PERCUTANEOUS NEPHROLITHOTOMY: OUR INITIAL EXPERIENCE WITH 125 CASES

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ABSTRACT

Background

Percutaneous nephrolithotomy (PCNL) is generally accepted to be a minimal invasive technique with low complication rates. In the current study we reviewed our initial experience with percutaneous nephrolithotomy.

Patients and Methods

A prospective study of 125 patients with mean age of (34.65) years, underwent PCNL in our center from April 2009 to November 2010. PCNL done in prone position by a single experienced faculty urologists under general or spinal anesthesia under fluoroscopic guidance. The kidney was punctured via a lower pole calyx whenever possible. The demographic data, stone parameters, PCNL complications and stone-free rate were evaluated.

Results

One hundred twenty five patients, underwent percutaneous nephrolithotomy , 85 male and 40 female, with a mean (range) age of 34.65 (3-83) years, and a mean (range) stone size of 39,6 mm (10-80) mm. Stone-free rate after PCNL monotherapy was 81.6%, which increased to 88% with clinically insignificant small residual fragments ≤4 mm.Overall complication rate was observed in twenty six patients (20.8%). Majority were minor complications, with the most common observations of transient fever (11.2%), need for blood transfusion (5.6%), pelvic and calyceal perforations were 4%, and all managed conservatively. No death, urosepsis, nor injuries to adjacent organs were recorded.

Conclusion

Our data demonstrate that PCNL is a safe and effective technique. Most of the intraoperative incidents or complications are minor and easy to solve. However, an adequate training is imperative in order to reduce the associated morbidity.

Keywords: *Percutaneous nephrolithotomy, renal calculi, comlication*

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INTRODUCTION

The formation of stones in the urinary tract is an ancient disease known to mankind for ages. Surgical management of urinary calculus disease has evolved considerably over the past two decades [1]. Specifically, the introduction and refinement of percutaneous and ureteroscopic access to the upper tracts, along with the nearly simultaneous development of both extracorporeal and intracorporeal lithotripsy, have relegated the role of open surgery to less than 1% of patients undergoing intervention for their stone disease [2].

Current indications for PCNL are large stone burdens, lower pole calculi, cystine stone disease, abnormal renal anatomy and stones not amenable to ureteroscopy or shock wave lithotripsy(SWL) [3] .

The advantages of the percutaneous method include lower morbidity and mortality faster convalescence, greater ease of repeat procedures, greater cost effectiveness, small incision, and minimum operative and postoperative complications [4-6]. PCNL remains an effective treatment with a very low major complication rate and a high success rate [7].

Although percutaneous renal surgery is less invasive than an open procedure, complications may occur. There are some complications that may be predictable or unpredictable, such as hemorrhage, collecting system injuries, contiguous organ injuries, intra-operative technical complications, hypothermia, fluid overload, sepsis, stricture formation, nephrocutaneous fistula, renal loss, and death [8,9]. Renal hemorrhage is one of the most common and worrisome complications of percutaneous renal surgery. Yet blood loss is considered as a complication only when blood transfusion is required. A transfusion rate of 1% to 23% has been reported. [7,10-15] Although most of the bleeding that is associated with PCNL can be managed conservatively, approximately <1% of patients require angioembolization to control intractable bleeding [10]. Mild to moderate elevation in body temperature in the immediate postoperative period are common and often attributed to the release of inflammatory mediators and rarely requires intervention, sepsis has been reported in 0.25% to 1.5% of patients undergoing percutaneous stone removal [10].

PATIENTS AND METHODS

This is a prospective study of 125 patients. They underwent PCNL from April 2009 to November 2010 in Urology Department of Sulaymania teaching hospital.

Patients became candidate for PCNL if their stone size was greater than 20 mm or had history of failed SWL with smaller stone size. Preoperative evaluation included history, examination, ultrasonography, plain X-ray, excretory urography, urine analysis, urine culture, blood counts, renal function tests , coagulation profile and CT were performed only when indicated.

Stone burden was calculated by multiplying the two largest dimensions, measured on preoperative radiography.

