

# Comparison of Tubeless Mini Percutaneous Nephrolithotomy and With Tubed Mini Percutaneous Nephrolithotomy for Kidney Stones: A Prospective Study

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## ABSTRACT

**Introduction:** Renal stone disease is a prevalent condition with a high recurrence rate, significantly impacting patients' quality of life. Different modalities of renal surgery are using globally. Mini Percutaneous nephrolithotomy (PCNL) is an effective treatment for renal stones. Due to the significant pain and morbidity after Percutaneous nephrolithotomy because of nephrostomy tubes, various modifications of Percutaneous nephrolithotomy are being performed. **Aims:** To compare the safety and efficacy of tubeless mini Percutaneous nephrolithotomy against tubed mini Percutaneous nephrolithotomy. **Methods:** It is prospective Hospital study conducted from July 2021 to December 2022 at Nobel Medical College. total 100 patients under inclusion criteria were divided into two groups: 50 in Group A (tubed mini Percutaneous nephrolithotomy) and 50 in Group B (tubeless mini Percutaneous nephrolithotomy) alternatively. The 2 groups were compared for Clavien Dindo grading of complications in Percutaneous nephrolithotomy analgesic requirements, hospital stay and time of operative procedure. Data was analysed by using the chi-square test for qualitative variables and the student t test for quantitative variables. A P value 0.05 was considered significant. Ethical clearance was obtained from institutional review committee. **Results:** The mean age was similar between groups (Group A: 35.44 years; Group B: 36.26 years). Complications were comparable, with postoperative pyrexia being the most common in both groups. However, Group B demonstrated significantly shorter hospital stays (80% discharged within 2 days vs. 30% in Group A) and lower analgesic requirements ( $p < 0.05$ ). **Conclusion:** Tubeless mini Percutaneous nephrolithotomy is a safe and effective alternative for selected patients, offering reduced hospital stays and lower analgesic needs compared to tubed mini Percutaneous nephrolithotomy.

**Keywords:** Renal stones, Tubed mini Percutaneous nephrolithotomy, Tubeless

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## INTRODUCTION

Renal stone disease is a persistent medical disorder with a recurrence rate of around 50%, and consequently has a significant influence on health-related quality of life.<sup>1</sup> Among different modalities of treatment, Percutaneous nephrolithotomy (PCNL) has become gold standard for management of simple and complex renal stones with success rates more than 90%.<sup>2,3</sup> Since the introduction of PCNL, different modifications have been made. Amongst which mini PCNL has been found to provide excellent surgical outcomes with reduced complications.<sup>4</sup> Initially, Chan and Jarrett reported a mini PCNL in 17 patients in whom the tract was dilated up to 13F.<sup>5</sup> These investigators

have reported that by using a mini PCNL, the morbidity was significantly reduced. Until 1997, when Bellman and co-workers reported tubeless PCNL, a nephrostomy tube had been placed routinely to reduce urinary extravasation, to provide tamponade to achieve haemostasis, and to deal with residual calculi, if any.<sup>6</sup> In mini PCNL, whether to place a nephrostomy tube or perform tubeless mini PCNL is an ongoing matter of debate. Recently, the study by Gupta DK et al in 2018 showed added advantage of significantly reduced postoperative pain, less analgesic requirement, shorter hospital stay, less postoperative blood loss mini tubeless PCNL in selected cases.<sup>7</sup> The rationale of the study is to evaluate efficacy and safety of tubeless mini PCNL in our setting.

**METHODS**

A total of 100 patients who underwent mini PCNL in Department of Urology, Nobel medical college Nepal, from July 2022 to December 2022 were included in this prospective study. Ethical clearance was obtained from Institutional Review Committee. Patient aged above 16 with solitary stone less than 3 cm were included in study. Those patients who needed more than one percutaneous tract or in whom significant intraoperative bleeding was observed or in whom excessive manipulation at the ureteropelvic junction was done or phad to be excluded from study. Out of 100 patients, Nephrostomy tube was kept in every alternate case. Patients who underwent standard mini PCNL with ureteric stent and Nephrostomy tube were grouped as Group A while patient who underwent mini tubeless mini PCNL with only ureteric stent were labelled as Group B.

In patients who needed bilateral PCNL, the priority to the kidney was given in following order: Infected obstructed, more symptomatic side, and technically easier side. Preoperatively, patients were evaluated by urinalysis, tests for renal function and ultrasonography, plain radiography of the kidneys, ureters, and bladder (KUB) and CT urography when needed. A prophylactic antibiotic was administered to all patients. The procedure was performed under subarachnoid block. With the patient in the lithotomy position, a ureteral access catheter was placed in the ipsilateral PCS. A 14 Fr Foley catheter was then placed and fixed to the ureteral access catheter with paper tape. The patient was then placed in the prone position, with all the pressure points well padded. The PCS was defined using retrograde contrast.

