

Percutaneous Kidney Biopsy for a Small Renal Mass: A Critical Appraisal of Results

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Abbreviations and Acronyms

CT = computerized tomography
RCC = renal cell carcinoma
RMB = renal mass biopsy
SRM = small renal mass

Accepted for publication September 12, 2015.
No direct or indirect commercial incentive associated with publishing this article.

The corresponding author certifies that, when applicable, a statement(s) has been included in the manuscript documenting institutional review board, ethics committee or ethical review board study approval; principles of Helsinki Declaration were followed in lieu of formal ethics committee approval; institutional animal care and use committee approval; all human subjects provided written informed consent with guarantees of confidentiality; IRB approved protocol number; animal approved project number.

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Purpose: We report the diagnostic accuracy of renal mass biopsy for a small renal mass (4 cm or less) and identify predictors of successful renal mass biopsy in a contemporary cohort of patients from 2 large tertiary referral centers.

Materials and Methods: A total of 442 biopsies of renal tumors 4 cm or less at 2 tertiary centers between 2008 and 2015 were included in study. Biopsy outcomes (malignant, benign or nondiagnostic) and concordance rates between renal mass biopsy and final surgical pathology were determined. Univariate and multivariate logistic regression analyses were performed to identify factors indicative of nondiagnostic biopsy.

Results: The initial biopsy was diagnostic in 393 cases (88.9%) and nondiagnostic in 49 (11.1%). Of diagnostic biopsies 76% revealed renal cell carcinoma and 24% were benign. Renal cell carcinoma histological subtyping and grading was possible in 90.2% and 31.3% of cases, respectively. A second biopsy was performed in 11 of the 49 nondiagnostic cases and a diagnosis was possible in 100%, including renal cell carcinoma in 10 and oncocytoma in 1. Small tumor size, cystic nature of tumors and biopsy during the initial years of the study were independent predictors of nondiagnostic biopsy. The rates of accuracy in identifying malignancies, histiotyping and 2-tier grading between renal mass biopsy and surgical pathology were 97.1%, 95.1% and 68.8%, respectively.

Conclusions: Renal mass biopsy for a small renal mass can be performed accurately. Nondiagnostic renal mass biopsy was common for smaller masses and cystic masses, and during the initial years of the study. A second biopsy should be considered in nondiagnostic biopsy cases.

Key Words: kidney; carcinoma, renal cell; biopsy; diagnosis; pathology

In the last 3 decades the incidence of RCC has been rising with the greatest increases observed in patients with localized disease. In particular SRMs, usually defined radiologically as a renal mass less than 4 cm in maximal diameter, have increased due to the increased use of cross-sectional imaging modalities.^{1,2} The rate of SRM

malignancy is directly related to tumor size and small tumor size is often related to the less malignant RCC subtypes than larger masses.³ Therefore, a significant proportion of patients with a SRM are treated with unnecessary surgery due to an incorrect diagnosis by conventional imaging.⁴

RMB has emerged as a safe and useful tool for the preoperative identification of benign tumors to avoid unnecessary extirpative or ablative treatment. To date several studies have shown the high diagnostic accuracy of RMB with 89% sensitivity and 60% specificity as well as acceptable low complication rates. However, most series have been limited by a small sample size and/or the long study period required.^{5–8}

Another important question related to RMB is whether patients with a SRM should be biopsied. Some groups advocated routine RMB in patients with a SRM. However, considering the 10% to 20% rate of nondiagnostic pathological findings in the literature great efforts should be made to identify those who need RMB among patients with a SRM and to improve the biopsy technique.^{6,7,9,10}

Although RMB has become an integral part of SRM management, whether the typically excellent outcomes of this procedure can be extrapolated to a contemporary cohort of SRMs in a real clinical setting is not clear. The aim of this study was to report the diagnostic accuracy of RMB for a SRM and identify predictors of successful RMB in a contemporary cohort of patients from 2 large tertiary referral centers.

