腎臟腫瘤
Kidney tumor

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111/10

Scenario

- A 65-year-old man with a history of well-controlled hypertension presents for a follow up visit after an incidental finding of a small mass in the right kidney on an abdominal computed tomographic (CT) scan. (The scan had been ordered to evaluate pain in the lower quadrant, which resolved.) The mass is 3.2 cm in its largest dimension, anterior, heterogeneous, and solid, and it is in the right renal hilum near the main renal artery, vein, and ureter; the left kidney appears normal.
- The patient feels well, and his physical examination is unremarkable. His serum creatinine level is 1.2 mg per deciliter. How should this patient be further evaluated and treated?

N Engl J Med. 2010 Feb 18;362(7):624-34.

Differential diagnosis

BOX 57-1 Renal Masses Classified by Pathologic Features

MALIGNANT
- Renal cell carcinoma
- Urothelium-based cancers
  - Urothelial carcinoma
  - Squamous cell carcinoma
  - Adenocarcinoma
- Sarcomas
  - Leiomyosarcoma
  - Liposarcoma
  - Angiosarcoma
  - Hemangiopericytoma
  - Malignant fibrous histiocytoma
  - Synovial sarcoma
  - Osteogenic sarcoma
  - Clear cell sarcoma
  - Rhabdomyosarcoma
- Wilms tumor
- Primitive neuroectodermal tumor
- Carcinoid tumor
- Lymphoma/leukemia
- Metastasis
- Invasion by adjacent neoplasm

BENIGN
- Cystic lesions
  - Simple cyst
  - Hemorrhagic cyst

BENIGN—cont'd
- Solid lesions
  - Angiomyolipoma
  - Oncocytoma
  - Renal adenoma
  - Metanephric adenoma
  - Cystic nephroma
  - Mixed epithelial-stromal tumor
  - Reninoma (juxtaglomerular cell tumor)
  - Leiomyoma
  - Fibroma
  - Hemangioma
- Vascular lesions
  - Renal artery aneurysm
  - Arteriovenous malformation
- Pseudotumor

INFLAMMATORY
- Abscess
- Focal pyelonephritis
- Xanthogranulomatous pyelonephritis
- Infected renal cyst
- Tuberculosis
- Rheumatic granuloma

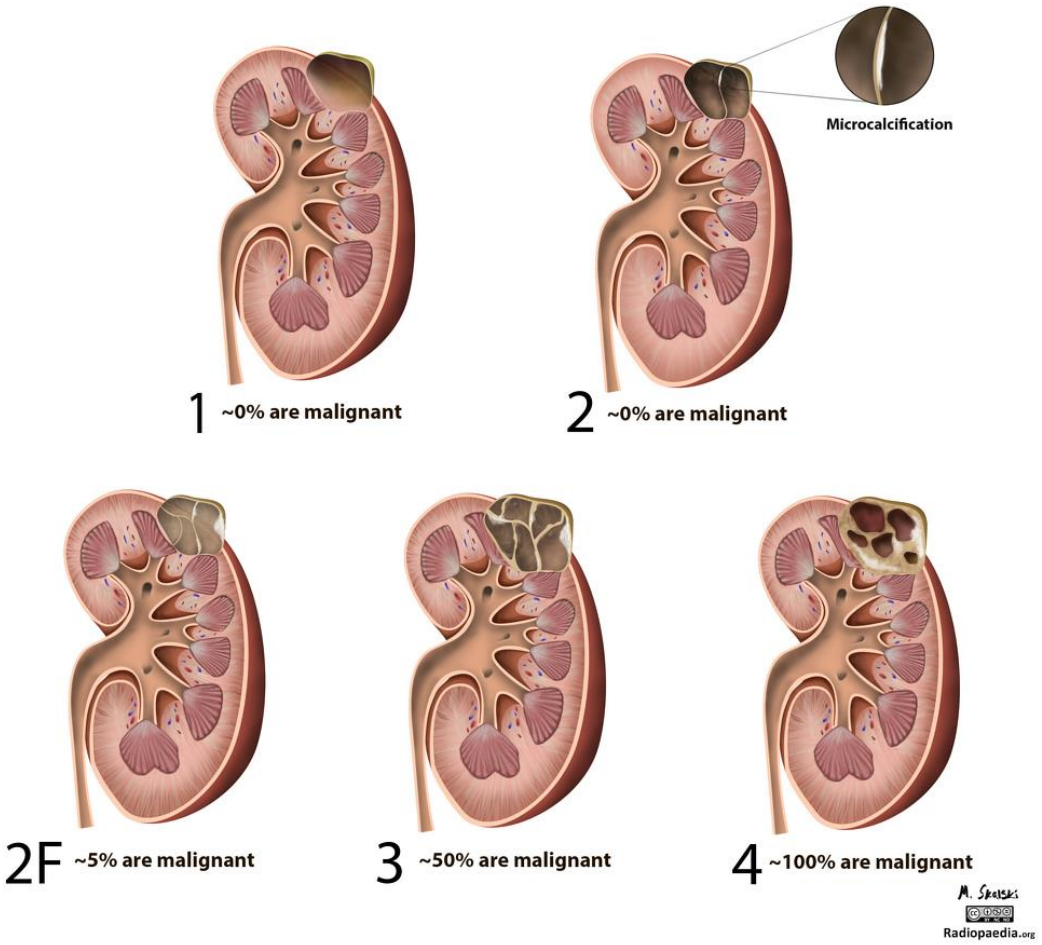
Small renal mass (<4cm)

- Cystic renal mass
  - Simple cyst
  - Cystic RCC
- Solid renal mass
  - Angiomyolipoma (AML)
  - Oncocytoma
  - Pseudotumor
  - Renal cell carcinoma (RCC)
  - Urothelial carcinoma (UC)
  - Lymphoma
  - Sarcoma
  - Metastasis

CT with/without contrast

Bosniak classification

Bosniak classification of renal cysts



Bosniak renal cyst classification

Category	CT features	Significance
I	Thin wall, water density & does not enhanced No septa, calcification, or solid component	Benign
II	Thin septa with "perceived" enhancement Fine or slightly thick calcification High attenuation non-enhancing cyst < 3 cm	Benign
IIF	Thick regular septa with "perceived" enhancement Thick regular wall with "perceived" enhancement Thick, nodular, & irregular calcification	Likely benign Follow-up
III	Thick smooth or irregular septa Thick smooth or irregular wall With measurable enhancement	Some benign Some malignant
IV	Criteria of category III Enhancing mass independent of wall or septa	Malignant Cystic carcinoma

Israel GM & Bosniak MA. Urology 2005 ; 66 : 484 – 488.

