

PERCUTANEOUS NEPHROLITHOTOMY AND COMPLICATIONS: OUR EXPERIENCE WITH 3,003 CASES

Ahmet Çamtosun, *Hüseyin Çelik, İbrahim Topcu, Cemal Taşdemir, Ramazan Altıntaş, Serhan Çimen, Ali Güneş

Department of Urology, Medical Faculty, Inonu University, Malatya, Turkey

**Correspondence to huseyin.celik@inonu.edu.tr*

Disclosure: The authors have declared no conflicts of interest.

Accepted: 01.05.15

Citation: EMJ Urol. 2015;3[3]:60-62.

ABSTRACT

We report the outcomes of 3,003 percutaneous nephrolithotomy (PCNL) procedures performed in our institution between March 1998 and December 2014. The PCNL procedures were performed under general anaesthesia. The ureteral catheter was installed in the supine position during cystoscopy under C-arm fluoroscopy guidance and, after turning the patient into the prone position, the kidney with stone was entered with a metal needle under fluoroscopy. The Amplatz renal dilator set was used (dilation or balloon renal dilator). The nephrostomy catheter was placed in the renal sheath. After completion of PCNL procedures, residual asymptomatic stones of 4 mm or less in size were considered clinically insignificant. Of the total number of patients, 2,699 (89.88%) achieved stone clearance. Bleeding requiring transfusion occurred in 186 cases (6.19%), of which 14 (0.47%) were treated with embolisation angiography. A double-J stent was inserted in 158 patients (5.26%). Pneumothorax occurred in 24 patients (0.80%) and colon perforation occurred in one patient (0.03%). In angiography, the bleeding site was not identified in one patient and open repair was performed. Mean duration of hospitalisation was 3.3 days and the nephrostomy tube was kept for a mean duration of 2.6 days.

Keywords: Percutaneous nephrolithotomy (PCNL), nephrolithotomy, complications.

INTRODUCTION

The incidence of urolithiasis varies according to age and geographical region, and is of particular concern in developing countries. With the introduction of percutaneous nephrolithotomy (PCNL) in 1976, open surgical approaches have begun to lose their popularity in the treatment of urolithiasis.¹ Although PCNL has been accepted as a minimally invasive treatment modality, the technique can lead to possible complications, including bleeding and injury to the collection system.² In this retrospective study we report our experience with PCNL and evaluate the clinical outcomes, including morbidity and mortality.

MATERIALS AND METHODS

This retrospective study was conducted in a single urology clinic and reviewed the medical data of 3,003 patients (3,003 renal units) up to the age

of 80 years who underwent PCNL between March 1998 and December 2014. Preoperative patient histories, physical examinations, and routine laboratory tests including blood biochemistry, urinalysis, and urine cultures were evaluated. An abdominopelvic ultrasound, plain abdominal films, and intravenous urography were used as diagnostic imaging tools to determine stone size, location, and anatomical clues, as well as for planning treatment. Computed tomography was used in patients suspected of having renal abnormalities, allergies to the contrast medium, and the presence of a retro-renal colon, and also in patients with a non-opaque stone. Patients with sterile urine underwent PCNL with antibiotic prophylaxis. Patients with urinary infections were operated on following treatment with an antibiotic prescribed after urine culture and sensitivity tests.

After the placement of a ureteral catheter via cystoscopy in the lithotomy position under

