



Kidney tumor - adult malignancies Printer Friendly Version

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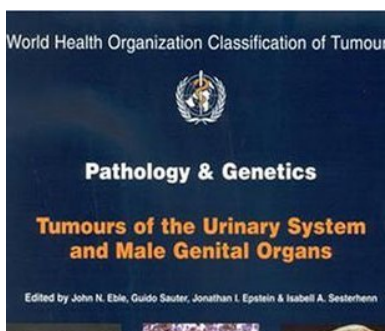


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Primary references

[AJCC Cancer Staging Manual \(6th Ed\)](#)

[American Journal of Clinical Pathology](#), January 2004 to April 2009

[American Journal of Surgical Pathology](#), March 1977 to April 2009

[Archives of Pathology and Laboratory Medicine](#) [free full text always], January 1976 to March 2009

[Human Pathology](#), March 1970 to April 2009

[Modern Pathology](#) [free full text after one year], January 1988 to April 2009

[Murphy: Tumors of the Kidney and Bladder \(AFIP Atlas of Tumor Pathology, Series 3, Vol 11\)](#); 1994

[Rosai, J: Ackerman's Surgical Pathology \(9th Ed 2004\)](#)

Websites: [www.WebPathology.com](#), [PathoPic](#)

Virtual slides: [University of Iowa](#), [USCAP](#), [vSlides](#)

Journal search terms: kidney, renal and each topic

Please refer to these primary references for more detailed discussions and photographs

Adult renal cell carcinoma

Classification of renal cell carcinoma - Kidney tumor - adult malignancies chapter

Based on cytology, tissue characteristics (Thoenes, Storkel & Rumpelt, [Path Res Pract 1986;181:125](#)) and cytogenetics

Heidelberg classification: [J Path 1997;183:131](#)

Recommended to not use diagnosis of granular cell variant of renal cell carcinoma ([Urology 2007;69:452](#))

Recommended to not use diagnosis of sarcomatoid carcinoma, but to classify as high grade carcinoma of type from which it originated, or as unclassified ([Cancer 1997;80:987](#))

WHO (2004) Classification

Kidney Tumors in Infants and Children:

Nephroblastic Tumors

Nephroblastoma

 Favorable histology

 Anaplasia (diffuse and focal)

Nephrogenic rests and nephroblastomatosis

Cystic nephroma and cystic partially differentiated nephroblastoma

Metanephric tumors and related entities

 Metanephric adenoma

 Metanephric adenofibroma

 Metanephric stromal tumor

Mesoblastic Nephroma

Cellular
Classic
Mixed

Clear Cell Carcinoma

Rhabdoid Tumor

Renal Epithelial Tumors of Childhood

Papillary renal cell carcinoma
Renal medullary carcinoma
Renal tumors associated with Xp11.2 translocations

Rare tumors

Ossifying renal tumor of infancy
Angiomyolipoma

Renal Tumors and Tumor-Like Conditions of Adults:

Renal Cell Carcinoma

Renal Cortical Adenoma

Metanephric Tumors

Metanephric adenoma
Metanephric adenofibroma
Metanephric stromal tumor
Metanephric adenocarcinoma

Oncocytoma

Rare Tumors with Epithelial and/or Parenchymal Differentiation

Carcinoid Tumor
Small cell carcinoma
Primitive neuroectodermal tumor
Juxtaglomerular cell tumor
Teratoma
Nephroblastoma and other "pediatric" renal tumors
Multilocular cyst (cystic nephroma)
Mixed epithelial and stromal tumor
Spiradenocylindroma

Mesenchymal Tumors

Angiomyolipoma
 Epithelioid angiomyolipoma
Medullary fibroma
Leiomyoma
Lipoma
Hemangioma
Lymphangioma
Other benign mesenchymal tumors
Leiomyosarcoma
Liposarcoma
Solitary fibrous tumor

Hemangiopericytoma
Fibrosarcoma and malignant fibrous histiocytoma
Rhabdomyosarcoma
Angiosarcoma
Osteosarcoma
Synovial sarcoma
Other malignant mesenchymal tumors

Lymphoid Tumors

Plasmacytoma

Metastatic Tumors

Tumor-Like Lesions

Xanthogranulomatous pyelonephritis
Inflammatory myofibroblastic pseudotumor
Perirenal and sinus cysts

References: [Eble: Pathology and Genetics of Tumours of the Urinary System and Male Genital Organs \(WHO, 2004\)](#)

Suggested new features to incorporate: VEGF expression ([Lab Invest 2008;88:962](#)), gene expression ([ScientificWorldJournal 2006;15:2505](#))

Renal cell carcinoma - Kidney tumor - adult malignancies chapter

Formerly called hypernephroma due to perceived origin from adrenal gland

Epidemiology: In 2008 in US, 54,000 new renal cancers, 13,000 deaths; 85% are renal cell carcinomas
Usually > 50 years old, 2/3 male, only 1% bilateral

Risk factors: tuberous sclerosis (although tumor may actually be epithelioid angiomyolipoma), von Hippel-Lindau disease (see [clear cell](#) type), other familial syndromes, renal transplantation, [acquired renal cystic disease](#) associated with end stage renal disease, cigarette smoking, high blood pressure, treated neuroblastoma

Hereditary leiomyomatosis and renal cell carcinoma syndrome: autosomal dominant, familial; leiomyomas are cutaneous or uterine; due to fumarate hydratase mutations; tumors have characteristic large nucleus with a very prominent inclusion-like orangiophilic or eosinophilic nucleolus, surrounded by a clear halo; poor prognosis ([Am J Surg Pathol 2007;31:1578](#))

Clinical: biopsy solitary small renal masses, since cannot predict tumor pathology using clinical features ([Am J Clin Pathol 2008;130:560](#))

"Great mimic" due to associated paraneoplastic syndromes of Cushing's syndrome, gynecomastia, hypercalcemia, hypertension, leukemoid reaction, polycythemia, Stauffer syndrome (hepatomegaly with hepatic dysfunction), systemic amyloidosis, polyneuromyopathy

Most tumors are detected incidentally; historically were large (10 cm) at diagnosis; "classic" clinical features of costovertebral pain, palpable mass and hematuria are now present in only 10%

Metastases: 25% present as metastases (lung, bones, lymph nodes, adrenals, liver, brain), at unusual locations (also melanoma and choriocarcinoma) such as contralateral adrenal gland or anus ([Arch Pathol Lab Med 2002;126:856](#)); metastases often solitary and detected years or decades after removal of primary; rarely metastases to bladder ([Mod Path 1999;12:351](#)) or phalanges ([Mod Path 1991;4:66](#))
Most common recipient of metastases from another tumor (usually lung)

Prognostic factors: stage and nuclear grade most important ([Am J Surg Pathol 2002;26:281](#))

Histologic classification may be significant, although less so after TNM classification ([Am J Surg Pathol 2003;27:612](#))

Lymphatic invasion associated with nodal metastases ([Am J Clin Pathol 2007;128:198](#))

Treatment: radical nephrectomy, partial nephrectomy for small peripheral tumors; cure possible even with extension into renal vein, inferior vena cava and right atrium; chemotherapy and radiation ineffective, interferon and anti-angiogenic agents may be helpful

Excision of solitary metastases is often effective

Occasionally regresses without treatment (also choriocarcinoma, melanoma, neuroblastoma)

5 year survival: 70% (all histologic types and stages), varies from 60-80% in stage I vs. 5% in stage IV
Gross: well circumscribed, centered on cortex, often extends into renal vein or vena cava, may have satellite nodules, often hemorrhage, necrosis, calcification and cystic change causing variegated appearance

Micro: subtypes are described below; commonly nuclear grooves (96%) and inclusions (65%, [Arch Pathol Lab Med 2008;132:940](#)); precursor lesion is intratubular epithelial dysplasia (seen in 1/3) with crowded tubular epithelium, large, vesicular nuclei, eosinophilic macronuclei, resembles carcinoma in situ ([Mod Path 1996;9:690](#), [Am J Surg Pathol 1994;18:1117](#))

Cytology: 25% sensitive for bladder washings/urine, higher for retrograde brushing; FNA helpful to differentiate cyst from carcinoma or to confirm recurrence; high false positive rate for FNAs in one study ([Arch Pathol Lab Med 2002;126:670](#))

In cytology, must distinguish carcinoma from renal tubular cells; tumor cells have abundant cytoplasm that is vacuolated, fluffy, or granular, usually with indistinct cell borders (but chromophobe renal cell carcinoma has distinct borders); tumor nuclei have variable atypia, irregular contours, haphazard orientation with abnormal chromatin, variably prominent nucleoli; renal tubular cells have well defined cell borders, homogenous cytoplasm, round, regular and orderly nuclei

Important features to distinguish from other neoplasms include heterogeneous cell population, small cytoplasmic vacuoles and hemosiderin deposits ([Arch Pathol Lab Med 2005;129:1017](#))

Positive stains (vary by histologic subtype): most commonly used - AE1-AE3, EMA, RCC-Ma (80% sensitive, 67% in metastases, most sensitive for papillary, 0% sensitive in collecting duct, [Am J Surg Pathol 2001;25:1485](#)); CD10 (81%), PAX-2 ([Am J Clin Pathol 2009;131:393](#))

other positive stains - kidney-specific cadherin, N-cadherin, CD15; occasionally vimentin (25%), S100 (5%), PSA in tumor associated vasculature only ([Mod Pathol 2008;21:727](#))

Negative stains: CK7, CK20, inhibin ([Mod Path 1998;11:1160](#)), MelanA/Mart1, calretinin, TTF1, CEA

Differential diagnosis:

- epithelioid angiomyolipoma - often classic angiomyolipoma elsewhere
- metastases to brain (inhibin-) may resemble hemangioblastoma (inhibin+, [Am J Surg Pathol 2003;27:1152](#))
- metastases to skin (CD10+) may resemble cutaneous adnexal tumors, but eccrine and apocrine tumors are CD10- ([Arch Pathol Lab Med 2006;130:1315](#))

References: [eMedicine](#), [US National Cancer Institute](#)

Adenocarcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Definition: rare pelvic neoplasm (1%) of urothelium that forms distinct glandular structures

Epidemiology: most primary renal neoplasms of renal pelvis are urothelial carcinomas; adenocarcinomas derive from pyelitis glandularis and pyelitis cystica, similar to lesions in bladder and ureter, secondary to chronic inflammation or renal stones

Case reports: 35 year old woman with pseudomyxoma peritonei ([Indian J Pathol Microbiol 2008;51:536](#)), 41 year old man with tumor in horseshoe kidney ([Hinyokika Kiyo 2002; 48:187](#)), 48 year old woman whose tumor was CEA+ ([Urology 2008;71:e7](#)), 53 year old man with tumor in solitary pelvic kidney ([Urology 1993; 41:292](#)), 57 year old man ([Case of Week #94](#)), 65 year man with mucin secreting tumor ([Arch Pathol Lab Med 1988;112:847](#)), 76 year old man with 22 cm tumor ([Hinyokika Kiyo 1997;43:727](#)), with urothelial carcinoma in renal pelvis and bladder ([Int J Urol 2004;11:1016](#))

Gross description: large, infiltrating tumor which fills dilated renal pelvis and calyces and invades adjacent renal parenchyma

Micro: subtypes are tubulovillous (72%), mucinous (22%) or papillary non-mucinous and non-intestinal (6%); tubulovillous have worst prognosis ([Arch Pathol Lab Med 1993;117:1156](#)); signet ring variant is rare, may be associated with collagenous spherulosis ([Int J Surg Pathol 2005;13:375](#))

Positive stains: *mucin stains* - PAS, Alcian blue, mucicarmine

Differential diagnosis: metastases from stomach, breast or other organs

Acquired cystic disease associated renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: carcinoma in kidneys with acquired cystic disease due to end stage renal disease

Epidemiology: acquired cystic disease occurs in 35% of long-term dialysis patients; of these, 6% develop carcinoma

Other end stage renal disease tumors are either similar to sporadic carcinomas, or [clear cell papillary renal cell carcinoma](#) (either cystic or non-cystic)

Clinical: may have sarcomatoid features, nodal or distant metastases and cause death ([Am J Surg Pathol 2006;30:141](#))

Case reports: clear cell and papillary subtypes with abundant calcium oxalate crystals ([Arch Pathol Lab Med 2003;127:E89](#)), sarcomatoid change ([Histol Histopathol 2008;23:1327](#))

Gross: dominant mass in 36% of kidneys, often multifocal, usually 3 cm or less

Micro: microcystic architecture, abundant eosinophilic cytoplasm with grade 3 nuclei, intratumoral oxalate crystals ([Am J Surg Pathol 2005;29:443](#)); may have focal papillary architecture and clear cytoplasm

Cytology: moderately cellular, papillary clusters of polygonal to columnar cells with abundant eosinophilic granular cytoplasm, round and central nuclei, finely granular chromatin, prominent central Fuhrman grade 3 nucleoli ([Diagn Cytopathol 2008;36:344](#))