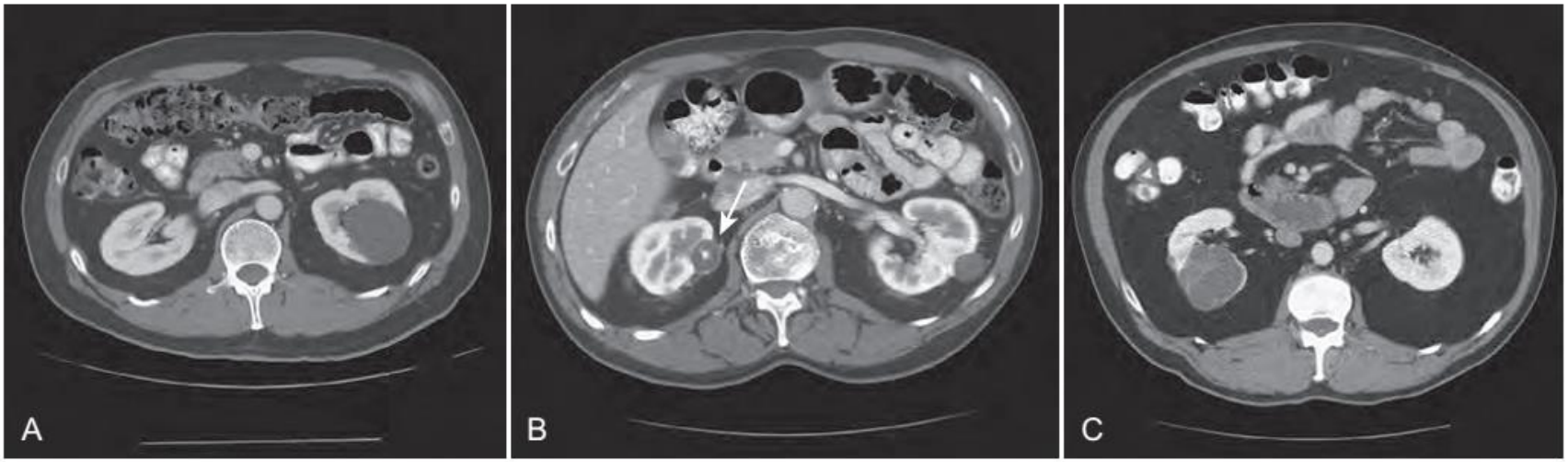


Figure 56-1. A, Computed tomography (CT) scan of a Bosniak I renal cyst. B, CT scan of a Bosniak II renal cyst. Note internal calcification. C, CT scan of a Bosniak IIF renal cyst. Several thin irregular septations are present within the cyst. (Copyright 2009, C. G. Wood.)

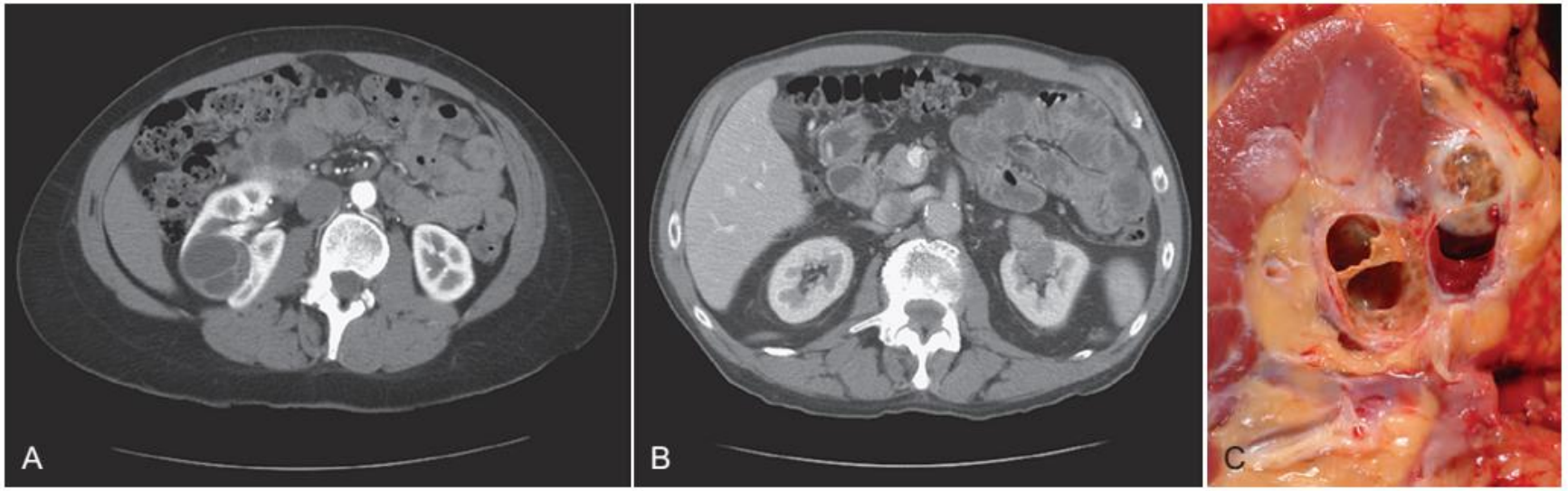


Figure 56-2. A, Computed tomography (CT) scan of a Bosniak III renal cyst. Thick, irregular septations are present within the cyst. B, CT scan of a Bosniak IV renal cyst, with a solid enhancing nodule. C, Bivalved Bosniak IV renal cyst demonstrating a solid component that proved to be conventional renal cell carcinoma. (Copyright 2009, C. G. Wood.)

Small renal mass (<4cm)

- Cystic renal mass
  - Simple cyst
  - Cystic RCC
- Solid renal mass
  - Angiomyolipoma (AML)
  - Oncocytoma
  - Pseudotumor
  - Renal cell carcinoma (RCC)
  - Urothelial carcinoma (UC)
  - Lymphoma
  - Sarcoma
  - Metastasis

CT with/without contrast

Abdominal CT for solid renal mass

Differential Diagnosis	CT
RCC	Enhancing (>12-20 HU) mass with IV contrast, may have cystic component, calcifications (30%), hemorrhage or necrosis [13]
Transitional cell carcinoma	Often ill-defined mass located centrally; radiolucent filling defect, obstruction or nonvisualization of the collecting system with IV contrast [1]
Sarcoma	Soft tissue mass arising from capsule or renal sinus, often quite large without lymphadenopathy; presence of fat suggests liposarcoma [1]
Lymphoma	Multiple small renal masses (most common pattern), diffuse renal involvement, or direct invasion of lymphadenopathy into kidney. Usually hypoattenuating, occasionally hyperattenuating. [1]
Metastases	Multiple masses, moderate enhancement with IV contrast. [1]
Oncocytoma	Central stellate scar [1]
Angiomyolipoma	Heterogeneous mass with areas of negative attenuation (below -20 HU) without calcifications [1]
Pseudotumor	Renal segment that is isodense with surrounding parenchyma [1]

Table 2. Differential diagnosis for solid renal mass

- In 10% to 20% of solid renal masses, CT findings are indeterminate
  - Poor enhanced RCC, fat-poor AML, oncocytoma…

