

# Percutaneous Nephrolithotomy: A Comparison of Tubeless versus the Standard technique

Zein El Amir<sup>1</sup>, Muhammad Ali Shahiman<sup>2</sup>, Zeeshan Qadeer<sup>3</sup>, Rameez Ahmed Mughal<sup>4</sup>, Ashfaq Ali<sup>5</sup>

<sup>1</sup> Professor and HOD, Department of Urology, Benazir Bhutto Hospital, Rawalpindi.

<sup>2</sup> Senior Registrar, Department of Urology, Benazir Bhutto Hospital, Rawalpindi.

<sup>3</sup> Assistant Professor, Department of Urology, Benazir Bhutto Hospital, Rawalpindi.

<sup>4,5</sup> Postgraduate Resident, Department of Urology, Benazir Bhutto Hospital, Rawalpindi.

## Author's Contribution

<sup>2</sup> Conception of study

<sup>1,3,4</sup> Experimentation/Study conduction

<sup>2</sup> Analysis/Interpretation/Discussion

<sup>2</sup> Manuscript Writing

<sup>1</sup> Critical Review

<sup>1,4,5</sup> Facilitation and Material analysis

## Corresponding Author

Dr. Muhammad Ali Shahiman,

Senior Registrar,

Department of Urology,

Benazir Bhutto Hospital,

Rawalpindi

Email: [dr\\_ali2875@yahoo.com](mailto:dr_ali2875@yahoo.com)

## Article Processing

Received: 31/12/2020

Accepted: 12/03/2021

**Cite this Article:** Amir, Z.E., Shahiman, M.A., Qadeer, Z., Mughal, A., Ali, A. Percutaneous Nephrolithotomy: A Comparison of Tubeless versus the Standard technique. *Journal of Rawalpindi Medical College*. 30 Mar. 2021; 25(1): 140-144.  
DOI: <https://doi.org/10.37939/jrnc.v25i1.1581>

**Conflict of Interest:** Nil

**Funding Source:** Nil

**Access Online:**



## Abstract

**Objective:** The proposed study aimed to assess the utility of tubeless PCNL in terms of efficacy and safety when compared with the standard tubed PCNL.

**Materials & Methods:** In this study 280 patients (age ranged 08-70 years) who underwent PCNL were included.

**Results:** The patients were from both genders i.e., 156 males and 124 females. Out of 280 patients, 140 had a 16 FR nephrostomy tube (Group A) while an equal number had 4.8F DJ Stent (Group B) for postoperative drainage. A comparison of the postoperative outcome among the two groups was made for a period of two years (November 2017 to October 2019). Neither any significant difference was found in the mean stone size, operative time, nor was stone-free status, nor any major complication observed. The mean hospital stay for group A and group B was 4.5 days (range 3 to 6) and 3.2 days (range 2 to 4) respectively. An early postoperative wound soakage was found in 18 (12.8%) cases of group A in contrast to the group B patients in whom only 2 (1.4%) had soakage.

**Conclusion:** It was concluded that Tubeless PCNL as compared to the standard tubed PCNL was found more efficacious and safer and it should be adopted as a routine procedure.

**Keywords:** Percutaneous nephrolithotomy (PCNL), Tubed, Tubeless, Hospital stay.

## Introduction

The management of urolithiasis in today's society demands expertise with minimally invasive techniques. Current treatment options include ESWL, ureteroscopy, and Percutaneous nephrolithotomy (PCNL).<sup>1</sup> Since PCNL was first described in 1973, many technological developments have made the procedure safer and more effective.<sup>2</sup> The past decade has provided us with significant technical innovations to experiment with and resulted in the miniaturization of PCNL which is now considered as most efficacious for managing both simple as well as large and complex renal stones and the success rates are progressively increasing courtesy of the advancements in both the endoscopic equipment and techniques.<sup>3,4</sup> The use of a nephrostomy at the end of the procedure remained a standard practice.<sup>5</sup> The purpose of nephrostomy is to tamponade any bleeding site, a good post-operative renal drainage, and also gives access for any further endoscopic intervention if required. Although having these benefits nephrostomy tubes are certainly associated with some bothersome disadvantages like postoperative tube-related pain and discomfort, urinary leakage from around the nephrostomy, and a prolonged hospital stay. With a growing interest in the field of endourology, efforts have been made for safer modifications of the conventional PCNL.<sup>6,7</sup> Modification of the procedure has now been done in the form of 'tubeless PCNL' where a double-J stent or a ureteral catheter has substituted the nephrostomy tube for renal drainage.<sup>5</sup> Tubeless PCNL has an advantage over the conventional PCNL in terms of early mobilization, less hospital stay, and fewer requirements for analgesia.<sup>8</sup> This study aimed to assess the utility of tubeless PCNL in terms of efficacy and safety when compared with the standard tubed PCNL.

