RESEARCH

# A COMPARATIVE STUDY OF PCNL WITH NEPHROSTOMY TUBE VS TUBELESS PCNL

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## Abstract

**Background:** The role of percutaneous nephrostomy tube for drainage after percutaneous nephrolithotomy (PCNL) procedure has come under scrutiny in recent years. The procedure has been modified to use of small diameter tubes and tubeless PCNL. The aim is to assess the efficacy, safety, and morbidity of tubeless percutaneous nephrolithotomy (PCNL) and compare it with conventional PCNL. **Materials and Methods:** A prospective randomized study conducted at our hospital comparing the outcome, morbidity between standard and tubeless PCNL. All cases of renal calculi who underwent percutaneous Nephrolithotomy, Renal calculi include calyceal calculi, pelvic calculi, upper ureteric caluculi or any of the combination of above are included in study. Case selection criteria were adequately matched and postoperative outcome was recorded in same way in both groups. **Result:** In our study total number of operated patients is 102; in group 1, 54 patients undergone conventional PCNL with nephrostomy tube & DJ stent, with mean age of 31.4 years, with mean stone size is 3.1 cm. In group 2 ,48 patients undergone tubeless PCNL, with mean age of 33.9 yrs, with mean stone size is 2.8 cm. Mean operative time is 40 mins in group 1, 31 mins in group 2. Mean operative time is 40 mins in group 1, 31 mins in group 2. Mean hospital stay is 6.9 days in group 1, 4.1 days in group 2. Mean analgesic requirement is 150 mg of diclofenac in in group 1, 85 mg in group 2. decrease in haemoglobin is almost same in two groups. When compared to standard PCNL, tubeless group advantages in terms of postoperative pain, morbidity, hospital stay, and period of convalescence which is statistically significant. **Conclusion:** Tubeless PCNL" decreases patient hospital stay and analgesic requirement there by increasing the chance of labelling PCNL as day care surgery.

## INTRODUCTION

Urinary stone disease is one of the oldest disease known to mankind. It was noticed in egyptian mummies. The incidence and characteristics of nephrolithiasis reflects a wide geographic variation and stones occurs at all ages without a clear gender predominance. Despite disparancy between hemispheres, nephrolithiasis is increasing in occurrence globally, likely reflecting westernized lifestyle and dietary changes, including higher salt intake with processed foods and decreased water consumption. Nephrolithiasis continues to be a major problem in India. It is more prevalent in northern states than in southern states of India.

In Telangana, its incidence is about 20% and in our hospital urolithiasis incidence is about 70% at our outpatient department, out of which pediatric incidence is about 8- 10%. With increasing incidence rates and lifelong risk of stone recurrence, minimal invasive endoscopic techniques are now the preferred treatment modality in who are prone to stone formation and who previously would be treated with multiple open procedures. PCNL (Percutaneous Nephrolithotomy) is an established procedure used primarily to treat patients with complex renal calculi and various other endourological indications. It is a safe and less invasive approach than open surgery in patients with complete or partial staghorn calculi.[1] In 1970's and early 1980's most renal, ureteral stones were removed by opensurgery, this is now a rare event. Moreover it has advantages of lower Morbidity, shorter operative time, shorter hospital stay and earlier return to Work.

Since the first description of percutaneous nephrolithotomy, it has become an integral part of

renal stone management.[2] The placement of percutaneous tube after the completion of the procedure has been considered standard practice to aid in hemostasis, to ensure proper drainage of urine and to facilitate easy access in case repeat PCNL is required.[3] Despite these apparent advantages, nephrostomy tube has been implicated in post-operative discomfort and morbidity. To reduce discomfort and tube related morbidity, modifications have been made like the use of smaller nephrostomy tube or avoiding it completely after an uncomplicated procedure with complete stone clearance and placing double-J stent as "tubeless PCNL".[4,5] we aim to assess the efficacy, safety, and morbidity of tubeless percutaneous nephrolithotomy (PCNL) and compare it with conventional PCNL.

## MATERIALS AND METHODS

A prospective randomized study conducted at our hospital comparing the outcome, morbidity between standard and tubeless PCNL.

**Inclusion Criteria:** All cases of renal calculi who underwent percutaneous Nephrolithotomy, Renal calculi include calyceal calculi, pelvic calculi, upper ureteric caluculi or any of the combination of above.

