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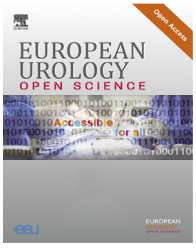

European Association of Urology

Kidney Cancer

Renal Mass Biopsy Prior to Surgical Excision: Practice, Diagnostic Performance, and Impact on Management in the UroCCR Registry (Ancillary Study No. 118)

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Abstract

Background and objective: A renal mass biopsy (RMB) is not systematically recommended before surgical excision of a renal mass, although it has demonstrated elevated accuracy in determining renal masses with low morbidity. Our aim was to determine the diagnostic accuracy of an RMB, the clinical and tumoral factors associated with RMB practice, and the impact of an RMB on renal cell carcinoma management in a contemporary prospective national registry—UroCCR (2010–2021).
Methods: We identified all patients with a single renal mass (pT1–4 N0–2 M0 or benign) who were treated surgically and stratified them according to the

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performance of a prior RMB. Patients treated by active surveillance, percutaneous ablative treatment, or stereotaxic radiotherapy were excluded. Diagnostic accuracy of an RMB was determined in the RMB group. Clinical and tumoral factors associated with the practice of RMBs were analyzed using logistic regression.

Key findings and limitations: In total, 9283 patients were included, who presented 1594 tumors (17%) with a prior RMB. RMBs were 92.4% contributive. The correlation between an RMB and excision in the determination of benign/malignant disease, histological subtype, and grade are, respectively, 96.9%, 86.4%, and 52.6%. The impact of an RMB versus no prior RMB was determined according to the rate of surgical excision for benign lesion and the rate of partial nephrectomy (63.9% vs 57.8%; $p < 0.001$).

Conclusions and clinical implications: An RMB is performed rarely when its diagnostic performance is high. A prior RMB significantly changes the management of localized renal masses, with fewer surgical procedures for benign renal masses and conservative treatment in a higher proportion of patients.

Patient summary: In a large and contemporary registry, we demonstrated that a renal mass biopsy has excellent diagnostic accuracy, significantly reduces renal surgery for benign masses and low-grade/stage renal cell carcinoma, and increases conservative surgical excision.

1. Introduction

The incidence of kidney cancer is increasing due to an increase in the detection of small renal masses [1] and is largely linked to the generalization and accessibility of abdominal imaging [2]. Nowadays, the diagnosis of renal tumor is mainly incidental, with a median tumor size of 3–4 cm at diagnosis. Excision surgery is the standard treatment for localized kidney tumors, and renal cancer is one of the rare cancers for which histological confirmation is not essential before surgical excision [3–5]. Indeed, apart from very specific situations that do not reflect the majority of renal tumor findings, the guidelines recommend that a renal mass biopsy (RMB) should be performed via a utility-based approach whenever it may influence clinical management [3–5].

However, contemporary renal surgery series report up to 10% benign tumors at final pathology and even up to 30% in series of small renal masses [6]. There are currently no clinical or radiographic features that accurately predict histological diagnosis. A tumor biopsy has demonstrated high performance in the determination of renal masses in large series summarized in a systematic review and meta-analysis [7]. However, biopsies are rare or not practiced systematically owing to concerns regarding noncontributive biopsies and insufficient material, a delay in clinical management, the risk of discordance with the final histology especially when a biopsy finds benign histology, the risk of complications, and more generally the lack of perceived impact on clinical management [8–11].

In a large registry study, we aimed to evaluate the practice and diagnostic performance of RMBs in the national prospective kidney tumor registry UroCCR, to identify the clinical and tumoral factors associated with the performance of an RMB and to evaluate to what extent an RMB could modify the clinical management of renal masses in terms of the rate of surgery for benign lesion and the rate of partial versus radical nephrectomy.

2. Patients and methods

2.1. Study design

From the French kidney cancer database UroCCR (NCT 03293563), recognized by the French National Cancer Institute and the French High Authority of Health, we included all patients who underwent surgery between May 2000 and November 2021 for localized or locally advanced renal cell carcinoma (RCC; cT1–4, N0–2, M0). All patients received oral and written information about the objectives and methodology of the UroCCR project, written informed consent was obtained (CNIL authorization number DR-2013-206), and data were collected prospectively. We excluded patients for whom definitive pathology based on surgical excision was not available (active surveillance, ablative therapy, and stereotaxic radiotherapy), patients with cystic tumors, and patients with metastasis. Patients with multiple renal mass biopsies (by repeated tumor biopsies, or multiple renal tumors) were also excluded to ensure a reliable correlation between each RMB and each excised specimen. Only core biopsies were included.

