Diagnostic and Interventional Imaging (2017) **98**, 589—599

SOLICITED REVIEW /*Interventional imaging*

Percutaneous image-guided biopsies of small renal tumors: Current practice and perspectives

C. Marcelin [a,*], D. Ambrosetti [b], J.C. Bernhard [c], C. Roy [d], N. Grenier [a], F.H. Cornelis [a,e]

[a] *Department of Radiology, hôpital Pellegrin, CHU Bordeaux, place Amélie-Raba-Léon, 33076 Bordeaux, France*
[b] *Department of Pathology, hôpital Cimiez, CHU Nice, 4, avenue Reine-Victoria, 06003 Nice, France*
[c] *Department of Urology, hôpital Pellegrin, CHU Bordeaux, place Amélie-Raba-Léon, 33076 Bordeaux, France*
[d] *Department of Radiology, CHU Strasbourg, 1, place de l'Hôpital, 67000 Strasbourg, France*
[e] *Department of Radiology, hôpital Tenon, AP—HP, 4, rue de la Chine, 75020 Paris, France*

KEYWORDS
Biopsy;
Renal cancer;
Imaging;
Interventional radiology;
Percutaneous biopsy

Abstract Percutaneous image-guided biopsies help better select patients with renal tumors smaller than 4 cm. These biopsies are performed to reduce the risks of overtreatment and to discriminate between patients who need ablation therapy and those who require active surveillance. Percutaneous image-guided biopsies are effective for a definitive diagnosis with little risk of complications when cautions are observed. With the current addition of multiparametric imaging, standardized biopsy protocols may further help adapt therapeutic decisions. The aim of this review is to report the current indications and techniques of biopsy performed in case of small solid renal masses and to clarify the optimal conditions for the realization of these biopsies.

Renal cancer represents 2—3% of cancer in adults [1]. It is the 7th most common cancer for men and the 9th for women. Incidence has increased in the last decades due to the growing incidental detection of small asymptomatic renal masses by imaging [1,2]. Although recent advances in imaging suggest a potential for characterization of renal masses [3—5], pathological examination thus far remains the standard for typifying renal tumors [6,7]. To date, it is obtained after nephrectomy or percutaneous biopsy.

* Corresponding author.
E-mail address: clement.marcelin@gmail.com (C. Marcelin).

http://dx.doi.org/10.1016/j.diii.2017.07.008

Following discussion in multidisciplinary committees, percutaneous image-guided biopsies are mainly performed for solid tumors of less than 4 cm in diameter (T1a), but also for larger, undefined and atypical tissue formations. The main reason is that approximately up to 50% of these T1a renal masses are benign in some series (20—46%) [8]. Moreover, as a broad spectrum of malignant renal tumors of varying aggressiveness has been reported, it may now affect the therapeutic decision in the era of the personalized medicine [9—11]. The accurate identification of tumor subtype appears required to adapt the treatment to the tumor and/or to the patient [12,13]. Biopsy may appeared as the simplest way to avoid the risks of overtreatment and to justify thermal ablation or active surveillance [12]. For this purpose, it now involves complex histopathological analysis or genotype assessment. Homogenization of practices is thus necessary to standardize the selection, techniques and management of renal biopsy allowing to provide the more accurate information before any therapeutic decision [14].

The aim of this article is to review the current indications and techniques of small renal mass biopsies as well as to use cumulative evidence from the literature to clarify the optimal management for the adequate realization of these biopsies.

Evidence acquisition

A systematic MEDLINE/PubMed© literature search was performed with different combinations of terms such as ''biopsy'', ''percutaneous'', ''kidney'', ''renal cell carcinoma'', ''renal tumor'' for all articles published in English between January 2000 and June 2017. Original articles, reviews and editorials were selected based on their clinical relevance. Cited references from selected articles were also analyzed to find and include significant papers not previously identified, including several articles published before 2000.

Diagnostic and prognostic considerations

Tumor morphometry and patient age

The median age at the diagnosis of renal cancer is 64 years [6,15]. Patient age and localization of the renal mass are not predictive of the malignancy or benignity of the tumor [16,17]. However, the risk of malignancy is proportional to the size of the renal tumor [18—20]. Between 0—4 cm, 17—40% of renal tumors are benign [8], whereas only 6.3% of renal tumors more than 7 cm are benign. Malignant tumors < 4 cm are often lower grade than tumors > 4 cm [8,21]. The risk of metastasis increases 3.5% per cm of tumor size and is often considered significant for tumors > 4 cm, justifying resection in the first intention [22]. Biopsies are then more often performed for T1a tumors to detect benign tumors or to justify ablations or active surveillance, however this is often balanced with the clinical context and history of patient [12]. By detecting specific imaging features, CT or MR imaging may have a role to select patients for further biopsies [3—5,23,24]. These techniques may accurately detect both benign subtypes and lowly aggressive tumors.

Histological subtype

The WHO classification of renal tumors [25] was updated several times over the last decades [26—28] and again recently in 2016 [29], adding new tumor subtypes and clarifications. The progress in histological and molecular subtyping made it possible to define new types of renal tumors [9,10,30], which has consequences on prognosis and treatment. Many markers now exist to accurately refine histological analysis [31]. For instance, the definition of the immunohistochemical profile of the tumors helps to classify tumors accurately into subtypes.

Clear cell renal cell carcinoma (ccRCC) remains the most frequent renal cancer (70—85%), followed by papillary RCC (pRCC) (7—15%) [32], and chromophobe RCC (chrRCC) (5—10%) [33,34]. Other tumors, including benign tumors (such as oncocytoma 3—5%) [35], are rarer (Table 1). However, as chrRCC and pRCC are at low risk of mortality [36], recently Halverson et al. [37] developed an algorithm identifying several subgroups: favorable prognosis (chrRCC, grade 1 ccRCC, type 1 and grade 1 pRCC), intermediate prognosis (grade 2 ccRCC, type 1 of grade 2 pRCC, atypical pRCC, and aspecific oncocytoma tumors), or unfavorable prognosis (type 2 pRCC, grade 3 or 4 ccRCC, unclassifiable RCC or sarcomatoid component). Although this classification has to be evaluated in a prospective way, it may provide the justification to perform biopsies widely to propose the most adequate therapeutic option to patients if the cataloging of

Table 1 World Health Organisation (WHO) Classification of renal tumors and incidence (%).

Malignant tumors	Benign tumors
Clear cell renal cell carcinoma (70—85%)	Oncocytoma (3—5%)
Multilocular clear cell renal cell carcinoma	Papillary adenoma
Papillary renal cell carcinoma (7—15%)	
Renal cell carcinoma associated to hereditary leiomyomatosis and renal cell cancer (HLRCC)	
Chromophobe renal cell carcinoma (5—10%)	
Carcinoma of the collecting ducts of Bellini	
Renal medullary carcinoma	
MiT family translocation renal cell carcinoma	
Carcinoma associated with deficit in succinate deshydrogenase	
Mucinous tubular and spindle cell carcinoma	
Tubulo-cystic renal cell carcinoma	
Acquired cystic disease associated renal cell carcinoma	
Clear cell papillary renal cell carcinoma	
Renal cell carcinoma, unclassified	