



Original article

Percutaneous radiofrequency ablation for renal cell carcinoma vs. partial nephrectomy: Comparison of long-term oncologic outcomes in both clear cell and non-clear cell of the most common subtype

Ning Liu, M.D.^{a,1}, Daoguang Huang, M.D.^{b,1}, Xiangming Cheng, M.D.^a, Yankun Chong, M.D.^a, Wei Wang, Ph.D.^a, Weidong Gan, Ph.D.^{a,*}, Hongqian Guo, Ph.D.^a

^a Department of Urology, Nanjing Drum Tower Hospital, Medical School of Nanjing University, Institute of Urology, Nanjing University, Nanjing, Jiangsu Province, People's Republic of China

^b Department of Urology, Lichuan People's Hospital, Lichuan, Hubei Province, People's Republic of China

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Abstract

Objectives: To compare the clinical outcomes of percutaneous radiofrequency ablation (PRFA) and partial nephrectomy (PN) in patients with clear cell renal cell carcinoma (ccRCC) and non-clear cell RCC (nccRCC) of the most common subtypes.

Materials and methods: A retrospective study was conducted to review the records of all the patients who underwent PRFA or PN between February 2005 and April 2014 at our institution. Patients with histologic confirmation of ccRCC, papillary RCC, and chromophobe RCC were included. The Mann-Whitney *U* test was applied to compare PRFA to PN in the ccRCC and nccRCC groups. The Kaplan-Meier method was used to generate the survival curves that were compared to the log-rank test.

Results: A total of 264 patients meeting the selection criteria were included in this study. The tumor size ranged from 0.9 to 7.0 cm. The median follow-up period was 78 months (range: 8–132 mo). Although PRFA provided comparable 10-year overall survival rates and 10-year disease-free survival (DFS) rates to PN both in ccRCC ≤ 4 cm and nccRCC, the 10-year DFS for patients treated with PRFA was lower than that of PN in ccRCC > 4 cm. The DFS survival curve between the 2 operations and 2 subtypes was statistically significant in patients with tumor size > 4 cm. Limitations include retrospective review and selection bias.

Conclusions: Patients with T1b ccRCC treated with PRFA have less favorable outcomes than those with PN whereas PRFA provides comparable oncologic outcomes to PN in patients with T1b nccRCC. It is necessary to take RCC subtypes into consideration when choosing a surgical approach to treat T1b RCC between PRFA and PN. © 2017 Elsevier Inc. All rights reserved.

Keywords: Renal Cell Carcinoma; Radiofrequency; Nephron Sparing Surgery; Percutaneous; Clear Cell Renal Carcinoma

1. Introduction

With the progress in surgical techniques, nephron sparing surgery including partial nephrectomy (PN) has been widely used and is now regarded as the standard treatment

for renal cell carcinoma (RCC) [1]. However, for the sake of minimally invasive therapy and maximally preserved renal function, radiofrequency ablation (RFA) has been increasingly used in treating RCC and can be applied using open, laparoscopic, and percutaneous approaches [2]. Of those 3 methods, percutaneous RFA (PRFA) has been considered the least invasive with the fastest recovery [3].

There are currently several individual RCC subtypes, and of these, the most common are clear cell RCC (ccRCC [75–85%]), papillary RCC (pRCC [10–15%]), and chromophobe RCC (chRCC [5–10%]) [4]. Achieving negative margins without residue in surgical resection is independent of tumor subtype although the biology of various RCCs can

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¹Both the authors contributed equally to the study.

* Corresponding author. Tel.: +86-258-373-3339; fax: +86-258-330-7115.

E-mail addresses: gwd@nju.edu.cn, dr.gwd@yeah.net (W. Gan).

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affect ablation success due to vascularity related to the “heat sink” effect during RFA [5]. Furthermore, hypovascular or avascular RCC are more likely to be categorized as non-clear cell RCC (nccRCC), especially pRCC and chRCC [6]. Therefore, our study was performed retrospectively to compare clinical and oncologic outcomes of PRFA with PN in patients with ccRCC and nccRCC of the most common subtypes.

