Outcomes of Tubeless Percutaneous Nephrolithotomy in Patients With Chronic Renal Insufficiency

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We evaluated the outcomes of percutaneous nephrolithotomy in patients with chronic renal insufficiency. A total of 60 patients with a creatinine level greater than 1.5 mg/dL who underwent PCNL were included. Serum creatinine level, as a kidney function index, was assessed before and after the operation. The mean calculus size was 31.13 ± 9.38 mm. The mean pre-operative and 2-week postoperative serum creatinine levels were 2.43 ± 0.75 mg/dL and 2.08 ± 0.78 mg/dL, respectively. There was a significant difference between the pre-operative and postoperative creatinine levels in all postoperative days (days 1, 2, and 14). Fifty of the 60 patients (83.3%) were stone free. Ten patients (16.6%) developed postoperative fever. We can conclude that percutaneous nephrolithotomy seems to be a safe and effective therapeutic option for kidney calculi in patients with chronic kidney disease.

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Urinary calculi may be associated with various degrees of renal insufficiency.[1,2] The etiology of renal insufficiency in patients with nephrolithiasis is multifactorial and includes renal obstruction, urinary infection, frequent surgical interventions, and coexisting medical diseases.[3-5] The prevalence of urinary calculus disease in patients on maintenance hemodialysis is reported to be 3.2%. On the other hand, 1.9% to 7.7% of patients who undergo percutaneous nephrolithotomy (PCNL) have chronic kidney disease (CKD).[6-8]

Removing obstructive urinary calculi and eradicating urinary infection through a minimally invasive procedure may improve kidney function. Extracorporal shockwave lithotripsy has limitations in poorly functioning kidneys.[9] Furthermore, any surgical intervention is complicated in the presence of azotemia and may deteriorate renal parenchymal injury. Percutaneous endourologic procedures seem to be the most suitable option, because of causing minimal morbidity and mortality.[10] Percutaneous nephrolithotomy is now commonly used for urolithiasis treatment with minimal morbidity compared to open surgery.[11] It would also have several advantages in patients with different associated diseases such as CKD.[11] Percutaneous nephrolithotomy in patients with CKD provides a high stone-free rate and may also improve kidney function.[12-14] Regarding the importance of finding an optimal therapeutic method for urolithiasis in patients with CKD and paucity of consistent data in literature, this study was conducted to determine the outcomes of percutaneous nephrolithotomy in patients with chronic renal insufficiency. We evaluated the stone-free rate, complication rate, and the course of renal function changes in CKD patients who underwent PCNL at our center.

The study was performed between October 2009 and March 2010. Of 500 patients who underwent PCNL in this period, a total of 60 patients had a creatinine level greater than 1.5 mg/dL. Patients with uncorrected urinary tract infection, an acute rise of creatinine, bleeding tendency, aspirin or anticoagulant use, or pregnancy were excluded. The calculus burden, anatomy of the renal collecting system, and the degree of hydronephrosis were evaluated using plain radiography; renal ultrasonography; and non–contrast-enhanced spiral computed tomography. Antimicrobial therapy was administered for patients with a positive urine culture for microorganisms.

Age, gender, calculus size, the cause of CKD, residual calculus on fluoroscopy, complications, and pre-operative and postoperative hemoglobin and serum creatinine levels were recorded.

Hemoglobin level was measured pre-operatively, every 12 hours on the 1st postoperative day, and then, daily if there was no significant hemoglobin drop until discharge. Serum creatinine, sodium, and potassium levels were measured pre-operatively and once daily after the operation until discharge. Two weeks after PCNL, all patients underwent kidney function tests and imaging studies including plain radiography (kidneys, ureters, and bladder), ultrasonography, and non–contrast-enhanced spiral computed tomography for nonopaque calculi. If there were no residual calculi larger than 4 mm, the patient was considered to be stone free.

Renal access was achieved under fluoroscopic guidance, preferably through the lower calyx. Tract dilation was performed using the 1-shot method, and a 30-F Amplatz sheath was placed. Pneumatic lithotripter (with or without ultrasonic guide; Swiss Master Lithoclast, EMS, Bern, Switzerland) was used for fragmentation of the calculi. Particles were extracted by suction or grasper. Percutaneous nephrolithotomy was performed using tubeless technique without insertion of nephrostomy or double-J ureteral stents. A 4.8-F ureteral double-J stent and 24- or 26-F nephrostomy were inserted for patients with a single kidney, pyonephrosis, or significant residual calculus. The nephrostomy tube was clamped and removed 24 to 48 hours after the operation, if the patient did not have fever, urinary leakage, or serum creatinine elevation. Ureteral double-J stent was removed 4 to 6 weeks after the operation. The Foley and ureteral catheters were removed 24 to 48 hours after the procedure, once hematuria ceased and the patient was discharged from hospital.