general anaesthesia, the patient was placed in a prone position. PCNL access was gained using an 18-G needle and a guide wire passed from inside, under biplanar fluoroscopic guidance. Using Amplatz dilators, the percutaneous tract was dilated up to 30 Fr for the 24 Fr nephroscope (Karl Storz, Germany) and up to 30 Fr for the 24 and 26 Fr adult-type nephroscopes (Karl Storz, Germany), according to the patient's age, caliceal dilatation, and the size of the stone(s). Following the breakage of the stones using a pneumatic lithotripter (Swiss LithoClast®), a 14-22 Fr Malecot or Foley catheter was placed into the renal tract. On the first postoperative day, plain abdominopelvic radiography and antegrade pyelography (if needed) were used to assess stone clearance and to detect any pathology of the pelvicalyceal system that occurred during surgery. Stone pieces that appeared smaller than 4 mm on plain X-ray were accepted as clinically insignificant residual fragments. Stone burden and location, number, size and location of the renal tract, types of instruments, complications, stone clearance, duration of nephrostomy, and hospitalisation time were recorded as pre and postoperative factors. Patients with missing data were excluded from the study.

RESULTS

Of the 3,003 cases, we achieved complete stone clearance in 2,699 (89.88%). When complications were evaluated: bleeding requiring transfusion occurred in 186 patients (6.19%), of which 14 cases (0.47%) required angioembolisation; a double-J stent was inserted in 158 patients (5.26%), and in 40 patients (1.33%) this was inserted because of

urinoma formation; pneumothorax occurred in 24 patients (0.80%); and in one patient (0.03%) colon perforation occurred. Horseshoe kidney abnormality was present in the patient with colonic perforation. In angiography, the bleeding site was not identified in one patient and open repair was performed. Mean duration of hospitalisation was 3.3 days and the nephrostomy tube was kept for a mean duration of 2.6 days as shown in [Table 1](#).

DISCUSSION

Currently, open surgery is rarely performed in the management of kidney stones, and PCNL has become a frequently applied minimally invasive surgery that leads to fewer complications, shorter durations of hospital stay, and reduced scar tissue formation.^{3,4} The success rate of PCNL procedures has been reported as 72-98% in a large series published in the literature.⁵⁻⁷ Segura et al.⁸ reported a 98% success rate in a total of 1,000 patients who underwent PCNL in 1985, which is one of the first larger published series. The success rate in our series was 89.88% in a total of 3,003 cases.

PCNL, as a minimally invasive surgical method for the treatment of renal stones, can lead to complications including bleeding requiring transfusion, lung injury, bowel injury, major vascular injury, and sepsis. In 2011, the Working Group of the CROES PCNL Global Study evaluated complications of PCNL and the overall complication rate was reported as 2.5%. Of those, 80% were minor and 20% were major complications. Fever and bleeding were the most frequently reported complications.^{9,10}

Table 1: Percutaneous nephrolithotomy (PCNL) in 3,003 cases: outcomes and complications.

Outcome/Complication (N=3,003)	Frequency, n (%)
Stone-free following PCNL	2,699 (89.88)
Bleeding requiring transfusion	186 (6.19)
Bleeding requiring angiography and embolisation	14 (0.47)
Insertion of double-J stent	158 (5.26)
Urinoma formation	40 (1.33)
Pneumothorax development	24 (0.80)
Colon perforation	1 (0.03)
Death	1 (0.03)

The overall complication rate in the present study was 12.3%, with haemorrhage being the most common complication. In our series, complex stones constituted a high percentage of cases, which might be a factor in the higher complication rate compared with the published literature.

During the PCNL procedure, one of the most important complications is the development of acute haemorrhage. The transfusion rate has been reported to be 0.5-4% and this can increase up to 20%.² Development of arteriovenous fistula or pseudoaneurysm can cause severe bleeding during PCNL, with a rate of 0.5%.⁵ Stone burden and prolonged percutaneous surgery operation time might be factors associated with bleeding.¹¹ In our series, the rate of bleeding requiring transfusion (6.19%) was in accordance with the published literature. Only 0.47% of cases required angioembolisation. Injuries to the neighbouring organs including liver, spleen, colon, and small intestine can also occur, with a reported rate of 0.2%.¹²

Supra and intercostal access might be related with occurrence of lung injury and pneumothorax. In the literature, the rates of hydrothorax and pneumothorax after PCNL were reported to be 6-12%.¹³ Palnizky et al.¹⁴ reported an 8% rate of

pulmonary complications in their experience. In our series, pulmonary complications occurred in 24 cases (0.80%) that were associated with intercostal and supracostal access. These complications were treated conservatively, such as by inserting a chest tube.

