Does Age Affect Outcomes of Percutaneous Nephrolithotomy?

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Introduction: The present study aimed to assess the efficacy and safety of percutaneous nephrolithotomy (PCNL) in elderly patients.
Materials and Methods: We retrospectively reviewed 50 PCNLs performed in the elderly patients (age > 65 years) carried out in our clinic from 2001 through 2007 and compared those with 248 PCNLs performed in younger patients (age < 40 years) during the same period.
Results: No significant difference was seen in calculus burden between the two groups. The success rates (stone-free patients and patients with residual calculi < 4 mm) were 85% for the elderly patients and 90% for the younger patients (P = .45). The major composition of calculi was calcium oxalate in 58% and 66.5% of the elderly and younger groups, respectively. No significant complication was observed in the elderly group. Fever without sign and symptoms of bacteremia was seen in 3 patients of each group (8.0% versus 1.2%, P = .004). The operative time was 75.0 ± 6.4 minutes and 76.0 ± 5.1 minutes (P = .25), and the mean hospital stay was 3.7 ± 0.3 days and 3.8 ± 0.9 days (P = .80) in the elderly and younger patients, respectively.
Conclusion: We found that PCNL in patients over 65 years was a safe and reliable technique with a stone-free rate of 85% for all types of calculi. Well-controlled comorbidities do not increase the risk of operation. It seems that despite the higher medical risk in the elderly patients, PCNL could be safe and yields a high stone-free rate.

Keywords: urinary calculi, percutaneous nephrolithotomy, aged

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INTRODUCTION

Extracorporeal shock wave lithotripsy (SWL) and conservative management can treat efficiently most of elderly patients with urinary calculi,[1] while percutaneous nephrolithotomy (PCNL) is considered to be associated with a higher risk in elderly patients compared with SWL. However, this technique is sometimes necessary for very large or complex calculi in patients with several comorbidities.[2] The number of elderly patients with urinary calculi has been growing along with the increasing life expectancy.[3] Because of high-risk complications of these calculi, observation and medical therapies are no longer recommended and PCNL is inevitable.[4] The changes in cardiorespiratory reserve of elderly patients make the patients less tolerant to certain stressors such as increase in demand during the peri-operative period, bleeding or septic complications, etc. In particular, the usual prone position of PCNL may be a challenge

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to both the patient and the anesthesiologist. Decrease in body reserve and comorbidities are always a concern in applying invasive treatment modalities, such as PCNL, in elderly patients.[5]

In this study, we reviewed our PCNL experience in patients older than 65 years, and compared their operative and postoperative complications with those of patients younger than 40 years.

MATERIALS AND METHODS

We retrospectively evaluated the records of 476 PCNLs over a 7-year period from 2001 to 2007 in our referral center for the treatment of urinary calculi. Fifty of the participants were in patients older than 65 years (mean, 69.2 years). We compared these patients with 248 patients younger than 40 years (mean, 31.4 years). Intravenous urography was the primary imaging modality in the diagnostic approach of all the patients. The calculus burden was determined by multiplying the calculus largest length by its width in centimeters, as measured on the pre-operative plain abdominal radiography, or on the intravenous urography in cases of radiolucent calculi. The study was approved by the ethics committee of the hospital.

The PCNL indications were SWL failures and pelvic or caliceal calculi larger than 2.5 cm in diameter, which were the same in both the elderly patients and the younger group. Patients with kidney anomalies and uncontrolled coagulopathies had been excluded. All of the PCNLs were done under general anesthesia. After ureteral catheterization and securing the patient in the prone position, contrast material was injected through the ureteral catheter. Then, percutaneous access was achieved under fluoroscopy guidance using an 18-gauge needle and a 0.038-inch guide wire (J tailed) by one surgeon. The nephrostomy tract was first dilated by an 8-F polyurethane dilator. After the dilator was removed, an Alken guide was replaced, and then, a 30-F Amplatz dilator was passed into the calyx. Nephroscopy was performed to localize the fragments and extract the calculi. After extraction of all fragments of calculi, a 14-F or 16-F Reentry nephrostomy tube was inserted, and the operation was terminated. An antegrade pyelography was obtained at 48 hours postoperatively, and the nephrostomy tube was clamped if no extravasation was seen. The tube was removed the next day unless there was pain or fever. The patient was discharged the same day following the removal of the tube.

