

A Prospective Study on Outcomes of Tubeless Percutaneous Nephrolithotomy – Our Experience in SVIMS

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ABSTRACT

Introduction: The standard PCNL includes insertion of a nephrostomy tube and a Double J stent after the procedure. In recent days practice started towards Tubeless PCNL i.e no nephrostomy tube or Double J stent following a PCNL in view of reduced morbidity and hospital stay. This leads to our study on tubeless PCNL with the objectives of evaluation of outcomes and complications with the same and systematically analyse to evaluate the efficacy and safety of tubeless percutaneous nephrolithotomy (PCNL).

Material and Methods: This study conducted in department of urology SVIMS, Tirupati, where 54 patients underwent tubeless PCNL. In the group of tubeless PCNL, no nephrostomy tube or DJ Stent was inserted after removal of the stone fragments. We compared the results of tubeless PCNL with those of traditional procedure. The operative time, blood loss, perioperative complications, postoperative analgesic requirements and duration of hospitalization in the two groups were analyzed.

Results: In our series, mean duration of surgery for Tubeless PCNL group is 56.4±6.52 minutes where as for traditional group it was 81.8±8.21 minutes, the average length of hospitalization was 2.5±0.93 days for tubeless PCNL group, and 4.8±1.2 days for traditional PCNL group (P<0.020). Besides, postoperative total analgesic requirements are significantly decreased in tubeless PCNL patients (P<0.0001). However, there were no statistical difference in patient's age and gender, and blood loss for both the groups. There were no major complications or mortality in these two groups.

Conclusions: Tubeless PCNL is a safe, economic and effective procedure compared with traditional PCNL, and it can markedly reduce the postoperative analgesic requirements and shorten the hospital stay and costs.

Keywords: nephrostomy tube, DJ Stent, duration of surgery, analgesic usage, complications

INTRODUCTION

Percutaneous nephrolithotomy (PCNL) is the current treatment of choice for large renal stones. Traditionally, following PCNL a nephrostomy tube and DJ Stent were placed; however, it often resulted in postoperative discomfort and other complications. Several authors recently did not insert nephrostomy tube and DJ Stent after PCNL to reduce postoperative morbidity.

A “Tubeless” percutaneous procedure—one that omits the postoperative nephrostomy tube—was initially proposed by Wickham and colleagues.¹ The concept was revived by Bellman and colleagues², with the addition of an internal ureteral stent left in place for a week or two.

Tubeless PCNL is mainly two types

- Tubeless with ureteral stent, where after completion of procedure only double J stent passed, no nephrostomy tube inserted.

- Totally tubeless PCNL i.e no nephrostomy tube or DJ stent placed after the procedure.

Karami et al³ reported their 5-year experience in 201 patients undergoing tubeless PCNL with only an externalized ureteral catheter, and concluded that it was a safe, effective, and economical option. Similar results were reported by Ashraf Abou-Elela et al in 128 patients and Gupta et al in a study of 69 patients.⁴

In light of the findings of studies comparing internal stents with nephrostomy tubes, it is not surprising that the three randomized controlled trials of “totally tubeless” percutaneous renal surgery (Aghamir et al, 2008; Crook et al, 2008a; Istanbuloglu et al, 2009) also found reduced duration and intensity of convalescence in the groups without nephrostomy tube and DJ stent.⁵

Purpose was to study outcomes and complications of tubeless PCNL and to systematically analyse the safety and efficacy of the tubeless PCNL.

MATERIAL AND METHODS

This was a prospective comparative study, conducted in the Department of Urology, SVIMS (Sri Venkateshwara Institute of Medical Sciences), Tirupati, for a period of 12 months from March 2015 to February 2016. A total number of 54 cases of tubeless PCNL was studied data collected and results analysed. Sample size estimated based on prevalence of the operable renal calculi (using formula $S = 4pq/l^2$) Results of study group were compared with other group of traditional PCNL with 58 patients.

Inclusion criteria: Patients with renal and/or upper ureteric calculi of greater than 1.5cm, negative urine culture and no coagulopathy.

