

Percutaneous nephrolithotomy with one-shot dilation method: Is it safe in patients who had open surgery before?

Tufan Süelözgen, MD;¹ Cemal Selcuk Isoglu, MD;¹ Hakan Turk, MD;² Mehmet Yoldas, MD;² Mustafa Karabıcak, MD;¹ Batuhan Ergani, MD;¹ Hayal Boyacioglu, MD;³ Yusuf Ozlem Ilbey, MD;¹ Ferruh Zorlu, MD¹

¹Tepecik Training and Research Hospital Department of Urology, Izmir, Turkey; ²Department of Urology, Faculty of Medicine, Dumlupinar University, Eviya Celebi Training and Research Hospital, Kütahya, Turkey; ³Ege University Faculty of Science, Department of Statistics, Izmir, Turkey

Cite as: *Can Urol Assoc J* 2016;10(3-4):E132-5. <http://dx.doi.org/10.5489/cuaj.3301>

Abstract

Introduction: This study aimed to evaluate whether one-shot dilatation technique is as safe in patients with a history of open-stone surgery as it is in patients without previous open-stone surgery.

Methods: Between January 2007 and February 2015, 82 patients who underwent percutaneous nephrolithotomy (PNL) surgery with one-shot dilation technique who previously had open-stone surgery were retrospectively reviewed and evaluated (Group 1). Another 82 patients were selected randomly among patients who had PNL with one-shot dilation technique, but with no history of open renal surgery (Group 2). Age, gender, type of kidney stone, duration of surgery, radiation exposure time, and whether or not there was any bleeding requiring perioperative and postoperative transfusion were noted for each patient.

Results: The stone-free rates, operation and fluoroscopy time, and perioperative and postoperative complication rates were similar in both groups ($p > 0.05$).

Conclusions: Our experience indicated that PNL with one-shot dilation technique is a reliable method in patients with a history of open-stone surgery.

Introduction

Percutaneous nephrolithotomy (PNL) is a minimally invasive surgical procedure used in the treatment of kidney stones.¹ In current practice, PNL has almost completely replaced open surgery.

Creation of the nephrostomy tract is one of the important steps of PNL. Various methods have been defined for this purpose, among them the one-shot technique, which has been shown to shorten operating times and reduce radiation exposure.² In this technique, tract dilatation is performed by a one-step 25–30F dilator, following an initial 6F dilation.² However, dilatation with one-shot technique in patients who previously underwent open-stone surgery is controversial. The objective of this study is to evaluate whether one-shot

dilatation technique is as safe in patients with a history of open-stone surgery as it is in patients without previous open renal surgery.

Methods

Study patients were divided into two groups and data was retrospectively reviewed. Group 1 consisted of 82 patients who had PNL with one-shot dilation technique for the first time between January 2007 and February 2015 and who had a history of open-stone surgery. Age, gender, type of stone, duration of surgery, radiation exposure time, as well as bleeding status requiring perioperative transfusion were noted. Postoperative complications were analyzed separately. Group 2, the control group, consisted of another 82 randomly selected patients who had PNL with one-shot dilation technique, but with no history of open surgery.

Additional contrast-enhanced imaging was not performed in the patients who were already scheduled to undergo surgery with preoperative non-contrast abdominal computed tomography (CT). Dimercaptosuccinic acid (DMSA) scintigraphy was not needed because CT imaging pointed out no uncertainty in terms of kidney functions. None of the included patients had non-opaque kidney stones. PNL decision was made according to the size of the stone or failure of the previously performed extracorporeal shock wave lithotripsy (ESWL) treatment. Because this was a retrospective study, information regarding the number of previous open surgeries the patients had was not available.