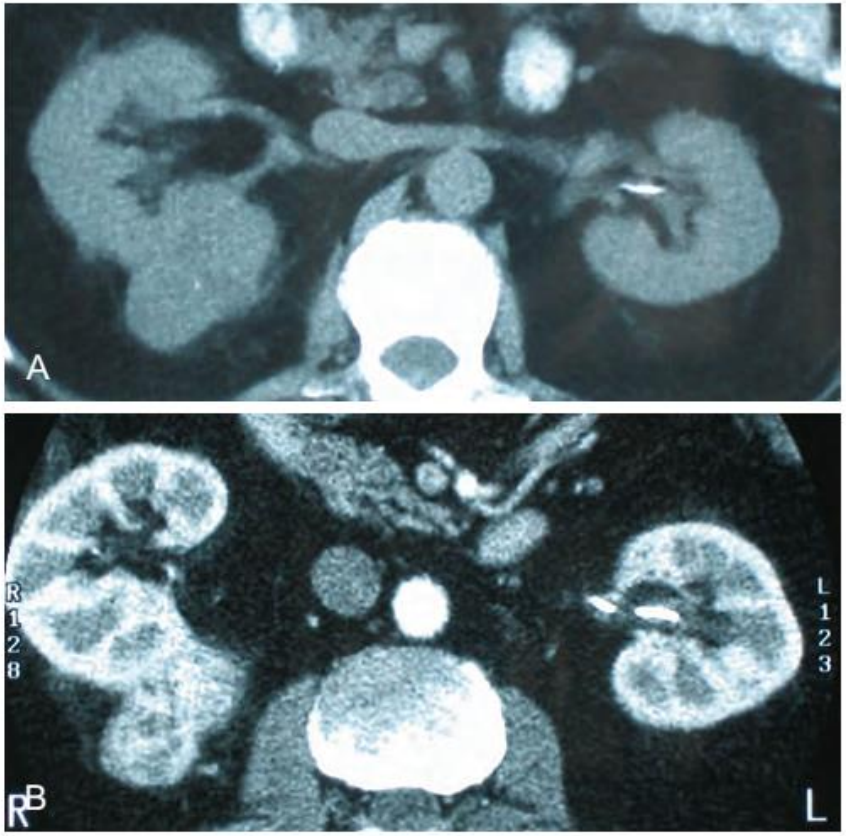


Figure 57-2. A, Computed tomography (CT) scan without administration of contrast material shows solid, right posterior renal mass. B, After administration of the contrast agent, CT scan shows that the mass enhances more than 20 HU and is thus highly suggestive of renal cell carcinoma (RCC). This mass was excised and confirmed to be a clear cell RCC. (Courtesy Dr. Terrence Demos, Maywood, IL.)

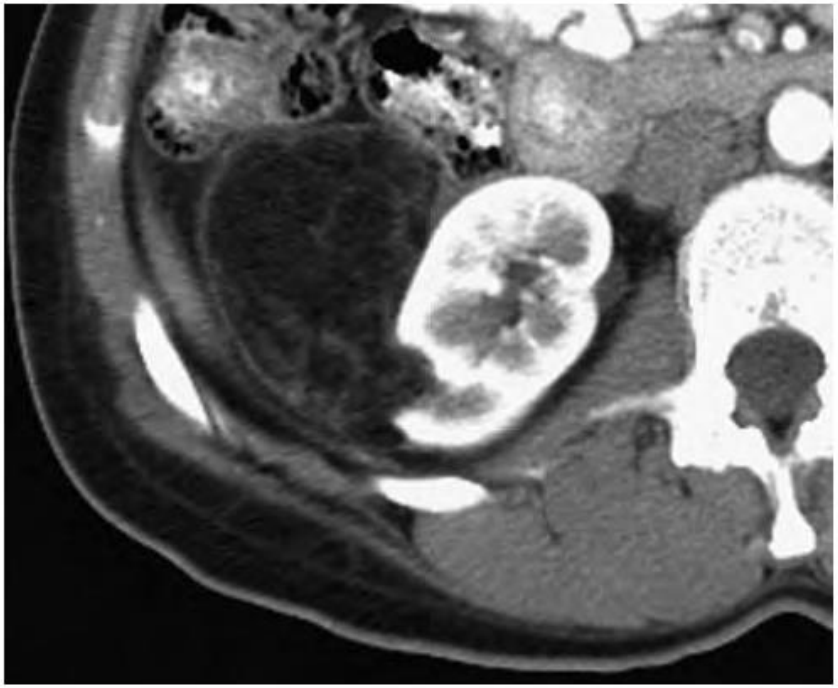
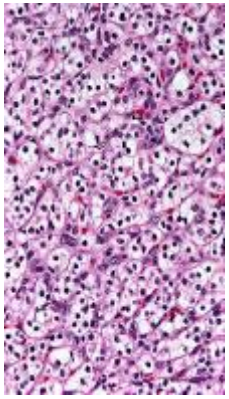
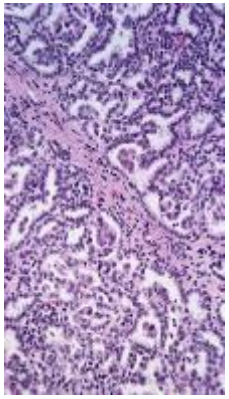
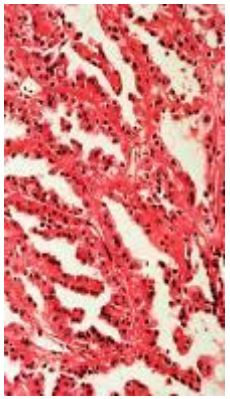
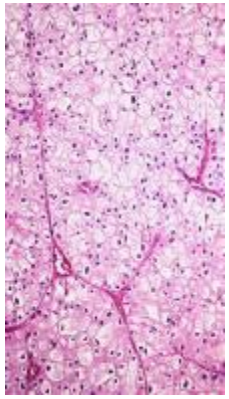
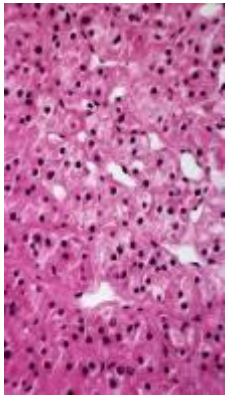
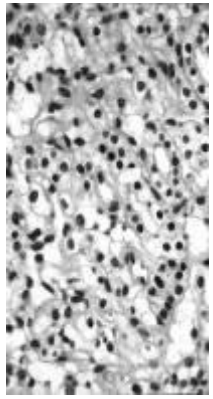


Figure 56-8. Computed tomography scan of angiomyolipoma with parenchymal indentation. (Copyright 2009, S. F. Matin.)

Figure 56-6. **Computed tomography scan of a patient with multiple bilateral oncocytomas. (Copyright 2009, S. F. Matin.)**

Histology and Molecular Pathogenesis of RCC

Non-Clear Cell

Tumor type	Clear Cell	Papillary (type I + II)		Chromophobic	Oncocytic	Collecting duct[3]
Histology[1]						
Incidence (%)[2]	80-90	10-15		4–5	2–4	1
Genetic mutation[1]	*VHL*	*c-MET*	*FH*	*BHD*	*BHD*	

BHD = Birt–Hogg–Dubé; *FH* = fumarate hydratase; *VHL* = von Hippel–Lindau

1. Reproduced from J Urol , 170, Linehan WM, et al. 2163–72, copyright (2003), with permission from the American Urological Association.
2. Motzer RJ, et al. N Engl J Med 1996;335:865–75. 3. Charney DA, Tomasula JR. The Internet Journal of Pathology 2001;2(1). Reproduced with permission

Needle biopsy

- CT-guided core biopsy, minimal risk of bleeding and seeding of the needle tract
- In past, higher false negative rate (negative predictive value, 60%)

- Recent, sensitivity 99.7%, specificity 93.2%
- 10% of patients could avoid treatment with confirmed begin histology
- 10-20% non-diagnostic biopsy, repeat biopsy
- Indications:
  - should be performed when results might alter surgical management
  - Pre-thermal ablation

