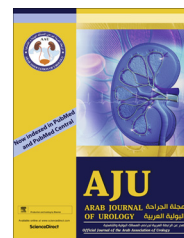




Arab Journal of Urology
(Official Journal of the Arab Association of Urology)

www.sciencedirect.com



STONES/ENDOUROLOGY
ORIGINAL ARTICLE

Can percutaneous nephrolithotomy be performed as an outpatient procedure?



Ahmed Fahmy^{*}, Hazem Rhashad, Omer Algebaly, Wael Sameh

Department of Urology, Alexandria University, Alexandria, Egypt

Received 24 October 2016, Received in revised form 21 November 2016, Accepted 27 November 2016
Available online 20 January 2017

KEYWORDS

Percutaneous nephrolithotomy;
Outpatient procedure;
Standard of care

ABBREVIATIONS

ER, emergency room;
PCNL, percutaneous nephrolithotomy;
SFR, stone-free rate

Abstract Objectives: To examine the safety and effectiveness of percutaneous nephrolithotomy (PCNL) as an outpatient procedure, as in most centres PCNL is performed as an inpatient procedure that necessitates postoperative hospital admission.

Patients and methods: Our study included 186 patients undergoing PCNL for renal calculi. Only those who met strict inclusion criteria were discharged home on the same day. Preoperative eligibility criteria for outpatient management included no complex medical problem, normal renal function, and easy access to an emergency room. Patients were divided into two groups. The outpatient group (Group 1) included those patients discharged on the same day as the PCNL and the hospitalised group (Group 2) included those who were considered appropriate for outpatient management but needed to be hospitalised.

Results: In all, 162 patients (87%) fulfilled the inclusion criteria for outpatient management and 146 of these patients (90.1%) planned for outpatient management were discharged on the same operative day (Group 1). The mean time to discharge home was 8.97 h. In all, 16 patients who opted for the outpatient approach subsequently required hospitalisation (Group 2). In the hospitalised group the mean operative time was longer, which was probably related to its higher stone burden.

Conclusion: PCNL can be safely performed with excellent outcomes as an outpatient procedure. Outpatient PCNL offers several advantages including a

^{*} Corresponding author at: Alexandria University, 41 St Abdelmoneam Sanad, Alexandria 321321, Egypt.
E-mail address: Drahmedfahmy@yahoo.com (A. Fahmy).

Peer review under responsibility of Arab Association of Urology.



Production and hosting by Elsevier

more rapid patient convalescence, reduced healthcare expenditure, decreased postoperative nosocomial infections with no additional morbidity for the patient, and with no compromising of the stone-free rate.

© 2017 Arab Association of Urology. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Percutaneous nephrolithotomy (PCNL) has stood the test of time as the procedure of choice for large renal stones [1]. In most centres, PCNL is performed as an inpatient procedure that necessitates postoperative hospital admission. Whether postoperative hospitalisation improves outcome or is necessary after PCNL has recently been challenged [1,2].

Due to large case volume of urolithiasis associated with refinement in PCNL technique and expertise, there is an ongoing shift towards decreasing the length of hospital stay and performing PCNL as an outpatient procedure whenever possible [3]. In addition, eliminating costs associated with a hospital admission represents an intriguing potential target in healthcare systems with limited resources and funds. In the present study, we examined the safety and effectiveness of PCNL as an outpatient procedure (see Fig. 1).

Patients and methods

This retrospective hospital record-based study was conducted on 186 patients undergoing PCNL for renal calculi. All patients were considered for an outpatient PCNL procedure, but only those who met strict inclusion criteria were discharged home on the same day. The inclusion criteria were:

- No complex medical problem, i.e., American Society of Anesthesiologists (ASA) class 1 or 2.
- Normal renal function, i.e., serum creatinine of < 1.2 mg/dL.

- Social support at home and easy access to an emergency room (ER).