The two groups of the elderly and young patients were compared in terms of demographic characteristics, operative time, location of calculi, hospital stay, body mass index, changes in hemoglobin level and serum level of creatinine (3 days postoperatively compared to pre-operative value), and complications, including peri-operative bleeding (need for transfusion), adjacent organ damage, respiratory disorders (postoperative respiratory distress), and laceration of the ureter. Stone-free status and residual calculus burden were determined by plain abdominal radiography and renal ultrasonography studies routinely obtained 3 months after the treatment. Success rate was defined as the proportion of patients who were stone free or those who had residual calculi smaller than 4 mm. Statistical analyses were performed using the independent *t* test, the Mann-Whitney test, the chi-square test, and the Fisher exact, where appropriate. A *P* value less than .05 was considered significant.

RESULTS

A total of 298 patients were included in this analysis (50 in the elderly group and 248 in the younger group). The elderly group constituted 10.5% of our patients who had undergone PCNL during the study period. Demographic and clinical characteristics of the patients are shown in Table 1. The calculi diameter and number were not significantly different between the groups of older and younger patients ($P = .71$ and $P = .30$, respectively).

Eight patients (16.0%) in the elderly group and 37 (14.9%) in the younger group had previously undergone open surgery for treatment of the kidney calculus ($P = .85$), and 9 (18.0%) and 54 (21.8%) had undergone SWL, respectively ($P = .55$). Twenty-one (42%) of the elderly patients and 31 (12.5%) of the younger patients had comorbid conditions as noted in Table 1 ($P < .001$). All of these conditions were

Table 1. Demographic and Clinical Characteristics of Older and Younger Patients Who Underwent Percutaneous Nephrolithotomy*

Characteristic	Elderly Patients	Younger Patients	*P*
Age, y	69.2 ± 4.1	31.4 ± 8.5	…
Sex			
Male	29 (58.0)	160 (64.5)	
Female	21 (42.0)	88 (35.5)	.38
Body mass index	26.7 ± 2.3	27.1 ± 1.8	.06
Medical history			
Hypertension	12 (24.0)	6 (2.4)	< .001
Diabetes mellitus	10 (20.0)	12 (4.8)	< .001
Coronary artery disease	8 (16.0)	2 (0.8)	< .001
Respiratory disorders	6 (12.0)	5 (2.0)	.004
Peptic ulcer	4 (8.0)	18 (7.3)	.85
Cerebrovascular disease	2 (4.0)	0	.03
Calculus location			
Superior calyx	6 (12.0)	26 (10.4)	
Middle calyx	12 (24.0)	69 (27.8)	
Inferior calyx	24 (48.0)	128 (51.6)	
Renal pelvis	8 (16.0)	25 (10.0)	.11
Number of calculi	2.0 ± 1.1	2.1 ± 1.5	.30
Calculus diameter	28.1 ± 3.3	27.4 ± 3.2	.71
Hydronephrosis			
Mild	16 (32.0)	82 (33.0)	
Moderate	26 (52.0)	132 (53.2)	
Severe	8 (16.0)	34 (13.7)	.89

*Values in parentheses are percents.

controlled and we performed PCNL with normal anesthetic conditions. The major composition of the calculi removed was calcium oxalate in 58.0% and 66.5% of the elderly and younger groups, respectively. Calculus analysis results in 20.0% of the elderly and 18.5% of the younger group were not available (Table 2).

In terms of complications, the elderly and younger patient groups were not significantly different (Table 3). In the elderly group, 2 patients received 2 units of packed cell postoperatively, one due to hypotension and hematocrit depletion and the other one based on the surgeon decision because of the intra-operative bleeding. In both groups, there were no differences between

Table 2. Kidney Calculi Analysis of Patients*

Calculus Composition	Elderly Patients	Younger Patients	*P*
Calcium oxalate	29 (58.0)	165 (66.5)	.24
Uric acid	8 (16.0)	22 (8.8)	.13
Calcium phosphate	2 (4.0)	10 (4.0)	.90
Cystine	1 (2.0)	5 (2.0)	.90
Unknown	10 (20.0)	46 (18.5)	.80

*Values in parentheses are percents.

Table 3. Intraoperative and Postoperative Data of Patients*

Outcome	Elderly Patients	Younger Patients	*P*
Access			
Superior calyx	2 (4.0)	9 (3.6)	
Middle calyx	8 (16.0)	25 (10.0)	
Inferior calyx	40 (80.0)	214 (86.2)	.56
Successful treatment	43 (86)	224 (90)	.45
Operative time, min	75 ± 6.4	76 ± 5.1	.25
Hospital stay, d	3.7 ± 0.3	3.8 ± 0.9	.80
Hemoglobin level, mg/dL			
Before operation	12.8 ± 2.1	13.2 ± 1.1	.60
After operation	12.1± 1.9	12.5 ± 1.5	.70
Change	-0.65 ± 0.30	-0.58 ± 0.35	.65
Creatinine level, mg/dL			
Before operation	1.10 ± 0.30	1.04 ± 0.20	.35
After operation	1.10 ± 0.30	1.07 ± 0.20	.40
Range of change	-0.1 to 0.1	-0.3 to 0.5	.23
Complications			
Peri-operative bleeding	2 (4.0)	4 (1.6)	.30
Perirenal Hematoma	0	0	…
Adjacent organ damage	0	1 (0.4)	.60
Respiratory complications	1 (2)	2 (0.8)	.40
Laceration of ureter	0	1 (0.4)	.60
Post operation fever	4 (8)	3 (1.2)	.004
Delay bleeding	0	0	…