Experienced faculty urologist under general or spinal anesthesia, using antibiotic prophylaxis, performed all the procedures. After retrograde catheterization with a 5F/7F ureteric catheter in the lithotomy position, patients were turned to prone and percutaneous access was established under fluoroscopic guidance. After tract dilatation using coaxial serial Teflon coated dilators, a 24–30F Amplatz sheath was placed and adult rigid nephroscope 17 Fr (Karl Storz) was used for the procedure. Pneumatic lithotripsy was used for stone fragmentation. Intraoperative percutaneous calyceal irrigation was used to remove small fragments avoiding additional punctures. Additional punctures were placed when required. Stone clearance was confirmed by fluoroscopy before termination of the procedure. A DJS was placed at the end of procedure, except for patients having a simple uncomplicated procedure where a ureteric catheter was left in situ. An 18-20 F nephrostomy tube was put at the end of procedure.

Postoperative evaluation included a haemogram, renal variables and a plain kidney, ureter and bladder X-ray (on the second postoperative day) to confirm stone clearance. Urethral catheters were removed the next morning in uneventful cases. Antegrade pyelography was done on the second postoperative day accordingly if there was distally patent ureter with no extravasation, nephrostomy tube was removed and the patient was discharged on the same day or the day after.

The operative and postoperative factors recorded include primary calyceal access, accessory tracts, tract number, stone-free status, intraoperative and postoperative complications, hospitalization time, and rate of ancillary procedures.

The PCNL procedure was considered successful if the patient was either free of stones or had any clinically insignificant residual fragments (CIRFs), defined as ≤4 mm, nonobstructive, noninfectious, and asymptomatic residual fragments. Patients were followed at 2-week intervals, when ultrasonography, plain-X-ray KUB were performed, DJ stent were removed when auxiliary treatment is not need it.

RESULTS

The mean age of the patient's population was 34.65 (range: 3-83 years). Among the 125 total patients, 85(68%) were male and 40 (32%) were female. Sixty-three patients (50.4%) had right sided stones and 62 (49.6%) had left sided stones. Out of the 125 patients, 38 patients (30.4%) had a history of stone intervention.

The most common site of stone was pelvic and caliceal which was found in 79 patients (63.2%) while the most uncommon was in the upper ureter found in 3 patients (2.4%). A single stone was seen in 36 patients (28.8%) and multiple stones (>1stone) were seen in 89 patients. The mean stone size was 39.06mm (range: 10-80mm), as shown in (Table-1).

Table 1. Charecterestic of patients.

No. of patients	125
Mean age year, (range)	34.65 (3-83)
Gender, No,(%)	Male 85 (68%) Female 40 (32%)
Side, No, (%)	Right 63 (50.4%) Left 62 (49.6%)
Size of stone, mean	39.06 mm, (10-80) mm
Site of the stone, No, (%)	Pelvic 17 (13.6%) Caliceal 16 (12.8%) Pelvic and calyceal 79 (63.2%) Upper ureteric 3 (2.4%) Upper ureteric and calyc 10 (8%)
Previous stone related surgery, No, (%)	Yes 38(30.4%) No 87(69.6%)

Access rate was 100% ,the numbers and percentage of tract were one tract in 110 patients (88%), two tract in 11 patients (8.8%), three tracts in 4 patients (3.2%), and the mean operation time was 95.14± 26.57 minutes (range: 10-120min). Stone free rate post-surgery was 81.6% (102 patients), those with clinically insignificant fragments ≤ 4 mm were 6.4% (8 patients), while 15 patients (12%) had residual stone fragments >4 mm. Auxiliary treatment (ESWL) were needed in 4 patients (3.2%), and the mean (range) hospital stays was 2.99 days (2-5). (Table-2).

Complications were observed in 26 patients (20.8%), Including pelvic and caliceal perforations in five patients (4%) and all were treated conservatively, seven patients (5.6%) required blood transfusion due to hemorrhage and fourteen patients (11.2%) developed post-operative fever. While Extravasation at time of surgery and postoperatively after nephrostomy tube removal, injury to near organs, hyponatremia, pleural injury and mortality were not seen (Table-2).

Table 2. Percutaneous nephrolithotomy results.

