

Risk Factors Analysis of Uygur Patients Progress to Chronic Kidney Disease after Partial Nephrectomy

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Abstract

Background: Despite the use of partial nephrectomy, some patients still progress to chronic kidney disease after treatment. If early interventions or surveillances were taken in patients with risk factors for chronic kidney disease, the prognosis of patients might be improved. At this time, Uygur population-based study is still unavailable. Hence, we aimed to examine new onset of chronic kidney disease in Uygur patients undergoing partial nephrectomy. **Methods:** Our study analyzed data of 108 patients who treated with partial nephrectomy between 2003 and 2017 at Hospital of Xinjiang Uygur Autonomous Region. Glomerular filtration rate (GFR) was estimated by the abbreviated modification in diet and renal disease study equation. Chronic kidney disease was defined as GFR <60 mL/min per 1.73 m². We used Chi-square and Wilcoxon signed-rank test to perform Univariate analyses, and logistic multivariate regression analysis to investigate determinants of post-operative chronic kidney disease. **Result:** Between chronic kidney disease group and normal renal function group, the development of chronic kidney disease in patients with pre-operative GFR >60 mL/min per 1.73 m² was related to age, pre-operative GFR, 1-week post-operative GFR, warm ischemia time, and tumor size. **Final Summary:** Despite the use of partial nephrectomy, some patients still progress to chronic kidney disease. Combining better surgical selection with pre-operative and post-operative chronic kidney disease surveillance may improve outcomes of patients with risk factors undergoing partial nephrectomy.

Key words: Chronic kidney disease, partial nephrectomy, risk factors

INTRODUCTION

In the past two decades, due to advances in abdominal imaging, detection rate of small renal masses was increasing. Meanwhile, some small renal masses were diagnosed pathologically as early stage or even benign.^[1] In addition, based on primarily retrospective data identifying radical nephrectomy as a significant risk factor for chronic kidney disease.^[4] Due to the small size, early stage of tumors and advanced surgical techniques, surgeons were able to perform partial nephrectomies without sacrificing safety and oncology efficiency.^[5] However, despite the use of partial nephrectomy some patients still progressed to chronic kidney disease.^[6] Moreover, chronic kidney disease is associated with a number of adverse health outcomes including an increased risk of morbid cardiac events and death.^[2] If early interventions were

taken in patients with risk factors for chronic kidney disease, the prognosis might be improved.

Normally, renal function is estimated by the concentration of serum creatinine in clinical practice. However, the American National Kidney Foundation (ANFK) and some researchers regard serum creatinine as an inaccurate method when estimating renal function.^[7-9] For this reason, glomerular filtration rate (GFR) or estimated GFR (eGFR) has become a better method when estimating renal function. Moreover,

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according to ANFK, chronic kidney dysfunction is defined as $GFR < 60 \text{ mL/min per } 1.73 \text{ m}^2$.

Uygur population is the largest one (8.8 million) in Xinjiang province, China. However, Uygur population-based study is still unavailable. Hence, it is necessary to complete the package of Uygur population-based study.^[3]

In this context, we reviewed data and used eGFR to assess kidney function outcomes in 108 Uygur patients undergoing partial nephrectomy.

METHODS

We analyzed data of 108 Uygur patients who underwent partial nephrectomy at Hospital of Xinjiang Uygur Autonomous Region from January, 2003 to June, 2017. The patients were selected for our study based on the following criteria: Race of selected patients should be Uygur, normal pre-operative renal function (defined as $GFR > 60 \text{ mL/min per } 1.73 \text{ m}^2$), sufficient follow-up time (at least 12 weeks). Table 1 summarizes identified pre-operative and post-operative characteristics including age, gender, pre-operative, and post-operative GFR.

GFR, for a long time, is regarded as the best overall measure of kidney function.^[10] In our study, GFRs were estimated with the abbreviated modification in diet and renal disease study equation.^[17] Moreover, the equation is: $GFR = 175 \times [(sCr/88.4) - 1.1540] \times (\text{age} - 0.203) \times (0.742 \text{ if female})$. Post-operative GFRs were not obtained until a week after treatment. Study outcome was new onset of eGFR lower than $60 \text{ mL/min per } 1.73 \text{ m}^2$.

We performed Univariate analyses using Pearson's Chi-square tests for categorical variables and Wilcoxon signed-rank test for continuous variables. Logistic regression analysis was used to investigate determinants of post-operative GFR.

We regarded $P < 0.05$ as significant. All data were analyzed using SPSS version 20.

RESULTS

A total of 108 patients met our study criteria. Pre-operative, post-operative, and pathological characteristics are provided in Table 1. The mean patient age was 54 years (range 25–81) with 70 males and 38 females. All patients had normal pre-operative CKD with $GFR > 60 \text{ mL/min per } 1.73 \text{ m}^2$.