All patients deemed unsuitable for the outpatient approach were excluded from the study. Exclusion criteria included: cases considered medically inappropriate for outpatient management and those living in remote areas distant from a hospital or in absence of social support at home. The stone burden or the presence of stag-horn stones were not exclusion criteria for out-patient management.

Patients were divided into two groups. The outpatient group (Group 1) included those patients discharged on the same day of surgery. The hospitalised group (Group 2) included those who were considered appropriate for outpatient management but needed to be hospitalised (physician preference). The study was approved by the Institutional Review Board at the Faculty of Medicine, Alexandria University, Egypt.

Preoperative laboratory evaluations included serum creatinine, urine culture and complete blood count. A UTI was present in 18% of the patients and was preoperatively treated with pathogen-specific antibiotics. Noncontrast CT was the primary radiological evaluation for most patients, except those who had undergone excretory urography elsewhere.

Preoperative, intraoperative, and postoperative data were prospectively collected from March 2011 to July 2014 and analysed, with attention on the need for re-hospitalisation, ER visit, perioperative complications, and stone-free rates (SFRs). Follow-up by telephone call was done on the second postoperative day, and at 1 and

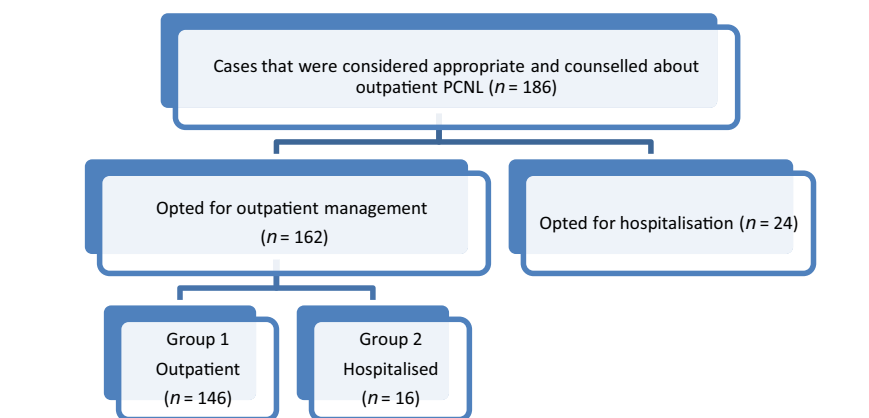


Figure 1 Study cases.

4 weeks postoperatively for any deviation in postoperative course.

Technique

After we received informed consent from our patients and administered prophylactic i.v. antibiotic, we induced general anaesthesia and each patient was placed in the prone position. The skin was punctured at the posterior axillary line under multidirectional C-arm fluoroscopic guidance through the posterolateral plane of the kidney after fixation of a ureteric catheter.

Only one percutaneous access was created in 148 procedures, whilst two tracts were needed in 14 (8.6%). Dilatation of the tract was performed using coaxial telescopic dilators. A 30-F Amplatz sheath and a 27-F nephroscope were used for all procedures. Pneumatic lithotripsy was used for stone fragmentation in 116 procedures, whilst in 46 patients stones were removed intact without the need for fragmentation. At the conclusion of the procedure, antegrade or retrograde insertion of a ureteric stent was performed in all cases. A nephrostomy tube (22 F) was placed in 128 patients and in 34 patients 'tubeless' PCNL was performed according to the surgeon's preference. Stone-free status was evaluated intraoperatively endoscopically and fluoroscopically.

Postoperatively, patients were transferred to the recovery room for observation. Patients were routinely monitored in the postoperative recovery unit, with analgesics used as indicated. After 0.5–1 h, patients were transferred to the day surgery unit. In patients left with an indwelling nephrostomy tube, the nephrostomy tube was removed at 4–6 h postoperatively. Patients were encouraged to ambulate with help when able to do so (typically within 2–3 h) and a regular diet was given once nausea resolved. The Foley catheter was removed just before discharge.