**Exclusion Criteria:** Patients who needed more than two percutaneous tracts; or patients who had a residual stone after the procedure, solitary kidney, Congenital anomalies- Horse shoe kidney, Mal rotated Kidney, Duplex moiety& Ectopic kidney, with bilateral renal calculi, Staghorn calculi. patients with pelvis injury& extravasation during surgery, Patients undergone Re-look PCNL for residual stones Between august 2012 and Dec 2014, 102 patients undergoing PCNL prospectively evaluated in 2 groups. One group patients undergone PCNL with nephrostomy placement (standard PCNL). Second group of patients undergone PCNL without nephrostomy tube and D-J stent (TUBELESS PCNL). Case selection criteria were adequately matched and postoperative outcome was recorded in same way in both groups.

Group 1- 54 patients in underwent PCNL with nephrostomy drainage.

Group 2 - 48 patients underwent PCNL without nephrostomy drainage and D.J-stent.

Of 102 patients 2 patients were presented with acute renal failure secondary to obstructive uropathy, an intial D.J stenting was done for improvement of renal function and PCNL was subsequently performed.

Two groups were compared in regard to total stone size, Operative time, Estimated blood loss (decrease in haemoglobin measured from preoperative and postoperative haemoglobin), Hospital stay, postoperative pain, analgesic requirement, duration of post-operative haematuria and complications like urinary leak, perinephric urinoma formation.

Preoperative Investigations like complete urine analysis, urine culture and sensitivity, complete hemogram, renal parameters, X-ray KUB, ultra sound KUB region, IVU and non-contrast CT scan KUB region for radiolucent calculi were done.

A standard technique of percutaneous nephrolithotomy was used. All procedures were performed with the patient under general anesthesia in prone position. After retrograde ureteral catheterisation, intial percutaneous access was obtained after injecting contrast retrogradely. The tract was dilated under fluoroscopic control using polytetrafluroethylene dilators, and an amplatz sheath of 28 to 30 Fr was placed depending on degree of dilation of selected calycx and the bulk of stone to be retrieved. Stone disintegration was done using a pneumatic lithotripter (swiss lithoclast).

After completion of the procedure D.J stent was placed over the guidewire across the ureteropelvic junction .Once it was ensured that tract bleeding was not alarming, in group 1 patients A 14 or16 no.foleys catheter is placed in pelvicalyceal system through the amplatz sheath under fluoroscopic guidance as nephrostomy drainage and amplatz sheath is removed . In group 2 patients after completion of the procedure amplatz sheath is removed and the Skin incison was closed with single 2-0 silk mattress suture.

Post-operative investigations as Hemogram, Renal parameters, X-ray KUB - done in all the patients to assess the stone clearance before removing the nephrostomy, Ultra sound KUB region - for perinephric collection and to assess the stone clearance and Non contrast CT scan KUB region for radiolucent calculi

The D.J stent was removed as an outpatient procedure after 4-6 wks from surgery

The data will be entered into a Microsoft Excel (Redmond, WA) spreadsheet. Statistical analysis will be performed using SPSS software. After compiling all the data, statistical analysis will be performed to evaluate the outcomes. Chi- square test will be used for comparing categorical variables. P value <0.05 will be considered statistically significant.

## RESULTS

Preoperative characteristics and Post operative outcomes are analysed between two group of patients.

In our study total number of operated patients is 102; in group 1, 54 patients undergone conventional PCNL with nephrostomy tube & DJ stent, with mean age of 31.4 years. In group 2, 48 patients undergone tubeles PCNL, with mean age of 33.9 yrs. Males are most commonly effect and right side is most common in both groups which is ingnificant on comaprision. [Table 2]

**Table 1: Demographic details in present study**

| Age group | Group 1 | Group 2 | Total |
|---|---|---|---|
| 0-14 | 10 | 7 | 17 |
| 15 + | 44 | 41 | 85 |


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| | | | |
|---|---|---|---|
| Total | 54 | 48 | 102 |
| Gender | | | |
| Male | 32 | 28 | 60 |
| Female | 22 | 20 | 42 |
| Laterality of stones | | | |
| Right | 34 | 30 | 64 |
| Left | 20 | 18 | 38 |