The 9283 included patients were stratified according to the performance of an RMB prior to surgery: "biopsy group" versus control (no biopsy) group.

2.2. Data measurements

Our first objective was to determine the accuracy of an RMB in the determination of a renal mass. For this objective, we considered tumor characteristic (benign vs malignant, histological subtype, and tumor grade) provided by the RMB versus pathology report from tumor excision.

Our second objective was to identify the clinical and tumoral factors correlated with the performance of an RMB. In this objective, we performed a univariate analysis that included clinical characteristics of patients and tumor characteristics.

Third, we compared management of the biopsy versus control groups in terms of the rate of surgery for benign tumor and rate of partial versus radical nephrectomy, globally and when stratified by tumor size.

2.3. Statistical analysis

A descriptive analysis was conducted. Qualitative variables were presented as percentages, and quantitative variables were presented as medians and 95% confidence intervals. Comparability between the two groups was performed using the chi-square test for categorical variables or Fisher's exact test when the sample was too small. The Mann-Whitney test was used for quantitative variables.

The accuracy of an RMB in the determination of a renal mass was evaluated with percentage of contributive RMBs, sensitivity and specificity for malignant versus benign pathology, and percentage of correlation between an RMB and final pathology for the histological subtype and grade. A biopsy was considered as contributive if there was sufficient tumor material to determine at least benign or malignant disease.

In order to evaluate the clinical and tumoral factors associated with the performance of an RMB, we first performed univariable logistic regression analyses. Rates of surgery for a benign tumor, and partial and radical nephrectomies were compared between the biopsy and control groups via the Mann-Whitney test. For each subanalysis, patients with the missing data were excluded. All statistics were performed with R software version 4.1.3.

Table 1 – Baseline preoperative characteristics of the patients and tumors

		Overall (n = 9283)	No biopsy (n = 7689)	Biopsy (n = 1594)	p value
Patient characteristics	Male	6267 (67.5)	5207 (67.7)	1060 (66.5)	0.572
	Age (yr)	63 (53–71)	63 (53–70)	64 (54–72)	<0.001
	BMI (kg/m^2)	26.5 (23.8–30)	26 (24–30)	27 (24–30)	0.948
	ECOG 0	5976	5024 (65.3)	952 (59.7)	<0.001
	ECOG 1	1413	1199 (15.6)	214 (13.4)	
	ECOG ≥2	337	293 (3.8)	44 (2.8)	
	Missing data	1557	1173 (15.3)	384 (24.1)	
	Creatinine (µmol/l)	82 (69–100)	82 (69–100)	82 (69–99)	0.453
	Clearance (ml/min)	83.5 (62.3–107.9)	84 (63–108.4)	80.5 (60–105.6)	0.018
	Medical history				
	High blood pressure	4293 (46.2)	3592 (46.7)	701 (44.0)	<0.001
	Smoking	1721 (18.5)	1415 (18.4)	306 (19.2)	<0.001
	Single kidney	434 (4.6)	332 (4.3)	102 (6.4)	<0.001
	Chronic kidney disease	714 (7.7)	590 (7.7)	124 (7.8)	<0.001
	Dialysis	166 (1.8)	156 (2.0)	10 (0.6)	<0.001
	Renal transplantation	186 (2)	175 (2.3)	11 (0.7)	<0.001
	AAG or AAP therapy	1153 (12.4)	981 (12.8)	172 (10.8)	<0.001
	Partial nephrectomy	239 (2.6)	187(2.4)	52 (3.3)	<0.001
Tumor characteristics	cT				
	T1a	4631 (49.8)	3746 (48.7)	875 (54.9)	<0.001
	T1b	2552 (27.5)	2225 (28.9)	327 (20.5)	
	T2a	758 (8.2)	673 (8.8)	85 (5.3)	
	T2b	345 (3.7)	321 (4.2)	24 (1.5)	
	T3a	562 (6.1)	514 (6.7)	48 (3)	
	T3b	168 (1.8)	159 (2.1)	9 (0.6)	
	T3c	20 (0.2)	18 (0.2)	2 (0.1)	
	T4	35 (0.3)	31 (0.4)	4 (0.3)	
	Missing data	222 (2.4)	2 (0.0)	220 (13.8)	
	cN				
	N0	7051 (76)	5978 (77.7)	1073 (67.3)	<0.001
	N1	224 (2.4)	197 (2.6)	27 (1.7)	
	N2	4 (0)	1 (0.0)	3 (0.2)	
	Nx	1804 (19.4)	1513 (19.7)	291 (18.3)	
	Missing data	200 (2.2)	0 (0)	200 (12.5)	
	RENAL score				
	Low-risk group (4–6)	2031 (21.9)	1651 (21.5)	380 (23.8)	0.04
	Medium-risk group (7–9)	2867 (30.9)	2300 (29.9)	567 (35.6)	
	High-risk group (10–12)	1750 (18.8)	1435 (18.6)	315 (19.8)	
	Missing data	2635 (28.4)	2303 (29.9)	332 (20.8)	
	PADUA score				
	Low-risk group (6–7)	1729 (18.6)	1396 (18.2)	333 (20.9)	0.33
	Medium-risk group (8–9)	2098 (22.6)	1695 (22)	403 (25.3)	
	High-risk group (≥10)	2734 (29.5)	2213 (28.8)	521 (32.7)	
	Missing data	2722 (29.3)	2385 (31)	337 (21.1)	
	Tumor diameter (cm)	3.7 (2.5–5.8)	3.8 (2.5–6)	3.5 (2.5–5)	<0.001