*Values in parentheses are percents.

pre-operative and postoperative serum creatinine and hemoglobin levels ($P = .23$ and $P = .65$, respectively). Peri-operative bleeding was not significantly different between the two groups, either ($P = .30$). In addition, the frequency of respiratory complications was not different between the two groups ($P = .40$). In the early postoperative period, fever without sign and symptoms of bacteremia was seen in 4 patients (8.0%) of the elderly group and 3 (1.2%) of the younger group ($P = .004$), who were treated with an antibiotic and conservative measures.

The success rates (stone-free patients and patients with residual calculi < 4 mm) were comparable; 85% for the elderly patients and 90% for the younger patients had a successful treatment ($P = .45$). In both groups, the operative time (75.0 ± 6.4 minutes versus 76.0 ± 5.1 minutes, $P = .25$) and the mean hospital stay days (3.7 ± 0.3 days and 3.8 ± 0.9 days, $P = .8$) were not significantly different.

DISCUSSION

Careful consideration must be given to the most appropriate treatment for any urinary calculus in an elderly patient. When serious medical conditions such as pulmonary or heart disease present, a high risk of potential anesthetic complications, minimally invasive therapy or observation should be done.[1] For elderly patients, SWL may actually have a less satisfactory result than the other treatment modalities.[5] Considering PCNL, Anagnostou and coworkers suggest that a high age and its associate morbidities would not be a major concern if the surgeon is experienced enough.[6]

Like most previous studies on geriatric kidney calculus formers, there was a male predominance in our study.[1,2,7] However, Sahin and colleagues in Turkey demonstrated female predominance in their elderly PCNL candidates.[3] It was reported that the first calculus episode in patients over 65 years was significantly later than in younger patients.[5] Therefore, it is reasonable to conclude that the pathogenesis of urinary calculi may be different in elderly patients.[3] Stoller and colleagues found a high incidence of uric acid calculus in the elderly compared with that in the younger cohort.[1] Likewise, Gentle and associates reported the high rate of uric acid calculi in older patients, after retrospective review of more than 6000 patients.[8] Sahin and colleagues showed the most calculus composition was calcium oxalate in 79% of patients.[3] Calculi analyses were available in 80% of our patients, with the following results: calcium oxalate in 58%, uric acid in 16%, calcium phosphate in 4%, and cystine in 2% of the elderly group with insignificant differences from those in the younger patients.

A long surgical procedure can impose risks to the elderly patients. The previously reported mean duration of PCNL in elderly was 60 to 130 minutes.[3,9,10] In our study, the mean operative time was 75.0 ± 6.4 minutes. This time is similar to that in younger patients or children with PCNL (89 minutes).[11] Renal scintigraphy for evaluation of kidney function detected no significant harmful effects of PCNL on the kidneys.[9,10] We could not perform these studies, because of their cost, but our patients did not show any complications that could be a sign of impaired kidney function.

Even for the expert urologists, major complications can still occur in 1.1% to 7% of patients undergoing PCNL, and minor complications may be encountered in 11% to 25% of patients. Hemorrhage is the most significant complication which has given rise to a transfusion rate reported from 1% to 10%.[12-14] Although the anesthetic risks for elderly patient is more than younger patients,[15] anesthetic complications in our study were not more frequent in the elderly than in the younger patients. The overall complication rate, in the previous studies was 6% with pyrexia as the most common complication,[16,17] fairly comparable with our study results.

Our 86% rate of stone-free status, as Stoller and associates pointed out, is certainly an acceptable outcome, especially because no long-term complications were seen in elderly populations.[1] Comparing with the normal adult patients, the structural and physiological difference in the elderly populations certainly affect our management for calculus diseases. With the advance in endoscopy design and experience,

PCNL in these ages seem to be providing the same efficacy and safety as the standard adult population.

CONCLUSION

The decrease in body reserve and comorbidities are always a concern in applying invasive treatment, such as PCNL, in elderly patients. Regarding the low overall complication rate of PCNL in our elderly cohort and the acceptable success rate of the treatment, we can imply that this procedure is a safe and effective method in the treatment of the urinary calculi in elderly patients even when they are assumed to be high risk.

CONFLICT OF INTEREST

None declared.

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