Positive stains: CD10, AE1-AE3 ([Mod Pathol 2006;19:780](#))

Negative stains: EMA, CK7, 34betaE12

Differential diagnosis: xanthogranulomatous pyelonephritis ([Nephrology \(Carlton\) 2003;8:101](#))

Adult papillary renal tumor with oncocytic cells - Kidney tumor - adult malignancies chapter

May be same entity as oncocytic papillary renal cell carcinoma with inverted nuclear pattern ([Pathol Int 2009;59:137](#))

Epidemiology: usually male, median age 71 years

Gross: median 3 cm, well circumscribed, no extrarenal extension

Micro: thin, nonfibrotic papillae lined by single layer of oncocytic cells with finely granular eosinophilic cytoplasm, round regular nonoverlapping nuclei, central nucleus (usually grade 2); usually focal necrosis ([Am J Surg Pathol 2005;29:1576](#))

Positive stains: AMACR, vimentin, CD10, variable RCCma, CK7

Cytogenetic: no +7, no +17 in one study, but all tumors had +7 and +17 in another study ([Hum Pathol 2008;39:96](#))

Differential diagnosis:

- oncocytoma - no papillary architecture, no necrosis
- type 2 tumors - no oncocytic cells

Chromophobe type, renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: tumor cells with well defined cell borders, cytoplasm is voluminous, pale and finely reticular, low grade nuclei

First described in 1985 ([Virchows Arch B Cell Pathol Incl Mol Pathol 1985;48:207](#))

Epidemiology: 5% of adult renal epithelial tumors; ages 45+, no gender preference

Patients with Birt-Hogg-Dube' syndrome (autosomal dominant, small dome-shaped papular fibrofolliculomas of face, neck and upper trunk, renal tumors, lung cysts, spontaneous pneumothorax) have multiple tumors (mean 5.3), mean age 51 years at first renal tumor diagnosis, usually bilateral chromophobe carcinomas, oncocytomas or hybrids, also oncocytosis ([Am J Surg Pathol 2002;26:1542](#))

Origin: intercalated cell of cortical collecting duct

Clinical: most are T1-T2 N0 M0 (i.e. confined within the renal capsule, [Cancer 2004;100:1406](#)) and have good prognosis (5 year survival is 78-92%, 3-6% die of disease); same behavior as clear cell when stratified by grade/stage

Poor prognostic factors: sarcomatoid change, microscopic necrosis, high stage ([Am J Surg Pathol 2008;32:1822](#))

Case reports: osteosarcoma-like differentiation ([Am J Surg Pathol 2002;26:1358](#)), with sarcomatoid and collecting duct carcinoma components ([Arch Pathol Lab Med 2003;127:e38](#)), sarcomatoid and squamous differentiation ([Arch Pathol Lab Med 2008;132:1672](#))

Gross: well circumscribed, tan brown (same color as cortex), geographic necrosis, mean 8 cm, small cysts, 8% multifocal, 3% bilateral; no central scar

Micro: compact architecture of nests or broad alveoli/trabeculae, composed of large polygonal cells with "hard" or distinct cell border ("vegetable cells", due to cytoplasmic retraction); abundant cytoplasm with reticular pattern (light/pale, flocculent, not clear), also called type 3 cells, some have perinuclear halo or translucent zone (type 2 cells); also type 1 cells that are small with solid, slightly granular, eosinophilic cytoplasm; usually lower grade nuclei, bunching of nuclear material at nuclear membrane; 50% have calcification; mitotic figures present but may be scant; usually no chicken wire vasculature (more fibrovascular than vascular)

Note: formalin fixation may obscure cytoplasmic features ([Arch Pathol Lab Med 2000;124:904](#))

Type 1 cells: small cells with solid, slightly granular eosinophilic cytoplasm

Type 2 cells: perinuclear halo or translucent zone

Type 3 cells: large, polygonal cells with hard cell border, abundant cytoplasm with reticular pattern

Note: Fuhrman nuclear grade may not have prognostic significance for these tumors ([Am J Surg Pathol 2007;31:957](#))

Cytology: single cells and small, discohesive, monolayered groups; cells vary in size from small to large; large cells show clear, flocculent cytoplasm with small, eccentric nuclei and frequent binucleation, occasional nuclear pseudoinclusions; small cells usually have dense, homogeneous cytoplasm, clear cytoplasmic spaces resembling perinuclear halos, binucleation and marginal nuclear location; no necrosis, no basement membrane or other stromal material ([Cytopathology 2009;20:44](#), [Cancer 1997;81:122](#))

Positive stains: most commonly used - Hales colloidal iron (stains acid mucopolysaccharides in microvesicles, diffuse and strong, reticular, [J Pathol 1988;155:277](#), [Am J Surg Pathol 1998;22:419](#)), low molecular weight keratin (CK 8/18), CK7 (diffuse and strong, [Am J Clin Pathol 2007;127:225](#))

other positive stains - EMA/MUC1 (diffuse cytoplasmic, [Mod Path 2004;17:180](#)), parvalbumin (calcium binding protein, [Mod Path 2001;14:760](#)), CD117/c-kit (membranous, [Mod Path 2004;17:611](#), [Am J Surg Pathol 2004;28:676](#)), E-cadherin, claudin-7 (distal nephron marker, [Arch Pathol Lab Med 2007;131:1541](#), [Hum Pathol 2009;40:206](#)), kidney-specific cadherin ([Am J Clin Pathol 2006;126:79](#), [Mod Pathol 2005;18:933](#))

variable expression: RCC-Ma, CD10 ([Mod Path 2004;17:1455](#))

Negative stains: vimentin (or weak), N-cadherin, low Ki-67 labeling index ([Mod Path 1999;12:310](#), [Mod Path 1998;11:1115](#)), PAX-2

Suggested panels:

(1) chromophobe versus oncocytoma, papillary or clear cell - beta defensin1+, parvalbumin+, vimentin- in 100% (8/8) ([Am J Surg Pathol 2003;27:199](#))

(2) chromophobe versus oncocytoma or clear cell - vimentin-, GSTalpha-, EpCAM+ (strong) ([Arch Pathol Lab Med 2007;131:1290](#)); second line markers are CD117+, CK7+

(3) chromophobe versus other renal carcinomas - CK7+, CK8+, CK18+ and vimentin- ([Am J Surg Pathol 2005;29:747](#))

EM: 150-350 nm membrane bound microvesicles (possibly from mitochondrial outpouchings), abnormal but few mitochondria with tubulovesicular cristae, rare short and stubby microvilli ([Am J Surg Pathol 2000;24:1248](#)); eosinophilic variant is similar but with more mitochondria

Cytogenetics: multiple monosomies; usually hypodiploid ([Hum Path 1998;29:1181](#)); 80% show loss of 1, 2, 6, 10, 13, 17, 21 or Y; also mitochondrial (mt) DNA rearrangements; loss of 3p in 25% of cases; sarcomatoid tumors have different genetic abnormalities ([Mod Pathol 2007;20:303](#))

Differential diagnosis:

- oncocytoma - no hard cell membranes, no mitotic figures, no loss of chromosomes 2, 6, 10 or 17 ([Mod Pathol 2005;18:161](#))
- eosinophilic papillary or clear cell carcinomas - Hales colloidal iron negative

Eosinophilic variant of chromophobe renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: 80%+ eosinophilic cells

40% of chromophobe carcinomas

First described in 1988 ([J Pathol 1988;155:277](#))

No difference in prognosis from classic type ([Eur J Surg Oncol 2008;34:687](#))

Gross: 11% bilateral, 22% multifocal, brown color resembles oncocytoma

Micro: large tumor cells with fine eosinophilic granularity, peripheral accentuation of cytoplasm, perinuclear halo, wrinkled nuclear membrane and coarse chromatin (resembles koilocytes), still some classic chromophobe cells; often focal areas resembling oncocyoma ([Am J Surg Pathol 2008;32:1822](#))

Cytology: nuclear atypia present

Positive stains: Hales colloidal iron; also CK7, CK18

Negative stains: vimentin

EM: abundant mitochondria with variable size and shape and predominantly tubulocystic cristae, also outpouchings of outer mitochondrial membranes resembling cytoplasmic microvesicles; abundant microvesicles, some containing homogenous, electron-dense, finely granular matrix similar to mitochondrial matrix

Cytogenetics: similar to classic chromophobe carcinoma (loss of #1, 2, 6, 10, and 17, [Mod Pathol 2005;18:161](#)).

Differential diagnosis:

- eosinophilic variant of clear cell carcinoma - vimentin+, Hales colloidal iron negative, different cytogenetics
- oncocyoma - no classic areas of chromophobe carcinoma, no prominent cell membranes, no crinkled or raisinoid nuclei, no binucleation, Hales colloidal iron negative, no loss of #2, 6, 10 or 17, no abundant microvesicles

Clear cell type, renal cell carcinoma - Kidney tumor - adult malignancies chapter

Also called conventional / classic type

Previously known as hypernephroma since tumor was believed to derive from adrenal gland

Epidemiology: 70% of adult renal epithelial tumors

Origin: tumor cells are derived from proximal convoluted tubule

Risk factors: adult polycystic disease, smoking (RR = 2.0), obesity in women, hypertension, von Hippel Lindau disease, hereditary renal cell carcinoma without VHL, tuberous sclerosis (but not via VHL mutations, [Mod Path 2002;15:205](#))

von Hippel Lindau disease: autosomal dominant syndrome with hemangioblastomas of retina and cerebellum, cysts of pancreas, liver and kidney, clear cell tumors of other sites, papillary cystadenoma of epididymis, pheochromocytoma; associated with bilateral or multiple renal cell carcinomas in 50% ([eMedicine](#))

Poor prognostic factors: high stage, renal sinus invasion ([Am J Surg Pathol 2000;24:451](#)); possibly high survivin expression ([Hum Pathol. 2008;39:1176](#))

Metastases: in declining order of frequency - lung, lymph nodes, liver, bone, adrenal glands, kidney, brain, heart, spleen, intestine, skin

Survival: overall 38% die of disease; metastases in 27-37%; poorer prognosis than papillary and chromophobe carcinoma

Case reports: metastases - anal ([Arch Pathol Lab Med 2002;126:856](#)), laryngeal ([Arch Pathol Lab Med 2000;124:1833](#)), parotid gland ([Hum Path 1989;20:195](#)), thyroid #1 ([Thyroid Res 2008 Oct 24;1\(1\):6](#)), #2-follicular variant of papillary carcinoma ([Arch Pathol Lab Med 1999;123:703](#))

other - neuromelanin pigmentation ([Am J Surg Pathol 1995;19:350](#), [Hum Path 2001;32:233](#)), Gamna-Gandy nodules ([Arch Pathol Lab Med 2003;127:372](#)), with syncytial giant cells ([Arch Pathol Lab Med 2004;128:1435](#)), with intravascular diffuse large B cell lymphoma ([Arch Pathol Lab Med 2001;125:1239](#))

Gross: orange/yellow (from lipid), usually upper pole, well circumscribed, hemorrhage, necrosis and calcification are common; frequent renal vein involvement; soft fleshy areas may indicate sarcomatous component; may undergo cystic degeneration, may be multifocal, bilateral in 1% (usually with von Hippel Lindau or tuberous sclerosis)

Micro: compact, tubulocystic, alveolar or rarely papillary architecture of cells with clear cytoplasm (from glycogen/lipid), distinct but delicate cell boundaries; cell size is 2x normal epithelial tubule cell; often glassy hyaline globules and myospherulosis; usually nuclear grade 2 or higher; chicken wire / delicate vasculature is common (sinusoids near each packet of cells); occasionally is irregular central area of edematous stroma; may have angioleiomyomatous features ([Am J Surg Pathol 2006;30:1372](#)), smooth muscle stroma ([Hum Pathol 2009;40:425](#)), myospherulosis ([Arch Pathol Lab Med 2000;124:1476](#)), papillary features but clear cell cytogenetics ([Arch Pathol Lab Med 2003;127:1176](#))

Positive stains: most important - PAS without diastase, oil red O (frozen tissue only), low molecular weight cytokeratin (CK 8/18, CK19, CK7), EMA/MUC1 (membranous), vimentin (note: coexpression of keratin and vimentin is somewhat specific), CD10 (94%), RCC-Ma (85%)

other positive stains - alpha-1-antitrypsin, alpha-1-antichymotrypsin, carbonic anhydrase IX ([Am J Surg Pathol 2008;32:377](#)); CD13, CD15, GST-alpha ([Am J Clin Pathol 2005;123:421](#)), LeuM1, S100, VHL ([Am J Clin Pathol 2008;129:592](#)), villin, variable N-cadherin

Negative stains: most important - Hales colloidal iron, mucin, cytokeratin 34betaE12 ([Int J Gynecol Pathol 2005;24:239](#)), CK20

other negative stains - c-kit, CA125, CEA ([Hum Path 2004;35:697](#)), E-cadherin, HepPar1, inhibin, MelanA, parvalbumin, thyroglobulin, TTF1