Exclusion criteria: Those patients with solitary kidney, more than 2 percutaneous accesses, significant perforation of the collecting system and significant intraoperative bleeding and patients with raised creatinine, patients with ectopic, malrotated and fused kidneys.

Pre-operative assessment done with indication for surgery and patient's complete history and physical examination. Important laboratory parameters such as urine analysis and culture / sensitivity, haemoglobin, electrolytes and serum urea/creatinine, coagulation profile were checked before the surgery. Hb%,

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serum electrolytes, creatinine and urea repeated after surgery also. Pre-operative intravenous urography (IVU), plain CT KUB, early morning X-ray KUB on the day of surgery was performed in all cases. Ultrasound and/or X-ray KUB were repeated 24 hours after surgery. Mean stone burden was calculated in each case by the horizontal and vertical dimensions of the stone, as seen on IVU.

The surgical technique was carried out under general anaesthesia. A 5F transurethral ureteric catheter was placed. Percutaneous access was created in all cases under fluoroscopic guidance with the patient in prone position. The nephrostomy tract was dilated with metal dilators and Amplatz sheath was left in situ. A 26 Fr angled Storz nephroscope was used and calculus disintegration was performed using lithoclast.

On completion of the procedure, the Amplatz sheath was removed. The wound was stitched with Prolene 4/0 mattress suture. A Foley's catheter was left in the bladder at the end of the procedure, for all study cases totally tubeless methodology followed i.e no nephrostomy and no DJ stenting. After surgery fluoroscopy and endoscopy were used to assess stone free status. Patients data such as age, stone size, stone site, type of puncture, duration of surgery, hemoglobin, complication rate, analgesic need, type of analgesic, dose of analgesic, duration of hospitalization and total cost of the procedure were noted.

STATISTICAL ANALYSIS

Collected data entered in to excel spread sheet and results analysed. The data was expressed in terms of Mean \pm standard deviation. The intergroup comparison done by unpaired t-test. All statistical tests were conducted with a significance of level of p value < 0.05 .

RESULTS

We evaluated the data of 112 cases undergoing PCNL in our hospital. We divided total cases in to 2 groups. There are 54 cases in group A who underwent totally tubeless PCNL and 58 patients in group B of traditional PCNL. Both groups has similar demographics according to age sex and comorbidities. Among these 54 cases (group A) 35 were male and 21 female patients. Male to female ratio is 1.66:1. The average age was 44.6 years with arrange of 20 to 65 years. Where as in group B male to female ratio is 2.3:1 and average age is 48.8 years. Out of 54 cases 12.9%(7pts) have hypertension, 9.25% (5) have diabetes mellitus, 2 patient have COPDs, 1 patient had hypothyroidism and 1 patient was known CKD.

Mean stone burden in group A is 2.24 cms with the smallest stone of 1.5cm to largest stone of size 3.2cms. In 29 (53.7%) cases lower calyceal puncture done, 14 (25.9%) patients underwent upper calyceal puncture and for 11 (20.3%) cases middle calyceal puncture done. Single tract access was successful in most of the cases.

Mean duration of surgery i.e from induction of anesthesia till the patient shifted from operation theatre was 56.4 minutes and mean operative time in group B is 81.8 minutes. Mean VAS score in 1st hour of surgery was 6.4 in group A, where in group B it was 7.5. After 6th hour of surgery mean VAS score in group A was 4.8 and for group B it was 5.9. Mean analgesic requirement throughout the hospital course is 62.4 mg Tramadol for group A patients and 116.2 mg tramadol for group B patients. Only 3 (8.33%) patients required blood transfusion due to bleeding.

Each patient received 1 unit of packed cell.

In addition, complications included high fever (more than 38.5°C) in 1 patient and prolonged renal pain were observed in 1 patient (1.85%) of totally tubeless PCNL patients. In Group A, for 51 (94.4%) patients and in Group B, for 53(91.3%) patients complete stone clearance was achieved. In Group A, Four patients were treated by placing a double j stent, 1(1.85%) patient underwent ureteroscopy for distal ureteric stone. In group B, 2 cases (3.44%) underwent ureterorenoscopy.