AAG = antiaggregant; AAP = antiplatelet; BMI = body mass index; ECOG = Eastern Cooperative Oncology Group; SD = standard deviation.
Continuous variables are presented as median (interquartile range) or as mean (SD), while categorical variables are presented as count (percentage).

3. Results

3.1. Patients and tumor characteristics

We included 9283 patients. The demographic and tumoral characteristics are reported in Table 1. Briefly, 67.5% of the patients were male and the median age at diagnosis was 63 yr. Tumors were classified as cT1a, cT1b, cT2, cT3, and cT4 in 49.8%, 27.5%, 11.9%, 8.1%, and 0.3%, respectively (Table 1); cN0 tumors were 76%, and the median tumor size was 3.7 cm (2.5–5.8). The tumors were predominantly of intermediate complexity according to the RENAL score (30.9%). Of the tumors, 89.2% were malignant on definitive pathology and 10.8% were benign. The majority of RCC cases were clear cell renal carcinoma (53.1%; Table 2).

3.2. RMB accuracy

Of the 9283 patients included, 1594 had an RMB, which corresponded to a 17% rate of RMBs prior to surgery. When considered by included center, the rate of RMBs ranged from 5% to 87% (Supplementary Table 2 and Supplementary Fig. 2).

RMBs were contributive in 92.4% of the patients (Table 3). When contributive, the correlation of an RMB and final pathology for benign/malignant disease was 96.9%, which corresponded to 97.4% sensitivity, 86.4% specificity, 99% positive predictive value, and 71.1% negative predictive value (Supplementary Table 3). The accuracy of the RMB was 86.4% in the determination of the histological subtype, 52.6% in the determination of the grade when stratified according to International Society of Urological Pathology (ISUP) grades 1–4, and 67.9% when stratified in low/high grade (ISUP 1–2 vs 3–4; Table 3).

T1a tumors accounted for 54.9% of the tumors in the biopsy group (Table 1). An RMB in T1a tumors presented similar accuracy to an RMB in ≥4-cm tumor, with 91.4% contributive biopsies (vs 92.4%), 96.8% correlation in benign versus malignant disease (vs 96.9%), 85.3% correlation in the determination of the histological subtype (vs 86.4%), and 73.6% correlation in the determination of low versus high grade (vs 67.9%; Table 3).

3.3. Factors associated with the performance of RMB

In a univariate analysis, the factors associated with the performance of an RMB prior to surgery were age, history of RCC, single kidney, stage cT1a, and tumor size. Dialysis and renal transplantation were factors associated with no prior RMB (Supplementary Table 1). A multivariate analysis was performed, but it did not identify any demographic or tumoral factor significantly associated with the practice of RMBs.

There tended to be a lower rate of surgery for benign tumors in centers with the highest rates of prior RMBs (Pearson coefficient –0.27, $p = 0.14$; Supplementary Table 2 and Supplementary Fig. 1). There was no significant correlation between the volume of the center and the practice of RMB prior surgery (Supplementary Table 3).