Suggested panels:

(1) vimentin+, CK 8/18+

(2) vimentin+, GSTalpha+ ([Arch Pathol Lab Med 2007;131:1290](#))

EM: abundant glycogen, well defined long microvilli similar to brush border of normal proximal tubules, numerous cell junctions; variable fat, scant organelles, may have scant microvesicles

Molecular: 3p- (considered the initial mutation) in 98% (3p25 is von Hippel Lindau gene); also 5q21+ (70%), 14q- (41%)

Sporadic cases usually demonstrate VHL inactivation and reduced frequency of ciliated tumor cells ([Mod Pathol 2009;22:31](#))

Nondeleted allele of the VHL gene shows somatic mutations or hypermethylated induced inactivation in 80% of cases

VHL is tumor suppressor gene that encodes elongin, which inhibits the generation of a transcriptional elongation complex of vascular endothelial growth factor; loss of VHL causes an increase in VEGF, which may cause the increased vascularity of these tumors

Differential diagnosis:

- clear cell hidradenoma - CK5+, CK7+, 34betaE12+, variable CEA, vimentin-, CD10- ([Arch Pathol Lab Med 2005;129:e113](#))
- clear cell hepatocellular carcinoma - HepA+, polyclonal CEA+, ubiquitin+ for Mallory bodies, EMA-, LeuM1-, pancytokeratin-; micro images [#1](#); [#2](#); [#3](#); [#4](#) ([Mod Path 2000;13:874](#))
- pancreatic endocrine tumors in von Hippel Lindau patients resemble clear cell carcinomas, but also have cords, festoons and gyriform architecture; also chromogranin+, synaptophysin+ ([Am J Surg Pathol 2001;25:602](#))
- metastases are usually RCCma+ or PAX2+ although this is not specific ([Am J Surg Pathol 2008;32:1462](#))

Variants of clear cell renal cell carcinoma - Kidney tumor - adult malignancies chapter

Up to 15% are cystic; 4 subtypes below ([Urology 1986;28:145](#))

Clear cell renal carcinoma with intrinsic multilocular growth pattern - Kidney tumor - adult malignancies chapter

Definition: at least 75% cystic

WHO terminology is multilocular cystic renal cell carcinoma

Epidemiology: 4% of all clear cell carcinomas, mean age 46 years, 2/3 male ([J Cancer Res Clin Oncol 2008;134:433](#))

Usually lower stage (pT1N0M0) than other renal cell carcinomas

Origin: appears to have same origin as classic clear cell carcinoma, despite better prognosis

Treatment: usually cured by resection regardless of stage; partial nephrectomy may be appropriate; excellent prognosis with 5 year survival of 100% ([Am J Clin Pathol 2006;125:217](#))

Gross: mean 4 cm, fibrous pseudocapsule surrounds expansile mass composed of variably sized, noncommunicating cysts separated by irregular, thick fibrous septa

Micro: variably sized cysts separated by fibrous / hyalinized septa, cysts lined by tumor cells, usually low grade, septa are hyalinized with calcification or ossification, often contain clear cells

Positive stains: MUC1

Negative stains: vimentin, LeuM1

Differential diagnosis:

- multilocular renal cyst - cysts have flat to hobnail epithelial lining, no nests of clear cells in septa ([Int Braz J Urol 2006;32:187](#))
- clear carcinoma carcinoma with cystic degeneration - cyst wall has irregular thickness, carcinoma in non-cystic areas, vimentin+, LeuM1+, usually MUC1- ([APMIS 2004;112:183](#))

Clear cell renal carcinoma with intrinsic unilocular growth pattern - Kidney tumor - adult malignancies chapter

Micro: thick irregular wall lined by tumor cells

Clear cell renal carcinoma with cystic degeneration - Kidney tumor - adult malignancies chapter

May still exhibit aggressive behavior even if only rare tumor cells ([Am J Surg Pathol 2000;24:988](#))

Micro: hemorrhage, necrosis, thick irregular cyst wall, may be papillary, may be few tumor cells

Clear cell renal carcinoma originating in a benign cyst - Kidney tumor - adult malignancies chapter

Cases include multilocular renal cysts with renal cell carcinoma ([Chang Gung Med J 2003;26:772](#), [Int Braz J Urol 2006;32:187](#))

Eosinophilic variant of clear cell renal cell carcinoma - Kidney tumor - adult malignancies chapter

Often extensive (>50%) necrosis; higher grade and stage than other renal cell carcinomas, higher risk of progression

Micro: perinuclear eosinophilia, cytoplasmic eosinophilic globules; classic clear cell areas present elsewhere

EM: similar to classic type but with more mitochondria that are swollen and pleomorphic, rarefied matrix and attenuated cristae; may have scant microvesicles

References: [Am J Surg Pathol 2000;24:1247](#)

Rhabdoid variant of clear cell renal cell carcinoma - Kidney tumor - adult malignancies chapter

Epidemiology: typically children, 5% adults (mean age 62 years), usually in transition with conventional clear cell renal cell carcinoma ([Am J Surg Pathol 2000;24:1329](#))

Clinical: usually high stage and high grade with aggressive behavior similar to sarcomatoid carcinoma ([Arch Pathol Lab Med 2007;131:102](#))

Case reports: 82 year old woman ([Arch Pathol Lab Med 2004;128:109](#))

Gross: rhabdoid component is white, firm, homogeneous

Micro: sheets/clusters of variably cohesive epithelioid cells with large paranuclear intracytoplasmic hyaline globules, vesicular and often eccentric nuclei, prominent nucleoli; rhabdoid foci always high grade, represents 5-50% of tumor volume; tumor necrosis common and sometimes extensive; usually no prominent vasculature; non-rhabdoid component also has high nuclear grade

Positive stains: vimentin (100%), NSE (79%), PAS (glycogen), pan cytokeratin (56%), EMA (47-80%), p53 (70% had at least 5% positive cells in rhabdoid areas), S100 (37%); paranuclear globular staining is present for CK, EMA, vimentin

Negative stains: desmin, smooth muscle actin

EM: inclusions composed of paranuclear whorled aggregates of intermediate filaments or condensed organelles, often with peripheral vacuolization ([Histopathology 2002;41:538](#))

Clear cell papillary renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: tumor cells with clear cytoplasm in papillary patterns, no +7 and no -Y (so not classic papillary), no 3p- (so not classic clear cell); no grade 3 nuclei or oxalate crystals (so not acquired cystic disease related carcinomas), may include cases otherwise unclassified ([Am J Surg Pathol 2008;32:1780](#))

Epidemiology: often associated with end stage renal disease ([Am J Surg Pathol 2006;30:141](#)), but not always ([Am J Surg Pathol 2008;32:1239](#))

Clinical: good prognosis, with no recurrence or metastases

Micro: cells with clear cytoplasm in papillary patterns, no grade 3 nuclei or oxalate crystals

Positive stains: AE1/AE3, CK7, CAM 5.2; also EMA, carbonic anhydrase IX

Negative stains: AMACR, CD10, TFE3; low PCNA ([Mod Path 1998;11:339](#), [Hum Path 2002;33:230](#))

Molecular: non-classic molecular mechanisms ([Mod Path 1999;12:301](#), [Arch Pathol Lab Med 1986;110:592](#))

Differential diagnosis:

- clear cell renal cell carcinoma - may be papillary, CK7-, AMACR-, has 3p-, no +7, no +17, no -Y ([Arch Pathol Lab Med 2003;127:1176](#))
- papillary renal cell carcinoma - AMACR+, CK7+, either +7 or +17, -Y, usually no 3p-

Collecting duct or Bellini duct carcinoma - Kidney tumor - adult malignancies chapter

Definition: aggressive epithelial malignancy of renal medulla with irregular tubules, high grade hobnail cells and marked desmoplasia

1-2% of adult renal epithelial tumors

Origin: likely from distal collecting (Bellini's) ducts

Epidemiology: 2/3 male, mean age 55 years, but often found in young adults; associated with analgesic nephropathy ([Am J Surg Pathol 1980;4:565](#))

Clinical: presents with painless gross hematuria; 50% have coexisting bladder urothelial tumors

Poorest prognosis of common subtypes, with death in months to a few years; 35-50% have metastases at presentation to regional lymph nodes, bone, adrenal glands, lung, skin

Major criteria: involvement of medullary pyramid (small tumors), irregular tubular architecture, marked desmoplasia, high grade hobnail cells, positive for high molecular weight cytokeratin and Ulex europaeus, no urothelial carcinoma elsewhere

Minor criteria: central location (large tumors), papillary architecture with wide fibrous stalks and desmoplastic stroma, inflammatory stroma with neutrophils; extensive renal, extrarenal and vascular infiltration, mucin positive

Case reports: 26 year old man with associated meningeal carcinomatosis ([Arch Pathol Lab Med 1999;123:638](#)), 80 year old man with tumor exhibiting sarcomatoid features ([Arch Pathol Lab Med 1999;123:338](#)), 2 cases with multiorgan metastases ([J Med Case Reports 2008 Sep 17;2:304](#))

Treatment: poor response to chemotherapy, tyrosine kinase inhibitors such as sorafenib may be useful ([Onkologie 2009;32:44](#))

Gross: infiltrative, firm, gray-white, mean 5 cm; originates in medulla (as do some clear cell carcinomas); may have intrarenal metastases; usually no hemorrhage

Micro: poorly circumscribed tubulopapillary tumor with infiltrative borders; irregular channels are lined by high grade hobnail cells with marked desmoplastic response, brisk neutrophilic infiltrate, mucin production; may have microcystic change; may have atypical hyperplastic component (not urothelial CIS, [Hum Path 1990;21:449](#)); may have sarcomatoid dedifferentiation

Cytology: ductal/tubular differentiation with benign, dysplastic and malignant features, prominent desmoplastic stroma, neutrophils ([Acta Cytol 2004;48:843](#))

Positive stains: most commonly used - high molecular weight keratin, CK7, CK8/18, CK19, EMA, Ulex europaeus, lectins/peanut agglutinin, mucin (strong), vimentin

other positive stains - c-kit / CD117, LeuM1, E-cadherin, lysozyme

Negative stains: glycogen, RCC-Ma

EM: features of adenocarcinoma, including intracellular and extracellular lumina

Cytogenetics: associated with loss of 1q, 6p, 14, 15, 22; NOT associated with loss of 3p

Differential diagnosis:

- adenocarcinoma from urothelium of renal pelvis - usually mucinous, resembles colon, vimentin negative
- metastatic carcinoma from GI or lung - usually well defined borders, multiple
- papillary renal cell carcinoma - not necessarily central, more circumscribed, often psammoma bodies and macrophages, usually no angiolymphatic invasion, no desmoplasia or inflammation, no dysplasia of collecting duct epithelium, LeuM1+, mucin-, Ulex europaeus-, E-cadherin-, CD117-, trisomy 7 or 17 ([Hum Pathol 2008;39:1350](#))
- renal medullary carcinoma - may be related ([Semin Diagn Pathol 1998;15:54](#)); blacks with sickle cell trait; usually yolk sac pattern
- urothelial carcinoma with glandular differentiation - only rarely is infiltrative, similar immunostaining pattern, must carefully examine multiple H&E slides

Collecting duct carcinoma variant with signet-ring features - Kidney tumor - adult malignancies chapter

Case reports: large intracytoplasmic vacuoles with compression of nuclei, mucin and glycogen negative, due to intracellular edema ([Mod Path 2001;14:623](#))

Lymphoepithelioma-like carcinoma - Kidney tumor - adult malignancies chapter

Definition: undifferentiated carcinoma with prominent lymphoid stroma

Rare in kidney

May be considered a variant of urothelial carcinoma in renal pelvis ([Mod Pathol 2006;19:494](#))

Case reports: 70 year old Japanese man ([Mod Path 1998;11:1252](#)), 75 year old woman ([Int J Urol 2007;14:851](#))

Micro: undifferentiated round or spindle cell carcinoma with ill-defined borders, arranged in syncytial sheets, with abundant T cells, plasma cells, macrophages

Positive stains: CK7, CK20, EMA

Negative stains: CD45/LCA (stains lymphocytes, not tumor cells), vimentin, EBV

Differential diagnosis:

- lymphoma - no keratin+ tumor cells, lymphocytes are clonal
- xanthogranulomatous pyelonephritis - no keratin+ tumor cells

Medullary carcinoma of kidney - Kidney tumor - adult malignancies chapter

Rare; <100 cases reported, first characterized in 1995 ([Am J Surg Pathol 1995;19:1](#))

Also called the seventh sickle cell nephropathy (others are unilateral hematuria, papillary necrosis, renal infarct, nephrotic syndrome, pyelonephritis, inability to concentrate urine)

Origin: arises from collecting duct system; may be due to regenerating renal papillary epithelium