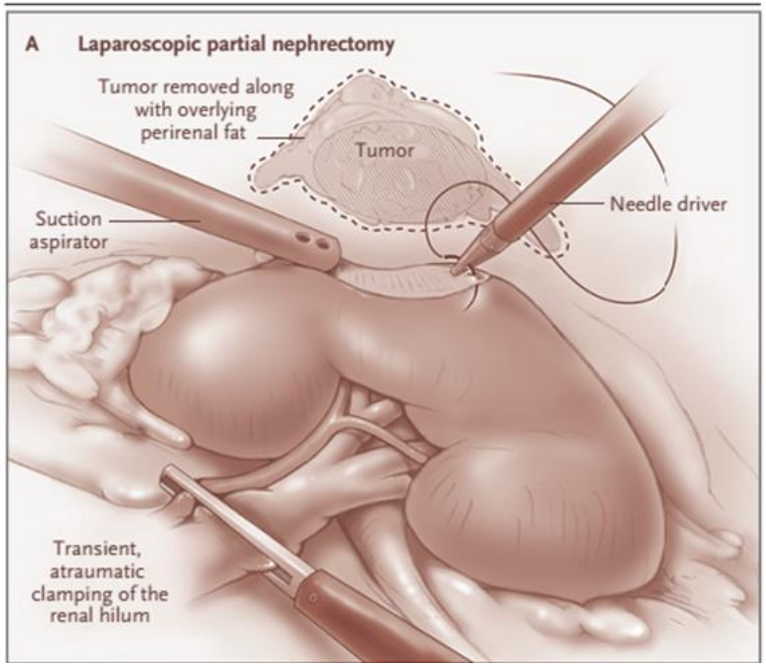
Active surveillance

- Serial image for size every 6-12 months
- Most small RCC(<4cm) grows slowly 2-3mm/year, <5% metastatic rate in first 3 years, SRM<1cm are benign in 50% of cases

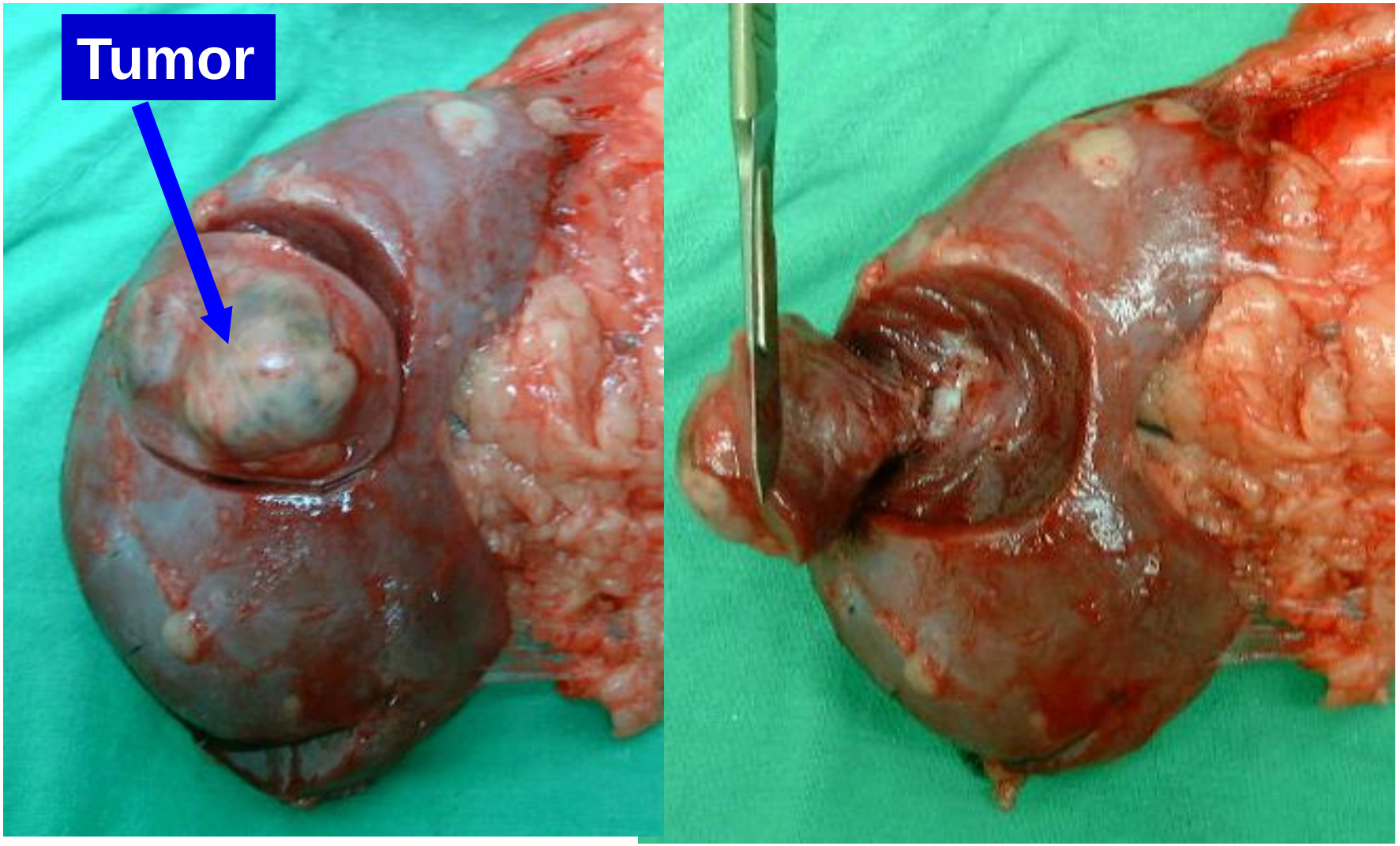
- Indications:
  - significant comorbidities
  - limited life expectancy(< 5-10years)
  - SRM <1cm

Partial nephrectomy

- Partial nephrectomy (PN) for SRMs is the standard treatment.
- Slight higher complication(vs. radical)
  - severe hemorrhage(3.1% vs. 1.2%)
  - urine leak (4.4% vs. 0%)
  - reoperation (4.4% vs. 2.4%)
- the most durable follow-up data (up to 15 yr) concerning oncology and renal function
- laparoscopic, open surgical, or robotic approach



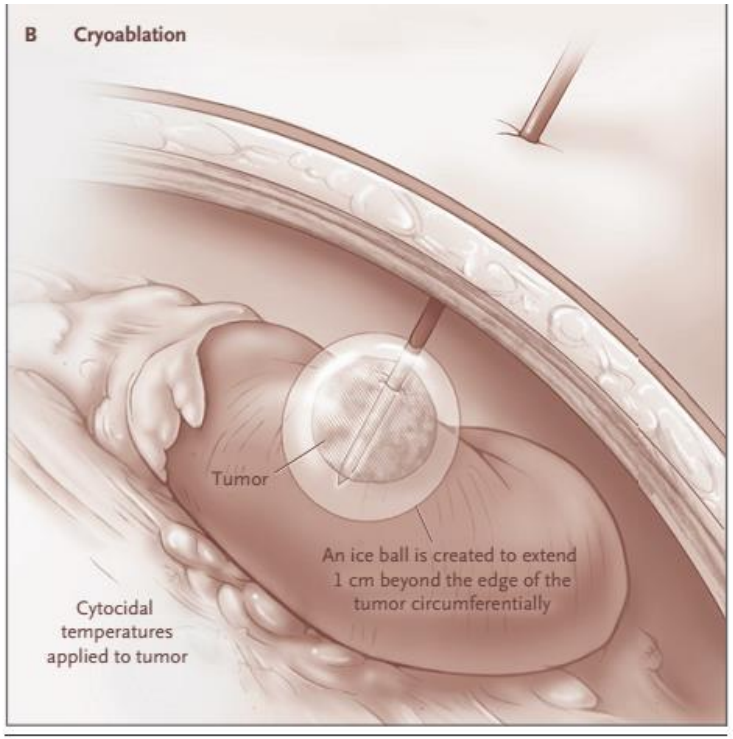
Partial nephrectomy



Thermal ablation

- Cryoablation (−20 to −40°C) or radiofrequency ablation(RFA) (60 to 100°C)
- Complication: 10%
- Lack of long-term oncological data

- Indications: elderly, poor candidates for operation, <3cm, alternative option for PN