Average cost of the procedure for tubeless PCNL was 30145.5 rupees (approx 30 k), where as 44895.4 rupees for (approx 45 k) standard PCNL. Mean duration of hospital stay was 2.5 days for totally tubeless PCNL group. Where as for standard PCNL group it was 4.8 days. The mean time to return daily activities in tubeless PCNL is 6.2 days and for standard PCNL it is 10.5 days.

DISCUSSION

Since the introduction of PCNL about 30 years ago, efforts have been made to improve the technique in order to decrease trauma to the kidney and the percutaneous tract, and reduce postoperative morbidity, hospital stay and costs. One of the clinically tested modifications is the mini-perc approach that was first reported in pediatric patients.⁶ This version(mini perc) of PCNL uses 13-20 Fr working sheaths and was soon adapted for adults, resulting in reduced operative time, less postoperative morbidity and shorter hospital stay.⁷ It did not, however, obviate the need for the placement of nephrostomy tubes. Pietrow et al used a narrower tube (10 Fr instead 22 Fr) and noted greater comfort in the immediate postoperative period without sacrificing safety.⁸

The concept of a tubeless technique represents a novel alternative in the search to miniaturize the procedure. Bellman et al. reported their initial experience with a series of 50 patients who underwent various percutaneous procedures. Later Limb and Bellman completed 112 successful tubeless procedures, representing almost one-third of all their percutaneous procedures.² Their Prospective randomized studies designed to compare tubeless vs. mini vs. standard PCNL confirmed the superiority of the tubeless PCNL.

In Our present study, we compared the effectiveness and

| S No | Comorbidity | Group A | Group B |
|------|-------------------|---------|---------|
| 1 | Hypertension | 7 | 8 |
| 2 | Diabetes mellitus | 5 | 4 |
| 3 | COPD | 2 | 3 |
| 4 | Hypothyroidism | 1 | 1 |
| 5 | CKD | 1 | 2 |

Table-1: Comorbidities in both groups

| S No | Parameter | Group A | Group B | P value |
|------|--------------------------------|-----------------|-----------------|---------|
| 1 | Age distribution | 44.6 yrs | 48.8 yrs | 0.2153 |
| 2 | Sex ratio | 1.66 | 2.33 | — |
| 3 | Stone burden | 2.24 \pm 0.84 | 3.15 \pm 0.72 | 0.0001 |
| 4 | Duration of surgery | 56.4 \pm 6.52 | 81.8 \pm 8.21 | 0.0001 |
| 5 | VAS score 1 st hour | 6.4 \pm 1.6 | 7.5 \pm 1.2 | 0.0010 |
| 6 | VAS score 6 th hour | 4.8 \pm 1.2 | 5.9 \pm 1.3 | 0.0003 |

Table-2: Perioperative parameters in both groups

| S No | Parametre | Group A | Group B | p value |
|------|--|-----------------|------------------|---------|
| 1 | Mean duration of procedure (minutes) | 56.4±6.52 | 81.8±8.21 | 0.0001 |
| 2 | Bleeding requiring transfusion | 3(5.55%) | 5(8.62%) | - |
| 3 | Mean Length of hospitalization (days) | 2.5±0.93 | 4.8±1.2 | 0.020 |
| 4 | Mean analgesic requirement (tramadol iv) | 62.4± 16.8 (mg) | 116.5± 20.2 (mg) | 0.0001 |
| 5 | Stone free rate | 34(94.4%) | 36(90%) | - |
| 6 | Mean Procedure cost (rupees) | 30145.5k | 44895.4k | 0.0001 |
| 7 | Time to return of daily life activities | 6.2±0.18 | 10.5 ±1.25 | 0.0001 |