Lee et al.¹⁵ reported renal pelvis laceration (0.9%), ureteral avulsion (0.2%), and urinoma formation (0.3%) in their series. In our series, we observed urinoma formation and treated this with double-J stent insertion.

Extravasation from the collecting system following PCNL, which was reported as 26%, could be treated with double-J stent insertion. Mousavi-Bahar et al.¹⁶ reported collecting system injury in 5.2% of 671 patients. In our study, this was detected in 5.26% of cases and we applied a double-J stent. Mortality has been reported to be 0.05%-0.3% in the literature.^{15,17} In our series, this complication occurred in one patient (0.03%).

CONCLUSION

In our experience, PCNL is a generally safe and effective minimally invasive surgical modality with acceptable complications and short durations of hospital stay when used for treating kidney stones.

REFERENCES

1. Fernström I, Johansson B. Percutaneous pyelolithotomy. A new extraction technique. *Scand J Urol Nephrol.* 1976;10(3):257-9.
2. Woodside JR et al. Percutaneous stone removal in children. *J Urol.* 1985;134(6):1166-7.
3. Ötünçtemur A et al. [On Yıllık Perkütan Nefrolitotomi Deneyimlerimiz: Retrospektif Çalışma]. *Okmeydanı Tıp Dergisi.* 2013;29(3):147-53.
4. Antonelli JA, Pearle MS. Advances in percutaneous nephrolithotomy. *Urol Clin North Am.* 2013;40(1):99-113.
5. Hasun R et al. Percutaneous coagulum nephrolithotripsy: a new approach. *Br J Urol.* 1985;57(6):605-9.
6. Goldwasser B et al. Factors effecting the success rate of percutaneous nephrolithotripsy and the incidence of retained fragments. *J Urol.* 1986;136(2):358-60.
7. Michaels EK et al. Bacteriuria following extracorporeal shock wave lithotripsy of infection stones. *J Urol.* 1988;140(2):254-6.
8. Segura JW et al. Nephrolithiasis Clinical Guidelines Panel summary report on the management of staghorn calculi. The American Urological Association Nephrolithiasis Clinical Guidelines Panel. *J Urol.* 1994;151(6):1648-51.
9. Celik H et al. An overview of percutaneous nephrolithotomy. *EMJ Urol.* 2015;3(1):46-52.
10. Labate G et al. The percutaneous nephrolithotomy global study: classification of complications. *J Endourol.* 2011;25(8):1275-80.
11. Richstone L et al. First Prize (tie): Hemorrhage following percutaneous renal surgery: characterization of angiographic findings *J Endourol.* 2008;22(6):1129-35.
12. Yalçın V et al. [Böbrek taşlarının tedavisinde perkütan nefrolitotomi]. *Türk Üroloji Dergisi.* 2002;28:194-200.
13. Clayman RV et al, "Endourology of the upper urinary tract: percutaneous renal and ureteral procedures", Walsh PC et al (eds.), *Campbell's Urology 7th Edition* (1998), Philadelphia, PA: WB Saunders, pp.2789-874.
14. Palnizky G et al. Pulmonary complications following percutaneous nephrolithotomy: a prospective study. *Curr Urol.* 2013;7(3):113-6.
15. Lee WJ et al. Complications of percutaneous nephrolithotomy. *AJR Am J Roentgenol.* 1987;148(1):177-80.
16. Mousavi-Bahar SH et al. Percutaneous nephrolithotomy complications in 671 consecutive patients a single-center experience. *Urol J.* 2011;8(4):271-6.
17. Lang EK. Percutaneous nephrostolithotomy and lithotripsy: a multi-institutional survey of complications. *Radiology.* 1987;162(1 PT 1):25-30.