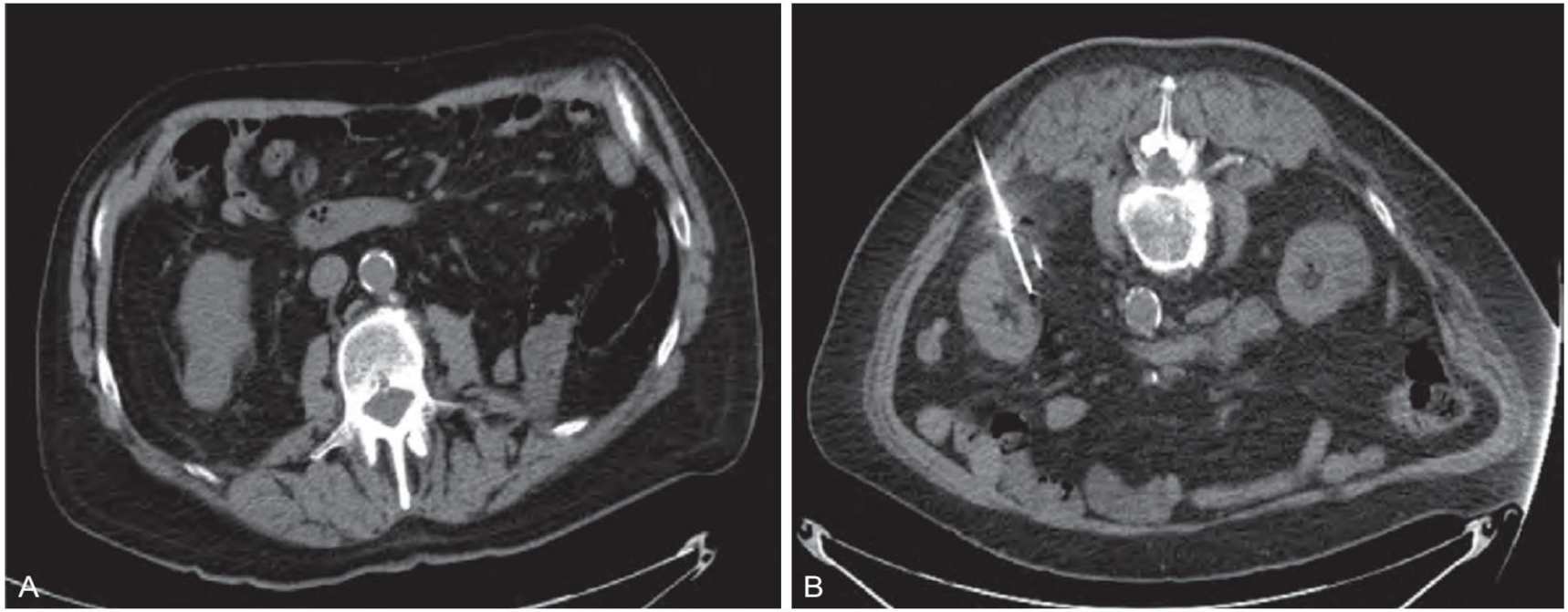


Figure 62-1. Percutaneous cryoablation. A, Preoperative imaging demonstrates a 2.6-cm exophytic renal cell carcinoma on the posterior aspect of the right kidney. B, Intraoperative image during percutaneous ablations shows low attenuation area corresponding to the ice ball. (Courtesy Ardeshir Rastinehad, MD, Department of Urology, North Shore-Long Island Jewish Health system.)

TABLE 62-1 Intermediate-Term to Long-Term Outcomes after Radiofrequency Ablation of Biopsy-Proved Renal Cell Carcinoma

AUTHOR	NO. PATIENTS (NO. TUMORS)	FOLLOW-UP (yr) (RANGE)	TUMOR SIZE (cm) (RANGE)	TECHNIQUE	% LOCAL RECURRENCE–FREE SURVIVAL	% METASTATIC RECURRENCE	% OVERALL DISEASE-FREE SURVIVAL	% CANCER-SPECIFIC SURVIVAL	% OVERALL SURVIVAL
Psutka et al, 2013	185 (185)	Median 6.43 (0.5-13.4)	Median 3 (1-6.5)	Perc	5-yr: 95.2	5-yr MFS 99.4	5-yr DFS 87.6	5-yr CSS 99.4	5-yr OS 73.3
Tracy et al, 2010	160 (179)	Mean 2.25 (0.13-7.5)	Mean 2.4 (1.0-5.4)	Perc and Lap	5-yr: 90	5-yr MFS 95	—	5-yr CSS 99	5-yr OS 85*
Zagoria et al, 2011	41 (48)	Median 4.67 (IQR 3-5.3)	Median 2.6 (0.7-8.2)	Perc	5-yr: 88	5-yr MFS 93	5-yr DFS 83†	1/41 (2.4) died of RCC	5-yr OS 66
Olweny et al, 2012	37 (37)	Median 6.5 (IQR 5.8-7.1)	Median 2.1 (IQR 1.8-2.8)	Perc and Lap	5-yr: 91.7	5-yr MFS 97.2	5-yr DFS 89	5-yr CSS 97.2	5-yr OS 97.2
Levinson et al, 2008	18 (18)	Mean 4.8 (3.4-6.7)	Mean 2.1 (1-4)	Perc	5-yr: 79.9	5-yr MFS 100	5-yr DFS 79.9	5-yr CSS 100	5-yr OS 58.3
McDougal et al, 2005	16 (20)	Mean 4.6 (4-6)	Mean 3.2 (1.1-7.1)	Perc	4-yr: 91	4-yr MFS 100	—	4-yr CSS 100	4-yr OS 68.7
Atwell et al, 2013	222 (256)	Mean 2.8 (1.2-4.1)	Mean 1.9 (0.6-3)	Perc	5-yr: 98.1	5 yr: 98.1‡	—	5 yr: 98.7‡	—

*Overall survival for entire cohort, including 22% with nondiagnostic or benign histology.
†No recurrences observed in patients with tumors less than 4 cm in size.
‡Patients with no history of RCC.
CSS, cancer-specific survival; DFS, disease-free survival; IQR, interquartile range; Lap, laparoscopic; MFS, metastasis-free survival; OS, overall survival; Perc, percutaneous; RCC, renal cell carcinoma.

TABLE 62-2 Intermediate-Term to Long-Term Outcomes after Cryoablation for Biopsy-Proved Renal Cell Carcinoma