2. Materials and methods

2.1. Patient selection

The data were obtained from a prospectively maintained database approved by an institutional review board and ethics committee. We reviewed the records of all the patients who underwent PRFA or PN between February 2005 and April 2014 at our hospital. Patients were divided into the following 2 groups: ccRCC and nccRCC. The RCC subtype was specifically identified and only those patients with histologic confirmation of ccRCC, pRCC, and chRCC were included. Patients with synchronous bilateral, multiple ipsilateral tumors, and distant metastases were excluded from this analysis, as were those who had a familial history of RCC or a history of hereditary RCC syndromes. The surgical choice was based on tumor location, tumor size, history of previous surgery, and the surgeon’s judgment. After full communication between patients and surgeons, a choice between PRFA and PN was made by the patients. In general, PRFA was recommended for patients with smaller tumors (<4 cm) and peripheral tumors.

2.2. PRFA technique

Preoperative contrast-enhanced ultrasonography (BK Ultrasound, Denmark) was applied to figure out the location and outline of the tumor. The patient was placed in a prone or decubitus position based on the location of the lesion. A 22-gauge biopsy under the guidance of ultrasonography for histologic assessment of the tumor was obtained immediately before the first RFA. We also used intraoperative ultrasonography to guide insertion of the electrode. After the biopsy (TruCore, 22 G) was finished, the Cool-tip system (Radionics, Burlington, MA) was applied for PRFA. Contrast-enhanced ultrasonography was given to evaluate the effectiveness of the previous ablation immediately after a cycle (12 min) of PRFA. If any suspicious residue was shown, extra cycles of ablation were performed at the surgeon’s discretion. The techniques of PRFA have been described at length previously by our team [2,7].

2.3. Follow-up

The examination during follow-up period included history review, physical examination, chest radiography,

contrast-enhanced computed tomography (CT), or enhanced magnetic resonance imaging (MRI) and serum chemistries. Initial contrast-enhanced CT was performed approximately 7 days after the PRFA, and then at 3 months, 6 months, and every 6 months thereafter. Patients with renal insufficiency or contrast agent allergy were followed up with gadolinium-enhanced MRI. Seven days after PRFA, a lesion with more than 10 Hounsfield unit of contrast medium enhancement on CT or qualitative evidence of enhancement after intravenous gadolinium contrast-enhanced MRI was described as tumor residue [8] and if that occurred within the follow-up period, we described the lesion as a local recurrence. The follow-up protocol of PN was similar to that of PRFA, except that the interval was every 6 months in the initial 3 years and annually thereafter. For PN, local recurrence was defined as a mass in the ipsilateral kidney. Metastatic recurrence was defined as extrarenal disseminated disease, with or without pathologic confirmation. Tumor recurrence included local recurrence and metastatic recurrence. Postoperative complications were categorized according to the Clavien system [9]. The glomerular filtration rate (GFR) was calculated using the modified modification of diet in renal disease equation [10]

$$\text{GFR} = 175 \times (\text{serum creatinine})^{-1.154} \times (\text{age})^{-0.203} \\ \times (0.742 \text{ if female}) \times (1.212 \text{ if black}).$$

Based on the estimated data, we compared the GFR at the last follow-up to the preoperative GFR. Disease-free survival (DFS) was defined as freedom from residue and recurrence at any site (local or metastatic). Overall survival (OS) was defined as freedom from death due to any cause.

2.4. Hypothesis

Our primary hypothesized PRFA could reach a comparable 10-year OS and 10-year DFS and less postoperative complication rate with PN in the treatment of small RCC (≤ 4 cm). Second, we hypothesized that the following results of PRFA between the ccRCC group and nccRCC group might be different.

2.5. Statistical analysis

Giving the limited patient review size, nonparametric statistics were used for statistical analysis. Demographics as well as perioperative data concerning differences between groups were analyzed using the Mann-Whitney *U* test for continuous variables and the results presented median values with a range. In dealing with categorical variables, Pearson’s chi-squared test and Fisher exact test were used for disordered variables, and the Mantel-Haenszel chi-squared test was used for ordinal variables. Clinical outcomes such as OS and DFS were calculated using the Kaplan-Meier method and compared among treatments in each subtype group using the log-rank test. Two-tailed hypothesis tests were used for each comparison.

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