Table 2 – Baseline surgery characteristics and pathology results

		Overall (n = 9283)	No biopsy (n = 7689)	Biopsy (n = 1594)	p value
Surgery characteristics	Partial nephrectomy	5838 (62.9)	4915 (63.9)	921 (57.8)	<0.001
	Total nephrectomy	2727 (29.4)	2400 (31.2)	327 (20.5)	
	Missing data	720 (7.7)	374 (4.8)	346 (21.7)	
	Laparoscopy	6515 (70.2)	5570 (72.4)	945 (59.3)	<0.001
	Open surgery	2011 (21.7)	1714 (22.3)	297 (18.6)	
	Missing data	757 (8.1)	405 (5.3)	352 (22.1)	
	Operating time (min)	149 (112–191)	149 (110–190)	150 (115–195)	0.230
	Blood loss (ml)	150 (50–350)	150 (50–300)	150 (50–400)	0.048
Surgery pathology results	Benign vs malignant				
	Benign	815 (8.8)	723 (9.4)	92 (5.8)	<0.001
	Malignant	6749 (72.7)	5616 (73.0)	1133 (71.1)	
	Missing data	1719 (18.5)	1350 (17.6)	369 (23.1)	
	Histological subtype				
	RCC	4930 (53.1)	4180 (54.4)	750 (47.1)	<0.001
	Tubulopapillary type 1	721 (7.8)	594 (7.7)	127 (8.0)	
	Tubulopapillary type 2	264 (2.8)	223 (2.9)	41 (2.6)	
	Chromophobe	566 (6.1)	414 (5.4)	152 (9.5)	
	Simple cyst	149 (1.6)	145 (1.9)	4 (0.3)	
	Mixed papillary	13 (0.1)	11 (0.1)	2 (0.1)	
	Papillary oncocytoma	39 (0.4)	33 (0.4)	6 (0.4)	
	Translocation MITF	38 (0.4)	38 (0.5)	0 (0)	
	Bellini	5 (0)	5 (0.1)	0 (0)	
	Oncocytoma	499 (5.4)	429 (5.6)	70 (4.4)	
	AML	167 (1.8)	149 (1.9)	18 (1.1)	
	Other	173 (1.8)	118 (1.5)	55 (3.5)	
	Missing data	1719 (18.5)	1350 (17.6)	369 (23.1)	
	Grades				
	1	337 (3.6)	290 (3.8)	47 (2.9)	<0.001
	2	3025 (32.6)	2529 (32.9)	496 (31.1)	
	3	2162 (23.3)	1828 (23.8)	334 (21)	
	4	737 (7.9)	656 (8.5)	81 (5.1)	
	Missing data	3022 (32.6)	2386 (31)	636 (39.9)	

AML = angiomyolipoma; RCC = renal cell carcinoma; SD = standard deviation.
Continuous variables are presented as median (interquartile range) or as mean (SD), while categorical variables are presented as count (percentage).

3.4. Impact of RMB on the surgical management

An RMB prior to surgery was associated with a significantly lower rate of surgery for benign tumors (7.5% vs 11.4%, $p < 0.001$). This corresponded to a +52% rate of benign renal masses at final pathology when an RMB was not performed prior to surgery (Table 4). In the subgroup of T1a tumors, the rate of surgery for benign tumors was 6.2% in the biopsy group versus 14.1% in the control group ($p < 0.001$), which corresponded to a +227% increase in surgery for benign tumors when an RMB was not performed prior to surgery, with tumors <4 cm (Table 4). In other words, the numbers of RMBs needed to avoid one renal surgery for benign tumor were 26 in the whole cohort and 13 in the T1a group.

Concerning surgical technique, we noted a higher rate of conservative treatment with partial nephrectomy in the control group (63.9%) than in the biopsy group (57.8%, $p < 0.001$; Table 2). In the group of benign tumors at final pathology, partial and radical nephrectomies were, respectively, 83.4% and 16.6% in the control group and 88.6% and 11.4% in the biopsy group (Table 5). However, in the malignant tumor group at final pathology, the performance of an RMB prior to surgery was associated with a superior rate of conservative treatment with partial nephrectomy. The performance of partial nephrectomy was superior in the biopsy group, for low-risk RCC (clear cell RCC [ccRCC] T1a low grade or chromophobe or papillary low grade; 81.1% vs 77.5%, $p = 0.03$) and also for high-risk RCC (ccRCC >T1a or grade 3–4; 60.1% vs 49.8%, $p < 0.001$; Table 5).

4. Discussion

No scientific society formally recommends performing an RMB before surgery. According to the European Association of Urology (EAU), an RMB should be considered in patients who are candidates for active surveillance of small masses and to obtain histology before ablative treatments. More generally, the EAU guidelines recommend that an RMB should be performed following a utility-based approach whenever it may influence management [3–5].

