1 (1.1–1.1)
30–44 ml/min/1.73 m²	1.8 (1.7–1.9)	2.0 (1.9–2.1)	1.5 (1.5–1.5)
15–29 ml/min/1.73 m²	3.2 (3.1–3.4)	2.8 (2.6–2.9)	2.1 (2.0–2.2)
<15 ml/min/1.73 m²	5.9 (5.4–6.5)	3.4 (3.1–3.8)	3.1 (3.0–3.3)

* The analyses were adjusted for age, sex, income, education, use or nonuse of dialysis, and the presence or absence of prior coronary heart disease, prior chronic heart failure, prior ischemic stroke or transient ischemic attack, prior peripheral arterial disease, diabetes mellitus, hypertension, dyslipidemia, cancer, a serum albumin level of 3.5 g per deciliter or less, dementia, cirrhosis or chronic liver disease, chronic lung disease, documented proteinuria, and prior hospitalizations.
† This group served as the reference group.

Go AS, Chertow GM, Fan D *et al.* Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med 2004; 351:1296-305.

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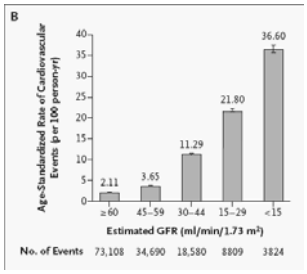

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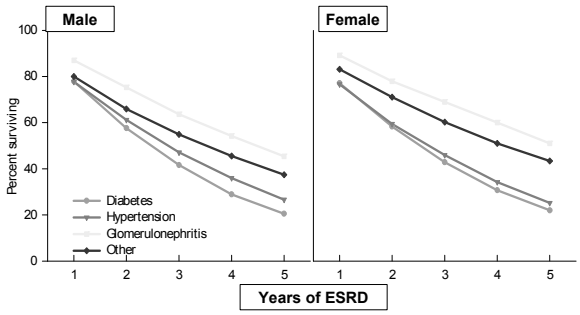
End Stage Chronic Kidney Disease (GFR<15) 5-year survival

Dialysis patients, adjusted for age & race, co-morbidity



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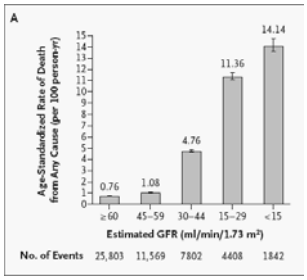

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30–44 ml/min/1.73 m²	1.8 (1.7–1.9)	2.0 (1.9–2.1)	1.5 (1.5–1.5)
15–29 ml/min/1.73 m²	3.2 (3.1–3.4)	2.8 (2.6–2.9)	2.1 (2.0–2.2)
<15 ml/min/1.73 m²	5.9 (5.4–6.5)	3.4 (3.1–3.8)	3.1 (3.0–3.3)

* The analyses were adjusted for age, sex, income, education, use or nonuse of dialysis, and the presence or absence of prior coronary heart disease, prior chronic heart failure, prior ischemic stroke or transient ischemic attack, prior peripheral arterial disease, diabetes mellitus, hypertension, dyslipidemia, cancer, a serum albumin level of 3.5 g per deciliter or less, dementia, cirrhosis or chronic liver disease, chronic lung disease, documented proteinuria, and prior hospitalizations.
† This group served as the reference group.

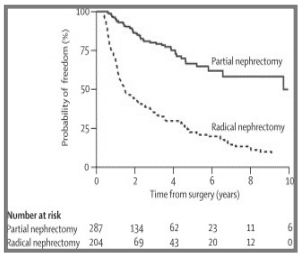
Go AS, Chertow GM, Fan D *et al.* Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med 2004; 351:1296-305.