No. of patient	125
Access tract	125 (100%)
No. of tract	One tract, 110 (88%) Two tract, 11 (8.8%) Three tract, 4 (3.2%)
Mean operation time (minutes)	95.14 ± 26.57
Complications No, (%)	26 (20.8%)
Blood transfusion, No, (%)	7(5.6%)
Fever, No, (%)	14 (11.2%)
Pelvic and calyceal perforation No, (%)	5(4%)
Pneumothorax and hydrothorax No, (%)	0(0%)
Adjacent organ injury No, (%)	0(0%)
Extravasation No, (%)	0(0%)
Hyponatremia No, (%)	0(0%)
Mortality No, (%)	0(0%)
Stone free rate, No, (%)	Stone free, 102 (81.6%) Fragments≤ 4 mm, 8 (6.4%) Fragments >4mm, 15 (12%)
Hospital stay ,day, mean (range)	2.99 (2-5)
Auxiliary treatment, No, (%)	4 (3.2%) ESWL 4(3.2%) URS, 0 (0%) PCNL, 0 (0%)

DISCUSSION

Surgical management of renal tract stone disease has been revolutionized during the last two decades after the introduction of minimal invasive techniques, like ESWL and PCNL [(1)]. Percutaneous nephrolithotomy is currently the procedure 0f choice for removing large and complex renal calculi [(16-18)].

Percutaneous nephrolithotomy is safe and effective [(1)]. In a community setting, approximately 90% of targeted stones can be removed successfully, and at experienced subspecialty care centers, this rate can approach 100 %[(2)]. Improvements in the technique of percutaneous renal surgery have decreased the morbidity associated with these procedures [(19)].

We defined stone free rate as complete clearance and stone fragments<4mm. In the present study, stone free rate was 88%. These results were similar to different studies conducted by Deane and Clayman [(20)], Rana et al [(21)], Liatsikos et al [(22)], Falahatkar et al[(18)] and Turna et al [(8)] . Their results of successful stone free rate varied from 80 to 87%.

While in other studies like Payne et al [(23)], steele and marshall [(24)], Guido et al [(25)], Knoll et al [(26)], zimmermanns et al [(12)] successful removal of stones was reported in 91-94% of cases.

A PCNL puncture and stone removal may reactivate infection . In the current study fever was developed in 14 cases (11.2%), which were treated conservatively with parenteral antibiotics. In our study neither septicemia nor mortality secondary to infection were reported. These results were in agreement with other studies such as

Sarhad Khan et al [(1)] in which febrile UTIs were observed in 8 patients (4%). Li MK and Lames S (27,28) reported symptomatic urinary tract infection in 5.5-9.2% and Zimmermanns V et al [(12)] report febrile pyelonephritis in 6.5% .While in other studies fever was observed in 21-39% of patients who underwent PCNL [(7, 12, 16)].

The most often organs injured during PCNL and stone removal are the lungs and the pleura, with possible pneumothorax or hydrothorax [(29,30)]. Neither complications were seen in our study because of the subcostal approach that we used for renal access in most of the cases.

Blood loss is a common occurrence during PCNL. Excessive bleeding can occur during needle passage, tract dilation, or nephrostomy [(5, 17, 31)]. It can present intraoperatively or postoperatively and can be severe enough to necessitate blood transfusion. The incidence of blood transfusion after percutaneous procedures has been 2% to 45% among different series [(6, 11, 12, 31-34)].

In this study, most of the bleedings were mild. Blood transfusion was needed in 5.6% of the cases. Fortunately no patient required selective embolization or nephrectomy.

Overall morbidity of PCNL ranges from 7.5% to 49% depending on the sample size and the presence of complicated renal stone [11, 12, 35-38] while in our study 26 patients (20.8%) develop complications although majority of them were minor complications.

Overall mortality of PCNL ranges from 0.5% to 1.1% and is generally attributed to severe hemorrhage, urosepsis or pulmonary embolism [27, 35, 39].

No mortality was recorded in the present study, thus highlighting the fact that PCNL is a safe and effective treatment modality in experienced hands.

Generally, in our study incidence of complications such as injury to near organs, hypothermia, hyponatremia, colon injury and pleura injury were not seen. While intraoperative and early postoperative complications were similar to other studies.

in conclusion, our data demonstrate that PCNL is a safe and effective technique. Most of the intraoperative incidents or complications are minor and easy to solve. However, an adequate training is imperative in order to reduce the associated morbidity.

REFERENCES

1. Khan S, Toori LA, Anwer K. The efficacy of percutaneous nephrolithotomy in renal and upper ureteric calculi. Pakistan Journal of Medical Sciences. (2005); 44(2):89-91.