The Percutaneous approach to the stone was achieved, under fluoroscopic guidance, by a transpapillary puncture in the superior, middle, or lower calyx. A small incision was made at the selected puncture site. Once the needle was in the calix, clear urine could be aspirated for confirmation. Once the correct position of the needle was confirmed, a straight-tip .038-inch guidewire was passed in the PCS, and the tract was dilated over this guidewire up to 18Fr by telescoping metal dilators. An 18 Fr Amplatz sheath was secured in the tract. The stone was fragmented by a Pneumatic Lithoclast and removed by forceps or suction. In patients with staghorn calculi, fragmentation was started at the peripheral part of the stone to clear the passage. Stones that blocked the UPJ were broken last to prevent fragments passing into the ureter. After completion of the procedure, the ureteral access catheter was removed and placement of a Double-J tip catheter was done in all cases. Finally, a 16 Fr nephrostomy tube was placed in all patients in group A. The skin was closed by taking deep sutures after the procedure. Per operative and post-operative complications were recorded. Patient was rendered stone free once it was not visible in plain X-ray KUB done in post-operative day 1. Post-operative pain was assessed using the Visual Analogue Scale Score. For pain management, all patients were given intravenous dose of Paracetamol 1gm 8 hourly and Ketorolac as when required. Nephrostomy tubes were taken out on subsequent post operative days in Group A after clinical judgement. Post operative complications were graded as per CD grades (table I).

Patients were followed up to 1 month and ureteric stents were removed on POD30. Variables such as mean operative time, complications, drop in Hb, analgesic requirement, hospital stay were compared in two groups.

Grades	Complications
I	Fever, transient elevation of Creatinine, atelectasis, pleural effusion
II	Peri tubal urinary leak, blood transfusion, pneumonia
IIIa	Angioembolization, chest tube placement, retention due to clots, dislodgement of nephrostomy tube
IIIb	Collecting system perforation, urethral stricture
IVa	Bowel injury, Nephrectomy
IVb	Sepsis
V	Death

**Table I: Clavien Dindo grading of complications in PCNL<sup>8</sup>**

**Statistical analysis**

Statistical analysis was performed by using the chi-square test for qualitative variables and the student t test for quantitative variables. A P value 0.05 was considered significant.

**RESULTS**

Mean age of tubed mini PCNL (Group A) was 35.44yrs with M/F ratio of 1.1, whereas mean age was 36.26yrs in tubeless mini PCNL (group B) with M/F ratio of 1.2 (table II). Preoperative Hb and stone size were not significantly different in either group. Mean operative time, drop in haemoglobin and grades of complications in both groups were comparable (table III). In tubed mini PCNL group, post operative pyrexia 26% (13) was the most common complication followed by retention due to clots 8% (4), dislodgement of tube 8% (4), peritubal leak 6% (3), blood transfusion 4% (2). While in tubeless mini PCNL group, postoperative pyrexia was seen in 28% (14) followed by retention due to clots in 12%(6) and blood transfusion was required in 6% (3). However, hospital stay and analgesic requirements were significantly lower in Group B. Majority of patients 64% (32) required more than 60 mg of inj. Ketorolac in tubed mini PCNL group while only 20% (10)of patients in tubeless mini PCNL group required more than 60 mg of inj. Ketorolac. Similarly, 80% (40) of patients in tubeless mini PCNL group were discharged within 2 days while only 30% (15) of patients in tubed mini PCNL were discharged within 2 days which was statistically significant.

Parameters	Group A (tubed PCNL)	Group B (tubeless mini PCNL)	P value
Mean age (yrs)	35.44	36.26	>0.05
Gender (M/F ratio)	1.1	1.2	>0.05
Preoperative Hb (gm/dl)	12.89	13.28	>0.05
Stone size (mm)	20.38	23.62	>0.05

**Table II: Patient Demographic profile**

Parameters	Group A (tubed mini PCNL)	Group B (tubeless mini PCNL)	P value
Mean operative time (min)	25.5	24.6	>0.05
Analgesic requirement (ketorolac)			<0.05
<=60mg	18 (36%)	40 (80%)	
>60mg	32 (64%)	10 (20%)	
Complications			>0.05
Grade 1	13 (26%)	14 (28%)	
Grade 2	5 (10%)	3 (6%)	
Grade 3	8 (16%)	6 (12%)	
Grade 4	0	0	
Grade 5	0	0	
Hospital stays (days)			<0.05
0-2 days	15	40	
>2 days	35	10	

Table III: Results

## DISCUSSION

As the result suggests, tubeless mini PCNL is as safe and effective as tubed mini PCNL. We observed complications comparable in both groups. However analgesic requirement and hospital stay were significantly lower in tubeless PCNL group.

