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Original article

Imaging strategy and outcome following partial nephrectomy

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Abstract

Objectives: The aim of this study was to analyze the outcomes of surveillance after partial nephrectomy (PN) in a single institution and the relevance of imaging studies in detecting recurrence.

Material and methods: Retrospective study of 830 patients who underwent PN for localized renal cell carcinoma between 2007 and 2015 at a single institution. We studied the characteristics of recurrence according to pathological and clinical features and elaborated risk groups. The type and the total number of imaging studies performed during surveillance or until recurrence were evaluated. Outcomes of surveillance were analyzed.

Results: There were 48 patients (5.8%) diagnosed with recurrence during median 36 [21–52] months follow-up, including local recurrence in 18 patients (37.5%) and metastasis in 30 patients (62.5%). Totally, 17/18 patients (94.4%) with local recurrence and 26/30 patients (86.6%) with metastasis were diagnosed within the first 36 months after PN. When studying the recurrence rate, and time-to-recurrence, 2 risk groups emerged. Patients with pathological characteristics (tumors with pT1b or higher or high-grade tumor or positive surgical margin status) or patients with anatomical characteristics (high or moderate R.E.N.A.L. score) or both had high recurrence rate. Chest x-ray and abdominal ultrasound detected 7.7% and 3.4% of all recurrences, respectively, whereas computed tomography scan and magnetic resonance imaging scan detected the rest. Of the 48 patients diagnosed with recurrence, 44 (91.6%) were suitable for secondary active treatment (systemic, surgery, and radiotherapy) including 26 (54.2%) suitable for metastasectomy. The rate of relapse after secondary treatment was 43.5% (16.6% for the local recurrence group and 60.7% for metastasis group).

Conclusion: Local recurrence emerges earlier than distant metastasis. Patients with any adverse pathological or anatomical features should be considered as high-risk group and followed closely in the first 36 months after PN with cross-sectional studies. Secondary active treatment is suitable for most patients, while surgical treatment fits fewer patients. Local recurrence is associated with increased rates of metastatic progression. © 2017 Elsevier Inc. All rights reserved.

Keywords: Partial nephrectomy; Recurrence; Imaging; Pattern; Renal cell carcinoma

1. Introduction

The standard treatment for localized renal cell carcinoma (RCC) remains surgical removal, either by partial nephrectomy (PN) or radical nephrectomy; additional treatment options include watchful waiting and ablative therapies [1]. After nephron-sparing surgical treatment approaches, recurrent disease may develop in the remaining kidney, renal fossa, retroperitoneal lymph node, or in distant organs. The incidence of local and distant recurrence has been reported to be 2.2% and 2.6%, respectively, after PN for pT1 tumor [2].

With the introduction of target therapy [3], immune checkpoint inhibitors [4], and the development of mini-invasive ablative therapy of recurrent lesions, the outlook of recurrent RCC is changing. With this change comes the need for good surveillance and early detection. As the purpose of surveillance is the detection of curable recurrence, recommendations for surveillance should take into consideration the optimal period of surveillance, the best

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surveillance modalities, the rapidly rising health care costs, and should be tempered by the ability of further treatments. Unfortunately, there is still no consensus on surveillance after RCC treated by PN [5,6]; however, there is a wide agreement that imaging studies play major role in diagnosing recurrence, while physical examinations and laboratory studies are not sensitive in detecting tumor recurrence.

The aim of this study is to analyze the surveillance strategy and outcomes after PN for cT1–2 in a single institution.

2. Material and methods

We, retrospectively, reviewed our institutional review board-approved PN database. Data consisted of 1,060 consecutive records of PN for clinically localized (cT1–2N0M0) RCC between 2007 and 2015. Patients who presented with bilateral synchronous tumors or in whom a metachronous renal mass developed were included only once using the initial PN as an index case. Overall, 830 patients with minimum 1 postoperative imaging follow-up were included in the analysis.

