Original Article

Effect of tubeless percutaneous nephrolithotomy on early renal function: Does it deteriorate?

Seyed Reza Hosseini, Mohammad Ghasem Mohseni, Hamzeh Roshan, Farshid Alizadeh[1]

Department of Urology, Tehran University of Medical Sciences, Tehran, [1]Department of Urology, Kidney Transplantation Research Center, Isfahan University of Medical Sciences, Isfahan, Iran

Abstract

Background: The impact of standard percutaneous nephrolithotomy (PCNL) on short or long-term renal function has been evaluated in many studies. We evaluated the effect of tubeless PCNL on early renal function.

Materials and Methods: A total of 117 patients referring to our university center for PCNL were enrolled in the study if they were matched with the inclusion criteria. Serum creatinine and hemoglobin (Hb) levels were measured before PCNL and 6, 24, 48, and 72 h after the operation. Glomerular filtration rate (GFR) was calculated using Cockroft-Gault formula.

Results: There were 79 (67.5%) men and 38 women (32.5%) with the mean age of 49.94 years ranging from 18 to 80 years in the study group. The mean creatinine level elevated in the first 48 h after PCNL but it started to reduce on the 3rd day (mean preoperative creatinine level: 1.32 ± 0.18 mg/dL, mean creatinine level after 48 h: 1.59 ± 0.24 mg/dL, creatinine level after 72 h: 1.42 ± 0.21245 mg/dL) ($P < 0.0001$). GFR values had the same rise and fall pattern as serum creatinine level (mean preoperative GFR: 74.89 mL/min, mean GFR after 48 h: 64.04 mL/min, GFR after 72 h: 69.54 mL/min, $P < 0.0001$). PCNL also affected blood Hb level. The mean preoperative Hb level was 15.06 ± 0.87 g/dL and it significantly decreased to 13.09 ± 1.06 g/dL after the operation ($P < 0.0005$).

Conclusions: Tubeless PCNL like standard PCNL decreases GFR in the very early postoperative days. It is recommended that factors that might have a negative impact on renal function during first few days after PCNL be avoided.

Key Words: Percutaneous nephrolithotomy, renal function, tubeless

Address for correspondence:
Dr. Farshid Alizadeh, Department of Urology, Kidney Transplantation Research Center, Isfahan University of Medical Sciences, Isfahan, Iran.
E-mail: f_alizadeh@med.mui.ac.ir

Received: 14.02.2015, **Accepted:** 08.04.2015

INTRODUCTION

The impact of standard percutaneous nephrolithotomy (PCNL) on short or long-term renal function has been evaluated in many studies. Creatinine,[1-4] DMSA scan,[5-7] DTPA scan,[8] and MAG3 scan[9] have been used for evaluating renal function. In most studies, the effects of standard PCNL on long-term renal function have been evaluated and no significant influence has been reported yet. A few studies have reported effects of standard PCNL on short-term renal function. In most studies, decrease in glomerular filtration rate (GFR) during the first few days after PCNL has been shown. Handa *et al*.[3] compared renal hemodynamic and excretory function in female pigs immediately before

Access this article online	
Quick Response Code:	Website: www.advbiores.net
	DOI: 10.4103/2277-9175.166144

How to cite this article: Hosseini SR, Mohseni MG, Roshan H, Alizadeh F. Effect of tubeless percutaneous nephrolithotomy on early renal function: Does it deteriorate?. Adv Biomed Res 2015;4:190.

and up to 5 h after percutaneous nephrostomy (PCN) using sequential Amplatz dilators ($n = 8$) or Nephromax balloon inflation ($n = 7$) and control pigs with no PCN access ($n = 8$). GFR, renal plasma flow, and urinary sodium excretion (UNaV) were significantly reduced in Amplatz- and Nephromax-treated kidneys throughout the 5-h observation period, by about 50%, 60%, and 80%, respectively. Nouralizadeh *et al*.[10] evaluated estimated GFR during the first few days after standard PCNL. Renal GFR decreased immediately after PCNL, reaching a nadir at 48 h after the operation and then, increases slowly. Given this trend, in this study we evaluated the effect of tubeless PCNL on early renal function.

MATERIALS AND METHODS

This prospective cohort study was performed on 117 patients referring to Sina Hospital, Tehran University of Medical Sciences. Inclusion criteria were kidney calculi ≥2 cm in diameters or resistance to extracorporeal shock wave lithotripsy treatment. The Ethical Board Committee of Tehran University of Medical Sciences and Iranian Registry of Clinical Trials center approved our study protocol and all patients declared their agreement to participate in our study by filing out an informed consent. Preoperative work-ups included urine culture and urine analysis test (patients with urinary infection were treated by appropriate antibiotics), serum biochemistry, and electrolytes test (creatinine, urea, Na, K, and Cl), bleeding and coagulation time test (prothrombin time and partial thromboplastin time), viral hepatitis markers (HBs Ag, HBc Ab, and HCV Ab), and complete blood count analysis, as well as body weight. Kidney-ureter-bladder imaging and computed tomography without contrast were obtained from all patients before PCNL. GFR was chosen as the renal functional indicator and calculated by using Cockroft-Gault formula (GFR = (140-age) × body weight/serum creatinine × 72). In female patients, results of the formula were multiplied by a constant of 0.85. Antibiotic (ceftriaxone) was prescribed before the operation and continued until discharge. Taking nephrotoxic medications was forbidden before and after the operation.

