



# Outcome of Standard Percutaneous Nephrolithotomy and Totally Tubeless Percutaneous Nephrolithotomy for Renal Calculi: A Comparative Study

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## Abstract

**Objective:** In standard PCNL usually placement of a double J stent and a nephrostomy tube is required. Several recent studies have reported the benefits of tubeless percutaneous nephrolithotomy (PCNL). Postoperatively, in standard PCNL patients have an indwelling ureteric stent placed, which is often associated with stent-related morbidity. We performed totally tubeless (without any stent or nephrostomy tube) PCNL. This study was conducted in the urology centre of Combined military Hospital, Dhaka, to evaluate the safety, effectiveness, and feasibility of totally tubeless PCNL and to compare with standard PCNL where both nephrostomy tube and double J stent were placed.

**Materials and Methods:** From January 2018 to June 2019, total 57 selected patients underwent standard or totally tubeless PCNL. In standard PCNL group, both D-J stent and nephrostomy tube were placed and Neither a nephrostomy tube nor a ureteral stent was placed in the totally tubeless PCNL group. We compared patient demographics and stone characteristics, operation time, length of hospital stay, analgesia requirements, stone-free rate, blood loss, change in creatinine, and postoperative complications between the standard and totally tubeless PCNL groups.

**Results:** There were no significant differences in preoperative patient characteristics, postoperative complications, and the stone-free rate between the two groups, but the totally tubeless PCNL group showed a shorter hospital stay and a lesser analgesic requirement compared with the standard PCNL group. Blood loss and change in serum creatinine level were not significantly different between the two groups.

**Keywords:** Renal calculi; Percutaneous nephrolithotomy; Stents, Tubeless.

**Conclusions:** Totally tubeless PCNL appears to be a safe and effective alternative for the management of renal stone in selected patients and is associated with a shorter length of hospital stay and less analgesic requirement.

## Introduction

Percutaneous nephrolithotomy (PCNL) is a minimally invasive surgical modality for the management of most renal stones. Technological advancements and refinements have contributed to further lowering the

morbidity associated with this procedure. Such refinements include the use of a smaller working sheath and nephroscope (mini PCNL)<sup>1</sup>, sealing of the percutaneous access tract with hemostatic agents<sup>2,3,4</sup>, substituting general anesthesia with regional blocks

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(ambulatory spinal tubeless PCNL)<sup>5</sup>, and avoidance of a nephrostomy tube (tubeless PCNL<sup>6,7</sup>). Tubeless PCNL has been known to be comparable to standard PCNL in hemorrhagic and postoperative complications. This modification in technique allows earlier discharge from the hospital, reduction in postoperative pain, and more rapid recovery. In most tubeless PCNL procedures, internal drainage is provided with a double-J stent or temporary ureteral catheter. In those cases, patients must undergo the uncomfortable procedure for removal of the stent. However, in totally tubeless PCNL, internal drainage is not provided. In the published data, there are few studies that include totally tubeless PCNL<sup>8,9,10</sup>. We performed totally tubeless PCNL without inserting ureteral stents in some patients since 2018.

The results have shown that totally tubeless PCNL does not differ significantly from standard PCNL in terms of complications and, moreover it is superior in terms of hospital stay and postoperative pain<sup>8,11-14</sup>. This aim of this study is to compare between totally tubeless and standard PCNL procedures as well as to identify cases appropriate for totally tubeless PCNL.

### Materials and methods

A Total, 65 patients were diagnosed with renal stones between January 2018 and June 2019. This was a prospective study. This study was conducted in the urology centre of Combined Military Hospital, Dhaka on 57 patients, with the exception of 8 patients. Eight cases were excluded for hemorrhage during surgery, the need for Redo PCNL owing to a large burden of remnant stones, and multiple tracts<sup>15,16</sup>. Purposive sampling was done in all admitted cases having renal stone. The patients were divided into two groups as standard PCNL and totally tubeless group. The inclusion criteria for standard PCNL group was renal stone size <4cm, main stone burden located in the renal pelvis or occupying two major calyces, residual stones following open stone surgery and patients without having significant co-morbidities. On the other hand, complex staghorn calculi, multiple stones located at different calyces, having significant co-morbidities were excluded from the study. The inclusion criteria for totally tubeless PCNL were stone size <2.5cm, single stone located in pelvis or a single major calyx, no previous surgery and no major co-morbidity. Patients having multiple stones, bilateral stones, combined with ureteric stones, had previous surgery and significant

