Adult Renal Neoplasms
Cytology, Immunohistochemistry, and Cytogenetic Characteristics

Jaylou Velez-Torres, MD, Luiz Paulo Guido, MD,
Merce Jorda, MD, PhD, MBA*

KEYWORDS

• Fine needle aspiration • FNAC • Kidney tumors • Small renal masses • SRM

Key points

- The combined use of core biopsy (CB) and fine-needle aspiration cytology (FNAC) as diagnostic methods of renal neoplasms is expanding in clinical practice, especially in small renal masses.
- The combined used of CB and FNAC plays a pivotal role in therapeutic decision-making in patients with renal neoplasms.
- Grouping the renal neoplasms in differential diagnostic groups helps in choosing specific immunohistochemical markers and reaching an accurate diagnosis.

ABSTRACT

Tissue sampling of renal masses is traditionally performed using percutaneous sonographic or CT guidance core biopsy (CB) with or without touch preparation cytology and/or fine-needle aspiration cytology (FNAC). The combined used of CB and FNAC is expanding in clinical practice, especially in small renal masses and plays a pivotal role in therapeutic decision making. Grouping the renal neoplasms in differential diagnostic groups helps in choosing specific immunohistochemical markers and reaching an accurate diagnosis.

OVERVIEW

Tissue sampling of renal masses is traditionally performed using percutaneous sonographic or CT guidance core biopsy (CB) with or without touch preparation cytology and/or fine-needle aspiration cytology (FNAC). By imaging, renal lesions are divided in 2 distinct groups: cystic and solid. The Bosniak renal cyst classification further categorizes renal cysts into benign, complex, undetermined, and malignant and they are rarely sampled.[1] Solid renal masses have been conventionally evaluated by its imaging characteristics and, if indicated, further sampling for tissue and/or cytologic interpretation is obtained. Indications for diagnostic procedure in renal lesions include infectious diseases; undetermined radiologic findings for the diagnosis of malignancy; untreatable malignancy or metastasis; treatment planning, including surveillance; and percutaneous ablation by either cryotherapy or radiofrequency.[2–5]

During the past decades, improvement in imaging technology has increased the detection and characterization of renal masses, with up to 80% of renal cell carcinomas (RCCs) incidentally detected during radiological work-up. At time of surgery, 70% to 90% of solid renal lesions proved to be RCCs and, consequently, an enhancing renal neoplasm by imaging studies has been

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Department of Pathology and Laboratory Medicine, University of Miami Miller School of Medicine, 1400 Northwest 12th Avenue, Miami, FL 33136, USA
* Corresponding author.
E-mail address: Mjorda@med.miami.edu

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considered a sufficient indication for surgery.[6,7] Recent studies, however, have demonstrated that up to 30% of detected renal lesions are benign, depending on lesion size,[8–10] or they represent indolent low-grade malignancies.[11–13] Small renal masses (SRMs) (<4 cm) have been increasingly detected and the patients may be candidates for conservative and minimally invasive therapies.[14–19] Most of the SRMs are incidental and patient management is largely based on pathologic diagnosis. In a Surveillance, Epidemiology, and End Results analysis, including 19,932 patients with localized RCC, 84% of SRMs proved to be indolent tumors.[13] Furthermore, the largest increase in incidentally detected SRMs has occurred in elderly patients, where the option for surveillance may be attractive because they are at higher risk for other health hazards.[20] Consequently, an early diagnosis of SRMs is highly beneficial for patient management.

CORE BIOPSY VERSUS FINE-NEEDLE ASPIRATION CYTOLOGY

Tissue or cytologic sampling of renal lesions is performed using percutaneous sonographic or CT-guided CB or FNAC. This has proved a useful technique to classify SRMs as benign or malignant and into different RCC subtypes, considering that some forms may respond differently to specific targeted therapies. In addition, cytologic evaluation of renal lesions can be obtained by endoscopic ultrasound-guided FNAC.[14–19] Endoscopic ultrasound-guided FNAC is associated with lower risk of needle seeding in comparison to percutaneous FNAC, and it can be extremely useful in the sampling of anterior renal tumors, whereas those located at the posterior aspect of the kidney may be better sampled by the percutaneous method.[8] Percutaneous FNAC is a safe, rapid, and widely accepted procedure and it is highly used in other abdominal organs.[21] FNAC, in comparison to CB, is relatively less invasive, cost effective, and amenable to immediate assessment and can guide the radiologist for accurate targeting using rapid on-site evaluation. FNAC can have a high value, yielding diagnosis in most of the cases,[21] and can separate benign from malignant neoplasms in more than 90% of cases with histologic classification of tumor type possible in 87% of tumors.[22] Nondiagnostic or inadequate specimens are largely due to sampling error and occur in approximately 30% of cases. On the other hand, FNAC of renal tumors has been used in advanced-stage disease, in patients with poor surgical status and/or with prior history of other malignancy, and in cases of discrepant clinical presentation and CT findings.[15,23–28] On most occasions, FNAC is placed on smears with or without collection of material for cell block preparation. Both alcohol-fixed smears and cell blocks are suitable for immunocytochemical and cytogenetic analysis. Liquid-based cytologic preparation, on the other hand, is a safe and valuable diagnostic tool used in many organs. Due to inexperience with this method, however, which alters the morphology, diagnosing renal tumors remains a challenge for the cytopathologist.[29] Considering all discussed previously, the use of percutaneous renal CB and/or FNAC is expanding in clinical practice and plays a pivotal role in therapeutic decision making. Both FNAC and CB demonstrate excellent diagnostic accuracy when diagnosing malignancy demonstrating synergistic results. In a previous study, the combination of FNAC and CB was found to significantly improve the diagnostic rate when compared with the use of FNAC alone (92% vs 72%; $P<.05$) and was better than CB alone (92% vs 87%).[30] The accuracy of FNAC alone distinguishing benign from malignant renal masses ranges from 73% to 94%.[31] FNAC cytology correctly subclassifies RCC in 74% of cases.[32] FNAC samples, however, may reduce the ability to differentiate between non–clear cell RCC (CCRCC) subtypes.[33] When pathologic characteristics are insufficient to accurately diagnose carcinoma or to issue a tumor subclassification, ancillary techniques, such as immunohistochemistry (IHC) and cytogenetics, seem to improve the diagnostic accuracy of both CB and FNAC.[33,34]

NORMAL ELEMENTS IN FINE-NEEDLE ASPIRATION CYTOLOGY OF KIDNEY

Although reviewing cytology smears belonging to FNAC cytology of kidney, it is common to find normal elements, such as glomeruli, proximal tubular cells, and distal tubular cells. Glomeruli, at low power, may mimic the papillae seen in papillary RCC (PRCC). They are globular structures with highly cellular globular content; however, the endothelial cells lining the capillary loops are seen at the extreme edge of many glomeruli. In RCCs, the nucleus is rounder than in endothelial cells, and the cytoplasm almost always extends peripherally beyond the nucleus.

Proximal tubular cells may be present and consist of sheets of cells with abundant granular