Percutaneous nephrolithotomy tubeless technique is summarized below. After general anesthesia, a 4 or 5 Fr ureteral catheter was inserted and fixed in a desired position with special care. The target calyx was punctured under fluoroscopic guidance; then, a guide wire was inserted and tract dilation was performed by Amplatz dilators in a one-shot manner for all cases. After amplatz sheath insertion, nephroscopy was performed and stones were fragmented by a pneumatic lithotripter (LithoCrack, Sp. Swiss-Germany) and removed. Normal saline was used for continuous irrigation. If there was a residual stone >2 cm that could not be accessed from the first tract, a second access was established. Residual stones of <2 cm in diameter were scheduled for shock wave lithotripsy (SWL). No SWL was performed during the first few days after surgery. Tubeless PCNL was performed for all patients. Foley and ureteral catheters were removed 12–24 h after the operation.

Creatinine, urea, and GFR were evaluated right before PCNL and 6, 24, 48, and 72 h after the operation.

Mean ± standard deviation, frequency, and percentage values are described. Pearson's coefficient of correlation and Chi-square analysis were used to determine the relationship between the levels of two categorical variables and the linear relationship between continuous variables. The Student's *t*-test was used to compare the two independent groups. IBM SPSS Statistics version 21 (SPSS Inc., Chicago, IL, USA) was used for data analysis. Significant value for statistical analysis was set at $P < 0.05$.

RESULTS

A total of 117 patients were included in the study. 79 (67.5%) of the patients were men and 38 (32.5%) were women. The mean age was 49.94 years (min = 18 years, max = 80 years). Preoperative and postoperative (6 h, 24 h and 72 h) rates of GFR, serum creatinine, and blood urea nitrogen (BUN) levels were recorded in a database and shown in Table 1. Furthermore, serum hemoglobin (Hb) changes were analyzed before and after the operation. Creatinine levels showed a significant increase in 48 h after the operation. The mean preoperative creatinine level was (1.32 ± 0.18 mg/dL) and postoperative

Table 1: Demographic and peri-operative data

Characteristics	Value
Number of men	71
Mean (SD) age, year	49.3 (16)
Stone location	
Left kidney	81
Upper calyces	13
Mid calyces	20
Lower calyces	59
Pelvic stone	25
Stone size; mean (SD), mm	38 (8)
Number of accesses	
One	88
Two	29
Operation duration (min)	74±14
Hospital stay (days)	2.3±1.2

SD: Standard deviation

values were as follows: 6th h = 1.34 ± 0.17 mg/dL, 24th h = 1.44 ± 0.21 mg/dL, 48th h = 1.59 ± 0.24 mg/dL. After the peak level on the 2nd day, creatinine levels start to decrease (72nd h = 1.42 ± 0.21245 mg/dL $P < 0.0001$). The mean BUN level before the operation was 34.21 ± 8.85 mg/dL, which increased to 37.47 ± 8.88 mg/dL at 6 h, 40.03 ± 9.55 mg/dL at 24 h and 41.87 ± 9.98 mg/dL at 48 h after PCNL ($P < 0.0001$). After this time, BUN levels did not show any significant correlation with time passing ($P = 0.8$). Furthermore, GFR significantly decreased to the lowest level during the first 2 days and increased afterwards at the beginning of the 3rd post-operative day. The mean pre-operative GFR was 74.89 mL/min and then decreased to the mean level of 64.04 mL/min at 48 h after the operation. On the 3rd day, the improvement in renal function resulted in better levels of GFR recording (69.54 mL/min).

Percutaneous nephrolithotomy also affected blood Hb levels. The mean preoperative Hb level was 15.06 ± 0.87 g/dL and it significantly decreased after the operation to 13.09 ± 1.06 g/dl ($P < 0.0005$).

DISCUSSION

Percutaneous nephrolithotomy has been established as the most preferred surgical treatment for patients with large renal stones. As a minimally invasive procedure, it is less morbid than open surgery but not without risk and postoperative complications. To choose between different treatment modalities, it is important to evaluate post-operative damages of each modality to the renal parenchyma and function. This issue is of even greater concern in patients with a single functioning kidney.

Many studies have evaluated the impact of PCNL on mid- and long-term renal function. Animal studies have revealed that scar formation after PCNL is <1% of the renal parenchyma.[11] In the study carried out by Dawaba *et al*.,[8] a total number of 65 children ranging from 9 months to 16 years were treated with PCNL. The patients were followed every 3 months during the 1st year and every 6 months in the 2nd year after PCNL. Technetium dimercaptosuccinic acid scan did not show renal scarring in any patients and technetium diethylenetetraminepentaacetic acid scan showed a statistically significant increase in GFR. A large group of patients undergoing PCNL are patients with the history of chronic kidney disease (CKD). In the study by Bilen *et al*.,[1] the effect of PCNL was investigated on GFR in patients with CKD. It was reported that within a 3 months follow-up period, all patients showed a significant increase in GFR and the mean GFR was more than 60 mL/min/1.73 m2 in 25% of the patients. Data regarding the early postoperative effects of PCNL on renal function are limited.