Surgery for Localized RCC

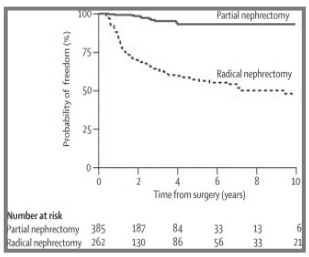
- **RCC pts are NOT renal donor pts**
  - ✓ **Mean age older (40 vs 61)**
  - ✓ **Often have co-morbidities**
    - **Diabetes**
    - **CV disease**
    - **HTN**
    - **Metabolic syndrome**
    - **Obesity**
- **Renal failure (GFR < 60) may be a risk factor for CV disease**
- **Retrospective review of 662 pts at MSKCC**
  - ✓ **Normal Cr (<1.4 mg/ml) and normal contralateral kidney, tumor 4 cm or less**
  - ✓ **GFR < 60 found in 26% pre nephrectomy pts**
  - ✓ **3 yr post neph. freedom from CRD (GFR<60) was 80% (partial) & 35% (radical)**
  - ✓ **3 yr post neph. freedom from CRD (GFR<45) was 94% (partial) & 59% (radical)**

Huang, Lancet Oncology 7:735, 2006

Probability of Freedom of Onset of Low GFR



GFR < 60 mL/min



GFR < 45 mL/ min

- **Conclusion: <u>Always</u> do a partial nephrectomy when technically feasible**

Huang, Lancet Oncology 7:735, 2006

Surgery for Localized RCC

Partial nephrectomy with negative surgical margins **=** **Radical nephrectomy**

For Local Recurrence and Overall Survival

Licht MR, Novick AC, J Urol 1993.

Under-utilized Kidney Sparing Centers vs. National Trends

- **MSKCC, Mayo Clinic, Cleveland Clinic, OSU: > 60% of kidney tumor operations are partial nephrectomy.**
- **U of Michigan Study: Nationwide Inpatient Sample of 54,069 patients undergoing kidney tumor surgery, only 9% were partial nephrectomy.**
- **PN more likely in recent years, major teaching centers, with *high* nephrectomy volumes (>28/yr).**
- **In 2009, partial nephrectomy rates up to 34% of tumors <4cm**

(Miller et al: J. Urol. 175:853, 2006)

Who's a Candidate?

- **Essential**
  - ✓ **Tumor in solitary kidney (functional or anatomical)**
  - ✓ **CRF**
  - ✓ **AODM**
  - ✓ **Urolithiasis**
  - ✓ **Multifocal**
  - ✓ **Bilateral tumors (sporadic, familial, hereditary)**

Who's a Candidate?

- Elective
  - ✓ Renal tumor of 7cm or less, particularly if exophytic

Who's a Candidate?

- Whoever has a tumor that is amenable to nephron-sparing approach

Who's a Candidate?

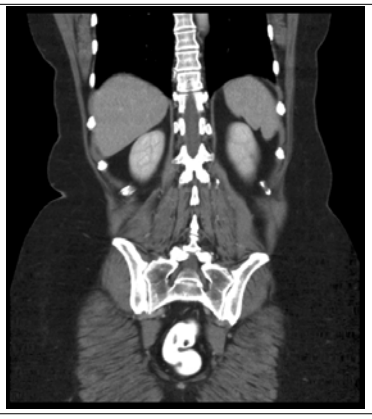
- Extended
  - ✓ Renal hilar
  - ✓ Renal sinus
  - ✓ Large cystic tumors

Robotic Partial Nephrectomy

- Minimally invasive-
  - ✓ Done through 4-5 small incisions
  - ✓ Less pain
  - ✓ Shorter recovery
- Easier, more precise intracorporeal suturing for renal reconstruction than traditional laparoscopic techniques
- Can assist for technically challenging cases, such as hilar and multiple renal tumors
- Difficulties-
  - ✓ Space limitations, ischemia time- requires warm ischemia, less precise reconstruction than open techniques, not all tumors amenable

Robotic Partial Nephrectomy

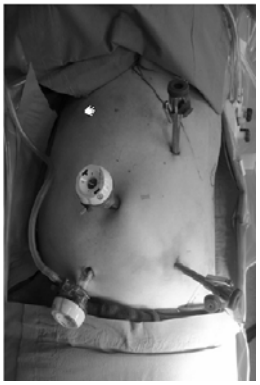
- Potential advantages
  - ✓ Smaller incisions
  - ✓ Quicker recovery
  - ✓ Less painful
- Potential disadvantages
  - ✓ learning curve
  - ✓ Dependant on technical advances in instrumentation
  - ✓ Effective methods of cooling difficult
  - ✓ Precision of closure of collecting system and parenchyma



Case Presentation

- 56 yo female, incidental finding of L renal mass
- L radical nephrectomy recommended, came for 2nd opinion
- PMHx sig for bilat LE lymphedema
- Preop GFR >60 mL/ min / 1.73 m^2, SCr = 0.7 ng/mL

Port Access



Dr. Sharp's Video

Who's a candidate?

