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A Multicentre Retrospective Analysis of Tubeless PNL in Patients with Renal Calculus

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Abstract: ***Introduction**: Percutaneous nephrolithotomy was first done by Fernstrom and Johansson and reported excellent results. Percutaneous nephrostomy drainage is an integral part of this procedure but nowadays it has shifted to "tubeless and total tubeless per cutaneous nephrolithotomy", with the development of miniature instruments for PNL. In this study, we share our experience of tubeless percutaneous nephrolithotomy (PNL) in patients with renal calculi. **Material and methods**: This is a multicentric retrospective study done over a period of 4 years (April 2019 and March 2023) at three tertiary centres in central India.All patients who underwent Tubeless PNL/mini PNL were included in the study. The data were analysed on the basis of demographic profile, intra-operative events, post-operative complications and duration of hospital stay. **Results**: Tubeless PNL was done in 843 renal units of 780 patients between April 2019 and March 2023 at three different centres across India. The most common calyceal puncture was inferior calyx. Prolonged analgesic requirement and bleeding were the common complications. The median duration of hospital stay was 3 days. **Conclusion**: Tubeless percutaneous nephrolithotomy is safe and feasible and can be done with good surgical outcomes in patients with renal stones under regional or general anaesthesia.*

Keywords: Percutaneous nephrolithotomy, Pneumatic lithotripter, Holmium LASER.

1. Introduction

Percutaneous nephrolithotomy (PNL) is the gold standard treatment for all kinds of renal stones. Tubeless PNL was first promoted by Bellman in 1997 [1]. With the gradual miniaturisation of instruments and development of LASER, tubeless PNL is commonly done nowadays with advantages of less bleeding, early mobilisation and short hospital stay. Herewith, we present a retrospective analysis of tubeless PNL over a period of 4 years (April 2019 to March 2023) at tertiary care institutes in central India.

2. Materials and Methods

The records of all the patients with renal stones who were managed with tubeless PNL at three tertiary care institutes in Central India for the period of 4 years (April 2019 to March 2023) were retrieved and retrospectively reviewed. Analysis was done on the basis of demographic profile, intra-operative events, post-operative complications and duration of hospital stay.

Patients across all age groups and with renal stones of all sizes and burden were included in the study. Patients with multiple calyceal stones, large stone burden, previous stone and renal surgery, patient on blood thinners and patients not giving consent for surgery were excluded from the surgery. All patients were admitted and the diagnosis was confirmed through investigations – CT (Computed Tomography) Urography and/or Intravenous Pyelography (IVP). The procedure was planned in patients with sterile urine. After written and informed consent for surgery, the patients underwent PNL and/or mini PNL under spinal or general anaesthesia as per the standard techniques. The ureteric catheter was introduced in supine position, then the patient was turned into prone position and the affected calyx was punctured under C arm and/or ultrasound guidance. The tract was dilated up to 16-30 Fr according to stone burden with either metal or plastic dilators and amplatz sheath was placed. Stones were fragmented with pneumatic lithotripter or holmium laser and the stone fragments were removed. Double J stentwas placed after completion of surgery. After removal of the sheath, the PNL site was compressed with pad for ten minutes and the incision was stitched without putting nephrostomy tube. Post operative X-ray was done to confirm stone clearance and position of DJ stents.

The data was entered in Microsoft Excel Sheet and analysed using SPSS 21. Categorical variables were represented as frequencies and percentages, and their distribution was illustrated using graphical representations. Quantitative variables were summarized as mean ± standard deviation (SD) or median with range.

3. Results

A total of 957 patients with 1055 renal units presented with renal calculi and underwent PNL during the above mentioned period. Amongst these, 177 patients (212 renal units) were excluded from the study as they required multiple punctures and a PCN tube was placed in them. Thus, tubeless PNL was done in 843 renal units of 780 patients and were included in our study. PNL was done by standard method in 736 renal units and mini PNL was done in 107 renal units. Patients demographic profile, clinical history, stone size, location and characters are presented in table 1.

Table 2 describes the intra-operative and post-operative events. The most common calyx chosen for initial puncture and PNL was inferior calyceal (50.7%) followed by mid posterior (31.6%) and multiple calyceal puncture needed in 116(13.7%) renal units. Mean operative time was 85 minutes ranging from 45 to160 minutes. Although we performed PNL in regional anaesthesia in most of our patients, conversion to general anaesthesia was required in 98 (12.5%) patients. The median hospital stay was 3 days (range 3-7 days).