**Table 2: Type and site of stones in both the groups**

| Stone types | Group 1 | Group 2 | Total |
|---|---|---|---|
| Small stone (< 2cm) | 12 | 20 | 32 |
| Large Stone (> 2 cm) | 42 | 28 | 70 |
| Total | 54 | 48 | 102 |
| Site | | | |
| Calyceal | 17 | 16 | 33 |
| Pelvic | 30 | 28 | 58 |
| Pelvic + calyceal | 7 | 0 | 7 |
| Upper ureter | 0 | 4 | 4 |

In our study total number of operated patients is 102; in group 1, 54 patients undergone conventional PCNL with nephrostomy tube & DJ stent with mean stone size is 3.1 cm. In group 2, 48 patients undergone tubeles PCNL with mean stone size is 2.8 cm. Pelvic site is most common area were stone is found.

**Table 3: Operative and post-operative out come in between groups**

| | Group 1 | Group 2 |
|---|---|---|
| Mean operative time | 40 mins | 31 mins |
| Mean days hospital stay | 6.9 days | 4.1 days |
| Mean analgesic requirement (diclofenac in mg) | 150 mg | 85 mg |
| Decrease in haemoglobin | 0.6 | 0.5 |

Mean operative time is 40 mins in group 1, 31 mins in group 2. Mean hospital stay is 6.9 days in group 1, 4.1 days in group 2. Mean analgesic requirement is 150 mg of diclofenac in in group 1, 85 mg in group 2. decrease in haemoglobin is almost same in two groups.

**Post-Operative Follow Up**

On the 1st Post-operative day: X-Ray KUB & Ultra Sound KUB Region done in all the patients to assess the stone clearance before removing the nephrostomy, All cases in this study are single stage PCNL.

**Table 4: Post-operative complications in our study**

| Complications | Number of patients | |
|---|---|---|
| | Group 1 | Group 2 |
| Fever | 2 | 3 |
| Hematuria | 3 | 6 |
| Blood Transfusion | 1 | 2 |
| Perinephric hematoma | 0 | 2 |
| Ileus | 1 | 0 |
| Sepsis | 0 | 0 |

Hematuria is seen in group-2 more than that of group-1.

When compared to standard PCNL, tubeless group advantages in terms of postoperative pain, morbidity, hospital stay, and period of convalescence which is statistically significant.

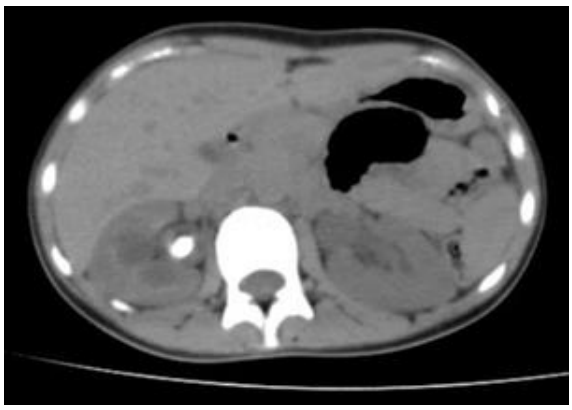

**Figure 1: Pre-operative plain CT scan abdomen showing single, 1.5 cm calculus in right renal pelvis with hydronephrosis.**


**Figure 2: post-operative X ray KUB showing right DJ stent insitu in a patient who undergone right TUBELESS PCNL. (no nephrostomy tube).**

## DISCUSSION

Since the first description of percutaneous nephrolithotomy, it has become an integral part of renal stone management. The placement of percutaneous tube after the completion of the procedure has been considered standard practice to aid in hemostasis, to ensure proper drainage of urine and to facilitate easy access in case repeat PCNL is required. Despite these apparent advantages, nephrostomy tube has been implicated in post-operative discomfort and morbidity. To reduce discomfort and tube related morbidity, modifications have been made like the use of smaller nephrostomy tube or avoiding it completely after an uncomplicated procedure with complete stone clearance with double-J stent as tubless PCNL. Because there is still apprehension without using a DJ stent, few have tried a totally tubeless PCNL.[6]

In the largest prospective randomized trial published yet, MS agarwal et al4 in 2010, 202 patients treated at their center, tubeless PCNL (101 patients) was