Similar study was conducted by Feng et al, in 2001 concluded the tubeless PCN population required less morphine use, had a decreased length of hospitalization, and had a smaller total procedural cost compared with the other two groups.<sup>9</sup>

Desai et al in 2004, performed meta-analysis of 15 RCTs involving 947 subjects comparing standard and tubeless PCNL and concluded postoperative pain, analgesia, hospital stay, and urine leakage was significantly reduced in tubeless PCNL group.<sup>10</sup> In respect of drop in haemoglobin, stone free, blood transfusion and pyrexia, tubeless PCNL group appeared to be equivalent with PCNL with tube group. Tubeless PCNL technology is associated with shorter hospitalization time, lower incidence of postoperative pain and less analgesia requirement after nephrolithotomy and they recommended tubeless PCNL to be used as a substitute for traditional PCNL with tube of the first-line treatment.

Furthermore, Aghamir and associates in 2004 reported the concept of totally tubeless PCNL i.e., PCNL without nephrostomy tube and ureteric stent.<sup>11</sup> They performed totally tubeless PCNL in 43 patients and compared it with tubed PCNL. The hospital stay was shorter and the major advantage for patients undergoing totally tubeless PCNL was the absence of stent-related flank pain and dysuria. However, we used an 6F DJ stent for drainage in both mini tubeless group and tubed mini PCNL group.

In a similar study, Shah and co-workers in 2005 reported the safety and effectiveness of simultaneous bilateral tubeless PCNL in 10 patients.<sup>12</sup> The investigators reported that the difference in the mean drop in haemoglobin, transfusion requirement, and complication rate was not statistically significant in patients undergoing tubeless PCNL in comparison with the tube placed group, but the mean hospital stay of the tubeless group was 20 hours less than that of the tubed PCNL group, although this was not significant.

Similarly in another article published by Merchant and co-workers in 2011, the patients in the tubeless group had a shorter hospital stay (3.7 vs. 5.8 days;  $P < 0.001$ ), and less postoperative pain at postoperative days 2 and 3 ( $P < 0.001$ ).<sup>13</sup> No significant difference in bleeding or leakage complications was observed. This study also supports the feasibility and safety of tubeless PCNL in a selected group of the patients, suggesting some intraoperative criteria to be considered when performing it.

In another study conducted by Lu et al in 2012 in mini PCNL, the two groups had similar age, maximum stone diameter and gender distribution.<sup>4</sup> There were no significant differences in operation time, presence of postoperative fever, stone clearance, and level of postoperative serum hemoglobin. However, the tubeless mini PCNL group had significantly shorter hospital stays (3 vs. 4 days,  $p = 0.032$ ) and significantly less back pain (5 patients vs. 14 patients,  $p = 0.003$ ) than the conventional mini PCNL group. Thus, reassuring safety and efficacy of tubeless PCNL even in mini PCNL.

In another study by Sebaey et al in 2016 where they compared tubeless and tubed PCNL, they found there was no statistically significant difference between the two groups for the mean operative time, mean postoperative drop in haemoglobin, mean postoperative urine leakage, mean hospital stay, and stone-free rate.<sup>14</sup> The mean (SD) postoperative dose of analgesia was statistically significantly higher in the tubed PCNL group compared with the Tubeless mini PCNL group, at 112.5 (48.03) versus 48.8 (43.5) mg, respectively. In study by Gupta DK et al in 2018, they found shorter hospital stay and lower analgesic requirement in tubeless mini PCNL.<sup>7</sup> However, they also observed significant drop in haemoglobin in tubed mini PCNL which was not seen in our study.

Hence, we can appreciate the fact that, even in mini PCNL, Tubeless PCNL has overtaken tubed PCNL with regards to safety and efficacy. Superior caliceal access gives the best clearance by a single tract, because the posterior superior calix provides direct access to the renal pelvis, upper pole calices, lower pole calices, and the upper ureter. The disadvantage is the associated pleural and chest complications. Because of the above complications, a nephrostomy tube is almost always recommended in supracostal superior caliceal tracts. In the study by Shah and co-workers, they reported the safety and effectiveness of tubeless PCNL in supracostal superior caliceal punctures.<sup>12</sup> In our study we performed supracostal puncture in 15 cases of tubeless mini PCNL group and 18 cases in tubed PCNL, however there were no thoracic complications in our study.

## LIMITATIONS

Since this is a single centre study, a multicentre study at a larger scale is required. The expenditure and complications of both interventions were not considered.

## CONCLUSION

Tubeless mini PCNL is safe and effective in a selected group of patients. It has significantly shorter hospital stay and less post-operative analgesic requirement in comparison with tubed mini PCNL.

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