ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

A study of standard versus tubeless percutaneous nephrolithotomy: Our institutional experience

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Submission: 02-01-2023 Revision: 02-06-2023 Publication: 01-07-2023

ABSTRACT

Background: Percutaneous nephrolithotomy (PCNL) is considered to be the standard procedure in patients with large renal calculus. The purpose of this study is to analyze the evidence-based literature regarding the "nephrostomy-free" or "tubeless" PCNL and to assess the safety, efficacy, possibility, and benefits of tubeless PCNL over standard PCNL. **Aims and Objectives:** The aim of the study was to review and compare tubeless PCNL with standard PCNL. **Materials and Methods:** It is a retrospective study done between August 2021 and December 2022. 100 cases of stone disease with stone size more than 2 cm who underwent PCNL in the Department of Urology, Govt hospital, Salem. Patients are divided into two groups (Group A and Group B) of 50 each depending on date of surgery. **Results:** In our study, we compared tubeless PCNL versus standard PCNL in patients with stone disease. Tubeless PCNL was performed with success in patients of age 13 years–65 years. 36 were female patients, whereas 64 were male patients in this study. All the results were presented in a tabulated form in our study. **Conclusion:** Tubeless PCNL is a safe and effective technique and is associated with decreased pain, low analgesic requirement, less operating time, and faster recovery. However, it has its own limitation that precludes secondary procedure for the treatment, removal of internal stent, dysuria, and need to visit hospital for subsequent removal of internal stent.

Key words: Percutaneous nephrolithotomy; Tubeless percutaneous nephrolithotomy; Standard percutaneous nephrolithotomy; Internal stents

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v14i7.51053

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the preferred treatment of choice for renal calculi. PCNL has evolved remarkably since the 80s when it was first described.

The concepts have changed in the context to miniaturization of instruments and advancements in energy and optics where even smaller stones are treated with PCNL with minimal morbidity and better stone clearance rates. The usual indications for PCNL are stones larger than 20 mm, staghorn, partial staghorn calculi. The contraindications for PCNL include pregnancy, bleeding disorders, and uncontrolled urinary tract infections.[1] The insertion of a nephrostomy tube after PCNL as a drainage is still considered a standard procedure. However, the recent literature suggests that the use of tubeless or totally tubeless drainage following PCNL also presents excellent results.

Nowadays, PCNL is still the main option for the treatment of large and complex renal stones. Standard PCNL consists of percutaneous access to the intrarenal collecting system from the flank surface to allow endoscopic stone frag-mentation and removal. Although continuous technical refinements have been made, complications of hemorrhage and urine extravasation are still a cause for concern. Postoperative nephrostomy tube placement may be performed to reduce such complications. Unfortunately,

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however, placement of a nephrostomy tube may increase the risk of postoperative pain and morbidity. By contrast, tubeless or totally tubeless PCNL may be considered a less painful alternative with proven efficacy.[2,3]

Tubeless PCNL is defined as PCNL without post-operative nephrostomy tube placement. When neither a nephrostomy tube nor a ureteral stent is used, the procedure is commonly referred to as totally tubeless PCNL.[4] Tubeless or totally tubeless PCNL is significantly associated with reduced use or demands for analgesics and a shorter hospital stay and is not as costly as nephrostomy PCNL.

Aims and objectives

The aim of the study was to systematically review and compare tubeless PCNL with standard PCNL.

MATERIALS AND METHODS

Cases include patients with renal calculus disease who undergo PCNL for the same in the Department of Urology. It is a retrospective observational study done between August 2021 and December 2022. 100 cases of stone disease with stone size more than 2 cm who undergo PCNL in the Department of Urology, Government hospital, Salem [GMKMCH/114/IEC/2023-17(6)] January 5, 2023.