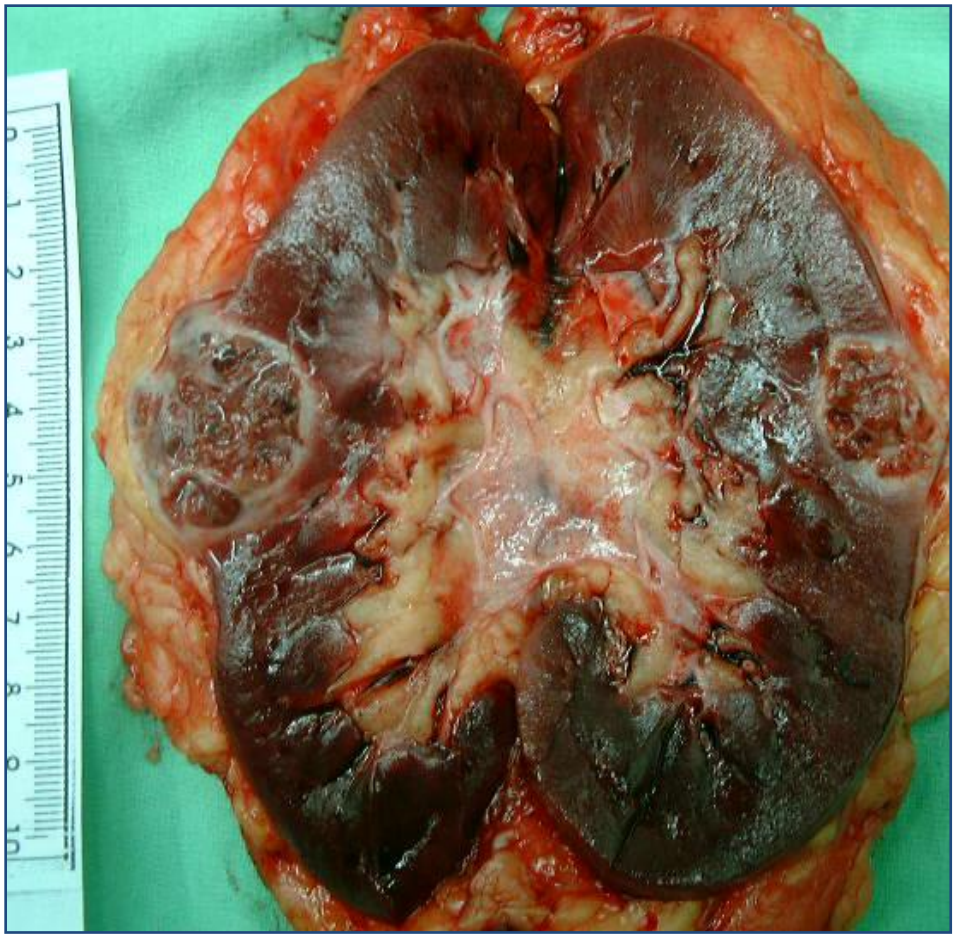
AUTHOR	NO. PATIENTS (NO. TUMORS)	FOLLOW UP (yr) (RANGE)	TUMOR SIZE (cm) (RANGE)	APPROACH	% LOCAL RECURRENCE–FREE SURVIVAL	% METASTATIC RECURRENCE	% OVERALL DISEASE-FREE SURVIVAL	% CANCER-SPECIFIC SURVIVAL	% OVERALL SURVIVAL
Aron et al, 2010	55 (55)	Median 7.8 (5-11)	Mean 2.3 (0.9-5.0)	Lap	87.3	89 MFR	5-yr DFS 81	5-yr CSS 92	5-yr OS 84
Guazzoni et al, 2010	44	Mean 5.1	Median 2.14 (0.5-4)	Lap	93.2*	95.5 MFS	—	5-yr CSS 100	5-yr OS 93.2
Tanagho et al, 2012	35	Mean 6.3 (SD 3.3)	Mean 2.5 (SD 0.98)	Lap	6-yr RFS 80	6-yr MFS 100	6-yr DFS 80	6-yr CSS 100	6-yr OS 76.2

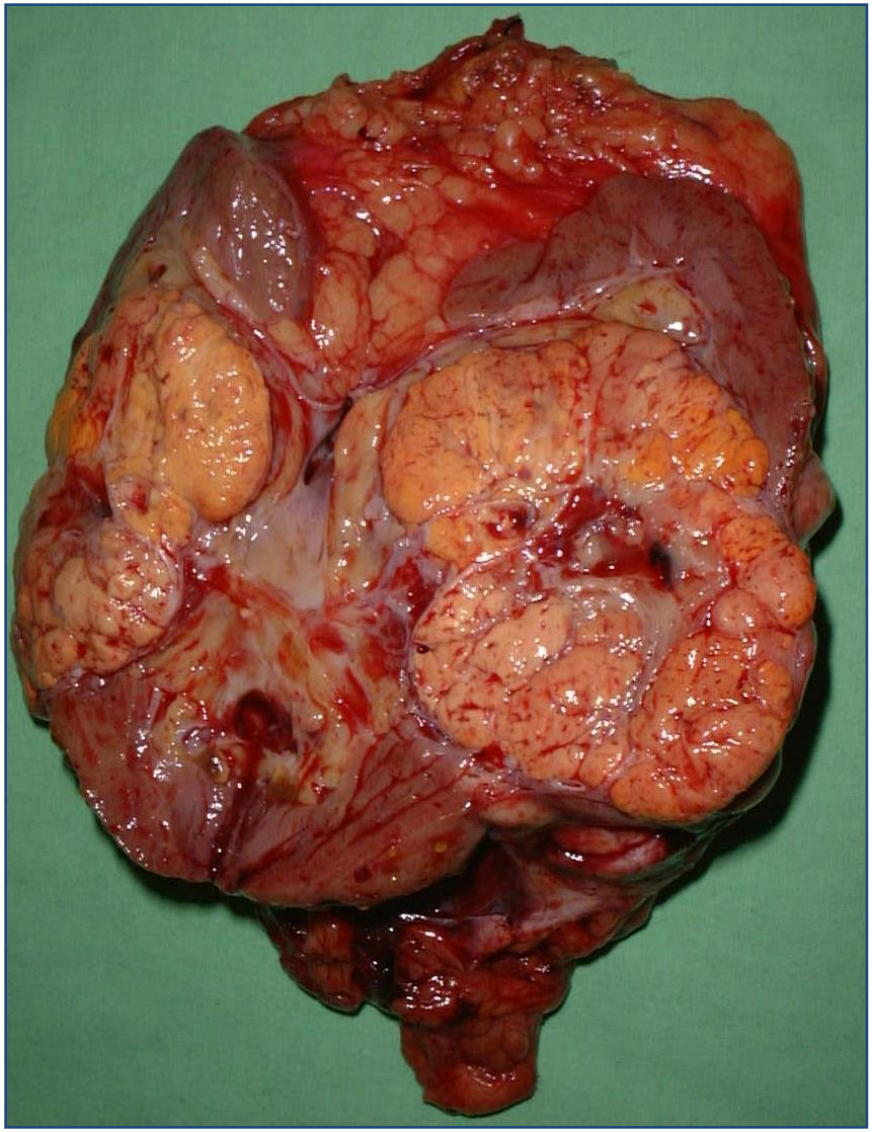
*Although these patients received salvage therapy by radiofrequency ablation or radical nephrectomy, the authors did not include them in their analysis of recurrences.
CSS, cancer-specific survival; DFS, disease-free survival; Lap, laparoscopic; MFS, metastasis-free survival; OS, overall survival; RFS, recurrence-free survival.

Radical nephrectomy

- Indications: only for patients who possess a tumor of significant complexity that is not amenable to PN
- Centrally located small renal mass enmeshed between the branches of the main renal vessels (if excision of the tumor would compromise the major vessels and the collecting-system continuity of the renal remnant)