Discharge criteria included: fully conscious patient who is ambulating and tolerating oral feeding, with

stable postoperative vital signs and insignificant or no pain and haematuria. Patients were discharged as soon as the discharge criteria were met, usually after 6–10 h of observation and after evaluation by the lead surgeon. Follow-up in clinic was scheduled at 1 and 4 weeks after PCNL. Postoperative analgesics were prescribed and warning signs were reviewed. Each patient was given verbal and written instructions about indications for returning to the ER and two telephone numbers (one primary and another alternative) were provided for contact with the surgeon if needed.

Statistical analysis

Descriptive statistics were calculated and means (SDs) were examined. The Student's *t*-test was used for continuous variables to compare the means of both groups. The chi-squared test was used for nominal variables comparisons. Differences were considered statistically significant for $P < 0.05$. Data were analysed using Sigma Plot software (Systat Software Inc., San Jose, CA, USA), v. 12.3.

Results

In all, 162 patients (87%) were identified that fulfilled the inclusion criteria for outpatient management. Of these, 146 (90.1%) patients were discharged on the same operative day (Group 1). The mean time to discharge home after discharge from the recovery room was 8.97 h. The remaining 16 patients who opted for the outpatient approach subsequently required hospitalisation (Group 2, nine for observation for significant blood loss, six for infective complications, and one for hydrothorax and chest tube insertion).

The patients' demographics and perioperative characteristics are summarised in [Table 1](#). The mean (range) patients age was 42 (16–68) years. The mean maximum

Table 1 The patients' demographic and perioperative characteristics.

Characteristics	Outpatient Group 1	Hospitalised Group 2	<i>p</i>
Number of patients	146	16	
Age, years, mean	43	46	0.84
Sex, male/female, <i>n</i>	92/54	11/5	0.64
Body mass index, kg/m ² , mean	31	31	0.80
Stone burden, mm ² , mean (SD)	504.5 (381)	562.2 (235)	0.58
Preoperative creatinine, mg/dL, mean	1.1	0.9	0.28
Preoperative haemoglobin, g/L, mean	12.6	13.2	0.67
Percutaneous access, <i>n</i>			
One puncture	135	13	0.52
Two punctures	11	3	
Nephrostomy, tube/tubeless, <i>n</i>	116/30	12/4	0.12
Operative time, min, mean	84	112	0.002
Duration of postoperative stay, h	9	28	0.001
SFR, %	88.9	92.4	0.609
Blood transfusion, <i>n</i>	0	4	< 0.001

stone diameter was 524 mm². The mean operative time was 94 min.

Group 2 had an average length of stay of 28.5 h. The mean stone burden was higher in the hospitalised group, although the difference was not significant ($P = 0.581$). We had 17 cases of complete staghorn stone (15 pts in Group 1 and two in Group 2). The presence of staghorn stone did not affect length of hospital stay. Operative time was longer in the Group 2 ($P = 0.002$). There were no major intraoperative complications except in one patient in which hydrothorax developed (Grade IIIa complication according to the modified Clavien–Dindo classification system [4]) and chest tube insertion was needed. There was no need for second-look nephroscopy or any other ancillary procedure in any patient. The SFR was 88.9% vs 92.4% in Group 1 and Group 2, respectively ($P = 0.609$). A blood transfusion was needed in four patients in Group 2 (2.4%).

Postoperatively, two patients were re-admitted in the Group 1 (1.3%). The first presented to the ER on postoperative day 5 with gross haematuria with blood clots, and imaging studies showed the presence of an arterial pseudoaneurysm and thus underwent superselective embolisation. The other patient presented with high-grade fever, lion pain with leucocytosis consistent with acute pyelonephritis, the patient was hospitalised and received i.v. fluid and parenteral antibiotics for 5 days (Table 2).

There were no ER visits or re-evaluations within the first 48 h after discharge in Group 1 except for three patients who needed postoperative assessment in the ER for haematuria, which was confirmed not to be significant and was managed conservatively. In all, 12 patients in Group 1 had low-grade fever and postoperative flank pain/stent colic that were managed conservatively upon follow-up telephone call vs three patients in Group 2.