Patients are divided into two groups (Group A and Group B) depending on the date of surgery

1. Group A: 50 cases of tubeless PCNL
2. Group B: 50 cases of standard PCNL.

Inclusion criteria

(1) Stone size more than 2 cm who underwent PCNL as primary procedure, (2) single puncture tract, (3) procedure lasting <2 h, (4) less than three stones with a diameter <25 mm, (5) complete extraction of all stones, and (6) no significant bleeding at the end of the procedure.

Exclusion criteria

(1) Residual calculi, (2) Significant bleeding at the end of procedure, and (3) Multiple puncture tract.

Patients were evaluated with physical examination and necessary investigations such as urine analysis, urine culture and sensitivity, complete blood count, renal function test, X-ray KUB, and plain and contrast-enhanced computerized tomography/IVP. Group A underwent tubeless PCNL and Group B underwent standard PCNL after obtaining anesthetic fitness for the procedure. Selected patients for the study were followed up at least 6-12 months post surgery. Patient medical records were used for the collection of data.

After PCNL procedure, 5 Fr ureteric stent was placed in Group A and skin incision sutured and compression bandage applied. A 20 Fr nephrostomy tube along with 5 Fr ureteric stent was placed in patients coming under group B. Preoperative parameters such as stone size, stone disease in the opposite kidney and ureter, preoperative creatinine, and associated comorbidities were done. Intraoperative parameters such as operative time, access tract, and any blood transfusions data were recorded. Post-procedure check X-ray KUB was taken before removing the nephrostomy tube in the first postoperative day in the standard PCNL group. Calculi size more than 4 mm was considered residual calculi. In both Groups A and B, ureteric stent was removed after 14 days.

RESULTS

In this study of (Table 1) 100 patients, 64 (64%) of them were males and 36 (36%) were females. In Group A, 32 (64%) patients were males and 18 (36%) patients were females. In Group B, 32 (64%) patients were males and 18 (36%) patients were females. In this study, 47 (47%) patients had stone on the left side and 53 (53%) patients had stone on the right side.

In Group A, 26 (52%) patients had stone on the left side and 24 (48%) patients had stone on the right side. In Group B, 21 (42%) patients had stone on the left side and 29 (58%) patients had stone on the right side.

In this study, (Table 2) 74 (74%) patients underwent lower calyceal puncture, 17 (17%) patients underwent middle calyceal puncture, and 9 (9%) underwent upper calyceal puncture.

In Group A, 36 (72%) patients underwent lower calyceal puncture, 9 (18%) patients underwent middle calyceal

Table 1: Parameters comparison

Various parameters	Group A	Group B
Age distribution	13 (Minimum)	65 (Minimum)
Gender	32 male 18 females	32 male 18 females
Preoperative creatinine	0.6 (Minimum)	2.0 (Maximum)
Associated stone disease	6	0
Side of stone	Left 26 Right 24	Left 21 Right 29
Complete stone clearance	48	47
Mean operative time	54.94	54.62
Mean hospital stay	3.32	4.16
Analgesic requirement (mg)	121	170

Table 2: Puncture site distribution

Puncture site	Group A	Group B	Total
Inferior calyx	36	38	74
Middle calyx	9	8	17
Lower calyx	5	4	9

puncture, and 5 (10%) underwent upper calyceal puncture. In Group B, 38 (76%) patients underwent lower calyceal puncture, 8 (16%) patients underwent middle calyceal puncture, and 4 (8%) underwent upper calyceal puncture.

In this study (Table 3), 16 (16%) patients had diabetes mellitus, 9 (9%) had hypertension, and 4 (4%) patients had both diseases. mellitus, 5 (5%) had hypertension and 2 (4%) had both. Among the Group B patients, 9 (18%) patients had diabetes mellitus, 4 (8%) had hypertension, and 2 (4%) had both among the Group A patients, 7 (14%) patients had diabetes. (Table 4) showing post operative complications distribution and comparison in both groups and (Table 5) showing ancillary procedures distribution in both groups.

