

Renal Biopsy for Tumour Histopathology Reporting Guide

Family/Last name

Date of birth

DD – MM – YYYY

Given name(s)

Patient identifiers

Date of request

DD – MM – YYYY

Accession/Laboratory number

Elements in **black text** are **CORE**. Elements in **grey text** are **NON-CORE**.
☐ indicates multi-select values ☐ indicates single select values

SCOPE OF THIS DATASET

OPERATIVE PROCEDURE (Note 1)

- ☐ Needle biopsy
☐ Incisional biopsy, wedge
☐ Other, *specify*

SPECIMEN LATERALITY (Note 2)

- ☐ Not specified
☐ Left
☐ Right
☐ Other (e.g., horseshoe kidney), *specify*

TUMOUR SITE (select all that apply) (Note 3)

- ☐ Upper pole
☐ Mid kidney
☐ Lower pole
☐ Cortex
☐ Medulla
☐ Other, *specify*

BLOCK IDENTIFICATION KEY (Note 4)

(List overleaf or separately with an indication of the nature and origin of all tissue blocks)

HISTOLOGICAL TUMOUR TYPE^a (select all that apply) (Note 5)

(Value list based on the World Health Organization Classification of Urinary and Male Genital Tumours (2022))

- ☐ Clear cell renal cell carcinoma
☐ Papillary renal cell carcinoma
☐ Chromophobe cell renal carcinoma
☐ Other oncocytic tumours of the kidney
☐ Collecting duct carcinoma
☐ Clear cell papillary renal cell tumour
☐ Mucinous tubular and spindle cell carcinoma
☐ Tubulocystic renal cell carcinoma
☐ Acquired cystic disease-associated renal cell carcinoma
☐ Eosinophilic solid and cystic renal cell carcinoma
☐ Renal cell carcinoma, not otherwise specified (NOS)
☐ *TFE3*-rearranged renal cell carcinomas
☐ *TFEB*-altered renal cell carcinomas
☐ *ELOC* (formerly *TCEB1*)-mutated renal cell carcinoma
☐ Fumarate hydratase-deficient renal cell carcinoma
☐ Hereditary leiomyomatosis and renal cell carcinoma (HLRCC) syndrome-associated renal cell carcinoma
☐ Succinate dehydrogenase-deficient renal cell carcinoma
☐ *ALK*-rearranged renal cell carcinomas
☐ *SMARCB1*-deficient renal medullary carcinoma
☐ Other,^b *specify*

Comments

^a Occasionally more than one histologic type of carcinoma occurs within the same kidney specimen. Each tumour type should be separately recorded.

^b This would apply to cases that are pending additional studies to identify molecularly defined subtypes.

PROVISIONAL HISTOLOGICAL TUMOUR GRADE^c (Note 6)
(WHO/ISUP)

- ☐ Not applicable^d
- ☐ Cannot be assessed
- ☐ Grade 1 - Nucleoli absent or inconspicuous and basophilic at 400x magnification
- ☐ Grade 2 - Nucleoli conspicuous and eosinophilic at 400x magnification, visible but not prominent at 100x magnification
- ☐ Grade 3 - Nucleoli conspicuous and eosinophilic at 100x magnification
- ☐ Grade 4 - Extreme nuclear pleomorphism and/or multi nuclear giant cells and/or rhabdoid and/or sarcomatoid differentiation

^c Histologic grading is provisional in biopsy because it can change in the nephrectomy specimen due to frequent heterogeneity in renal cancer.

^d For further information see Note 6.

SARCOMATOID FEATURES (Note 7)

- ☐ Not identified
- ☐ Present

RHABDOID FEATURES (Note 8)

- ☐ Not identified
- ☐ Present

NECROSIS^e (Note 9)

- ☐ Indeterminate
- ☐ Not identified
- ☐ Present

^e Core element for clear cell renal cell carcinoma and chromophobe renal cell carcinoma only; in all other cases it is non-core.

