Percutaneous Nephrolithotomy in Patients With Solitary Kidney

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Introduction: The aim of this study was to evaluate percutaneous nephrolithotomy (PCNL) in the patients with solitary kidneys.

Materials and Methods: Between 1995 and 2005, we had 11 patients with a solitary kidney and kidney calculi who underwent PCNL at our center. Tubeless and standard PCNLs were performed in 3 and 7 patients. In 1 patient, we could not achieve access to the system due to the stricture of the infundibulum.

Results: The calculi were extracted or fragmented successfully in 10 patients. In 2 patients with residual calculi, a double-J catheter was inserted and extracorporeal shock wave lithotripsy (SWL) was performed. Retroperitoneal hematoma was detected in 3 cases by ultrasonography 1 week after the procedure, which was treated conservatively. Also, fever occurred in 3 patients after the procedure which was treated successfully. The patients were discharged on the 3rd and 4th postoperative days.

Conclusion: Although PCNL is accompanied by the risk of complications such as severe bleeding that may result in kidney loss in patients with a solitary kidney, the rate of success and complications seem to be similar to the other patients if careful operation and correct selection of candidates are done. Therefore, we recommend cautious performance of PCNL in patients with solitary kidneys.

Keywords: percutaneous nephrolithotomy, solitary kidneys, nephrostomy, urinary calculi

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INTRODUCTION

Percutaneous nephrolithotomy (PCNL) was firstly introduced in 1976 as a method of treatment for kidney calculi.[1] The advent of new instruments and techniques of this procedure helped urologists to perform PCNL with a high level of accuracy and less complications. Given its less morbidity and costs and shorter convalescence period, nowadays, PCNL is the treatment of choice for large and complex calculi. It is now the preferred method of treatment in patients with calculi not appropriate for extracorporeal shock wave lithotripsy (SWL).[2] Almost all of the pyelocaliceal calculi can be treated by PCNL. However, since bleeding is a common complication of this procedure, nephrectomy might be needed to be performed in case of uncontrollable bleeding.[2-12] Therefore, PCNL in solitary kidney patients should be performed with great caution. In this study, we evaluated PCNL in patients with solitary kidneys.

MATERIALS AND METHODS

Between 1995 and 2005, we had 11 patients with calculi in their solitary kidney who were admitted

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to Imam Reza Hospital for PCNL. The patients had a solitary functioning kidney as a result of agenesis in 4 (36.4%), previous nephrectomy in 4 (36.4%), and no function in the contralateral kidney in 3 (27.3%). Function of the kidneys was assessed by dimercaptosuccinic acid renography. Potential complications and the anticipated rate of success were explained for the patients and after taking written consent, PCNL was performed. Routine laboratory tests including complete blood count, fasting blood glucose, blood urea nitrogen, serum creatinine, serum uric acid, blood group and Rh, urinalysis, and urine culture were performed before the procedure. In the children, hypercalciuria, hyperuricosuria, hypercalcemia, hyperuricemia, serum and urine levels of sodium and potassium, and serum level of parathormone were evaluated, as well. Radiological assessments including ultrasonography, abdominal radiography, and intravenous urography were performed in all patients.

After reserving 2 blood units, the patient was secured in the prone position by giving a 30°C angle to the bed. For fluoroscopic guidance, contrast medium was injected by the appropriate PCNL needle. Then, we entered the targeted calyx. The tract was dilated up to 28 F or 30 F, Amplatz sheath was placed, and nephroscopy was performed. After removing the blood clots and evaluating the system, calculi smaller than 1 cm in diameter were removed using a forceps. Pneumatic, ultrasound, laser, and finally, electrohydraulic lithotripsy were performed and fragments were removed by grasping. Nephrostomy tube was placed at the end of the procedure. In 3 cases, we performed tubeless PCNL.

RESULTS

Data on the characteristics of the patients and the outcomes are listed in the Table. The mean age of the patients was 38.8 ± 16.1 years (range, 6 to 62 years). They were 8 men (72.7%) and 3 women (27.3%). The mean size of the calculi was 18.6 ± 5.7 mm (range, 8 mm to 25 mm). One of the patients was a 6-year-old child with an 8-mm calculus in the renal pelvis. Seven patients (63.6%) had a single calculus in the renal pelvis, 3 (27.3%) had a single calculus in the lower calyx, and 1 (9.1%) had multiple calculi in the lower calyx and pelvis. History of calculus passage was recorded in 6 patients (54.6%). Seven patients (63.6%) had undergone SWL before PCNL. The calculus had been fragmented into pieces in 2 of them and in 5, the procedure had failed. These patients became candidates for PCNL.