Our study confirms the diagnostic performance of an RMB as reported in the systematic literature review by Marconi et al [7]. This systematic review reported a contributive rate of 92%; sensitivity and specificity of, respectively, 99.7% and 98.2% for benign-malignant diagnosis; and concordance for histological subtype of 90.3% and 62.5% for the grade considering a four-tier grading system versus 87% with a

Table 3 – Diagnostic performance of tumor biopsy for the diagnosis of renal tumors

		Overall (n = 1594)	cT1a subgroup (n = 875)	cT1b subgroup (n = 327)
Contributive biopsy (%)	Yes	92.4	91.4	93.5
	No	7.5	8.6	6.5
Correlation benign/malignant (%)	Yes	96.9	96.8	98.2
	No	3.1	3.2	1.8
Correlation histological subtypes (%)	Yes	86.4	85.3	88.7
	No	13.6	14.7	11.3
Correlation grades ISUP (%)	Yes	52.6	58.3	40.7
	No	47.4	41.7	59.2
Correlation grades ISUP low/high (%)	Yes	67.9	73.6	59.9
	No	32.1	26.4	40.1

ISUP = International Society of Urological Pathology.

Table 4 – Descriptive table of the percentage of nephrectomies for benign lesions according to TNM stage

	No biopsy	Biopsy	Δ	p value
Overall	723 (11.4)	92 (7.5)	1.6×	<0.0001
T1a	422 (14.1)	41 (6.2)	2.3×	<0.0001
T1b	205 (10.8)	23 (7.8)	1.4×	0.12
T2a	49 (8.4)	7 (8.9)	0.9×	0.9
T2b	33 (13.1)	4 (17.4)	0.75×	0.56

TNM = tumor, node, metastasis.

Table 5 – Percentages of partial or total nephrectomies for benign, and low-, intermediate-, or high-risk malignant tumors by group

		No biopsy (N = 6045)	Biopsy (N = 1104)	p value
Benign	Partial nephrectomy	601 (83.4)	78 (88.6)	0.2
	Radical nephrectomy	120 (16.6)	10 (11.4)	
Low-risk malignant	Partial nephrectomy	2422 (77.5)	533 (81.1)	0.03
	Radical nephrectomy	703 (22.5)	123 (18.7)	
Intermediate- or high-risk malignant	Partial nephrectomy	1097 (49.8)	217 (60.1)	<0.001
	Radical nephrectomy	1102 (50)	143 (39.6)	

two-tier grading system [7]. It included 57 series, which were mainly single-center series with 13–517 patients (median: 67 patients per series or 91% of the series with <200 patients) [7]. Our series brings additional evidence to the diagnostic performance of an RMB owing to the size of the cohort and the fact that the UroCCR registry now reflects a significant part of renal surgery but on a national scale.

UroCCR is a national prospective registry that includes the main academic centers involved in the management of kidney tumors as well as a growing number of private institutions. According to the recent data from the Programme de médicalisation du système d'information, the UroCCR registry represents 18% of renal surgery in France, enabling us to draw conclusions not on a single institution level but on a national scale. We have therefore shown that current application of the guidelines, that is, performing an RMB if it changes management, leads to an preoperative biopsy rate of 17%. This percentage is also correlated with recent practice surveys carried out among urologists, which showed that the place of an RMB before surgery remains very debated at present despite high diagnostic accuracy [12,13]. We have identified factors associated with performing the biopsy: tumor size <4 cm and single kidney situations (congenital or acquired following nephrectomy for cancer, or tumors on renal transplant). Conversely, renal transplantation or renal dialysis was associated with no preoperative biopsy. Chronic kidney disease (CKD) is indeed one of the main risk factors for kidney cancer, with up to 4–7× incidence compared with the general population and a risk that increases with time spent on dialysis [14,15]. Considering this higher risk of RCC in the population of CKDs, excision surgery without a biopsy is not debatable in our opinion when it concerns a nonfunctioning kidney.

Patients managed conservatively were excluded from the study as the rate of benign tumors could not be measured because of the lack of pathology (no excision and no systematic biopsy); this is because there is no information on patients managed conservatively, and this is a limitation of the present work.