COEXISTING PATHOLOGY IN NON-NEOPLASTIC KIDNEY
(Note 10)

- ☐ Not identified
- ☐ Present, *specify*

ANCILLARY STUDIES (Note 11)

- ☐ Not performed
- ☐ Performed (select all that apply)
- ☐ Immunohistochemistry, *specify test(s) and result(s)*

- ☐ Molecular findings, *specify test(s) and result(s)*

- ☐ Other, *record test(s), methodology and result(s)*

Representative blocks for ancillary studies, specify those blocks best representing tumour and/or normal tissue for further study

Definitions

CORE elements

CORE elements are those which are essential for the clinical management, staging or prognosis of the cancer. These elements will either have evidentiary support at Level III-2 or above (based on prognostic factors in the National Health and Medical Research Council (NHMRC) levels of evidence¹). In rare circumstances, where level III-2 evidence is not available an element may be made a CORE element where there is unanimous agreement by the Dataset Authoring Committee (DAC).

Molecular and immunohistochemical testing is a growing feature of cancer reporting. However, in many parts of the world this type of testing is limited by the available resources. In order to encourage the global adoption of ancillary tests for patient benefit, International Collaboration on Cancer Reporting (ICCR) includes the most relevant ancillary testing in ICCR Datasets as CORE elements, especially when they are necessary for the diagnosis. Where the technical capability does not yet exist, laboratories may consider temporarily using these data elements as NON-CORE items.

The summation of all CORE elements is considered to be the minimum reporting standard for a specific cancer.

NON-CORE elements

NON-CORE elements are those which are unanimously agreed should be included in the dataset but are not supported by level III-2 evidence. These elements may be clinically important and recommended as good practice but are not yet validated or regularly used in patient management.

Key information other than that which is essential for clinical management, staging or prognosis of the cancer such as macroscopic observations and interpretation, which are fundamental to the histological diagnosis and conclusion e.g., macroscopic tumour details, may be included as either CORE or NON-CORE elements by consensus of the DAC.

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Scope

The dataset has been developed for biopsy specimens for neoplasms of renal tubular origin. Excision specimens are not included – a separate ICCR dataset is available and should be used for these cases.²

Urothelial carcinoma arising from the upper renal tract, Wilms tumours and other nephroblastic and mesenchymal tumours are not included. Metastatic tumours are excluded from this dataset. This dataset is not to be used for clearly benign tumours, such as papillary adenoma and oncocytoma. However other neoplasms of uncertain behaviour (e.g., clear cell papillary tumours, other oncocytic tumours) may be reported using this dataset.

This dataset is designed for the reporting of a single laterality of specimen i.e., left or right. If both lateralitys are submitted then separate datasets should be completed.

The second edition of this dataset includes changes to align the dataset with the World Health Organization (WHO) Classification of Tumours, Urinary and Male Genital Tumours, 5th edition, 2022.³ The ICCR dataset includes 5th edition Corrigenda, July 2024.⁴

In development of this dataset, the DAC considered evidence up until January 2025.

A list of changes in this dataset edition can be accessed [here](#).

The authors of this dataset can be accessed [here](#).

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Note 1 – Operative procedure (Non-core)

Renal mass biopsies are most commonly obtained via core needle approach under imaging guidance in current practice. Less commonly, wedge biopsy may be performed, such as when an incidental lesion is found during kidney collection for possible organ transplantation.

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Note 2 – Specimen laterality (Core)

Specimen laterality information is important for correlation with clinical and imaging findings, as well as quality assurance and patient safety purposes.

Although patients may have more than one tumour, it is uncommon for multiple tumours to be biopsied at once. Often biopsy would target the largest or more clinically worrisome tumour. A rare scenario in which multiple tumours may be sampled is in presumed von Hippel Lindau syndrome patients. If, for example, more than one tumour is being monitored for growth rate, both may be sampled as part of the same procedure.

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Note 3 – Tumour site (Non-core)

If provided by the submitting physician, the tumour site within the kidney should be noted. However, this information is not always given.

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Note 4 – Block identification key (Non-core)

The origin/designation of all tissue blocks should be recorded. In the biopsy setting, the tissue is typically small, such that it can be submitted entirely in one or two tissue blocks without any dissection.