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found to have significant advantages over standard PCNL (101 patients) in terms of postoperative pain, morbidity, hospital stay, and period of convalescence. The average visual analogue scale (VAS) pain score on postoperative day 1 for tubeless group patients was 31 mm compared with 59 mm in standard PCNL (P <0.01). The difference in average blood loss and urinary infection for the two groups was not statistically significant. The incidence of urinary leakage from the nephrostomy site was significantly less for the tubeless group (0/101), compared with the standard PNL group (7/101). The average hospital stay in the tubeless group was less than 24 h (21.8 ± 3.9 h) and was significantly shorter than that of the standard PCNL group (54.2 ± 5 h) (P < 0.01).

Tubeless group patients took 5-7 days for complete convalescence, whereas standard PCNL patients recovered in 8-10 days. No long-term sequelae were noticed in the median follow-up period of 18 months in any patient. Advances in surgical instruments, radiological imaging, and urologist's skills have made PCNL surgery easier, safer, and more effective in the management of renal stones. Clayman et al.[7] reported that there was no significant difference in the size of the resultant renal scar when comparing renal parenchymal damage associated with 24 F and 36 F nephrostomy tracts. Traxer et al.[8] found that renal parenchymal damage resulting from the creation of a nephrostomy tract is small compared to overall renal volume regardless of the size of the nephrostomy tract, and there is no advantage to using a small-access sheath based on renal scarring alone

Goh and Wolf reported on 10 of 26 renal units treated with an internal stent or externalized ureteral catheter placed for 1 or 2 days after PNL.[9] Exclusion criteria included stone burden larger than 3 cm, more than one access, obstructive renal anatomy, need for a second-look procedure, and significant bleeding or perforation during the procedure. They reported a reduction in hospital stay in the tubeless group with morbidity comparable to that of patients with standard nephrostomy tube drainage. However, 4-mm residual fragments were noted in two patients.

Shah et al,[10] compared the outcome of tubeless PCNL with small-bore nephrostomy drainage after PCNL. In this study, patients undergoing tubeless PCNL experienced significantly less postoperative pain, needed less analgesia, and were discharged 9 h earlier than patients in the other group. However, 39.4% of patients in the tubeless group had bothersome stent-related symptoms, of which 61.5% needed analgesics and/or antispasmodic agents.

Limb and Bellman (2002),[11] described 112 patients undergoing tubeless PNL; strict criteria were used to select these patients, who had a mean stone burden of 3.30 cm2. They reported a 93% stone-free rate and a mean length of hospitalization of 1.56 days; 7% required subsequent SWL ancillary treatments. These findings have recently been reproduced in similar, albeit smaller, studies (Aghamir et al, 2004 ; Karami and Gholamrezaie, 2004; Patel and Abubacker, 2004)

Feng and associates (2001),[12] performed a randomized controlled study comparing standard PNL, mini-PNL, and tubeless PNL. They found no advantage for the mini-PNL over the standard PNL and also found that the tubeless cohort experienced the least morbidity. Lojanapiwat and colleagues,[13] (2001) demonstrated a reduction in patient discomfort in patients who underwent an uncomplicated tubeless PCNL with an externalized 6-Fr ureteral stent for 48 hours.

Desai and associates (2004),[14] also performed a prospective randomized study of patients undergoing PNL with conventional large-bore nephrostomy drainage, small-bore nephrostomy drainage, or no nephrostomy drainage. The authors reported that tubeless PNL was associated with the least pain. However, they did not comment on the need for ancillary procedures or the stone-free status of the patients.

In the study of Mishra S, Sabnis et al,[14] 22 patients were prospectively randomized equally into two groups, group 1 (early nephrostomy removal) or group 2 (tubeless) during a 1-month study period. Inclusion criteria for the study were: a simple stone of <3 cm, no significant bleeding, no perforation, single-tract access and 'on-table' complete stone clearance. In group 1, a 20 F nephrostomy, 6 F retrograde ureteric catheter and a Foley catheter were used, while in group 2 only a 6 F retrograde ureteric catheter and Foley catheter were placed at the end of the procedure. Computed tomography (CT) with no contrast medium was done on the first morning after surgery before removing all catheters/tubes, and patients discharged subsequently. The variables assessed were stone clearance, hospital stay, analgesic requirement, postoperative complications and auxiliary procedures.

