IMMUNOPROFILES OF THE MAJOR RENAL NEOPLASMS (%staining)										
Stain	**Clear Cell RCC**	**Papillary RCC**	**Chromophobe RCC**	**Collecting Duct Carcinom**	**Sarcomatoid RCC**	**Xp11 Translocation RCC**	**MTSCC**	**Tubulocystic RCC**	**Urothelial Carcinoma**	**Oncocytoma**
CK7	± (0-37)	+ (80-87)	+ (73-86)	+ (83)	N/A	+ (17)	+ (79-100)	+ (62-91)	+ (92)	**± (0-10)**
CK8	+ (40)	+ (87)	+ (53)	+ (83)	N/A	N/A	-	+ (100)	+ (100)	**+ (100)**
CK18	+ (100)	+ (100)	+ (100)	+ (100)	N/A	N/A	+ (100)	+ (100)	+ (83)	**+ (100)**
CK20	-	-	-	-	N/A	N/A	-	-	+ (25-68)	**-**
HMW CKs	± (0-13)	+ (33)	-	+ (29-67)	N/A	N/A	+ (15-33)	± (0-67)	+ (100)	**+ (10)**
CK5/6	-	-	-	+ (17)	N/A		-	-	+ (75)	**-**
AE1/AE3 CKs	+ (35)	+ (82)	+ (16)	N/A	N/A	+ (0-25)	+ (83)	N/A	+ (100)	**+ (16)**
Vimentin	+ (87)	+ (100)	-	+ (100)	N/A	+ (65-70)	+ (55-100)	+ (55)	+ (33)	**-**
AMACR	+ (4-68)	+ (80-100)	± (0-29)	± (0-18)	N/A	+ (100)	+ (92-100)	+ (77-100)	+ (20)	**+ (2-25)**
Carbonic anhydrase IX	+ (100)	+ (57)	-	+ (40-100)	N/A	+ (40)	-	+ (42)	+ (100)	**-**
PAX2	+ (92)	+ (87)	± (0-83)	± (0-100)	-	± (0-100)	+ (75-100)	+ (37-42)	-	**+ (88-100)**
PAX8	+ (98)	+ (87)	+ (83)	+ (100)	+ (28)	+ (100)	+ (100)	+ (100)	± (0-8)	**+ (87-95)**
RCC marker	+ (72-85)	+ (87-95)	+ (0-91)	-	+ (0-22)	+ (100)	+ (7-92)	+ (100)	-	**-**
CD10	+(94-100)	+ (67-93)	± (0-72)	+ (25)	N/A	+ (100)	+ (9-50)	+ (33-100)	+ (50)	**+ (12-58)**
E-cadherin	± (0-14)	+ (13-31)	+ (100)	+ (75)	N/A	+ (66)	+ (93)	N/A	+ (76-100)	**+ (47-100)**
Kidney-specific	± (0-30)	± (0-29)	+ (86-100)	-	N/A	+ (66)	-	+ (71)	-	**+ (75-95)**
Parvalbumin	± (0-8)	± (0-31)	+ (80-100)	N/A	N/A	N/A	N/A	N/A	N/A	**+ (47-100)**
Claudin-7	-	+ (28-35)	+ (67-95)	N/A	N/A	N/A	N/A	N/A	N/A	**+ (23-73)**
Claudin-8	N/A	N/A	+ (27)	N/A	N/A	N/A	N/A	N/A	N/A	**+ (88)**
S100A1	+ (57-73)	+ (62-94)	± (0-26)	N/A	N/A	N/A	N/A	N/A	N/A	**+ (93)**
CD82	± (2-23)	-	+ (78-87)	N/A	N/A	N/A	N/A	N/A	N/A	**± (0-7)**
CD117	± (0-5)	± (0-13)	+ (82-100)	± (0-53)	± (4-95)	N/A	N//A	N/A	+ (4-30)	**+ (58-100)**
TFE3	-	-	-	-	-	+ (87)	-	-	-	**-**
Thrombomodulin	-	N/A	N/A	N/A	-	N/A	N/A	N/A	+ (49-100)	**N/A**
Uroplakin III	0/32 RCCs	-	-	N/A	N/A	N/A	N/A	N/A	+ (33-100)	**N/A**
p63	-	-	-	+ (0-14)	-	N/A	N/A	N/A	+ (81-100)	**N/A**
S100P	-	-	-	-	-	N/A	N/A	N/A	+ (71-96)	**N/A**
HMB-45	N/A	N/A	N/A	N/A	N/A	+ (46)	N/A	N/A	N/A	**N/A**
Melan-A	N/A	N/A	N/A	N/A	N/A	+ (89)	N/A	N/A	N/A	**N/A**
Reference: Truong LD, Shen SS. Immunohistochemical diagnosis of renal neoplasms. Arch Pathol Lab Med. 2011 Jan;135(1):92-109.										