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Note 5 – Histological tumour type (Core and Non-core)

Histologic diagnosis of renal epithelial neoplasms is based on the 2022 WHO Classification of Urinary and Male Genital Tumours, 5th edition (Table 1).³ The ICCR dataset includes 5th edition Corrigenda, July 2024.⁴ Occasionally more than one histologic type of carcinoma occurs within the same kidney specimen. Each tumour type should be separately recorded. Benign tumours, such as oncocytoma and papillary adenoma, are not included in the scope of this dataset. Multilocular cystic renal neoplasm of low malignant potential cannot be diagnosed in a biopsy setting. It is currently uncertain whether outright diagnosis of clear cell papillary renal cell tumour can be made in a biopsy specimen, or if this should be handled like an oncocytic neoplasm, with a comment indicating that the features are in keeping with clear cell papillary renal cell tumour; however, definitive diagnosis in a biopsy specimen is controversial.

Histologic tumour type has several important clinical implications, including for prognosis, treatment, likelihood of tumour multifocality, and implications of hereditary syndromes. Clear cell renal cell carcinoma (RCC) is the most common subtype and generally considered to have a higher risk of metastasis than the other common subtypes, such as papillary and chromophobe RCC.⁵ Much of the treatment guidelines for metastatic renal cancer are centred around clear cell RCC, with most other renal cancers being considered as 'non-clear cell' for treatment purposes.⁶ Clear cell papillary renal cell tumour, formerly known as clear cell papillary RCC,⁷ is an example of a tumour type that closely resembles clear cell RCC, yet is associated with highly favourable behaviour, such that it has been relabelled as a neoplasm rather than carcinoma in the latest WHO Classification.³ Although these tumours may mimic clear cell RCC, almost no aggressive behaviour has been described. However, they have a relatively high rate of multifocality in both end-stage and non-end-stage kidneys.⁸ Similarly, papillary RCC is more prone to multifocality than clear cell RCC. If tumour size is not known and the capsule is not visible in grade 1/2 papillary neoplasms, the diagnosis of papillary adenoma versus papillary RCC is not feasible in a biopsy specimen. In this instance, a diagnosis of 'papillary renal cell neoplasm' may be used, with a comment that distinction of adenoma from RCC depends on tumour size, grade, and encapsulation, which cannot be fully assessed in a biopsy specimen. Other tumour histologies on the basis of their diagnosis have a strong implication for hereditary syndromes, such as fumarate hydratase (FH)-deficient RCC and succinate dehydrogenase (SDH)-deficient RCC,⁹⁻¹³ implying a need for close surveillance of the patient and family members for development of subsequent tumours. Additionally, some tumour types are particularly aggressive, such as FH-deficient RCC, SMARCB1-deficient renal medullary carcinoma, RCC with *TFEB* amplification, and others,⁹⁻¹¹ which might necessitate different therapy in the metastatic setting than clear cell and other non-clear cell RCCs.

A group of emerging types of oncocytic renal tumours has recently been recognised, including eosinophilic solid and cystic RCC, low grade oncocytic tumour, and eosinophilic vacuolated tumour.¹¹ These appear to have recognisable differences in histology and immunohistochemistry, although they share similarities in molecular alterations involving the *TSC1/TSC2/MTOR* genes. Like the paradigm of clear cell RCC, these appear to have hereditary forms (associated with tuberous sclerosis complex) and sporadic forms (with mutations of the same genes). It remains to be determined whether these necessitate different clinical management, particularly in the case of low grade oncocytic tumour and eosinophilic vacuolated tumour, from the closest histologic mimic, chromophobe RCC. Eosinophilic solid and cystic RCC has been included as a distinct entity in the WHO Classification,¹⁴ whereas the others in this group would currently fall under the category of 'other oncocytic tumours of the kidney'.¹⁵ In some instances, oncocytic tumours cannot be reliably diagnosed on a biopsy because of tumour heterogeneity. In this situation, comment should be made on the report. For tumours that are judged to be of renal cell origin but which cannot be definitively placed into a specific category, due to either unusual morphology, mixed morphology of more than one entity, pure sarcomatoid pattern without a recognisable originating tumour histology, or other reasons, the category of RCC, not otherwise specified (NOS) can be used. Given that there are an increasing number of molecularly defined renal carcinomas and many laboratories may not have rapid access to the necessary immunohistochemical or molecular techniques to verify these diagnoses, it is reasonable to use the category 'other' and specify RCC, pending additional studies for subtype.

