Evaluation of Renal Mass Biopsy Risk Stratification Algorithm for Robotic Partial Nephrectomy—Could a Biopsy Have Guided Management?

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Purpose: We evaluated a published biopsy directed small renal mass management algorithm using a large cohort of patients who underwent robotic partial nephrectomy for tumors 4 cm or smaller.

Materials and Methods: A simplified algorithm of biopsy directed small renal mass management previously reported using risk stratified biopsies was applied to 1,175 robotic partial nephrectomy cases from 5 academic centers. A theoretical assumption was made of perfect biopsies that were feasible for all patients and had 100% concordance to final pathology. Pathology risk groups were benign, favorable, unfavorable and intermediate. The algorithm assigned favorable or intermediate tumors smaller than 2 cm to active surveillance and unfavorable or intermediate 2 to 4 cm tumors to treatment. Higher surgical risk patients were defined as ASA® 3 or greater and age 70 years or older.

Results: Patients were assigned to the pathology risk groups of benign (23%), favorable (13%), intermediate (51%) and unfavorable (12%). Patients were also assigned to the management groups of benign pathology (275, 23%), active surveillance (336, 29%) and treatment (564, 48%). Most of the 611 (52%) patients in the benign or active surveillance groups were low surgical risk and had safe treatment (2.6% high grade complications). A biopsy may not have been feasible or accurate in some tumors that were anterior (378, 32%), hilar (93, 7.9%) or less than 2 cm (379, 32%). Of 129 (11%) high surgical risk patients the biopsy algorithm assigned 70 (54%) to benign or active surveillance groups.

Conclusions: The theoretical application of a biopsy driven, risk stratified small renal mass management algorithm to a large robotic partial nephrectomy database suggests that about half of the patients might have avoided surgery. Despite the obvious limitations of a theoretical assumption of all patients receiving a perfect biopsy, the data support the emerging role of renal mass biopsies to guide management, particularly in high surgical risk patients.

Key Words: kidney neoplasms; carcinoma, renal cell; biopsy

Abbreviations and Acronyms

AS = active surveillance

ASA® = American Society of Anesthesiologists score

ECOG = Eastern Cooperative Oncology Group

RCC = renal cell carcinoma

RMB = renal mass biopsy

RPN = robotic partial nephrectomy

SRM = small renal mass

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RENAL cancer is the third most common diagnosed urological cancer in the United States.[1] There has been an increase in the incidence of renal cell cancer, driven largely by the increased use of radiographic imaging with incidental detection of small renal masses.[2,3] Partial nephrectomy is a standard treatment option for SRM[4] but active surveillance is an alternative option in select patients.[5]

Halverson et al published a simplified biopsy directed management algorithm for the SRM that divided patients into treatment and active surveillance groups based on tumor size and pathology.[6] We evaluated this biopsy algorithm using a large cohort of patients who underwent robotic partial nephrectomy for small renal masses and assessed whether the algorithm could have changed patient management if an accurate biopsy had been performed.

Table 1. *Final pathology of 4 risk groups and subsequent management groups according to biopsy directed SRM management algorithm*

Pathology Risk Group		Treatment	Active Surveillance	Benign
Benign:				
Oncocytoma	126 (10.7)			126 (10.7)
Angiomyolipoma	76 (6.5)			76 (6.5)
All others	73 (6.2)			73 (6.2)
Favorable:				
Clear cell grade 1	69 (5.9)		69 (5.9)	
Papillary type 1	3 (2.6)		3 (2.6)	
Chromophobe	79 (6.7)		79 (6.7)	
Intermediate:				
Clear cell grade 2	344 (29.3)	246 (20.9)	98 (8.3)	
Papillary type 1/unspecified	223 (19.0)	145 (12.3)	78 (6.6)	
Mixed RCC	36 (3.1)	27 (2.3)	9 (0.8)	
Unfavorable:				
Clear cell, grade 3–4	132 (11.2)	132 (11.2)		
Papillary type 1/unspecified	1 (0.1)	1 (0.1)		
Papillary type 2	13 (1.1)	13 (1.1)		

METHODS

After obtaining institutional review board approval we retrospectively reviewed the records of consecutive cases of RPN performed at 5 high volume centers in the U.S. from 2007 to mid 2013. Our inclusion criteria encompassed RPN for tumors smaller than 4 cm. Cases missing information about tumor pathology or tumor size (80) were excluded from the study. A total of 1,175 patients met the criteria of having tumors 4 cm or smaller with information available about final pathology and tumor size. Tumor complexity was assessed using the R.E.N.A.L. nephrometry score.[7] All procedures were performed by experienced surgeons. Comorbidities were assessed using the ASA. Glomerular filtration rate was calculated using the Modification of Diet in Renal Disease formula. Margin status was assessed by final pathology evaluation. Postoperative complications were graded according to the Clavien classification.[8] A high grade complication was defined as Clavien score 3 or greater.

Algorithm Analysis

A simplified algorithm of small renal mass management reported by Halverson et al using histological risk stratified biopsies and tumor size was applied to RPN cases based on final pathology reports.[6] A renal mass biopsy was not routinely performed in our patient population and RMB reports were not available in our multicenter data set to assess concordance with final pathology. A theoretical assumption was made of perfect biopsies that were feasible for all patients and had 100% concordance to final pathology. Patients were divided into 4 risk groups based on final pathology, including benign (angiomyolipomas, oncocytomas and other benign pathologies), favorable (grade 1 clear cell RCC and chromophobe RCC), unfavorable (type 2 papillary RCC, and any grade 3 or 4 RCC subtype or unclassified RCC) and intermediate (all others including grade 2) (table 1). The algorithm assigned tumors into 3 management subgroups, with benign tumors assigned to followup per physician, favorable or intermediate tumors smaller than 2 cm assigned to active surveillance, and unfavorable or intermediate 2 to 4 cm tumors assigned to treatment.

An additional analysis was performed that considered comorbidities and potential surgical risk. We did not use ECOG performance status or depth of tumor invasion as mentioned in a more expanded algorithm in the study by Halverson et al as these variables were not available in our data set. We defined high surgical risk patients as ASA 3 or greater (severe systemic disease) and age 70 or older. High surgical risk patients with favorable 2 to 4 cm or intermediate 2 to 4 cm tumors were assigned to active surveillance. Low risk patients with favorable 2 to 4 cm or intermediate 2 to 4 cm tumors were assigned to the treatment group. Analyses were also performed stratified by gender.

Statistical Analysis

Demographics, surgical, pathological and followup data were assessed. Patient characteristics, pathology, intraoperative parameters and postoperative outcomes were compared among treatment subgroups. For continuous data, variables were presented as mean ± SD and mean values were compared using Student's t-test. Categorical variables were compared using the chi-square test. Statistical significance was set at $p < 0.05$. Statistical analysis was performed using SPSS® software version 22.0.

RESULTS

Patients were assigned to several pathology risk groups including benign (275, 23.4%), favorable (151, 12.9%), intermediate (603, 51.3%) and unfavorable (146, 12.4%) (fig. 1). Patients in the intermediate group were subdivided into 2 groups of tumor smaller than 2 cm (185, 30.7%) and tumor 2 to 4 cm (418, 69.3%). The active surveillance group (336, 28.6%) included favorable pathology (151,