Sixty patients with a mean age (± standard deviation) of 51.7 ± 12.2 years (range, 18 to 75 years) were included in the study. Thirty-four patients (56.7%) were men and 26 (43.3%) were women. The mean calculus size was 31.1 ± 9.4 mm (range, 15 mm to 55 mm). Pre-operative and postoperative creatinine values are listed in the Table. All postoperative creatinine measurements showed a significant decrease compared with the pre-operative values. Serum creatinine level decreased after PCNL with a slight slop on postoperative days 1 and 2, and a more pronounced slope 2 weeks after the operation. Fifty of the 60 patients (83.3%) were stone free. Double-J stent and nephrostomy tube were inserted for 8 patients (13.3%). Five patients (8.3%) required blood transfusion. Fever was seen in 10 patients (16.6%), which responded to antibiotic therapy. No visceral injuries were encountered. None of the patients developed renal deterioration requiring hemodialysis after 2 weeks. No auxiliary procedures such as transurthral lithotomy or extracorporal shockwave lithotripsy were needed in this series.

Creatinine values in preoperative and postoperative measurements.

Time	Value
Preoperative creatinine	2.40 ± 0.75 (1.6 to 5.0)
Creatinine on postoperative day 1	2.35 ± 0.79 (1.4 to 4.5)
Creatinine on postoperative day 2	2.27 ± 0.77 (1.4 to 4.8)
Creatinine on postoperative day 14	2.08 ± 0.78 (1.0 to 4.8)

Urolithiasis can cause renal damage because of the resultant obstruction, infection, frequent surgical interventions, and coexisting medical diseases.[3] Percutaneous nephrolithotomy has become the mainstay of treatment for large kidney calculi over the past 30 years, even in patients with comorbid diseases such as CKD.[12] Several technical and instrumental improvements have contributed to decreasing morbidity and increasing efficacy of PCNL. The presence of kidney calculi in patients with CKD requires special consideration. Kidney failure is frequently a progressive condition and the presence of calculi in the urinary tract may accelerate the course of the disease. Obstruction and infection are responsible for kidney function deterioration in patients with urinary calculi.

In our study, the early effect of PCNL in patients with urinary calculi and chronic renal insufficiency who had a serum creatinine level above 1.5 mg/dL was assessed. The effects of PCNL on kidney function of these patients were studied by serial serum creatinine measurements during a 2-week period after the operation. This study showed that PCNL is a safe and effective therapeutic option in patients with renal insufficiency. As we showed, 83.3% of patients were stone free by PCNL. Low rate of complications and early decline in postoperative serum creatinine values are noticeable findings in our study.

In a study by Kurien and colleagues, 91 patients with CKD were evaluated. Complete calculus

clearance, auxiliary procedures, and complication rate were 83.7%, 2.5%, and 17.1%, respectively.[12] Their reported a high stone-free rate and low complication rate, which were similar to our study. Our patients did not need any auxiliary procedure either. Kuzgunbay and coworkers evaluated 19 patients with pre-operative serum creatinine values greater than 1.4 mg/dL who underwent PCNL. The mean follow-up time was 51.1 ± 10.1 months. Stone-free rate was 50% in their study. The mean serum creatinine value was 2.30 ± 0.56 mg/dL before surgery, and 2.67 ± 1.41 mg/dL at the end of the follow-up. Creatinine values decreased to normal range in 6 patients (37.5%), remained stable (creatinine, 1.4 to 4 mg/dL) in 6 (37.5%), and increased (> 4 mg/dL) in 4 (25%) requiring renal replacement therapy. Three patients progressed to end-stage renal failure postoperatively. All these 3 patients had insulin-dependent type 2 diabetes mellitus; one of them had also a solitary kidney and atherosclerosis. They concluded that most patients presenting with urinary calculi disease and renal insufficiency experience improvement or stabilization of kidney function after PCNL. Although we had a shorter follow-up in our study, our sample size was larger.[15]

Records of 300 consecutive patients who underwent PCNL were retrospectively reviewed by Yaycioglu and colleagues.[13] Pre-operative serum creatinine values higher than 1.5 mg/dL were seen in 6.3% of the patients. There were no significant differences in success and complication rates between study cases and control patients with normal kidney function. They concluded that surgery did not cause biochemical deterioration in patients with compromised kidney function.[13] Also, Bilen and colleagues evaluated 185 patients with renal calculi and CKD and found that patients with CKD had a significant increase in glomerular filtration rate after PCNL.[14]

Percutaneous nephrolithotomy has a favorable outcome in our CKD patients and results in a good calculus clearance rate, good kidney function outcomes, and a low complication rate. Totally, it could be concluded that PCNL procedure is a safe and effective therapeutic option in patients with CKD and urinary calculi and may be used as the first choice in them. However, further interventional studies with larger sample sizes are needed.

CONFLICT OF INTEREST

None declared.

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