May be related to collecting duct carcinoma based on similar histologic and immunoreactive features

May be related to rhabdoid tumor, based on shared molecular/genetic alteration (loss of INI1)

Epidemiology: all patients have been black; sickle cell trait or hemoglobin SC disease in almost all cases; average age 21-24 years, 75% male; 75-89% occur in right kidney ([Urology 2007;70:878](#))

Clinical: aggressive; usually advanced disease at presentation with metastases to lymph nodes, adrenal gland, peritoneum, perinodal retroperitoneum, liver, lungs or inferior vena cava; death in 4-6 months, resistant to radiotherapy and chemotherapy, although one 8 year old boy is free of disease 8 years after surgery ([Mod Pathol 2007;20:914](#))

Case reports: 15 year old black girl with sickle cell trait, lymphadenopathy, pleural and pericardial effusions ([Arch Pathol Lab Med 2003;127:e288](#)), 20 year old pregnant black woman with sickle cell trait ([Arch Pathol Lab Med 2002;126:627](#)), 21 year old black man with sickle cell disease ([Arch Pathol Lab Med 2003;127:e135](#)), 33 year old black man with sickle cell trait ([Arch Pathol Lab Med 2000;124:1561](#)), 37 year old black woman with tumor and presence of sickle cell trait discovered at autopsy ([Am J Surg Pathol 1998;22:260](#))

Gross: ill-defined, firm, rubbery, tan-gray tumor in renal medulla and adjacent soft tissues; mean 7 cm; satellite nodules in cortex; hemorrhage and necrosis common

Micro: tubular, solid, reticular, adenoid cystic or yolk sac-like patterns, but **not** tubulopapillary; tumor cells have hyperchromatic nuclei, prominent nucleoli, rhabdoid features; angiolymphatic invasion, desmoplastic stroma, infiltrative borders and intratumoral neutrophils are common; lymphocytes at rim; hemorrhagic and geographic necrosis, frequent mitotic figures; contains mucin

Cytology: cohesive groups of cells with vacuolated cytoplasm that often displace or indent the nuclei; nuclei often have irregular membranes, coarse or vesicular chromatin and prominent nucleoli ([Cancer 2005;105:28](#))

Positive stains: high molecular weight cytokeratin, variable vimentin and mucicarmine, occasional EMA and CEA

Negative stains: loss of INI1 expression ([Mod Pathol 2008;21:647](#)), colloidal iron, PAS, desmin

Cytogenetics: associated with monosomy 11 (beta globin gene is at end of 11p)

Differential diagnosis:

- collecting duct carcinoma - tubulopapillary pattern of irregular glands within desmoplastic stroma with neutrophils
- high grade urothelial carcinoma

- rhabdoid tumor

Metastases to kidney - Kidney tumor - adult malignancies chapter

Usually small, multiple and bilateral, wedge shaped, intracortical

Renal cell carcinoma is the most common recipient of tumor to tumor metastasis in malignant tumors ([Urology 1987;30:35](#))

Primary sites are usually lung, melanoma (skin), breast, GI, pancreas, ovary, testis

Case reports: breast adenoid cystic carcinoma ([Hum Pathol 2007;38:1425](#)), cervical metastasis resembling an abscess ([Eur J Cancer Care \(Engl\) 2007;16:526](#)), lung and pancreatic tumors metastatic to angiomyolipoma ([Arch Pathol Lab Med 2008;132:1016](#)), lung adenocarcinoma metastatic to clear cell renal cell carcinoma ([Arch Pathol Lab Med 2005;129:e49](#)), osteosarcoma ([Clin Genitourin Cancer 2008;6:124](#)), parotid gland malignant mixed tumor ([Am J Surg Pathol 2000;24:1159](#))

Mucinous tubular and spindle cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: low grade polymorphic renal epithelial neoplasm with mucinous tubular and spindle cell features

Also called low grade tubular-mucinous renal neoplasm, low grade collecting duct carcinoma, low grade myxoid renal epithelial neoplasm with distal nephron differentiation

First described in 2001-2 ([Hum Path 2001;32:506](#), [Mod Path 2002;15:1162](#)), prior cases were classified as sarcomatoid papillary renal cell carcinoma or unclassified

Epidemiology: primarily women, 32-79 years

Origin: tumor cells apparently have differentiation of distal nephron segments

Clinical: almost always benign behavior with recurrences but very rare distant metastases or death from disease ([Histol Histopathol 2008;23:1517](#), [Int J Clin Exp Pathol 2008;1:180](#))

Case reports: sarcomatoid change #1 ([Am J Surg Pathol 2009;33:44](#)), #2 ([Hum Pathol 2008;39:966](#)), unclassified tumor resembling pleomorphic adenoma ([Am J Surg Pathol 2007;31:632](#)), 63 year old woman ([Univ Oklahoma](#)); 67 year old woman ([Can Urol Assoc J 2008;2:635](#))

Gross: well circumscribed, 3-10 cm, confined to kidney, often with epicenter in renal medulla; yellow-tan-brown-pink cut surface; may have focal hemorrhage; no renal vein invasion

Micro: well circumscribed with partial surrounding rim of compressed fibrous tissue; long tubular profiles or cordlike growth pattern of uniform, low cuboidal cells with eosinophilic, focally vacuolated cytoplasm and spindling, low grade nuclei; stroma is myxoid and bubbly with abundant extracellular mucin; focal clusters of foamy macrophages; may have limited mucin (highlighted by Alcian blue), well formed papillae, clear cells, necrosis ([Am J Surg Pathol 2006;30:1554](#)); rarely neuroendocrine differentiation ([Am J Clin Pathol 2006;125:99](#)), no desmoplasia, no inflammation, no psammoma bodies, no infiltrative growth, no atypia, no hobnail epithelium, no cysts

Cytology: epithelial tumor with round to oval nuclei associated with strands of metachromatic stromal tissue ([Diagn Cytopathol 2007;35:593](#))

Positive stains: EMA (95%), AMACR (93%, [Am J Surg Pathol 2006;30:13](#), [Hum Pathol 2006;37:698](#)), AE1-AE3, CK7 (81%), CK 8/18, CK19, PAS (highlights basal lamina around tubules), Alcian blue highlights mucin; also neuron specific enolase and either chromogranin or synaptophysin ([Histol Histopathol 2006;21:7](#)), occasionally high molecular weight cytokeratin 34betaE12 (15%), vimentin, Ulex or CD10 (15%)

Negative stains: RCC-Ma (positive in 7%), villin, low proliferative rate (<1%)

EM: tubular structures reminiscent of the loop of Henle or distal convoluted tubule

Molecular: multiple chromosomal losses (-1, -4, -6, -8, -9, -13, -14, -15, -22) but no identifiable pattern ([Mod Pathol 2006;19:186](#))

Differential diagnosis:

- papillary renal cell carcinoma, solid variant (or type 1 / basophilic) - may have compact areas of low grade spindle cells lining thin, angulated tubules resembling mucinous tubular and spindle cell carcinoma, but no mucinous stroma, +7, +17 ([Am J Surg Pathol 2008;32:1353](#), [Mod Pathol 2006;19:488](#))
- sarcomatoid renal cell carcinoma - infiltrative, more pleomorphic cells, area of classic renal cell carcinoma

Papillary type, renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: papillary or tubulopapillary tumor with foamy macrophages and intracellular hemosiderin, no clear cells; trisomy 7, 17

Also called chromophil; some cases were formerly called renal cell carcinoma-granular type due to granular cytoplasm, but this term is obsolete and may also refer to oncocytoma or eosinophilic variant of clear cell carcinoma

10-20% of adult renal carcinomas

Origin: proximal or distal convoluted tubule

Epidemiology: 75% male

Clinical: tends to present at early stage

Survival: 5 year survival is 82-90%, may be better than clear cell carcinoma ([Am J Surg Pathol 2002;26:281](#)); metastasizes to regional lymph nodes

Case reports: 63 year old man with bilateral renal masses ([Univ Oklahoma](#)), focal mucin production ([Am J Surg Pathol 1998;22:1037](#)), arising in calyceal cyst ([Arch Pathol Lab Med 1996;120:879](#))

Gross: thick capsule with reactive changes and hemorrhage, red/brown (from hemorrhage); multifocal (80% of tumors), occasionally bilateral; mean 7 cm; tissue "pours out" of kidney; looks necrotic but microscopically less necrosis than expected

Micro: well circumscribed, often with distinct fibrous capsule; papillary or tubulopapillary in every case; have papillary fibrovascular cores that may be edematous and look cystic; papillae may be long and solidly packed; foamy macrophages in papillary core and intracellular hemosiderin are sensitive/specific features; papillae are composed of columnar/cuboidal cells with finely granular cytoplasm, lower grade nuclei, longitudinal nuclear grooves in low grade cases; often tubular dysplasia; may have glassy hyaline globules; variable psammoma bodies, neutrophils and necrosis

Note: this is a different entity from papillary clear cell carcinoma

One study recommends assessing nucleolar prominence based upon high power field with greatest nuclear pleomorphism ([Am J Surg Pathol 2006;30:1091](#))

Cytology: foamy macrophages and intracytoplasmic hemosiderin ([Cancer 1998;84:303](#))

Positive stains: most common - AE1-AE3, low molecular weight cytokeratin (CK7) (83% type 1, 20% type 2), CK 8/18, CK19, AMACR ([Am J Surg Pathol 2004;28:69](#), [Hum Pathol 2006;37:698](#)), EMA/MUC1 (membranous), RCC-Ma, CD10; also CD117/c-kit (cytoplasmic, [Mod Path 2004;17:611](#)), variable vimentin, variable glycogen

Suggested positive staining panel: CK7, CK8/CK18, CK19, and vimentin ([Am J Surg Pathol 2005;29:747](#))

Negative stains: 34betaE12 (high molecular weight cytokeratin), Ulex europaeus, parvalbumin, WT1

EM: variably sized microvilli, small amounts of cytoplasmic lipid, no glycogen

Molecular/cytogenetics: +7 (75%), +17 (80%), +12, +16, +20, +3q, -Y, -X (p or q for all chromosomes); these changes occur early in tumor neoplasia ([Mod Path 2003;16:1053](#)), point mutation in *c-kit* intron 17; mutations in MET proto-oncogene on #7 are common

Also associated with papillary RCC gene on #1; not associated with p53 mutations or 3p-

Differential diagnosis

- collecting duct carcinoma - infiltrates tubules, desmoplasia
- papillary tumors with clear cell features - either clear cell carcinoma (AMACR-, CK7-, 3p-, no +7 or +17, no Y-), papillary carcinoma (AMACR+, CK7+, +7 or +17, Y-, usually no 3p-) or unclassified ([Am J Surg Pathol 2008;32:1780](#))

References: [Hum Path 2001;32:590 \(type 1 vs. 2\)](#), [Am J Surg Pathol 1997;21:621](#)

Type 1 (basophilic) papillary renal cell carcinoma - Kidney tumor - adult malignancies chapter

More common and better prognosis than type 2

Micro: cells arranged on single layer on basement membrane of papillary cores; small cells with scant pale cytoplasm and hyperchromatic nuclei so cell looks blue; frequent psammoma bodies, foamy macrophages, glomeruloid papillae; lower nuclear grade than type 2

Positive stains: CK7, MUC1 (polarized expression) ([BJU Int 2008;102:183](#))

Molecular: associated with c-met mutation

Type 2 (eosinophilic) papillary renal cell carcinoma - Kidney tumor - adult malignancies chapter

Poorer prognosis than type 1; typically presents at higher stage

Gross: often distinct fibrous capsule

Micro: papillae covered by larger cells with abundant eosinophilic granular cytoplasm and grade 3 nuclei (prominent nucleoli), pseudostratified nuclei, variable foam cells and necrosis

Cytology: papillary structures, foamy histiocytes, intracytoplasmic hemosiderin and nuclear grooves

Positive stains: Hales colloidal iron due to hemosiderin; also topoisomerase II alpha ([Cancer Res 2005;65:5628](#))

Negative stains: MUC1

Molecular: 1p-, 3p-, +5q ([Clin Cancer Res 2009;15:1162](#))

EM: similar to classic type but with more mitochondria

Solid variant of papillary renal cell carcinoma - Kidney tumor - adult malignancies chapter

Micro: solid sheets of cells, often with distinct micronodules resembling abortive papillae; less than 50% true papillae but otherwise similar to classic papillary; cells have abundant eosinophilic cytoplasm, open chromatin, often prominent nucleoli; may have clear cytoplasm and nuclear grooves; may have compact areas of low grade spindle cells lining thin, angulated tubules resembling mucinous tubular and spindle cell carcinoma, but no mucinous stroma ([Am J Surg Pathol 2008;32:1353](#))

Positive stains: EMA, CK7

Negative stains: 34betaE12

Molecular: trisomy 7 and 17

Differential diagnosis: mucinous tubular and spindle cell carcinoma - spindle cell areas are uniformly low grade, no mucinous stroma, no +7 or +17

