

Review

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The role of the renal biopsy and surveillance in the management of small renal masses

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How to cite this article: Muttin F, Barret E. The role of the renal biopsy and surveillance in the management of small renal masses. *Mini-invasive Surg* 2019;3:10. <http://dx.doi.org/10.20517/2574-1225.2018.005>

Received: 30 Nov 2018 **First Decision:** 14 Jan 2019 **Revised:** 7 Mar 2019 **Accepted:** 11 Mar 2019 **Published:** 17 Apr 2019

Science Editor: Richard Lawrence John Naspro **Copy Editor:** Cai-Hong Wang **Production Editor:** Huan-Liang Wu

Abstract

Cross-sectional imaging shows a limited diagnostic accuracy for the histological discrimination of small renal masses (SRM). In this scenario, a renal tumor biopsy is a safe, feasible and effective diagnostic tool that can guide treatment strategy by providing the histological characterization of a SRM. Although nephron-sparing surgery is still considered the gold standard treatment for patients with SRM, more and more evidence suggests that active surveillance (AS) is a reasonable alternative option, especially in old and comorbid patients. Indeed, owing to the relatively slow growth and favorable biology of SRM, AS followed up by, if necessary, a delayed intervention provides an optimal oncological outcome with low rates of systemic progression or death.

Keywords: Small renal masses, cross-sectional imaging, renal biopsy, surveillance

INTRODUCTION

Traditionally, kidney cancer is one of the few tumors that is only treated if there is a radiological probability of malignancy. This concern is related to the limited diagnostic accuracy of computed tomography and magnetic resonance imaging in the histologic characterization of small renal masses (SRM)^[1]. In recent years, a percutaneous renal tumor biopsy (RTB) has emerged as a promising diagnostic tool that may help in the clinical decision-making process by distinguishing benign from malignant radiological inconclusive renal lesions, and thus may be considered suitable for patients who are candidates for either active surveillance or nephron-sparing treatments^[1-3].



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Renal tumor biopsy

In the context of SRM, RTB has been used to identify low- and high-risk malignant renal tumors, to reveal a suspected metastasis in a non-renal neoplasm, to exclude lymphoma or abscess or, when an ablative therapy (e.g., radiofrequency ablation) is planned, to obtain the histology or to confirm the success of the treatment^[4]. Contraindications include comorbid and frail patients only suitable for conservative management irrespective of biopsy results; patients with coagulation impairment; patients with a contrast-enhanced renal mass for whom surgery is already planned^[1,4].

According to a patient's habits, anatomical tumor location and personal experience, ultrasounds and computed tomography are conventionally used for guidance when RTBs are performed. Tissue sampling can be realized with fine needle aspiration (FNA) and/or core biopsy (CB)^[1,4]. In FNA, a twenty-one-gauge needle is inserted through a coaxial sheath to obtain multiple cytologic samples while limiting discomfort and the risk of tumor seeding. For CB, an eighteen-gauge needle with the same coaxial technique provides better diagnostic samples when at least 10 mm long cores are taken from the central and peripheral zones while avoiding necrotic areas.

In a recent systematic review and meta-analysis, CBs have been found to have a better diagnostic accuracy for the detection of malignancy compared to FNA, with a sensitivity of 99.1% vs. 93.2% and a specificity of 99.7% vs. 89.8%, respectively^[3]. Higher diagnostic accuracy is reached when large solid exophytic lesions are biopsied or when a combination of the two techniques is performed^[1,2]. A non-diagnostic result can occur in up to 8%-14.7% of all RTB (range 0%-22.6% for CB and 0%-36% for FNA). However, a repeated biopsy is diagnostic in > 90% of cases. After surgical resection, the positive and negative predictive values of RTB are > 99% and 70%, respectively^[2,3,5,6]. When focusing on SRM only, RTB shows a sensitivity of 99.7% and a specificity of 98.2%. Furthermore, after surgical resection of SRM only, the concordance rate for tumor histotype is 96% while the concordance rate for tumor grade is 66.7% and increases to 86.5% when a simplified low-high grading system is used^[3].

Overall, RTB is feasible and safe when the coaxial technique is used. Morbidity after percutaneous sampling is low (8.1%) and complications include spontaneous resolving subcapsular/perinephric hematoma (4.3%-4.9%), clinically significant pain (1.2%-3%), self-limiting hematuria (1%-3.15%), pneumothorax (0.6%), hemorrhage requiring blood transfusions (0.4%-0.7%) and infections. Fewer than 1% of the patients experience major complications such as a gross hematuria or a pseudoaneurysm that requires embolization. Anecdotal cases are reported for tumor seeding along the needle tract^[3,5].