Access to the system was not possible in 1 patient due to the stricture of the infundibulum. In 8 patients (72.7%), the calculi were completely removed and the patients became stone free. The calculi were fragmented and removed using pneumatic and ultrasonic lithotripters in 7 and 3 patients, respectively. In the 2 remaining patients (18.2%), a double-J catheter was inserted and SWL was performed later.

No intra-operative complication occurred and urine output was favorable after the procedure.

Characteristics and Clinical Outcome of Percutaneous Nephrolithotomy in Patients With a Solitary Kidney

Patients	Age, y	Sex	Calculus Size, mm	Calculus Location	Previous SWL*†	Contralateral Kidney	Outcome
1	54	Male	15	Pelvis	Failed	Nephrectomy	Stone free
2	6	Male	8	Lower calyx	…	Agenesis	Stone free
3	28	Female	18	Lower calyx	Failed	Agenesis	Stone free
4	32	Female	22	Pelvis	…	Nonfunctioning	Stone free
5	48	Male	25	Pelvis and lower calyx	Failed	Agenesis	Residue
6	29	Male	25	Pelvis	Failed	Nephrectomy	Stone free
7	48	Male	20	Pelvis	Failed	Nonfunctioning	Stone free
8	50	Male	15	Pelvis	…	Nonfunctioning	Stone free
9	62	Female	25	Lower calyx	Failed	Nephrectomy	Residue
10	26	Male	20	Pelvis	Failed	Nephrectomy	Failed access
11	44	Male	12	Pelvis	…	Agenesis	Stone free

*SWL indicates shock wave lithotripsy.
†Ellipses indicate that SWL had not been attempted.

In 3 patients (27.3%), retroperitoneal hematoma was detected which was spontaneously resolved. Fever developed in 3 patients (27.3%) after the procedure which was treated with wide-spectrum antibiotics. In tubeless method, the patients were discharged at the 3rd postoperative day, while the patients who had undergone standard procedure, were discharged at the 4th day. One week postoperatively, control ultrasonography was performed and retroperitoneal hematoma was detected in 2 patients (18.2%), which were treated conservatively.

DISCUSSION

Complications of PCNL are more important in patients with solitary kidneys in comparison with patients with 2 intact kidneys. Bleeding is the major concern in them and if it become uncontrollable, nephrectomy may be required. The collecting system is surrounded by an arteriovenous complex with approximately 20% of the cardiac output. Segmental and interlobar arteries and veins are the most important surrounding vessels. Access to the pyelocaliceal system may cause trauma and severe bleeding with an average hemoglobin loss of 2.1 g/dL to 3.3 g/dL.[3-7]

Treatment of complex and staghorn calculi that involve multiple calyxes needs several tracts for better access to the system which result in more extensive bleeding.[5,12] Blood transfusion is usually required in 1% to 11% of patients who undergo PCNL and in 2 % to 53% of those with staghorn calculi.[2-11] None of our patients had a staghorn calculus and we did not have any case of transfusion. Most of the bleeding cases caused by PCNL are treated conservatively. About 0.8% of the cases need angio-embolization for the treatment of uncontrollable bleeding.[13] Severe bleeding may take place during the passage of the needle, the tract dilation or nephroscopy, after the procedure, and after removing the staghorn calculi. Placement of a nephrostomy tube and clumping it for 10 minutes is usually enough for controlling the bleeding. The Kaye tamponade catheter[14] should be inserted if bleeding is not controlled by the nephrostomy tube and angiography should be immediately performed for the diagnosis of arteriovenous fistula or false aneurism. Angiography is both for diagnosis and treatment, because both arteriovenous fistula and false aneurism are well treated by embolization. In case of the continuation of bleeding or life-threatening bleeding, partial and even total nephrectomy may be needed.[13] In patients with a solitary kidney, this complication may result in anephric status and permanent need for hemodialysis. Other complications of PCNL do not usually lead to nephrectomy and PCNL can be a good choice to remove complex calculi.[15]

It has been shown that percutaneous nephrostomy can increase the chance of successful lithotripsy in the patients with a solitary kidney and opaque calculi.[16] In the literature review, there are a few reports on limited number of patients with a solitary kidney who have undergone PCNL without any complications.[15,17,18] Our patients had solitary kidneys and SWL failed or it was not indicated because of the density and location of the calculus. Surgery was necessary to be performed and also regarding our experience (performing at least 2000 PCNLs so far). We carried out tract dilation in all steps under the guidance of fluoroscopy. This method was successful and the results were not very different from the results in patients with 2 kidneys. Concerning the risk of the surgical procedures in these patients, PCNL can be a safe method if the surgeon is experienced enough.

CONCLUSION

Percutaneous nephrolithotomy is recommended to be performed in patients with solitary kidneys by experienced surgeons with caution. However, patients with very large or staghorn calculi are not good candidates for PCNL due to the risk of severe bleeding.

CONFLICT OF INTEREST

None declared.

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