## Materials and Methods

**Objective:** The purpose of this study was to compare the surgical outcome of tubeless PCNL with the standard tubed PCNL regarding the postoperative pain, analgesic requirement, urinary leakage, and postoperative hospital stay.

**Settings and Study Design:** The study was carried out at Benazir Bhutto hospital, RMU, Rawalpindi, Pakistan from November 2017 to October 2019. During this period a total of 280 consecutive cases of PCNL performed were prospectively evaluated using the randomized control trial.

**Study Protocol:** All patients were admitted to the Urology ward at Benazir Bhutto Hospital, Rawalpindi. The diagnosis of urolithiasis along with an assessment of stone site and size was established by abdominal ultrasonography and IVU or CT KUB. After the baseline investigations, urine culture, bleeding profile, CXR, and ECG a pre-anesthesia assessment was done for all patients.

**Distribution of Patients:** The study includes 280 PCNL procedures on 280 patients. Patients were randomized into two groups. Group A (n=140) underwent standard tubed PCNL with 16 FR nephrostomy tubes and group B (n=140) had 4.8F DJ Stent for postoperative drainage.

**Operative Details:** All the procedures were performed under general anesthesia with retrograde ureteric catheterization which was followed by a repositioning of patients in a completely prone position. Puncture of the pelvicalyceal system was followed by tract dilatation using serial metallic telescopic dilators under fluoroscopic guidance by urologists in all the cases. After nephroscopy stone fragmentation was done with Swiss lithoclast MasterR followed by retrieval of stone particles and gravel. A 16 FR nephrostomy tube was placed under fluoroscopic guidance and secured with skin in group A, while a 4.8F DJ Stent was placed in an antegrade fashion under both fluoroscopic and endovision control.

**Postoperative Evaluation:** X-Ray KUB was done on the first postoperative day in all patients to confirm the stone-free status. The nephrostomy tube was clamped on the first postoperative day and removed on the second postoperative day in patients who did not have any flank pain, fever, or urinary leakage from a wound site. The visual analogue scale was used to assess and compare the postoperative pain between the two groups. Postoperative hospitalization was recorded in days. Patients with tubeless PCNL had a follow-up at 4 weeks as well to confirm the stone-free status and for subsequent stent removal. The post-operative surgical outcomes were evaluated and compared among the two groups, using the independent t-test. Data were collected, tabulated, and statistically analyzed, and compared using the Microsoft Excel version 2016.

## Results

In this study, 280 consecutive PCNL procedures were randomized into two groups. Group A (n=140) underwent standard tubed PCNL with a 16 FR nephrostomy tube and Group B (n=140) underwent tubeless PCNL with a 4.8F DJ Ureteric Stent for postoperative drainage. The median age of 280

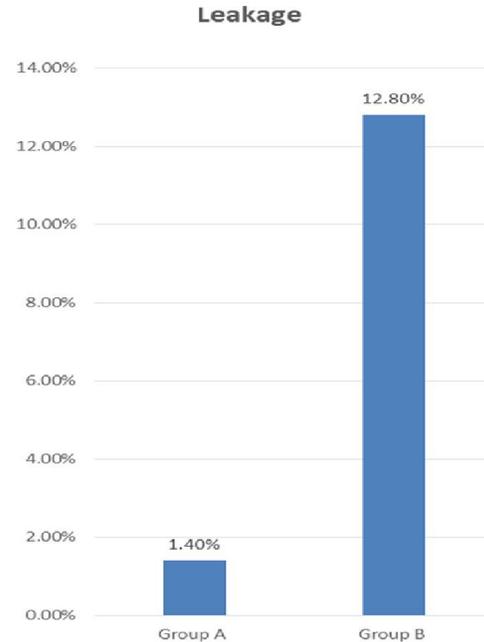
patients was 35.1 years (range 08 to 70), with 156 males (55.7%) and 124 females (44.2%). Age distribution in group A was 10 to 66 (mean 35.5, SD  $\pm$  0.91) years with 77 males and 63 females, while in group B the age distribution was 08 to 70 (mean 35.1, SD  $\pm$  0.87) years with 79 males and 61 females. The mean stone size was 2.5 cm (SD  $\pm$  0.84) for group A and 2.8 cm (SD  $\pm$  0.71) for group B. The mean operative time was 62.3 minutes (SD  $\pm$  0.57) for group A and 61.3 minutes (SD  $\pm$  0.69) for group B. Complete stone clearance (stone-free at day one) was observed in 123 cases (87.8%) of standard and 118 cases (84.2%) of tubeless PCNL.

