Percutaneous Nephrolithotomy Success Rate and Complications in Patients with Previous Open Stone Surgery

Mohammadhatef Khorrami, Mazaher Hadi, Mehrdad Mohammadi Sichani, Kia Nourimahdavi, Mohammad Yazdani, Farshid Alizadeh, Mohammad-hosein Izadpanahi, Farhad Tadayyon

Department of Urology, Isfahan Urology and Renal Transplantation Research Center, Alzahra Hospital, Isfahan University of Medical Sciences, Isfahan, Iran.

Corresponding Author:

Mehrdad Mohammadi Sichani, MD
Department of Urology, Isfahan Urology and Renal Transplantation Research Center, Alzahra Hospital, Isfahan University of Medical Sciences, Isfahan, Iran

Tel: +98 311 624 9031
Fax: +98 311 669 2174
E-mail: m_mohammadi@med.mui.ac.ir

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Purpose: To determine the effect of previous single or multiple open stone surgeries on percutaneous nephrolithotomy (PCNL) results and complications.

Materials and Methods: We reviewed medical records of 1422 patients who had been undergone PCNL in our institute between 1998 and 2011 by the same surgeon. Patients were divided into 3 groups. The first group included patients with no history of previous ipsilateral open stone surgery ($n = 711$). Patients in second group had been undergone only one open stone surgery before PCNL ($n = 405$) and patients with more than one previous open stone surgery were placed in third group ($n = 306$). We compared operation duration, stone free rate (SFR), number of attempts to access the collecting system and intraoperative and postoperative complications between 3 groups.

Results: There were no differences in sex, body mass index, stone burden and laterality between 3 groups. Operation time was significantly shorter in the first group ($P = .000$) while there was no statistically significant differences in operation duration between second and third groups ($P > .973$). The number of attempts to enter the collecting system was significantly lower in the first group in comparison to other two groups ($P = .00$). We didn't find significant differences between 3 groups in hospital stay, SFR, intraoperative and postoperative complications.

Conclusion: Our findings demonstrated that PCNL can be performed in patients with one or more open stone surgery history successfully without further complications.

Keywords: kidney calculi; surgery; nephrostomy; percutaneous; treatment outcome; lithotripsy; retrospective studies.

INTRODUCTION

Percutaneous Nephrolithotomy (PCNL) was described by Fernstrom and johannson in 1976.[1] Improvements in PCNL technology and instruments after its invention have made it the most useful surgical treatment to large kidney stones.[2] Recently European Association of Urology (EAU) has considered PCNL as the first surgical option for large, multiple or inferior calyx kidney stones.[3] Open stone surgery has been replaced by PCNL because of its cost effectiveness, lower morbidity, shorter operative time and lower post-operative complications.[4,5] Some patients with the history of open stone surgery need PCNL because of renal stone recurrences.[6,7] Open stone surgery cause scar tissue and anatomical modifications in kidney that may affect later PCNL. Some studies have reported that previous open stone surgery can increase PCNL failure rate[8] while others show that previous open stone surgery does not affect PCNL outcome.[9,10] The aim of our study is to compare PCNL efficiency and complications in patients with and without the history of open stone surgery.

MATERIALS AND METHODS

We reviewed records of all PCNL procedures (1422 procedures) that had been performed in Alzahra hospital from 1998 till 2011 by the same surgeon. patients categorized into 3 groups based on previous open stone surgery. Group 1 included patients with no history of open renal stone surgery on the ipsilateral kidney (n = 711). Patients who had been undergone only one previous open stone surgery classified as second group (n = 405). The third group consisted of patients with more than one open surgical history (n = 306). Patients with body mass index (BMI) ≥ 30, patients with abnormal renal anatomy such as ectopic or horse shoe kidneys and a stone burden of more than 700 mm^2 were excluded from the study.

