SCIENTIFIC ARTICLE

Shifting the paradigm of percutaneous treatment for renal stones ; experience from a single tertiary care centre in Sri Lanka

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Abstract

Supine Percutaneous Nephrolithotomy (PCNL) is increasingly recognized as an effective and patient-friendly technique for managing complex renal calculi. This study evaluates the efficacy and treatment outcome of 32 supine PCNLs performed by a surgical trainee in a tertiary care hospital in Sri Lanka. Efficacy in view of operative time, stone free rates and the outcome in view of postoperative complications were assessed.

Results demonstrated a high complete Stone Free Rate (SFR) of 87.5% with a mean operative time of 49.7 min. All the patients had a double J stent in situ for 2 weeks and only one patient required a Percutaneous Nephrostomy (PCN) tube sitting. Three patients developed minor postoperative complications. One was a febrile Urinary Tract Infection (UTI) managed with intravenous antibiotics; two patients developed haematuria which needed irrigation via 3-way catheter. None of the patients had colonic injury or developed bleeding which required blood transfusion.

Supine PCNL is a safe and effective technique which can be adopted with acceptable postoperative complication rates with comparable stone free rates. It provides potential advantages of reduced operative time, less patient handling and simultaneous ureteroscopic access.

Introduction

Percutaneous Nephrolithotomy (PCNL) is the gold standard for treating large renal calculi [1]. Though the conventional prone PCNL has been widely practiced as the treatment of choice for the management of large renal stones, the paradigm is shifting globally with the introduction of the supine PCNL technique due to its inherent advantages such as improved anesthetic access, reduced cardiopulmonary risks, and enhanced ergonomics for the surgeon [2], [3]. It is particularly useful in obese patients where prone position can compromise anesthetic safety. Modified Valdivia position is well recognized for supine PCNL due to its safety and high success rates.

The aim of this study is to analyze the efficacy and treatment outcome of a cohort of supine PCNLs, performed by a surgical trainee in a tertiary care hospital in Sri Lanka.

Materials and methods

Study Design

This a prospective, single-center, observational study, conducted at the National Hospital of Colombo, Sri Lanka, on a cohort of 32 patients undergoing supine PCNL for renal calculi from April 2022 to August 2022. The procedures were performed in the modified Valdivia position by a postgraduate surgical trainee. A retrospective analysis of collected data was performed.

Patients with stone size ≥20 mm who did not have contraindications to general anesthesia were included. Patients with uncorrected coagulopathy or complex renal anatomy such as horseshoe kidney were excluded from the study. Demographic variables including patients' age and gender, clinical variables including stone size (maximal diameter for single stones and maximal diameter of the largest stone for multiple stones) and location (upper/mid/lower/partial or complete staghorn) were recorded.

Procedure

All the procedures were carried out by a postgraduate surgical trainee in modified Valdivia position. Patients were positioned supine with a slight flank elevation to facilitate renal access. Mid and posterior axillary lines were marked to guide the boundaries of surgical access. Procedure was started by performing a cystoscopy and placing a ureteric catheter. Under fluoroscopic guidance, renal puncture was performed,

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fragmented using pneumatic lithotripsy and stone fragments were retrieved using stone retrieval forceps. A double J stent was routinely inserted at the end of each procedure and a nephrostomy tube was placed only if there was a concern of bleeding. A 16Fr urethral catheter was placed on free drainage in every patient.

Operative parameters including time for renal access, operative time and need for blood transfusion were recorded. Routine postoperative care was carried out in the urology ward and the urethral catheter was removed on postoperative day 1, provided there wasn't a significant hematuria. Nephrostomy tube was removed on day 1-2 depending on clinical judgment.

Outcome measures were the stone-free rate (SFR), assessed by postoperative imaging (Xray KUB, non-contrast CT or ultrasound) and complications, a categorized using the Clavien-Dindo classification. The duration of hospital stay (duration from surgery to discharge) was also recorded.

Results

A total of 32 patients underwent supine PCNL during the study period, out of them 22 (68.7%) were males and 10 (31.2%) were females. Mean age was 50.3 (range 24-66) years. Procedure was performed on the left side in 24 (75%) patients and on the right side in 8 (25%) patients. None of the patients underwent bilateral PCNL.

The average stone size was 3.3cm (range 2-4.9cm) with an average density of 1165.8HU (range 600-1480HU). Stones were located in the renal pelvis in 20 (62.5%), in the lower pole in 2 (6.2%), in the upper pole in 1 (3.1%) of the patients and 9 presented with staghorn stones (28.1%) (Table1).

Renal access was obtained via a single puncture in 30 (93.7%) patients, among them only one patient required an upper calyx puncture. 2 (6.2%) patients required a second puncture due to a complete staghorn extending to the upper calyx. Successful access was solely achieved via lower calyx in 29 (90.6%) patients.

Mean operative time was 49.7min (range 20-100) and the average time to access the pelvicalyceal system was 4.9min. Complete stone clearance was achieved in 28 (87.5%) patients. There was a significant correlation between stone size and operative time ($p<0.05$) (Figure1). A double J stent was inserted in all 32 patients and a simultaneous percutaneous nephrostomy was sited in one patient. This was following a multiple puncture for a complete staghorn.