Regarding the postoperative pain assessment, the visual analogue score was 6.1 and 3.6 for group A and group B respectively. Similarly, the mean length of hospital stay was 4.5 days (SD  $\pm$  2.1) and 3.2 days (SD  $\pm$  1.1) for group A and group B respectively. Soakage of wound dressing was observed in 18 (12.8%) cases of group A, in contrast to the group B patients where only 02 (1.4%) had postoperative soakage of wound dressing (Figure 1).

No major complication was observed in any of the groups. Moreover, no significantly different values were observed among the groups relating to the stone size, operative time, and stone-free status. However, statistically, significant differences were recorded when the two groups were compared in terms of the postoperative pain scores, urinary leakage, and length of the hospital stay (Table 1).

**Table 1: Distribution of patients details of postoperative pain scores with the postoperative hospital stay among group A and group B**

Group	A (n=140)	B (n=140)
Mean Age $\pm$ SD (years)	35.5 $\pm$ 0.91	35.1 $\pm$ 0.87
Male	77	79
Female	63	61
Stone Size $\pm$ SD (cm)	2.5 $\pm$ 0.84	2.8 $\pm$ 0.71
Operative time $\pm$ SD (minutes)	62.3 $\pm$ 0.57	61.3 $\pm$ 0.69
Stone Clearance (%)	87.8	84.2
<b>Post-Operative Pain (Visual Analogue Score)</b>	Mean $\pm$ SD	6.1 $\pm$ 1.9
	P-Value	<0.05
<b>Hospital Stay (Days)</b>	Mean $\pm$ SD	4.5 $\pm$ 2.1
	P-Value	<0.05



**Figure 1: A comparison of postoperative leakage and soakage of wound dressing between group A and group B patients**

## Discussion

Renal stones remain one of the most commonly encountered urological problems worldwide, however, in this modern era of endourology with lots of technological advances in minimally invasive surgery have improved the efficacy and outcome of renal stone management.<sup>9,10</sup> PCNL is now considered the 'gold standard' treatment and has almost completely replaced open surgery for managing simple as well as large and complex renal calculi and the reported success rates are now exceeding 90%.<sup>11,12,13,14</sup>

The standard tubed PCNL involves the use of a nephrostomy tube which is placed and secured as a final step of the procedure. Nephrostomy is important for drainage of the pelvicalyceal system, tamponading of the renal access tract, and also provides access for a 'second look' procedure if required in near future. However, despite these benefits, there are several side-effects as well, such as tube-related pain and a prolonged hospital stay.<sup>14,15,16</sup> To encounter the procedure-specific morbidities several modifications have been made to refine the standard PCNL, with a goal to decrease the tube-related morbidity, analgesic requirement, and to reduce the hospital stay. Such modifications include the use of a smaller working sheath and nephroscope (mini-PCNL), omitting the

use of a nephrostomy tube (tubeless PCNL), sealing of the nephrostomy tract with hemostatic materials, and PCNL under regional anaesthesia. All of which are being carried out successfully with promising results worldwide.<sup>17</sup>

Husain I et al studied 90 patients who underwent PCNL and were distributed into three groups, that is, conventional PCNL with large bore nephrostomy tube, conventional PCNL with small-bore nephrostomy tube, and tubeless PCNL. They reported a shorter hospital stay in the tubeless group with a mean reading of 3.1 as compared to 5.7 days in the tubed groups.<sup>18</sup> In their study, Qadir I et al studied 60 cases of PCNL which were randomized into tubeless and tubed groups. They reported a less operative time as well as a less postoperative hospital stay in tubeless PCNL when compared with the standard tubed PCNL. The mean length of hospitalization was 4.0 versus 6.2 days in the tubeless and conventional PCNL groups respectively.<sup>19</sup>

Sofer M et al conducted their study on 126 patients with 66 tubeless and 60 conventional PCNL procedures and reported a significantly shorter hospital stay in the tubeless group. They concluded that the tubeless approach is a reasonably safe choice in selected patients with an uncomplicated procedure and the absence of a complex stone burden.<sup>20</sup>