References: [Am J Surg Pathol 1997;21:1203](#)

Primary thyroid-like follicular carcinoma - Kidney tumor - adult malignancies chapter

Definition: kidney tumor that mimics well differentiated thyroid follicular neoplasm

Epidemiology: no gender preference, age range of 29-83 years

Clinical: low malignant potential (1 of 6 metastasized to renal lymph nodes, [Am J Surg Pathol 2009;33:393](#))

Case reports: 32 year old woman ([Am J Surg Pathol 2006;30:411](#))

Gross: 2-4 cm, encapsulated

Micro: follicular architecture with micro- and macrofollicles containing inspissated colloid-like material; may have focal tightly packed follicles without secretions; follicular cells have moderate amphophilic to eosinophilic cytoplasm, round nuclei, occasional prominent nucleoli

Positive stains: CK7, CK20, CAM 5.2, vimentin ([Virchows Arch 2008;452:91](#))

Negative stains: thyroglobulin, TTF1, RCC, CD10

Molecular: gene expression profile is distinct from clear cell or chromophobe renal cell carcinoma

Differential diagnosis:

- metastatic thyroid carcinoma - very rare, usually obvious thyroid primary with widely disseminated metastases, thyroglobulin+ or TTF1+
- metastatic follicular carcinoma arising in struma ovarii in females
- carcinoid tumor - rare, pattern is insular, cords, nests or ribbons but not follicular, neuroendocrine histology, synaptophysin+, chromogranin+

Rhabdoid features in renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: a distinct histologic entity in children, but not in adults (merely descriptive); rhabdoid cells make up 5-90% of tumor cells

Occurs in 5% of adults

Epidemiology: mean age 62 years (range 33-84 years), 2/3 men

Associated with high stage tumors having Fuhrman grade 3 or 4 nuclei in nonrhabdoid component

Median survival only 8 months ([Arch Pathol Lab Med 2007;131:102](#))

Case reports: 47 year old woman ([Can Urol Assoc J 2008;2:631](#)), 82 year old woman ([Arch Pathol Lab Med 2004;128:109](#)), in mixed epithelial and stromal tumor ([Hum Pathol 2007;38:1432](#))

Gross: solid, white uniform masses

Micro: sheets and clusters of variably cohesive, large epithelioid cells with abundant eosinophilic cytoplasm; large, paranuclear, intracytoplasmic hyaline globules and eccentric nuclei with prominent nucleoli; reduced lipid content, usually tumor cell necrosis; no branching vascular pattern; usually also has a nonrhabdoid component, most commonly clear cell renal cell carcinoma

Positive stains (rhabdoid component): vimentin (100%), PAS (glycogen), NSE (79%), AE1-AE3 (56-75%), EMA (47-80%); also p53, S100 (37%)

Note: staining is globular and paranuclear for cytokeratin, EMA and vimentin

Negative stains (rhabdoid component): CK7, CK20, SMA, desmin, muscle specific actin, HMB45, GFAP

EM: paranuclear intermediate filament aggregates or paranuclear condensation of organelles, associated with peripheral vacuolization

References: [Am J Surg Pathol 2000;24:1329](#)

Sarcomatoid renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: not a distinct histologic entity, but the common pathway of transformation of different subtypes of renal cell carcinoma

Also called spindle cell carcinoma, carcinosarcoma

5% of renal cell carcinomas have a sarcomatoid component; often associated with clear cell carcinoma or chromophobe carcinoma ([Am J Surg Pathol 1997;21:1188](#))

Report presence of even a focal sarcomatoid component, which is associated with a poorer prognosis ([Am J Surg Pathol 2001;25:275](#))

Epidemiology: mean age 60 years, 60% men, usually stage 3 or 4; metastases to lungs most common Aggressive with median survival of 19 months; 5/10 year survival is 22%/13% vs. 79%/76% for other renal cell carcinomas

Poor prognostic factors: high stage, presence of 50% or more sarcomatoid component, distant metastases at time of nephrectomy, histologic tumor necrosis ([Am J Surg Pathol 2004;28:435](#))

Case reports: papillary renal cell carcinoma with sarcomatoid transformation ([Arch Pathol Lab Med 2000;124:1830](#)), with divergent growth pattern ([Arch Pathol Lab Med 2005;129:1057](#)), sarcomatoid chromophobe renal cell carcinoma with squamous differentiation ([Arch Pathol Lab Med 2008;132:1672](#))

Gross: fleshy, gray-white, infiltrative margins; mean 9 cm; if it looks sarcomatoid, must prove otherwise; may have clear cell component (yellow, hemorrhagic, necrotic)

Micro: atypical spindle cells or tumor giant cells with marked nuclear pleomorphism and abnormal mitotic figures; may resemble MFH or fibrosarcoma with poorly formed fascicles; occasionally undifferentiated with rhabdomyosarcomatous component, bone or cartilage

Must have an epithelial component for this diagnosis (may need generous sampling); should have sarcomatoid overgrowth of at least one low power field to call sarcomatoid

Usually considered to be nuclear grade 4

Positive stains: AE1-AE3, vimentin (56%), EMA (50%), CAM5.2 (40%); also actin (33%) and LeuM1 (22%) in spindled areas

Negative stains: high molecular weight keratin 34betaE12, S100 (usually) ([Arch Pathol Lab Med 1993;117:636](#))

EM: desmosomes, microvilli

Molecular: may have different genetic abnormalities than nonsarcomatoid tumor ([Mod Pathol 2007;20:303](#))

Differential diagnosis:

- primary renal sarcoma - usually leiomyosarcoma, no epithelial component after careful sampling
- primary retroperitoneal soft tissue sarcoma - no epithelial component after careful sampling
- clear cell carcinoma with early spindle cell change - stroma is not malignant ([Hum Pathol 2007;38:1372](#))

Small cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: neuroendocrine morphology resembling tumors elsewhere

Rare, < 30 cases reported in kidney

Epidemiology: median age 63 years, 75% women

Clinical: aggressive behavior; often has local or distant metastases ([Cancer 2003;97:1436](#))

Case reports: 71 year old woman with combined small cell-urothelial carcinoma of renal pelvis ([Arch Pathol Lab Med 1993;117:239](#)), 76 year old woman with gross hematuria ([Arch Pathol Lab Med 2001;125:796](#)), with metastases to lymph nodes ([Am J Surg Pathol 1984;8:855](#))

Gross: median 11 cm

Micro: diffuse growth of small cells with minimal cytoplasm, indistinct nucleoli, high mitotic activity; often extensive tumor necrosis ([BJU Int 2007;100:1030](#)), similar to lung tumor

Positive stains: chromogranin, synaptophysin, CD56, neurofilament, CK 8/18, CK19

Negative stains: CD45/LCA

Differential diagnosis:

- lymphoma - use immunostains to differentiate
- metastatic small cell lung cancer - clinical history of primary
- other small blue cell tumors - children may have neuroblastoma, Ewing's sarcoma/PNET or embryonal rhabdomyosarcoma)

Squamous cell carcinoma of kidney - Kidney tumor - adult malignancies chapter

Associated with squamous metaplasia of renal pelvis, renal calculi or infection

Usually advanced at diagnosis; poor prognosis ([J Urol 2007;178:51](#))

Case reports: with carcinosarcoma ([Pathol Res Pract 2003;199:489](#)), renal pelvis tumor after radiotherapy for seminoma ([Urology 2007;70:812.e3](#))

Gross: large, necrotic, ulcerated tumor

Translocation carcinoma (adults) - Kidney tumor - adult malignancies chapter

Definition: tumor has gene fusion involving TFE3 transcription factor gene

Also called MiT translocation subgroup carcinomas

3% of adult renal cell carcinomas ([Clin Cancer Res 2009;15:1170](#)), much less common in adults than children

Epidemiology: 80% women, usually age 35 or less, usually high stage at diagnosis ([Am J Surg Pathol 2007;31:1149](#)), aggressive clinical course ([Am J Clin Pathol 2007;128:70](#))

Case reports: 20 year old woman with metastasis to placenta ([Int J Surg Pathol 2009 Jan 22 \[Epub ahead of print\]](#))

Gross: tan yellow, frequently hemorrhagic and necrotic

Micro: papillary and nested growth pattern with clear cells; fibrous pseudocapsule, often calcified; polygonal tumor cells with sharp cell borders, voluminous clear to eosinophilic cytoplasm, irregular nuclei containing vesicular chromatin and small nucleoli; surrounded by thin walled vessels; also minor solid, acinar, alveolar and tubular patterns; foci of calcification are common; no/rare mitotic figures

Positive stains: RCC, TFE3 (nuclear staining) or TFEB (nuclear staining), CD10, AMACR, vimentin, E-cadherin (2/3), cytokeratin (30-50%), EMA (50%, frequently only focal); weak expression of melanocytic markers ([Am J Surg Pathol 2002;26:1553](#), [Am J Surg Pathol 2008;32:656](#))

Negative stains: CD45, HMB45, calretinin, smooth muscle actin

Molecular: t(X;17)(p11.2;q25) - balanced translocation of TFE3 gene at Xp11.2 and ASPL gene at 17q25; also found in alveolar soft part sarcoma, but unbalanced

t(X;1)(p11.2;q21) - TFE3 and PRCC genes

t(6;11)(p21;q12) - TFEB and alpha genes; appears to have low malignant potential in contrast to other translocation carcinomas ([Am J Surg Pathol 2005;29:230](#), [Int Urol Nephrol 2008 Nov 8 \[Epub ahead of print\]](#))

Hereditary papillary carcinoma: t(X;1)(p11.2; p34) - fusion of TFE3 and PSF

EM: features of clear cell carcinoma, including cell junctions, numerous mitochondria, microvilli, basement membrane, abundant glycogen

Differential diagnosis:

- clear cell renal cell carcinoma - older patients, no papillary pattern, vimentin+, keratin+, TFE3-, 3p-, no intracisternal microtubules on EM
- papillary renal cell carcinoma - predominantly papillary, no nested alveolar patterns, no extensive areas of clear cells, keratin+, TFE3-, trisomy 7 and 17
- clear cell sarcoma of kidney - usually children, cells have indistinct cell margins, TFE3-

Tubulocystic carcinoma - Kidney tumor - adult malignancies chapter

Definition: mixture of tubules and micro/macro cysts with low grade nuclear features

Also called low grade collecting duct carcinoma, Bellini duct carcinoma

Not part of WHO 2004 classification

Epidemiology: rare; mean age 54 years, 85% male ([Am J Surg Pathol 2009;33:384](#))

Origin: appears to derive from proximal convoluted tubule and distal nephron

Clinical: often an incidental finding, usually low stage; prognosis is usually excellent with recurrences but only rare distant metastases or death from disease

Case reports: 56 year old man ([Case of the Week #51](#))

Gross: up to 17 cm, usually well circumscribed, gray-white and cystic ("bubble wrap" appearance), with a medullary location; often surrounded by rim of compressed fibrous tissue; minimal hemorrhage, necrosis or invasion of adjacent renal parenchyma

Micro: mixture of closely packed tubules and micro/macro cysts of variable sizes with low grade nuclear features; tubules and cysts are lined by single layer of cuboidal or columnar cells with abundant eosinophilic cytoplasm, uniform nuclei with distinct nucleoli; often have hobnail appearance; overall low grade nuclear features; cysts are closely spaced with variable intervening fibrotic stroma; 40% coexist with papillary renal cell carcinoma; minimal mitotic activity, no atypia, no desmoplasia

Positive stains: mucin, keratins (AE1-3, Cam 5.2 [CK8/18] and CK19); vimentin, EMA, PAX2; variable 34betaE12, variable CK7

Molecular: distinct molecular signature from other carcinomas although similar to papillary; often +17 but not +7 ([Am J Surg Pathol 2008;32:177](#))

EM: short microvilli with brush border organization

Differential diagnosis:

- multilocular renal cell carcinoma - aggregates of clear cells with atypia within the septae dividing cystic spaces
- multilocular renal cyst/cystic nephroma - children under 2 years old and women 40-69 years, architecture is predominantly cystic, not tubulocystic; multilocular cysts are lined by flattened or attenuated epithelium with indistinct nucleoli; occasionally hobnail morphology; has hyalinized, fibrotic or ovarian-like stroma
- mucinous tubular and spindle cell neoplasm - predominantly females, typically long tubular profiles or cordlike growth pattern of uniform, low cuboidal cells with eosinophilic, focally vacuolated cytoplasm and spindling; stroma is myxoid and bubbly with abundant extracellular mucin

References: [Urology 1997;50:679](#), [Am J Surg Pathol 2005;29:747](#) (keratin staining)

Unclassified renal cell carcinoma - Kidney tumor - adult malignancies chapter

Definition: tumors that cannot be otherwise classified, often because they fit more than one category
5% of all renal tumors