The rate of noncontributive RMBs varies greatly according to studies and can even reach 23%. The main predictive factors of a noncontributive biopsy are cystic tumors, tumors with low enhancement, and a skin-tumor distance of >13 cm [7,16]. In addition, interoperator variability appears to be low in the performance and analysis of RMBs [16,17]. Interestingly, a recent study from the UroCCR registry showed that the main predictive factor of biopsy/final pathology discordance was a biopsy performed outside the center, but this study was restricted to the surgery-biopsy concordance when it diagnosed a renal oncocytoma [18]. A limitation of our study is that it was not possible to identify whether the biopsy was performed within the center performing the surgery or outside the center.

Beyond validating the high diagnostic performance of an RMB, our study highlights the real impact of a biopsy on the management of a renal mass. In our study, the comparison of two large cohorts with similar demographic and tumor characteristics highlights that performing an RMB before surgery was associated with a significant reduction in surgery for benign tumors, in particular for small renal masses of <4 cm, and the preferential use of conservative surgery with partial nephrectomy. Smaller series have also demonstrated that an RMB was associated with a reduction in surgery for benign tumors, up to 4× for small renal masses [19–22].

Series of surgeries for renal tumors usually report a rate of benign tumors of up to 10%, with even 20–30% in tumors <4 cm [6]. These benign tumors are essentially angiomyolipomas not diagnosed by imaging (low-fat angiomyolipomas) and renal oncocytomas [6]. It is important to note that in our study, even centers with a high level of RMB practice (85% of renal tumors) maintain a minimal rate of surgery for benign tumors that correspond to elective treatment [23,24].

The risk of a biopsy error when diagnosing a benign tumor, in particular a renal oncocytoma, is probably one of the main reasons for the lack of an RMB before surgery. The correlation between the biopsy and the surgical specimen when the biopsy concludes with a renal oncocytoma varies from 65% to 91% [11,18,23,24]. The biopsy/excision specimen discrepancies in the diagnosis of a renal oncocytoma concern mainly tumors of the oncocytic group (18–26% chromophobe carcinoma, hybrid tumors, and hybrid oncocytic tumors) and rarely a low-grade clear cell carcinoma (3–13%) [11,18,23,24].

A systematic review and meta-analysis recently synthesized data from series of active surveillance for biopsy-proven renal oncocytomas, making it possible to establish several conclusions on the natural history of renal oncocytomas [23]. Average tumor growth is 2–3 mm/yr no matter the size, which is similar to RCC; 15% remain stable and 15% have a growth speed of >5 mm/yr, which is not correlated with a higher risk of diagnostic error of the biopsy [24,25]. Active surveillance was oncologically safe and associated with a high compliance rate [23]. The factors associated with conversion from surveillance to radical treatment were age on diagnosis, a low Charlson comorbidity score, and tumor size on diagnosis [21,23–32]. For young patients, delayed surgery for a biopsy-proven renal oncocytoma appears as an alternative to surveillance but should favor partial nephrectomy anytime. Radical nephrectomy for an asymptomatic renal oncocytoma is debatable in our opinion.

Our study is in favor of a wider use of biopsies before renal surgery owing to their impact on surgical technique and the rate of surgery for benign tumors, especially when the tumor is <4 cm. There is currently no alternative to an RMB in the determination of a renal mass. Several series have reported the interest of nuclear imaging techniques, but none of these techniques has provided diagnostic performance comparable with an RMB until now [33,34].

Our study relies on the retrospective analysis of a prospectively conducted national registry. As any retrospective study, our work suffers from several lacks and limits: first, the lack of a clear and consensual indication of an RMB across the participating centers. The biopsy rate of 17% prior to renal surgery was a mean, but RMB practice was heterogeneous among the participating centers and our study failed to identify demographic/tumoral factors associated with the performance of an RMB. These observa-

tions reflect the bias of interpretation inherent to guidelines when these recommend performing an RMB "when it can change the management of the renal mass." This kind of a recommendation could be interpreted in many different ways: is it a significant modification of the management when allocating the patient to surveillance versus excision, delaying excision in case of benign or low-grade carcinoma in a healthy patient, preferring a partial nephrectomy to a radical nephrectomy in a benign renal mass of >7 cm, or performing surgery knowing that the tumor is a benign one? Second, patients allocated to active surveillance or percutaneous ablative treatment were excluded from the analysis, which probably lead to an underestimation of the potential impact of an RMB on the management of a renal mass. Third, complications are reported rarely. The reported complication rate is 8%, with a majority of Clavien I-II complications occurring within an hour of performing an RMB and corresponding to hematomas or pain. We have not reported data on biopsy complications in this study because no data are available on this subject in the UroCCR database. Finally, several studies have reported that an RMB does not complicate the performance of renal surgery, particularly partial nephrectomy [35,36].