On Univariate analysis between chronic kidney disease group and normal renal function group, development of chronic kidney disease ($n = 35$) in patients with pre-operative $GFR > 60 \text{ mL/min per } 1.73 \text{ m}^2$, was related to age ($P < 0.001$), pre-operative GFR ($P = 0.003$), 1-week post-operative GFR ($P < 0.001$), tumor size ($P = 0.002$) and, gender ($P = 0.063$), pathological types ($P = 0.751$) had no effect on the incidence of chronic kidney disease. The patients undergoing partial nephrectomy had a mean warm ischemia time of 31 min (range 20–50 min). The duration of ischemia affects the rate of new-onset CKD ($P = 0.001$).

Base on the results of Univariate analysis between chronic kidney disease group and normal renal function group, we selected age, pre-operative GFR, 1-week post-operative GFR, warm ischemia time, and tumor size to perform logistic regressive analysis. We found those factors were also independent risk factors for post-operative chronic kidney disease.

DISCUSSION

The past decade has seen a push in favor of elective partial nephrectomy for renal cell carcinoma (RCC), based primarily on retrospective data identifying radical nephrectomy

Table 1: Pre-operative, post-operative, and pathological characteristics of patients

Characteristics	CKD ($n=35$)	NRF group ($n=73$)	P
Age	59 (44-81)	51 (20-72)	$P < 0.001$
Gender			
Male (%)	27 (38.6)	43 (61.4)	$P = 0.063$
Female (%)	8 (21.4)	30 (78.6)	
Pre-operative GFR (mL/min)	83.1 (61.9-131.2)	92.2 (66.5-207.6)	$P = 0.003$
Post-operative GFR (mL/min)	60.4 (36.2-97.2)	91.8 (63.4-213.4)	$P < 0.001$
Pathological types			
RCC (%)	31 (91.4)	66 (89.0)	$P = 0.751$
Other types (%)	3 (8.6)	8 (11.0)	
Ischemia time (min)	34 (27-45)	28.5 (20-50)	$P = 0.001$
Tumor size	4.2 (3.0-5.8)	2.6 (1.3-6.5)	$P = 0.002$

CKD: Chronic kidney disease, NRF: Normal renal function, RCC: Renal clear cell carcinoma, GFR: Glomerular filtration rate

as a significant risk factor for chronic kidney disease and its complications.^[4] A systematic review^[11] confirmed that partial nephrectomy was associated with better post-operative renal function, as shown by higher post-operative eGFR, lower likelihood of post-operative chronic kidney disease, and lower declination of GFR. Furthermore, partial nephrectomy is a viable treatment option for larger renal tumors, as it can offer an acceptable surgical morbidity, equivalent cancer control, and better preservation of renal function. Despite these advantages, the patients undergoing partial nephrectomy still have the possibility of progressing to chronic kidney disease after treatment (35 out of 108 patients progressed to chronic kidney disease after partial nephrectomy in our study). Fortunately, we analyzed data of these patients and found age, pre-operative GFR, 1-week post-operative GFR, warm ischemia time, and tumor size as independent risk factors for post-operative chronic kidney disease. Furthermore, they may be used as a monitoring index for post-operative chronic kidney disease surveillance.

In this context, what if we combine better surgical selection (partial nephrectomy and better surgical approach) with pre-operative and post-operative chronic kidney disease surveillance? Is it possible to improve patient's prognosis? Lane *et al.*^[12] examined the association between post-operative GFR and overall survival in cohort of 4180 patients who are undergone radical or partial nephrectomy. In their study, they confirmed, although GFR did not predict survival in patients with normal pre-operative renal function, in those who with pre-existing chronic kidney disease (GFR <60 mL/min per 1.73 m²) from medical causes, lower post-operative GFR is associated with increased mortality independent of age and comorbidities. Furthermore, Weight *et al.*^[13] found the risk of cardiovascular mortality to be associated with pre-existing coronary artery disease and pre-operative renal function, rather than functional nephron loss as a result of surgery.

Some studies showed that post-operative acute kidney injury (AKI) in patients with RCC was also a potential risk factor for new-onset chronic kidney disease after partial or radical nephrectomy.^[14,15] For now, new criteria provide more accuracy definitions of diagnosis of AKI. However, we still rely on serum creatinine when diagnosing post-operative AKI. Furthermore, SCr is known to be an inaccurate marker when predicting early change in renal function. Fortunately, there are several novel urinary and serum biomarkers; we can use to complement the gap associated with the use of SCr. It may also improve the accuracy of diagnosing AKI.^[16] However, for novel biomarkers, there still have drawbacks. The most important reason behind it may be the rarely use of novel biomarker in urologic surgery settings and the limited availability of lectures.^[16] Hence, in our further study, we would like to perform pre-operative and post-operative surveillance with novel AKI biomarkers, and hopefully, we could complement the limitation of novel biomarkers in clinical practice.

CONCLUSION

Despite the use of partial nephrectomy, some patients still progress to chronic kidney disease. In the future clinical practice, if combining better surgical selection with pre-operative and post-operative chronic kidney disease surveillance may improve outcomes of patients with risk factors undergoing partial nephrectomy.

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