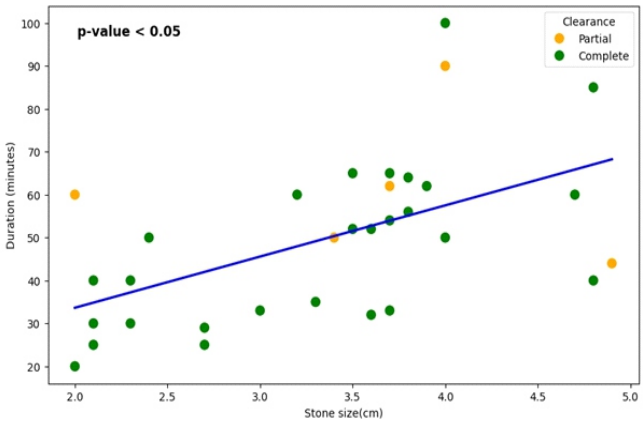

Figure 1: Stone clearance and duration of the surgery based on stone size

The median hospital stay was 2 (1-5) days (Figure 2). 3 (9.3%) patients developed minor postoperative complications (Clavien-Dindo Grade I-II). Figure3 One was a febrile urinary tract infection (UTI), managed with iv antibiotics, and 2 patients developed hematuria which needed irrigation via a 3-way catheter. None of the patients developed major complications such as colonic injury, sepsis requiring ICU admission or developed bleeding which required blood transfusion.

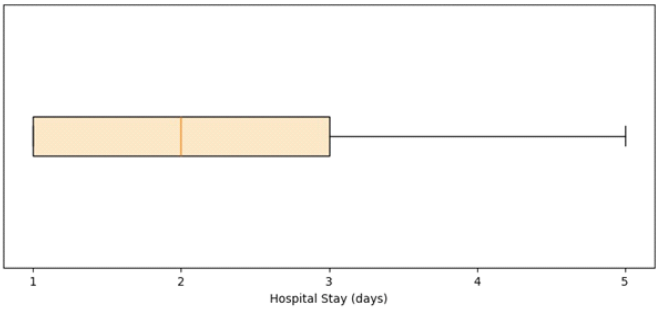

Figure 2: Duration of hospital stay

Varaible		Mean (SD)	Count (Percentage)
Gender	Male	-	22(69)
	Female	-	10(31)
Age		50(10.4)	-
Stone size(mm)		3.3(0.87)	-
Stone density(HU)		1165.8(227.3)	-
Side	Left	-	24(75)
	Right	-	8(25)
Location	Upper		1(3.1)
	Lower		2(6.2)
	Renal pelvis		20(62.5)
	Stag horn		9(28.1)

Table 1 : Clinicopathological features

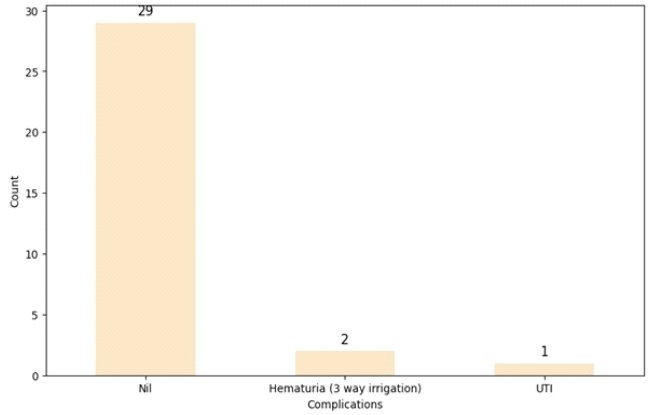

Figure 3 : Incidence of complications

Discussion

Prone PCNL is the traditionally favored technique in managing large renal stones due to increased surface area to make the puncture and low risk of intra-abdominal visceral injury [6]. However, supine PCNL is becoming increasingly popular due to its advantages over prone position which includes shorter operative times, simultaneous retrograde access and favorable anesthetic outcome in high-risk patients [7], [8].

Supine approach for PCNL demonstrated high efficacy and the safety in this cohort. The stone-free rate of 87.5% aligns with results from previous studies comparing supine and prone PCNL [9]. The supine position facilitated reduced operative times, likely due to efficient patient positioning and this could have been further improved by simultaneous retrograde access using a flexible ureterorenoscope. Although the literature recommends "total tubeless PCN" as a safe and effective method, insertion of a double J stent or a nephrostomy tube depends on clinical judgement and surgeon's preference. Definitive guidelines on whether to insert a stent or not are lacking [10]. High number of JJ stent insertions in this cohort reflects the practice of our center.

Complication rates of this cohort were low, with occurrence of minor complications, primarily managed without invasive surgical or radiological interventions. The single case of febrile UTI was effectively treated with IV antibiotics, underscoring the importance of preoperative infection control.

The study's findings reinforce the feasibility of supine PCNL in achieving good stone clearance while keeping the post operative complications low. This approach is recognized for improving anesthetic access, reducing cardiopulmonary risks, and providing better ergonomics for surgeons. The fact that this cohort demonstrates comparable outcomes with a low complication rate suggests that supine PCNL can be adopted by an experienced surgical trainee which would shift the paradigm of percutaneous treatment of large renal stones towards the supine PCNL in Sri Lanka.

Limitations

This study's primary limitation is its small sample size. Larger, multi-center trials are needed to validate these findings. Lack of availability of flexible ureterorenoscopes might have compromised the complete stone clearance rate compared to cohorts from high volume centers in the world.

Conclusions

Supine PCNL is a safe and effective alternative to the traditional prone approach for managing large renal calculi. In this cohort, the procedure achieved a high stone-free rate with a low complication rate. Future studies should explore long-term outcomes and refine techniques to further optimize supine PCNL outcomes.

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