Khan N et al conducted a study on 102 consecutive patients who underwent PCNL in 2015. They were divided into two groups. Group 1 patients were those in whom the nephrostomy tube was inserted at the end of the procedure and group 2 patients were those in whom nephrostomy was not used. These two groups were followed for 3 months and compared for complications, hospital stay, and need for analgesia postoperatively. According to them the length of postoperative hospitalization was high in Group 1 (2.3 days) as compared to Group 2 (1.1 days), postoperative pyrexia, blood transfusion rates, and readmission were higher in the nephrostomy group. Postoperative analgesia requirement was also less among Group 2 over the Group 1 patients.<sup>8</sup>

A similar result was also reported by Nalbant et al, they compared 85 cases of tubeless PCNL with 110 cases of conventional PCNL. The reported postoperative hospitalization was 1.6 and 3.5 days for tubeless and non-tubeless cases respectively.<sup>21</sup>

In a meta-analysis of 127 studies (1365 cases) carried out by Zhong Q et al comparing conventional with the tubeless PCNL, the mean length of hospital stay for the tubeless group was almost 24 hours less than that for the conventional PCNL group. Although Meta-

analysis of some studies showed that tubeless pcnl has the advantage of less hospital stay and less requirement of post-operative analgesia<sup>22,23</sup>, Zhao PT et al advocated that QoL is significantly worse with stent placement than with temporary nephrostomy drainage in the immediate aftermath following PCNL using a validated QoL assessment instrument specific for nephrolithiasis.<sup>24</sup>

In the present study, an insignificant difference was observed while comparing the stone size, operative time, and stone clearance between the two groups. However, remarkable variations among the two groups were recorded in terms of the postoperative pain scores, urinary leakage, and hospital stay. The visual analogue score for postoperative pain was higher for the nephrostomy group with a mean value of 6.1 (SD  $\pm$  1.9) versus 3.6 (SD  $\pm$  1.1) for the tubeless group. Similarly, the length of hospital stay was shorter in the tubeless PCNL group with a mean value of 3.2 days (SD  $\pm$  1.1) versus 4.5 days (SD  $\pm$  2.1) for the nephrostomy group. Soakage of wound dressing was observed in the early postoperative period in 18 (12.8%) cases in whom nephrostomy was used, in contrast to the tubeless group where only 02 (1.4%) had postoperative soakage of dressing. Although the results of our study support the utility and safety of tubeless PCNL, we think that we lacked in terms of evaluating the impact of DJ Ureteric stents on the quality of life of patients in the tubeless group.

## Conclusion

Our study supports the advantages of tubeless PCNL over the conventional technique in terms of less postoperative patient discomfort, less tube-related morbidity, early mobilization, and reduced hospital stay. We believe that this study represents another contribution to the further popularization of the tubeless technique which should be employed in routine practice in this modern era of endourology.

## References

1. Deem S, DeFate B, Modak A, Emmett M, Martinez F, Davalos J. Percutaneous nephrolithotomy versus extracorporeal shock wave lithotripsy for moderate sized kidney stones. *Urology*. 2011 Oct 1;78(4):739-43.
2. Fernstrom I, Johansson B. Percutaneous pyelolithotomy: a new extraction technique. *Scand J Urol Nephrol* 1976;10:257-9. DOI: 10.1016/j.urology.2011.04.010
3. Tailly T, Denstedt J. Innovations in percutaneous nephrolithotomy. *International Journal of Surgery* 2016; 36: 665-672. DOI: 10.1016/j.ijssu.2016.11.007