The mean (SD) stone bulk was similar between the groups, at 2737 (946.9) and 2934.2 (2090.7) µL, respectively. Despite an on-table complete clearance, clearance assessed by CT was nine of 11 vs eight of 11 in groups 1 and 2, respectively. CT showed a 6 mm stone in one patient in group 1, while the remaining patients had stones of <4 mm. The mean (SD) analgesic requirement, haemoglobin decrease, urine leak and hospital stay in the two groups were 72.7 (51.8) vs 68.2 (46.2) mg of tramadol (P= 0.25), 1.6 (0.7) vs 1.6 (0.9) g/dL (P= 0.39), 13.9 (6.3) vs 7.1 (14.2) h (P= 0.018) and 72.8 (2.1) vs 70.2 (18.5) h (P= 0.09), respectively. Complications noted were early haematuria in none vs three (P= 0.21), urinoma none vs one, and fever in two vs one, respectively; one patient in group 1 required a check nephroscopy for a residual fragment. Overall clearance including re-treatment was 10/11 vs eight of 11 (P= 0.009), respectively.

Early tube removal after PCNL results in an equivalent analgesic requirement, decrease in haemoglobin and hospital stay as tubeless PCNL. It has a significantly lower incidence of early haematuria, better clearance rates and preserves the option of check nephroscopy. It can be considered as


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an accepted standard of care, with the preserved advantages of tubeless PCNL.

In the study of Yates DR, Safdar et al,[15] between January 2004 and October 2006, they performed 55 standard (with nephrostomy tube) PCNLs (Group 1). From October 2006 onwards, have performed 46 consecutive 'nephrostomy-free' PCNLs (JJ stent inserted), independent of patient and stone factors (Group 2). We have compared the two groups in terms of length of hospital stay (LOS), analgesia requirements, transfusion rates, haemoglobin (Hb) decrease and immediate, early and late complications.

'Nephrostomy-free' PCNL significantly reduced the length of hospital stay (2.8 vs 5.1 days; $P < 0.001$), morphine-based analgesia requirements (23% no morphine required vs 2.8%; $P < 0.001$), transfusion rate (2.5% vs 7%; $P < 0.01$) and mean Hb decrease (1.89 g/dl vs 2.25 g/dl; $P > 0.05$). Overall, no patient experienced a serious complication. All attempted 'nephrostomy-free' PCNLs were completed (stone clearance 95%) and no patient needed an unplanned nephrostomy. Only 5% in Group 2 needed their ureteric JJ stent removing earlier than planned secondary to pain. Both groups were comparable in terms of immediate, early and late complications, though three patients in Group 1 developed chronic loin pain and one patient in the 'nephrostomy- free' group developed a delayed perirenal haematoma.

'Nephrostomy-free' percutaneous nephrolithotomy is a safe, effective and feasible procedure independent of patient and stone factors. It decreases the length of hospital stay, the pain experienced and the need for morphine-based analgesia; we feel it should be the standard of care for patients undergoing a PCNL

Wahib Isac, Emad et al,[16] comapared the outcome of tubelees pcnl for expanded indications. A retrospective review of the charts of patients who underwent PCNL at their institute was performed. Patients were assigned to one endourologist who routinely performed tubeless PCNL and to a second endourologist who routinely left a small-bore pigtail nephrostomy. Preoperative demographics operative and postoperative outcomes were compared.

Out of 159 patients included, 83 patients had tubeless PCNL while 76 patients had standard PCNL. There was no difference between groups regarding age, gender, ASA score, number, maximum diameter of stones, number of calyces involved, stone density (HU), laterality and use of preoperative narcotics. While staghorn stones were more common in patients who underwent standard PCNL ($p = 0.008$). Tubeless patients had less number of access tracts ($p \leq 0.001$), shorter hospital stay (1.7 vs. 3.0 days, $p = 0.001$) when compared to standard PCNL group. Multivariable analysis controlling for confounding factors including staghorn calculi and number of accesses confirmed that tubeless PCNL was associated with shorter hospital stay and less postoperative pain. There was no significant difference in complication rates between the two groups.