Radical nephrectomy





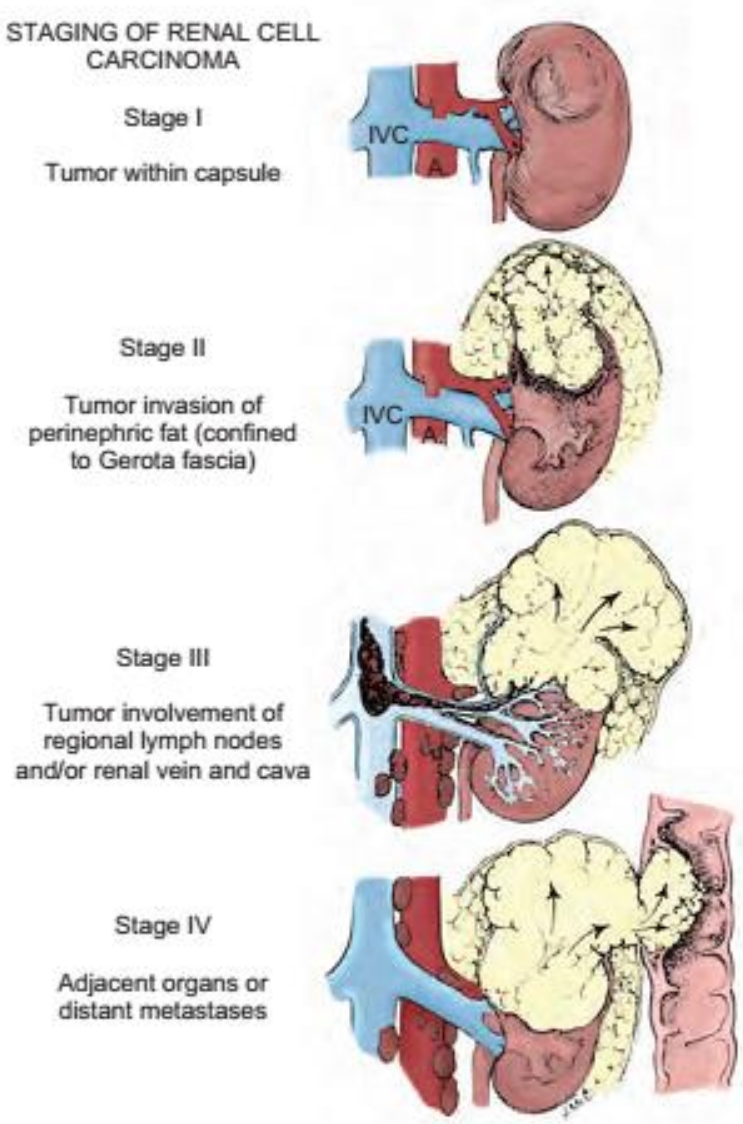


Figure 57-12. **Staging of renal cell carcinoma as proposed by Holland, in accordance with classification systems developed by Robson, Murphy, and Flocks and Kadesky. A, aorta; IVC, inferior vena cava. (From Holland JM. Cancer of the kidney: natural history and staging. Cancer 1973;32:1030. Copyright © 1973 American Cancer Society.)**

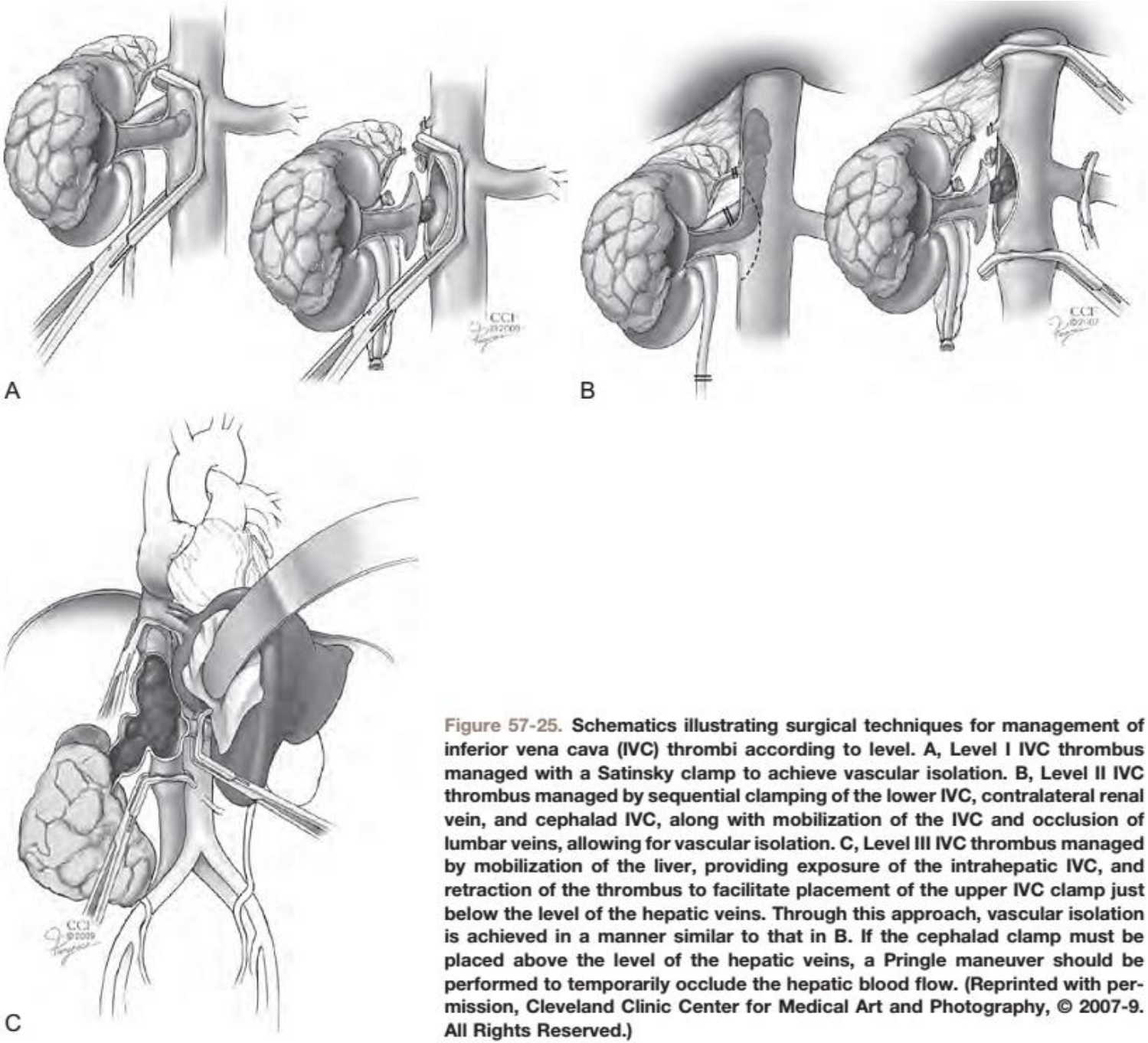


Figure 57-25. **Schematics illustrating surgical techniques for management of inferior vena cava (IVC) thrombi according to level. A, Level I IVC thrombus managed with a Satinsky clamp to achieve vascular isolation. B, Level II IVC thrombus managed by sequential clamping of the lower IVC, contralateral renal vein, and cephalad IVC, along with mobilization of the IVC and occlusion of lumbar veins, allowing for vascular isolation. C, Level III IVC thrombus managed by mobilization of the liver, providing exposure of the intrahepatic IVC, and retraction of the thrombus to facilitate placement of the upper IVC clamp just below the level of the hepatic veins. Through this approach, vascular isolation is achieved in a manner similar to that in B. If the cephalad clamp must be placed above the level of the hepatic veins, a Pringle maneuver should be performed to temporarily occlude the hepatic blood flow. (Reprinted with permission, Cleveland Clinic Center for Medical Art and Photography, © 2007-9. All Rights Reserved.)**