- **Not just the skinny easy ones**

Open vs Min Invasive Partial Nx

Comparison of 1,800 Laparoscopic and Open Partial Nephrectomies for Single Renal Tumors

Inderbir S. Gill, Louis R. Kavoussi, Brian R. Lane, Michael L. Blute, Denise Babineau, J. Roberto Colombo, Jr., Igor Frank, Sompol Permpongkosol, Christopher J. Weight, Jihad H. Kaouk, Michael W. Kattan and Andrew C. Novick*

From the Glickman Urological Institute (ISG, BRL, JRC, CJW, ACN) and Department of Quantitative Health Sciences (DB, MWK), Cleveland Clinic, Cleveland, Ohio, and Departments of Urology, The Johns Hopkins Hospital (LRK, SP), Baltimore, Maryland, and Mayo Clinic (MLB, IG), Rochester, Minnesota

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LPN: ↓ EBL, LOS, O.R. time

LPN: ↑ ischemia, complications (post-op hemorrhage)

Cancer control same

Renal function same

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What Technique When?

- **What is important is:**
  - ***Location, Location, Location.***
  - ***Size Matters (but not that much)***
  - **Centrally-extending renal tumors require more complex reconstructions and are more likely to have post-op complications**
- **Robotic partial nephrectomy/ MIS for exophytic or when ischemia times comfortably less than 30 minutes**
- **Regardless of technique, goal is Nephron Sparing Surgery**

Robotic Partial Nephrectomy for Complex Renal Tumors: Surgical Technique

Table 2 – Summary of results after robotic partial nephrectomy for complex renal tumors

Mean warm ischemia time, min (range)	31 (24–45)
Mean operative time, min (range)	192 (165–214)
Mean blood loss, ml (range)	230 (100–450)
Mean hospital stay, d (range)	2.6 (2.0–3.0)
Mean increase in serum creatinine at discharge, mg/dl (range)	0.03 (−0.2–0.2)
Mean decrease in eGFR, ml/min/1.73 m^2 (range)	−5.6 (−3.4–15)
Complex tumor features (n)	
Hilar	5
Endophytic	4
Multiple	3

eGFR = estimated glomerular filtration rate.

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

More Advanced Disease

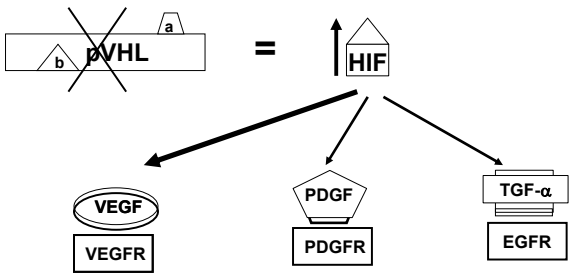
- **Surgery remains a integral part of the management of patients with advanced disease**
  - ✓ **Metastatic disease**
    - **Cytoreductive nephrectomy (open or laparoscopic)**
    - **Excision of metastatic deposits**
  - ✓ **Tumor thrombus into IVC**
  - ✓ **Locoregional lymphadenopathy**

Treatment of Metastatic RCC

- Until recently, options limited to immunotherapy regimens
  - ✓ IL-2 or IFN-α
  - ✓ Response rates low (10-15%)
  - ✓ Median survival 13 months at best
  - ✓ For those that failed first-line therapy, no effective treatment existed with response rates for second-line regimens <5%