Their report confirms the previous reports of shorter hospital stay, less pain and analgesia as compared to standard PCNL, and establishes its safety irrespective of bleeding, perforation, extravasation or other intraoperative issues that have previously been utilized as exclusionary criteria for this approach

According to yew, and bellman,[17] a tubeless approach to any renal surgery should only be attempted in select uncomplicated cases. The exclusion criteria should include operative times longer than 2 hours, three or more percutaneous accesses, significant perforations or disruptions of the collecting system, significant residual stone burden, and significant bleeding. In these instances, and when second-look nephroscopy is desired, traditional external nephrostomy tube drainage should be used. In their select cases, in lieu of the standard double-J stent, we place a 7F/3F tail-stent with the string attached exiting the urethral meatus. Care is taken in correct placement to avoid having the tail of the stent exiting the meatus. In their initial 4 patients, tail-stents were successfully placed. The pain scores were low and stent symptoms appeared minimal. All stents were easily removed without the use of cystoscopy. Fluoroscopic visualization of the 3F tail is poor, and positioning of the tail can be difficult. Nevertheless, this modification appears feasible and safe with excellent patient satisfaction.

According to metaanalysis conducted by Wrag, Zhao et al,[18] a review of the English language literature on studies involving randomized controlled trials for PCNL was done. The studies chosen to be included in our review compared tubeless PCNL with standard PCNL and described the advantages of each in the outcomes. Two reviewers independently screened the studies for eligibility, evaluated their quality and extracted the data from the eligible studies, with confirmation by cross-checking. Data were processed using RevMan 5.0.

Seven studies involving 1365 cases met the inclusion criteria, and these were included in the meta-analysis. The patients' baseline characteristics were comparable in all the studies. By comparing the four common characteristics, we found no difference in efficacy between the two surgical approaches in terms of mean operation duration and postoperative haematocrit change ($P > 0.05$). We found that the mean analgesic requirement and number of days in hospital were lower for tubeless PCNL ($P < 0.05$).

Their results show that tubeless PCNL is a good option in non-complicated cases, with the advantages of reduced hospital stay and little need for postoperative analgesia. There was no difference between the two approaches in operation duration, or haematocrit change after surgery.

According to a systematic review of standared versus tubeless PCNL by Amer, Ahmed et al,[19] The Medline, EMBASE, PsycINFO, Cochrane and DARE databases were searched from 1997 to February 2011. Comparative studies evaluating outcomes from standard versus tubeless PCNL were included. Primary outcome measures were post-


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operative pain scoring, analgesic requirements, duration of hospitalisation/convalescence, operation time, major/minor complications and stone- free rates.

Twenty-four studies were included (11 randomised control trials and 13 retrospective or prospective studies). Levels of pain recorded, analgesic requirements, duration of inpatient stay and convalescence time were all significantly reduced in the tubeless PCNL group. Cost was reduced in two studies. Morbidity was not significantly different between the groups. There was no significant difference between groups regarding stone-free status.

This systematic review has demonstrated that tubeless PCNL is a viable alternative to tubed PCNL in uncomplicated cases. Benefits are as described above. There is no evidence suggesting that patient safety is compromised by the absence of post-operative nephrostomy. The tubeless method has been reported in challenging cases such as stag-horn stones, horseshoe or ectopic kidneys. Promising outcomes have been demonstrated in elderly patients and when clinical needs demand a supracostal approach.

Mikhail and coworkers (2003) retrospectively compared outcomes after the use of fibrin glue (Tissel Vapor Heated Fibrin Sealant, Baxter Healthcare) in the nephrostomy tract after tubeless PCNL. Differences in the hematocrit drop between the experimental and control groups were not statistically different. Although the use of fibrin glue was demonstrated to be safe in this study, a definitive clinical benefit was not demonstrated.

In contrast, a non comparative study by Noller and colleagues (2004),[20] assessed the ability of fibrin sealant to facilitate tubeless PCNL in 10 renal units with an average stone burden of 3.37 cm2. The goal was to prevent urinary extravasation and promote early hospital discharge without the inconvenience of urinary leak from the access site after antegrade placement of a ureteral stent. All patients in this study were discharged on postoperative day 1 without evidence of soaked dressings or extravasation on postoperative CT.