co-morbidities were excluded. Ethical clearance was taken from hospital ethical committee prior to study. Standard PCNL and totally tubeless PCNL were performed on 30 and 27 patients respectively. At first, standard PCNL was performed then tubeless procedure was performed. The surgery was performed under general anesthesia. With the patient in the lithotomy position, 6-Fr ureteric catheter was inserted retrogradely. Following the placement of a 14-Fr Foley catheter, the patient was turned to prone position, and the kidney punctured under fluoroscopic guidance and the percutaneous tract was dilated. Then, the tract was secured by the placement of a 28-Fr Amplatz sheath, and the surgery was performed with a 26-Fr rigid nephroscope (Karl Storz,). The stone was fragmented with the use of pneumatic lithoclast and by Laser or both. After completion of the procedure, nephrostomy tube was placed in cases of standard PCNL and removed on second post operative day. In the case of totally tubeless PCNL, nephrostomy and ureteral stents were not placed. The surgical site was sutured after compression for about 10 minutes, and the patient was discharged from the hospital on 3<sup>rd</sup> post operative day. Patients who complained of pain after surgery were given intramuscular injections tramadol (50 mg) and Tab paracetamol as and when required.

A comparison was made between the two groups in clinical values, such as patients' characteristics, stone characteristics, operation time, transfusion rate, blood loss, changes in serum creatinine levels, length of hospital stay, analgesia requirements, stone-free rate, perioperative complications, and auxiliary treatment. Stone volume was calculated by using the formula of a sphere, with the mean radius of a major axis and a minor axis (stone volume =  $\frac{4}{3}\pi$  [major axis + minor axis / 4]<sup>3</sup>)<sup>17</sup>. Blood loss was calculated by using the formula of active blood loss<sup>18</sup>. The stone-free rate was defined as all cases in which the stone disappeared on the computed tomography or simple X-ray after PCNL. Statistical analyses were conducted by using SPSS Version 16. and chi square t test were used as appropriate. P-values of less than 0.05 were considered significant.

### Results

A total of 57 patients undergone PCNL for renal stones. 30 patients in the standard group and 27 patients in the totally tubeless group. There were no significant

statistical differences in patient age, gender distribution, body mass index, stone size, or stone laterality (Table I). The stone-free rates were 95% and 100% in the standard group and totally tubeless group respectively with no significant statistical difference. The mean operation time was slightly longer in the standard group (78.5 minutes) than in the totally tubeless group(40.7min),but there was no statistically significant difference. There was no significant difference between the two groups with regard to serum creatinine change or blood loss. However, the length of hospital stay in the totally tubeless group was significantly shorter than the standard group, and analgesic requirements were less in the totally tubeless group. with statistical significance (Table 3). There were no adjacent organ injuries during the operation in the two groups, and the postoperative complication rates were similar. The transfusion rates were 7% (2/30) and 4% (1/27) in the standard and totally tubeless groups respectively with no significant statistical difference. Postoperative hydronephrosis was 0% (0/30) and 7% (2/27) in the standard and totally tubeless groups respectively with no significant statistical difference (Table 4). There were 14 cases having residual stones in standard PCNL group, 5 cases managed by extracorporeal shock wave lithotripsy (ESWL) and remaining 9 cases managed by ureteroscopic stone removal (URS). There was no hydronephrosis after URS or retrograde ureteral stent insertion.

**Table I : Characteristics of patients**

Characteristic	Standard	Totally tubeless
Mean age in yrs (Mean±S.D) (yr)	52.54±12.03	58.32±13.78
Gender		
Male	17	15
Female	13	12
Mean Body mass index (kg/m2)	23.68±4.27	23.21±3.98

Values are presented as mean±SD

**Table II: Characteristics of stones**

Characteristic	Standard	Totally tubeless
Operation site		
Right	13	11
Left	17	16
Bilateral	00	00
Type of stones		
Renal stone	25	27
PUJ stone	05	00
Multiplicity		
Single	22	21
Multiple(<3)	08	06
Mean Stone volume (cm <sup>3</sup> ) (Mean±S.D)	13.583±8.252	17.360±8.866
Total	30	27

**Table III. Postoperative outcomes**

Characteristic	Standard	Total tubeless	p-value
Mean Operation time (min) (Mean±S.D)	78.5±48.3	128.7±40.2	0.06
Length of hospital stay (d)	8.25±3.24	3.92±1.56	<0.001
Analgesia requirement (mg)	69.54±40.22	30.27±18.36	<0.001
Stone-free rate (%)	73.3	77.8	0.725
ABL (ml) (Mean±S.D)	163±205	158±225	0.45
Mean Change of creatinine (mg/dl)	0.28±0.12	0.25±0.09	0.351

Values are presented as mean ±SD.