In this study, 3 (3%) patients required Left Ureteroscopy (LT URS) for left ureteric calculus, 5 (5%) patients required Left URS (LT URS), 4 (4%) patients needed extracorporeal shock wave lithotripsy (ESWL), and 1 (1%) patient underwent PCN.

In Group A, 1 (2%) patient required LT URS for left ureteric calculus, 2 (4%) patients required RT URS, 2 (4%) patients needed ESWL, and 1 (2%) patient underwent PCN. In Group B, 2 (4%) patients required LT URS for left ureteric calculus, 3 (6%) patients required RT URS, 2 (4%) patients needed ESWL, and no patient underwent PCN.

DISCUSSION

Renal stone disease is one of the most common urological problems. Medical management may not be feasible in all circumstances. Surgical management is more effective in the treatment of stone disease. Furthermore, medical management is more helpful in preventing recurrences following surgical removal rather than as primary therapy. Surgical management comprises both open and endourological procedures. In the contemporary age, renal calculus surgery is always done through minimal access procedures. Over a period, PCNL has developed to be a safer and relatively less morbid procedure when compared to an open stone surgery. Due to its lesser cost, shorter operative time, minimal requirement for blood transfusion, and analgesics and ability of the patients to regain their routine daily life activities sooner make PCNL, the preferred procedure at recent times.

Table 3: Comorbidity distribution

Comorbidity	Group A	Group B	Total
Nil	36	35	71
Hypertension	5	4	9
Diabetes mellitus	7	9	16
Both	2	2	4

Table 4: Complications distribution

Complications	Group A	Group B	Total
No complications	44	43	87
Hematuria	1	2	3
Urosepsis	5	5	10

Table 5: Ancillary procedures distribution

Ancillary procedure	Group A	Group B	Total
Left URS	1	2	3
Right URS	2	3	5
ESWL	2	2	4
PCN	1	0	1
Nil	44	43	87

URS: Ureteroscopy, PCN: Percutaneous nephrostomy, ESWL: Extracorporeal shock wave lithotripsy

In our study, mean hospital stay for patients those underwent tubeless PCNL was significantly shorter than standard PCNL. This was in accordance with previous studies by Bellman et al., Kwon and Kim, Karami and Gholamrezaie, Bdesha et al., and Crook et al.[5-9]

Post-operative analgesia requirement (Inj. Diclofenac) was significantly high in standard PCNL group (mean dose±SD=171.84 mg±31.944 mg) than in tubeless PCNL group (mean dose±SD=121.84 mg±30.46 mg). This was in accordance with the studies done by Karami and Gholamrezaie, Bdesha et al., Ni et al., and Shah et al.[7,8,10,11]

In our study, post-operative complications such as hematuria were less in tubeless PCNL group in comparison with standard PCNL. Similar observation was also done by Shah et al., Sichani et al., and Zhao et al.,[12,13] in their study.

Tubeless or totally tubeless PCNL is significantly superior to standard PCNL in terms of length of hospital stay, post-operative pain (visual analog scale) score, demands or dosage of analgesics required, as well as faster return to activity for the patients.

Despite the advancements and subsequent perfections, a few morbidities continue to affect the patients. Nephrostomy tube kept after the procedure adds to the patient's discomfort. In our study, we compared tubeless PCNL versus standard PCNL in patients with stone disease. Tubeless PCNL was performed with success in patients of age 13 years–65 years.

Limitations of the study

This is a retrospective observational study confined to single institution with limited sample size.

CONCLUSION

Tubeless PCNL is a safe and effective technique and is associated with decreased pain, low analgesic requirement,

less operating time, and faster recovery. However, it has its own limitation that precludes secondary procedure for the treatment, removal of internal stent, dysuria, and need to visit hospital for subsequent removal of internal stent.

ACKNOWLEDGEMENT

Authors acknowledge the Medical Record Section and Hospital Administration for their constant help and support.