Similarly, in a small pilot study (n = 2), injection of a gelatin matrix hemostatic sealant into the nephrostomy tract after tubeless PCNL demonstrated value in providing immediate and effective hemostasis. It is clear tubeless PCNL is safe and feasible. However, additional clinical studies are needed to prove a definitive clinical benefit after percutaneous renal surgery.

In our centre, we have operated a total number of 102 patients and in group 1, 54 patients undergone conventional PCNL with nephrostomy tube & DJ stent, with mean age of 31.4 years, with mean stone size is 3.1 cm. In group 2,48 patients undergone tubeles PCNL, with mean age of 33.9 yrs, with mean stone size is 2.8 cm.

Mean operative time is 40 mins in group 1, 31 mins in group 2. Mean hospital stay is 6.9 days in group 1, 4.1 days in group 2. Mean analgesic requirement is 150 mg of diclofenac in in group 1, 85 mg in group 2. decrease in haemoglobin is almost same in two groups.

All the patients were followed post operatively with the following protocol. First POD – X-ray KUB and ultra sound KUB region done in all patients to assess stone clearance. When there was no residual stone, nephrostomy tube was removed. Patient was stone free at the time of discharge.

When study at our center compared with study of MS agarwal, desai, feng and sing number of patients treated in tubeless manner are considerabilly higher in our group(except for agarwal group),[21] mean stone size is comparable, unlike in sigh group diathermy was not used in our study, mean hospital stay 4.1days in our study is slightly higher than others, stone clearance of 100% is comparable to other studies.

When compared to bellman, delnay, limb and bellman, goh and wolf, number of patients treated in tubeless manner are considerabilly higher in our group (except for limb and bellman group, comparable to bellman), mean stone size is comparable, unlike goh and wolf, external ureteric catheter is not used in our study. mean hospital stay 4.1days in our study is slightly higher than others, stone clearance of 100% is comparable to other studies.

When compared to Lozanapiwat, Karami, Gupta, Yew And Bellman,[22] number of patients treated in tubeless manner in our study was lower than gupta, karami group, higher than yew and bellman, lozanpiwat et al. mean stone size is comparable, unlike Lozanapiwat, Karami, Gupta's study , external ureteric catheter is not used in our study. Unlike yew and bellman, tail-stent is not used in our study. mean hospital stay 4.1days in our study is slightly higher than others, stone clearance of 100% is comparable to other studies.

Within our study when compared to standard pcnl, tubeless group advantages in terms of postoperative pain, morbidity, hospital stay, and period of convalescence and complications are comparable.

Since we could clear almost the stones with the PCNL alone, we did not find any necessity for sandwich therapy using SWL technique. Our stone clearance rates almost similar to all other series. External ureteral catheters, tail-stents not used in our group, because JJ stents were used. Slightly higher postop duration in our study probably due to intial experience, not using additional hemostasis procedures like diathermy, small sample size when compared to some studies. Our success rates and complication rates were almost same as that of other series reported in Tables below.


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**Table 5: Statistical analysis between group 1 and group 2 patients and with other studies.**

| | Study at osmania hospital (2012-2014) | | Study at AIIMS, Newdelhi (2000-2007),[23] | | Study by T.J.Crook-published paper 2008 (Journal of urology),[24] | |
|---|---|---|---|---|---|---|
| | **Group 1** | **Group 2** | **Group 1** | **Group 2** | **Group 1** | **Group 2** |
| No.patients | 54 | 48 | 185 | 135 | 25 | 25 |
| Mean pt age | 31.4 yrs | 33.9 yrs | 32.6 | 34-4 | 33.5 yrs | 30.2 yrs |
| No.stone side: Right Left | 34 20 | 30 18 | | | | |
| No. male/ female | 32/22 | 28/20 | 100/85 | 85/50 | | |
| Average stone size | 3.1 cm | 2.8 | 3.6 | 3.2 cms | 2.16 cms | 1.75 cms |
| No stone site: Calyceal<br>Pelvic Pelvic+ calyceal<br>Upper ureter | 17<br>30<br>7 | 16<br>28<br>4 | | | | |
| Mean operative time | 40 mins | 31 mins | N0 statistical difference | | N0 statistical difference | |
| Mean days hospital stay | 6.9 days | 4.1 days | 2.9 days | 1.8 days | 3.4 days | 2.3 days |
| Mean analgesic requirement (diclofenac in mg) | 150 mg | 85 mg | 210 mg | 68 mg | 150 mg | 58 mg |
| Decrease in haemoglobin | 0.6 | 0.5 | 0.4 | 0.5 | 2.03 | 1.18 |