The renal functions tests, serum electrolytes, hemoglobin, hematocrit, coagulation tests and urine culture were assessed before and daily after operation in all patients. If urine culture was positive, appropriate antibiotic prescribed for at least 2 weeks before undergoing PCNL. Intravenous urography was our preferred imaging modality and computed tomography (CT) scan was performed in patients with history of open surgery. Patients with retrorenal colon in CT scan were candidate for open stone surgery. One patient had incisional hernia due to previous open renal surgery, so he excluded from the study because of the risk of intestine perforation during PCNL.

After general anesthesia, a 5 or 6 French (F) ureteral catheter was inserted and fixed to a Foley catheter. Patients were then turned into a prone position with special care for the pressure points. The desired calyx was punctured under fluoroscopic guidance and a guide wire was inserted. Tract dilation was performed by serial metallic dilators. After Amplatz sheath insertion, nephroscopy was performed and stones were fragmented by a pneumatic lithotripter (Litho Crack, Sp. Swiss-Germany) and removed. Normal saline was used for continuous irrigation. If there was a more than 2 cm residual stone that could not be accessed from the first tract, a second access was established. Residual stones of less than 2 cm in diameter were scheduled for extracorporeal shock wave lithotripsy (SWL). No SWL was performed during first few days after surgery. Foley and ureteral catheter were removed 24 h after operation. Nephrostomy tube was clamped 48 h after operation and removed after 24 h if there was no urine leakage, pain or fever.

Seven days after surgery plain radiography and abdominal ultrasonography or CT scan (for radiolucent stones) were performed to determine the residual stones. Then we compared them to modalities were done before surgery to evaluate the stone free rate (SFR).

Patients' age, sex, BMI, stone burden, laterality, operative duration, length of hospital stay, number of attempts before successful entry into collecting system, SFR and complications rate were compared between three groups. Statistical analysis was performed with statistical package for the social science (SPSS Inc, Chicago, Illinois, USA) version 16.0 using the Chi-square and ANOVA tests. A P value < .05 was considered as significant.

RESULTS

Table 1 illustrates patients' demographic and renal stones characteristics. Patients' mean age in group 3 was significantly higher (50.4 ± 14.5, P = .001) in comparison to other two groups. There were no statistically significant differences in patients' sex, mean BMI, stone laterality and mean stone

Table 1. Demographic and clinical characteristics of study groups.

Variables	No. (%)	Mean (SD)	*P*	*P***
Male/Female				
Group 1	**1052/370 (74)**	---		---
Group 2	**150/55 (73)**		.669[a]	
Group 3	**98/38 (72)**			
Right/Left side				
Group 1	**892/520 (62.7)**	---		---
Group 2	**121/84 (59)**		.370[a]	
Group 3	**87/49 (64)**			
Age (years)				
Group 1‡#	---	42.5 ± 12.25		.000#
Group 2‡*		45.7 ± 17.27	.000[b]	.003*
Group 3# *		50.4 ± 14.5		.003‡
Body mass index (kg/m^2)				
Group 1		27.44 ± 2.5		---
Group 2	---	27.50 ± 2.6	.88[b]	
Group 3		267.9 ± 1.7		
Stone burden (cm)				
Group 1		4.76 ± 1.39		---
Group 2	---	4.92 ± 1.34	.301[b]	
Group 3		4.83 ± 1.38		

a: Chi-square test; b: One-way ANOVA test.
** *P* value between study groups.

burden between 3 groups. All patients had pelvis stone; 80, 82 and 83% of patients had concurrent lower or middle calyceal stones in first, second and third groups respectively (*P* = .87). Upper calyceal stone were detected in 15% of group 1, 13% of group 2 and 14% of patients in group 3 (*P* = .9). Mean Stone burden was the same in all groups. It was 4.76 ± 1.39 mm in group 1, 4.92 ± 1.34 mm in group 2 and 4.83 ± 1.38 mm in group 3 (*P* = .301). Mean operation duration was 116 ± 24, 128 ± 14 and 128 ± 14 minutes in groups 1, 2 and 3, respectively (*P* = .00). The mean hospital stay between 3 groups was not statistically different (*P* = .962) (Table 2). We also didn't observe any significant differences between three groups in SFR (*P* = .75). Mean number of attempts to access collecting system was significantly lower in the first group (1.5 ± 0.9 vs. 2.5 ± 0.5 and 2.3 ± 0.4 in groups 2 and 3 respectively) (*P* = .00).