REFERENCES

1. Agrawal MS and Agrawal M. Percutaneous nephrolithotomy: Large tube, small tube, tubeless, or totally tubeless? Indian J Urol. 2013;29(3):219-224.
   https://doi.org/10.4103/0970-1591.117285
2. Koo KC, Park SU, Jang HS and Hong CH. Tubeless percutaneous nephrolithotomy with non-absorbable hemostatic sealant (Quikclot®) versus nephrostomy tube placement: A propensity score-matched analysis. Urolithiasis. 2015;43(6):527-533.
   https://doi.org/10.1007/s00240-015-0796-y
3. Garofalo M, Pultrone CV, Schiavina R, Brunocilla E, Sanguedolce F, Borghesi M, et al. Tubeless procedure reduces hospitalization and pain after percutaneous nephrolithotomy: Results of a multivariable analysis. Urolithiasis. 2013;41(4):347-353.
   https://doi.org/10.1007/s00240-013-0565-8
4. Turk C, Knoll T, Petrik A, Sarica K, Skolarikos A, Straub M, et al. Guidelines on Urolithiasis. Arnhem, Netherlands: European Association of Urology; 2015.
5. Bellman GC, Davidoff R, Candela J, Gerspach J, Kurtz S and Stout L. Tubeless percutaneous renal surgery. J Urol. 1997;157(5):1578-1582.
6. Kwon S and Kim HG. A comparative study between standard and tubeless percutaneous nephrolithotomy. Korean J Urol. 2017;48:45-48.
7. Karami H and Gholamrezaie HR. Totally tubeless percutaneous nephrolithotomy in selected patients. J Endourol. 2004;18(5):475-476.
   https://doi.org/10.1089/0892779041271580
8. Bdesha AS, Jones CR, North EA, Pinfield J and Boyd PJ. Routine placement of nephrostomy tube is necessary after pertutaneous nephrolithotomy. Br J Urol. 1997;79 Suppl 4:1.
9. Crook TJ, Lockyer CR, Keoghane SR and Walmsley BH. A randomized controlled trial of nephrostomy placement versus tubeless percutaneous nephrolithotomy. J Urol. 2008;180(2):612-614.
   https://doi.org/10.1016/j.juro.2008.04.020
10. Ni S, Qiyin C, Tao W, Liu L, Jiang H, Hu H, et al. Tubeless percutaneous nephrolithotomy is associated with less pain and shorter hospitalization compared with standard or small bore drainage: A mata analysis of randomized, controlled trials. Urology. 2011;77(6):1293-1298.
    https://doi.org/10.1016/j.urology.2010.10.023
11. Shah H, Khandkar A, Sodha H, Kharodawala S, Hegde S, Bansal M, et al. Tubeless percutaneous nephrolithotomy: 3 years of experience with 454 patients. BJU Int. 2009;104(6):840-846.
    https://doi.org/10.1111/j.1464-410X.2009.08496.x
12. Sichani MM, Babaeian M, Haghdani S, Alizadeh F, Mazdak H, Hadi M, et al. Is it necessary to perform nephrostomy before tube removal after percutaneous nephrolithotomy? Adv Biomed Res. 2017;6:35.
    https://doi.org/10.4103/2277-9175.203160
13. Zhao PT, Hoenig DM, Smith AD and Okeke Z. A randomized controlled comparison of nephrostomy drainage vs ureteral stent following percutaneous nephrolithotomy using wisconsin StoneQOL. J Endourol. 2016;30(12):1275-1284.
    https://doi.org/10.1089/end.2016.0235

Authors' Contributions:
RR- Interpreted the results, reviewed the literature and manuscript preparation; **SKP, RS-** Concept, coordination, interpretation, and publication work; **GRV, GS-** Concept and design of the study, prepared first draft of manuscript; **SS-** Data collection, statistical analysis, and preparation of manuscript.

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Source of Support: Nil, **Conflicts of Interest:** None declared.