Table 1: World Health Organization classification of renal epithelial neoplasms.³

Descriptor	ICD-O codes ^a
<i>Clear cell renal tumours</i>	
Clear cell renal cell carcinoma	8310/3
Multilocular cystic renal neoplasm of low malignant potential	8316/1
<i>Papillary renal tumours</i>	
Papillary adenoma	8260/0
Papillary renal cell carcinoma†	8260/3
<i>Oncocytic and chromophobe renal tumours</i>	
Oncocytoma	8290/0
Chromophobe cell renal carcinoma	8317/3
Other oncocytic tumours of the kidney	
<i>Collecting duct tumours</i>	
Collecting duct carcinoma	8319/3
<i>Other renal tumours</i>	
Clear cell papillary renal cell tumour†	8323/1
Mucinous tubular and spindle cell carcinoma	8480/3
Tubulocystic renal cell carcinoma	8316/3
Acquired cystic disease–associated renal cell carcinoma	8316/3
Eosinophilic solid and cystic renal cell carcinoma	8311/3
Renal cell carcinoma, not otherwise specified (NOS)	8312/3
<i>Molecularly defined renal carcinomas</i>	
TFE3-rearranged renal cell carcinoma	8311/3
TFEB-altered renal cell carcinoma	8311/3
ELOC (formerly TCEB1)-mutated renal cell carcinoma	8311/3
Fumarate hydratase–deficient renal cell carcinoma	8311/3
Hereditary leiomyomatosis and renal cell carcinoma (HLRCC) syndrome–associated renal cell carcinoma	8311/3
Succinate dehydrogenase–deficient renal cell carcinoma	8311/3
ALK-rearranged renal cell carcinoma	
SMARCB1-deficient renal medullary carcinoma	8510/3

^a These morphology codes are from the International Classification of Diseases for Oncology, third Edition, second revision (ICD-O-3.2).¹⁶ Behaviour is coded /0 for benign tumours; /1 for unspecified, borderline, or uncertain behaviour; /2 for carcinoma in situ and grade III intraepithelial neoplasia; /3 for malignant tumours, primary site; and /6 for malignant tumours, metastatic site. Behaviour code /6 is not generally used by cancer registries. Subtype labels are indented. Incorporates all relevant changes from the 5th edition Corrigenda, July 2024.⁴

† Labels marked with a dagger constitute a change in terminology of a previous code.

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Note 6 – Provisional histological tumour grade (WHO/ISUP) (Core)

In the biopsy setting, histologic grading is not final, but provisional because it can change in the nephrectomy specimen due to frequent heterogeneity in renal cancer. Histologic grade of renal cancer is best validated in clear cell RCC and papillary RCC.^{17,18} The currently accepted WHO/International Society of Urological Pathology (ISUP) grading system^{19,20} utilises nucleolar prominence, rather than the multiple nuclear parameters of the prior Fuhrman grading system. Nucleoli visible/prominent at 10x objective magnification define grade 3, whereas nucleoli that are prominent only at higher magnification warrant grade 2. If nucleoli are inconspicuous/absent even at high magnification (40x), this warrants nuclear grade 1. Grade 4 includes sarcomatoid or rhabdoid features, as well as bizarre multilobate nuclei. There is no consensus on the area of higher-grade tumour required to assign said grade. Some studies have used an entire high-magnification field as the threshold.²¹

The WHO/ISUP grading system^{19,20} is relevant to clear cell and papillary RCC; however, less data exist for other tumour types.²² For chromophobe RCC, some alternative grading systems have been proposed, considering that these tumours typically have variable nuclei, yet they are classically favourable. However, no validated grading system for chromophobe carcinoma is currently available, and it is typically appropriate to indicate that grade is 'not applicable' for this tumour type, unless an alternate grade is required by institutional protocols or clinical trials. The 2022 WHO Classification notes that grade may not be useful for *TFE3* rearranged RCC, and may be misleading for tumours such as tubulocystic RCC, acquired cystic kidney disease-associated RCC, eosinophilic solid and cystic RCC, and eosinophilic vacuolated tumour, which have prominent nucleoli despite usually favourable behaviour.¹⁹ In these scenarios, there is no universal agreement as to whether a descriptive grade should be provided, despite the lack of prognostic value, or if 'not applicable' should be used.

