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Comparison of Partial Nephrectomy and Percutaneous Ablation for cT1 Renal Masses

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Abstract

Background: Partial nephrectomy (PN) is a preferred treatment for cT1 renal masses, whereas thermal ablation represents an alternative nephron-sparing option, albeit with higher reported rates of recurrence.
Objective: To review our experience with PN, percutaneous radiofrequency ablation (RFA), and percutaneous cryoablation for cT1 renal masses.
Design, setting, and participants: A total of 1803 patients with primary cT1N0M0 renal masses treated between 2000 and 2011 were identified from the prospectively maintained Mayo Clinic Renal Tumor Registry.
Intervention: PN compared with percutaneous ablation.
Outcome measurements and statistical analysis: Local recurrence-free, metastases-free, and overall survival rates were estimated using the Kaplan-Meier method and compared with log-rank tests.
Results and limitations: Of the 1424 cT1a patients, 1057 underwent PN, 180 underwent RFA, and 187 underwent cryoablation. In this cohort, local recurrence-free survival was similar among the three treatments ($p = 0.49$), whereas metastases-free survival was significantly better after PN ($p = 0.005$) and cryoablation ($p = 0.021$) when compared with RFA. Of the 379 cT1b patients, 326 patients underwent PN, and 53 patients were managed with cryoablation (8 RFA patients were excluded). In this cohort, local recurrence-free survival ($p = 0.81$) and metastases-free survival ($p = 0.45$) were similar between PN and cryoablation. In both the cT1a and cT1b groups, PN patients were significantly younger, with lower Charlson scores and had superior overall survival ($p < 0.001$ for all). Limitations include retrospective review and selection bias.
Conclusions: In a large cohort of sporadic cT1 renal masses, we observed that recurrence-free survival was similar for PN and percutaneous ablation patients. Metastases-free survival was superior for PN and cryoablation patients when compared with RFA for cT1a patients. Overall survival was superior after PN, likely because of selection bias. If these results were validated, an update to clinical guidelines would be warranted.
Patient summary: Partial nephrectomy and percutaneous ablation for small (<7-cm) and localized renal masses are associated with similar rates of local recurrence.

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1. Introduction

Radical nephrectomy has historically been the standard of care for management of renal masses. Initially reserved for imperative situations, partial nephrectomy (PN) has been increasingly used after observations suggested that oncologic control was similar when compared with radical nephrectomy, with the additional benefits of renal preservation [1–5]. Consistent with this situation, the American Urological Association (AUA) guidelines state that PN should be strongly considered for healthy patients with cT1a renal masses and should be discussed as an alternate standard for cT1b patients, particularly when there is a need to preserve renal function [5]. Other treatment options, including thermal ablation and active surveillance, represent further management strategies that should be discussed, though with appropriate levels of discretion depending on the clinical scenario [5]. Accordingly, the European Association of Urology guidelines state that thermal ablation should be considered predominately in patients with small tumors who are unfit for surgery with the understanding that local progression rates are higher [6].

In the last 10–15 yr, we have amassed significant experience with percutaneous cryoablation and radiofrequency ablation (RFA) for renal masses. Ablative options, initially reserved for patients who were poor candidates for surgery, now have expanded indications and are routinely discussed. Nevertheless, direct comparisons of cancer-related outcomes among PN, RFA, and cryoablation patients are lacking, especially from institutions that routinely perform all the aforementioned nephron-sparing options [7]. Thus, we evaluated our experience with management of cT1 renal masses to compare oncologic outcomes among patients treated with PN, percutaneous RFA, and percutaneous cryoablation.

2. Materials and methods

2.1. Patient selection

Following institutional review board approval, we queried the Mayo Clinic Renal Tumor Registry to identify patients treated with PN, percutaneous RFA, or percutaneous cryoablation for sporadic, localized (N0M0), cT1 solid renal masses between 2000 and 2011. Patients with a history of prior renal cell carcinoma (RCC) or genetic syndromes were excluded. In total, there were 1424 patients treated with PN ($n = 1057$), RFA ($n = 180$), or cryoablation ($n = 187$) for cT1aN0M0 renal masses and 379 patients treated with PN ($n = 326$) or cryoablation ($n = 53$) for cT1bN0M0 renal masses. Eight patients treated with RFA for cT1b renal masses were not evaluated in this study after this practice was discontinued in lieu of cryoablation [8].

2.2. Clinical features and patient management

Clinical features included age, gender, Charlson score, and serum creatinine (milligrams per deciliter). Pathologic features included tumor size, histology, and grade. All patients were first evaluated in the Department of Urology. For those patients electing PN, the procedure was performed as previously described [2]. Patients further interested in percutaneous ablation were referred to the Department of Interventional Radiology, and the procedure was performed as previously described [9,10]. The selection of RFA versus cryoablation was at the discretion of the interventional radiologist; however, in general, RFA was reserved for patients with smaller tumors (ie, < 3 cm) and peripheral tumors [8].

Over the study time frame, patient surveillance was generally recommended at 3, 6, 12, 18, and 24 mo, followed by yearly intervals; variation from this protocol was further based on pathologic features and clinical health status. Local recurrence following ablation was defined as new focal enhancement in the ablation bed or enlargement of the ablation defect on follow-up imaging. Local recurrence following PN was defined as a mass in the ipsilateral kidney. Development of metastatic disease was defined as extrarenal disseminated disease, with or without pathologic confirmation.

2.3. Statistical methods

Comparisons of features by treatment were evaluated using the Kruskal-Wallis, Wilcoxon rank sum, χ^2, and Fisher exact tests. Since ablation patients had pathology results from only a needle core biopsy, those without diagnostic features of RCC (ie, atypical oncocytic neoplasm/tumor, suspicious, spindle cell tumor) were not considered to harbor RCC. Local recurrence-free, distant metastases–free, and overall survival were estimated using the Kaplan-Meier method and compared among treatments using log-rank tests. Because of the few cancer-related deaths (eight for cT1a patients and nine for cT1b patients), cancer-specific survival was not analyzed. The duration of follow-up for local recurrence-free survival was calculated from treatment to local recurrence, from treatment to last follow-up for patients treated with PN, or from treatment to last imaging for patients treated with ablation. Because the definition of ablation success requires lack of contrast uptake in the ablated mass, we required imaging follow-up for patients treated with ablation. The duration of follow-up for distant metastases–free survival was calculated from treatment to distant metastases or to last follow-up. The duration of follow-up for overall survival was calculated from treatment to last follow-up. The effect of treatment on overall survival was further evaluated after adjusting for age and Charlson score using Cox proportional hazards regression models. Statistical analyses were performed using SAS v.9.2. All tests were two-sided, with p values <0.05 considered significant.

3. Results

3.1. Patients with cT1a tumors

Clinical and pathologic features for the 1424 patients with cT1a tumors are depicted in Table 1. Patients treated with PN were significantly younger ($p < 0.001$) and had lower Charlson scores ($p < 0.001$) compared with patients treated with RFA and cryoablation. Median tumor size was 2.4 cm, 1.9 cm, and 2.8 cm for patients treated with PN, RFA, and cryoablation, respectively ($p < 0.001$). As expected, the percentage of patients with benign or unknown histology was higher for those treated with ablation versus PN ($p < 0.001$).

3.2. Local recurrence-free survival for cT1a patients

Twenty-seven patients treated with RFA or cryoablation had no oncologic follow-up and were excluded from analyses of local recurrence-free survival, leaving 1057, 166, and 174 patients treated with PN, RFA, and cryoablation, respectively. Thirty-six patients treated with PN