In the study performed by Nouralizadeh *et al*.,[10] serum creatinine and GFR were was evaluated 6, 24, 48, and 72 h after PCNL. It was revealed that during the first 2 days after PCNL, GFR decreased from 87.5 ± 32.2 mL/min to 75.9 ± 25.0 mL/min but then on the 3rd day, it raised to 81.9 ± 26.4 mL/min. Another study on this subject was done by Bayrak *et al*.[12] They investigated early post-PCNL changes of GFR, as well and found that GFR increased from the mean preoperative value of 104.30 ± 37.30 mL/min to the mean postoperative value of 112.38 ± 40.1 mL/min. They also indicated that multiple access, operation time, and type of lithotripter had no effect on GFR changes during early post-PCNL hours.

Nevertheless, the above mentioned studies evaluated effects of standard PCNL on renal function. To our knowledge, this is the first study focused on the effect of tubeless PCNL on early kidney function.

According to our results, the mean pre-operative GFR was 74.8944 mL/min and then it reached the mean post-operative value of 64.0427 mL/min in 48 h and then to 69.5417 mL/min 72 h after PCNL.

The fact that GFR decreses during the 1st day (and also the 2nd day in the current study) after PCNL is also supported by our study and we found a slight decrease in the very early hours after tubeless PCNL (<48 h) which may be the results of minimal renal parenchymal damages due to kidney dilation made to access the pyelocaliceal system during PCNL operation, based on our results and other studies.[10,12]

The limitation of this study is that it does not have a control group consisting of patients of the same age and sex, who have undergone a non-renal surgery to evaluate the effect of the operation itself, and not the anesthesia, on the GFR.

CONCLUSIONS

Tubeless PCNL like standard PCNL decreases GFR in the very early postoperative days. It is recommended that factors that have negative impact on renal function be avoided during the first few days after PCNL.

REFERENCES

1. Bilen CY, Inci K, Kocak B, Tan B, Sarikaya S, Sahin A. Impact of percutaneous nephrolithotomy on estimated glomerular filtration rate in patients with chronic kidney disease. J Endourol 2008;22:895-900.
2. Chandhoke PS, Albala DM, Clayman RV. Long-term comparison of renal

function in patients with solitary kidneys and/or moderate renal insufficiency undergoing extracorporeal shock wave lithotripsy or percutaneous nephrolithotomy. J Urol 1992;147:1226-30.
3. Handa RK, Matlaga BR, Connors BA, Ying J, Paterson RF, Kuo RL, *et al*. Acute effects of percutaneous tract dilation on renal function and structure. J Endourol 2006;20:1030-40.
4. Tok A, Ozturk S, Tepeler A, Tefekli AH, Kazancioglu R, Muslumanoglu AY. The effects of percutaneous nephrolithotomy on renal function in geriatric patients in the early postoperative period. Int Urol Nephrol 2009;41:219-23.
5. Moskovitz B, Halachmi S, Sopov V, Burbara J, Horev N, Groshar D, *et al*. Effect of percutaneous nephrolithotripsy on renal function: Assessment with quantitative SPECT of (99m) Tc-DMSA renal scintigraphy. J Endourol 2006;20:102-6.
6. Samad L, Qureshi S, Zaidi Z. Does percutaneous nephrolithotomy in children cause significant renal scarring? J Pediatr Urol 2007;3:36-9.
7. Wadhwa P, Aron M, Bal CS, Dhanpatty B, Gupta NP. Critical prospective appraisal of renal morphology and function in children undergoing shockwave lithotripsy and percutaneous nephrolithotomy. J Endourol 2007;21:961-6.
8. Dawaba MS, Shokeir AA, Hafez A, Shoma AM, El-Sherbiny MT, Mokhtar A, *et al*. Percutaneous nephrolithotomy in children: Early and late anatomical and functional results. J Urol 2004;172:1078-81.
9. Chatham JR, Dykes TE, Kennon WG, Schwartz BF. Effect of percutaneous nephrolithotomy on differential renal function as measured by mercaptoacetyl triglycine nuclear renography. Urology 2002;59:522-5.
10. Nouralizadeh A, Sichani MM, Kashi AH. Impacts of percutaneous nephrolithotomy on the estimated glomerular filtration rate during the first few days after surgery. Urol Res 2011;39:129-33.
11. Traxer O, Smith TG 3rd, Pearle MS, Corwin TS, Saboorian H, Cadeddu JA. Renal parenchymal injury after standard and mini percutaneous nephrostolithotomy. J Urol 2001;165:1693-5.
12. Bayrak O, Seckiner I, Erturhan SM, Mizrak S, Erbagci A. Analysis of changes in the glomerular filtration rate as measured by the cockroft-gault formula in the early period after percutaneous nephrolithotomy. Korean J Urol 2012;53:552-5.

Source of Support: Nil, **Conflict of Interest:** None declared.