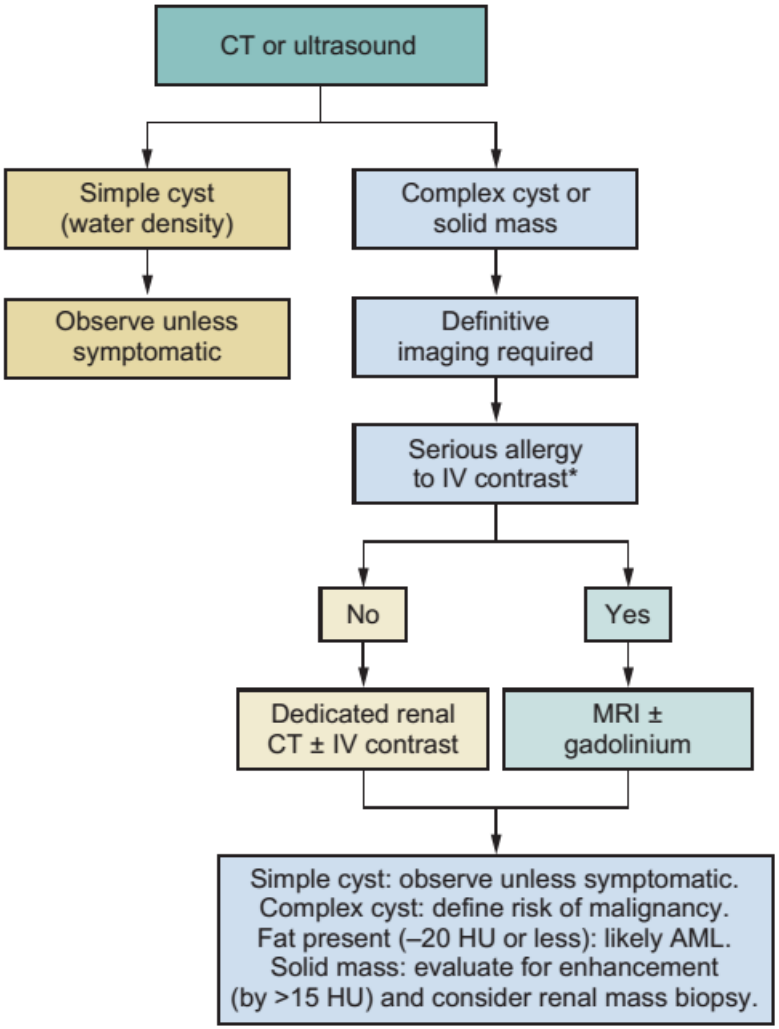


Figure 57-1. Algorithm for radiographic evaluation of renal masses. AML, angiomyolipoma; CT, computed tomography; HU, Hounsfield units; IV, intravenous; MRI, magnetic resonance imaging. *In the presence of chronic kidney disease, the risks of contrast nephropathy must also be weighed against those of nephrogenic systemic fibrosis associated with gadolinium administration.

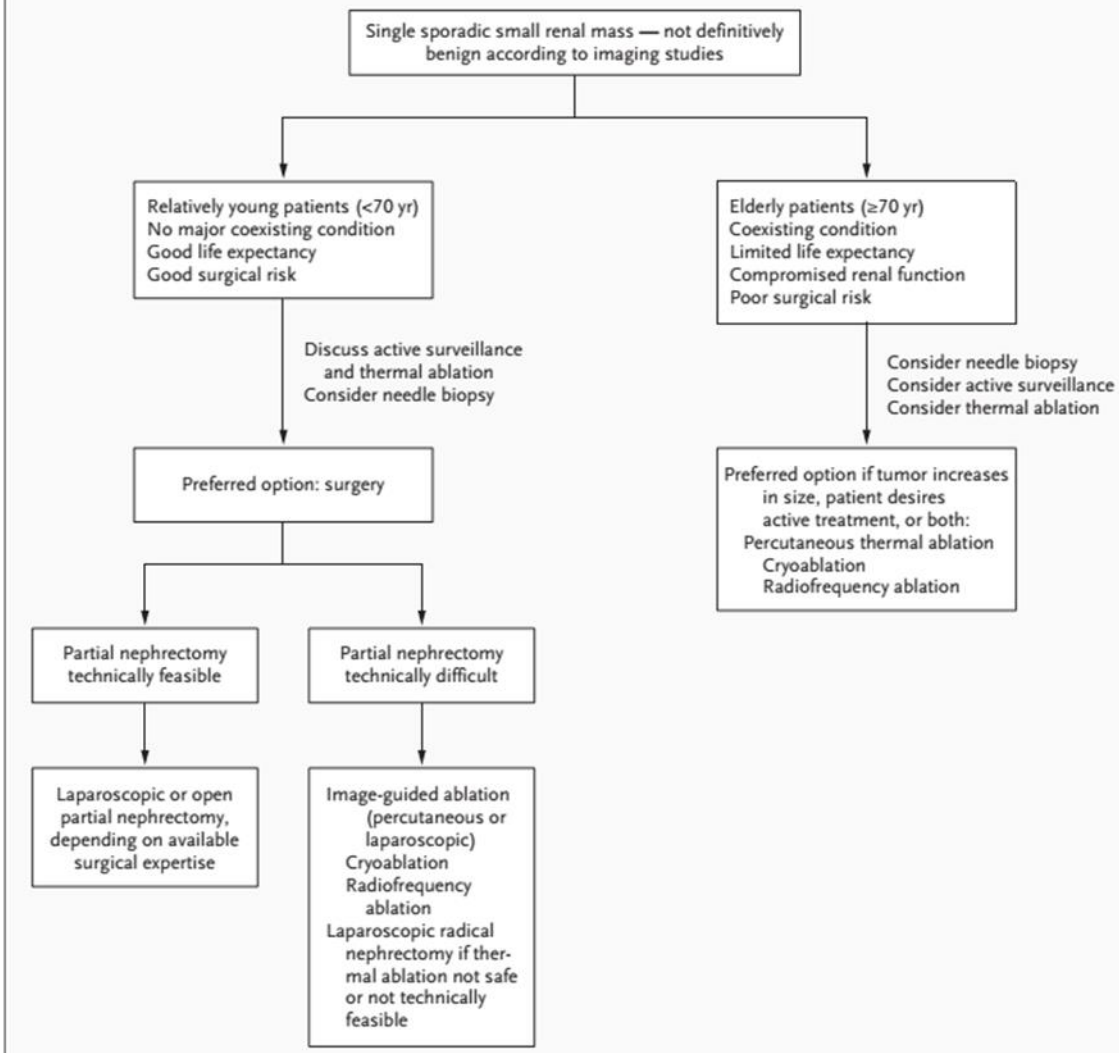


Figure 4. Suggested Algorithm for Management of a Small Renal Mass.

If the patient is relatively young (<70 years) and healthy, needle biopsy should be considered and the current literature about active surveillance and thermal ablation should be discussed with the patient, even though active surveillance is not recommended. Tumor size is an important factor that must be considered when finalizing the treatment plan. For example, a spherical 1-cm tumor has a volume of 0.5 ml, whereas a 4-cm tumor has a volume of 33.5 ml, implying considerably greater tumor burden.

Back to patient

- 65 M with HTN, 3.2cm solid right hilum tumor
- Management ??

Take home message

- Differential diagnosis for renal mass
- Cystic mass: Bosniak classification
- Solid mass:
  - RCC: enhancing mass(>15HU)
  - AML: negative attenuation (<-20HU)
- Needle biopsy: limitation, indication
- Management for solid mass
  - Active surveillance
  - Partial nephrectomy
  - Tumor ablation (cryoablation or radiofrequency ablation)
  - Radical nephrectomy

References

- N Engl J Med. 2010 Feb 18;362(7):624-34. Small renal mass.
- Campbell-Walsh Urology - 11th Edition, Chapter 56.57 Benign and malignant renal tumor
- J Clin Oncol. 2017 Feb 20;35(6):668-680. Management of Small Renal Masses: American Society of Clinical Oncology Clinical Practice Guideline.