**Table IV : Complications between standard percutaneous (PCNL) and totally tubeless PCNL**

Complications	Standard (n=30)	Total tubeless (n=27)	p-value
Hydronephrosis	0 (0)	2 (7)	0.091
Febrile UTI	1 (3)	1 (4)	1.00

Values are presented as number (%).UTI, urinary tract infection.

## Discussion

PCNL has now established as a standard procedure for the management of large renal stones<sup>19-22</sup>. Traditionally, placement of nephrostomy tube drainage after PCNL has been advocated for several reasons<sup>13</sup>. It provides reliable urinary drainage and hemostatic tamponade to the fresh percutaneous renal tract. Despite these obvious and important advantages, nephrostomy tubes especially in the vicinity of a rib, are thought to contribute to postoperative pain and morbidity. Kader et al<sup>22</sup> reported that hospitalization could be curtailed and the use of analgesics could be reduced by applying a small-diameter nephrostomy tube after PCNL. since Wickham et al.<sup>12</sup> reported first the result of tubeless PCNL in 1984. Thereafter, Bellman et al.<sup>6</sup> challenged the necessity of placing a nephrostomy tube after a PCNL procedure in 50 patients. In that study, the nephrostomy tube was replaced with a double-J stent. The hospitalization time, analgesic requirements, time to return to normal activities, and cost were significantly lower with this technique. The authors concluded that tubeless PCNL is a safe procedure that offers numerous advantages over the routine placement of a nephrostomy tube. After this report, tubeless PCNL became popular in many centres. Likewise, Bdesha et al<sup>24</sup> reported that hospitalization was curtailed in 40 patients on whom nephrostomy tube placements were not performed. Crook randomly performed standard PCNL and totally tubeless PCNL on 50 patients with renal stones and reported that there were no significant intergroup differences in hemorrhage, infection, blood transfusion, or clinical values, but that the length of hospital stay was shorter in the totally tubeless PCNL group than in the standard PCNL group<sup>14</sup>.

In our study the stone free rate was 95% in the standard PCNL group and 100% in the totally tubeless group. We have managed 14 residual calculi patients with ESWL and URS. Perioperative blood loss, transfusion, and the complication rate in the totally tubeless group were also comparable to the standard PNL group. The length of hospitalization and analgesic requirements were significantly lower in the totally tubeless group. The procedure for removal of the stent was not required in the totally tubeless group as opposed to the standard group. In totally tubeless PCNL the additional postoperative cost was also less and discomfort associated with removal of the stent was also less. The possible limitation of the tubeless procedure is that it

may require secondary procedures for the treatment of residual stones. However, alternatively, residual calculi can be safely managed by ESWL or retrograde intrarenal surgery by use of flexible ureteroscopy. We have managed 05 cases of residual calculi with ESWL, and the other 09 patients were managed by URS. The most common complications of PCNL are bleeding and urinary extravasation. Nephrostomy tube placement at the end of the standard PCNL procedure is thought to prevent these complications. A concern of many urologists with the tubeless technique is the lack of a tamponade effect in the nephrostomy tract. Despite this, tubeless PCNL retains its role in selected patients with renal stones who are undergoing uncomplicated PCNL. However, a nephrostomy tube should be placed if serious disruption or significant laceration of the collecting system is noted. Also, if significant intrarenal bleeding is found and endoscopic visualization is impossible, a nephrostomy tube should be inserted. The tube is then clamped, allowing the pelvicaliceal system to be tamponaded.

With the intent of reducing postoperative discomfort and pain, hospital stay, and cost, the totally tubeless PCNL procedure has gained its popularity in recent years. Appropriate patients should be selected for totally tubeless PCNL. We believe that this procedure will be acceptable only when safety has not been sacrificed. We believe that uncomplicated percutaneous nephrolithotripsy can be performed without leaving a nephrostomy tube or ureteral stent. We also believe that the major advantage for patients undergoing totally tubeless PCNL is the absence of stent-related flank pain and dysuria.

## Conclusions

The results of the present study showed that totally tubeless PCNL did not differ significantly from standard PCNL in the consideration of effectiveness and safety and that it curtailed length of hospitalization and reduced the analgesia requirement. A long term prospective and larger-scale study may be needed to validate the result of this study. Totally tubeless PCNL may be an alternative for the management of renal stones in selected patient.

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