2. Rassweller JJ, Renner C, Eisenberger F. The management of complex renal stones. British Journal of Urology. (2000); 86(8):919-928.

3. Thüroff JW, Gillitzer R. Percutaneous Endourology & Ureterorenoscopy : Smith's General Urology. 7th ed. New York: Mcgraw hill; 2008. P. 114-132.

4. Dimopoulous C, Gialias A, Likourinas M, Androutsos A, Kostakopoulos A. Hippo crates: founder and pioneer of urology. British Journal of Urology .1980; 52(2): 73-4.

5. Lee WJ, Smith AD, Cubelli V, Badlani GH, Lewin B, Vernace F, et al. Complications of percutaneous nephrolithotomy. AJR American journal of roentgenology. 1987; 148(1):177-80.

6. Jones DJ, Russell GL, Kellett MJ, Wickham JE. The changing practice of percutaneous stone surgery. Review of 1000 cases 1981-1988. British journal of urology. 1990; 66(1):1-5.

7. de la Rosette J, Assimos D, Desai M, Gutierrez J, Lingeman J, Scarpa R, et al. The Clinical Research Office of the Endourological Society Percutaneous Nephrolithotomy Global Study: indications, complications, and outcomes in 5803 patients. Journal of endourology / Endourological Society. 2011; 25(1):11-7.

8. Turna B, Nazli O, Demiryoguran S, Mammadov R, Cal C. Percutaneous nephrolithotomy: variables that influence hemorrhage. Urology. (2007); 69(4): 603-7.

9. Assimos DG Marshall L, Stoller MD, Smith AD. Complications of Stone Removal. Smith's Textbook of Endourology. First edition. St. Louis, Missouri, USA: Quality Medical Publishing; (1996):298-308.

10.Mantu Gupta, Michael C. Ost, Jay B. Shah, Elspeth M. McDougall, and Arthur D. Smith .Percutaneous management of the upper urinary tract. Campbell-Walsh urology. 9th ed. Philadelphia: Saunders; 2008.

11. Tefekli A , Ali Karadag M, Tepeler K, Sari H , Berberoglu Y, Baykal M, et al. Classification of Percutaneous Nephrolithotomy Complications Using the Modified Clavien Grading System: Looking for a Standard . European urology. 2008; 53(1): 184–190.

12. Zimmermanns V, Liske P, Lahme S. Minimal invasive PCNL in the treatment of nephrolithiasis –analysis of efficiency and complications after 335 consecutive patients. European Urology Supplements. 2009; 8(4): 326.

13. Ko R, Soucy F, Denstedt JD, Razvi H. Percutaneous nephrolithotomy made easier: A practical guide, tips and tricks. BJU international. 2008; 101(5): 539-9.

14. Chew BH, Chiu RY, Hamidizadeh R, Wright I, Chan SH, Rowley VA, et al. Success and complication rates in 729 percutaneous nephrolithotomy at a single center. The journal of urology. 2009; 181(4).

15. El-Nahas AR, Shokeir AA, El-Assmy AM, Mohsen T, Shoma AM, Eraky I, et al. Post-percutaneous nephrolithotomy extensive hemorrhage: a study of risk factors. The Journal of urology. 2007; 177(2):576-9.

16. Shah HN, Kausik VB, Hegde SS, Shah JN, Bansal MB. Tubeless percutaneous nephrolithotomy: a prospective feasibility study and review of previous reports. British journal of urology International. 2005; 96(6):879-83.

17. Roth RA, Beckmann CF. Complications of extracorporeal shock wave lithotripsy and percutaneous nephrolithotomy. Urologic Clinics of North America. 1988; 15(2):155-166.

18. Falahatkar S, Khosropanah I, Roshani A, Neiroomand H, Nikpour S, Nadjafi-Semnani M, et al. Tubeless percutaneous nephrolithotomy for staghorn stones. Journal of endourology / Endourological Society. 2008; 22(7):1447-51.

19. Davidoff R, Bellman GC. Influence of technique of percutaneous tract creation on incidence of renal hemorrhage. The Journal of urology. 1997;157(4):1229-31.

20. Deane LA, Clayman RV. Advances in percutaneous nephrostolithotomy. The Urologic clinics of North America. 2007; 34(3):383-95.

