

Original article

Nephron-sparing surgery is superior to radical nephrectomy in preserving renal function benefit even when expanding indications beyond the traditional 4-cm cutoff

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Received 9 December 2013; received in revised form 10 March 2014; accepted 11 March 2014

Abstract

Objectives: To analyze to what extent partial nephrectomy (PN) is superior to radical nephrectomy (RN) in preserving renal function outcome in relation to tumor size indication.

Methods and materials: Clinical data from 973 patients operated at 9 academic institutions were retrospectively analyzed. Glomerular filtration rate (GFR) before and after surgery was calculated with the abbreviated Modification of the Diet in Renal Disease equation. For a fair comparison between the 2 techniques, all imperative indications for PN were excluded. A shift to a less favorable GFR group following surgery was considered clinically significant.

Results: Median age at diagnosis was 60 years (19–91). Tumor size was smaller than 4 cm in 665 (68.3%) cases and larger than 4 cm in 308 (31.7%) cases. PN and RN were performed in 663 (68.1%) and 310 (31.9%) patients, respectively. In univariate analysis, patients undergoing PN had a smaller risk for developing significant GFR change following surgery than those undergoing RN did. This was true for tumors ≤ 4 cm ($P = 0.0001$) and for tumors > 4 cm ($P = 0.0001$). In multivariate analysis, the following criteria were independent predictive factors for developing significant postoperative GFR loss: the use of RN ($P = 0.0001$), preoperative GFR < 60 ml/min ($P = 0.0001$), tumor size ≥ 4 cm ($P = 0.0001$), and older age at diagnosis ($P = 0.0001$).

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Conclusions: The renal function benefit carried out by elective PN over RN persists even when expanding nephron-sparing surgery indications beyond the traditional 4-cm cutoff. © 2014 Elsevier Inc. All rights reserved.

Keywords: Renal cell carcinoma; Partial nephrectomy; Renal function; Glomerular filtration rate; Chronic renal disease; Survival

1. Introduction

Owing to increased incidental detection and excellent oncologic results, partial nephrectomy (PN) is now considered as the standard of care for small renal tumors [1–4]. Initially performed for small, exophytic, and favorably located renal tumors, the indications for elective PN have, with growing experience, expanded to larger size and more complex tumors. The 4-cm cutoff has been for a long while the upper limit for elective PN indication. More recently, this paradigm has been placed under pressure to change when several series have demonstrated similar oncologic outcomes for appropriately selected patients with T1b-category renal tumors treated either by radical nephrectomy (RN) or elective PN [5–9]. Furthermore, our group demonstrated that pushing PN indications translated into a slightly increased but acceptable morbidity [10]. Then, the gained expertise in PN surgical technique and development of mini-invasive approaches such as laparoscopic-assisted or robot-assisted PN have contributed to more frequent use of PN in many expert centers [9,11].

Accumulated data demonstrate that PN for tumors measuring less than 4 cm preserved renal function better than RN. This may be a key component to improved overall survival (OS) that was observed in a large retrospective series on PN [12–14]. Additionally, there is an increasing body of evidence outlining the deleterious effects of decreased renal function on OS in the general medical population [15]. One hypothesis would be that chronic renal failure might induce comorbidities, thus being responsible for an excess of cardiovascular mortality. However, persistence of renal function benefit in tumors larger than 4 cm remains controversial. It could be fairly speculated that maintaining good oncologic outcome in complex technical situations could be achieved at the cost of higher rates of pedicle clamping and durations of warm ischemia, therefore minimizing potential functional benefit.

The aim of this retrospective multicenter study was to explore whether expanding the indications of PN to include larger tumors (>4 cm) maintains nephron-sparing benefits compared with those of RN.

2. Methods and materials

2.1. Patient and tumor assessment

This multicenter retrospective study included patients from 9 international academic centers: Rennes, Saint-Etienne, Toulouse, Bordeaux, Rouen, Lyon, Lille (France), University of California at Los Angeles, Los Angeles (US),

and Milano (Italy). The following variables were extracted from each institutional database after board approval: age, gender, American Society of Anesthesiologist score, Eastern Cooperative Oncology Group Performance Status, TNM stage, tumor size, type of surgery (PN vs. RN), Fuhrman grade, histologic subtype, preoperative and postoperative serum creatinine, preoperative and postoperative glomerular filtration rate (GFR). Years of treatment ranged from 1984 to 2001. The choice to perform PN or RN was based on preoperative clinical parameters and treating physician preferences at each institution. Tumor stage was determined according to the 2009 Union for International Cancer Control revised TNM classification [16]. The Heidelberg classification was used for tumor histology assessment [17]. Tumors were graded according to the Fuhrman grading scheme by pathologists at each of the 9 institutions [18].

2.2. Renal function assessment

In conjunction with clinical practice guidelines, GFR was estimated with the abbreviated Modification of Diet in Renal Disease (MDRD) study equation [19]. Only patients with available preoperative and postoperative MDRD-GFR measurements were included in the study. We stratified patients into 4 GFR groups according to the National Kidney Foundation classification of the chronic kidney disease: group 1, ≥ 60 ml/min/1.73 m²; group 2, 45 to 59 ml/min/1.73 m²; group 3, 30 to 44 ml/min/1.73 m²; and group 4, <30 ml/min/1.73 m² [20]. Those with imperative indications for PN and MDRD-GFR <30 ml/min/1.73 m² before surgery were excluded from analysis. MDRD-GFR loss was assessed from the preoperative value to the last postoperative value at the end of follow-up. A shift to a less favorable MDRD group following surgery was considered clinically significant.

2.3. Statistical analysis

The chi-square (the Fisher exact test) and the Student *t* tests were used for comparing qualitative and quantitative variables, respectively. GFR change free survival was determined from the date of surgery to the date of shift to a less favorable MDRD group or last follow-up. Estimations of cumulative survival distributions were assessed by the Kaplan-Meier method and log-rank tests were used to compare the differences among curves. We used the multi-variable Cox proportional hazards regression analysis to investigate whether operation type (RN or PN) was associated with chronic kidney disease after surgery. All *P* values were 2-sided, and *P* < 0.05 was considered

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