One hundred eighty three patients (12.8%) in group 1, 61 patients (15%) in group 2 and 22 (16.1%) patients in group 3 required a second access tract for additional stone removal (*P* = .5).

As listed in Table 3 there were no differences between 3 groups regarding intraoperative and postoperative complications. Seventy one patients (5%) in group 1, 11 (5.4%) in group 2 and 8 (5.8%) in group 3 received blood transfusion during or after procedures (*P* = .7). Postoperative fever developed in 170 patients (23.9%) in group 1, 91 (22.4%) in group 2 and 72 (23.5%) in group 3 (*P* = .9).

Auxiliary procedures such a second look PCNL and SWL were performed in 9.7, 10.2 and 11% of patients in groups 1, 2 and 3, respectively (*P* = .9). Delayed hematuria (more than 14 days after surgery) was seen in 16 patients in group 1, 3 in group 2 and 1 in group 3. One of 16 patients in group 1 required arteriography and angioembolization of an arteriovenous fistula. All other cases were managed conservatively. Colon perforation was occurred in 2 patients (both in group 1) that managed conservatively.

Table 2. Percutaneous nephrolithotomy results and complications in study groups.

Variables	No. (%)	Mean (SD)	CI 95%	*P*	*P***
Hospital stay (day)	---				
Group 1		**3.93 ± 1.47**			
Group 2		3.90 ± 1.47		.962[a]	
Group 3		3.92 ± 1.45			
Operation time (min)					
Group 1 # *		116 ± 24	114-117		.000#
Group 2 #‡	---	128 ± 14	126-130	.000[a]	.000*
Group 3 ‡*		128 ± 14	125-130		.973‡
Access attempts (n)					
Group 1 ‡#		2.5 ± 0.9			.00#
Group 2 ‡*	---	1.5 ± 0.5		.00[a]	.122*
Group 3 # *		1.3 ± 0.4			.00‡
Transfusion rate, no. (%)					
Group 1 #‡	71 (5)				
Group 2 ‡*	11(5.4)			**.7**[b]	---
Group 3 *#	8 (5.8)				
Auxiliary procedures, no. (%)		---	---		
Group 1	138 (9.7)				
Group 2	21 (10.2)				
Group 3	15 (11)			.9	
Fever, no. (%)					
Group 1	341 (24)	---	---		---
Group 2	46 (22.5)			.9[b]	
Group 3	31 (23.7)				
Secondary tract, no. (%)					
Group 1	183 (12.8)				
Group 2	61 (15.0)	---	---	.5[b]	---
Group 3	22 (16.1)				
Stone free rate (%)					
Group 1		90.60 ± 5.96	---	.75[a]	
Group 2		90.45 ± 5.92			---
Group 3		89.63 ± 5.91			

a: One-way ANOVA test; b: Chi-square test.
** *P* value between groups.

DISCUSSION

Our findings showed that previous open stone surgery doesn't affect subsequent PCNL results and complications. Conversely some studies demonstrated that anatomical changes that happen after open stone surgery such as infundibulum stenosis, perinephric fibrosis, bowel displacement and incisional hernia may decrease PCNL success rate and increase its complications.[11,12] Same as our study a number of studies showed that PCNL can perform successfully without higher risk of complications in patients with a history pf open surgery history.[12-14] The number of patients in our study is not comparable to others. We reviewed PCNL records of 1422 patients which was extremely higher than sample size in similar studies. On the other hand we didn't find any study which compared patients with single and multiple stone surgery history with ones without such a history separately as we did. Based on our findings history of single or multiple ipsilateral open renal stone surgeries does not af-

fect PCNL success rate.