In Group 2, no patient needed re-evaluation in the ER or readmission except for two patients, one presented on 5 days after discharge to ER with moderate haematuria and was managed conservatively, the other complained of persistent urine leakage after removal

of the nephrostomy tube that resolved spontaneously after 1 week (Table 2).

Discussion

For decades it has been the accepted norm that PCNL is an operation that necessitates postoperative admission to hospital. There are several reasons supporting this practice: observation for haematuria; indwelling nephrostomy tube for tamponade of tract bleeding and to ensure haemostasis and adequate drainage of the kidney thus avoiding urinary stasis and leakage; parenteral antibiotics to prevent infective complications; serial laboratory tests to assess for haemorrhage, infection and renal function; imaging to assess SFR and to exclude any residual stones; and observation for the development of postoperative medical or surgical complications [1].

A large proportion of diagnostic and some therapeutic urological procedures are now performed on an outpatient basis [5,6]. To improve the safety of PCNL, there has been a trend towards using progressively smaller nephrostomy tracts. The modified techniques of PCNL, such as miniperc, microperc and ultraminiperc, have been introduced for clinical use with the aim to reduce the likelihood of major complications, such as bleeding and renal injury that could enable accomplishing these procedures in an outpatient setting [7,8].

PCNL as an outpatient procedure was first reported more than two decades ago by Preminger et al. [9] with the aim to streamline PCNL and reduce costs. In their study, nephrostomy tubes were placed to provide adequate drainage of the kidney, tamponade of bleeding tract and to minimise or prevent urinary extravasation. Despite this initial report of outpatient PCNL in five patients, very few, if any, endourologists were enthusiastic about adopting the same approach.

With the advent of tubeless PCNL, the need for postoperative hospitalisation is no longer thought to be necessary in all cases [10]. Tubeless PCNL relies on ureteric stents to provide adequate drainage and reportedly causes less postoperative pain than traditional PCNL [10,11].

There is an increasing trend towards outpatient PCNL, which represents a safe and feasible surgical option for carefully selected patients. Our present results are comparable to the growing body of evidence suggesting that the outpatient PCNL procedure can be safely done with excellent outcomes, and could potentially become the standard of care for many patients [9–11].

Two case series published in 2010, described good outcomes with outpatient PCNL in carefully selected patients [12,13]. Since then, outpatient management has been performed in more complex patients, including

Table 2 Postoperative complications.

Complications, <i>n</i>	Outpatient Group 1 (<i>n</i> = 146)	Hospitalised Group 2 (<i>n</i> = 16)
ER visit with readmission	2	0
Fever	2	0
Haematuria		
Mild-moderate	3	1
Severe	1	0
Flank pain/stent colic	12	3
Persistent urinary leakage	0	1

a case report on tubeless PCNL for bilateral staghorn stones [14].

In the present study, three patients in Group 1 were re-evaluated within 48 h of the procedure for mild haematuria, which was managed conservatively. There were two cases of readmission in Group 1 (1.3%): the first patient presented with an arterial pseudoaneurysm on postoperative day 5 and the other needed readmission for treatment of acute pyelonephritis. As such, admitting these patients for 1–2 days postoperatively would not have changed their course. In fact, hospitalisation, at least in theory, can increase the risk of certain complications, such as hospital-acquired infection. Therefore, it seems that routine hospitalisation after PCNL is an inherited practice that needs careful re-assessment.

In the present study, the absence of significant blood loss and a shorter operative time favoured performing PCNL as an outpatient procedure. The hospitalised group in the present study was associated with a longer mean operation time ($P = 0.002$), possibly related to its higher stone burden. This higher stone burden might have contributed in part to the need for hospitalisation; however, it was not statistically significant ($P = 0.58$). The use of more than one puncture did not affect the need for overnight hospitalisation ($P = 0.52$).