21. Rana AM, Mithani S. Tubeless percutaneous nephrolithotomy: call of the day. Journal of endourology / Endourological Society. 2007; 21(2):169-72.

22. Liatsikos EN, Kapoor R, Lee B, Jabbour M, Barbalias G, Smith AD. "Angular Percutaneous Renal Access". Multiple Tracts Through A Single Incision for Staghorn Calculous Treatment in a Single Session. European Urology. 2005; 48: 832–837.

23. Payne SR, Ford TF, Wickham JE. Endoscopic management of upper urinary tract stones. The British journal of surgery. 1985; 72(10):822-4.

24. Steele D, Marshall V. Percutaneous nephrolithotomy in the supine position: a neglected approach? Journal of endourology / Endourological Society. 2007; 21(12):1433-7.

25. Giusti G, Piccinelli A, Taverna G, Benetti A, Pasini L, Corinti M, et al. Miniperc? No, thank you! European urology. 2007; 51(3):810-4.

26. Knoll T, Heger K, Haecker A, Osman M, Michel MS, Kohrmann KU, et al. Percutaneous nephrolithotomy Experience with 348 cases. European Urology Supplements. 2004; 3(2): 13.

27. Li MK, Wong MY, Toh KL, Ho GH, Foo KT. Percutaneous nephrolithotomy--results and clinical experience. Annals of the Academy of Medicine, Singapore. 1996; 25(5):683-6.

28. Lahme S, Bichler KH, Strohmaier WL, Gotz T. Minimally invasive PCNL in patients with renal pelvic and calyceal stones. European urology. 2001; 40(6):619-24.

29. Reddy PK, Hulbert JC, Lange PH, Clayman RV, Marcuzzi A, Lapointe S, et al. Percutaneous removal of renal and ureteral calculi: experience with 400 cases. The Journal of urology. 1985; 134(4):662-5.

30. Young AT, Hunter DW, Castaneda-Zuniga WR, Hulbert JC, Lange P, Reddy P, et al. Percutaneous extraction of urinary calculi: Use of the intercostal approach. Radiology. 1985; 154(3):633-8.

31. Patterson DE, Segura JW, LeRoy AJ, Benson RC, Jr., May G. The etiology and treatment of delayed bleeding following percutaneous lithotripsy. The Journal of urology. 1985; 133(3):447-51.

32. Stoller ML, Wolf JS, Jr., St Lezin MA. Estimated blood loss and transfusion rates associated with percutaneous nephrolithotomy. The Journal of urology. 1994; 152(6 Pt 1):1977-81.

33.Walsh PC, Retnik AB, Vaughan E. Campbell's Urology. 8th ed. Philadelphia: WB Saunders; 2002. P. 3320–3360.

34. Segura JW, Patterson DE, LeRoy AJ, Williams HJ, Jr., Barrett DM, Benson RC, Jr., et al. Percutaneous removal of kidney stones: review of 1,000 cases. The Journal of urology. 1985; 134(6):1077-81.

35. Jemni M, Bacha K, Ben Hassine L, Karray MS, Ayed M. [Results of the treatment of renal lithiasis by percutaneous nephrolithotomy: apropos of 115 cases]. Progres en urologie : journal de l'Association francaise d'urologie et de la Societe francaise d'urologie. 1999; 9(1):52-60.

36. Sahin A, Atsu N, Erdem E, Oner S, Bilen C, Bakkaloglu M, et al. Percutaneous nephrolithotomy in patients aged 60 years or older. Journal of endourology / Endourological Society. 2001; 15(5):489-91.

37. Hossain M, Ullah AT, Regmi S, Rahman H, Kibria SA. Safety and efficacy of the supracostal access for percutaneous nephrolithotomy: Our initial experience. Bangladesh Medical Research Council Bulletin. 2011; 37(1): 34-38.

38. Mousavi-Bahar SH, Mehrabi S, Moslemi MK. Percutaneous nephrolithotomy complications in 671 consecutive patients: a single-center experience. Urology journal. 2011; 8(4):271-6.

39. Corbel L, Guille F, Cipolla B, Staerman F, Leveque JM, Lobel B. [Percutaneous surgery for lithiasis: results and perspectives. Apropos of 390 operations]. Progres en urologie : journal de l'Association francaise d'urologie et de la Societe francaise d'urologie. 1993; 3(4):658-65.