Clavin-dindo classification was used for grading the complications. Twenty-two patients developed haemothorax and intercostal drain was put in 14(1.6%) patients. Blood transfusion was needed in74 patients due to low haemoglobin (9-10g%) pre-operatively, requirement of

multiple punctures, development of haemothorax and intra operative blood loss. Analgesic requirement for more than 3 days postoperatively was seen in 12.8% patients (most patients recovered with oral paracetamol or diclofenac tablets but 73 patients required administration of intravenous tramadol). In 22(2.6%) patients, nephrectomy was done with multiple stones and 10 patients died postoperatively.

4. Discussion

Placement of percutaneous nephrostomy (PCN) tube has been an integral part of PNL to drain the kidneys and is still placed at various centres. Placement of PCN tube was initially described over 10-14 G needles in 1955 [2] and first PCN tube had been used as a splint for open ureterotomy in previous decade [3]. Use of PCN tube after PNL was advocated for urine drainage, to maintain access for future manipulations and as a tamponade for haemostasis of percutaneous tract[4], making it an integral part of the standard procedure [5]. The disadvantages of placing PCN tube are pain, discomfort to patient and hospitalization is longer [6]. In our study we used PCN tube for re-entry to pelvi-calyceal system and removal of residual stones but we excluded such cases during final analysis.

Continuous new developments are made in the field of urinary stone management including use of miniaturised instruments and LASERs, leading to start of mini PNL and tubeless PNL. However, they may not be available at every centre so large tract needed which leads to urine extravasation and bleeding from tract and are of real concern; thus putting a PCN tube becomes mandatory for drainage and haemostasis.

The main indications for tubeless PNL are small stone burden where single access tract is needed, less blood loss and no evidence of pelvi calyceal system injury [7]. Tubeless PNL is considered a less painful option with similar results in some studies [8]. Tubeless PNL is defined as PNL without PCN tube placement and totally tubeless PNL was defined when even DJ stent is also not placed in pelvi-calyceal system [9]. In our study we did tubeless PNL in 843 renal units including mini PNL in 107 renal units with less analgesic requirement, short hospitalisation and less need for blood transfusion. We excluded large stones which needed multiple puncture and rest of all cases we did tubeless PNL.

Recently various studies were done on tubeless PNL with short hospital stay, less analgesic requirements and minimal blood loss in carefully selected patients [10,11,12]. In some studies haemostatic agents were used to seal the PCN tract but relatively high cost of these agents excludes their frequent use [7]. In our study we did not used such agents in any of our cases. A large number of randomized controlled trials have been conducted to assess the advantages of tubeless PNL which showed superiority of tubeless PNL in terms of analgesic requirement, hospital stay and rapid recovery of patients who underwent tubeless PNL [8,11,15,16,17] and similar advantages as these studies are seen in our cases. Zilberman DE et al[19] in their study reported similar complication rates in tubeless and standard PNL with nephrostomy tube[18]. There are also no significant differences noted in the operative time, blood loss and drop of haemoglobin level between tubeless PNL and with nephrostomy tube [21,22,23]. In our study too, we did tubeless PNL in single or partial staghorn stones with similar results as of previous studies.

With this study, we present our experience of tubeless PNL in patients with renal stones. This technique is safe, causes less discomfort to the patients and has the advantage of short duration of hospital stay. This decreases the financial burden in developing countries.

5. Conclusion

Tubeless PNL is safe and effective and can be used in patients with renal stones with advantages of speedy post-operative recovery, less discomfort to the patients and early discharge.

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Tables

Table 1: Patient demographic profile and stone characters

Age (Yrs)	51.5yrs (23-74yrs)
Sex (M: F)	3:1
Stone location (R: L: BL)	530:315:110
Stone size	1.6 to 4.9 cm
Stone character (Single: Partial staghorn: Complete staghorn)	537:376:142

Table 2: Intraoperatie and post operative datas

Calyceal puncture	1. Superior- 32 2. Mid posterior- 267 3. Inferior- 428 4. Multiple- 116
Conversion to GA	98 (12.5%)
Operative time	85 min (45-160)
Hospital stay	3 days (3-7 days)
Intercostal drain	14 (1.6%)
Blood transfusion	74 (8.7%)
Prolong analgesic requirement (>3days)	108 (12.8%)
Nephrectomy required	22 (2.6%)
Death	10 (1.18%)