Active surveillance

Active surveillance (AS) is defined as the initial monitoring of tumor size by serial abdominal ultrasounds or cross-sectional imaging with delayed treatment (DT) reserved for those patients whose SRMs show clinical progression during the follow-up examination^[1]. Indications for AS are still controversial, though an elderly patient with a high surgical risk or competing risks of death and a very small low-growing renal mass represents the optimal candidate for AS [Table 1]. A recent systematic review of the oncological outcomes of currently published AS data indicates this treatment modality is a safe initial management strategy for SRM, especially for patients with very small tumors (< 2 cm) and elderly and/or sicker patients (> 75 years), followed by DT only if required because of progression. Specifically, metastatic progression and cancer-specific mortality (CSM) rates for cT1a tumors have been found to be low, accounting for 0-6% and 1%, respectively. Conversely, the other-cause mortality (OCM) rate is 1%-45%, reflecting the advanced age and prevalence of comorbidities in these AS patients AS^[7].

The data supporting these findings are manifold. Up to 52% of all resected SRM are suitable for AS, with 23% of benign histology and 29% of favorable risk or intermediate risk < 2 cm tumors^[8]. Moreover, a significant proportion of SRM which satisfy the criteria of AS are benign tumors or low-grade renal cell

Table 1. Factors favoring active surveillance

Patient-related	Tumor-related
Elderly	Tumor size < 3 cm
Life expectancy < 5 years	Tumor growth < 5 mm/year
High comorbidities	Non-infiltrative on imaging
Excessive perioperative risk	Low complexity
Frailty (poor functional status)	Favorable histology (if RTB is performed)
Patient preference for AS	
Marginal renal function	

RTB: renal tumor biopsy; AS: active surveillance

carcinoma, with relatively indolent biologic and clinical behavior^[9,10]. Indeed, most of SRM grow slowly, with a median linear growth rate (LGR) of 0.22 cm/year for cT1a tumors^[7]. Conversely, although benign tumors may grow significantly, high median LGR (0.37 cm/year) has been associated with a progression to metastasis and may be mirror more aggressive cancers^[7,9,11,12].

Elderly and comorbid patients with SRM have a relative low risk of CSM but a significant risk of OCM, thus questioning their eligibility for surgery, which may also expose the patient to a greater risk of post-operative morbidity^[13-17]. In comparative retrospective and prospective analyses, although patients in the AS arm were older with greater comorbidity and smaller tumors with respect to the surgical counterpart, no statistically significant difference in OS and CSS were observed once adjusted for patients and tumor characteristics^[10,13,18,19].

Triggers for AS cessation and commencement of treatment are poorly understood and include tumor volume doubling time < 12 months, LGR > 0.5 cm/year, tumor maximal diameter at risk of systemic dissemination (3-4 cm), malignant RTB results, new onset of tumor-related symptoms and/or patient's preference^[11,20]. Up to one-third of patients in AS cross over to treatment and most of them within the first 2-3 years^[1,2]. For the 1%-26% of cT1a tumors undergoing surgical DT, the median LGR has been found 0.62 cm/year^[7]. Furthermore, increasing growth kinetics at the first follow-up imaging appear to be associated with higher treatment crossing over but not with OS, which suggests that rapidly growing masses early in AS may not necessarily require immediate treatment^[12].

The optimal follow-up schedule for patients in AS is still unknown and therefore hasn't been standardized. Current recommendations suggest imaging at relatively frequent intervals initially, which may increase as the stability of the lesion is demonstrated: cross-sectional imaging every 3-4 months for the first year, followed by cross-sectional imaging or ultrasound every 4-6 months for the second year and every 6-12 months thereafter^[20].

Nephron-sparing surgery

Although AS and ablative therapies have been regarded as attractive treatment modalities, partial nephrectomy (PN) represents the standard of care for the management of SRMs^[1,15,21-23]. Indeed, PN has demonstrated comparable cancer control^[24-26] but a lower incidence of chronic kidney disease^[27-30], cardiovascular events^[31,32], overall and competing-cause mortality^[31,33-35] when compared to radical nephrectomy.

According to a surgeon's experience and preference, a PN can be performed with open (OPN), laparoscopic (LPN) or robot-assisted (RAPN) approach^[1]. Specifically, RAPN provides non-inferior oncological and functional outcomes and an improved morbidity profile with respect to OPN^[36,37]. Moreover, RAPN is now considered the preferable minimally invasive approach to PN because it eliminates the technical issues of LPN and reduces the surgical learning curve^[38-40].

CONCLUSION

An accurate diagnosis of SRM can be made by using RTB and will further improve the risk-stratification of patients and guide the treatment strategy. Moreover, AS is a viable alternative to standard PN for SRM and should be discussed with candidates for active intervention, according to the baseline health status and the characteristics of the tumor provided by the RTB.

DECLARATIONS

Authors' contributions

Data analysis and interpretation, manuscript writing and editing: Muttin F

Conception and design of the study, supervision and critical revision for important intellectual content: Barret E

Availability of data and materials

Not applicable.

Financial support and sponsorship

None.

Conflicts of interest

Both authors declared that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable

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