Tumors are histologically heterogeneous and often high grade (93% Fuhrman's nuclear grade 3 or 4) and high stage (45%-83% stage 3 and 4) ([Am J Surg Pathol 2002;26:281](#), [BJU Int 2007;100:802](#))

Molecular techniques may be useful

Case reports: tumor with features of oncocytoma, chromophobe carcinoma, collecting duct carcinoma and sarcomatoid carcinoma ([Arch Pathol 2004;128:1274](#))

Urothelial carcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Formerly called transitional cell carcinoma

Recommended to fix specimen prior to grossing for accurate staging ([Am J Surg Pathol 2004;28:1545](#))

Epidemiology: usually adults (7% of primary renal carcinomas), 64% men, mean age 67 years

Recommended to stage renal caliceal tumors based on the extent of invasion relative to the corticomedullary junction ([Hum Pathol 2007;38:1639](#))

Inverted growth patterns are associated with microsatellite instability and hereditary nonpolyposis colorectal cancer syndrome ([Hum Pathol 2003;34:222](#))

Poor prognostic factors: high pT classification and vascular invasion ([Mod Pathol 2006;19:272](#)), also older patient age, high tumor grade, nodal metastases, sessile architecture ([Cancer 2009;115:1224](#)); high Ki-67 predicts development of bladder tumors ([Urol Int 2008;81:306](#))

Case reports: with adjacent nodule resembling giant cell tumor of bone #1 ([Am J Surg Pathol 1984;8:139](#)); #2 ([Arch Pathol Lab Med 1997;121:162](#)), with choriocarcinomatous features ([Hum Path 2002;33:1234](#)), lipoid cell variant ([Am J Surg Pathol 2007;31:770](#)), nested variant ([Pathol Res Pract 2009 Jan 24 \[Epub ahead of print\]](#))

Gross: mean 4 cm, 28% multifocal

Micro: may have osteoclast-like giant cells ([Mod Pathol 2006;19:161](#)), clear cell change or other unusual morphologic features ([Mod Pathol 2006;19:494](#))

References: [eMedicine](#)

Subtypes / Variants of urothelial carcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Low grade urothelial carcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Micro: similar to bladder tumor

Cytology: not as specific as for high grade tumors; suggestive features are 5 or more papillary groups, cellular overlapping, anisonucleosis, hyperchromasia ([Diagn Cytopathol 1997;16:437](#))

High grade urothelial carcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Epidemiology: 70% male, mean age 70 years (range 28-92 years)

Clinical: associated with phenacetin nephropathy (25%), Thorotrast radiologic dye, cyclophosphamide, horseshoe kidney, hereditary nonpolyposis colorectal cancer syndrome

Patients present with hematuria due to fragmentation within renal pelvis

40-50% have preexisting or coexisting bladder urothelial tumors

5 year survival of 10% due to invasion of wall of pelvis and calyces; 50% if complete surgical resection

Poor prognostic features: extra-renal invasion, coexisting bladder tumor ([Urol Oncol 2009;27:223](#))

Treatment: standard therapy is nephroureterectomy including bladder cuff since multicentric and often implants within bladder; renal preserving surgery may also be effective ([J Endourol 2009;23:341](#))

Case reports: with ipsilateral renal cell carcinoma ([Can Urol Assoc J 2009;3:64](#)), rhabdoid features ([Am J Surg Pathol 1992;16:515](#))

Gross: soft, gray-red masses with smooth glistening surfaces

Micro: resembles other urothelial carcinomas; carcinoma in situ may be present in non-adjacent areas; often extends along collecting tubules (resembling CIS of cervix extending into cervical clefts) but are not adenocarcinomas; vascular invasion in 35%; rarely is sarcomatoid, resembles giant cell tumor of bone or has rhabdoid features ([Hum Pathol 2006;37:168](#)); analgesic abuse is associated with thickening of small stromal vessels

Cytology: high nuclear/cytoplasmic ratio, isolated cells, anisonucleosis, nuclear hyperchromasia, coarse chromatin ([AJCP 2002;117:444](#))

Positive stains: low molecular weight keratin (CK 8/18, CK19, CK7, CK20), squamous type keratins (CK 5, CK14, CK17, CK13), p53

Negative stains: vimentin

Molecular: 31% have microsatellite instability ([Mod Path 2002;15:790](#))

Cytogenetics: complex aberrations include -9, -17p, +8q, -13q, -18q, +17q

Microcystic variant of urothelial carcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Usually described in bladder

Case reports: 70 year old man ([Bostwick Laboratories](#)), cases in renal pelvis ([Arch Pathol Lab Med 2002;126:859](#)), focal neuroendocrine differentiation ([Virchows Arch 2009;454:223](#))

Micro: invasive urothelial carcinoma with prominent cystic features; cysts are irregular in size and deeply infiltrative, lined by variable layers of cuboidal or flattened cells with minimal atypia

Differential diagnosis:

- cystitis glandularis or cystitis cystica - not invasive, no high grade atypia
- nephrogenic metaplasia - not invasive, circumscribed growth
- adenocarcinoma - more marked atypia, mitotic activity and necrosis

Micropapillary variant of urothelial carcinoma of renal pelvis - Kidney tumor - adult malignancies chapter

Epidemiology: rare variant, more common in bladder; mean age 64 years (range 22-76 years)

Clinical: aggressive; usually associated with high stage at presentation, nodal metastases, distant metastases and poor prognosis ([Arch Pathol Lab Med 2009;133:62](#), [Am J Clin Pathol 2006;126:86](#))

Case reports: 68 year old man whose tumor has focal micropapillary areas ([Am J Surg Pathol 1996;20:125](#)), 73 year old woman ([Med Sci Monit 2007;13:CS47](#))

Micro: invasive component has small infiltrating clusters of tumor cells within lacunae (small round empty spaces that represent fixation artifact, not actual lymphovascular spaces); noninvasive pattern has slender micropapillae on surface of tumor; micropapillary component represents 10-80% of total tumor, remainder is classic urothelial carcinoma; lymphovascular invasion always present (in addition to the apparent invasion within lacunae)

Positive stains: CK7, CK20, MUC1 (on stroma forming surface), p53

Negative stains: bcl2

Other neoplasms – adult or adult/child

Angiosarcoma - Kidney tumor - adult malignancies chapter

Definition: malignant vascular tumor with anastomosing vascular spaces lined by atypical endothelial cells

Very rare as primary kidney tumor (< 50 cases reported); primary tumors are usually in skin of elderly men
Poor prognosis

Risk factors at other sites include exposure to arsenic, Thorotrast, polyvinyl chloride or radiation; also posttreatment lymphedema

Case reports: 38 year old woman with adult Wilms' tumor and angiosarcoma ([Cancer Chemother Pharmacol 2008;61:717](#)), 50 year old man with kidney mass, liver and lung nodules ([Arch Pathol Lab Med 2002;126:478](#)), 61 year old man whose tumor had minute clear cell carcinomas ([Pathol Res Pract 2009 Jan 13 \[Epub ahead of print\]](#)), mixture of poorly differentiated spindle sarcoma and angiomatous differentiation ([Arch Pathol Lab Med 1998;122:929](#)), occurrence in brothers at ages 52 and 69 years ([Arch Pathol Lab Med 1995;119:75](#))

Cytology: highly pleomorphic cells, some containing hemosiderin; neovascular structures with intracytoplasmic lumina containing erythrocytes; cells are non-cohesive with long cytoplasmic processes; erythrophagocytosis is present; variable cellularity due to necrosis

Positive stains: vimentin, Factor VIII related antigen, CD34, CD31, Ulex europaeus

Negative stains: keratin, S100, CEA, EMA, desmin, smooth muscle actin

EM: spindle cells with abundant pinocytotic vesicles, intermediate filaments, rare Weibel-Palade bodies

Differential diagnosis: sarcomatoid renal cell carcinoma - has non-vascular malignant component, keratin+

Carcinoid tumor of kidney - Kidney tumor - adult malignancies chapter

Definition: low grade (well differentiated) neuroendocrine tumor with finely granular cytoplasm, uniform nuclei and stippled chromatin; similar morphology to tumors elsewhere
Also called low grade neuroendocrine carcinoma

Epidemiology: rare, <100 cases reported; associated with horseshoe kidney, which has an increased risk of renal tumors in general

Clinical: usually NOT associated with carcinoid syndrome; often metastatic at presentation ([Am J Surg Pathol 2007;31:1539](#))

Poor prognostic factors: age >40 years, size >4 cm, >1 mitotic figure/10 HPF, metastasis at diagnosis, extension through renal capsule ([J Urol 2006;176:2359](#))

Case reports: 30 year old woman with tumor in teratoma ([Arch Pathol Lab Med 2002;126:979](#)), 34 year old man ([Arch Pathol Lab Med 1990;114:68](#)), tumor metastatic to liver ([Arch Pathol Lab Med 1993;117:855](#))

Micro: pure or associated with teratoma; usually well demarcated but may have focal infiltration; extracapsular extension in 52%; tightly packed cords, trabeculae with variable stroma, nests or ribbons; uniform cells with eosinophilic, finely granular cytoplasm and uniform nuclei with stippled chromatin; often calcifications; no/rare mitotic activity, no necrosis

Cytology: monotonous plasmacytoid cells arranged singly and in small clusters; occasional cells in acinar pattern resembling glandular differentiation; tumor cells have fine speckled chromatin ([Diagn Cytopathol 2007;35:306](#))

Positive stains: CAM 5.2, vimentin, neuron-specific enolase, synaptophysin, chromogranin; also VEGF ([Urol Oncol 2008 Dec 24 \[Epub ahead of print\]](#)), occasionally CK7, rarely CK20

Negative stains: TTF1, WT1

EM: membrane bound dense core granules

Differential diagnosis: metastatic carcinoid tumor - clinical history, may have multiple renal tumors

Castleman's disease of kidney - Kidney tumor - adult malignancies chapter

Very rare

Multicentric disease may be associated with renal amyloidosis ([Clin Nephrol 2007;68:171](#))

Case reports: 38 year old man with history of hyaline-vascular type ([Am J Clin Pathol 2007;127:465](#))

Clear cell sarcoma of soft parts-adults - Kidney tumor - adult malignancies chapter

Also called melanoma of soft parts

Very rare in kidney, with only one case report

Case reports: 20 year old man with metastases to liver and lung and death 5 years later ([Am J Surg Pathol 1999;23:589](#))

Micro: nests or short fascicles of spindled or epithelioid cells with clear to granular eosinophilic cytoplasm separated by fibrous septa; surrounds normal epithelial elements; also multinucleated giant cells, variable melanin

Positive stains: S100, HMB45

Negative stains: keratin, CD99

Molecular: t(12;22)(q13;q12), EWS-ATF1 gene region rearrangement in >95% [at other sites]

Differential diagnosis:

- clear cell sarcoma - very young children, similar histology but nests are formed by vascular structures, S100-, HMB45-, different translocation
- Wilms' tumor - usually triphasic, no dominant nesting pattern, negative for melanocytic markers

Desmoplastic small round cell tumor of kidney - Kidney tumor - adult malignancies chapter

Definition: aggressive malignant tumor due to t(11;22)(p13;q12)

First described in 1989 ([Pediatr Pathol 1989;9:177](#))

Epidemiology: usually male teenagers and young adults, rare in children ([Am J Surg Pathol 2007;31:576](#))

Sites: usually serosal; rare in kidney

Clinical: usually presents with advanced stage and poor prognosis

Case reports: 7 year old girl ([J Pediatr Urol 2006;2:52](#)), 41 year old man with kidney tumor ([Am J Surg Pathol 2004;28:1379](#))

Micro: nests of small round blue cells of variable size and shape within cellular desmoplastic stroma; tumor cells have scant stroma, indistinct cell borders, hyperchromatic nuclei; frequent mitotic areas and necrotic foci; occasional rosettes; no glandular differentiation

Positive stains: AE1-AE3, desmin (dot like pattern), vimentin (dot like pattern), neuron specific enolase; also WT1 ([Am J Surg Pathol 2000;24:830](#)), EMA

Molecular: t(11;22)(p13;q12) with EWS-WT1 fusion transcript

Differential diagnosis:

- Ewing's/PNET - no prominent desmoplastic stroma, WT1-, different t(11;22)
- lymphoma - no prominent desmoplastic stroma, positive for B or T cell markers
- neuroblastoma - rosettes, no prominent desmoplastic stroma, WT1-
- small cell carcinoma - nuclear molding, crush artifact, no prominent desmoplastic stroma; no t(11;22), WT1-
- Wilms' tumor-blastema predominant - usually no nesting pattern, no desmoplastic stroma, no t(11;22)

Ewing's sarcoma / Primitive NeuroEctodermal Tumor (PNET) - Kidney tumor - adult malignancies chapter

Rare

Epidemiology: median age 18 years, range 0-72 years

Clinical: abdominal/flank pain or hematuria; usually stage 3 or 4; highly aggressive with rapid death in many cases within 1 year; metastases to lung and pleura; also bone and liver; may recur locally