METHODS

Study Participants and Design

The study was performed with the approval and oversight of the institutional review boards of Asan Medical Center and Samsung Medical Center, which waived the requirement for informed consent because of the retrospective nature of the analyses. At our institutions RMB was performed mainly to diagnose SRMs with a malignant status that remained indeterminate on imaging to characterize incidentally diagnosed SRMs in patients who were potential candidates for minimally invasive ablative therapy. However, some urologists recommend routine RMB in all patients with a SRM regardless of findings on imaging.

The medical records of 442 consecutive patients with a renal mass who underwent percutaneous biopsy according to the described indications between January 2008 and April 2015 were retrospectively reviewed. Patient demographics and clinical status were evaluated. All patients underwent CT of the abdomen and pelvis. Parameters evaluated in the study were patient age and gender, tumor size, tumor side, tumor location, tumor structure, biopsy imaging type, RMB year, benign or malignant lesion histopathology, type of malignant lesion and Fuhrman nuclear grade of RCC.

Biopsy Technique and Pathological Evaluation

Percutaneous biopsies were performed by our experienced radiologists in the genitourinary division of the radiology department of Asan Medical Center and Samsung Medical Center. Of 442 patients 292 (66.1%) underwent

ultrasound guided biopsy and 150 (33.9%) underwent CT guided biopsy. The biopsy site was chosen in the peripheral area of the tumor and biopsy in a necrotic area was avoided.

The patient was placed prone. Using local anesthesia and helical CT-fluoroscopy or ultrasound guidance an 18-gauge core biopsy needle was inserted to obtain 2 or 3 core biopsies. The core specimens obtained were placed in 10% formalin solution and sent for pathological analysis.

The cores were fixed in Bouin solution (LD) and histopathologically evaluated with hematoxylin and eosin staining. RCC was graded according to the Fuhrman nuclear system.¹¹ Nonrenal cell tumors were stained with specific techniques (Hale staining) as well as immunohistochemical staining. The observation of fibrosis on a biopsy was not considered a failed biopsy but rather considered inconclusive.

Percutaneous Biopsy Outcomes

Histological diagnoses of the biopsies and the clinical outcomes of all patients were collected. Biopsy results were categorized as malignant tumor, benign tumor or nondiagnostic (ie insufficient material, inconclusive and normal renal parenchyma).¹² In all patients who underwent surgery after biopsy histopathological results were compared and the biopsy accuracy was calculated.

Statistical Analysis

Patients were divided into those with diagnostic vs nondiagnostic findings after RMB. Descriptive statistics were used for demographic and clinical data. The chi-square test was applied for simple associations of categorical variables. Concordance was evaluated between RMB and surgical pathology by the κ statistic. Univariate and multivariate logistic regression models were used to determine the independent association of variables with nondiagnostic pathological findings. All statistical tests were 2-tailed with $p < 0.05$ considered significant. SPSS®, version 21.0 was used for all statistical analyses.

RESULTS

Table 1 lists the characteristics of study patients from the 2 hospitals. Mean age at biopsy was 56.2 years (range 18 to 89) and mean size of the renal mass at biopsy was 2.3 cm (range 0.7 to 4.0). There were no significant differences between the 2 centers in demographic and clinical variables except the ratio of cystic tumors and imaging type for biopsy.

The diagnostic rate at initial RMB was 88.9% (393 cases). Of these 393 cases 299 (67.6%) were RCC and 94 (21.3%) were benign (table 2). Benign tumors were commonly angiomyolipoma in 73.6% of patients. In the total cohort of 442 patients 49 (11.1%) masses were nondiagnostic and 20 (4.5%) were classified as cystic. The nondiagnostic rate of RMB for a cystic mass was significantly higher than for a solid mass (25.0% vs 10.4%, $p = 0.043$).

RMB was repeated in 11 of 49 cases (22.4%) in which biopsy was initially nondiagnostic. All 11

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