Considering the impact of an indwelling nephrostomy tube on performing an outpatient procedure, several groups have shown that tubeless PCNL can be safely performed with the advantages of less postoperative discomfort, lower analgesia requirement, and shorter hospital stay than those who receive nephrostomy tubes. Outpatient tubeless percutaneous nephrolithotomy has been reported to be safe and effective in an appropriately selected population [15–17].

Contrary to previous studies, no advantage was noticed in the present study for those who received a tubeless PCNL over those who needed a nephrostomy tube as regards hospital stay. However, one should consider that a ureteric stent was inserted at the end of the procedure in all our patients making it not totally tubeless. We think that adequate drainage of the kidney by a ureteric stent, together with insertion of a percutaneous tube for a few hours after PCNL for tamponading the tract can ameliorate any potential postoperative bleeding and accelerate postoperative discharge. However, larger-scale studies are needed to evaluate any possible associations.

The idea of performing PCNL as an outpatient procedure is highly attractive due to the decreased length of hospital stay with the attendant healthcare cost saving and associated minimising of potential postoperative nosocomial infections. However, in the present study a true cost benefit of outpatient PCNL vs inpatient PCNL was not analysed, but it is obvious that, in general, outpatient procedures have potential cost savings over the

equivalent inpatient procedure provided patients do not require postoperative readmission. It is conceivable that cost-cutting will allow more institutions to provide rapid turnover in a safe and efficient way.

Our experience with outpatient PCNL has been very satisfactory. We have shown that outpatient PCNL can be feasibly and effectively applied for urolithiasis surgery. Only two patients in Group 1 needed readmission, one for control of severe haematuria by superselective embolisation for arterial pseudoaneurysm and the other for i.v. fluids and parenteral antibiotic for acute pyelonephritis. Admitting the patients for 1 or 2 days would not have changed the course of these postoperative adverse events at least for the patient with pseudoaneurysm. In fact, hospitalisation, at least in theory, could increase the risk of certain complications, such as hospital-acquired infections.

Appropriate and careful patient selection was a crucial aspect for attaining this favourable outcome and ensuring procedural safety. Patients had to be in close proximity to a hospital and with the availability of transportation for quick access to the ER lest postoperative complications arose and medical care and/or surgical intervention were needed. Patient reliability and compliance with postoperative instructions were facets of the inclusion criteria for eligibility for same day discharge.

Paying attention to technical details during PCNL, adhering to meticulous technique, avoiding intraoperative complications, such as injury or perforation of the collecting system or excessive bleeding, and evaluation of the patients before discharge by the lead surgeon should receive considerable critical attention.

Consulting by telephone is now common practice in contemporary patient care and has evolved to adapt to increasing patients' demands, especially for out-of-hours healthcare providers. However, it is absolutely imperative that we make telephone consultations medicolegally and clinically safe and effective.

To avoid adverse health outcomes associated with inaccurate assessment, 'wellness bias' and premature decision-making, the rationale for out-patient management was explained to the patient together with its risks and benefits. We ensured that the patient understood and approved the proposed management plan. Adequate provision for follow-up in the event of no improvement, worsening symptoms or side-effects was made by the treating physician.

The present study has certain limitations, including its retrospective nature. We did not calculate analgesic requirement or use a visual analogue scale for pain in the postoperative period for stratifying pain impact on hospital stay. Conversely, the strengths of the present study include that the management protocol was standardised and we excluded cases inappropriate for outpatient management from analysis. These strengths in

combination led to more meaningful comparison among groups.

Conclusions

In the present study, we have shown that PCNL can be safely performed with excellent outcomes as an outpatient procedure. Outpatient PCNL offer several advantages, including more rapid patient convalescence, reduction in healthcare expenses, decreased postoperative nosocomial infection with no additional morbidity to the patient, and without compromising SFR.

Multi-institutional studies on larger patient populations are needed to examine whether PCNL as an outpatient procedure could potentially become the standard of care for selected patients with renal calculi.