Tumours such as collecting duct carcinoma, SMARCB1-deficient renal medullary carcinoma, and FH-deficient RCC are typically considered inherently aggressive, and thus should be considered aggressive independent of grade.¹⁹ In other histologic subtypes of RCC, it is reasonable to provide a grade, with the caveat that grading has not been validated in tumour subtypes other than clear cell and papillary RCC. Indicating that grade 'cannot be determined' should be rarely chosen, as it is unlikely that a tumour can be diagnosed as RCC but grade cannot be assessed. One scenario might be if there is no viable tumour post-treatment, but the tumour was thought to be, or proven to be, a RCC pre-treatment.²³

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Note 7 – Sarcomatoid features (Core)

The term sarcomatoid features is synonymous with sarcomatoid changes, morphology and (de) differentiation. Sarcomatoid features should be noted in the pathology report if identified. This change can be present with any RCC subtype,^{10,24} and is thought to be not a unique subtype but a form of de-differentiation in a high grade disease.^{10,24,25} The presence of sarcomatoid features warrants a WHO/ISUP grade 4 diagnosis in the clear cell RCC and papillary RCC (the types that generally conform to conventional WHO/ISUP grading).^{10,24} If the underlying RCC subtype is identified in the lower grade areas, then it should be labelled as the specific RCC subtype with sarcomatoid differentiation. If the tumour is composed entirely of sarcomatoid morphology and the workup confirms a tumour of renal epithelial origin then it can be diagnosed as a RCC, NOS with sarcomatoid features. Sarcomatoid change constitutes a very aggressive RCC disease with most tumours being stage IV disease upon diagnosis,^{24,26} and these tumours are associated with a significantly increased risk of death.²⁷ Recent evidence has shown that RCCs with sarcomatoid change often benefit significantly from immune checkpoint therapy.^{10,24,28-30} These dedifferentiated tumours also commonly overexpress PD-L1, and have increased immune infiltrates in the tumour microenvironment.^{28,30}

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Note 8 – Rhabdoid features (Core)

The term rhabdoid features, similar to sarcomatoid features, is synonymous with rhabdoid change(s), morphology, and (de)differentiation. Rhabdoid features, similar to sarcomatoid change is regarded as a sign of de-differentiation of high grade tumours and is associated with poor disease outcome.^{28,31} Rhabdoid and sarcomatoid morphologies are often present in the same tumours.³¹ Rhabdoid differentiation can also be associated with any RCC subtype, but it is more commonly associated with clear cell RCC.³¹ It also constitutes a WHO/ISUP grade 4.¹⁰ Rhabdoid morphology is defined by non-cohesive polygonal/round cells with eccentric high grade nuclei and eosinophilic cytoplasmic inclusions.³¹ Generally, rhabdoid differentiation is less studied than its sarcomatoid counterpart but is regarded empirically by many to be synonymous with the sarcomatoid differentiation.²⁸ Studies have often lumped the sarcomatoid and rhabdoid RCC as one category.²⁸ There is also some evidence that rhabdoid RCC might respond to immune checkpoint therapy.²⁸

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Note 9 – Necrosis (Core)

The presence of histological tumour necrosis has been shown to be a prognostic indicator for clear cell RCC and chromophobe RCC independent of tumour stage.^{20,32-38} Papillary RCC often contains foci of necrosis; however, the prognostic significance of this is debated.^{32,39,40} The presence of microscopic tumour-type (granular) necrosis, defined as the existence of granular nuclear and cytoplasmic debris,^{35,36,41,42} should be recorded for clear cell carcinoma and chromophobe RCC if present (core). At present, it is non-core for the remainder of histological tumour types due to limited data, but it is recommended that the presence of necrosis be recorded. For patients who have undergone pre-surgical renal embolization, the degree of tumour-associated necrosis cannot be assessed, because thromboembolic infarction results in coagulative necrosis, which is difficult to distinguish from tumour-associated necrosis.⁴³ Likewise, the presence of and extent of necrosis in tumours that have been treated with neoadjuvant therapies (immune checkpoint inhibitors, targeted therapies, ablative therapies, etc.) likely loses its relevance, as it is usually not possible to discern tumour necrosis from treatment response. In the biopsy setting, necrosis cannot be comprehensively evaluated due to sampling; however, if necrosis is present, it should be noted.