Treatment: surgery, early and aggressive chemotherapy

Case reports: 17 year old girl ([Am J Surg Pathol 1997;21:354](#)), 19 year old man ([Arch Esp Urol 2007;60\(3\)](#)), 22 year old man with abdominal mass ([Arch Pathol Lab Med 1999;123:541](#)), 32 year old man with spontaneously ruptured tumor ([Int Urol Nephrol 2007;39:393](#)), 56 year old woman ([Am J Surg Pathol 1997;21:461](#)), 3 cases ([Hum Path 1997;28:767](#))

Gross: mean 12 cm, often renal medulla or pelvis, hemorrhage and necrosis common, may have cystic change

Micro: vaguely lobular growth of highly cellular, round to oval, poorly differentiated cells with minimal to modest pale staining cytoplasm and hyperchromatic nuclei; may have bubbly to clear cytoplasm with light and dark round cells, rosettes (in well differentiated tumors) with central solid eosinophilic core containing neurofibrillary material (Homer-Wright rosettes); neuropil common; rarely has central lumen (Flexner-Wintersteiner rosettes); also occasional spindle cells (MPNST-like), ganglion cells, clear cell sarcoma-like foci, rhabdoid cells, epithelial cells, organoid foci, adenomatous hyperplasia of Bowman's capsule epithelium; no tubules or glomeruloid formations as seen in Wilms' tumor

Azzopardi phenomenon: blood vessels deeply encrusted with basophilic material consistent with DNA; associated with small cell carcinoma

Positive stains: CD99 (membranous staining), FLI1, PAS+ diastase sensitive (glycogen), vimentin, neuron-specific enolase

Note: CD99 negative cases are usually fusion protein negative

Negative stains: cytokeratin (usually), desmin, WT1, GFAP

Note: reliance on immunohistochemistry as sole means of ancillary diagnosis can lead to confusing results - molecular testing is recommended ([Hum Pathol 2007;38:205](#))

EM: neurosecretory granules

Molecular: 90% have EWS/FLI1 fusion product by RT-PCR due to t(11;12)(q24;q22;q12)

Differential diagnosis:

- clear cell sarcoma of kidney - young children, nests of cells separated by vascularized stroma, CD99-, FLI1-, different cytogenetics
- desmoplastic round cell tumor - prominent desmoplastic stroma, WT1+, different translocation
- monophasic synovial sarcoma - fascicular pattern, no rosettes or neuroendocrine features, often hemangiopericytoma-like vascular pattern, different translocation
- neuroblastoma - usually young children, FLI1-, different cytogenetics
- small cell carcinoma - older patients, molding, no light/clear cytoplasm, no rosettes, keratin+, FLI1-, different cytogenetics
- Wilms' tumor - usually younger patients, triphasic, WT1+, CD99-, FLI1-

References: [Am J Surg Pathol 2001;25:133](#), [Am J Surg Pathol 2002;26:320](#)

Hemangioblastoma - Kidney tumor - adult malignancies chapter

Very rare ([Am J Surg Pathol 2007;31:1545](#))

Sporadic or associated with von Hippel-Lindau disease

Both renal cell carcinoma and hemangioblastoma are caused by loss of function of VHL tumor suppressor protein

Usually occurs in CNS

Case reports: metastatic renal cell carcinoma to CNS hemangioblastoma ([Arch Pathol Lab Med 2007;131:641](#))

Micro: highly vascular tumor identical to CNS tumor; variable stromal cellularity; may have cystic spaces; stromal cells have clear, foamy, lipid-containing cytoplasm or eosinophilic cytoplasm; variable nuclear atypia

Positive stains: inhibin-alpha (inhibin A) and aquaporin1 ([Am J Surg Pathol 2008;32:1051](#)), Leu-7/CD57

Negative stains: AE1-AE3, CD10 ([Mod Pathol 2005;18:788](#))

Differential diagnosis: renal cell carcinoma - AE1/AE3+, CD10+, negative for inhibin alpha and aquaporin1

Hemangiopericytoma - Kidney tumor - adult malignancies chapter

Rare; <50 cases reported

May arise in perirenal tissues or renal capsule with secondary invasion of kidney

Epidemiology: often older patients; may be associated with hypoglycemia

Case reports: 15 year old boy with tumor of renal pelvis ([Urology 2007;70:811e13](#)), 50 year old man ([Internet Journal of Urology 2008;5\(2\)](#)), bilateral metastases to kidney from CNS primary ([Int Braz J Urol 2006;32:306](#))

Gross: large circumscribed tumor

Micro: rich network of branching vessels with staghorn configuration, lined by single layer of endothelium, surrounded by haphazard pattern of round/oval tumor cells with indistinct cell borders

Cytology: cellular, single and tightly packed clusters of oval to spindled cells aggregated around branched capillaries; usually basement membrane material; nuclei are uniform and oval with finely granular chromatin and inconspicuous nucleoli; no mitotic figures, no necrosis ([Cancer 1999;87:190](#))

Leiomyosarcoma - Kidney tumor - adult malignancies chapter

Rare, <200 cases reported; 0.12% of all invasive renal malignancies

Epidemiology: mean age 58 years, range 40-75 years; 70% women in one study

Median overall survival is 25 months, 5 year overall survival is 25% ([Can J Urol 2007;14:3435](#))

Patients usually die of disease, particularly if intermediate or high grade tumors ([Am J Surg Pathol 2004;28:178](#))

Case reports: arising from blind end of a bifid renal pelvis ([Yonsei Med J 2007;48:557](#))

Gross: mean 14 cm, usually circumscribed and encapsulated with firm and whorled cut surface; usually necrosis

Micro: alternating fascicles of spindle cells with eosinophilic cytoplasm and blunt ended, nontapering nuclei; usually focal necrosis (<50% of specimen), often myxoid areas; mean 10 mitotic figures/10 HPF but wide range (3-43 mitotic figures/10 HPF); minimal inflammation; occasional vascular invasion; usually no epithelioid cells or marked pleomorphism

Positive stains: smooth muscle actin, desmin, calponin, h-caldesmon

Negative stains: EMA (usually), cytokeratin, S100, HMB45

Differential diagnosis:

- angiomyolipoma - triphasic, may have degenerative changes but no marked atypia, no mitotic activity, positive for melanocytic markers
- leiomyoma - not infiltrative, no atypia, no mitotic figures, no necrosis
- sarcomatoid renal cell carcinoma - more pleomorphic, no alternating fascicles, usually no smooth muscle morphology, usually keratin+ and muscle marker negative

Leukemia - Kidney tumor - adult malignancies chapter

Leukemic infiltrates may cause acute renal failure ([Ann Diagn Pathol 2006;10:230](#))

Case reports: congenital AML with leukemic infiltrates ([J Pediatr Hematol Oncol 2003;25:240](#)), male infant with bilateral renal and orbital involvement ([Pediatr Hematol Oncol 2007;24:141](#)), 42 year old man with ALL and renal failure ([Nat Clin Pract Nephrol 2007;3:106](#)), renal infiltration by CMML ([Arch Pathol Lab Med 2001;125:657](#))

Lymphoma - Kidney tumor - adult malignancies chapter

Less than 1% of renal tumors

Clinical: more often metastatic than primary; usually bilateral, usually B cell; diffuse large cell lymphoma is most common subtype

FNA usually conclusive, but high index of suspicion is important for a correct interpretation ([AJCP 2001;115:18](#))

May occur in transplanted kidney ([Clin Transplant 2008;22:512](#))

Case reports: diffuse large B cell lymphoma/intravascular lymphoma - 72 year old man ([Arch Pathol Lab Med 2003;127:1380](#)); 77 year old woman with coexisting renal cell carcinoma ([Arch Pathol Lab Med 2001;125:1239](#)), with minimal change disease ([Hum Path 1989;20:263](#)), donor origin ([Mod Path 1998;11:99](#)), HIV+ patient ([Arch Pathol Lab Med 1993;117:541](#)), limited to kidney ([Int J Hematol 2009 Mar 26 \[Epub ahead of print\]](#))

intravascular T cell lymphoma - AIDS patient ([Hum Path 2003;34:950](#)), long term renal allograft recipient ([Mod Path 1996;9:671](#)),

MALT lymphoma - 9 year old boy ([Arch Pathol Lab Med 2000;124:1520](#)), low grade #1 in elderly woman ([Arch Pathol Lab Med 2000;124:919](#)), #2 ([Arch Pathol Lab Med 1993;117:780](#)), #3 ([Arch Pathol Lab Med 2006;130:86](#))

other - 19 year old man with B-ALL ([Case of the Week #126](#)), SLL/CLL in renal cyst ([Arch Pathol Lab Med 2005;129:111](#))

Micro: glomeruli and other structures are usually intact

References: [Am J Surg Pathol 1995;19:134](#), [eMedicine](#)

Metanephric / mesonephric adenosarcoma - Kidney tumor - adult malignancies chapter

Very rare, only 2 case reports using this terminology

Case reports: 21 year old woman with metanephric adenoma mixed with a malignant spindle cell component ([Am J Surg Pathol 2001;25:1451](#)); rhabdomyoblastic differentiation ([Am J Surg Pathol 1985;9:610](#))

Myxoma of kidney - Kidney tumor - adult malignancies chapter

Rare; <20 cases reported

Case reports: 36 year old man ([Int J Urol 2007;14:242](#)), 37 year old man with renal capsular tumor ([Path Res Pract 2005;200:835](#))

Gross: well demarcated, gelatinous, intraparenchymal tumor

Micro: abundant myxoid stroma with occasional spindle cells

Positive stains: vimentin

Negative stains: S100, EMA, CAM 5.2, HHF-35, smooth muscle actin

EM: fibroblast-like cells with elaborate cytoplasmic processes

Differential diagnosis:

- fibroepithelial polyp - polypoid, usually in renal pelvis and covered by urothelium
- myxoid sarcoma - spindle cells are more numerous and demonstrative atypia
- myxolipoma - lipomatous component predominates
- renomedullary interstitial cell tumor - fibroblast like cells and collagen; cells contain lipid, but overall appearance is not primarily myxoid

References: [Am J Surg Pathol 1994;18:187](#)

Post-kidney transplant tumors - Kidney tumor - adult malignancies chapter

See also [Lymphomas: non B cell](#) chapter for discussion on post-transplant lymphoproliferative disorders. Tumors can rarely be of donor origin (glioblastoma multiforme-[Hum Path 1993;24:1256](#), lymphoma-[Hum Path 1991;22:1291](#)), but are usually due to immunosuppression

Risk for cancers due to immunosuppression is 1.9; in Italian study, most common are viral related Kaposi's sarcoma and EBV+ non-Hodgkin's lymphoma, with common sites being native kidney, uterus and liver ([Epidemiol Prev 2008;32:205](#)); in Thailand study, most common are urothelial and hepatocellular carcinomas ([Transplant Proc 2008;40:2403](#))

Also increased risk of skin cancers ([Br J Dermatol 2006;154:498](#))

Hodgkin's lymphoma: 2% of post-transplant lymphomas, occur mean 4 years after transplant; usually males; case report at [Arch Pathol Lab Med 2001;125:1480](#); typical staining of Reed-Sternberg cells is CD15+, CD30+, EBER+, negative for B and T cell markers, [micro images](#)

Non-Hodgkin lymphoma: well recognized risk post-transplant, usually EBV associated extranodal B cell lymphomas that respond to reduction of immunosuppressive treatment; EBV promotes proliferation of B cells, which may escape T cell control

Post-transplant lymphoproliferative disorders: plasmacytic and polymorphic B cell hyperplasias are not monoclonal by flow cytometry; most B cell lymphomas or myelomas are clonal by flow cytometry, even if genotypic studies are negative ([AJCP 2002;117:24](#)); Reed-Sternberg-like cells are usually CD20+, EBV+, CD30+ but CD15- ([Hum Path 1997;28:493](#))

Treatment: reduction in immunosuppression usually not sufficient for tumors in general, also need chemotherapy ([Acta Haematol 2008;120:36](#))

Case reports of post kidney transplant tumors, not in kidney: bladder urothelial carcinoma, polyoma virus+ ([Br J Cancer 2008;99:1383](#)), Kaposi's sarcoma in 5 year old boy ([Hum Path 1992;23:956](#)), plasmacytoma in tonsil ([Arch Pathol Lab Med 2004;128:e76](#)), T cell lymphoma ([Am J Surg Pathol 1993;17:1046](#)), T cell lymphoma of vulva ([Am J Surg Pathol 1993;17:842](#))

Sarcoma of kidney - Kidney tumor - adult malignancies chapter

See also [anaplastic sarcoma](#), [angiosarcoma](#), [clear cell sarcoma \(childhood\)](#), [clear cell sarcoma of soft parts](#), [Ewing's sarcoma/PNET](#), [leiomyosarcoma](#), [synovial sarcoma](#)