Comparison of Metastatic and Primary Renal Cell Carcinomas (RCC)

	Metastasis		Primary	
Stain	**Positive cases%**	**Staining Extent**	**Positive cases %**	**Staining extent**
PAX2	74	61% of tumour cells (mean)	85	50% of tumour cells (mean)
RCC marker	35-46	46% of tumour cells (mean) >50% of tumour cells stained in 17% of cases	85	>50% of tumour cells stained in 72% of cases
Kidney-specific cadherin	2[a]	Rare cells	34[b]	>50% of tumour cells stained in 64% of cases
PAX8	Similar to PAX2	Similar to PAX2	Similar to PAX2	Similar to PAX2
CD10	100[c]	>50% tumour cells stained in 86% of cases	86	>50% of tumour cells stained in 73% of cases
Parvalbumin	10[d]	Most cells	27[e]	60%-100% of tumour cells
AMACR	82[f]	>50% of tumour cells stained in 60% of cases	70	Diffuse staining in most cases
AMACR	100[g]	Most cells	35[h]	>90% of cells

[a] These were metastatic clear cell RCCs; metastatic chromophobe RCC was not present
[b] Most of these cases are chromophobe RCC
[c] Only clear cell RCCs were included
[d] Of 10 metastatic RCCs, 1 was positive (10%) and it was a metastatic chromophobe RCC
[e] Most positive cases were chromophobe RCC
[f] Of 28 metastatic RCCs, 23 were positive (82%), and all 28 cases (100%) were clear cell RCCs
[g] Of 6 cases, all 6 (100%) were papillary metastatic RCC
[h] There were 35 primary papillary RCCs included, and all of them (100%) were positive

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Chromophobe vs Oncocytoma

ANTIBODY	CHROMOPHOBE	ONCOCYTOMA
DIFFUSE CK7	65%	RARE
FOCAL CK7	35%	79%
CD15	NEG	63%
CK20	NEG	53%
CD117	MOST	MOST
RCC	45%	<5%
CD82	78%	RARE
AMACR	36%	>90%
PAX 2	6%	>90%

Ref: Prof S Fleming

Immunoprofiles of "Small Round Cell Tumour" of the Kidney

	CK	LCA	S100	WT1	Vim	Des	CD99	CD56	Chro	Synp
Nephroblastoma (Wilms tumour)	+	-	-	+	+	+	-	+	-	-
Ewing sarcoma/PNET	Variable	-	-	-	+	-	+	-	-	-
Synovial sarcoma, poorly Differentiated	Variable	-	Usually -	-	+	-	+	+	-	-
Lymphoma	-	+	-	-	+	-	-	-	-	-
Small cell carcinoma	+	-	-	-	-	-	-	+	Variable	Variable
Metanephric tumour	+	-	-	+	+	-	-	-	-	-
Congenital mesoblastic nephroma, cellular	-	-	-	-	+	Variable	-	-	-	-
Rhabdoid tumour	Variable	-	-	-	+	-	-	-	-	-
Clear cell sarcoma	-	-	-	-	+	-	-	-	-	-

REFERENCE: Truong LD, Shen SS. Immunohistochemical diagnosis of renal neoplasms. Arch Pathol Lab Med. 2011 Jan;135(1):92-109.