Patient demographics (age, sex, race, body mass index, Charlson comorbidity index, American Society of Anesthesiologists score; solitary kidney, prior abdominal surgery, surgical approach), pathological tumor characteristics (American Joint Cancer Committee staging, histology subtype, margin status, grade, lymphovascular invasion, and tumor necrosis), and anatomic tumor characteristics (R.E.N.A.L. nephrometry score: consists of (R)adius (tumor size as maximal diameter), (E)xophytic/endophytic properties of the tumor, (N)earness of tumor deepest portion to the collecting system or sinus, (A)nterior (a)/posterior (p) descriptor and the (L)ocation relative to the polar line) were assessed. The complexity of the surgery was defined by the R.E.N.A.L. score. Renal masses with a R.E.N.A.L. range of 4 to 6, 7 to 9, and 10 to 12 are deemed low-, moderate-, and high-complexity lesions, respectively. Continuous variables were described as median and interquartile range. Categorical variables were described as frequency and percentage.

Follow-up was done according to the surveillance protocol and consisted of medical history, routine blood tests, chest x-ray or computed tomography scan (CT), abdominal CT scan or ultrasound, and abdominal magnetic resonance imaging scan (MRI) if indicated, whereas brain CT scan and skeletal MRI were done if clinically indicated. The surveillance protocol coincides with AUA guideline recommendations. Local recurrence was defined as tumor development in the operated renal fossa or resection bed, and metastatic recurrence defined as tumor development in systemic distant sites or retroperitoneal lymph nodes. Asymptomatic recurrence was defined as when the recurrence was diagnosed with routine diagnostic imaging without relevant complaints. Symptomatic recurrence was defined as when the patient reported symptoms justifying an imaging examination.

We studied the characteristics of recurrence in terms of rate, pattern, site, and time to relapse. The type of imaging and the total number of imaging studies performed during surveillance or until recurrence were evaluated.

Progression-free survival (PFS) was defined as the time from PN to biopsy-proven recurrence. The first recurrence in time for each patient was counted as an event, and all other recurrences were censored to prevent double counting. Patients free of disease on last follow-up were also censored. We assessed the survival according to pathological stage, tumor grade, margin status, and R.E.N.A.L. score. PFS was estimated by the Kaplan-Meier method, and survival differences were analyzed using the log rank test.

Analysis was performed using SPSS v22 software (IBM SPSS Statistics, Armonk, NY: IBM Corp., USA). All tests used 5% as a significance threshold.

3. Results

Table 1 lists the clinical features and pathological characteristics of the cohort. Of the 830 RCC treated by PN, 545 (65.7%) were pT1a, 176 (21.2%) were pT1b, 13 (1.6%) were pT2, and 96 (11.6%) were pT3a. Higher pT stage was associated with higher tumor grade ($P < 0.01$), higher rate of lymphovascular invasion ($P < 0.01$), higher rate of tumor necrosis ($P < 0.01$), and higher rate of positive surgical margin ($P < 0.01$).

3.1. Characteristics of recurrence in the cohort

3.1.1. Pattern of recurrence

There were 48/830 patients (5.8%) diagnosed with recurrence during median 36 [21–52] months follow-up (mean 38 ± 20 mo), including local recurrence in 18 patients (37.5%) and metastasis in 30 patients (62.5%). All relapses were initially detected at a single site. The recurrence was symptomatic in 5 patients (10.4%) and asymptomatic in 43 patients (89.6%). The number of patients to follow in order to detect 1 asymptomatic recurrence was 19 (Table 2).

3.1.2. Site of recurrence

The sites of recurrence were abdominal in 30 patients (62.5%), chest in 13 patients (27%), bone in 4 patients (8.3%), and brain in 1 patient (2.1%). Of the 30 abdominal recurrences, there were 5 recurrences (10.4%) in tumor bed, 13 (27%) in renal fossa, 4 (8.3%) in retroperitoneal lymph nodes, 2 (4.2%) in peritoneum, 2 (4.2%) in omentum, 2 (4.2%) in adrenal gland, and 2 (4.2%) in pancreas, whereas the chest recurrences were in lung for 11 patients (23%) and in mediastinum for 2 (4%) (Table 2).

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