Isolated renal pelvis or calyx stones were considered simple stones; pelvis + calyx or staghorn stones were considered complex. Complete blood count, biochemical analyses, coagulation tests, and urine culture were performed for all the patients preoperatively. Appropriate antibiotic therapy was given to patients with positive urine culture and all the patients were operated with urine culture sterile. A 6-French (6F) open-ended ureteral catheter was inserted under cystoscopic guidance while the patient was in the lithotomy position under general anesthesia, following which

the patient was placed in prone position. After opaque material was instilled through the ureteral catheter, access was obtained from the selected calyx to the intrarenal collecting system by an access needle under fluoroscopic guidance. After the placement of the guide catheter, tract was created by first dilating using a 6F Amplatz dilator set, then with one-shot method by using 25–30F dilator. Access failure did not develop in any of the patients. Access was not performed blindly. The stones were broken up with ultrasonic lithotripter in all patients. A 14F Malecot drain was routinely placed following the completion of the operation. If not at postoperative Day 1, the nephrostomy tube was withdrawn at postoperative Day 3 if extravasation of opaque material was determined out of the tract by sonoscopy. All patients were re-evaluated by non-contrast abdominal tomography at the first postoperative month. The operation was considered successful if there were no fragments at all or if the fragments were smaller than 4 mm.

Statistical analysis

Summary statistics were used for continuous variables (mean, standard deviation, standard error). Associations between categorical variables were analysed using χ^2 test. When the expected number of observations in one or more categories was ≤ 5 , we used the Fisher's exact test. Independent-samples *t* test and Mann-Whitney *U* test were used to compare differences between two independent groups. Data were analyzed using SPSS version 15.0 software (SPSS Inc., Chicago, IL). All *p* values < 0.05 were considered statistically significant.

Results

Of 82 patients in Group 1, 47 were men and 35 were women. The mean age was 48.2 ± 14 years (range 19–75 years); mean operation time 102 ± 266 minutes (range 30–270 minutes); and fluoroscopy time 230 ± 294 seconds (range 28–300 seconds). The type of kidney stone was simple in 42 patients (51.2%) and complex in 40 patients (48.8%).

Group 2 included 82 patients, 46 men and 36 women. The mean age was 44.05 ± 17 years (range 21–70 years); mean operation time 134 ± 44 minutes (range 35–210); and fluoroscopy time 194 ± 44 seconds (range 40–263). Of Group 2 patients, 43 (52.4%) had simple and 39 (47.6%) had complex stones. There was no significant difference in terms of these data between the groups ($p > 0.05$) (Table 1). A second access was required due to a complex stone in five patients (6.1%) in Group 1 and 12 patients (14.6%) in Group 2 ($p = 0.122$).

One patient (1.2%) in both groups required blood transfusion preoperatively ($p = 1$). Blood transfusion was required because of postoperative hemodynamic instability in three patients (3.7%) of Group 1, whereas none of Group 2 patients required transfusion ($p = 0.245$).

Five patients (6.1%) in Group 1 and 12 patients (14.6%) in group 2 had postoperative fever ($p = 0.122$). Double J stent was inserted because of prolonged postoperative urinary tract drainage in two patients (2.4%) in Group 1. The stents were removed after four weeks and no additional intervention was required.

Patients without any postoperative complications were discharged and were controlled with abdominal contrast CT after one month. Residue stones of ≥ 4 mm size were detected in 17 (20.7%) of Group 1 and in 12 (14.6%) of Group 2 patients ($p = 0.40$). There were no significant differences between two groups in terms of operation success and postoperative complications (Table 2).

Discussion

Since the first series of PNL operations were reported by Wickham in 1981,³ open-stone surgery has become a very rarely applied method. Creation of the nephrostomy tract is certainly one of the first and most important stages of PNL. Three types of dilators are available: Amplatz fascial dilator, telescopic metal dilator, and balloon dilator. Balloon dilators are limited in use because of their high costs, although they are safe and widely accepted.⁴ Amplatz and telescopic metal dilators are less expensive, but dilation takes longer, increasing radiation exposure. It was reported that retroperitoneal fibrosis associated with the past operations can cause difficulties in creating a percutaneous nephrostomy tract and prolong nephrostomy access time.⁵ Operation time and access time were not calculated separately in our study so we don't have the data for the time spent during access; however, there was no statistical difference between the two groups in terms of total operation time ($p = 0.176$).