ISUP recommended immunopanels[Ψ]

Tumours comprised predominantly of "Clear" Cells

Tumour type	CA IX	CK7	CD117	Cathepsin-K*	HMB 45
Clear cell RCC	Positive (diffuse memebranous)	Negative	Negative	Negative	Negative
Clear cell PRCC	Positive (cup like)	Positive	Negative	Negative	Negative
Chromophobe RCC	Negative	Positive (cytoplasmic)	Positive (membranous)	Negative	Negative
Epithelioid AML	Negative	Negative	Negative	Positive (cytoplasmic)	Positive (cytoplasmic)
MiTF-TFE tumours					
Xp11 family	Variable but focal	Negative	Variable	Positive 50% (cytoplasmic)	Negative
t(6;11)	Variable but focal	Negative	Negative	Positive (cytoplasmic)	Positive (always focal)

*Cathepsin K more sensitive than Melan A or HMB45 which have similar staining pattern.

Tumours with a significant papillary component

Tumour type	CA IX	CK7	AMACR	Cathepsin-K**	34βE12	TFE3/TFEB
ccRCC with papillary growth	Positive (membranous)	Negative	Negative	Negative	Negative	Negative
PRCC "type 1"	Negative	Positive	Positive	Negative	Negative	Negative
PRCC "type 2"	Negative	+/- Positive	Positive	Negative	Negative	Negative
Clear cell PRCC	Positive (cup-shaped)	Positive (diffuse)	Negative	Negative	Positive	Negative
MiTF-TFE tumours	Variable but focal	Negative	Positive	Positive (50%)	Negative	Positive*

*Antibodies are difficult to standardise on automated platforms – FISH assays more reliable.
**Cathepsin K more sensitive than Melan A or HMB45 which have similar staining pattern.

Solid PRCC vs Metanephric adenoma vs Wilms tumour

Tumour type	CK7	AMACR	WT-1	CD57
Solid PRCC	Positive	positive	Negative	Negative
Metanephric adenoma	Negative or isolated cells	Negative	Positive (nuclear)	
Wilms tumour	Negative or isolated cells	Negative	Positive (nuclear)	Negative

[Ψ] Reuter VE, et al. Best practices recommendations in the application of immunohistochemistry in the kidney tumors: report from the International Society of Urologic Pathology consensus conference.Am J Surg Pathol. 2014 Aug;38(8):e35-49.

Tumours with Oncocytic features

Tumour type	CD117	CK7	Ksp-cadherin	HMB-45	Cathepsin-K*
Oncocytoma	Positive (membranous)	Negative	Positive	Negative	Negative
Chromophobe RCC eosinophilic	Positive (membranous)	Positive (but variable)	+/- Positive	Negative	Negative
Oncocytic PRCC	Negative	Positive (but focal)	Not known	Negative	Not known
Oncocytic AML	Negative	Negative	Negative	Positive (focal)	Negative

Other antibodies: S100A1 – expressed by oncocytoma but not chromophobe RCC.
Hales colloidal iron – cytoplasmic granular in chromophobe, negative in oncocytoma
*Cathepsin K more sensitive than Melan A or HMB45 which have similar staining pattern.

Tumours with a predominant sarcomatoid pattern of growth[1]

Tumour type	Vimentin[2]	CA IX[3]	PAX 8	CK7	34βE12	GATA3	p63
ccRCC	Positive	Positive (membranous)	Positive	Negative	Negative	Negative	Negative
PRCC	Positive	Negative	Positive	Focal or Negative	Negative	Negative	Negative
Chromophobe RCC	Positive	Negative	Positive	Positive	Negative	Negative	Negative
MTSC	Positive	Negative	Positive	Positive	Variable	Negative	Negative
Urothelial Ca	Positive	+/- Negative	Negative[4]	Positive	Positive	Positive	Positive
Sarcoma	Positive	Negative	Negative	Negative	Negative	Negative	Negative

[1]Stains should be performed in the better differentiated areas,
[2]In sarcomatoid areas,
[3]positive adjacent to necrosis or focal cytoplasmic in high grade areas of various tumours.
[4]Positive in up to 20% of upper tract Urothelial Ca.

"Distal Nephron-like" Carcinoma

Tumour type	INI-1/BAF47	OCT4	GATA 3	PAX 8
Collecting duct Ca	Retained[1]	Negative	Negative	Positive
Medullary Ca	Lost	Positive[2]	Negative	Positive
Urothelial Ca	Retained	Negative	Positive	Negative[3]

[1]One study reports 15% of CDC with INI-1 loss
[2]Unpublished data
[3]20% positive