Loss of pVHL in Conventional Clear Cell Ca

Stimulation of tumor cell growth and vascularity



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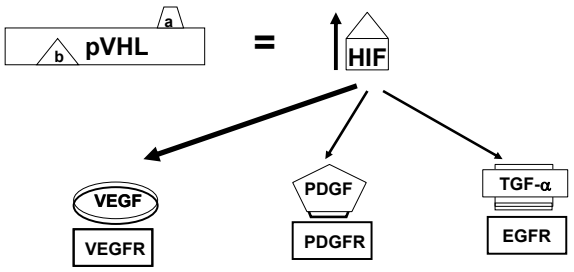
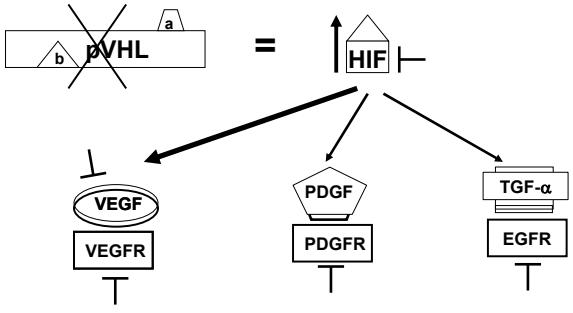


Targeted Approach to RCC Therapy

Drugs and Targets



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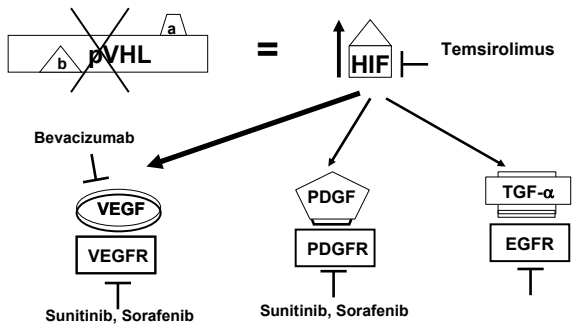

Cytoreductive Nephrectomy

- Initially nephrectomy performed for palliation in patients with metastatic RCC
- Spontaneous regression noted in 0.8% of patients with metastatic disease
- Survival advantage of debulking radical nephrectomy followed by IFN-α in patients with metastatic RCC has been confirmed

Current Targeted Therapies

- FDA approved:
  - ✓ Sunitinib (*Sutent®, Pfizer*)
  - ✓ Sorafenib (*Nexavar®, Bayer/ Onyx*)
  - ✓ Temsirolimus (*Torisel™, Wyeth*)
  - ✓ Everolimus (*Afinitor™*, asdf)
  - ✓ Pazopanib (*Votrient™*, GlaxoSmithKline)
  - ✓ Bevacizumab (*Avastin®, Genentech*) with IFN- α
  - ✓ IL-2

SWOG 8949 and EORTC 30947

- Combined results:

	Nephrectomy/IFNα	IFNα	
Pt number	161	163	
Median OS (mos)	13.6	7.8	p=0.002
% Response	6.9	5.7	p=0.60

  - ✓ Overall survival increased a median of 5.8 mos in pts who had a cytoreductive nephrectomy
  - ✓ Healthier pts with less bulky disease did better than sick pts with kidney removal

Flanigan, J Urology 171:1071, 2004

How does this apply to oral targeted therapies?

How does this apply to oral targeted therapies?

We don't know…..

Cytoreductive nephrectomy remains standard of care when surgically resectable

How does this apply to oral targeted therapies?

We don't know…..

Areas of Exploration

- **Adjuvant therapy being explored in clinical trials**
- **In certain patients, neoadjuvant targeted therapy is a reasonable option**
- **Further research necessary to further delineate the role of targeted meds and surgery and in what order**
- **Multimodality treatment will be the mainstay of treatment for locally advanced and metastatic RCC**

Conclusions

- Renal cell carcinoma is increasing in incidence
- Imaging is increasingly precise and specific
- Biopsy rarely indicated
- Nephron-sparing surgery is underutilized for the treatment of small renal masses
- The ability to offer NSS via minimally-invasive robotic surgery increases the acceptance
- Targeted therapies are leading to exciting advances in the treatment of advanced RCC
- Technological advances will continue to decrease morbidity while improving surgical outcomes and cancer cure