Multi-Quadrant Biopsy Technique Improves Diagnostic Ability in Large Heterogeneous Renal Masses

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Abbreviations and Acronyms

CT = computerized tomography

mRCC = metastatic renal cell carcinoma

quadBX = multi-quadrant biopsy technique

RCC = renal cell carcinoma

sBX = standard biopsy technique

US = ultrasound

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See Editorial on page 867.

For another article on a related topic see page 1112.

Purpose: Percutaneous biopsy obtained from a single location is prone to sampling error in large heterogeneous renal masses, leading to nondiagnostic results or failure to detect poor prognostic features. We evaluated the accuracy of percutaneous biopsy for large renal masses using a modified multi-quadrant technique vs a standard biopsy technique.

Materials and Methods: Clinical and pathological data for all patients with cT2 or greater renal masses who underwent percutaneous biopsy from 2009 to 2014 were reviewed. The multi-quadrant technique was defined as multiple core biopsies from at least 4 separate solid enhancing areas in the tumor. The incidence of nondiagnostic findings, sarcomatoid features and procedural complications was recorded, and concordance between biopsy specimens and nephrectomy pathology was compared.

Results: A total of 122 biopsies were performed for 117 tumors in 116 patients (46 using the standard biopsy technique and 76 using the multi-quadrant technique). Median tumor size was 10 cm (IQR 8–12). Biopsy was nondiagnostic in 5 of 46 (10.9%) standard and 0 of 76 (0%) multi-quadrant biopsies (p=0.007). Renal cell carcinoma was identified in 96 of 115 (82.0%) tumors and nonrenal cell carcinoma tumors were identified in 21 (18.0%). One complication occurred using the standard biopsy technique and no complications were reported using the multi-quadrant technique. Sarcomatoid features were present in 23 of 96 (23.9%) large renal cell carcinomas studied. Sensitivity for identifying sarcomatoid features was higher using the multi-quadrant technique compared to the standard biopsy technique at 13 of 15 (86.7%) vs 2 of 8 (25.0%) (p=0.0062).

Conclusions: The multi-quadrant percutaneous biopsy technique increases the ability to identify aggressive pathological features in large renal tumors and decreases nondiagnostic biopsy rates.

Key Words: kidney neoplasms; carcinoma, renal cell; biopsy; metastasis; neoadjuvant therapy

In patients with large renal tumors, especially locally advanced or metastatic renal tumors, percutaneous biopsy may identify rare tumors or confirm the presence of renal cell cancer. Accurate diagnosis is especially important for patients with metastatic disease, with recent studies suggesting that only 35% to 45% with metastatic RCC are treated

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with cytoreductive nephrectomy.[1,2] In patients who cannot tolerate or refuse up-front surgery, and patients considering preoperative clinical trials, biopsy can provide information about subtype or aggressive pathological features that may influence the choice of systemic therapy and guide treatment decisions. However, standard renal mass biopsy techniques are prone to sampling error and inaccuracy when evaluating large tumors[3] related to the heterogeneity present in large RCC primary tumors.[4] Although techniques for small renal mass biopsy are well described, there remains a paucity of data evaluating the optimal techniques for percutaneous biopsy of large renal masses.

Core sampling of renal masses is accomplished using 14 to 24-gauge needles[5] and US or CT to target the tumor. Increased accuracy has been demonstrated when multiple cores are obtained from tumors for pathological evaluation.[6] However, since large tumors frequently exhibit different phenotypes within spatially distinct regions, we hypothesized that sampling multiple different areas would further improve the ability of biopsy to evaluate pathological features and decrease the rate of nondiagnostic biopsies. We evaluated the accuracy and safety of a novel technique for percutaneous biopsy of large renal masses (quadBX) in which tissue samples are obtained from multiple separate solid enhancing locations in each tumor.

PATIENTS AND METHODS

After institutional review board approval, clinical and pathological data for consecutive patients with cT2 or greater renal masses at the University of Wisconsin Hospital and Clinics from 2009 to 2014 were reviewed. Patients with clinical T2 or greater renal masses were offered biopsy after discussion of risks and benefits. During the study period 198 patients with clinical T2 renal masses or greater were evaluated, 152 were treated with up-front surgery at our institution and 116 (58.5%) had preoperative biopsy (supplementary figure, http://jurology.com/). All biopsies were performed with the patient under local anesthesia by an attending radiologist using US or CT guidance if not amenable to US guidance, at the discretion of the radiologist. No patients received systemic treatment before tumor biopsy.

In all patients an 18-gauge biopsy needle was used to obtain core tissue samples. The quadBX was conceived in 2011 to sample multiple areas of large tumors. The percutaneous quadBX is identical to standard renal biopsy techniques but includes samples from at least 4 separate, solid enhancing areas in the tumor (fig. 1). QuadBX was requested for patients with a large renal mass after informed consent by 1 attending urologist (EJA). In biopsies where core samples were obtained from less than 4 areas in the tumor, the biopsy technique was defined as standard, which was requested by other attending urologists during the study period. Nondiagnostic biopsies were defined when only necrotic/sclerotic tissue or benign renal parenchyma was present and neoplasm was unable to be diagnosed. Patients were assessed for complications via direct observation for 2 hours after the procedure, and subsequently by telephone from radiology staff and at followup clinical appointments for 30 days after biopsy.

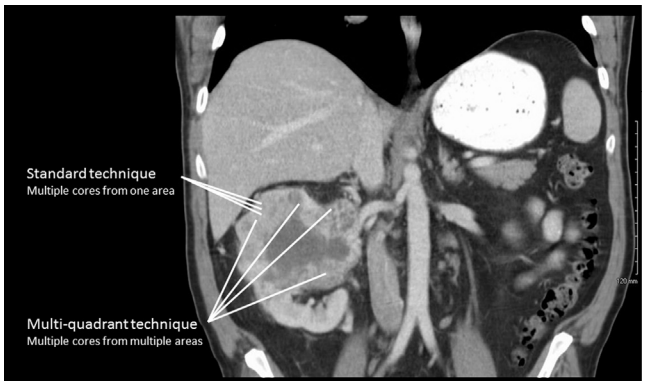

Figure 1. Large renal masses demonstrate significant heterogeneity in radiological appearance. QuadBX samples cores from multiple enhancing areas in tumors whereas standard technique obtains tissue from 1 location.

Summary statistics and frequencies were used to describe baseline demographic, clinical and pathological characteristics of the study population. Differences among variables between cohorts and differences in concordance between sBX and quadBX were evaluated using ANOVA for continuous variables and the chi-square or Fisher's exact test for categorical variables. Results using the quadBX were compared with sBX after an expert genitourinary pathologist (WH) performed a blinded central review of each biopsy core. All analyses were performed using SAS® 9.2 with 2-sided $p \leq 0.05$ considered significant.

RESULTS

A total of 122 percutaneous biopsies were performed for 117 large (cT2 or greater) renal masses in 116 patients from 2009 to 2014. The sBX was used for 46 biopsies in 41 patients and the quadBX was used for 76 biopsies performed in 75 patients. The table shows the baseline demographic and clinical characteristics of the study population. Median age, gender, Charlson comorbidity index and race were similar between the sBX and quadBX groups. Median tumor size for the entire cohort was 10.0 cm (IQR 8.0–12.0) with no differences between the groups. Median number of cores obtained was higher in the quadBX group and ultrasound guidance was used in the majority of cases for both groups. QuadBX was used more often for patients with clinical stage 3 tumors while sBX was used more often in patients with clinical stage 4 tumors.