5. Conclusions

In a large registry study, we report high diagnostic performance of a biopsy in the determination of renal tumors. With recommendations to perform a biopsy only if it will change management, the biopsy rate before surgery was only 17%. We noted that 10% of renal surgery concerns benign tumors with an average size of 3–4 cm. In this study, we demonstrated that performing a biopsy before surgery was associated with a significant reduction in the rate of surgery for benign tumors and higher practice of conservative surgery by partial nephrectomy, which was even more significant in small renal masses.

Author contributions: Pauline Proye had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Boissier.
Acquisition of data: Proye, Bensalah, Bigot, Audenet, Champy, Merlin, Bruyere, Roupret, Marcq, Surlemont, Parier, Waeckel, C. Michel, Branger, Tricart, Sarrazin, Patard, Vallée, Beauval, Fontenil, Mallet, Guillotreau, Panthier, Belas, De Vergie, Le Clerc, Doumerc, Taha, Rouget, Gimel, Bernhard, Boissier.
Analysis and interpretation of data: Proye, Boissier.
Drafting of the manuscript: Proye, Boissier.
Critical revision of the manuscript for important intellectual content: Boissier.
Statistical analysis: Gondran-Tellier.
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Appendix A. Supplementary data

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References

[1] Siegel RL, Giaquinto AN, Jemal A. Cancer statistics, 2024. CA Cancer J Clin 2024;74:12–49.
[2] Volpe A, Panzarella T, Rendon RA, Haider MA, Kondylis FI, Jewett MAS. The natural history of incidentally detected small renal masses. Cancer 2004;100:738–45.
[3] Campbell SC, Clark PE, Chang SS, Karam JA, Souter L, Uzzo RG. Renal mass and localized renal cancer: evaluation, management, and follow-up: AUA guideline: part I. J Urol 2021;206:199–208.
[4] Bigot P, Barthelemy P, Boissier R, et al. French AFU Cancer Committee guidelines—update 2022–2024: management of kidney cancer. Progres Urol 2022;32:1195–274.
[5] Ljungberg B, Albiges L, Abu-Ghanem Y, et al. European Association of Urology guidelines on renal cell carcinoma: the 2022 update. Eur Urol. 2022. https://www.sciencedirect.com/science/article/pii/S0302283822016761.
[6] Vijay V, Vokshi FH, Smigelski M, Nagpal S, Huang WC. Incidence of benign renal masses in a contemporary cohort of patients receiving partial nephrectomy for presumed renal cell carcinoma. Clin Genitourin Cancer 2023;21:e114–8.
[7] Marconi L, Dabestani S, Lam TB, et al. Systematic review and meta-analysis of diagnostic accuracy of percutaneous renal tumour biopsy. Eur Urol 2016;69:660–73.
[8] Barwari K, de la Rosette JJ, Laguna MP. The penetration of renal mass biopsy in daily practice: a survey among urologists. J Endourol 2012;26:737–47.
[9] Leveridge MJ, Finelli A, Kachura JR, et al. Outcomes of small renal mass needle core biopsy, nondiagnostic percutaneous biopsy, and the role of repeat biopsy. Eur Urol 2011;60:578–84.