4. 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 meta-analysis of randomized, controlled trials. *Urology*. 2011; 77: 1293-8. DOI: 10.1016/j.aju.2015.11.005
5. Agrawal MS, Agrawal M. Tubeless percutaneous nephrolithotomy. *Indian J Urol* 2010;26:16-24. DOI: 10.4103/0970-1591.60438
6. Istanbuluoglu OM, Cicek T, Ozturk B, Gonen M Ozkardes H. Percutaneous nephrolithotomy: Nephrostomy or Tubeless or Totally Tubeless? *Urology* 2010; 75:1043-1046. DOI: 10.1016/j.urology.2009.06.104
7. Desai MR, Kukreja RA, Desai MM, Mhaskar SS, Wani KA, Patel SH, et al. A prospective randomized comparison of type of bore nephrostomy drainage following percutaneous nephrolithotomy: large versus small bore versus tubeless. *J Urology* 2004;172: 565-7. DOI: 10.1097/01.ju.0000130752.97414.c8
8. Khan N, Khan R, Khan KH, Manzoor S, Khan N, Rahman AU. Tubed vs tubeless PCNL, our experience at North West General Hospital and Research Center, Peshawar. *Pak J Surg*. 2015;31(3):17-23. DOI: 10.1016/j.urology.2009.06.104
9. Türk C, Petrík A, Sarica K, Seitz C, Skolarikos A, Straub M, et al. EAU Guidelines on Interventional Treatment for Urolithiasis. *Eur Urol* 2016;69:475–82. Doi : 10.1016/j.aju.2017.09.004
10. Yun SI, Lee YH, Kim JS, Cho SR, Kim BS, Kwon JB. Comparative study between standard and totally tubeless percutaneous nephrolithotomy. *Korean J Urol* 2012;53:785-9. DOI: 10.4111/kju.2012.53.11.785
11. Karaolides T, Moraitis k, Bach C, Masood J, Buchholz N. Positions for percutaneous nephrolithotomy: Thirty-five years of evolution. *Arab Journal of Urology* 2012; 10:307-316. DOI: 10.1016/j.aju.2012.06.005
12. Ferakis N, Stavropoulos M. Mini percutaneous nephrolithotomy in the treatment of renal and upper ureteral stones: lessons learned from a review of the literature. *Urol Ann* 2015;7:141–8. DOI: 10.4103/0974-7796.152927.
13. Gonen M, Basaran B. Tubeless percutaneous nephrolithotomy: spinal versus general anesthesia. *Urol J* 2014;11:1211–5.
14. Yuan H, Zheng S, Liu L, Han P, Wang J, Wei Q. The efficacy and safety of tubeless percutaneous nephrolithotomy: a systematic review and meta-analysis. *Urol Res* 2011;39:401–10. DOI: 10.1007/s00240-010-0355-5
15. 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. *Urology* 2011;77:1293–8. DOI: 10.1016/j.urology.2010.10.023.
16. Isac W, Rizkala E, Liu X, Noble M, Monga M. Tubeless percutaneous nephrolithotomy: outcomes with expanded indications. *Int Braz J Urol* 2014;40:204–11. DOI: 10.1016/j.aju.2015.11.005
17. Sebaey A, Khalil MM, Soliman T, Mohey A, Elshaer W, Kandil W, et al. Standard versus tubeless mini-percutaneous nephrolithotomy: A randomised controlled trial. *Arab journal of urology*. 2016 Mar 1;14(1):18-23. DOI: 10.1016/j.aju.2015.11.005
18. Husain I, Tahir MM, Ashraf S, Khan MU. Percutaneous nephrolithotomy; randomized comparison of large bore, small bore and tubeless. *Professional Med J*. 2011; 18: 575-80. DOI: 10.5152/tud.2018.19616
19. Qadir I, Ali M, Subhani GM, Jafari AA, Akmal M, Munir MI, et al. Percutaneous Nephrolithotomy (PCNL): Comparison of Tubeless versus Conventional Method in terms of Hospital Stay and Duration of Operation. *Annals of Punjab Medical College*. 2013 Oct 31;7(2):154-60.
20. Sofer M, Beri A, Friedman A, Aviram G, Mabjeesh NA, Chen J et al. Extending the application of tubeless percutaneous nephrolithotomy. *Urology* 2007; 70(3): 412-417. DOI: 10.4103/0970-1591.60438
21. Nalbant I, Ozturk U, Sener NC, Dede O, Bayraktar AM, Imamoglu MA. The comparison of standard and tubeless percutaneous Nephrolithotomy procedures. *Int Braz J Urol*. 2012; 38: 795-800. DOI: 10.1590/1414-431X20154878
22. Zhong Q, Zheng C, Mo J, Piao Y, Zhou Y, Jiang Q. Tubeless versus standard percutaneous nephrolithotomy: A meta analysis. *BJU Int*. 2012;109:918-924. DOI: 10.1089/end.2012.0421
23. Shen P, Liu Y, Wang J. Nephrostomy tube-free versus nephrostomy tube for renal drainage after percutaneous nephrolithotomy: A systematic review and meta-analysis. *Urol Int*. 2012;88:298-306. DOI: 10.1159/000332151
24. Zhao FT, Hoenig DM, Smith AD, Okeke Z. A randomized controlled comparison of nephrostomy drainage vs ureteral stent following percutaneous nephrolithotomy using the Wisconsin StoneQOL. *Journal of endourology*. 2016 Dec 1;30(12):1275-84. DOI: 10.1089/end.2016.0235