

Renal Function after Nephron-Sparing Surgery

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ABSTRACT

The incidence of kidney cancer has been rising over the last two decades, especially in cases where the disease is localized and small in size (<4 cm). This is mainly due to the widespread use of routine abdominal imaging such as ultrasonography, computed tomography, and magnetic resonance imaging. As a result, the utilization of partial nephrectomy (PN) was increased for preserving the renal parenchyma to prevent chronic kidney disease (CKD). Although it has been shown that the development of CKD or decreased kidney function is higher in patients with RCC after radical nephrectomy (RN) than PN, the renal outcomes between RN and PN are not well-understood in these patients. Several researchers proposed that RN is associated with acute kidney injury (AKI), kidney function decline, and new-onset CKD in patients with renal tumors compared to PN. Moreover, AKI increases the risk of CKD and end-stage renal disease. According to these consequence, PN would be the better surgical management rather than RN because of the benefit of preserving renal function.

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Key words: Kidney function; Nephrectomy; Nephron sparing surgery

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REVIEW

The incidence of renal cancer has been increasing over the last two decades, particularly in when the disease is localized and small (<4 cm). This is mainly due to the widespread use of routine abdominal imaging, such as ultrasonography, computed tomography, and magnetic resonance imaging. As a result, use of partial nephrectomy (PN) has increased to preserve the renal parenchyma and prevent chronic kidney disease (CKD).

Although the development of CKD or decreased kidney function is higher in patients with renal cell carcinoma after radical nephrectomy (RN) than after PN^[1,2], the renal outcomes between RN and PN are not well-understood in these patients. Several researchers have proposed that RN is associated with acute kidney injury (AKI), declining kidney function, and new-onset CKD in patients with renal tumors compared to those who have undergone PN^[3]. Moreover, AKI increases the risk for CKD and end-stage renal disease^[4-6]. Thus, PN is a better surgical option than RN to preserve renal function.

CKD after RN is associated with cardiovascular events and non-cancerous mortality^[7], suggesting worse overall and cardiovascular survival after RN. However, Lane et al. reported that the impact of surgically induced CKD on survival is not substantial^[8], and survival in a donor nephrectomy group and healthy participants is identical^[9]. In addition, the only existing prospective randomized controlled trial reported by van Poppel *et al* concluded that overall survival after PN and RN is similar^[10].

Some evidence suggests that PN results in better postoperative renal function than that after RN but similar overall survival is observed between RN and PN in patients > 65 years^[11]. However, Takagi et al. showed better overall survival for PN compared with RN for patients > 65 years^[12]. Therefore, PN has an obvious benefit for preserving renal function, and the negative effect of decreased postoperative kidney function after RN on survival may be smaller than expected.

Control of the pedicle vessel during PN results in whole-kidney ischemia, which may associated with a significant reduction in

glomerular filtration rate (GFR) of the clamped kidney. However, no difference in Tc99m-DTPA GFR is observed 3 months after PN, compared to that before PN^[13]. Presence of a tumor in a solitary kidney, absence of pedicle clamping, and limiting the duration of ischemia are essential to preserve renal function after PN^[14]. The unclamped or selective clamped technique for selective exophytic small renal masses was introduced to prevent whole-kidney ischemia, and has shown favorable postoperative outcomes^[15,16]. Nephron-sparing surgical techniques differ widely and have not been adequately evaluated. No data support tumor enucleation instead of tumor-resection. The same is true for laparoscopic and robotic surgery.

Whether preserving non-neoplastic renal parenchymal volume during PN is associated with postoperative renal function is controversial. Ischemia time during PN and reducing the parenchyma are related with renal function after PN^[17]. However, the net quantity of parenchyma is not associated with long-term renal function^[18].

A lower GFR before PN also affects postoperative kidney function. No difference is observed in 5-year probability of freedom from developing new-onset GFR < 45 mL/min/1.73 m² in patients with CKD stage-I (>90 mL/min/1.73 m²) and CKD stage-IIIa (45–59 mL/min/1.73 m²) between those who underwent PN and RN. However, patients with preoperative CKD stage II (60–89 mL/min/1.73 m²) show high (84%) 5-year probability of freedom from developing new-onset GFR < 45 mL/min/1.73 m² compared to RN (74%)^[19]. Therefore, PN was more beneficial in patients with preoperative CKD stage-II compared to those who underwent RN. In addition, these results would lead to a practical discussion about postoperative function in patients with pre-existing renal impairment.

Contradictory findings exist regarding overall survival after RN and PN. However, PN is a better treatment option for managing small renal tumors, preserving postoperative renal function, and preventing AKI or CKD (T1-T2). In addition, a nephron-sparing technique should be used when feasible from technical point of view when residual kidney is sufficient and R0 resection is guaranteed. Moreover, appropriate patients selection is important.

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CONFLICT OF INTERESTS

There is no conflict of interest.

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