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# Renal Function Outcomes Following Radical or Partial Nephrectomy for Localized Renal Cell Carcinoma: Should Urologists Rely on Preoperative Variables to Predict Renal Function in the Long Term?

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For T1a kidney tumors, partial nephrectomy (PN) achieves equivalent oncological outcomes, with superior preservation of renal function (RF) and postulated lower cardiovascular and overall mortality, to radical nephrectomy (RN) [1–3]. PN is recommended as the surgical treatment of choice for patients with localized renal cell carcinoma when technically feasible [4–6].

RF following nephrectomy (RN or PN) is the result of complex and dynamic interactions among modifiable and nonmodifiable factors including patient and disease-specific characteristics as well as surgical variables [7]. Despite the complexity and uncertainty associated with prediction of RF following nephrectomy, variables associated with short- and long-term RF are well established. Preoperatively, renal parenchymal quality and tumor size and complexity are predictors of RF [8,9]. Various studies have shown that tumor size and complexity are related to the two ultimate determinants of functional preservation: ischemia and quantity of parenchyma preserved [9]. While the effect of preoperative, surgical, and postoperative variables on RF outcomes is variable, there is an established body of evidence suggesting that the quality and quantity of parenchymal mass preserved are most important, and ischemia appears to have a secondary role, but is also relevant [7].

In this issue of *European Urology*, Bhindi et al. [10] report on a large, single-center, retrospective cohort study to assess the long-term estimated glomerular filtration rate (eGFR) in patients undergoing PN and RN. All patients underwent RN or PN for a single localized nonmetastatic renal tumor (≤T2, N0M0) and had median follow-up of nearly 5 yr. Patient characteristics (including preoperative eGFR and proteinuria), tumor size, and surgical approach were used to identify variables predictive of RF beyond 30 d after surgery using a hierarchical generalized linear mixed-effect model. In addition, predictors of early postoperative renal failure were identified. At any point in time beyond 30 d after surgery, the strongest individual predictor of long-term RF was preoperative eGFR. For patients undergoing RN, a multivariable model identified older age, diabetes, lower preoperative eGFR, worse preoperative proteinuria, smaller tumor size, and an interaction between age and time from surgery as predictors of long-term eGFR (marginal and conditional $R^2_{GLMM}$ values of 0.41 and 0.83, respectively). In the PN group, older age, solitary kidney, hypertension, lower preoperative eGFR, worse preoperative proteinuria, and open surgical approach were associated with worse long-term eGFR. In the PN cohort, there was a significant interaction between time from surgery and age, diabetes, preoperative eGFR, and preoperative proteinuria (marginal and conditional $R^2_{GLMM}$ values of 0.62 and 0.85, respectively).

Bhindi et al. present one of the largest series on RF outcomes over time following RN and PN. Various studies have been published on this subject, most of which focused on short-term RF outcomes based on a single measurement

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of eGFR or creatinine at a certain time point after surgery. The findings of Bhindi et al. are generally in line with previously published data on the role of preoperative predictors of RF and provide a valuable tool for urologists to better counsel patients regarding expected RF and even the surgical option of choice (RN vs PN) for patients who are surgical candidates.

This study adds to the growing literature on the role of preoperative variables affecting RF in the long term [10]. The models proposed have relatively modest predictive ability for RF in the long term and demonstrate relatively large variability in predicting eGFR over time (marginal and conditional $R^2_{GLMM}$, 0.41 and 0.83 for the RN model, 0.62 and 0.85 for the PN model). This large variability underscores the limitation of preoperative variables in predicting postoperative RF outcomes and suggests a major role for other well-known variables that were not accounted for in the model. Tumor complexity measures (RENAL nephrometry score and PADUA) are commonly used by surgeons when discussing the type of surgery (RN vs PN) and surgical approach (open vs minimally invasive) offered to patients. While the focus of the proposed model is on preoperative variables, intraoperative measures including ischemia type and duration, excision technique, and most importantly the quantity of preserved parenchyma play a major role in RF outcomes. More importantly, it is known that all these variables are influenced by tumor complexity [7–9]. In addition, the role of the surgeon in PN outcomes was recently highlighted in a study by Dagenais et al. [11], who demonstrated significant between-surgeon variability in outcomes after PN, even after adjusting for patient characteristics.

In conclusion, pending external validation, the model proposed by Bhindi et al. may be a valuable tool for urologists to better counsel patients in regard to expected RF outcomes. The model would especially be helpful in situations in which the dilemma between a complex PN and laparoscopic RN arises. The ability to estimate RF in such situations may persuade the urologist to plan for RN rather than a complex PN with a known higher complication rate. However, one should be cognizant of the main limitation of the model, which is a lack of tumor complexity data and the impact of intraoperative events. Clearly, RF after RN or PN is the result of complex and dynamic interactions among many variables and more accurate prediction of RF is likely to be possible when patient, disease, surgeon, and surgical variables are accounted for in a hierarchical regression model.

***Conflicts of interest:*** The authors have nothing to disclose.

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