The mean operation time in the present study was significantly higher in groups with single or multiple previous stone surgeries in compare to first group while there was not any difference between patients categorized in second and third group. Two other studies also have expressed that operative time is longer in patients with a history of open nephrolithotomy.[12,13] Factors that may cause prolonged PCNL in patients after open surgery are difficulties in tract dilation in scarred collecting system and perinephric spaces, difficulties in stone fragments removal by grasping forceps and rigid nephroscopy in scarred kidneys and cautious fixation of kidney in the retroperitoneum.

The rate of auxiliary procedures like second-look PCNL or SWL was the same in all groups. Some other studies have reported the same result.[7,10,13,14] Only two studies have reported different results about auxiliary procedures need.[12,15] Margel and colleagues compared PNCL efficiency and morbidity in patients with previous nephrolithotomy with primary patients.[12] Based on their findings secondary procedures was higher in patients with nephrolithotomy history. Gupta and colleagues also found that relook PCNL is higher in patients with previous open surgery (18.2% vs. 7.8%).[15]

The mean number of attempts to enter the collecting system was significantly lower in group 1. Similar to our results Margel found that access attempts is higher in patients with open surgery history.[12] We didn't find any other study which had reported significant differences between two groups in access attempts. Probably this difference is because of distorted calyceal anatomy due to previous open surgeries and subsequent scarring.

Same as other studies our study showed that there are no differences between primary patients and patients with open surgery history in SFR and hospitalization time.[7,10,14] We also didn't find any differences in PCNL complications including fever and transfusion rate between three groups. In small group of patients, distortion of pyelocalyceal system due to previous surgery or recurrent stone formation may decrease stone free rate.[11,12] Performing intravenous urography or CT-urography may helpful to identify such circumstances before operation.

Although our findings have demonstrated that PCNL can be performed successfully in patients with one or more open stone surgery history without further complications, some important items should be considered. Each endourologist encounters some cases with difficult rod insertion and tract dilation. Sometimes balloon or one shot dilation must be replaced by tract dilation with metallic dilators. It seems that perinephric fibrosis has an essential role in such cases. Perinephric scar tissue formation depends on some factors including long standing calculus pyelonephritis, previous surgery complications (prolonged urine leakage), previous surgery type (nephrolithotomy, pyeloplasty, pyelolithotomy and etc) and severity of endogenous patients' reaction to operation. Urinary tract infection usually leads wide adhesion resulted from serious inflammatory reaction around renal parenchyma. It has been shown that tract dilation is especially difficult in patients with cystinuria. It may be related to parenchymal fibrosis in such patients.[16] It seems that in this conditions stone free rate and complications may be different. So it is so important to consider above mentioned situations before PCNL of previous operated kidneys and prepare yourselves to encounter such difficult conditions. So it is so useful to review previous surgery files, search about post operation infections and urine leakage, determine previous surgery type and get sure about metallic dilators accessibility in operating room. A complete imaging evaluation is also necessary to collect more information about such challenging cases.

Some authors prefer a supracostal approach[11] while a lower calyceal puncture preferred by others.[9] Scarring after open nephrolithotomy is usually subcostal so the best approach which helps to avoid colonic injury is supracostal.[17] A surgeon should avoid scar tissue when select the access site, but scar tissue alone is not an indication for upper-pole access as advocated by Margel and associates.[12] The calyx that provides access to maximum stone burden is chosen as a primary calyx of entry regardless of its relation to scar tissue or ribs.

CONCLUSION

Based on our findings it doesn't seem that previous open surgical procedures affect PCNL efficiency. PCNL complications are also the same in patients with or without the history of open stone surgery.

CONFLICT OF INTEREST

None declared.

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