Conflicts of interest

None.

Source of funding

None.

References

- [1] Duvdevani M, Razvi H, Sofer M, Beiko DT, Nott L, Chew BH, et al. Third prize: contemporary percutaneous nephrolithotripsy: 1585 procedures in 1338 consecutive patients. *J Endourol* 2007;**21**:824–9.
- [2] Al-Kohlany KM, Shokeir AA, Mosbah A, Mohsen T, Shoma I, Eraky I, et al. Treatment of complete staghorn stones: a prospective randomized comparison of open surgery versus percutaneous nephrolithotomy. *J Urol* 2005;**173**:469–73.
- [3] Beiko D, Kokorovic A, Roberts G, Elkoushy M, Andonian S. Pioneering ambulatory PCNL: the Canadian experience. *Eur Urol Suppl* 2014;**13**:e504.
- [4] Seitz C, Desai M, Häcker A, Hakenberg OW, Liatsikos E, Nagele U, et al. Incidence, prevention, and management of complications following percutaneous nephrolitholapaxy. *Eur Urol* 2012;**61**:146–58.
- [5] Young A, Ismail M, Papatsoris AG, Barua JM, Calleary JG, Masood J. Entonox® inhalation to reduce pain in common diagnostic and therapeutic outpatient urological procedures: a review of the evidence. *Ann R Coll Surg Engl* 2012;**94**:8–11.
- [6] Masood J, Ismail M, El-Husseiny T, Moraitis K, Albanis S, Papatsoris A, et al. 'An interventional urology list' – a novel concept for UK urological services. *Ann R Coll Surg Engl* 2011;**93**:27–30.
- [7] Ganpule AP, Bhattu AS, Desai M. PCNL in the twenty-first century: role of Microperc, Miniperc, and Ultraminiperc. *World J Urol* 2015;**33**:235–40.
- [8] Zeng G, Wan S, Zhao Z, Zhu J, Tuerxun A, Song C, et al. Super-mini percutaneous nephrolithotomy (SMP): a new concept in technique and instrumentation. *BJU Int* 2016;**117**:655–61.
- [9] Preminger GM, Clayman RV, Curry T, Redman HC, Peters PC. Outpatient percutaneous nephrostolithotomy. *J Urol* 1986;**136**:355–7.
- [10] Singh I, Kumar A, Kumar P. 'Ambulatory PCNL' (tubeless PCNL under regional anesthesia) – a preliminary report of 10 cases. *Int Urol Nephrol* 2005;**37**:35–7.
- [11] Limb J, Bellman GC. Tubeless percutaneous renal surgery: Review of first 112 patients. *Urology* 2002;**59**:527–31.
- [12] Beiko D, Lee L. Outpatient tubeless percutaneous nephrolithotomy: the initial case series. *Can Urol Assoc J* 2010;**4**:E86–90.
- [13] Shahrou W, Andonian S. Ambulatory percutaneous nephrolithotomy: initial series. *Urology* 2010;**76**:1288–92.
- [14] Kokorovic A, Wilson JW, Beiko D. Outpatient bilateral supra-costal tubeless percutaneous nephrolithotomy for staghorn calculi. *Can Urol Assoc J* 2014;**8**:e273–5.
- [15] Singh I, Singh A, Mittal G. Tubeless percutaneous nephrolithotomy: is it really less morbid? *J Endourol* 2008;**22**:427–34.
- [16] Desai MR, Kukreja RA, Desai MM, Mhaskar SS, Wani KA, Patel SH, et al. A prospective randomized comparison of type of nephrostomy drainage following percutaneous nephrostolithotomy: large bore versus small bore versus tubeless. *J Urol* 2004;**172**:565–7.
- [17] Feng MI, Tamaddon K, Mikhail A, Kaptein JS, Bellman GC. Prospective randomized study of various techniques of percutaneous nephrolithotomy. *Urology* 2001;**58**:345–50.