**Table 6: Comparision of group 2(tubeless) of present study at osmania hospital with other prospective randomised studies.**

| | Desai et al,[14] | Feng et al,[12] | Singh et al,[21] | Present study |
|---|---|---|---|---|
| Number of tubeless / renal unit | 10 | 8 | 30 | 48 |
| Mean stone burden | 250 mm2 | 4.4 cm3 | 4.4 cm3 | 2.8 cm2 |
| Postoperative drainage | JJs | JJs | JJs | JJs |
| Additional hemostasis used | Nil | Nil | diathermy | Nil |
| Analgesia requirement | 8.5 mg D | 5.25 mg M | 6 mg M, 415 mg D | 85 mg D |
| Average Hb drop (g/dl) | 4.2g% | -- | 1.2% | 0.5 |
| Stone-free rates (%) | -- | 85.7 | 100 | 100 |
| Length of stay | 3.4days | 1,9days | 2.1days | 4.1 days |
| Complications | -- | -- | UTI (2), Stent dysuria (2) | Hematuria(6) , transfusion(2),fever(3), perinephric hematoma(2) |

N-Number of tubeless patients/renal unit; JJs-Double-J stent; MP- Meperadine; M-Morphine sulphate; D-Diclofenac sodium

Hematuria (6), transfusion (2), fever (3), perinephric hematoma (2) (N-Number of patients/renal unit; JJs-Double-J stent; JJsN-Double-J stent + Nephrostomy tube; EUC-External ureteric catheter)

**Table 7: Comparision of group 2(tubeless) of present study at osmania hospital with other prospective randomised studies.**

| | Lozanapiwat et al,[13] | Karami et al,[22] | Yew and bellman, | Present study |
|---|---|---|---|---|
| Number of tubeless / renal unit | 37 | 201 | 4 | 48 |
| Mean stone burden | 3.06cm | 3cm | >3cm | 2.8 cm2 |
| Postoperative drainage | EUC | EUC | Tail stent (7f/3f) | JJs |
| Additional hemostasis used | Nil | Nil | Nil | Nil |
| Stone-free rates (%) | 92 | 91 | 100 | 100 |
| Length of stay(DAYS) | 3.63 | 3.5 | 1.5 | 4.1 days |
| Complications | Minor bleeding(2) | UTI(16) | Nil | Hematuria(6) , transfusion(2),fever(3), perinephric hematoma(2) |

(N-Number of patients/renal unit; JJs-Double-J stent; JJsN-Double-J stent + Nephrostomy tube; EUC-External ureteric catheter)

Traditionally a wide bore neprostomy tube is placed in pelvicalyceal systemat end of PCNL. It not only provides an effective tamponade to neprostomy tract, can also provide adequate drainage of pelvicalyceal system, same tract can be used for second look PCNL. Despite these obvious advantages, the nephrostomy tube is associated with significant post operative discomfort and pain especially if it lies in vicinity of rib cage. Many studies have reported the use of small-bore nephrostomy decreases morbidity, but it does not completely eliminates discomfort and morbidity of nepropstomy placement. This led to modifications of complete elimination nephrostomy tube as tubeless PCNL.

Our results show that tubeless PCNL is a good option in non-complicated cases, with the advantages of reduced hospital stay and little need for postoperative analgesia. There was no statistical difference between the two approaches in operation duration, or haematocrit change after surgery. However large,


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muticenter, prospective randomized trials needed to confirm this.

## CONCLUSION

This study demonstrates that percutaneous nephrolithotomy without nephrostomy is a safe and well tolerated procedure in selected patients. Length of stay was reduced with no major complications in either group. We believe that tubeless percutaneous nephrolithotomy may be considered an accepted standard of care for selected cases and it is possible to reserve placement of a nephrostomy tube for specific indications. The present prospective study shows that “tubeless PCNL” decreases patient hospital stay and analgesic requirement there by increasing the chance of labelling PCNL as day care surgery. In future ,a large cohort of patients studied in randomised fashion would prove the advantage making PCNL, a tubeless procedure and real meaning of tubeless would be worth appreciating.

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