[10] Volpe A, Kachura JR, Geddie WR, et al. Techniques, safety and accuracy of sampling of renal tumors by fine needle aspiration and core biopsy. J Urol 2007;178:379–86.
[11] Patel HD, Druskin SC, Rowe SP, Pierorazio PM, Gorin MA, Allaf ME. Surgical histopathology for suspected oncocytoma on renal mass biopsy: a systematic review and meta-analysis. BJU Int 2017;119:661–6.
[12] Prebay ZJ, Patel A, Johnson A, et al. Perspectives on the role of biopsy for management of T1 renal masses: survey results from two regional quality improvement collaboratives. Urology 2022;165:206–11.
[13] Kümmerlin IPED, Borrego J, Wink MH, et al. Nephron-sparing surgery and percutaneous biopsies in renal-cell carcinoma: a global impression among endourologists. J Endourol 2007;21:709–13.
[14] Maisonneuve P, Agodoa L, Gellert R, et al. Cancer in patients on dialysis for end-stage renal disease: an international collaborative study. Lancet 1999;354:93–9.
[15] Rodríguez Faba O, Boissier R, Budde K, et al. European Association of Urology guidelines on renal transplantation: update 2018. Eur Urol Focus 2018;4:208–15.
[16] Prince J, Bultman E, Hinshaw L, et al. Patient and tumor characteristics can predict nondiagnostic renal mass biopsy findings. J Urol 2015;193:1899–904.
[17] Ferrari M, Cartolari R, Barizzi J, Pereira Mestre R, D'Antonio E, Renard J. Percutaneous biopsy of small renal mass: can diagnostic accuracy be affected by hospital volume? Cent Eur J Urol 2021;74:334–40.
[18] Branger N, Bigot P, Pignot G, et al. Oncocytoma on renal mass biopsy: is it still the same histology when surgery is performed? Results from UroCCR-104 study. World J Urol 2023;41:483–9.
[19] Amaral BS, Macek P, Arora A, et al. Renal tumor biopsy: rationale to avoid surgery in small renal masses. Curr Urol Rep 2021;22:46.
[20] Okhunov Z, Gorin MA, Jefferson FA, et al. Can preoperative renal mass biopsy change clinical practice and reduce surgical intervention for small renal masses? Urol Oncol 2021;39:735.e17–e23.
[21] Richard PO, Lavallée LT, Pouliot F, et al. Is routine renal tumor biopsy associated with lower rates of benign histology following nephrectomy for small renal masses? J Urol 2018;200:731–6.
[22] Rahbar H, Bhayani S, Stifelman M, et al. Evaluation of renal mass biopsy risk stratification algorithm for robotic partial nephrectomy—could a biopsy have guided management? J Urol 2014;192:1337–42.
[23] Peabody H, Patel A, Johnson A, et al. Development of a novel scoring system quantifies opportunities to reduce surgery for benign renal neoplasms: a retrospective quality improvement analysis within the MUSIC-KIDNEY Collaborative. J Urol 2020;204:1160–5.
[24] Patel AK, Lane BR, Chintalapati P, et al. Utilization of renal mass biopsy for T1 renal lesions across Michigan: results from MUSIC-KIDNEY, a statewide quality improvement collaborative. Eur Urol Open Sci 2021;30:37–43.
[25] Baboudjian M, Moser D, Yanagisawa T, et al. Benefit and harm of active surveillance for biopsy-proven renal oncocytoma: a systematic review and pooled analysis. Eur Urol Open Sci 2022;41:8–15.
[26] Deledalle FX, Ambrosetti D, Durand M, et al. Active surveillance for biopsy proven renal oncocytomas: outcomes and feasibility. Urology 2021;156:185–90.
[27] Neves JB, Varley R, Agnesi S, et al. Growth and renal function dynamics of renal oncocytomas in patients on active surveillance. BJU Int 2021;128:722–7.
[28] Neuzillet Y, Lechevallier E, Andre M, Daniel L, Nahon O, Coulange C. Follow-up of renal oncocytoma diagnosed by percutaneous tumor biopsy. Urology 2005;66:1181–5.
[29] Kawaguchi S, Fernandes KA, Finelli A, Robinette M, Fleshner N, Jewett MAS. Most renal oncocytomas appear to grow: observations of tumor kinetics with active surveillance. J Urol 2011;186:1218–22.
[30] Kurup AN, Thompson RH, Leibovich BC, et al. Renal oncocytoma growth rates before intervention. BJU Int 2012;110:1444–8.
[31] Liu S, Lee S, Rashid P, et al. Active surveillance is suitable for intermediate term follow-up of renal oncocytoma diagnosed by percutaneous core biopsy. BJU Int 2016;118(Suppl 3):30–4.
[32] Alderman MA, Daignault S, Wolf JS, et al. Categorizing renal oncocytic neoplasms on core needle biopsy: a morphologic and immunophenotypic study of 144 cases with clinical follow-up. Hum Pathol 2016;55:1–10.
[33] Meagher MF, Lane BR, Capitanio U, et al. Comparison of renal functional outcomes of active surveillance and partial nephrectomy in the management of oncocytoma. World J Urol 2021;39:1195–201.
[34] Roussel E, Capitanio U, Kutikov A, et al. Novel imaging methods for renal mass characterization: a collaborative review. Eur Urol 2022;81:476–88.
[35] Miller BL, Mankowski Gettle L, Van Roo JR, et al. Comparative analysis of surgery, thermal ablation, and active surveillance for renal oncocytic neoplasms. Urology 2018;112:92–7.
[36] Pasquier D, Rozet F, Fregeville A, et al. Renal tumor biopsy does not increase the risk of surgical complications of minimally invasive partial nephrectomy. Progres Urol 2022;32:843–8.