Table-3: Post operative Issues

| Reference study | N | Mean stone burden | Postoperative drainage | Analgesia requirement | Average Hb drop gm/dl | Stone free rates (%) |
|--------------------------------|-----|---------------------|------------------------|-----------------------|-----------------------|----------------------|
| Agarwal et al ¹² | 101 | 3.8 cm ² | JJs | 81.7 mg MP | 0.36 gm% | 100 |
| Desai et al | 10 | 250 | JJs | 8.5 mg D | 4.2 gm% | - |
| Feng et al | 8 | 4.4 cm ³ | JJs | 5.25 mg M | - | 85.7 |
| Singh et al | 30 | 750mm | JJs | 6 mg M, 415 mg D | 1.2 gm% | 100 |
| Limb and Bellman ¹³ | 112 | 3.3 cm ² | JJs | - | 1.5 gm% | 93 |
| Goh and Wolf | 10 | 1.8 cm | EUC, JJs | - | 2.4 gm% | 80 |
| Karami et al | 201 | 3 cm | EUC | - | 2.2 gm% | 91.04 |
| Yang et al | 138 | - | JJs | 6.4 mg M | 1.6 gm% | 94.5 |

Table-4: Reference studies- intra operative parameters

safety of Standard PCNL and tubeless PCNL for operative time, postoperative analgesia, hospital stay, and stone-free rate. In the present study, there was no statistically significant difference between both groups for the age and sex of patients, comorbidities, stone side and location, this minimised the effect of any of them on the outcomes of the procedures. There was no significant difference in initial stone burden between tubed and tubeless groups.

The mean operative time in our study was longer in the standard PCNL group than in the Tubeless PCNL group [for group A - 56.4min for group B 81.8 min, respectively] this difference was statistically significant. Ni et al. reported that tubeless PCNL had a reduced operative time versus standard PCNL. For the blood transfusion rate, there was a no significant difference between the two groups in the present study. Blood transfusion rate for group A was 5.55%, and for group B was 8.62%. In the study of Khairy Salem et al. there was no need for blood transfusion during or after the operation due to insignificant blood loss.⁹ In studies conducted by Gupta et al and Crook et al there is no statistically significant difference in blood transfusion rates between two groups i.e standard PCNL and tubeless PCNL¹⁰

Hospital stay plays an important role in the evaluation of a technique, in our present study it was lower in Tubeless PCNL group [2.5 versus 4.8 days] than standard PCNL group; this difference was statistically significant. This result was similar to other published studies, such as in the study of Khairy Salem et al. in which the mean (range) hospital stay was 1.7 (1–4) days in the tubeless PCNL group and 2.8 (3–4) days in the Standard PCNL.⁹

In our present study, the postoperative analgesic requirement (tramadol) in the Tubeless PCNL group was less than that of Standard PCNL group [mean 62.4 versus 116.2 mg, respectively]. This advantage of tubeless PCNL and has also been reported in other studies, such as that of Zhong et al. as their overall results indicated that the tubeless PCNL group had a lesser analgesic requirement.¹¹ In our study for Tubeless PCNL group the Mean VAS pain score after 1st hour of surgery and after 6hrs

of surgery was 6.4 and 4.8 in group A, where in group B it was 7.5 and 5.9. Mean VAS score is significantly reduced at 1st hour and 6th hour after Tubeless PCNL compared with standard PCNL group. Average cost of the procedure for tubeless PCNL was less compared to standard PCNL was 30145.5 rupees (approx 30 k), versus 44895.4 rupees for (approx 45 k). In a study conducted by Feng et al the procedure cost for standard and tubeless PCNL were 7555\$ and 5562 \$ respectively where they proved that cost was significantly less in tubeless PCNL.⁹ The mean time to return daily activities in our study for tubeless PCNL is 6.2 days and for standard PCNL it is 10.5 days. Zhong et al. reported that the time for return to normal activity in the totally tubeless group was significantly lower than the standard PCNL group.¹¹

CONCLUSION

Our findings demonstrated that tubeless PCNLs can be safely and effectively performed by an experienced endourologic team without limiting the number of eligible candidates by preoperative patient selection. Tubeless PCNL has an obvious advantage of significantly reduced postoperative pain, less analgesic requirement and shorter hospital stays. Complications rate are less with tubeless PCNL and blood transfusion is less when compared with traditional PCNL. We believe that this study will contribute to the further popularization of the tubeless technique for the benefit of the patient, the medical team, and the health care system

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