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Note 10 – Coexisting pathology in non-neoplastic kidney (Non-core)

If a biopsy performed for mass/neoplasm shows unequivocal histologic feature of a medical renal disease like amyloidosis or diabetic nephropathy, it is appropriate to report these findings.⁴⁴⁻⁴⁸ However, changes such as glomerular sclerosis and interstitial fibrosis should be interpreted with caution due to the possibility of distortion by mass effect.

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Note 11 – Ancillary studies (Non-core)

While there are no established predictive markers for treatment response, ancillary tests for diagnostic/prognostic purposes should be performed in selected cases, especially to identify molecularly defined renal carcinoma subtypes. It may be reasonable to defer advanced molecular studies for tumour resection in the biopsy setting.

Ancillary studies, particularly immunohistochemistry, fluorescence in situ hybridisation (FISH), cytogenetics/copy number assessment, and next-generation sequencing (NGS), are of help in the diagnosis of selected tumour types. However, in many cases, diagnosis can be achieved without the need for any of these methodologies, especially in the most common types, including clear cell, papillary, and chromophobe RCC.⁹

Some helpful immunohistochemical markers include PAX8 (or PAX2) for confirmation that a tumour is of renal cell origin, with caveat that some upper tract urothelial carcinomas are also positive for this marker.⁴⁹ Carbonic anhydrase 9 (CA9) is a helpful marker to support that a tumour is clear cell RCC. However, this should be utilised with caution when 1) renal cell origin is not certain (it can be positive in non-renal carcinomas); and 2) positivity can be present in tumours or tissues with ischemia/necrosis, due to the role of this protein in the hypoxia pathway.⁹ Clear cell RCC usually shows diffuse circumferential membrane positivity, so focal staining for this marker may be interpreted as equivocal or negative, especially when only present adjacent to areas of necrosis or in the tips of papillary structures.

Other markers with major diagnostic roles include staining for fumarate hydratase (FH), 2-succinocysteine (2SC), and succinate dehydrogenase subunit B (SDHB). Abnormal absence of staining in the cytoplasm for FH and positive nuclear/cytoplasmic staining for 2SC would support a diagnosis of FH-deficient RCC, whereas abnormal negative staining of the cytoplasm for SDHB would support a diagnosis of SDH-deficient RCC.^{9,50,51} Abnormal negative staining for SMARCB1 (INI1) would support a diagnosis of SMARCB1-renal medullary carcinoma (in a patient with hemoglobinopathy) or RCC, NOS with medullary phenotype (in the absence of hemoglobinopathy).^{52,53} Cathepsin K, TFE3, and TFEB proteins may be used to support the diagnosis of *TFE3*-rearranged RCC and *TFEB*-altered RCC.^{9,54} However, cathepsin K is only positive in a subset of translocation tumours and TFE3/TFEB proteins have some technical challenges in staining.^{9,54} In general, a positive FISH result for *TFE3* or *TFEB* is highly supportive of the diagnosis of *TFE3*-rearranged RCC and *TFEB*-altered RCC.

A subset of *TFE3* gene fusions may be subtle or negative using FISH due to intrachromosomal inversion within the X chromosome, such as gene partners *NONO*, *RBM10*, *RBMX*, and *GRIPAP1*.^{9,55} As such, NGS methods such as anchored multiplex fusion testing may be superior for recognising tumours with such cryptic fusions/rearrangements. Although confirmation of these diagnoses is desirable, it is probably reasonable in low resource settings to regard a tumour with suspicious features and negative CA9 as non-clear cell RCCs or suspicious for translocation carcinomas. It is also reasonable to report a tumour with these studies pending using the ‘other’ category and ‘renal cell carcinoma, pending additional studies for subtype’.

A group of emerging oncocytic renal tumours has been found to have recurrent gene alterations in *TSC1*, *TSC2*, and *MTOR*.¹¹ Similarly, in the setting of a metastatic renal cancer, where confirmation of clear cell RCC is desired prior to therapy initiation or enrolment in a clinical trial, molecular testing with recognition of *VHL* or related gene alterations may be helpful.⁹ Usage of conventional cytogenetics or copy number testing can also help to recognise the common chromosomal alterations of RCC types, such as 3p loss in clear cell RCC, multiple chromosomal losses in chromophobe RCC, or trisomy 7/17 in papillary RCC.



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