Lojanapiwat reported that gradual dilation technique with Amplatz dilators can be comfortably used in patients with a history of open-stone surgery.⁶ However, frequent and widespread use of PNL procedure has created exposure-related concerns among urologists and other surgical team members, leading to search for new alternatives. Various studies have reported that one-shot technique — described

Table 1. Demographic data of the study patients

Variable	Group 1 (n=82)	Group 2 (n=82)	<i>p</i> value
Mean age (years \pm SD)	48.24 ± 14	44.04 ± 17	0.96
Women (%)	35 (42.7)	36 (43.9)	0.87
Men (%)	47 (57.3)	46 (56.1)	0.87
BMI (kg/m ² \pm SD)	29.1 ± 5.2	29 ± 7.4	0.93
Right kidney (%)	54 (65.9)	42 (51.2)	0.92
Left kidney (%)	28 (34.1)	40 (48.8)	0.92
Simple stone (%)	42 (51.2)	43 (52.4)	0.92
Complex stone (%)	40 (48.8)	39 (47.6)	0.92

SD: standard deviation.

Table 2. Significant preoperative and postoperative findings

Variable	Group 1 (n=82)	Group 2 (n=82)	p value
Mean operation time (minutes \pm SD)	102 \pm 266	134 \pm 44	0.17
Mean fluoroscopy time (seconds \pm SD)	230 \pm 294	194 \pm 44	0.36
Need for multiple access (%)	5 (6.1)	12 (14.6)	0.12
Preoperative blood transfusion (%)	1 (1.2)	1 (1.2)	1
Postoperative blood transfusion (%)	3 (3.6)	0	0.24
Postoperative fever (%)	5 (6.09)	12 (14.6)	0.12
Operation success (%)	65 (79.2)	70 (85.3)	0.4
Additional intervention after discharge (double j stent implantation) (%)	2 (2.4)	0	0.24

SD: standard deviation.

as acute dilatation with 25–30F after initial 6F dilatation with a view to reduce radiation exposure and operation time^{6,7} — was a safe method.

Frattini et al have stated that, because of the development of retroperitoneal scar, dilatation with the one-shot technique generally fails in patients with a history of open-stone surgery and, therefore, balloon or metal dilatation techniques are preferred in this patient group. In their study of 112 patients, Falahatkar et al examined one-shot technique by using a PVC dilator (Amplatz) and reported that nephrostomy access failed in three patients who had open-stone surgery;⁹ they nevertheless commented that it was an effective and reliable method. However, access failure did not occur in any of the patients and no other dilatation method was needed.

Amjadi et al have shown that the one-shot dilatation technique can be safely applied in patients who previously underwent open surgery and is a risk-free method with less exposure to radiation.¹⁰ In our study, we determined no difference between the groups in terms of radiation exposure ($p=0.361$).

Bleeding is one of the most important complications of PNL. Reasonable amount of bleeding can occur during renal access. Bleeding requiring transfusion must be regarded as a more serious complication; it has been reported in rates of 0–20 %.¹¹ In our study, transfusion was needed in four patients (4.8%), one perioperatively and three postoperatively. These patients had staghorn stones, which is a known risk factor for bleeding.¹²

Fever is seen commonly after PNL, with an incidence of 0–32.1%.¹¹ In our study, five patients (6.1%) in Group 1 had postoperative fever, but none of them developed urosepsis.

When the nephrostomy tube is removed, urine drainage from the urinary tract is considered normal until the collecting system is healed. The prolonged drainage, however, should be considered as a complication. It occurs at an incidence of 1.5–3%, generally in the presence of peripheral obstruction related with stones or clots, and requires intervention.¹³ In our study, two patients (2.4%) in Group 1 had prolonged drainage without any known cause of obstruction; double J stents were inserted and left there for four weeks. After the removal of the stents, we observed that

drainage discontinued. Although this complication was not observed in Group 2 and these groups indeed did not show any difference ($p=0.24$), this situation may be correlated with retarded healing of the urinary tract area due to scar development. When the groups were compared in terms of operation success, residual fragments ≥ 4 mm were detected in 17 patients (20.7%) in Group 1 and 12 patients (14.6%) in Group 2; there was no statistically significant difference between the two groups ($p=0.4$).

Ziaee et al have stated that one-shot dilation technique is applicable in almost all adult patients.¹⁴ Amirhassani et al have expressed that PNL with one-shot technique is a safe and tolerable method due to low complication rate and radiation exposure.¹⁵ Our results for PNL with one-shot method performed in patients who had and had not had previous open surgery were similar to the results in the literature.