Sarcomatoid carcinomas or extension of retroperitoneal sarcomas are much more common than primary renal sarcoma, and should be ruled out by looking for epithelial elements and getting a clinical history

Case reports: liposarcoma ([Am J Surg Pathol 1990;14:268](#)), malignant fibrous histiocytoma ([Arch Pathol Lab Med 2000;124:913](#)), osteosarcoma ([Arch Pathol Lab Med 1991;115:1262](#))

Synovial sarcoma of kidney - Kidney tumor - adult malignancies chapter

Previously diagnosed as embryonal sarcoma of kidney

Clinical: usually extremities of young adults, rare in kidney (<50 cases reported)

Case reports: 40 year old woman ([Case of the Week #19](#)), 60 year old man ([Arch Pathol Lab Med 2005;129:238](#))

Gross: large, partially necrotic, soft to rubbery masses, smooth walled cysts in 70%

Micro: usually short, intersecting fascicles of monophasic spindle cells with indistinct cell borders, ovoid nuclei and indistinct nucleoli that infiltrate around non-neoplastic, dilated renal tubules; often foci with hemangiopericytoma-like vascular pattern; cysts lined by hobnail epithelium; rarely rhabdoid ([Am J Surg Pathol 2004;28:634](#)), biphasic (epithelial and spindle cells) or poorly differentiated (sheets of undifferentiated round cells with scant cytoplasm and high grade nuclei); also large cell epithelioid variant, small cell variant and high grade spindle cell variant

Cytology: malignant biphasic tumor (one case) characterized by minimally atypical tubular epithelium, immature spindle cells and foci of coagulative tumor necrosis ([Acta Cytol 2003;47:668](#))

Positive stains: CD56, CD99, vimentin; variable bcl2, calponin and EMA

Negative stains: keratin (usually), S100, CD34, smooth muscle actin, desmin

Molecular: SYT-SSX2 transcript due to t(X;18)(p11.2;q11.2) in >90% of cases

Differential diagnosis:

- Ewing's sarcoma/PNET - neuroendocrine features including rosettes, CD56-, different translocation
- hemangiopericytoma - minimal cellular pleomorphism, staghorn vascular pattern, no/rare mitotic activity, CD34+, no SYT-SSX2
- malignant peripheral nerve sheath tumor - more pleomorphic cells with tapering nuclei, S100+, keratin-, CD99-, no SYT-SSX2
- metastatic sarcoma - clinical history of primary, no SYT-SSX2
- primary retroperitoneal sarcoma - kidney is not primary location, no SYT-SSX2
- sarcomatoid renal cell carcinoma - has primary renal cell carcinoma component, sarcomatoid area is often EMA+, vimentin+, no SYT-SSX2
- solitary fibrous tumor - collagen fibers, hemangiopericytoma-like vascular pattern, CD34+, no SYT-SSX2

References: [Am J Surg Pathol 2000;24:1087](#)

Teratoma of kidney - Kidney tumor - adult malignancies chapter

Rare, may be extension of retroperitoneal teratoma or Wilms' tumor with teratoid features

Case reports: immature teratoma in horseshoe kidney in newborn ([J Pediatr Surg 2006;41:1313](#)), primary carcinoid tumor arising in mature teratoma of kidney #1 ([Arch Pathol Lab Med 2002;126:979](#)), #2 ([Diagn Pathol 2007 May 17;2:15](#))

References: [Radiographics 2005;25:481](#)

Wilms' tumor - adult - Kidney tumor - adult malignancies chapter

Rare, prognosis considered poor in past, but now overall survival is 83% ([J Clin Oncol 2004;22:4500](#))

Past cases may have been PNET/Ewing's, clear cell sarcoma of soft parts or synovial sarcoma ([Am J Surg Pathol 2000;24:1663](#))

Epidemiology: mean 32 years old, range 21-67 years (for patients greater than 18 years old)

Criteria for diagnosis: primary renal neoplasm with primitive blastematos spindle or round cell component, abortive or embryonal tubular or glomeruloid structures (i.e. at least biphasic morphology), no renal cell carcinoma or other histology, age 15 years+

Poor prognostic factors: large size, high mitotic rate ([Mod Path 1990;3:321](#))

Case reports: 48 year old man ([Diagn Pathol 2006 Dec 5;1:46](#)), 50 year old man with teratoid tumor ([Pathol Int 2009;59:44](#)), 62 year old woman ([Arch Pathol Lab Med 2003;127:245](#))

Gross: large (mean 12 cm), nodular, bulging, gray-white

Micro: similar to pediatric Wilms' with varying amounts of blastema, epithelium and stroma (triphasic); many "monophasic Wilms'" are actually PNET/Ewing's; anaplasia is unusual; no persistent renal blastema

Positive stains: cytokeratin, CD56; blastema is rarely CD99+

Negative stains: vimentin, CD99

Molecular: associated with 11p15 (Wilms' tumor suppressor gene product), isochromosome 7q

Differential diagnosis:

- Ewings/PNET - rosettes, no blastema, no epithelial structures, CD99+, FLI1+, 90% have EWS/FLI1 fusion product by RT PCR due to t(11;12)(q24;q22;q12)
- clear cell sarcoma of soft parts (nests or short fascicles of spindle or epithelioid cells with clear to granular eosinophilic cytoplasm separated by fibrous septa; S100+, HMB45+, keratin-, t(12;22)(q13;q12)
- sarcoma NOS - no epithelium (keratin-)

Miscellaneous malignancies

Features to report - Kidney tumor - adult malignancies chapter

Specimen type / laterality

Tumor location(s)

Histologic subtype

Tumor size(s)

Nuclear grade

Invasion of capsule, fat, Gerota's fascia, renal vessels, renal sinus, ureter, other tissue

Margins: Gerota's fascia, renal vessels, ureter

Additional margins for partial nephrectomy: perinephric fat, renal parenchyma, renal capsule

Angiolymphatic invasion

Lymph nodes: location, number obtained, number involved by tumor, size of largest metastasis

Involvement of adrenal gland or other tissues

Other renal disease: diabetic nephropathy and other medical renal disorders are frequently unrecognized ([Am J Surg Pathol 2007;31:1703](#)); also nephrosclerosis ([Arch Pathol Lab Med 2009;133:189](#)); useful to assess risk of progressive renal failure post-nephrectomy ([Am J Surg Pathol 2006;30:575](#))

There are several possible "capsules" - fibrosis over tumor, actual renal capsule (missing in hilar region) and Gerota's fascia (covers perirenal adipose tissue)

Frozen sections / intraoperative consultations - Kidney tumor - adult malignancies chapter

Indications: assess surgical margins ([Urology 2006;67:923](#)), also possibly in partial nephrectomy margins ([Scand J Urol Nephrol 2005;39:222](#) but see [J Urol 2005;173:385](#)), solid renal mass in unusual setting,

synchronous renal and extrarenal masses, cystic renal lesions, multiple renal masses, solid mass in diffusely cystic kidney

However, no consensus exists ([J Urol 2008;179:461](#))

Cystic and spindle cell tumors are often misdiagnosed

Clear cell renal cell carcinoma is often confused with inflammatory lesions

References: [Arch Pathol Lab Med 2005;129:1585](#)

Grossing - Kidney tumor - adult malignancies chapter

Ink surface opposite tumor before sectioning, which causes capsular retraction

Measure and weigh kidney (important for some clinical trials)

Check renal vein for thrombus (submit in separate block)

Bivalve kidney

In adults only, remove perirenal fat (Gerota's fascia) by blunt dissection, except over tumor

Submit fresh tissue for special studies (cytogenetics, flow cytometry, EM)

Optional: weigh kidney without perirenal fat

Make parallel cuts in sagittal plane; refrigerated fixation is recommended for better sections

Sections: 1 of tumor per cm of tumor diameter, include all areas with different colors, especially white/grey; sample all tumor nodules; also tumor and adjacent kidney, capsule, Gerota's fascia, renal sinus ([Am J Surg Pathol 2007;31:1089](#), [Am J Surg Pathol 2004;28:1594](#)), other adjacent tissue, surgical margins; tumor thrombi, other kidney lesions, normal kidney, renal pelvis, renal artery and vein, ureter margin, lymph nodes, adrenal gland

For Wilms' tumor of childhood, take sections through renal pelvis/sinus and include medial sinus margin (medial end of soft tissues surrounding renal artery and vein), junction between normal kidney and tumor, tumor capsule and uninvolved kidney; document where sections are taken on a diagram; snap freeze tumor and normal kidney for molecular studies

Kidney morcellation: fragmentation of kidney and associated tumors due to laparoscopic nephrectomy
Suggested sampling is influenced by radiologic features, probably should sample 5% of specimen including grossly visible tumor; staging is severely limited ([Am J Surg Pathol 2001;25:1158](#))

Staging - Kidney tumor - adult malignancies chapter

Excludes sarcomas, adenomas and tumors of renal pelvis/ureter (see Bladder outline), Wilms' tumor of childhood

TNM classification (AJCC, 6th Edition)

Primary tumor (pT) - Kidney tumor - adult malignancies chapter

pTX: primary tumor cannot be assessed

pT0: no evidence of primary tumor

pT1: tumor 7 cm or less, limited to kidney

pT1a: tumor 4 cm or less, limited to kidney

pT1b: tumor more than 4 cm, not greater than 7 cm, limited to kidney

pT2: tumor more than 7 cm, limited to kidney

pT3: tumor extends into major veins or invades adrenal gland or perinephric tissue, but not beyond Gerota's fascia

pT3a: tumor directly invades adrenal gland, perirenal fat or renal sinus fat, but not beyond Gerota's fascia

pT3b: tumor grossly extends into renal vein or its segmental (muscle containing) branches, or vena cava below diaphragm

pT3c: tumor grossly extends into vena cava above diaphragm or invades wall of vena cava

pT4: tumor invades beyond Gerota's fascia

Notes:

(a) for pT3b tumors, nodules within renal sinus fat usually represent renal involvement ([Mod Pathol 2007;20:44](#))

(b) breakpoint at 5.5 cm instead of 7 cm for pT1 versus pT2 is recommended ([Cancer 2005;104:2116](#))

Regional lymph nodes (pN) [not affected by laterality] - Kidney tumor - adult malignancies chapter

pNX: regional lymph nodes cannot be assessed

pN0: no regional lymph node metastases

pN1: metastases in a single regional lymph node

pN2: metastases in 2 or more regional lymph nodes

Note: if a lymph node dissection is performed, pathologic examination should include 8+ nodes

Distant metastasis (M) - Kidney tumor - adult malignancies chapter

MX: distant metastasis cannot be assessed

M0: no distant metastasis

M1: distant metastasis

Stage grouping - Kidney tumor - adult malignancies chapter

I: T1N0M0

II: T2N0M0

III: T1-T2, N1M0 or T3 N0-N1, M0

IV: T4 N1-N2, M0 or any T, N2 M0 or any T, any N, M1

Robson classification- Kidney tumor - adult malignancies chapter

I: Within renal capsule

II: Infiltrates perinephric fat or adrenal gland but within Gerota's fascia

IIIA: gross renal vein or inferior vena cava involvement (only large veins with smooth muscle in wall, and outside or at edge of main tumor)

IIIB: regional lymph nodes

IIIC: angiolymphatic invasion

IV: invades beyond Gerota's fascia (thin fibrous membrane separating kidney and perinephric adipose tissue from retroperitoneum)

IV A: adjacent organs other than ipsilateral adrenal gland

IV B: distant metastases

Templates: [Michigan Cancer Consortium](#)

References: [J Urol 1969;101:297](#)

Nuclear grading (Fuhrman) - Kidney tumor - adult malignancies chapter

Based on most malignant features in one high power field ([Am J Surg Pathol 1982;6:655](#))

Note: every cell need not show the criteria, but if most cells in one high power field show a higher grade, that grade should be used

1 - small, round, uniform nuclei (10 microns), inconspicuous nucleoli, look like lymphocytes (may not exist)

2 - slightly irregular nuclei, see nucleoli at 40x only, nuclear diameter 15 microns, open chromatin [40% of tumors]

3 - see nucleoli at 10x, nuclei very irregular, diameter 20 microns, open chromatin [30-40% of tumors]

4 - mitoses, bizarre, multilobated, pleomorphic cells plus grade 3 features, macronucleoli [15% of tumors]

Moderate intra- and interobserver agreement is improved to substantial agreement if collapse to 2 categories of grades 1/2 and 3/4 ([Arch Pathol Lab Med 2003;127:593](#), [Cancer 2005;103:625](#))

May not have prognostic significance for chromophobe carcinomas ([Am J Surg Pathol 2007;31:957](#))

One study regarding papillary carcinoma recommends assessing nucleolar prominence based upon high power field with greatest nuclear pleomorphism ([Am J Surg Pathol 2006;30:1091](#))

Additional References: [Cancer 2005;103:68](#)

End of Kidney tumor chapter - adult malignancies

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