The primary limitation of our study is its retrospective nature. The access time could not be calculated separately from the operation time. Due to the lack of preoperative data, the number of open operations that patients underwent was not known.

Conclusion

One-shot dilation technique with PVC dilators could become a standard method for all patient groups in the near future; however, further studies with larger study groups are required.

Competing interests: The authors declare no competing financial or personal interests.

This paper has been peer-reviewed.

References

- Segura JW, Patterson DE, LeRoy AJ, et al. Percutaneous removal of kidney stones: Review of 1000 cases. *J Urol* 1985;134:1077-81.
- Travis DG, Tan HL, Webb DR. Single-increment dilation for percutaneous renal surgery: An experimental study. *Br J Urol* 1991;68:144-7. <http://dx.doi.org/10.1111/j.1464-410X.1991.tb15282.x>
- Wickham JE, Kelleher MJ. Percutaneous nephrolithotomy. *Br Med J (Clin Res Ed)* 1981;12:1571-2. <http://dx.doi.org/10.1136/bmj.283.6306.1571>

4. Dehong C, Liangren L, Huawei L, et al. A comparison among four-tract dilation methods of percutaneous nephrolithotomy: A systematic review and meta-analysis. *Urolithiasis* 2013;41:523-30.
5. Tugcu V, Su FE, Kalfazade N, et al. Percutaneous nephrolithotomy (PCNL) in patients with previous open stone surgery. *Int Urol Nephrol* 2008;40:881-4. <http://dx.doi.org/10.1007/s11255-008-9376-1>
6. Lojanapiwat B. Previous open nephrolithotomy: Does it affect percutaneous nephrolithotomy techniques and outcome? *J Endourol* 2006;20:17-20. <http://dx.doi.org/10.1089/end.2006.20.17>
7. Rusnak B, Castaneda-Zuniga W, Kotula F, et al. An improved dilator system for percutaneous nephrostomies. *Radiology* 1982;144:174. <http://dx.doi.org/10.1148/radiology.144.1.7089252>
8. Frattini A, Barbieri A, Salai P, et al. One shot: A novel method to dilate the nephrostomy access for percutaneous lithotripsy. *J Endourol* 2001;15:919-23. <http://dx.doi.org/10.1089/089277901753284143>
9. Falahatkar S, Neiroomand H, Akbarpour M, et al. One-shot versus metal telescopic dilation technique for tract creation in percutaneous nephrolithotomy: Comparison of safety and efficacy. *J Endourol* 2009;23:615-8. <http://dx.doi.org/10.1089/end.2008.0330>
10. Amjadi M, Zolfaghari A, Elahian A, et al. Percutaneous nephrolithotomy in patients with previous open nephrolithotomy: One-shot versus telescopic technique for tract dilatation. *J Endourol* 2008;22:423-6. <http://dx.doi.org/10.1089/end.2007.0206>
11. Turk C, Knoll T, Petrik A, et al. European Association of Urology Guidelines on Urolithiasis. 2015. <https://uroweb.org/guideline/urolithiasis/>. Accessed on April 1, 2016.
12. Seitz C, Desai M, Hacker A, et al. Incidence, prevention, and management of complications following percutaneous nephrolitholapaxy. *Eur Urol* 2012;61:146-58. <http://dx.doi.org/10.1016/j.eururo.2011.09.016>
13. Dirim A, Turunc T, Kuzgunbay B, et al. Which factors may effect urinary leakage following percutaneous nephrolithotomy? *World J Urol* 2001;29:761-6.
14. Ziaee SA, Karami H, Aminsharifi A, et al. One-stage tract dilation for percutaneous nephrolithotomy: Is it justified? *J Endourol* 2007;21:1415-20. <http://dx.doi.org/10.1089/end.2006.0454>
15. Amirhassani S, Mousavi-Bahar S, Kashkouli A, et al. Comparison of the safety and efficacy of one-shot telescopic dilatation in percutaneous nephrolithotomy: A randomized, controlled trial. *Urolithiasis* 2014;42:269-73. <http://dx.doi.org/10.1007/s00240-014-0644-5>

Correspondence: Dr. Hakan Turk, Department of Urology, Faculty of Medicine, Dumlupinar University, Evliya Celebi Training and Research Hospital, Kütahya, Turkey; hkntrk000@hotmail.com